

Technical Assistance Consultant's Report

FINAL REPORT

VOLUME II: APPENDICES

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Preparing the Ben Luc-Long Thanh Expressway Project

ADB

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For: Asian Development Bank



**TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT**

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APPENDIX A:

TERMS OF

REFERENCE

TERMS OF REFERENCE FOR CONSULTANTS UNDER THE TECHNICAL ASSISTANCE FOR PREPARING THE BEN LUC-LONG THANH EXPRESSWAY PROJECT

1. Asian Development Bank (ADB) provides a technical assistance. (TA)¹ for preparing the Ben Loc-Long Thanh Expressway Project, to be financed on a grant basis by the Japan Special Fund, funded by the Government of Japan. The TA scope covers a feasibility study for the whole outer ring of the Ho Chi Minh City (HCMC) Urban Expressway and access to the HCMC-Vung Tau Expressway, as the Ben Loc-Long Thanh Expressway is an important link of these expressways. The engineering, economic, financial, social, and environmental studies will be carried out based on the planned alignment. An environmental impact assessment, environmental management plan, resettlement plan, and ethnic minority development plan (or ethnic minority specific actions) for construction of the Ben Luc-Long Thanh Expressway will be prepared. Two bridges, or river tunnels, need to be constructed across the Nha Be and Long Tau rivers. These rivers are used as navigation channels for large cargo ships accessing the HCMC river port. Therefore, if bridges are selected, long-spanned bridges with 50-60 m navigational clearance will be needed. An engineering study to determine the river crossing structures is included in the scope.

A. Introduction

2. HCMC is the largest city in Viet Nam and the country's economic hub, with a population (including both the permanent and the transient population) forecast to grow by 2.1% yearly from the current 7.9 million to 10.3 million by 2020. The volume of trade through HCMC'S port grew by more than 15% in value in 2006. With economic growth expected to continue in the medium term, and households earning higher incomes, many more families will be able to buy cars and the number of journeys undertaken will significantly increase. Already, the roads within and around HCMC are becoming heavily congested, travel speeds are dropping, and transport costs are rising. There is an urgent need to provide relief to the city roads connecting the center of HCMC and the port area with the suburbs to the city, and, further out, to the roads leading north from the city to central and northern Viet Nam. In the southern area of HCMC, east-west traffic is restricted due to lack of bridges and tunnels across the Nha Be River and its tributary streams in the Mekong Delta. Goods and people are forced to travel by way of the center of HCMC, and this raises concerns about traffic levels in the city center.

3. As part of development planning for HCMC, several master plans have been prepared to deal with the needs of specific sectors. A transport master plan was prepared in 2004, with assistance from the Japan International Cooperation Agency². This plan was later consolidated with a second master plan prepared by the People's Committee of Ho Chi Minh City and work done by the Ministry of Transport's Technical Engineering and Design Institute. This consolidated transport master plan, approved by the Government in January 2007, sets out a \$26 billion investment program up to 2020. The Ben Loc-Long Thanh section is included in the program.

4. The 60 km Ben Loc-Long Thanh Expressway will be a southern link of the outer ring of HCMC urban expressway as well as a short link of the north-south expressway in Viet Nam. It will be connected to the planned HCMC-Vung Tau Expressway, which forms part of the GMS Southern Economic Corridor route from Bangkok to Phnom Penh, HCMC, and Vung Tau. Due to the lack of river bridges and tunnels in the southern area of HCMC, the proposed expressway will have significant impacts on socioeconomic activities in the cities and towns around HCMC. The proposed feasibility study will cover the whole outer ring expressway of HCMC, as well as access to the HCMC-Vung Tau expressway. Two bridges, or river tunnels, need to be constructed across the Nha Be and Long Tau rivers, which are used as navigation channels for large cargo ships accessing the HCMC river port. If bridges are selected, these will have to be long-spanned, cable-suspension bridges with a 50-60 meter (m) navigational clearance.

¹ The TA is piggybacked to Loan 2460-VIE: Greater Mekong Subregion (GMS) Ha Lang Son, GMS Ha Long-Mong Cai, and Ben Loc-Long Thanh Expressways Technical Assistance Project.

² Japan International Cooperation Agency. 2004. The Study on Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area. Ho Chi Minh City.

5. The Project is located north of the Can Gio protected area. The Can Gio mangrove ecosystem has been recognized as an international biosphere reserve by United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 2000. Even if the proposed alignment is outside of the protected area, wetlands with mangroves could be present along the alignment. Terrestrial ecology field surveys will be conducted with a focus on species presence, distribution, and condition in mangrove ecosystems. The proposed expressway will link to Provincial Road 15 (currently being rehabilitated), which goes through the Can Gio mangrove forest. Linkage with the Ben Luc-Long Thanh Expressway is expected to increase the number of visitors in the protected area and lead to high pressure on land development in this area. The eastern part of the expressway crosses lowland terrain with an altitude of 0-1 m. This area is a sunken, low delta with alum soil, and could be inundated by tidal movements. The Project is likely to have significant adverse environmental impact that is sensitive, diverse, or unprecedented, and affects an area broader than the sites or facilities where the physical works will be carried out.

B. Scope of the Consulting Services

6. The expected outputs of the TA should include rationale (sector performance, problems, and opportunities), design and monitoring frameworks (impact, outcome, outputs, and inputs), specific features, cost estimates, benefits and impacts, assumptions and risks, economic and financial feasibility assessment, environmental impact assessment, and resettlement plan for the Ben Loc-Long Thanh Expressway Project³, and also should cover requirements for the Government of Viet Nam's General Guidelines on Feasibility Study (2008).³

7. The scope of the consulting services covers a feasibility study for the whole outer ring of the HCMC urban expressway, and access to the HCMC-Vung Tau Expressway. General alignment of the Ben Luc-Long Thanh Expressway will be determined, taking into consideration social and environmental impacts and cost-effectiveness. The engineering, economic, financial, social, and environmental studies will be carried out based on the general alignment. Especially, the engineering study is important to determine the river crossing structures across the Nha Be and Long Tau rivers. These rivers are used as navigation channels for large cargo ships accessing the HCMC river port.

8. The consulting services will be undertaken so that fact-finding of an investment loan for the Ben Luc-Long Thanh Expressway Project may start in January 2010, and the loan negotiations may take place in July 2010.

C. Implementation Arrangement

9. Vietnam Expressway Corporation (VEC) is ADB'S counterpart for the TA. VEC will establish a project implementation unit no.3 (PIU3) for the TA, headed by a director and appropriately staffed for day-to-day coordination. The director for PIU3 will have the overall responsibility for supporting the implementation of the TA and for providing guidance, administrative and technical support, counterpart staff, documentation, and other services that may be required.

10. The consulting services will be undertaken by an international consulting firm in association with national consultants. The consultants will be hired by ADB according to its Guidelines on the Use of Consultants (2007, as amended from time to time) and its quality- and cost-based recruitment procedures. About 117 person-months of consulting inputs will be required-52 person-months of international consultant services and 65 person-months of national consultant services. The consultants will have expertise in (i) traffic and highway engineering, (ii) transport economics, (iii) financial analysis and expressway operations, (iv) environmental impact assessment, (v) resettlement planning, (vi) social and poverty analysis, (vii) social development and gender, and (viii) HIV/AIDS and human trafficking prevention and control. Equipment financed under the TA will

³ Socialist Republic of Viet Nam. 2008. Decision on Issuance of Common General Guidelines on Feasibility Study Preparation for Official Development Assistance (ODA) Projects Funded by the Five Banks (Asian Development Bank, French Development Agency, Japan Bank for International Cooperation, German Development Bank, World Bank). Promulgated together with the Prime Minister's Decision No. 48/2008/QĐ-TTg issued on 3 April 2008 by the Prime Minister. Ha Noi.

be procured according to ADB'S Procurement Guidelines (2007, as amended from time to time) and will be handed over to VEC at the end of the services. The consulting services to undertake project feasibility study will be implemented over 9 months from May 2009 to January 2010, and the consulting services to assist ADB'S loan processing and VEC'S the Government approval process will be implemented over 5 months from February to June 2010. All surveys necessary to undertake project feasibility study will be commissioned by the consultants and funded through the consulting services contract.

11. The consultants will consult with VEC, People's Committee of HCMC, Dong Nai and Long An Provincial People's Committee, and the relevant local authorities such as river way management agencies and electrical management agencies when the feasibility study on the expressway horizontal and vertical alignment, navigation clearance, land acquisition, and environmental assessment is made.

D. Terms of Reference for Consultants

12. The terms of reference under the TA include, but not limited to, the services set out below.

1. Traffic Demand and Flow Analysis

13. Collect data and information on origin-destination (OD) of trips, technical specifications and traffic volumes on the existing roads and highways in the vicinity of HCMC. Collect existing development plans for transport facilities such as relocation of logistics facilities and new port development, and agricultural, industrial and residential areas, and analyze road traffic demand generated from the development plans. Estimate potential demand increase in the project areas and analyze perspective of modal shift from motorcycles to passenger cars in future.

14. Develop a computer-based traffic assignment model for the HCMC road network as a tool of traffic flow analysis, noting that the model should be used for the economic analysis. Forecast traffic volume on the project expressway and the existing roads and highways, and traffic diversion to the project expressway. Identify change of travel distance and time for each OD pair, and change of average travel speed of each road link between before and after completion of the expressway. Determine number of lanes of the expressway based on the traffic demand forecast.

2. Highway Engineering

15. Review all technical aspects presented in the Government's pre-feasibility study and available engineering designs. Recommend general alignment for the expressway based on the comparative analysis with respect to relevance to the existing economic development plans and strategies, socioeconomic impacts on the project area, engineering difficulty, cost estimate, and social and environmental impacts of the possible expressway alignment options. Assist public consultation meetings on the expressway project to be held by the Ministry of Transport, VEC, and the project provinces and districts so that the general alignment will be determined at the early stage.

16. Identify technical requirements for bridges and tunnels for the Nha Be and Long Tau rivers, paying attention to navigation of large-size cargo ships. Undertake necessary engineering and social surveys and prepare initial design of the bridges and tunnels. Recommend adequate type of the river crossing structure based on construction cost and period, operation cost, and road safety.

17. Conduct topographical, geological, hydrological testing and surveys, or equivalent studies, for engineering designs of all work items. The surveys must comply with applicable procedures and standards of Viet Nam and supply sufficient data for documentation of the ensuing detail engineering design. Coordinate with etc in planning these engineering surveys in accordance with the General Guidelines on Feasibility Study (2008). Based on results of testing and surveys, prepare outline engineering designs of the expressway, including (i) horizontal and vertical alignment and typical cross section', (ii) interchanges and ramps, toll stations, and service areas', (iii) soft soil treatment, (iv) pavement, (v) bridges, tunnels, and culverts', (vi) drainage facilities', (vii) road safety features', (viii) environmental protection works', (ix) landscaping; and (x) changes of the existing roads and highways.

18. Review the existing and planned traffic control and operation systems for the HCMC urban expressway. Prepare basic design for guide signs, traffic flow counters, information boards, toll collection system, and communication system, ensuring easy upgradeability, extensibility, and connection to the other systems with reasonable cost.

19. Estimate bills of quantities and unit prices for all work items, and civil works cost for expressway construction. Review the current road maintenance operation and management systems, and estimate the costs of routine and periodic maintenance for the expressway. Recommend suitable road maintenance operation and management systems and necessary equipment.

3. Transport Economics

20. Review the current status and future plans of road development in the greater HCMC area. Evaluate the economic growth potential of the project area on the basis of existing and planned investment projects. Identify the role of the project in the framework of the Government's Socioeconomic Development Plan (2006-2010).

21. Describe the provision of transport services within each country and between countries along the Southern Economic Corridor, evaluate competition in the provision of services and setting of tariffs, and determine the project's potential to improve these services. Determine how much benefit from improving the transport network will be passed on to different end users, particularly the poor.

22. Review traffic counts and OD surveys, and obtain any additional necessary information on the present pattern of traffic by vehicle type and mode in the zone of influence of the Project. Assess the capacity of the existing road networks and the effects of the capacity constraints on vehicle operating costs (VOCs), travel time, and patterns of transport movement. Review VOC information by vehicle type, calculate VOCs for existing and proposed road networks, and quantify the benefits using shadow prices.

23. Undertake economic evaluation in accordance with the ADB'S Guidelines for Economic Analysis of Projects for the Project, comprising various components, during construction and operation by calculating the economic internal rate of return. A standard conversion factor or a shadow exchange rate factor will be used. The analysis should take into account construction, operation and maintenance costs, VOCs, passenger and freight time savings, producer surplus, accident savings, climate change impacts, and any other quantifiable benefits attributable to the Project. Undertake sensitivity analysis, calculate switching values, and carry out risk analysis.

24. Carry out distribution analysis of project benefits, calculate the poverty impact ratio, and undertake a cause-and-effect analysis. Develop a results-based monitoring system, using the design and monitoring framework in an ADB format, including monitoring indicators that will be used to assess project performance, and baseline and target values for the selected indicators.

4. Financial Analysis and Expressway Operation:

25. Review and update the proposed financing plan of the Project. Calculate a discounted return to equity over the project life, and assess its attraction for private investment. Financially evaluate the Project during construction and operation by calculating the financial internal rate of return, using proposed toll rates, and compare it with a weighted average cost of capital. Determine and justify appropriate toll rates by vehicle type? Taking into account the relationship between the toll rates and cost of providing the road services. Undertake sensitivity tests and risk analysis.

26. Assess and prepare pro-forma financial statements for a proposed expressway project and consolidated VEC over the life of ADB loan based on ADB'S Guidelines for the Financial Management and Analysis of Projects (2008). The financial assessment of the operating entity should include (i) corporate planning and budgetary control, (ii) financial and management accounting, (iii) cost accounting, (iv) internal control and audit system, and (v) data processing. In light of ADB'S Policy on Governance (1995.), recommend ways to improve corporate governance of VEC. Assess VEC'S financial management capacity so that ADB can design fund flow mechanism for the ensuing project and identify appropriate disbursement procedure.

27. Explore the possibility of private sector participation in expressway development and operations in Viet Nam and assess the potential for operating the project expressway as a corporation or as a concession by the private sector. Identify arrangements to implement such a strategy, considering options such as leasing, secularization, joint venture, build-operate-transfer, and other arrangements for operation and maintenance.

5. Environmental Assessment

28. Prepare a full environmental impact assessment (EIA) according to ADB'S Environment Policy (2002) and Environmental Assessment Guidelines (2003), and the Government's environment regulations. In preparing the EIA, the consultants will carry out the following tasks for the Project: (i) review the environmental documentation prepared by the Government and the Government's related laws, regulations and environmental and vehicle standards, and identify the updating needs and gaps that must be filled to comply with existing regulations and ADB'S environmental safeguard requirements', (ii) conduct field surveys along the proposed alignments and areas in the vicinity of the expressway to identify anticipated environmental impacts, including potential cumulative and regional impacts, and conduct comprehensive environmental analyses on project alternatives, and conduct soil survey to assess the type of soils crossed and the potential environmental impacts linked to the Project', (iii) compare the project alternatives, and make a comparative assessment between the project and the alternatives', (iv) carry out air quality and noise simulations on the basis of the predicted traffic flow, vehicle types, and emission factors', (v) carry out soil erosion studies in mountainous areas and propose measures for enhancement of erosion control, (vi) assess other potential environmental impact-direct, indirect, and cumulative-including but not limited to impact on water quality and hydrology, solid wastes, soil, flora and fauna: public health, and road safety, and propose mitigation measures and environmental management activities to be included in the environmental management plan, and assess the potential impact of alternatives to the Project', (vii) develop an environmental management plan (EMP) that includes institutional requirements, environmental monitoring program, mitigation measures, and estimated costs, and (viii) review the institutional capacity of VEC for environmental management and propose an institutional framework and capacity-building plan. The format and content of detailed EIA and summary ETA (SEIA) reports are to follow closely that detailed on ADB'S website (<http://www.adb.org>).

29. The coastal protection values of mangrove ecosystems are becoming increasingly recognized. Therefore, prepare a mangrove management and monitoring plan in order to (i) identify measures to avoid or minimize the loss of mangroves ecosystems along the proposed alignment, (ii) identify practical and cost-effective measures to compensate for residual impacts and rehabilitate mangroves to protect coastal protection and regional ecosystem values, and (iii) Propose a regime of ongoing monitoring to ensure the success of mitigation and compensation measures and the health of mangrove ecosystems.

30. Estimate cost of the mitigation measures and the environmental management plan, and make an economic assessment of the potential environmental impact of the Project. Reflect necessary environmental mitigation measures to minimize adverse impacts during construction and operation of the expressways in the procurement documents. Discuss these matters with VEC and obtain consensus, and prepare a public consultation plan and materials, assist VEC in conducting at least two public consultations, and document the consultation process and results.

6. Resettlement Plan

31. Undertake the following resettlement tasks in accordance with ADB's Involuntary Resettlement Policy (1995) and other relevant policies and guidelines of ADB, i.e., Policy on Gender and Development (1998), Policy on Indigenous Peoples (1998), Accountability Mechanism (2003), and Public Communications Policy (2005)³ (i) undertake social analysis in line with ADB'S Policy on Involuntary Resettlement and Handbook on Resettlement: A Guide to Good Practice and Handbook on Poverty and Social Analysis and review and assess impacts of land acquisition or loss of land-use on project affected persons, in terms of loss of homes, agricultural, aquaculture, forestry and other lands, or loss of access to current income generating activities, and in terms of impacts caused by permanent or temporary acquisition', (ii) Carry out a full census of the affected people and an inventory of the assets and access they stand to lose, in full or in part, permanently

or temporarily, regardless of tenure, conduct a baseline socioeconomic and perception survey of at least 10% of the people who will be affected by the Project, and 20% of those who will be severely affected', and determine the replacement costs of all categories of losses', (iii) prepare a full resettlement in accordance with ADB's Policy on Involuntary Resettlement and Operations Manual (OM) F2, and (iv) estimate the cost of land acquisition and resettlement. The full resettlement plan will cover the proposed project and all auxiliaries' facilities (interchange, services areas etc.). The resettlement plan will become the property of VEC and must therefore be written in full consultation with VEC and the responsible institutions in the project area, which must deem it capable of implementation in Viet Nam, as appropriate, while still meeting ADB'S policy requirements. Preparation is to involve full stakeholder-participation including VEC and the responsible institutions in the project area.

32. Assist VEC in the land acquisition and resettlement planning process, and monitor information disclosure to the project alerted persons in compliance with ADB'S Public Communications Policy and in consultation with the project affected persons. Assess the capacity of the responsible institutions in the project area to plan and implement the resettlement plan and to design and implement training and capacity-building interventions.

33. Design and implement a consultation and disclosure program. Prepare an information brochure to be distributed to the project affected persons by VEC. It should contain a brief description of the Project, the types of impacts, basic compensation policy and entitlements implementation schedule, implementing organizations, public consultation mechanisms, and grievance procedures.

34. Propose compensation strategies / innovative measures to address long-term support to households who will be made landless, seriously affected, and those who belong to the poor and vulnerable affected households. This will entail review effectiveness and relevance of current regulations, legislations and other policies for sharing benefits of projects (power or transport) with affected people and prepare guidelines for benefit sharing mechanisms in line with Vietnamese context that have incorporated lessons learned from other countries and in consultation with the Government.

7. Poverty and Social Impact Assessments

35. To assess the potential impact of the Project on poverty and social conditions, (i) conduct a full poverty and social analysis in accordance with ADB'S Handbook on Poverty and Social Analysis (2001) and Policy on Indigenous Peoples (1998), (ii) assess how the proposed Project may help improve people's livelihoods', (iii) assess gender issues, ethnic minority issues, identify vulnerable groups, and recommend measures to address impacts and promote development opportunities during construction, and operation and maintenance of the Project', (iv) estimate (a) the number of project beneficiaries by area, occupation, and income', and (b) the number of adversely affected people by type of impact', (v) assess the risks of HIV/AIDS and human and drug trafficking caused by the Project and propose mitigation measures for any high-risk groups', (vi) quantify how the Project will improve benefits for local people by income group and ethnicity', and (vii) formulate an ethnic minority development action. The objective will be to minimize the negative impact of the Project through appropriate mitigation measures and to maximize its positive impact by including appropriate measures that are consistent with a major transport infrastructure project. These tasks will be guided by ADB'S Handbook on Social Analysis (2007) and Core Labour Standards Handbook (2006).

36. Prepare socioeconomic and poverty profiles for the project area. The information should include population, income levels, occupations, unemployment, education levels, health conditions, transport expenditures, and other relevant socioeconomic data, separated by gender and ethnicity. Poverty incidence will be assessed in terms of (i) poverty (US\$ 1 poverty line), (ii) extreme poverty (use the Viet Nam poverty line), and (iii) vulnerability (US\$ 2). Review the government's policy, strategy, and programs for poverty reduction and regional economic development. Conduct surveys to develop a profile of transport services and costs, which are available in the project areas, and assess whether accessibility is affordable for low-income groups.

37. Undertake the following poverty studies: (i) in coordination with the above ethnic minority development and resettlement studies, collect quantitative data on the poverty situation in the project area, and conduct a participatory appraisal and assess the poverty situation in the project area (by gender and ethnic grouped; (ii) describe the causes and incidence of poverty in the project area by various ethnic groups, and prepare a poverty matrix for ethnic minority groups', (iii) assess the extent to which economic growth potential of the project area will have an impact on economic opportunities and the livelihood system of various ethnic groups, with a specific focus on ethnic minority groups', (iv) assess the impact of the project on poverty reduction, provision of social services, movement of goods and people, and wage-employment during construction work and employment opportunities in the project area, (v) identify potential barriers for the poor to benefit from economic growth and recommend interventions that may be included in the project to maximize the impact of Project on poverty reduction for poor households, ethnic minority groups, vulnerable groups, and poor women; and (vi) develop poverty impact monitoring indicators by ethnic groups and gender.

8. Ethnic minorities

38. If the social analysis determines that ethnic minority people are likely to be affected significantly by the Project because of land acquisition and resettlement or that ethnic minority people are disadvantaged or vulnerable because of their social or cultural identity, an Ethnic Minority Development Plan (EMDP) will be prepared to address the concerns of the ethnic minorities in accordance with ADB'S Policy on Indigenous People (OM-F3) and in full consultation with VEC and key shareholders, and concerned ethnic minority groups. If impacts on the ethnic minority people are not significant, some specific actions will be proposed in the resettlement plan in order to ensure that members of ethnic minority groups will fully benefit from the project.

39. To prepare an EMDP, (i) identify Government policies in relation to ethnic minority population, (ii) in coordination with the resettlement specialist to prepare a resettlement plan, undertake an asset inventory survey and prepare an inventory of lost assets for ethnic minority groups and prepare a comparative analysis for ethnic minority groups and the Kinh; (iii) undertake an socioeconomic survey of the ethnic minority groups affected by land acquisition, and resettlement including collection and analysis of data on land acquisition, displacement, temporary disruption etc; (iv) prepare socio-cultural characteristics of the ethnic minority groups', (v) assess the extent to which resettlement will change the livelihood activities of the ethnic minority groups, and (vi) assess the socioeconomic influence of the dominant ethnic groups) on the ethnic minorities in the Project areas.

40. In coordination with the resettlement specialist, develop strategies and mechanisms for ethnic minority groups in the following areas: (i) livelihood strategies, (ii) local level consultation process, (iii) appropriate information disclosure process, and (iv) appropriate grievance process', and develop specific measures and approaches to be taken to address the concerns of the ethnic minorities.

41. Identify areas for institutional strengthening of VEC in implementing EMDP and recommend capacity building training of VEC staff. Develop monitoring indicators for the implementation of measures for ethnic groups under the resettlement plan. Prepare a budget for the activities required under the EMDP and an implementation schedule.

9. Social Development and Gender Action Plan

42. Conduct focus group discussion, consultation with various shareholders, to assess the following: (i) existing access to market and movement of goods to other provinces and potential increase in access to market and movement of goods', (ii) the potential for increases in manufacturing of goods, farm production, agribusinesses and other commercial venture in the Project areas and its positive and negative impact on the population in the Project areas', (iii) the potential for increases in land and property value and commercial development in the Project area together with possible impacts arising from the displacement of middle, low income and poor people', and (iv) the impact on people's daily life and livelihood activities arising from the expressway cutting through farm land, urban and semi-urban settlements. Undertake focus group discussion with the affected communities to determine community infrastructure to be included in the Project design.

43. Prepare demographic, social, and economic profiles of the population within the project area, including the districts and communes, e.g., profiles of primary and secondary beneficiaries the poor, and the vulnerable (disaggregated by gender and ethnicity) –their needs, demands, constraints, and capacity, as well as access to social (education and health facilities) services (disaggregated by gender and ethnicity), using census and secondary data. Identify key gender issues in the project area and prepare a gender analysis. Assess the impact of land acquisition and resettlement on (a) women (by ethnic group) from the affected households, and (b) women-headed households.

44. Prepare resettlement related gender strategy, which is to include measures to minimize the negative impact of relocation and land acquisition on women from various ethnic groups, specifically poor women-headed households from various ethnic groups', and also measures to ensure that: (i) women do not become more vulnerable because of relocation', (ii) women are involved in the consultation process, for preparation of loss-of-inventory, and grievance procedures on resettlement and compensation issues; (iii) women retain land title and or access to land-user titles during resettlement', (iv) women are involved in community level information disclosure', (v) women are involved in the selection of resettlement sites and identification of income restoration activities, (vi) women's income restoration activities are linked to existing micro-credit programs, training, extension, and (vii) women are involved in community level mechanisms to address potential social problems in the project. Identify groups, such as women's unions, that can provide inputs to gender issues during the preparation and implementation of resettlement activities and activities related to ethnic minorities. Identify the capacity-building training needs of provincial, district, and commune resettlement committees.

45. Assess potential impacts of construction related activities on living condition of the people around the construction sites. These impacts include: air pollution due to rock crushing, cutting and filling works, asphalt processing, disposal of waste, and general construction noise. Develop mitigation strategies to address any negative impact.

46. Prepare social monitoring indicators for the Project and the resettled communities. Develop gender sensitive activities, gender-based monitoring indicators, and budgets at the community level as well as district level, in relation to the HIV/AIDS and human trafficking prevention program.

10. Prevention of HIV/AIDS and Human Trafficking

47. Collect information on incidence of HIV/AIDS and human trafficking in the Project area. Assess the type of and level of vulnerability of the population along the proposed expressway to HIV/AIDS (disaggregated by gender, ethnicity, age type of occupation, mobility, etc) and human trafficking, and assess the potential risk of HIV/AIDS and human trafficking. Review existing government programs in the Project area for prevention of HIV/AIDS and human trafficking as well as programs implemented by donors, nongovernmental organizations (NGOs). Assess the capacity building training need assessment of the HCMC, Provincial, and District Committees responsible for implementing HIWAIDS awareness and prevention of human trafficking program. In coordination with existing programs, recommend a HIV/AIDS awareness and prevention of human trafficking program for the Project (construction and post construction period). Recommend relevant linkages with other donors and NGOs' programs. Prepare budget for awareness campaign, activities for preventive measures, HIV/AIDS tool kits for the health facilities in the Project areas, capacity building training cost and implantation of the program.

11. Public Consultation

48. Help establish consultation and participatory processes during project preparation that will continue throughout project design, construction, and operation. Stakeholders should be identified and representatives consulted so their needs and demands can be considered for incorporation into the Project or as parallel initiatives. Prepare a stakeholder participation and consultation report.

12. Assistance to ADB Loan 'Processing and the government Approval

49. ADB'S project team will start loan processing for the Ben Luc-Long Thanh Expressway Project immediately after the consultants submits a draft final report to ADB. The ADB board approval of the loan for the project is expected in the third quarter of 2010. Assist the project team

in undertaking fact-finding and appraisal missions, and finalizing the necessary project documents, including economic and financial assessment, EIA and summary EIA, resettlement plan and the EMDP if required. Also, assist VEC in obtaining the Government approval of the feasibility study of the Ben Luc-Long Thanh Expressway Project.

E. Reporting and Meeting Requirements

50. The consultants will prepare the following documents and reports, and submit 3 copies in English of them to ADB and 17 copies (2 English and 15 Vietnamese) to VEC: (i) an inception report, to be submitted within 1 month after the start of the services', (ii) brief monthly based on the implementation and the staffing schedules' (iii) an interim report progress reports in the form of the Government of Viet Nam's General Guidelines on Feasibility Study (2008), to be submitted within the fourth month of the services', (iv) draft final reports (a feasibility study report, an EIA report, and a resettlement plan report) including all outputs of the consulting services in the form of the Government of Viet Nam's General Guidelines on Feasibility Study (2008), to be submitted within 7 months of the start of the services', and (v) final reports incorporating ADB'S and VEC'S comments on the draft final reports, to be submitted within 9 months of the start of the services (by the end of January 2010). The structure and contents of the final reports will be developed through discussions with ADB and VEC.

51. VEC will undertake additional engineering studies by using the TA counterpart fund to prepare the Government's project feasibility study report for approval of the Project in parallel with ADB'S consulting services. VEC will provide outputs of the additional engineering studies to the consultants. The consultants will incorporate the outputs into the final reports in Vietnamese, and prepare a consulting service completion report in Vietnamese no later than 30 June 2010. The consultants will submit one copy of the report to ADB Vietnam Resident Mission and 15 copies to VEC.

52. A workshop will be held after the submission of the interim report to present a proposal for the general expressway alignment, project benefits, project cost estimate, economic and financial viability, and potential social and environmental impacts to the Government, VEC, potential co-financiers, nongovernment organizations, and other shareholders. A tripartite meeting will be held after the submission of the draft final reports to confirm the project feasibility.

APPENDIX B:

TRAFFIC DEMAND

AND FLOW

ANALYSIS REPORT

**TRAFFIC DEMAND AND FLOW ANALYSIS REPORT
FINAL REPORT**

**TA 7155-VIE PREPARING THE BEN LUC-LONG THANH
EXPRESSWAY PROJECT
IN
VIETNAM**

FEBRUARY 2010

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1. COLLECT DATA AND INFORMATION

A great amount of data and information of the Ho Chi Minh City area was collected so that the traffic forecast could be as accurate as possible. The following reports and studies were used extensively:

- HOUTRANS Model: The traffic demand forecast was based on the Study on Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area which is commonly known as HOUTRANS. This model was produced using JICA funds in June 2004. The HOUTRANS model predicted person trip base trips. HOUTRANS study has set 30% and 50% target for public transport use by 2020. This model was kindly lent to the project by JICA so that it could be adapted for the traffic forecast of the Ben Luc – Long Thanh Expressway Project.
- JETRO Study on Southern Inter-Regional Highway: The Study on Southern Inter-Regional Highway including Binh Khanh and Phuoc Khanh Bridge, in the Socialist Republic of Vietnam was produced using funds from the Japan External Trade Organization or JETRO in March 2008.
- ADB TA No. 4695 –VIE : HCMC – Long Thanh - Dau Giay PPTA (Finroad in association with Bacco)
- Study on the terminal operation for Cai Mep/Thi Vai ports in Vietnam (JETRO, March 2007)
- The Comprehensive Study on the Sustainable Development of Transport System in Vietnam (VITRANSS2) Interim Report (Draft)(JICA, August 2008).

1.1. Traffic Surveys

For the purpose of obtaining the traffic data for traffic demand forecast, traffic surveys were conducted in July 2009.

1.1.1. Outline of the Traffic Surveys

Types of Traffic Surveys

The traffic surveys consisted of the following two surveys:

Table 1: Types of the Survey

Survey Name	Survey Period [Date]	Survey Time
(1) Traffic Count Survey	3 days (Weekday) [22/June/2009~24/June/2009]	24 hours (6:00 ~ 6:00)
(2) Roadside OD Interview Survey	1 day (Weekday) [23/June/2009]	24 hours (6:00 ~ 6:00)

Source: Consultant

Locations of the Surveys

Traffic surveys were carried out on two major roads near the start and end of the Project, i.e., National Highway No.1 and No.51. These roads are to be connected by the proposed Project as shown in the map in Figure 1 below.

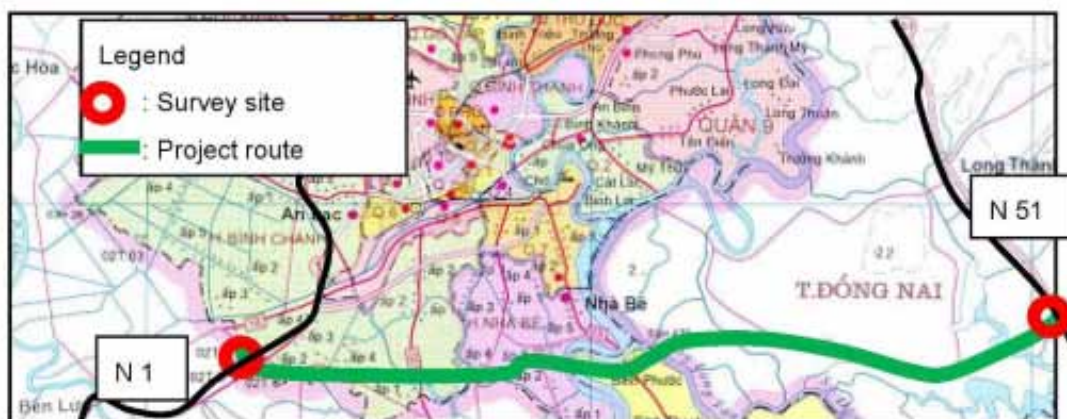


Figure 1: Traffic Survey Location

Zone Coding

As an analytical unit, the zone for the OD survey is split and set up based on HOUTRANS¹ zoning system, but two zones were divided for the this project traffic analysis as shown below.

Table 2: Zoning Difference between This Study and HOUTRANS

This Study Zone Number	Area	HOUTRANS Zone Number	Area
216	CAN GIO DISTRICT, Binh Khanh	216	CAN GIO DISTRICT
273	CAN GIO DISTRICT, An Thoi Dong, Can Thanh, Long Hoa, Ly Nhon, Thanh An		
265	NHON TRACH DISTRICT Vinh Thanh	265	NHON TRACH DISTRICT Vinh Thanh, Phuoc An, Phuoc Khanh
271	NHON TRACH DISTRICT Phuoc An		
272	NHON TRACH DISTRICT Phuoc Khanh		

¹ HOUTRANS: The Study on Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area): This study was carried out as Transport master plan in Ho Chi Minh by JICA (June 2006)



Figure 2: Zone Coding Map (1)

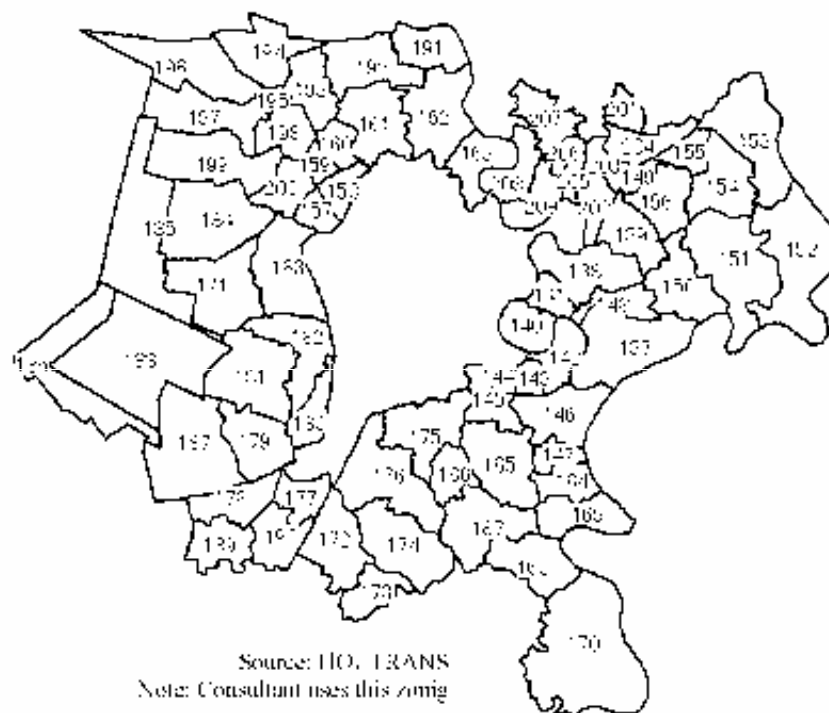


Figure 3: Zone Coding Map (2)



Figure 4: Zone Coding Map (3)

Vehicle Types

Classification of vehicle types for the traffic count survey is as follow. This classification basically follows the HOUTRANS (2004).

- Bicycle
- Motorcycle
- Passenger Car
- Taxi
- Cyclo
- Lambro
- Minibus
- Standard Bus
- Small Truck
- Big Truck
- Container Truck
- Others (military, police, ambulance and etc.).

Surveyed vehicle types for OD survey are listed below.

- Motorcycle
- Passenger Car
- Minibus
- Standard Bus
- Small Truck
- Big Truck
- Container Truck

1.2. Results of the Survey**1.2.1. Through Traffic on NH1A and N51**

Daily traffic volumes are shown in the following tables.

Table 3: Traffic Count Survey Results Highway N1A

Direction	Date	Motorcycle	Passenger Car	Taxi	Minibus	Standard Bus	Small Truck	Big Truck	Container Truck
HCM-Longan	22-Jun-09	22,452	2,465	295	2,361	1,437	2,313	2,678	769
	23-Jun-09	25,579	1,795	243	2,319	1,204	2,481	2,993	679
	24-Jun-09	26,423	2,692	282	2,384	1,433	2,511	2,640	788
	Ave	24,818	2,317	273	2,355	1,358	2,435	2,770	745
Longan-HCM	22-Jun-09	29,856	2,248	262	2,758	1,164	3,058	3,438	1,101
	23-Jun-09	26,882	3,010	260	2,184	1,144	2,980	2,801	393
	24-Jun-09	27,221	2,835	262	2,762	1,197	2,456	2,422	432
	Ave	27,986	2,698	261	2,568	1,168	2,831	2,887	642
Both Directions		52,804	5,015	535	4,923	2,526	5,266	5,657	1,387

Note: Vehicle/day

Source: Consultant

Table 4: Traffic Count Survey Results Highway N51

Direction	Date	Motorcycle	Passenger Car	Taxi	Minibus	Standard Bus	Small Truck	Big Truck	Container Truck
Dong Nai-	22-Jun-09	12,669	2,012	216	1,013	550	807	2,205	434
Vung Tau	23-Jun-09	14,129	1,759	165	970	370	404	1,810	387
	24-Jun-09	14,541	1,857	237	976	363	819	2,559	372
	Ave	13,780	1,876	206	986	428	677	2,191	398
Vung Tau -	22-Jun-09	13,288	1,912	180	582	194	1,928	1,056	541
Dong Nai	23-Jun-09	11,104	1,914	207	624	215	1,899	1,367	411
	24-Jun-09	11,724	1,983	214	659	230	1,689	1,475	449
	Ave	12,039	1,936	200	622	213	1,839	1,299	467
Both Directions		25,818	3,812	406	1,608	641	2,515	3,491	865

Note: Vehicle/day

Source: Consultant

1.2.2. Fluctuation of Hourly Traffic Volume

Traffic volume at NH51

Traffic volumes of 4 wheel vehicle are shown below

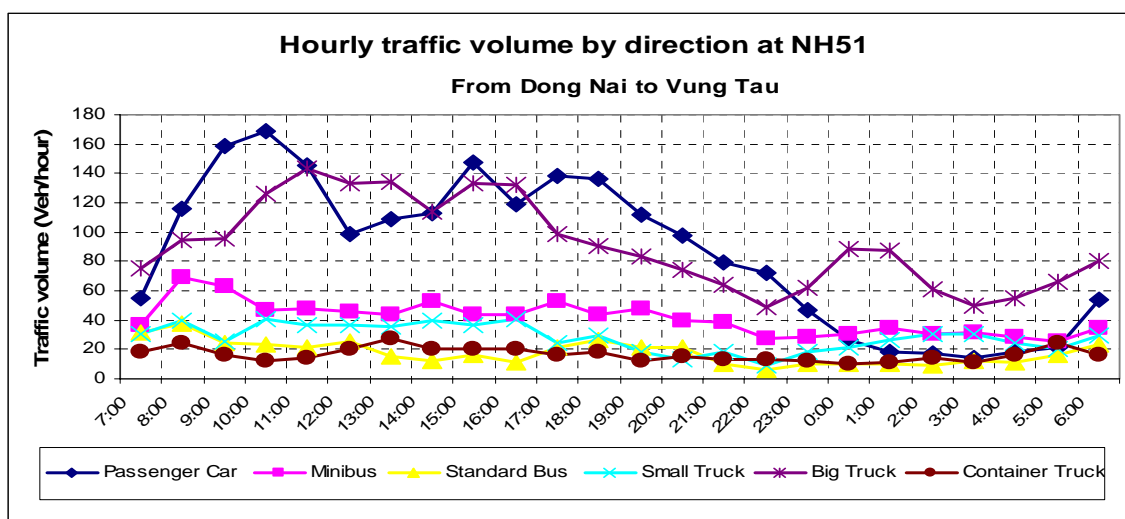


Figure 5: Hourly Traffic Volume by direction NH51 Dong Nai to Vung Tau

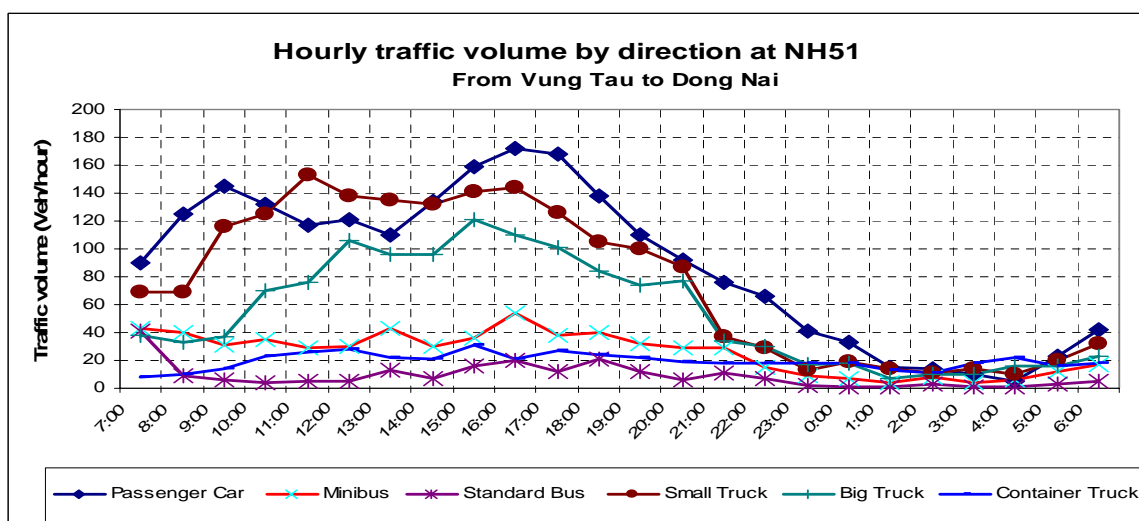


Figure 6: Hourly Traffic Volume by direction NH51 Vung Tau to Dong Nai

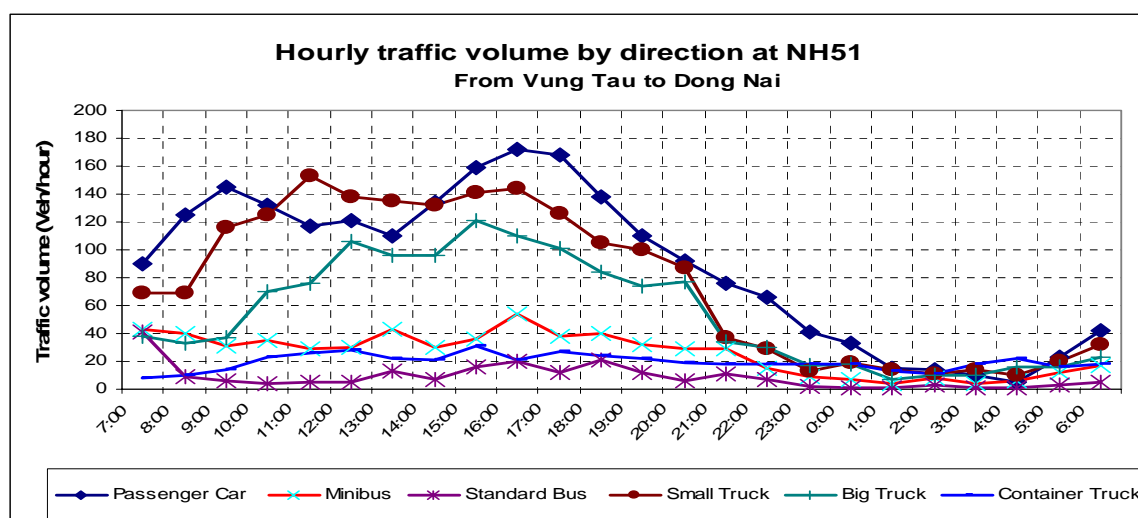


Figure 7: Hourly Traffic Volume both directions NH51

2. TRAFFIC MODEL

2.1. Current OD and Road Network

2.1.1. Traffic Demand and Flow Analysis

Traffic demand was forecasted for target years 2016 (start of operations), 2026 and 2036. The traffic model is based on HOUTRANS data. The study team used the JICA STRADA software package for traffic demand analysis which HOUTRANS also used for the demand forecasts. The JICA STRADA is a computer software programme developed for the JAPAN ODA project by JICA for application in transport demand analysis and assignment. The STRADA is adapted for many traffic demand forecasts for transport projects.

2.2. Socio –Economic Frame work

Traffic volume is related to the socio-economic indicators such as GRDP and GRDP per capita. Thus GRDP and GRDP per capita were estimated for demand forecasts. Each district has plan of population and GRDP in 2020. This study basically used these data.

HOUTRANS study area is HCM and some adjoining areas such as Binh Dong, Dong Nai and Long An. On the other hand, the end of the project is located near the boundary of Ba Ria - Vung Tau. Ba Ria area economic activity will influence traffic volume of the project. Therefore, this study set a socio-economic frame of Ho Chi Minh and the adjoining area including Binh Dong, Dong Nai, Long An and Ba Ria - Vung Tau Provinces.

2.2.1. Population

Ho Chi Minh City and the adjoining provinces have been increasing rapidly. The annual average growth rate (2002 – 2009) of Binh Duong and Ho Chi Minh has been high. The trend will probably be maintained in the near future. However, in the far future, the growth rate could well decrease. Ho Chi Minh City expects a population of ten-million in 2020. Other districts also have a 2020 population plan. These areas forecast that in 2020 they will maintain similar average growth rate that have been experienced until now. On the other hand, Ba Ria - Vung Tau's growth rate has been more than 5%. This is too high a growth rate to be maintained. Therefore it is assumed that Ba Ria - Vung Tau population growth rate will be 2.0%. After 2020, it is assumed that the growth rate will be reduced further.

These future growth rates are acceptable considering the past trends. Population growth rates are set as shown in Table 5 considering these situations.

Table 5: Population of Ho Chi Minh City and Adjoining Area 2002 to 2009

	2002	2003	2004	2005	2006	2007	2009*	Average Growth 2002 – 2009
Ho Chi Minh City	5,479	5,555	5,731	5,912	6,108	6,347	6,807	3.1%
Dong Nai	2,096	2,143	2,172	2,195	2,225	2,253	2,330	1.5%
Binh Duong	788	851	886	923	967	1,023	1,134	5.3%
Ba Ria - Vung Tau	856	885	898	914	935	947	986	2.0%
Long An	1,364	1,392	1,401	1,412	1,423	1,431	1,465	1.0%
Adjoining Area	5,103	5,271	5,357	5,444	5,550	5,654	5,915	2.1%

Note: Source: General Statistic Office of Vietnam,

*: estimated by consultant

Unit: Thousand

Table 6: Estimated Population of Ho Chi Minh City and Adjoining Area 2009-2020

	2009	2010	2015	2016	2020	Average Growth 2002-2007
Ho Chi Minh City	6,807	7,049	8,396	8,695	10,000	3.6%
Dong Nai	2,330	2,369	2,576	2,619	2,800	1.7%
Binh Duong	1,134	1,194	1,545	1,627	2,000	5.3%
Ba Ria-Vung Tau	986	1,006	1,113	1,136	1,231	2.0%
Long An	1,465	1,483	1,574	1,592	1,670	1.2%
Adjoining Area	5,915	6,052	6,807	6,974	7,701	2.4%

Note: Source: Ho Chi Minh City in 2020= Masterplan of socio - economic up to 2020 of HCM city, by Economic Institute of HCM city, 2006. Dong Nai in 2020 = Prime Minister Decision No. 73/2008/QĐ-TTg. Prime Minister Decision No. 81/2007/QĐ-TTg. Binh Duong = Long An in 2020 = www. longan.gov.vn. Rest of the populations were estimated by consultants.

After 2020,

The consultant has assumed that the population growth rate will be reduced. The growth rates are as shown in below;

Table 7: Future Population Growth Rate

	2010-2020	2020-2030	2030-2036
Ho Chi Minh City	3.6%	3.1%	2.6%
Adjoining Area	2.4%	2.0%	1.5%

Source: Consultant

2.2.2. Gross Regional Domestic Product (GRDP)

The Gross Regional Domestic Product of Ho Chi Minh City and adjoining area have had large increases. The Ho Chi Minh City average growth rate has been 12.5% and the adjoining Provinces 12.5% per year were from 2002 to 2007. Forecasts to 2010 were used as DRGP for the demand forecast. It assumed that Ho Chi Minh will keep high growth rate, but adjoining area's growth rate will decrease in the future, the increasing trend will be maintained but the growth rate will be decreased.

Table 8: GRDP of Ho Chi Minh and Adjoining Area

Unit: VMD Billion at 1994 constant price

	2002	2003	2004	2005	2006	2007	2008	2009*	Average Growth 2002 – 2009
Ho Chi Minh City	63,670	70,947	79,237	88,866	99,672	112,258	124,220	132,294	11.0%
Dong Nai	13,058	14,798	16,813	19,179	21,941	24,850	n/a	n/a	
Binh Duong	5,557	6,359	6,973	8,482	9,757	11,225	n/a	n/a	
Ba Ria-Vung Tau	27,844	30,836	36,903	39,235	42,244	48,045	n/a	n/a	
Long An	5,617	6,132	6,728	7,461	8,294	9,784	n/a	n/a	
Adjoining Area	52,076	58,125	67,417	74,357	82,236	93,904	n/a	106,508	10.8%

Source: Statistic book and plan 2005-2010 of all provinces in southeast key economic zone (Development Strategy Institute in the South of MPI)

Note: *=estimation by consultant

The consultant assumed the growth rate as shown below (Refer to the chapter about economics),

Table 9: Future GRDP Growth Rate

	2010-2020	2020-2030	2030-2036
Ho Chi Minh City	8.5%	7.8%	7.0%
Adjoining Area	8.5%	7.8%	7.0%

Source: Consultant

2.2.3. Gross Domestic Product per capita of Region

The Gross Domestic Product per capita of Ho Chi Minh City and adjoining area are shown in the following tables:

Table 10: Gross Domestic Product per capita of Ho Chi Minh City and adjoining area

	2002	2003	2004	2005	2006	2007	2009	Average Growth 2002 – 2009
Ho Chi Minh City	11.6	12.8	13.8	15.0	16.3	18.1	21.3	9.1%
Dong Nai	6.2	6.9	7.7	8.7	9.9	11.0	14.0	12.3%
Binh Duong	7.1	7.5	7.9	9.2	10.1	11.0	12.2	8.2%
Ba Ria-Vung Tau	32.5	34.8	41.1	42.9	45.2	50.7	60.3	9.2%
Long An	4.1	4.4	4.8	5.3	5.8	6.8	8.7	11.3%
Adjoining Area	10.2	11.0	12.6	13.7	14.8	16.6	20.1	10.1%

Source: Consultants

Table 11: Future GDP per Capita Growth Rate

	2010-2020	2020-2030	2030-2036
Ho Chi Minh City	6.2%	5.2%	4.3%
Adjoining Area	7.4%	6.4%	5.4%

Source: Consultant

3. TRAFFIC MODEL

3.1. Base Year (2009) Validation

3.1.1. Road Network

The 2009 road network was updated using the 2002, 2010 HOUTRANS road network and current road network information. Our study adopted HOUTRANS road data such as capacity and maximum speed.

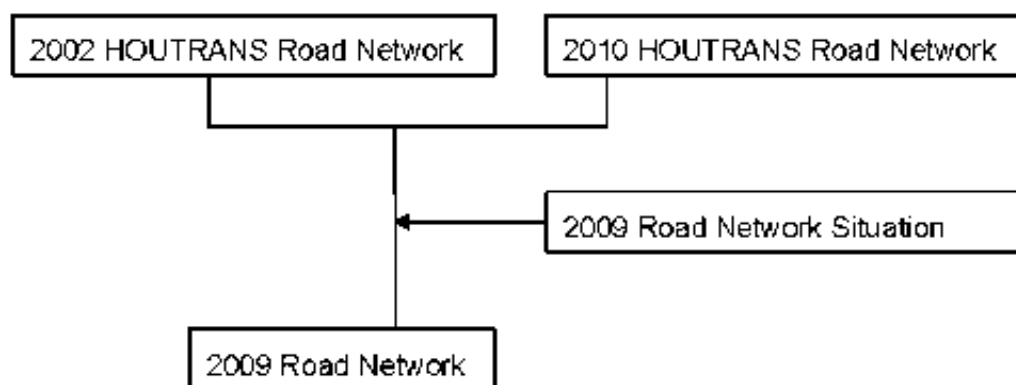


Figure 8: Updating the Traffic Model

The Major Differences of 2010 and 2009 are follows;

- West East Highway is not open yet (still under construction) in 2009.
- Arraignment of North section of Nguyen Huu Tho road
- Ho Hoc Lam road doesn't connect Trinh Quang Nghi in 2009



Figure 9: Road Network in 2009

3.1.2. Road Capacity of the Model

The road capacity assumptions employed in the HOUTANS were based on Japanese standards and the assumption according to the situation observed in HCMC. This study accepts the capacity. The HOUTRANS road capacity is shown as below.

Table 12: Estimated Road Capacity by this Study Area used in the Model

Class	Urban/ Rural	V _{max}	Carriage-way		No. of Lanes	Cross Section (Max)	Q _{max} (PCU)/day		
			Min	Max			Service Level 1	Service Level 2	Service Level 3
Car Exclusive	Urban	80			2		26,000		
		100			4		88,000		
		100			6		132,000		
	Rural	70			2		20,000		
		80			4		70,000		
Primary	Urban	80			6		106,000		
		30		<6m	2	3m	16,250	17,500	20,000
		35	7m	<12m	2+α	3.5+2.5m	16,250	17,500	20,000
		40	13m	<20m	4+α	3.5+3.5+2.0m	56,250	63,750	70,000
		45	21m	<28m	6	3.5+3.5+3.5+2.0m	85,000	95,000	105,000
		50	29m <		8	3.5+3.5+3.5+3.5+2.0m	112,500	126,250	141,250
	Rural	40		<6m	2	3m	17,000	19,000	23,000
		45	7m	<12m	2+α	3.5+2.5m	17,000	19,000	23,000
		50	13m	<20m	4+α	3.5+3.5+2.0m	59,000	67,000	79,000
		55	21m	<28m	6	3.5+3.5+3.5+2.0m	89,000	101,000	119,000
		60	29m <		8	3.5+3.5+3.5+3.5+2.0m	119,000	135,000	158,000
		30		<6m	2	3m	13,750	16,250	17,500
Secondary	Urban	35	7m	<12m	2+α	3.5+2.5m	13,750	16,250	17,500
		40	13m	<20m	4+α	3.5+3.5+2.0m	48,750	55,000	61,250
		45	21m	<28m	6	3.5+3.5+3.5+2.0m	73,750	83,750	92,500
		50	29m <		8	3.5+3.5+3.5+3.5+2.0m	98,750	111,250	123,750
		40		<6m	2	3m	13,000	15,000	18,000
	Rural	45	7m	<12m	2+α	3.5+2.5m	13,000	15,000	18,000
		50	13m	<20m	4+α	3.5+3.5+2.0m	46,000	52,000	62,000
		55	21m	<28m	6	3.5+3.5+3.5+2.0m	69,000	79,000	92,000
		60	29m <		8	3.5+3.5+3.5+3.5+2.0m	92,000	105,000	123,000
		25		<6m	2	3m	13,750	15,000	17,500
Tertiary	Urban	30	7m	<12m	2+α	3.5+2.5m	13,750	15,000	17,500
		35	13m	<20m	4+α	3.5+3.5+2.0m	47,500	53,750	60,000
		35		<6m	2	3m	9,000	11,000	13,000
	Rural	40	7m	<12m	2+α	3.5+2.5m	9,000	11,000	13,000
		45	13m	<20m	4+α	3.5+3.5+2.0m	33,000	37,000	44,000

Source: HOUTRANS

3.1.3. Value of Time (VOT)

HOUTRANS estimated the value of time from the interview survey for road transport users. This study set VOT for 2016, 2026 and 2036 based on the HOUTRANS data.

Table 13: Value of Time in the Model

	2009	2016	2026	2036	Remarks
Motorcycle	0.33	0.42	1.02	1.32	Per Vehicle with average loads
Car	3.12	3.63	9.33	12.15	
Bus	17.66	22.36	54.76	70.63	
Truck	8.66	9.16	23.61	30.74	

Source: Consultant
Unit: US\$/Hour/PCU

3.1.4. The 2009 OD matrices

The 2009 OD tables were established with 2009 draft OD matrices based on HOUTRANS's OD tables, and the results of the traffic count survey. There are combination of 2009 and adjusted 2009 HOUTRANS based OD matrices, OD matrices on N1a and N51.

Process of establishment of 2009 OD matrices is shown below.

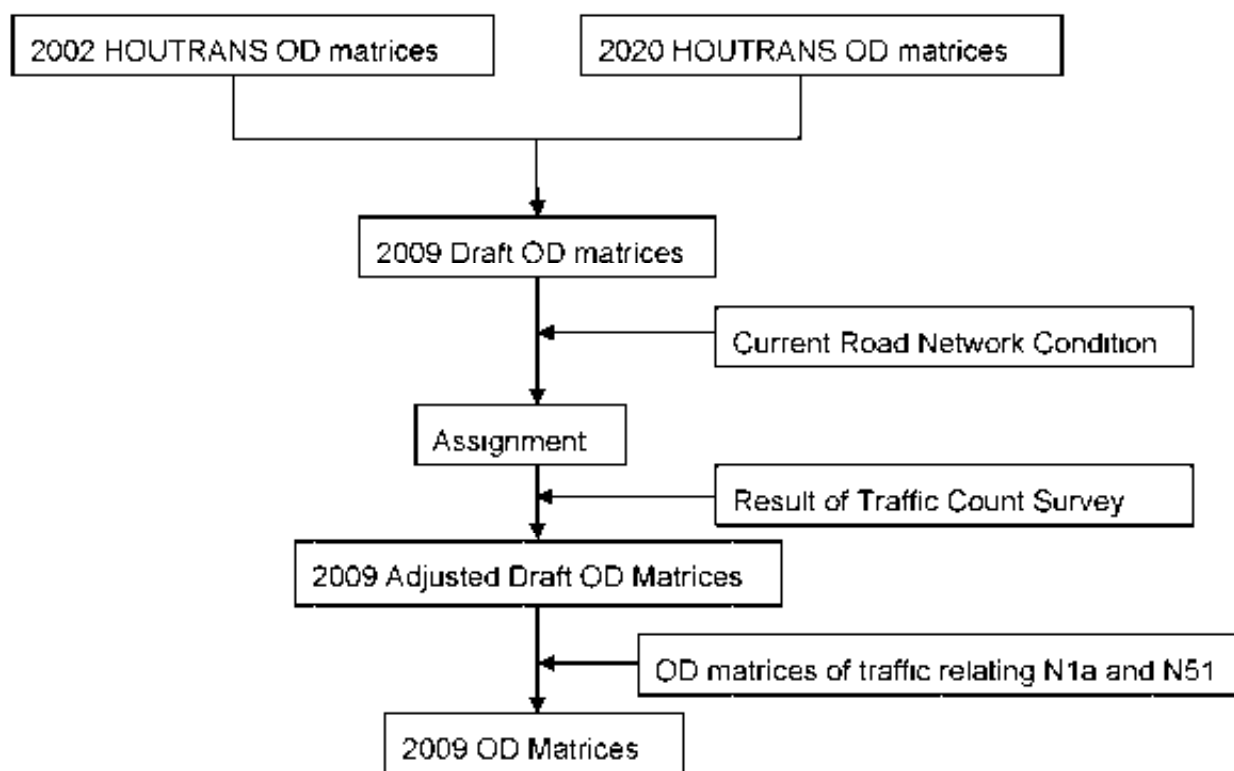


Figure 10: Process of Establishing of the 2009 OD Matrices

2009 Draft OD matrices

The 2020 Car OD matrix of HOUTRANS includes cars and trucks. Therefore, 2020 HOUTRANS Car OD matrix was divided into Car and Truck. Ratio of Car and Truck was used 54:48, person trip base in 2002.

The Draft 2009 OD matrix was calculated by interpolation method between 2002 OD and 2020.

The number of HOUTRANS OD zones is 270, but this study has adopted three extra zones for a total of 273 zones for a detailed analysis of the project area. Zone 2 was divided for detailed analysis using the ratio of population in 2008. Two zones (Zone 216 and Zone 265) in HOUTRANS were divided. Zone 216 was divided into 216 and 273. Zone 265 is divided into 265, 271 and 272.

Table division ratio of new zones (1)

Table 14: Division of Ratios for new Zone Can Gio

HOUTRANS Zone	This Study Zone	District	Ward	Population in 2008	Ratio
216	216	CAN GIO DISTRICT	BNH KHANH	18,032	26%
	273		AN THO IDONG	13,291	74%
			CAN THANH	11,424	
			LONG HOA	11,059	
			LY NHON	5,823	
			TAM THON HIEP	5,645	
			THANH AN	4,649	
			Total	69,923	100%

Source: Statistic Office of Can Gio Peoples Committee

Table 15: Division of Nhon Trach for new Zone

HOUTRANS Zone	This Study Zone	District	Ward	Population in 2008	Ratio
265	265	NHON TRACH DISTRICT	VINH THANH	16,050	47%
	271		PHUOC AN	7,240	21%
	272		PHUOC KHANH	11,014	32%
			Total	34,304	100%

Source: <http://www.nhontrach-dongnai.gov.vn>

2009 Adjusted Draft OD Matrices

The Assignment was done with the draft 2009 OD matrices and the 2009 network. Differences between results of assignment and traffic count surveys of NH1A and NH51 were analyzed. The difference ratio is used for adjustment of the 2009 draft OD matrices.

The difference in rates after the adjustment is 0.96 and 1.02. These differences are acceptable as 2009 Adjusted Draft OD Matrices. Table 16 shows the difference in ratios between the Traffic Count Survey result and Traffic Volume of Assignment in 2009 (Using Adjusted Draft 2009 OD matrices)

Table 16: Difference Ratio between Traffic Count Survey

	Survey	Assignment	B/A
	A	B	
N1a	52,900	50,587	0.96
N51	21,799	22,338	1.02

Unit : PCU/Day
Source: Consultant

OD matrices of traffic relating N1a and N51

OD matrices of traffic on National Highway 1A (near the starting point of the project) and 51 (near the end point of the project) were established using results of OD and Traffic count survey. Some trips may pass through two traffic survey sites. Double counted trips were therefore corrected (on the theoretical procedure).

The OD matrices relating N1A and N51 were adopted for part of 2009 OD matrices.

2009 Adjusted OD matrices relating trips N1A and N51 were replaced to the OD matrices of these OD matrices.

Distribution pattern

The HOUTRANS distribution patterns were adopted except for traffic that was obtained by the traffic survey for 2009 OD matrices except the NH1A and NH51 OD matrices.

3.1.5. Calibration of the OD matrices

Incremental assignment was carried out using the above road network and OD matrices. Differences between results of assignment and traffic count surveys were 0.90 – 1.03 as shown in the table below. These differences are acceptable for the traffic demand model.

Table 17: Ratio between Traffic Count Survey Result & Volume of Assignment in 2009

N1A	Survey	Assignment	B/A	N51	Survey	Assignment	B/A
	A	B			A	B	
MC	52,804	50,745	0.96	MC	25,818	25,480	0.99
Car	5,550	5,373	0.97	Car	4,219	4,244	1.01
Bus	7,449	6,729	0.90	Bus	2,249	2,219	0.99

Table 18: Opening Dates & Service of New Major Roads

Highway	Opening Date	Situation		
		2016	2026	2036
Ho Chi Minh-Trung Luong Expressway	2009	✓	✓	✓
Trung Luong-Can Tho Expressway	2015	✓	✓	✓
Ring Road #4, HTL to RR#2	2015	✓	✓	✓
Ring Road #4, HTL to Southern HCMC Expy	2020		✓	✓
Ring Road #4, Southern HCMC Expy to N1	2020		✓	✓
Ring Road #4, N1 to Hwy 20	2020		✓	✓
Ring Road #4, Hwy 20 to Hwy 13	2015	✓	✓	✓
Ring Road #4, Hwy 13 to HLN Expy	2015	✓	✓	✓
Ring Road #4, HLN Expy to Hwy 1A	2015	✓	✓	✓
Ring Road #3, HTL to Hwy 20	2013	✓	✓	✓
Ring Road #3, Hwy 20 to HLN Expy	2013	✓	✓	✓
Ring Road #3, HLN Expy to Hwy 1A	2013	✓	✓	✓
Ring Road #3, Hwy 1A to HLD Expy	2011	✓	✓	✓
Ring Road #3, HLD Expy to BT-LT Expy	Before 2020		✓	✓
Southern Ho Chi Minh Expy Long An	2011	✓	✓	✓
Southern Ho Chi Minh Expy Tay Ninh	2015	✓	✓	✓
N1 National Highway	Existing	✓	✓	✓
Ho Chi Minh-Moc Bai Expressway	2015	✓	✓	✓
Ho Chi Minh-Loc Ninh Expressway	2015	✓	✓	✓
East-West Highway	2010	✓	✓	✓
Ring Road #2, SSP to Hwy 1A	2012	✓	✓	✓
Ring Road #2, Hwy 1A to HLN Expressway	Existing	✓	✓	✓
Ring Road #2, HLN Expressway to Q9	2010	✓	✓	✓
Ring Road #2, Q9 to SSP	2010	✓	✓	✓
Ring Road #2, South Saigon Parkway	Existing	✓	✓	✓
Ho Chi Minh-Long Thanh-Dau Giay Expressway	Detail Design	✓	✓	✓
Ho Chi Minh-Lien Khuong Expy			✓	✓
Bien Hoa-Vung Tau Expressway	Before 2020		✓	✓

Note: ✓ = in service

According to the HOUTRANS concept, a mass transit system will be introduced by 2020, and public transportations such as the mass transit and bus will take 30% of the passenger traffic. However, the development of the mass transit system is delayed. Therefore, it is assumed that the Network in 2016 does not have a mass transit but the mass transit system will be developed for 2026 and 2036 network.

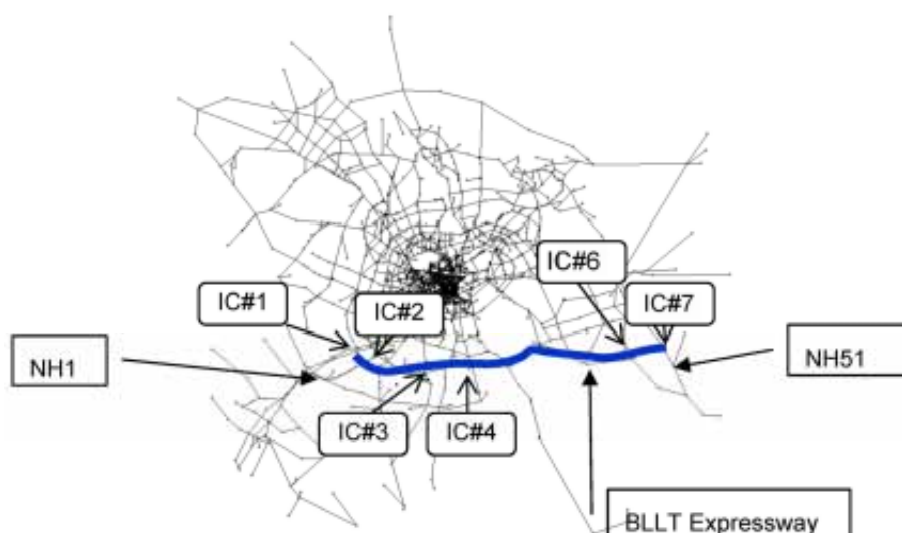


Figure 12: Road Network in 2016

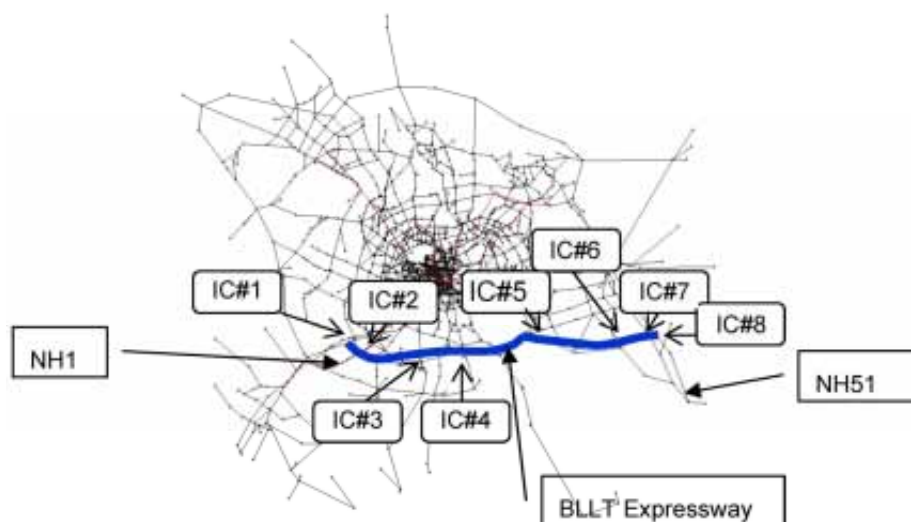


Figure 13: Road Network in 2026 & 2036

Currently in Vietnam tolls are charged as per an open system where each type of vehicle is charged as shown in Table 19. This derives a toll index for each type of vehicle. A closed type of toll system is proposed for the Project so that each type of vehicle will be charged the distance traveled at the rate shown for Toll Regime A: the base case.

Table 19: Current Tolls & the Proposed Toll Regime A: Base Case

Toll Rate Regime	Passenger Car	Minibus	Standard Bus	Small Truck	Big Truck	Container Truck
Current Toll	10,000 VND	15,000 VND	22,000 VND	22,000 VND	40,000 VND	80,000 VND
Toll Index	1.00	1.50	2.20	2.20	4.00	8.00
A: Base Case	685 VND/km	1,028 VND/km	1,507 VND/km	1,507 VND/km	2,740 VND/km	5,480 VND/km

Future Toll

The assumptions of toll system are;

- Base Case Toll for the BLTT project is Toll Regime A: 685 VND per kilometer for “Passenger Car” and the others shown in Table 19.
- Current toll of existing road will be as existing current toll

- Ho Chi Minh-Long Thanh-Dau Giay Expressway toll is Toll Regime A: 685 VND per kilometer for “Passenger Car” and the others shown in Table 19.
- Toll of Ring road 3, Ho Chi Minh – Trung Lung Expressway and Bien Hoa – Vung Tau Expressway are Toll Regime A: 685 VND per kilometer for “Passenger Car” and the others shown in Table 19.

3.3. Future OD matrices

3.3.1. Traffic Generation and Attraction Trip Volume

The generation and attraction trip volumes of Motorcycle, Car and Bus have relationship with GDP per capita, the generation and attraction volumes of Truck have relationship with GDP. Thus traffic forecasts were based on the elasticity of traffic volume growth rate to the growth rates of GDP per capita and GDP. This study uses this relationship for demand forecast.

The elasticity formula is as follows.

Motorcycle, Car and Bus

Elasticity = annual average growth rate of trip / annual average growth rate of GRDP per capita

Truck

Elasticity = annual average growth rate of trip / annual average growth rate of GRDP
Ho Chi Minh City and adjoining Area Trip growth rates were estimated from 2002 HOUTRANS OD and estimated by 2009 OD. Growth rates Trips through NH1A and NH51(Traffic survey points) are calculated with assignment results of 2002 and 2009.

Table 20: annual average growth rate

All -NH1A-NH51			
Ho Chi Minh		Adjoining	
MC	1.03	MC	1.04
Car	1.15	Car	1.02
Bus	1.03	Bus	1.14
Truck	1.04	Truck	1.18
NH1A			
Ho Chi Minh		Adjoining	
MC	1.06	MC	1.18
Car	1.06	Car	1.04
Bus	1.09	Bus	1.24
Truck	1.10	Truck	1.08
NH51			
Ho Chi Minh		Adjoining	
MC	1.14	MC	1.07
Car	1.02	Car	1.03
Bus	1.02	Bus	1.07
Truck	1.16	Truck	1.16

The Population and GRDP data are shown in section 2. The Elasticity between trip growth rate and economic indicators is shown in the table below.

Table 21: Elasticity between Trips and Socio Economic Indicators

All except N1a and N51				Elasticity to
Ho Chi Minh		Adjoining		
MC	0.95	MC	0.95	GRDP/pop

Car	1.06	Car	0.92	GRDP/pop
Bus	0.95	Bus	1.04	GRDP/pop
Truck	0.92	Truck	1.05	GRDP
N1a				
Ho Chi Minh		Adjoining		
MC	0.97	MC	1.07	GRDP/pop
Car	0.97	Car	0.94	GRDP/pop
Bus	1.00	Bus	1.13	GRDP/pop
Truck	0.98	Truck	0.96	GRDP
N51				
Ho Chi Minh		Adjoining		
MC	1.04	MC	0.97	GRDP/pop
Car	0.93	Car	0.94	GRDP/pop
Bus	0.94	Bus	0.98	GRDP/pop
Truck	1.03	Truck	1.04	GRDP

Source: Consultant

For this study, the 2016-2026 period, it has been assumed that the elasticities will reduce 2% in comparison with 2009-2016. Further, for 2026-2036 it has been assumed that the elasticities in 2 % in comparison with 2016-2026.

3.3.2. Transport Facilities Development Plan and Major Development

Port Relocation Expansion and Development Plan

The HOUTRANS considered this matter. In addition JICA study forecast annual cargo Volume. On the other hand JETRO study estimated the traffic volume of Nha Be Port, Cat Lai Port Hiep Phuoc Port and Cai Mep –Thi Vai Port in 2010 2020 and 2030.

Total traffic volume is estimated considering JETRO estimation, and composition of each port is estimated from JICA study.

Table 22: Demand Forecast of Cargo through each port in the Region in 2020

	2020	2020
	Non Container	Container
	1000ton	1000TEU
Sai Gon/Tan Cang/Ben Nghe/VICT	7,500	760
Other Ports in HCMC Port Group	4,800	0
Cat Lai IZ Port	400	300
Hiep Phuoc Port	6,600	380
Cai Mep Thi Vai Port	9,500	4,750

Source: JICA Study; The Port Development Study in the South of The Socialist Republic of Vietnam

Table 23: Cargo Traffic Demands Forecast through each port

	2016	2026	2036
Saigon and other Ports in HCMC	8,625	11,759	14,712
Cat Lai IZ Port	258	333	372
Hiep Phuoc Port	4,209	6,057	8,244
Cai Mep Thi Vai Port	29,831	40,853	51,530

Unit: PCU/Day
Source: Consultant

Long Thanh International Airport

According to the Prime Minister's Decision No. 703/QĐ-TTg dated 20/7/2005 on approving the plan of location, scale and functions of Long Thanh International Airport, the capacity of the airport is proposed to be 100 million passengers/year and 5 million tons of cargo per year. The time for operation is proposed to be about 2015. Construction and development of Long Thanh Airport will create car, bus, and truck traffic flows.

Table 24: Planning of Air Transportation in Southern Viet Nam

	2015	2020	2030
Total passenger: (Million pax)	13.657	20.279	43.800
- International pass. (Million pax)	8.683	12.758	28.032
- Domestic pass. (Million pax)	4.974	7.521	15.768
Total Cargo: (Million T)	0.400	0.600	1.500

Source: Long Thanh Airport Planning, Vietnam Civil Aviation Bureau.

Consultant estimated the traffic volume is based on the forecast of the Vietnam Civil Aviation Bureau' Plan.

Assuming that:

- About 80% of the air passengers will be to and from Ho Chi Minh City, Mekong Delta and other province. 20% will go to inter zonal or near zones trips.
- 80% of above passengers will use public transport such as bus and 20% will use the Taxi or private cars.
- Cargo truck average capacity is 10ton.

The results of the estimation, developed traffic volume is as follow;

Table 25: Estimation of the developed traffic volume

	2016	2026	2036
Bus	2,592	4,148	12,190
Car(Taxi)	4,319	6,913	20,317
Truck	4,952	8,227	29,672
Total PCU	11,863	19,288	62,180

Unit PCU/day

Source: Consultant

Development of the Can Gio Region

The HOUTRANS model predicted that person trips will increase with an average growth rate as 2.1%. This area is conservation area, on the other hand this area has tourist destination. Thus it seems acceptable that 2.1% growth rate is an acceptable assumption.

Other developments such as Nhon Trach Industrial Park

The HOUTRANS model considered the industrial park development such as Nhon Trach and Hiep Phuoc Port. Location of industrial parks are shown in Figure 14. The HOUTRANS model predicted that the population will increase. Our study accept this trend for the traffic

forecast.

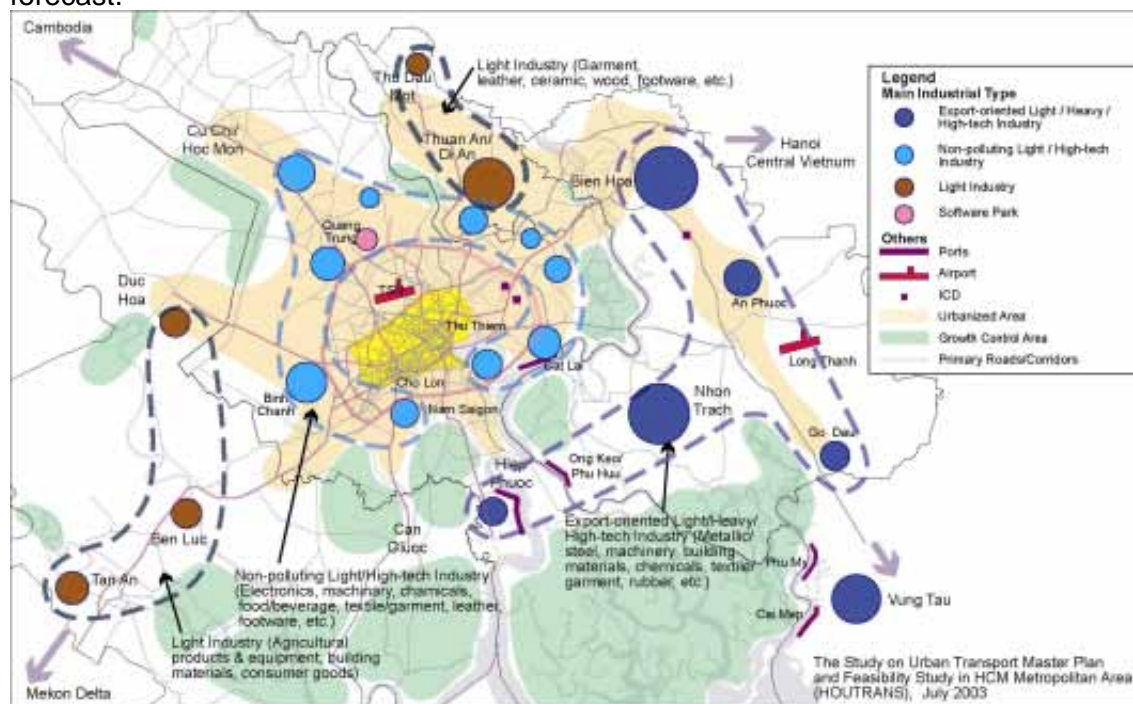


Figure 14: Location of industrial Parks in the HOUTRANS Study Area

Source: HOUTRANS

3.3.3. Total Generation and Attractions Trips

The total number of generation and attraction trips in the Study Area is shown in the table below. Distribution pattern is based on HOUTRANS Distribute Pattern.

Table 26 Table Generation and Attraction Trips

	2002	2009	2016	2020	2026	2036
MC	10,173,480	11,222,010	12,064,826	12,575,302	13,375,726	14,823,378
Car	262,312	610,261	1,230,787	1,690,368	2,580,520	4,197,197
Bus	597,668	1,506,765	3,334,308	4,819,735	7,940,687	14,430,295
Truck	242,805	556,903	1,257,512	1,835,293	3,005,001	5,246,697
Total	11,278,267	13,897,948	17,889,449	20,922,718	26,903,960	38,699,603

Unit: Person trip/day

Source: Consultant

3.4. Assignment and Traffic Demand Analysis Software Package

The study team has used the HOUTRANS model for the traffic assignment model. Incremental assignment with method of ascertaining minimum pass has been carried out and the model run for a range of toll rates.

The study team has also used the JICA STRADA software package for traffic demand analysis which HOUTRANS also used for the demand forecasts. The JICA STRADA software was developed by JICA

3.5. Output

3.5.1. Future Traffic Volume

The case of traffic volume forecast of the Project (Base Case Toll Regime A: 685VND/Km for car) in future are shown in the table below.

Table 27: Future Daily Traffic Volume in 2016 (Toll Regime A: 685VND/Km for Car)

Unit: PCU/Day

	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
Car	2,848	754	136	320	320	192	
Bus	1,160	1,012	216	242	242	166	
Truck	18,732	11,300	6,340	17,274	17,274	8,792	
2016	22,740	13,066	6,692	17,836	17,836	9,150	0

	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
Car	9,777	4,541	4,189	8,444	5,243	2,553	266
Bus	1,662	2,965	2,069	1,291	1,293	927	553
Truck	52,776	36,075	30,637	55,203	51,893	45,009	24,878
2026	64,215	43,581	36,895	64,938	58,429	48,489	25,697

	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
Car	19,452	13,168	12,411	17,512	11,971	5,023	1,015
Bus	2,651	6,254	4,150	2,374	2,104	1,464	906
Truck	83,890	90,195	79,857	108,364	94,929	84,075	46,868
2036	105,993	109,617	96,418	128,250	109,004	90,562	48,789

Source: Consultant

The JETRO Study Report mentions the total traffic volume (vehicles/day) by section. JETRO Study is forecast in 2016, 2020 and 2036. Therefore, JETRO's traffic volume in 2026 is calculated by consultant with interpolation method. The comparison is shown in below table.

This study forecasted traffic volumes are higher than JETRO 2026 and 2036, especially project starting area and East area that have industrial estates.

Table 28: Comparison between this Project Forecast and JETRO Study Forecast

		IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	A	11,205	5,679	2,758	7,326	7,326	3,775	-
	B	7,255	11,595	11,981	19,941	5,362	5,005	2,884
2026*	A	31,552	20,157	17,271	31,042	26,517	20,927	10,438
	B	18,106	26,099	24,461	36,981	14,893	12,622	7,639
2036	A	54,068	51,748	46,014	61,807	50,684	39,239	20,125
	B	34,686	45,241	39,228	60,299	32,420	27,542	14,203
2016	a/b	1.54	0.49	0.23	0.37	1.37	0.75	-
2026	a/b	1.74	0.77	0.71	0.84	1.78	1.66	1.37
2036	a/b	1.56	1.14	1.17	1.03	1.56	1.42	1.42

Source: JETRO Study & Consultant

Note: a = TA Study forecast, b = JETRO forecast

3.5.2. With and Without Project Network Results

The PCU-KM and PCU-Hour Comparisons between the “With Projects Case (Base Case)” and the “Without Project Case” results of the assessments are shown in the Tables below.

Table 29: Difference between With Project (Base Case) and Without Project Cases

YEAR		PCU Km	PCU Hour
2016	Base Case	57,875,614	1,817,129
	Without Project	60,655,108	1,906,220
	Difference	2,779,494	89,091
2026	Base Case	113,601,971	4,827,760
	Without Project	127,339,578	5,763,442
	Difference	13,737,607	935,682
2036	Base Case	184,679,261	10,718,985
	Without Project	212,980,823	14,032,017
	Difference	28,301,562	3,313,032

Source: Consultant

The differences shown in Table 29 are the daily network savings of PCU/Km and PCU hours throughout the network. These results will be used in the economic evaluation of the Project.

3.5.3. Other Two Scenarios

Two cases for the traffic volume in 2026 (10years after opening) are forecasted for comparison between three road development scenarios. The results are as shown in below.

- **Case 1.** The Bien Hoa-Vung Tao Expressway is not constructed
- **Case 2.** Ring Road #3 is not constructed (or delayed) so the BL-LT Expressway is not connected to RR#3 and the HCMC-LT-DG Expressway

Table 30: Traffic Volume by Sections in 2026

	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
Base Case	64,215	43,581	36,895	64,938	58,429	48,489	25,697
Case 1	61,185	47,860	41,826	61,155	46,808	34,387	-
Case 2	61,474	49,262	40,005	70,487	50,913	37,129	21,026

Unit : PCU/Day

Source: Consultant

Table 31: Traffic Volume Comparison between Network Cases in 2026

	PCU*km	Ratio to Base case
Base Case	3,032,192	1.00
Case 1	2,738,134	0.90
Case 2	2,980,808	0.98

Source: Consultant

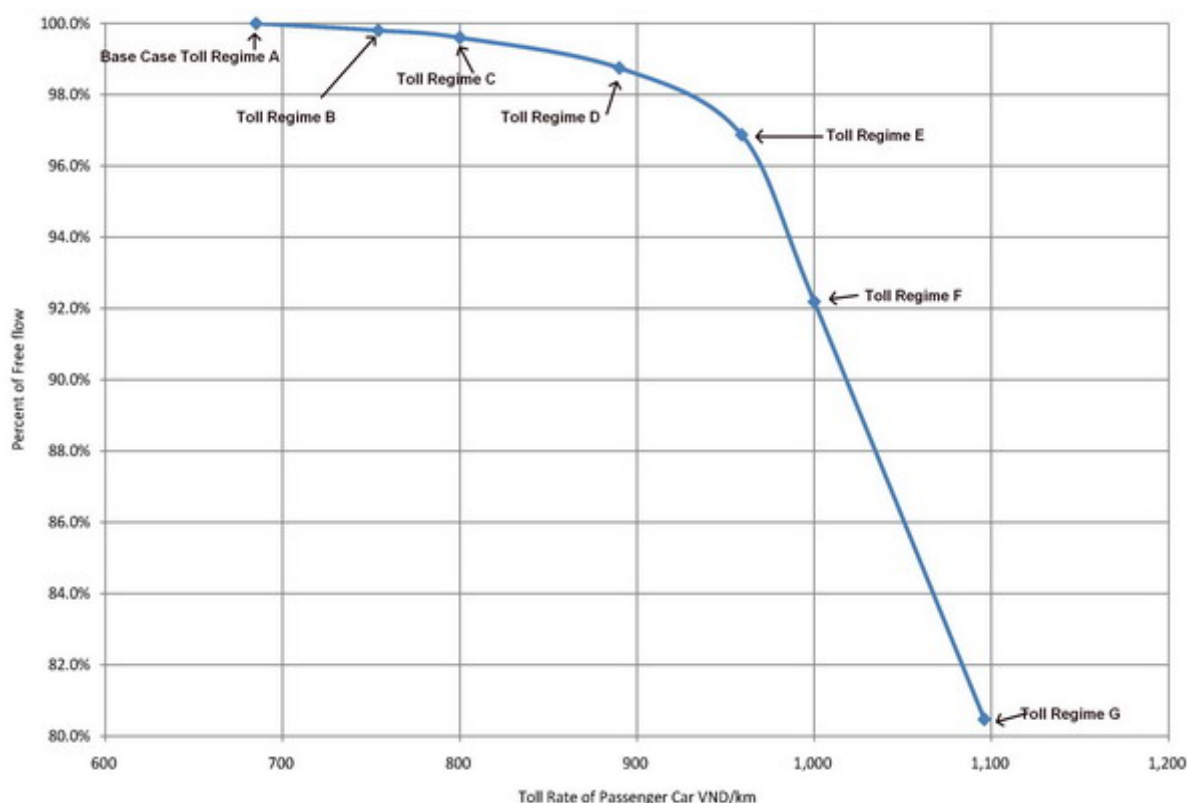
3.6. Traffic Flow at different Toll Regimes

The traffic forecast model was rerun under various toll rate regimes as shown below:

Table 32: Toll Rate in VND per km by type of vehicle used to Calculate Toll Revenue

Toll Rate Regime	Passenger Car	Minibus	Standard Bus	Small Truck	Big Truck	Container Truck
TR A: Base Case	685	1,028	1,507	1,507	2,740	5,480
TR B	754	1,131	1,659	1,659	3,016	6,032
TR C	800	1,200	1,760	1,760	3,200	6,400
TR D	890	1,335	1,958	1,958	3,560	7,120
TR E	959	1,439	2,110	2,110	3,836	7,672
TR F	1,000	1,500	2,200	2,200	4,000	8,000
TR G	1,096	1,644	2,411	2,411	4,384	8,768

As the toll rate increases the traffic demand will decrease as shown in the following chart.

**Figure 15: Toll Rate Increase Traffic Demand Decreases**

These traffic numbers are used to calculate the toll revenue per year for each of the six toll regimes. Please note that once the traffic forecast reaches 70,000 pcu's per day for each section then that is the saturation point and traffic cannot go above this amount. In the following Tables once the number is shaded it indicates that saturation has been reached.

Table 33: Traffic Forecast in PCU's per day for Toll Regime A (Car = 685 VND/KM)

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	22,740	13,066	6,693	17,836	17,836	9,150	0
2017	26,873	14,520	8,393	21,817	21,446	12,960	0
2018	31,011	16,326	10,387	25,959	25,157	16,798	0
2019	35,149	18,490	12,674	30,265	28,966	20,665	0
2020	39,293	21,009	15,255	34,731	32,876	24,559	10,617
2021	43,439	23,884	18,128	39,362	36,885	28,478	13,204
2022	47,590	27,112	21,296	44,151	40,993	32,427	15,767
2023	51,740	30,696	24,755	49,106	45,203	36,402	18,301
2024	55,895	34,636	28,509	54,221	49,511	40,403	20,811

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2025	60,054	38,931	32,557	59,498	53,920	44,433	23,294
2026	64,214	43,582	36,896	64,939	58,430	48,490	25,753
2027	68,379	48,587	41,530	70,000	63,038	52,574	28,184
2028	70,000	53,947	46,455	70,000	67,745	56,684	30,589
2029	70,000	59,662	51,675	70,000	70,000	60,826	32,968
2030	70,000	65,734	57,187	70,000	70,000	64,991	35,322
2031	70,000	70,000	62,993	70,000	70,000	69,183	37,648
2032	70,000	70,000	69,093	70,000	70,000	70,000	39,949
2033	70,000	70,000	70,000	70,000	70,000	70,000	42,225
2034	70,000	70,000	70,000	70,000	70,000	70,000	44,475
2035	70,000	70,000	70,000	70,000	70,000	70,000	46,697
2036	70,000	70,000	70,000	70,000	70,000	70,000	48,894

Table 34: Traffic Forecast in PCU's per day for Toll Regime B (Car = 754 VND/KM)

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	22,695	13,040	6,678	17,800	17,800	9,133	0
2017	26,821	14,490	8,377	21,775	21,404	12,935	0
2018	30,948	16,294	10,366	25,909	25,107	16,765	0
2019	35,081	18,454	12,650	30,206	28,909	20,624	0
2020	39,216	20,968	15,224	34,662	32,810	24,508	10,595
2021	43,352	23,836	18,093	39,284	36,812	28,421	13,177
2022	47,494	27,059	21,254	44,066	40,914	32,362	15,734
2023	51,638	30,635	24,707	49,009	45,113	36,329	18,266
2024	55,784	34,567	28,452	54,112	49,413	40,323	20,771
2025	59,935	38,855	32,491	59,381	53,813	44,345	23,249
2026	64,087	43,495	36,824	64,810	58,313	48,394	25,701
2027	68,243	48,491	41,448	70,000	62,912	52,470	28,128
2028	70,000	53,841	46,362	70,000	67,610	56,573	30,529
2029	70,000	59,544	51,572	70,000	70,000	60,704	32,904
2030	70,000	65,602	57,075	70,000	70,000	64,861	35,252
2031	70,000	70,000	62,867	70,000	70,000	69,048	37,574
2032	70,000	70,000	68,955	70,000	70,000	70,000	39,871
2033	70,000	70,000	70,000	70,000	70,000	70,000	42,142
2034	70,000	70,000	70,000	70,000	70,000	70,000	44,386
2035	70,000	70,000	70,000	70,000	70,000	70,000	46,606
2036	70,000	70,000	70,000	70,000	70,000	70,000	48,798

Table 35: Traffic Forecast in PCU's per day for Toll Regime C (Car = 800 VND/KM)

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	22,648	13,013	6,665	17,765	17,765	9,113	0
2017	26,766	14,460	8,359	21,730	21,360	12,910	0
2018	30,886	16,261	10,345	25,856	25,056	16,733	0
2019	35,011	18,416	12,622	30,143	28,849	20,581	0
2020	39,136	20,925	15,195	34,592	32,744	24,460	10,574
2021	43,265	23,788	18,056	39,203	36,738	28,363	13,152
2022	47,397	27,004	21,211	43,977	40,830	32,296	15,704
2023	51,533	30,573	24,657	48,908	45,022	36,255	18,229
2024	55,672	34,498	28,396	54,004	49,315	40,242	20,727
2025	59,814	38,776	32,426	59,260	53,705	44,255	23,203
2026	63,957	43,407	36,748	64,679	58,196	48,296	25,648

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2027	68,104	48,392	41,362	70,000	62,785	52,364	28,071
2028	70,000	53,732	46,268	70,000	67,474	56,459	30,467
2029	70,000	59,424	51,468	70,000	70,000	60,582	32,836
2030	70,000	65,470	56,958	70,000	70,000	64,731	35,181
2031	70,000	70,000	62,740	70,000	70,000	68,908	37,498
2032	70,000	70,000	68,815	70,000	70,000	70,000	39,791
2033	70,000	70,000	70,000	70,000	70,000	70,000	42,056
2034	70,000	70,000	70,000	70,000	70,000	70,000	44,296
2035	70,000	70,000	70,000	70,000	70,000	70,000	46,511
2036	70,000	70,000	70,000	70,000	70,000	70,000	48,699

Table 36: Traffic Forecast in PCU's per day for Toll Regime D (Car = 890 VND/KM)

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	22,455	12,902	6,609	17,612	17,612	9,036	0
2017	26,537	14,337	8,288	21,543	21,178	12,799	0
2018	30,623	16,121	10,257	25,635	24,841	16,589	0
2019	34,710	18,260	12,517	29,887	28,603	20,405	0
2020	38,802	20,746	15,063	34,296	32,465	24,250	10,484
2021	42,896	23,584	17,903	38,869	36,422	28,122	13,040
2022	46,993	26,773	21,030	43,601	40,481	32,021	15,568
2023	51,093	30,312	24,446	48,492	44,639	35,945	18,073
2024	55,196	34,203	28,153	53,543	48,893	39,897	20,551
2025	59,301	38,445	32,148	58,753	53,246	43,877	23,003
2026	63,411	43,035	36,434	64,126	57,698	47,882	25,430
2027	67,523	47,979	41,009	69,657	62,249	51,916	27,831
2028	70,000	53,273	45,875	70,000	66,899	55,976	30,207
2029	70,000	58,916	51,028	70,000	70,000	60,064	32,556
2030	70,000	64,911	56,471	70,000	70,000	64,178	34,879
2031	70,000	70,000	62,206	70,000	70,000	68,318	37,179
2032	70,000	70,000	68,227	70,000	70,000	70,000	39,450
2033	70,000	70,000	70,000	70,000	70,000	70,000	41,696
2034	70,000	70,000	70,000	70,000	70,000	70,000	43,918
2035	70,000	70,000	70,000	70,000	70,000	70,000	46,112
2036	70,000	70,000	70,000	70,000	70,000	70,000	48,282

Table 37: Traffic Forecast in PCU's per day for Toll Regime E (Car = 959 VND/KM)

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	22,029	12,658	6,483	17,278	17,278	8,865	0
2017	26,033	14,065	8,131	21,135	20,775	12,555	0
2018	30,042	15,816	10,062	25,149	24,369	16,273	0
2019	34,052	17,913	12,278	29,319	28,061	20,019	0
2020	38,065	20,352	14,779	33,646	31,848	23,791	10,285
2021	42,082	23,137	17,562	38,131	35,732	27,587	12,791
2022	46,101	26,265	20,631	42,772	39,713	31,413	15,272
2023	50,122	29,737	23,983	47,570	43,789	35,264	17,729
2024	54,149	33,554	27,620	52,526	47,965	39,140	20,161
2025	58,175	37,715	31,539	57,639	52,236	43,044	22,566
2026	62,207	42,220	35,743	62,909	56,603	46,974	24,948
2027	66,243	47,068	40,231	68,335	61,067	50,931	27,303
2028	70,000	52,260	45,003	70,000	65,629	54,913	29,632
2029	70,000	57,798	50,060	70,000	70,000	58,924	31,939
2030	70,000	63,678	55,400	70,000	70,000	62,960	34,219

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2031	70,000	69,904	61,023	70,000	70,000	67,021	36,471
2032	70,000	70,000	66,932	70,000	70,000	70,000	38,702
2033	70,000	70,000	70,000	70,000	70,000	70,000	40,905
2034	70,000	70,000	70,000	70,000	70,000	70,000	43,084
2035	70,000	70,000	70,000	70,000	70,000	70,000	45,240
2036	70,000	70,000	70,000	70,000	70,000	70,000	47,366

Table 38: Traffic Forecast in PCU's per day for Toll Regime F (Car = 1,000 VND/KM)

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	20,961	12,045	6,169	16,442	16,442	8,435	0
2017	24,773	13,384	7,737	20,111	19,771	11,948	0
2018	28,586	15,052	9,574	23,930	23,192	15,486	0
2019	32,403	17,045	11,685	27,899	26,703	19,049	0
2020	36,224	19,368	14,063	32,018	30,307	22,639	9,788
2021	40,046	22,017	16,712	36,286	34,003	26,253	12,173
2022	43,870	24,993	19,632	40,703	37,791	29,893	14,534
2023	47,697	28,298	22,822	45,269	41,670	33,557	16,872
2024	51,527	31,929	26,282	49,984	45,643	37,246	19,185
2025	55,361	35,890	30,012	54,850	49,708	40,961	21,475
2026	59,198	40,175	34,014	59,865	53,863	44,700	23,740
2027	63,036	44,790	38,284	65,029	58,112	48,467	25,980
2028	66,876	49,732	42,824	70,000	62,453	52,256	28,200
2029	70,000	55,000	47,637	70,000	66,885	56,071	30,393
2030	70,000	60,597	52,717	70,000	70,000	59,913	32,562
2031	70,000	66,521	58,070	70,000	70,000	63,778	34,707
2032	70,000	70,000	63,692	70,000	70,000	67,670	36,828
2033	70,000	70,000	69,585	70,000	70,000	70,000	38,926
2034	70,000	70,000	70,000	70,000	70,000	70,000	40,998
2035	70,000	70,000	70,000	70,000	70,000	70,000	43,049
2036	70,000	70,000	70,000	70,000	70,000	70,000	45,075

Table 39: Traffic Forecast in PCU's per day for Toll Regime G (Car = 1,096 VND/KM)

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2016	18,298	10,513	5,384	14,353	14,353	7,363	0
2017	21,626	11,683	6,754	17,556	17,257	10,430	0
2018	24,953	13,137	8,359	20,889	20,243	13,518	0
2019	28,285	14,879	10,200	24,353	23,309	16,628	0
2020	31,618	16,905	12,275	27,947	26,454	19,762	8,543
2021	34,954	19,218	14,589	31,672	29,682	22,915	10,624
2022	38,292	21,816	17,137	35,528	32,987	26,093	12,687
2023	41,634	24,700	19,921	39,514	36,374	29,292	14,727
2024	44,977	27,871	22,941	43,630	39,841	32,512	16,746
2025	48,323	31,326	26,196	47,878	43,387	35,753	18,745
2026	51,672	35,070	29,689	52,254	47,017	39,019	20,722
2027	55,022	39,097	33,417	56,762	50,725	42,304	22,679
2028	58,377	43,410	37,381	61,401	54,512	45,614	24,614
2029	61,732	48,010	41,580	66,168	58,382	48,943	26,529
2030	65,089	52,894	46,018	70,000	62,332	52,298	28,422
2031	68,452	58,065	50,688	70,000	66,360	55,670	30,296

Year	IC1- IC2	IC2- IC3	IC3- IC4	IC4- IC5	IC5- IC6	IC6- IC7	IC7- IC8
2032	70,000	63,523	55,598	70,000	70,000	59,067	32,148
2033	70,000	69,263	60,741	70,000	70,000	62,486	33,977
2034	70,000	70,000	66,120	70,000	70,000	65,926	35,787
2035	70,000	70,000	70,000	70,000	70,000	69,389	37,575
2036	70,000	70,000	70,000	70,000	70,000	70,000	39,344

The toll revenues per year are shown in Table 40 below.

Table 40: Total Toll Revenue by year in Million VND

Year No.	Year	Toll Rate Regime A	Toll Rate Regime B	Toll Rate Regime C	Toll Rate Regime D	Toll Rate Regime E	Toll Rate Regime F	Toll Rate Regime G
1	2016	312,153	343,033	362,857	400,263	423,327	419,684	401,674
2	2017	375,382	412,547	436,404	481,386	509,117	504,748	482,983
3	2018	442,142	485,900	514,092	567,065	599,652	594,526	568,886
4	2019	512,480	563,223	595,783	657,271	695,008	689,059	659,425
5	2020	589,855	648,195	685,762	756,449	799,879	793,017	758,896
6	2021	668,125	734,231	776,757	856,902	906,039	898,180	859,612
7	2022	749,863	824,111	871,865	961,752	1,016,914	1,008,060	964,875
8	2023	835,208	917,880	970,979	1,071,181	1,132,588	1,122,778	1,074,585
9	2024	924,056	1,015,432	1,074,281	1,185,155	1,253,053	1,242,145	1,188,855
10	2025	1,016,431	1,117,030	1,181,702	1,303,678	1,378,328	1,366,394	1,307,754
11	2026	1,112,361	1,222,430	1,293,179	1,426,620	1,508,330	1,495,273	1,431,127
12	2027	1,209,438	1,329,761	1,407,497	1,554,182	1,643,107	1,628,950	1,559,026
13	2028	1,284,877	1,412,744	1,495,392	1,653,970	1,758,364	1,765,075	1,691,527
14	2029	1,345,244	1,480,089	1,567,709	1,738,745	1,859,984	1,872,432	1,828,524
15	2030	1,393,249	1,532,875	1,623,472	1,800,374	1,925,024	1,966,243	1,962,645
16	2031	1,435,493	1,579,875	1,673,797	1,858,771	1,992,980	2,033,610	2,073,452
17	2032	1,454,085	1,600,683	1,696,195	1,885,589	2,026,696	2,089,135	2,180,478
18	2033	1,457,048	1,604,343	1,700,495	1,892,360	2,038,687	2,121,229	2,250,671
19	2034	1,457,642	1,604,993	1,701,179	1,893,111	2,039,470	2,123,559	2,292,544
20	2035	1,458,288	1,605,708	1,701,932	1,893,940	2,040,339	2,124,404	2,324,062
21	2036	1,458,924	1,606,404	1,702,665	1,894,745	2,041,178	2,125,224	2,327,406
Total Revenue		21,492,344	23,641,487	25,033,995	27,733,511	29,588,064	29,983,725	30,189,008

The maximum total toll revenue amount is actually produced by Toll Regime G but we have recommended using Toll Regime F as the optimum rate. It produces a similar total amount as G but in the critical early years also produces more revenue.

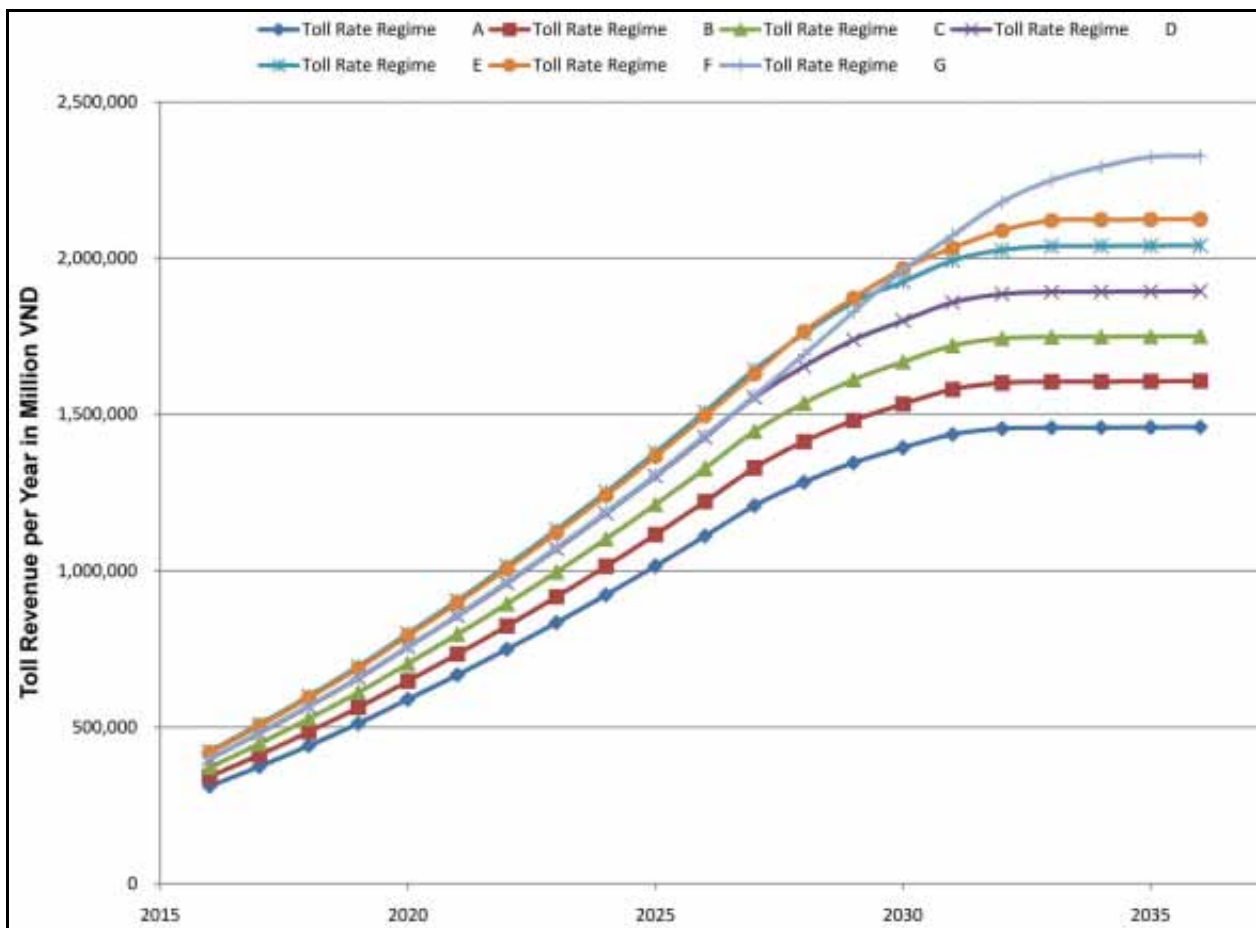


Figure 16: Toll Revenue per year by toll rate regime

3.7 Traffic Flow at Interchanges in 2026

The peak hour traffic has been determined to be 8% of the AADT. The Base Case traffic flow at Interchanges is shown in the following figures:

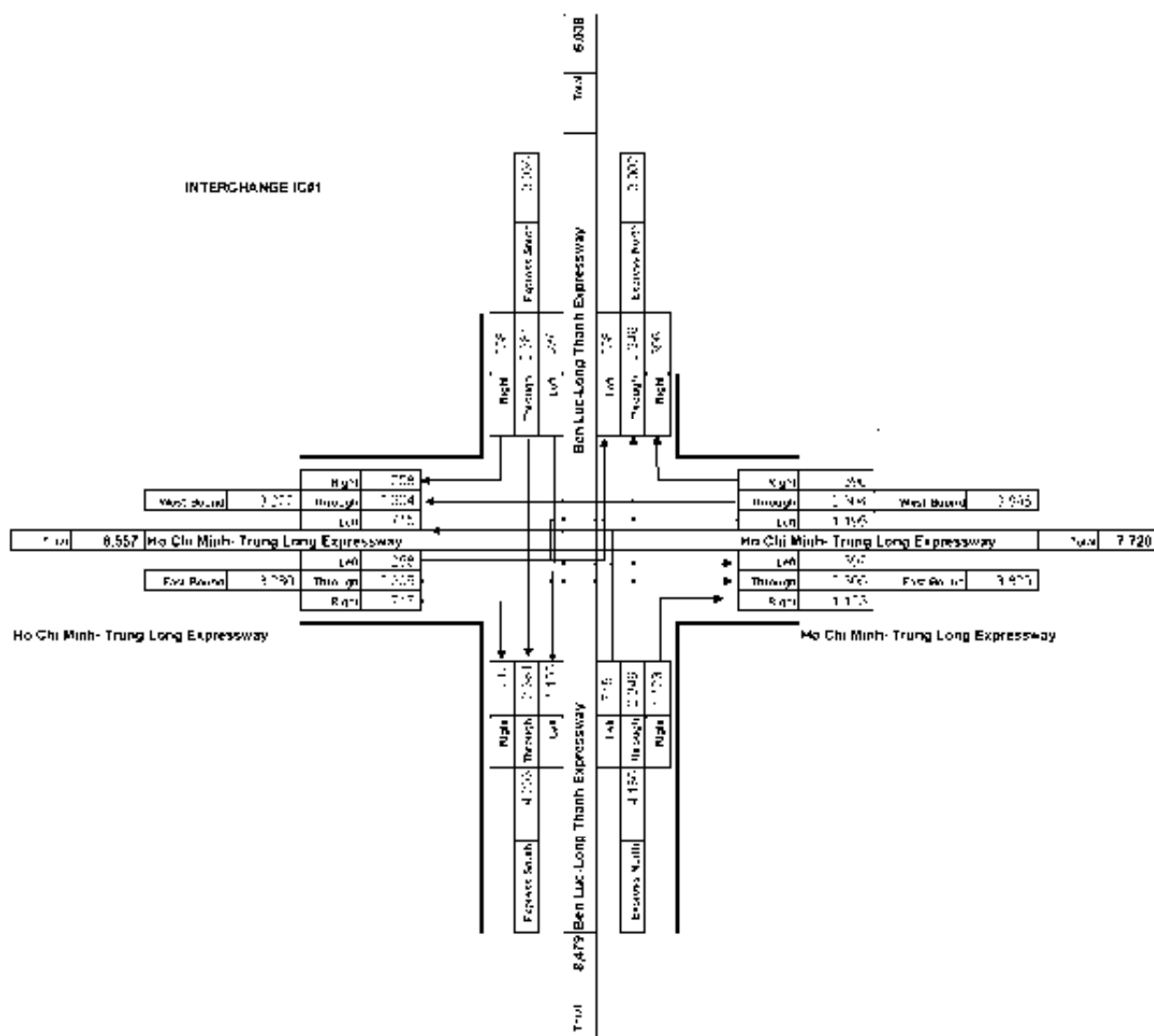


Figure 17: Peak hour traffic flow at Interchange IC#1 in 2026

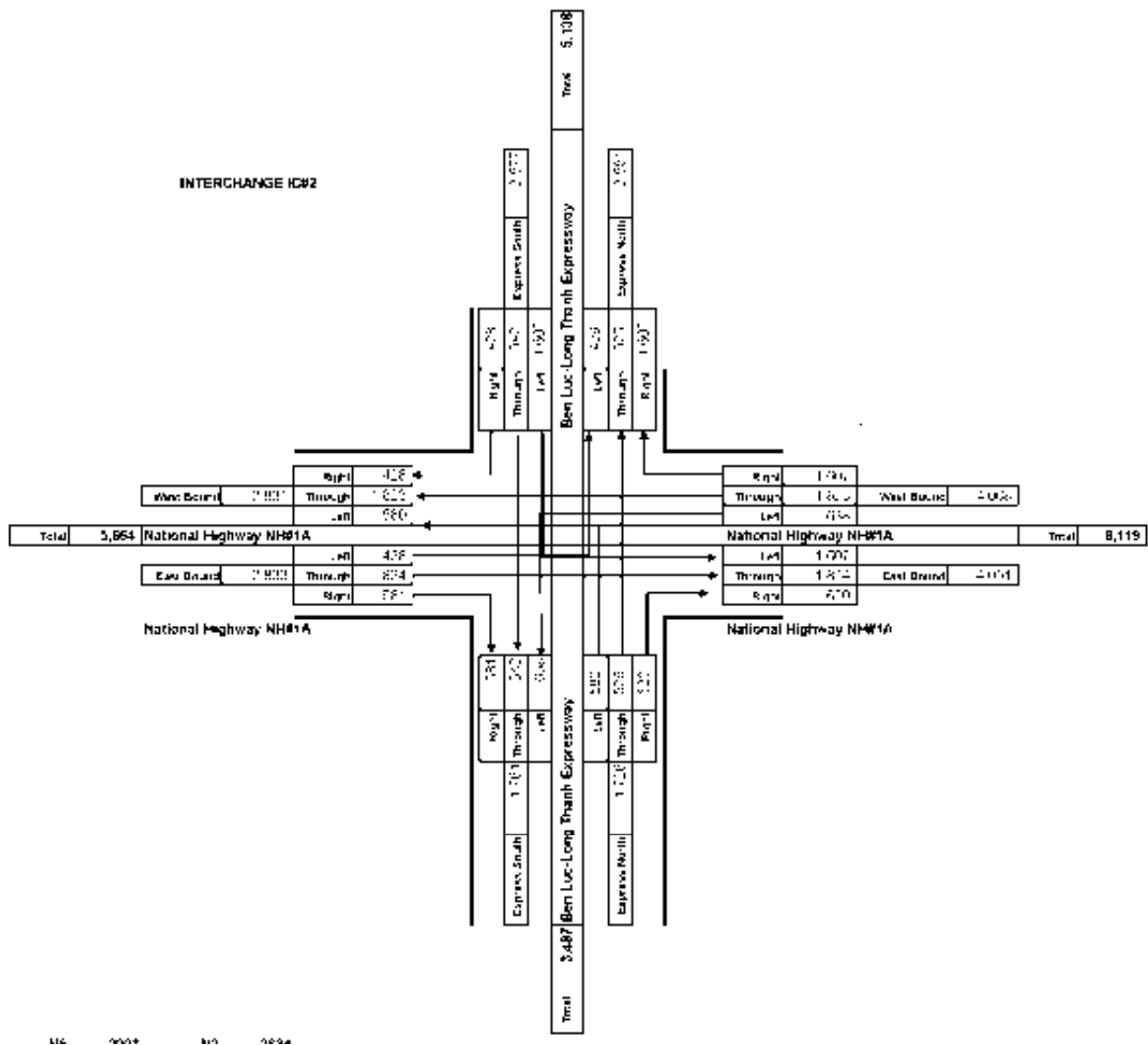


Figure 18: Peak hour traffic flow at Interchange IC#2 in 2026

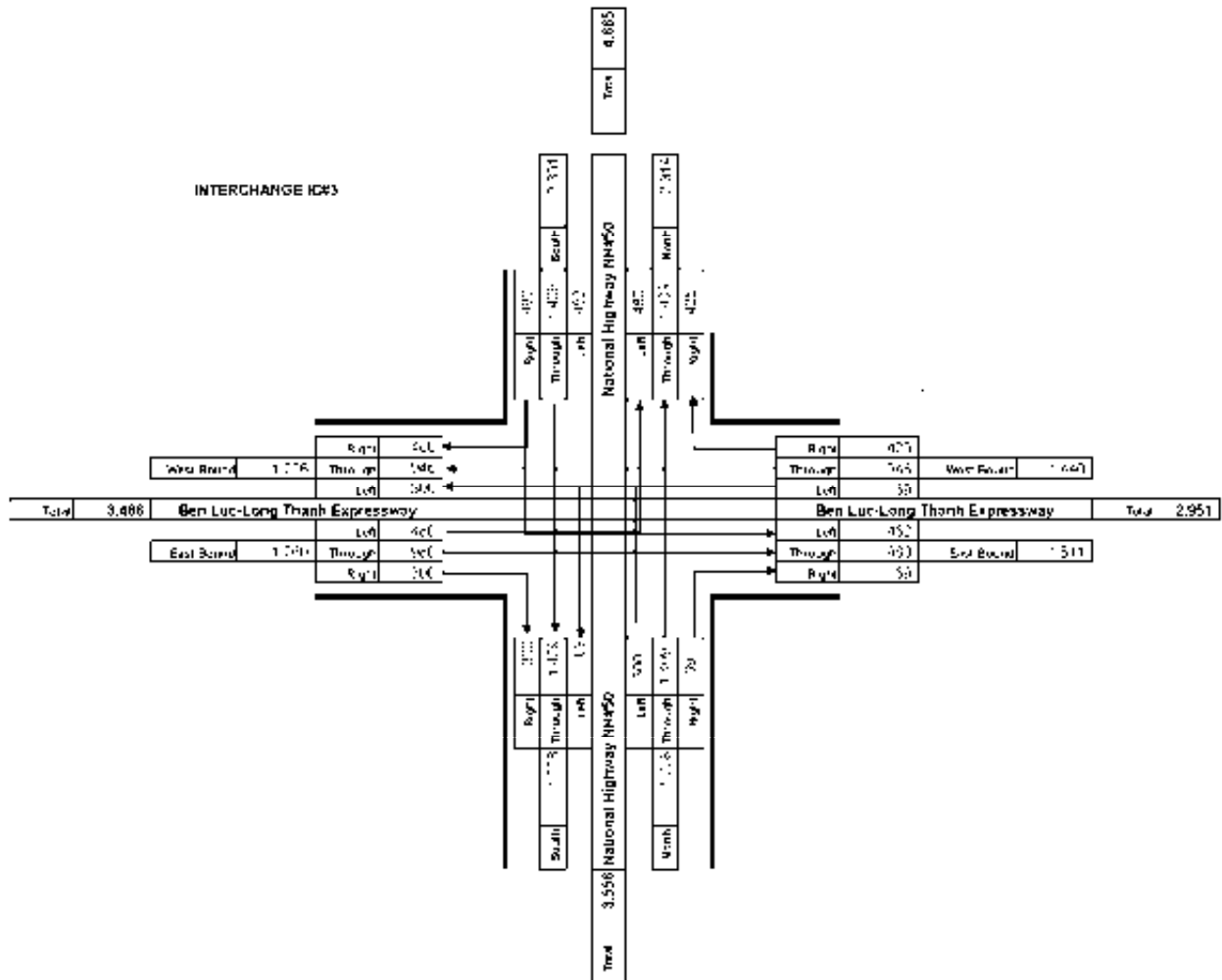


Figure 19: Peak hour traffic flow at Interchange IC#3 in 2026

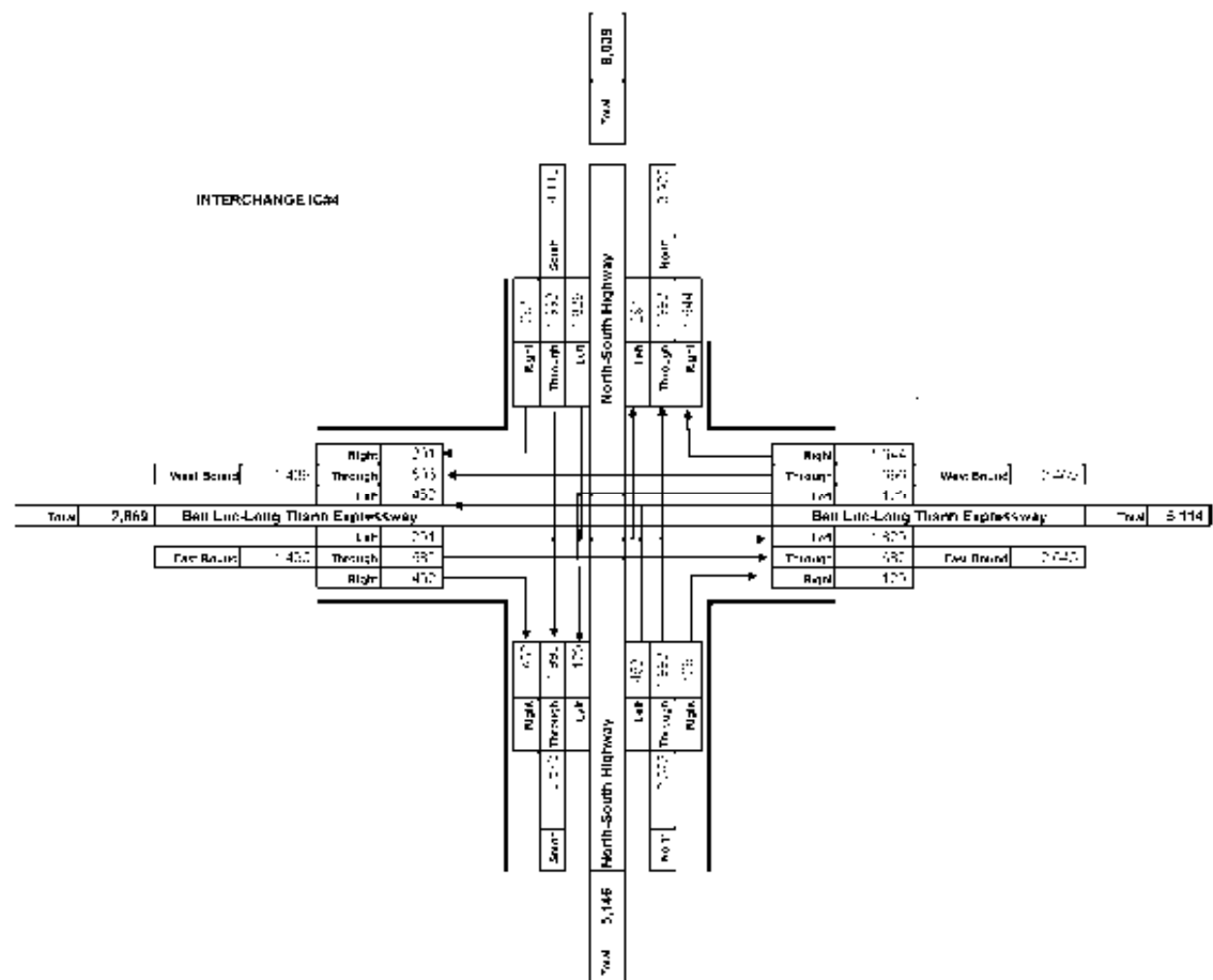


Figure 20: Peak hour traffic flow at Interchange IC#4 in 2026

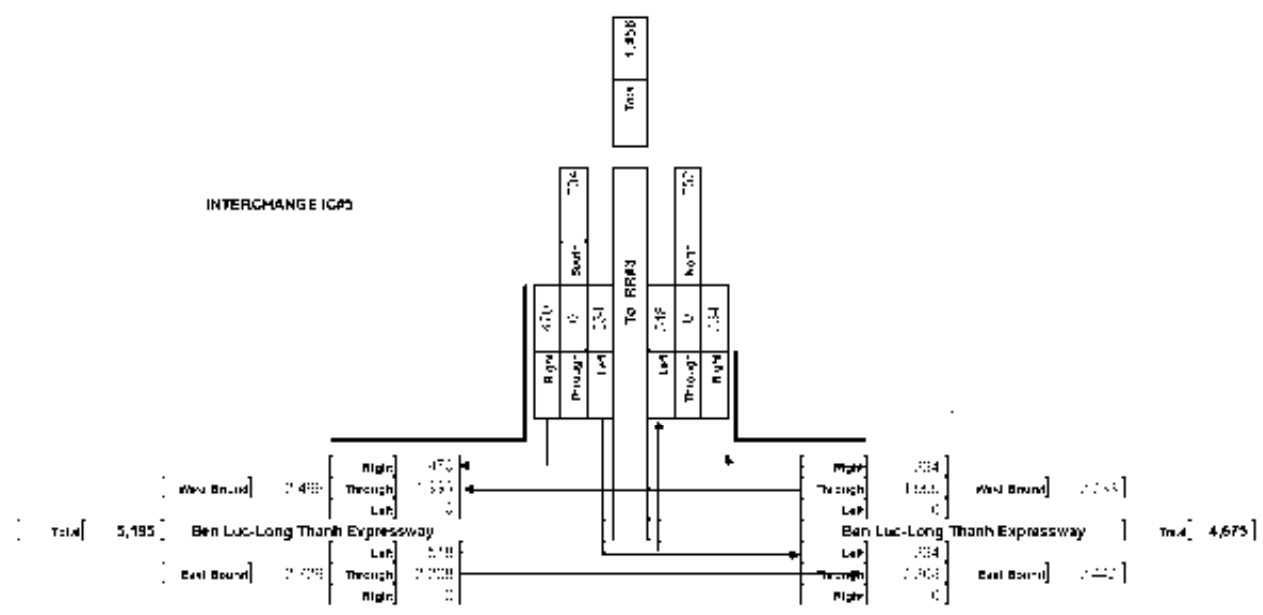


Figure 21: Peak hour traffic flow at Interchange IC#5 in 2026

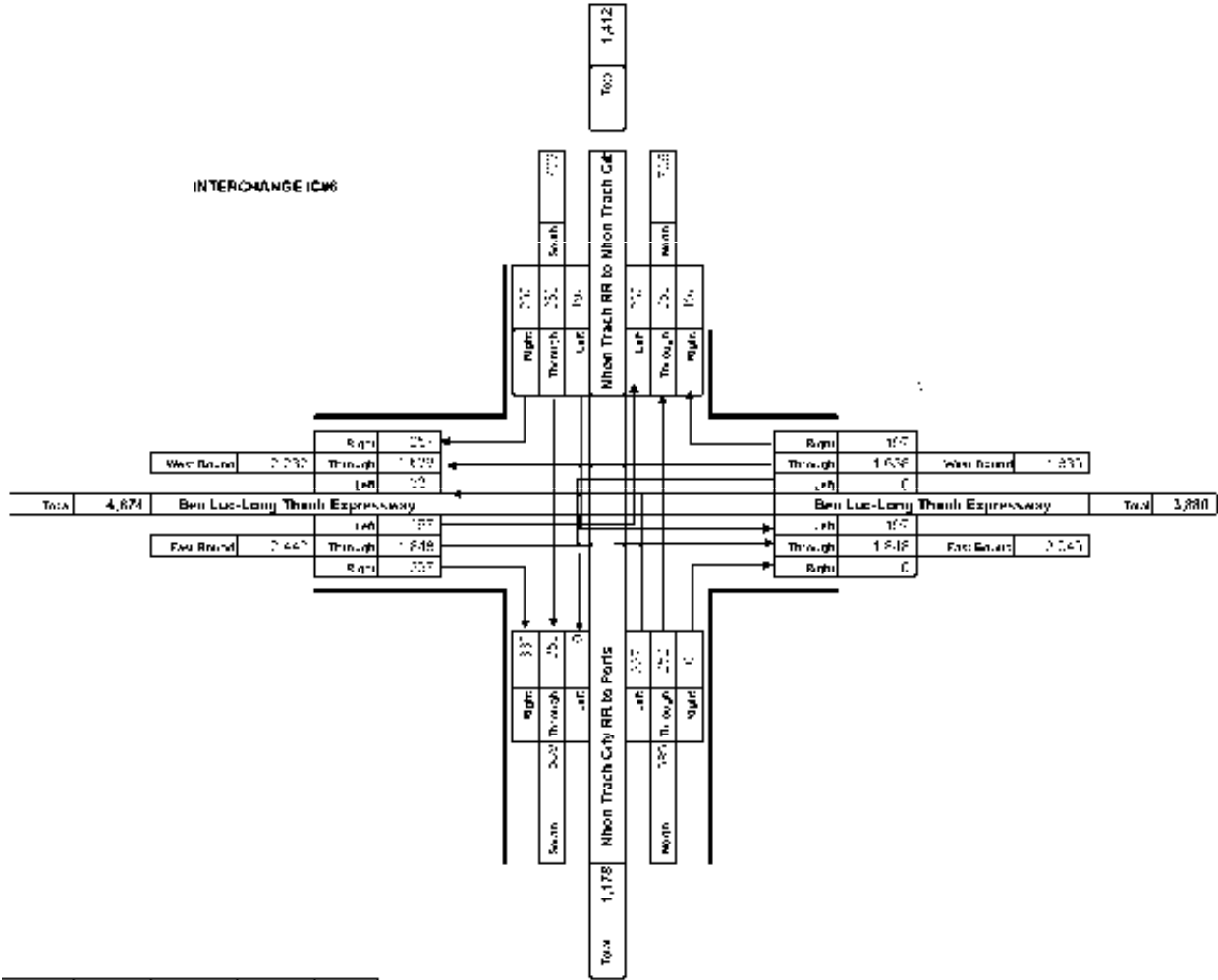


Figure 22: Peak hour traffic flow at Interchange IC#6 in 2026

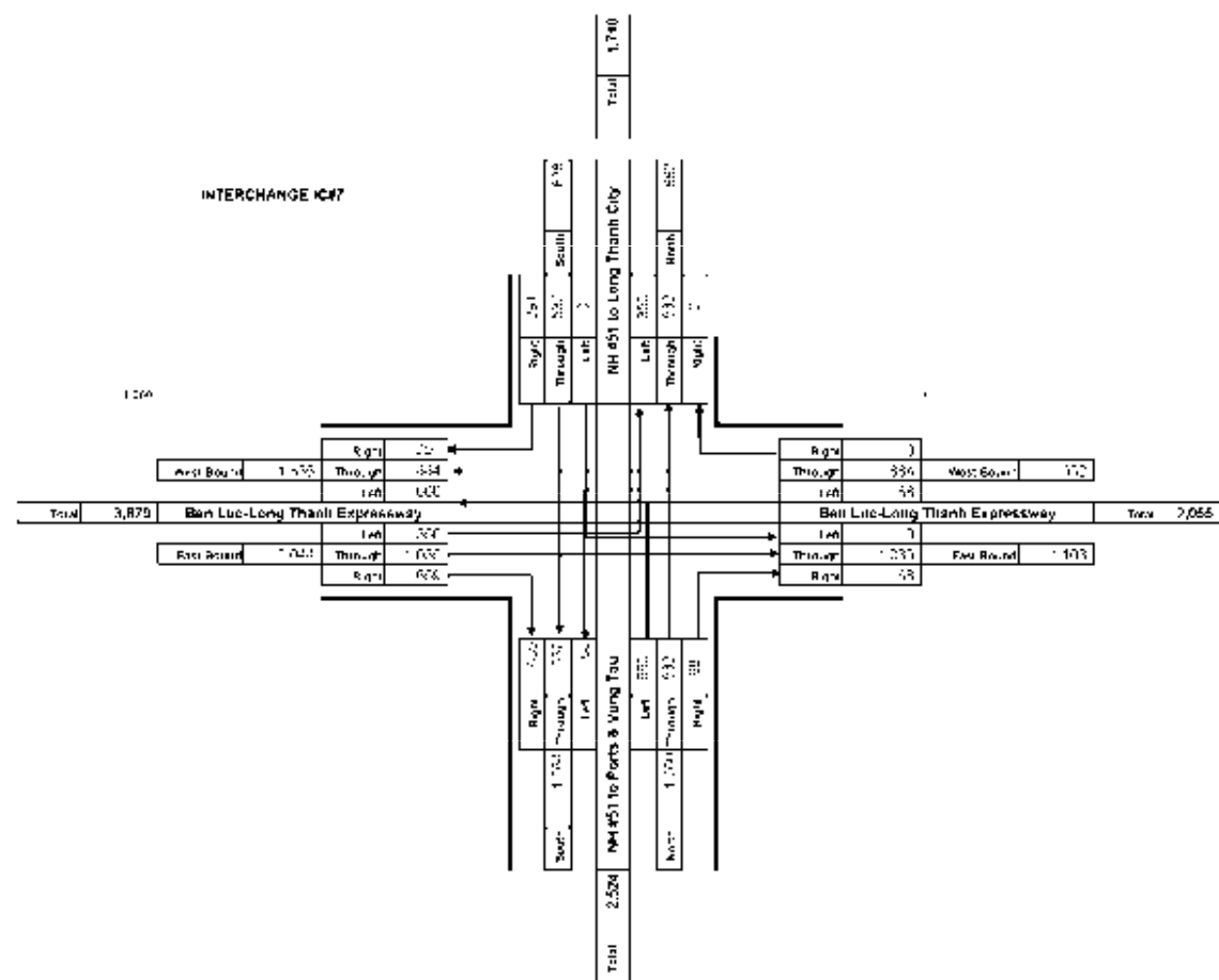


Figure 23: Peak hour traffic flow at Interchange IC#7 in 2026

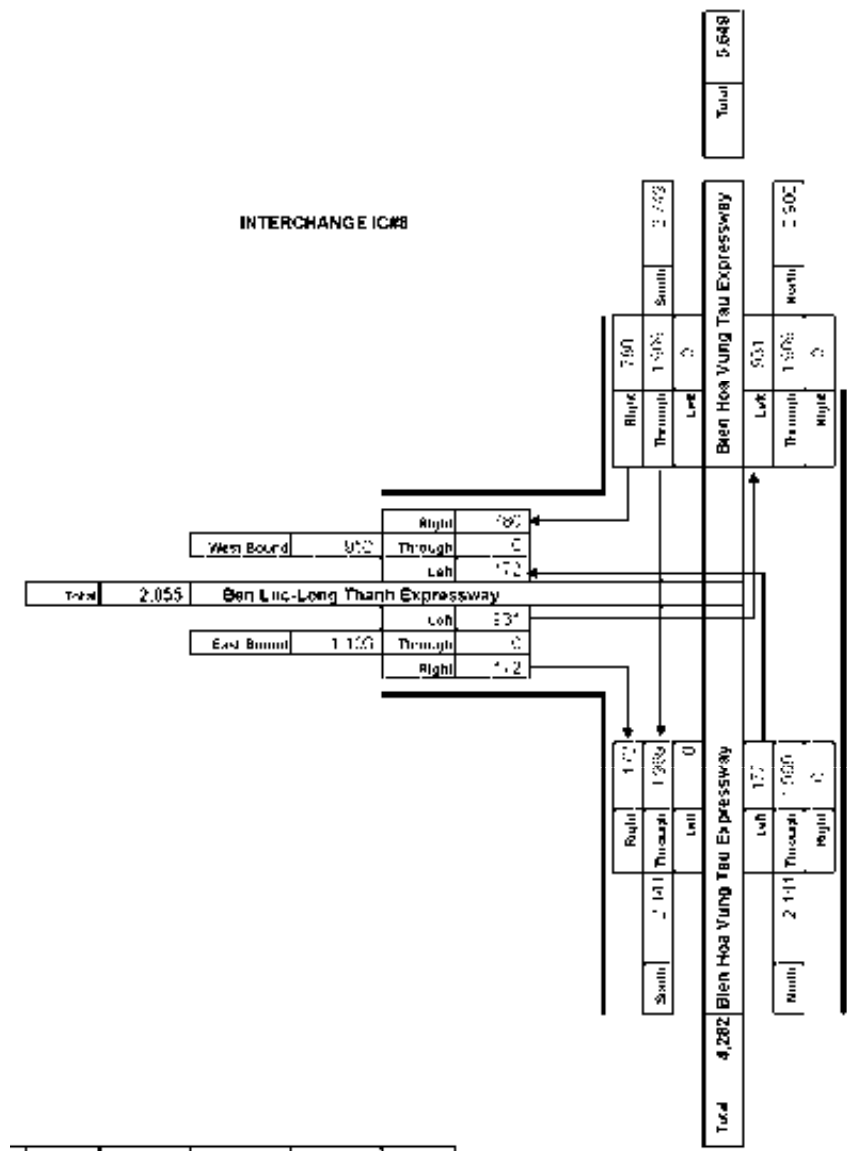


Figure 24: Peak hour traffic flow at Interchange IC#8 in 2026

APPENDIX C1:

HIGHWAY

DRAWINGS

I: General Drawing
I: Các bản vẽ chung

DRAWING LIST MỤC LỤC BẢN VẼ

No. STT	TITLE	TÊN BẢN VẼ	LEGEND KÝ HIỆU
I	GENERAL DRAWINGS	CÁC BẢN VẼ CHUNG	
1	DRAWING LIST (1/2)	MỤC LỤC BẢN VẼ (1/2)	RW-GD-010
2	DRAWING LIST (2/2)	MỤC LỤC BẢN VẼ (2/2)	RW-GD-020
3	LOCATION MAP	BẢN ĐỒ HƯỚNG TUYẾN	RW-GD-030
4	LEGEND	CHỈ CHU KÝ HIỆU	RW-GD-040
5	DETAILS OF GEOMETRIC DESIGN	CHI TIẾT THIẾT KẾ HÌNH HỌC	RW-GD-050
6	THE ELEMENTS OF HORIZONTAL ALIGNMENT CURVES	CÁC YẾU TỐ ĐƯỜNG DÒNG	RW-GD-060
II	TYPICAL CROSS SECTION	MẶT CẮT NGANG ĐIỂN HÌNH	
1	TYPICAL CROSS SECTION (1/3)	MẶT CẮT NGANG ĐIỂN HÌNH (1/3)	RW-CS-010
2	TYPICAL CROSS SECTION (2/3)	MẶT CẮT NGANG ĐIỂN HÌNH (2/3)	RW-CS-020
3	TYPICAL CROSS SECTION (3/3)	MẶT CẮT NGANG ĐIỂN HÌNH (3/3)	RW-CS-030
4	DETAIL OF PAVEMENT STRUCTURE (1/2)	CHI TIẾT KẾT CẤU ĐƯỜNG (1/2)	RW-CS-040
5	CONCRETE PAVEMENT AT TOLL GATE (2/2)	MẶT ĐƯỜNG BÊ TÔNG XÃ MĂNG TẠI TRẠM THU PHÍ (2/2)	RW-CS-050
6	DETAIL OF MEDIAN CURB	CHI TIẾT BỜ VÁ	RW-CS-060
7	SLOPE PROTECTION TYPE 1	CHI TIẾT BẢO VỆ MẶT TÀ LUY LOẠI 1	RW-CS-070
8	SLOPE PROTECTION TYPE 2	CHI TIẾT BẢO VỆ MẶT TÀ LUY LOẠI 2	RW-CS-080
III	PLAN AND PROFILE	BÌNH ĐỒ VÀ TRẮC ĐOC	
1	PLAN AND PROFILE KM0+000 - KM1+700	BÌNH ĐỒ VÀ TRẮC ĐOC KM0+000 - KM1+700	RW-PP-010
2	PLAN AND PROFILE KM1+700 - KM3+400	BÌNH ĐỒ VÀ TRẮC ĐOC KM1+700 - KM3+400	RW-PP-020
3	PLAN AND PROFILE KM3+400 - KM5+100	BÌNH ĐỒ VÀ TRẮC ĐOC KM3+400 - KM5+100	RW-PP-030
4	PLAN AND PROFILE KM5+100 - KM6+800	BÌNH ĐỒ VÀ TRẮC ĐOC KM5+100 - KM6+800	RW-PP-040
5	PLAN AND PROFILE KM6+800 - KM8+500	BÌNH ĐỒ VÀ TRẮC ĐOC KM6+800 - KM8+500	RW-PP-050
6	PLAN AND PROFILE KM8+500 - KM10+200	BÌNH ĐỒ VÀ TRẮC ĐOC KM8+500 - KM10+200	RW-PP-060
7	PLAN AND PROFILE KM10+200 - KM11+900	BÌNH ĐỒ VÀ TRẮC ĐOC KM10+200 - KM11+900	RW-PP-070
8	PLAN AND PROFILE KM11+900 - KM13+700	BÌNH ĐỒ VÀ TRẮC ĐOC KM11+900 - KM13+700	RW-PP-080
9	PLAN AND PROFILE KM13+700 - KM15+500	BÌNH ĐỒ VÀ TRẮC ĐOC KM13+700 - KM15+500	RW-PP-090
10	PLAN AND PROFILE KM15+500 - KM17+200	BÌNH ĐỒ VÀ TRẮC ĐOC KM15+500 - KM17+200	RW-PP-100
11	PLAN AND PROFILE KM17+200 - KM18+900	BÌNH ĐỒ VÀ TRẮC ĐOC KM17+200 - KM18+900	RW-PP-110
12	PLAN AND PROFILE KM18+900 - KM20+600	BÌNH ĐỒ VÀ TRẮC ĐOC KM18+900 - KM20+600	RW-PP-120
13	PLAN AND PROFILE KM20+600 - KM22+300	BÌNH ĐỒ VÀ TRẮC ĐOC KM20+600 - KM22+300	RW-PP-130
14	PLAN AND PROFILE KM22+300 - KM24+000	BÌNH ĐỒ VÀ TRẮC ĐOC KM22+300 - KM24+000	RW-PP-140
15	PLAN AND PROFILE KM24+000 - KM25+700	BÌNH ĐỒ VÀ TRẮC ĐOC KM24+000 - KM25+700	RW-PP-150
16	PLAN AND PROFILE KM25+700 - KM27+400	BÌNH ĐỒ VÀ TRẮC ĐOC KM25+700 - KM27+400	RW-PP-160
17	PLAN AND PROFILE KM27+400 - KM29+100	BÌNH ĐỒ VÀ TRẮC ĐOC KM27+400 - KM29+100	RW-PP-170
18	PLAN AND PROFILE KM29+100 - KM30+800	BÌNH ĐỒ VÀ TRẮC ĐOC KM29+100 - KM30+800	RW-PP-180



No. STT	TITLE	TÊN BẢN VẼ	LEGEND KÝ HIỆU
19	PLAN AND PROFILE KM29+100 - KM30+800	BÌNH ĐỒ VÀ TRẮC ĐOC KM29+100 - KM30+800	RW-PP-190
20	PLAN AND PROFILE KM30+800 - KM32+500	BÌNH ĐỒ VÀ TRẮC ĐOC KM30+800 - KM32+500	RW-PP-200
21	PLAN AND PROFILE KM32+500 - KM34+200	BÌNH ĐỒ VÀ TRẮC ĐOC KM32+500 - KM34+200	RW-PP-210
22	PLAN AND PROFILE KM34+200 - KM36+000	BÌNH ĐỒ VÀ TRẮC ĐOC KM34+200 - KM36+000	RW-PP-220
23	PLAN AND PROFILE KM36+000 - KM37+800	BÌNH ĐỒ VÀ TRẮC ĐOC KM36+000 - KM37+800	RW-PP-230
24	PLAN AND PROFILE KM37+800 - KM39+400	BÌNH ĐỒ VÀ TRẮC ĐOC KM37+800 - KM39+400	RW-PP-240
25	PLAN AND PROFILE KM39+400 - KM41+000	BÌNH ĐỒ VÀ TRẮC ĐOC KM39+400 - KM41+000	RW-PP-250
26	PLAN AND PROFILE KM41+000 - KM42+600	BÌNH ĐỒ VÀ TRẮC ĐOC KM41+000 - KM42+600	RW-PP-260
27	PLAN AND PROFILE KM42+600 - KM44+200	BÌNH ĐỒ VÀ TRẮC ĐOC KM42+600 - KM44+200	RW-PP-270
28	PLAN AND PROFILE KM44+200 - KM45+800	BÌNH ĐỒ VÀ TRẮC ĐOC KM44+200 - KM45+800	RW-PP-280
29	PLAN AND PROFILE KM45+800 - KM47+400	BÌNH ĐỒ VÀ TRẮC ĐOC KM45+800 - KM47+400	RW-PP-290
30	PLAN AND PROFILE KM47+400 - KM49+000	BÌNH ĐỒ VÀ TRẮC ĐOC KM47+400 - KM49+000	RW-PP-300
31	PLAN AND PROFILE KM49+000 - KM50+600	BÌNH ĐỒ VÀ TRẮC ĐOC KM49+000 - KM50+600	RW-PP-310
32	PLAN AND PROFILE KM50+600 - KM52+200	BÌNH ĐỒ VÀ TRẮC ĐOC KM50+600 - KM52+200	RW-PP-320
33	PLAN AND PROFILE KM52+200 - KM53+800	BÌNH ĐỒ VÀ TRẮC ĐOC KM52+200 - KM53+800	RW-PP-330
34	PLAN AND PROFILE KM53+800 - KM55+400	BÌNH ĐỒ VÀ TRẮC ĐOC KM53+800 - KM55+400	RW-PP-340
35	PLAN AND PROFILE KM55+400 - KM57+000	BÌNH ĐỒ VÀ TRẮC ĐOC KM55+400 - KM57+000	RW-PP-350
36	PLAN AND PROFILE KM57+000 - KM58+500	BÌNH ĐỒ VÀ TRẮC ĐOC KM57+000 - KM58+500	RW-PP-360
IV	INTERCHANGE	NÚT GIAO	
1	TYPICAL CROSS SECTION OF INTERCHANGE RAMPWAY (1)	MẶT CẮT NGANG ĐIỂN HÌNH ĐƯỜNG NHÁNH NÚT GIAO (1/2)	RW-C-010
2	TYPICAL CROSS SECTION OF INTERCHANGE RAMPWAY (2)	MẶT CẮT NGANG ĐIỂN HÌNH ĐƯỜNG NHÁNH NÚT GIAO (2/2)	RW-C-020
3	PLAN OF INTERCHANGE NO.1	BÌNH ĐỒ NÚT GIAO SỐ 1	RW-C-030
4	ALIGNMENT OF INTERCHANGE NO.1	YẾU TỐ HÌNH HỌC NÚT GIAO SỐ 1	RW-C-040
5	PROFILE OF RAMP A,B,C,D OF INTERCHANGE NO.1	TRẮC ĐOC NHÁNH A,B,C,D NÚT GIAO SỐ 1	RW-C-050
6	PROFILE OF RAMP E,F,G,H,I OF INTERCHANGE NO.1	TRẮC ĐOC NHÁNH E,F,G,H,I NÚT GIAO SỐ 1	RW-C-060
7	TRAFFIC FORECAST AT INTERCHANGE NO.1	ƯỚC BẢO LƯU LƯỢNG GIAO THỔNG TẠI NÚT GIAO SỐ 1	RW-C-070
8	PLAN OF INTERCHANGE NO.2	BÌNH ĐỒ NÚT GIAO SỐ 2	RW-C-080
9	ALIGNMENT OF INTERCHANGE NO.2	YẾU TỐ HÌNH HỌC NÚT GIAO SỐ 2	RW-C-090
10	PROFILE OF NH1A	TRẮC ĐOC NHÁNH QUỐC LỘ 1A	RW-C-100
11	TRAFFIC FORECAST AT INTERCHANGE NO.2	ƯỚC BẢO LƯU LƯỢNG GIAO THỔNG TẠI NÚT GIAO SỐ 2	RW-C-110
12	PLAN OF INTERCHANGE NO.3	BÌNH ĐỒ NÚT GIAO SỐ 3	RW-C-120
13	ALIGNMENT OF INTERCHANGE NO.3	YẾU TỐ HÌNH HỌC NÚT GIAO SỐ 3	RW-C-130
14	PROFILE OF RAMP A,B OF INTERCHANGE NO.3	TRẮC ĐOC NHÁNH A,B NÚT GIAO SỐ 3	RW-C-140
15	PROFILE OF RAMP C,D,E OF INTERCHANGE NO.3	TRẮC ĐOC NHÁNH C,D,E NÚT GIAO SỐ 3	RW-C-150

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								1	FEB-2010	FINAL DRAWING	
											SCALE
						DRAWING TITLE:					
						(1/2) MỤC LỤC BẢN VẼ					

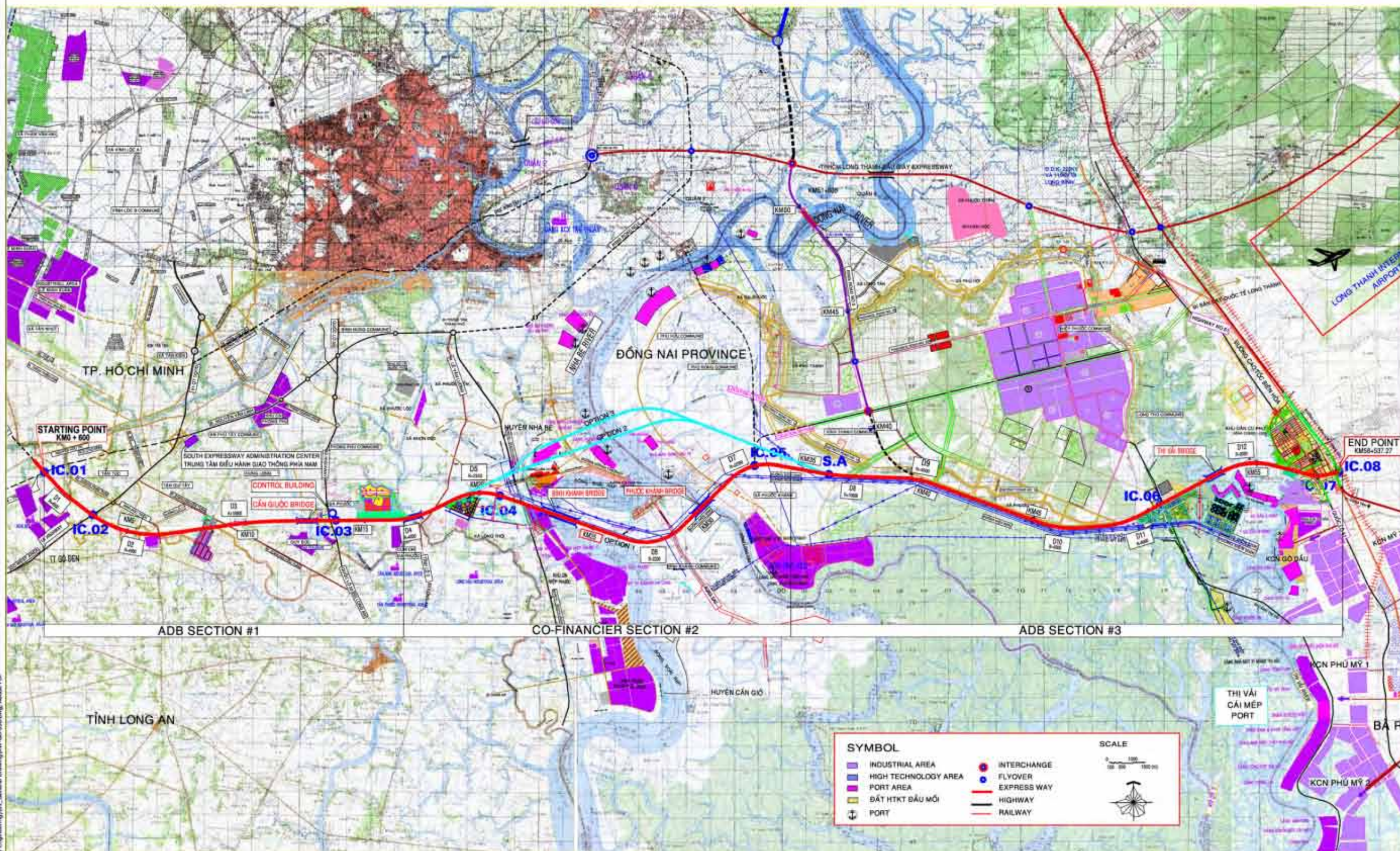
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MỤC LỤC BẢN VẼ

No. STT	TITLE	TÊN BẢN VẼ	LEGEND KÝ HIỆU
16	TRAFFIC FORECAST AT INTERCHANGE NO 3	DỰ BÁO LƯU LƯỢNG GIAO THÔNG TẠI NÚT GIAO SỐ 3	RW-IC-160
17	PLAN OF INTERCHANGE NO 4	BÌNH ĐỒ NÚT GIAO SỐ 4	RW-IC-170
	PLAN OF INTERCHANGE NO 4 - STAGE 2	BÌNH ĐỒ NÚT GIAO SỐ 4 - GIAI ĐOẠN 2	RW-IC-171
18	ALIGNMENT OF INTERCHANGE NO 4	YÊU TỐ HÌNH HỌC NÚT GIAO SỐ 4	RW-IC-180
19	PROFILE OF RAMP A B OF INTERCHANGE NO 4	TRẮC ĐỌC NHÁNH A B NÚT GIAO SỐ 4	RW-IC-190
20	PROFILE OF RAMP C D E OF INTERCHANGE NO 4	TRẮC ĐỌC NHÁNH C D E NÚT GIAO SỐ 4	RW-IC-200
21	TRAFFIC FORECAST AT INTERCHANGE NO 4	DỰ BÁO LƯU LƯỢNG GIAO THÔNG TẠI NÚT GIAO SỐ 4	RW-IC-210
22	PLAN OF INTERCHANGE NO 5	BÌNH ĐỒ NÚT GIAO SỐ 5	RW-IC-220
23	ALIGNMENT OF INTERCHANGE NO 5	YÊU TỐ HÌNH HỌC NÚT GIAO SỐ 5	RW-IC-230
24	TRAFFIC FORECAST AT INTERCHANGE NO 5	DỰ BÁO LƯU LƯỢNG GIAO THÔNG TẠI NÚT GIAO SỐ 5	RW-IC-240
25	PLAN OF INTERCHANGE NO 6	BÌNH ĐỒ NÚT GIAO SỐ 6	RW-IC-250
26	ALIGNMENT OF INTERCHANGE NO 6	YÊU TỐ HÌNH HỌC NÚT GIAO SỐ 6	RW-IC-260
27	PROFILE OF INTERCHANGE NO 6	TRẮC ĐỌC NÚT GIAO SỐ 6	RW-IC-270
28	TRAFFIC FORECAST AT INTERCHANGE NO 6	DỰ BÁO LƯU LƯỢNG GIAO THÔNG TẠI NÚT GIAO SỐ 6	RW-IC-280
29	PLAN OF INTERCHANGE NO 7	BÌNH ĐỒ NÚT GIAO SỐ 7	RW-IC-290
30	ALIGNMENT OF INTERCHANGE NO 7 (1/2)	YÊU TỐ HÌNH HỌC NÚT GIAO SỐ 7 (1/2)	RW-IC-300
31	ALIGNMENT OF INTERCHANGE NO 7 (2/2)	YÊU TỐ HÌNH HỌC NÚT GIAO SỐ 7 (2/2)	RW-IC-310
32	PROFILE OF INTERCHANGE NO 7	TRẮC ĐỌC NÚT GIAO SỐ 7	RW-IC-320
33	TRAFFIC FORECAST AT INTERCHANGE NO 7	DỰ BÁO LƯU LƯỢNG GIAO THÔNG TẠI NÚT GIAO SỐ 7	RW-IC-330
34	PLAN OF INTERCHANGE NO 8	BÌNH ĐỒ NÚT GIAO SỐ 8	RW-IC-340
35	ALIGNMENT OF INTERCHANGE NO 8	YÊU TỐ HÌNH HỌC NÚT GIAO SỐ 8	RW-IC-350
36	TRAFFIC FORECAST AT INTERCHANGE NO 8	DỰ BÁO LƯU LƯỢNG GIAO THÔNG TẠI NÚT GIAO SỐ 8	RW-IC-360
V	DRAINAGES AND TECHNICAL CULVERTS	HỆ THỐNG THOÁT NƯỚC VÀ CÔNG KỸ THUẬT	
1	CULVERT INVENTORY	DANH MỤC CÔNG	RW-DT-010
2	GENERAL VIEW OF BOX CULVERT 4x3.2x3.0M	BỘ TRƯ CHUNG CÔNG HỘP 4x3.0x3.0M	RW-DT-020
3	GENERAL VIEW OF BOX CULVERT 2x3.2x3.0M	BỘ TRƯ CHUNG CÔNG HỘP 2x3.0x3.0M	RW-DT-030
4	GENERAL VIEW OF BOX CULVERT 1.3.2x3.0M	BỘ TRƯ CHUNG CÔNG HỘP 1.3.0x3.0M	RW-DT-040
5	GENERAL VIEW OF BOX CULVERT 1.2.2x2.0M	BỘ TRƯ CHUNG CÔNG HỘP 1.2.0x2.0M	RW-DT-050
6	GENERAL VIEW OF BOX CULVERT 2x1.2x2.0M	BỘ TRƯ CHUNG CÔNG HỘP 2x1.0x2.0M	RW-DT-060
7	GENERAL VIEW OF PIPE CULVERT Ø2.0M	BỘ TRƯ CHUNG CÔNG TRÒN Ø2.0M	RW-DT-070
8	GENERAL VIEW OF PIPE CULVERT Ø1.5M	BỘ TRƯ CHUNG CÔNG TRÒN Ø1.5M	RW-DT-080
9	GENERAL VIEW OF PIPE CULVERT Ø1.0M	BỘ TRƯ CHUNG CÔNG TRÒN Ø1.0M	RW-DT-090
10	GENERAL VIEW OF TECHNICAL CULVERT 2.0x2.0M	BỘ TRƯ CHUNG CÔNG HỘP KỸ THUẬT 2.0x2.0M	RW-DT-100
11	TYPICAL IRRIGATION CROSS SECTION	MẶT CẮT NGANG ĐẠI DIỆN CẢI MƯƠNG	RW-DT-110
VI	UNDERPASS AND OVERPASS	CÔNG CHUI VÀ CẦU VƯỢT	
1	TABLE OF LIG AND RELocate ROAD	BẢNG THÔNG KẾ CÔNG CHUI CẢI VƯỢT ĐƯỜNG GOM DẪN SỰ	RW-UO-000
2	GENERAL VIEW OF UNDERPASS CULVERT (4.5x3.2M (1/2)	BỘ TRƯ CHUNG CÔNG CHUI 4.5x3.2M (1/2)	RW-UO-010
3	GENERAL VIEW OF UNDERPASS CULVERT (4.5x3.2M (2/2)	BỘ TRƯ CHUNG CÔNG CHUI 4.5x3.2M (2/2)	RW-UO-020
4	GENERAL VIEW OF UNDERPASS CULVERT (6.0x3.2M (1/2)	BỘ TRƯ CHUNG CÔNG CHUI 6.0x3.2M (1/2)	RW-UO-030

No. STT	TITLE	TÊN BẢN VẼ	LEGEND KÝ HIỆU
5	GENERAL VIEW OF UNDERPASS CULVERT (6.0x3.0M) (1/2)	BỒ TRÍ CHUNG CÔNG CHU (6.0x3.0M) (1/2)	RW-U0-040
6	DETAIL OF R.C.PILE (30x30)CM	CẦU TẠO CỌC BÊ TÔNG COT THÉP (30x30)CM	RW-U0-050
7	PLAN AND PROFILE OF N.H.S FLYOVER	BÌNH BỐ VÀ TRẮC ĐỌC CẦU VƯỢT QUỐC LỘ S0	RW-U0-060
VII	TRAFFIC SAFETY	AN TOÀN GIAO THÔNG	
1	DETAILS OF PAVEMENT MARKING (1/3)	CHI TIẾT VẠCH SƠN (1/3)	RW-TS-010
2	DETAILS OF PAVEMENT MARKING (2/3)	CHI TIẾT VẠCH SƠN (2/3)	RW-TS-020
3	DETAILS OF PAVEMENT MARKING (3/3)	CHI TIẾT VẠCH SƠN (3/3)	RW-TS-030
4	DETAILS OF GUARD RAIL	CHI TIẾT LÀN CÁN TỌA SÔNG	RW-TS-040
5	DETAILS OF KM POST AND LANDMARK	CHI TIẾT CỘT LY TRÌNH VÀ MỐC LỘ GIỚI	RW-TS-050
6	DIMENSION OF BOARDS SIGNS (1/2)	KÍCH THƯỚC CÁC LOẠI BIỂN BÁO (1/2)	RW-TS-060
7	DIMENSION OF BOARDS SIGNS (2/2)	KÍCH THƯỚC CÁC LOẠI BIỂN BÁO (2/2)	RW-TS-070
8	TRAFFIC SIGN ONE POST TYPE 1 AND 2	CẦU TẠO CỘT BIỂN BÁO 1 CỘT KIỂU 1 VÀ 2	RW-TS-080
9	CANTILEVER SIGN (BT-3 (461))	CẦU TẠO DẠNG NGÀM (BT-3 (461))	RW-TS-090
10	OVERHEAD SIGN (2 LANES/ ONEWAY) (459G, 463B, 463C)	DẠNG TREO TRÊN CAO (2 LÀN - 1 CHIỀU) (459G, 463B, 463C)	RW-TS-100
VIII	LIGHTING AND POWER SUPPLY	HỆ THỐNG CHIẾU SÁNG VÀ CẤP NGUỒN	
1	EMBANKMENT CROSS SECTION	MẶT CẮT NGANG ĐƯỜNG	RW-LP-010
2	CROSS SECTION OF BRIDGE	MẶT CẮT NGANG CẦU	RW-LP-020
3	TOLL PLAZA CROSS SECTION	MẶT CẮT NGANG TRẠM THU PHÍ	RW-LP-030
4	DETAIL OF 10M POLE	CHI TIẾT CỘT 10M	RW-LP-040
5	DETAIL OF 14M POLE	CHI TIẾT CỘT 14M	RW-LP-050
6	UNDER BRIDGE LIGHT	ĐEN DƯỚI GẦM CẦU	RW-LP-060
7	NAVIGATION LIGHT	ĐEN THÔNG THUẬN	RW-LP-070
8	MANHOLE AND CABLE TROUGH	HỐ GÀ LƯỚI CÁP VÀ RÀNH CÁP	RW-LP-080
9	SUBSTATION	TRẠM BIẾN ÁP	RW-LP-090
IX	MISCELLANEOUS	CÁC CHI TIẾT KHÁC	
1	GUARD FENCE DETAILS	CHI TIẾT HÀNG RÀO BẢO VỆ	RW-MI-010
2	DETAILS OF TREES PLANNING	CHI TIẾT QUY HOẠCH CÂY XANH	RW-MI-020
3	SERVICE AREA - OPTION 1	TRẠM PHỤC VỤ - PHƯƠNG ÁN 1	RW-MI-030
4	SERVICE AREA - OPTION 2	TRẠM PHỤC VỤ - PHƯƠNG ÁN 2	RW-MI-040
5	CROSS SECTION OF TOLL GATE	CÁC KIỂU CẮT NGANG TRẠM THU PHÍ	RW-MI-050
6	PLAN OF TOLL PLAZA	MẶT BẰNG TRẠM THU PHÍ	RW-MI-060
7	GENERAL VIEW OF TOLL PLAZA OF INTERCHANGE NO.1	BỒ TRÍ CHUNG TRẠM THU PHÍ NÚT GIAO SỐ 1	RW-MI-070
8	GENERAL VIEW OF TOLL PLAZA OF INTERCHANGE NO.2	BỒ TRÍ CHUNG TRẠM THU PHÍ NÚT GIAO SỐ 2	RW-MI-080
9	GENERAL VIEW OF TOLL PLAZA OF INTERCHANGE NO.3	BỒ TRÍ CHUNG TRẠM THU PHÍ NÚT GIAO SỐ 3	RW-MI-090
10	GENERAL VIEW OF TOLL PLAZA OF INTERCHANGE NO.4	BỒ TRÍ CHUNG TRẠM THU PHÍ NÚT GIAO SỐ 4	RW-MI-100
11	GENERAL VIEW OF TOLL PLAZA OF INTERCHANGE NO.5	BỒ TRÍ CHUNG TRẠM THU PHÍ NÚT GIAO SỐ 5	RW-MI-110
12	GENERAL VIEW OF TOLL PLAZA OF INTERCHANGE NO.6	BỒ TRÍ CHUNG TRẠM THU PHÍ NÚT GIAO SỐ 6	RW-MI-120
13	GENERAL VIEW OF TOLL PLAZA OF INTERCHANGE NO.7	BỒ TRÍ CHUNG TRẠM THU PHÍ NÚT GIAO SỐ 7	RW-MI-130
X	DETAILS CROSS SECTION	MẶT CẮT NGANG CHI TIẾT	RW-DCS-000

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								1	FEB-2010	FINAL DRAWING			
						DRAWING TITLE:		DRAWING LIST					SCALE:
						(2/2)		MỤC LỤC BẢN VẼ					-
TITLE				NAME		SIGNATURE							
PREPARED BY				NGUYEN THANH PHUONG									
CHECKED BY				LE ANH HIEU									
APPROVED BY				TIMOTHY COLLETT									

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
LOCATION MAP SCALE 1:150.000



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								1	FEB-2010	FINAL DRAWING												
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						<table><tr><th>TITLE</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>Le Ngoc HIEU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TITLE	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	Le Ngoc HIEU		APPROVED BY	Timothy COLLETT		
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ABBREVIATIONS AND SYMBOLS

CHỮ VIẾT TẮT VÀ KÝ HIỆU

	HOUSE WITH HILL OR 2 NHÀ 1 HOẶC 2 LẦU		HANGING TRANSFORMER BIẾN THẾ TRÓC		SEPARATE TREES CỤM CÂY ĐỘC LẬP		BIG TREE LINE HÀNG CÂY TO		INFLAMMABLE HOUSE ON COLUMN NHÀ KÉM CHỮ LỬA-TRÊN CỘT		SCHOOL TRƯỜNG HỌC
	BRICK HOUSE NHÀ GẠCH		POST OFFICE BƯỞNG CH		CONSTRUCTION BLOCK CỤM LỎ		FLOWER HUA		INFLAMMABLE HOUSE NHÀ KÉM CHỮ LỬA		WALL TƯỜNG
	BUILDING HOUSE WITH PLATE ROOF NHÀ XÂY MẶT TÓN		LIFTING CRANE CÁN CÀU		RADIO STATION BÀ PHÁT THANH		BOREHOLE MỎ KHỎA		HOUSE WITHOUT WALL NHÀ KHÔNG TƯỜNG		LONG WALL TƯỜNG DÀI
	WOODEN HOUSE WITH LEAVES ROOF NHÀ GỖ MÀU LÁ		UNDERGROUND CABLE CÁP NGẦM		WATER FOUNTAIN BỂ PHUN NƯỚC		NORTH HƯỚNG BẮC		CHURCH NHÀ THỜ		ROCK CLIFF VÁCH ĐÁ
	PLATE HOUSE NHÀ TÓN		STRING TREE CÂY DÂY		FLAT ROCK ĐÁ NỔI		METEOROLOGY KHÍ TƯỢNG		HOUSE ON COLUMNS NHÀ TRÊN CỘT		CROP VẾT LỎ
	TEMPLES ĐÌNH MIẾU		BUSHY TREE CÂY RẬM		FULL ĐẢO ĐỎ		KM		INCINERATOR MỸ HOÁ TẮNG		COOK VƯỜN NƯỚC
	MEMORIAL STELE BIA TƯỞNG NIỆM		SHADOW TREE CÂY ẦM		N LIGHT ĐÈN CHỈ M		MAUSOLEUM LĂNG LẮN		CHIMNEY ÔNG KHỐ		HIGH VOLTAGE POLE CỘT ĐIỆN CAO THẾ
	SEPARATE TOMB MỘ XÂY ĐỘC LẬP		UMBRELLA TREE CÂY TÀN BÈ		DOUBLE LIGHT ĐÈN ĐÔI		REED LAU SẤY		THORNY FENCE RÀO GÀ		LOW VOLTAGE POLE CỘT ĐIỆN HẠ THẾ
	TRAFFIC SIGNAL BẢO HIỆU GIAO THÔNG		CREEPER CÂY TRÊN DÂY		SIGNAL LIGHT ĐÈN HIỆU		BLOCK HOUSE LỖ CỘT		VEGETABLE RAU		SLOPE BORDER BÊN TÀI LỖ
	TELEPHONE BOX HỘP ĐIỆN THOẠI		INDUSTRIAL AREA CỤM CÔNG NGHIỆP		N LIGHT ĐÈN M		SEPARATE CONSTRUCTION CÔNG TRÌNH ĐỘC LẬP		SPARSE FOREST RỪNG THưa		BUILDING WALL TƯỜNG XÂY
	TRANSFORMER STATION TRẠM BIẾN LƯU		WATCH TOWER CHỖ QUAN		S LIGHT ĐÈN S		BUNGALOW BỤI CÂY LƯA		SALT FOREST RỪNG NGẬP VẠN		FENCE HÀNG RÀO
	COCONUT TREE CÂY DỪA		HIGH GRASS CỎ CAO		SIGNAL LIGHT ĐÈN TÍN HIỆU		FIELD MƯỜI		AIRPORT SÂN BAY		FRUIT TREE CÂY AN QUẢ
	WATER COCONUT TREE CÂY DỪA NƯỚC		WATER HORN CORN NƯỚC		STAR/ROUND POINT ĐÈN THIÊN VÂN		LAND SURVEY BENCHMARK MỐC BẠCH CHINH		LOTUS SEN AU		CULVERT CỐNG
	ANTENNA ĂNG TEN		LIGHTNING ROD CỘT CHỐNG SÉT		TELEPHONE LINE DƯỜNG ĐIỆN THOẠI		ELEVATION BENCHMARK MỐC ĐO CAO		CHANNEL GATE CÁM QUAN		SECONDARY TRAVERSE ĐƯỜNG CHUYỂN CẤP 2
	FLOATING ROCK PLAIN BÀ ĐÁ NỔI		FLAG POLE CỘT CỜ		PILING TELEPHONE ĐIỆN THOẠI CÔNG CỘNG		GRADE BENCHMARK MỐC HẠNG M		ANGKOR TOWER THÁP CỎ		GNB STONE MỐC GRANITE
	INFORMATION BOARD BẢNG TIN		HEADLIGHT COLUMN CỘT ĐÈN PHA		WIND MACHINE CƠ XAY GIÓ		BAMBOO SUGAR CANE TRÉ - MÍA		STONE FENCE RÀO SỎNG SẮT		MANHOLE HỐ GÀ
	RCA STATION BẾN ĐÓ		CLOCK POLE CỘT ĐỒNG HỒ		RAILWAY ĐƯỜNG SẮT		GATE COLUMN TRỤ CỘT		TREE FENCE RÀO CÂY		
	HOSPITAL BỆNH VIỆN		TOWER COLUMN CỘT THÁP		BELL TOWER GÁC CHUÔNG		RIGHT OF WAY - RANH GIỚI PHÒNG MẶT BẰNG STATION - LÝ TRÌNH ELEVATION - CAO ĐỘ				
	FERRY BẾN PHÀ		TUNNEL GATE CỬA HẦM		WIND MACHINE CƠ XAY GIÓ						
	DRILL NO FRAME WORK SÀN KHỎA		GRAVEYARD NGHĨA TRANG		RAILWAY CROSSING CẮT CH						
	BUILDING WELL GIẾNG XÂY		CONSTRUCTING HOUSE NHÀ ĐANG XÂY		PIN TREE CÂY THÔNG PH LẠO						
	WATER PUMP GIẾNG NƯỚC		BROKEN HOUSE NHÀ HỎNG		HYDROELECTRIC STATION TRẠM THỦY ĐIỆN						
	YOUNG TREE ROW HÀNG CÂY NON				TRANSITION FUEL STATION TRẠM TIẾP XĂNG						
					FUEL STATION TRẠM XĂNG						

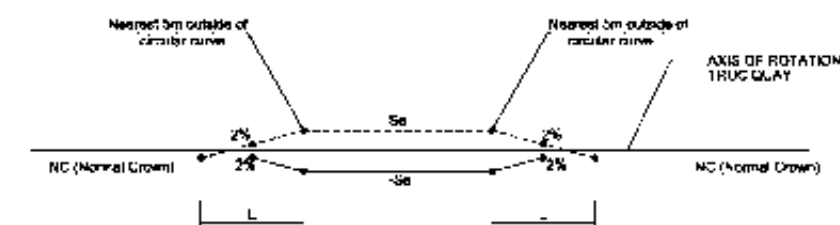
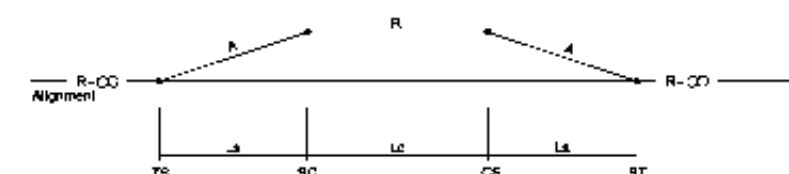
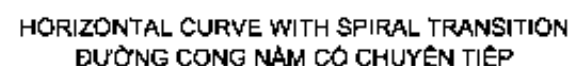
GENERAL NOTES

1. DESIGN FLOOD LEVEL (DFL) IS THE DESIGN FLOOD LEVEL FOR THE FREQUENCY ALL CULVERTS SHOULD BE CONSTRUCTED AFTER THE SOFT SOIL IMPROVEMENT.
2. DESIGN FLOOD LEVEL (DFL) IS THE DESIGN FLOOD LEVEL FOR THE FREQUENCY ALL CULVERTS SHOULD BE CONSTRUCTED AFTER THE SOFT SOIL IMPROVEMENT.
3. ALL CULVERTS SHOULD BE CONSTRUCTED AFTER THE SOFT SOIL IMPROVEMENT.

GHI CHÚ CHUNG

1. MỨC NƯỚC THIẾT KẾ (DFL) LÀ MỨC NƯỚC THIẾT KẾ VỚI TẦN SUẤT M. TẤT CẢ CỐNG CHỈ ĐƯỢC XÂY DỰNG SAU KHI ĐIỀU LỊNH.
2. MỨC NƯỚC THIẾT KẾ (DFL) LÀ MỨC NƯỚC THIẾT KẾ VỚI TẦN SUẤT M. TẤT CẢ CỐNG CHỈ ĐƯỢC XÂY DỰNG SAU KHI ĐIỀU LỊNH.
3. MỨC NƯỚC THIẾT KẾ (DFL) LÀ MỨC NƯỚC THIẾT KẾ VỚI TẦN SUẤT M. TẤT CẢ CỐNG CHỈ ĐƯỢC XÂY DỰNG SAU KHI ĐIỀU LỊNH.

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								1	FFB-2010	FINAL DRAWING	
											SCALE
						LEGEND CHỈ CHỮ KÝ HIỆU					



(PAVEMENT ROTATION ABOUT INNER EDGE OF CARRIAGEWAY)
(QUAY MẶT ĐƯỜNG QUANH MÉP TRONG LÀN XE)

- PI = POINT OF INTERSECTION
- IA = INTERSECTION AND CENTRAL ANGLE OF CIRCULAR CURVE
- R = RADIUS OF THE CIRCULAR CURVE
- A = PARAMETER OF THE TRANSIT ON CURVE $A = \sqrt{R \Delta}$
- LS = LENGTH OF SPIRAL
- IS = SPIRAL ANGLE AT SC OR CS
- IC = CENTRAL ANGLE OF THE CIRCULAR CURVE SC TO CS
- LC = LENGTH OF THE CIRCULAR CURVE FROM SC TO CS
- Xa, Yb = TANGENT DISTANCE AND OFFSET FROM TB TO SC & S' TO C
- ES = TOTAL EXTERNAL DISTANCE FROM PI TO MIDDLE OF CURVE
- P = OFFSET BETWEEN CIRCULAR CURVE & MAIN TANGENT
- Xm = TANGENT DISTANCE TO THE PROJECTION OF M
- LI = LENGTH TANGENT OF SPIRAL
- SR = SPIRAL ANGLE OF SPIRAL
- TI = TOTAL TANGENT DISTANCE FROM TS TO PI
- TS = BEGINNING OF SPIRAL CURVE
- SC = POINT OF CHANGE FROM SPIRAL TO CIRCULAR CURVE
- CS = POINT OF CHANGE FROM CIRCULAR CURVE TO SPIRAL
- ST = END OF SPIRAL CURVE
- M = CENTER OF CIRCULAR CURVE

- H - BÌNH BƯỜNG SONG NÀM
- IA - GÓC CHUYỂN HƯỚNG
- R - BÁN KÍNH BƯỜNG CONG NÀM
- A - THÂN SƠ BƯỜNG CONG CHUYỂN TIẾP A-TRAIL
- Lb - CHIỀU DÀI BƯỜNG CONG CHUYỂN TIẾP
- If - GÓC CHUYỂN HƯỚNG BƯỜNG CONG CHUYỂN TIẾP
- lc - SÓC CHUYỂN HƯỚNG BƯỜNG CONG TRÒN
- Lc - CHIỀU DÀI BƯỜNG CONG TRÒN
- Xa, Ya - KHOẢNG CÁCH VÀ ĐỘ DỊCH TỶ TÊN BÊN SÓC SỰ GIỚI CH
- ES - ĐỘ DỊCH TỶ ĐỈNH PHÂN ĐIỂM CỦA BƯỜNG CONG TRÒN
- P - KHOẢNG CÁCH SỬA CONG TRÒN VÀ CẢNH TUYẾN
- Xm - KHOẢNG CÁCH TỰ ĐIỂN NƠI ĐÁI BÊN TÂN BƯỜNG CONG TRÒN THEO PHƯƠNG CẢNH TUYẾN
- Li - CHIỀU DÀI CẢNH TUYẾN CỦA BƯỜNG CONG CHUYỂN TIẾP
- Si - CHIỀU DÀI TIẾP TUYẾN CỦA BƯỜNG CONG CHUYỂN TIẾP
- Ti - CHIỀU DÀI TIẾP TUYẾN CỦA BƯỜNG SONG NÀM
- TB - MÔI BẦU
- SC - TIẾP BẦU
- CS - TIẾP CƯỜI
- ST - MÔI CƯỜI
- M - TÂN BƯỜNG CONG TRÒN

- PVI = POINT OF VERTICAL INTERSECTION
- PVC = POINT OF VERTICAL CURVATURE
- PVT = POINT OF VERTICAL TANGENCY
- L = LENGTH OF VERTICAL CURVE
- G1, G2 = GRADE IN PERCENT
- MO = MIDDLE ORDINATE
- X = DISTANCE FROM PVC OR PVT TO POINT ON VERTICAL CURVE
- Y = VERTICAL OFFSET AT DISTANCE X FROM TANGENT TO VERTICAL CURVE

1 FOR SYNTHETIC PARADOX CURVE

$$WD = \frac{(G1 - G2) \times L}{800} \quad Y = \frac{(G1 - G2) \times X^2}{2000}$$

2. TO CONVERT THE SYNTHETICAL PARABOLIC CURVE TO EQUIVALENT CIRCULAR CURVE USE FORMULA

$$R = \frac{100 \text{ L}}{67 \text{ g}} = 100 \text{ K}$$

- PVI = ĐỈNH ĐƯỜNG CÔNG ĐƯỜNG
- PVC = ĐIỂM ĐẦU ĐƯỜNG CÔNG ĐƯỜNG
- PVT = ĐIỂM CUỐI ĐƯỜNG CÔNG ĐƯỜNG
- L = CHIỀU DÀI ĐƯỜNG CÔNG ĐƯỜNG
- G_{1, G₂} = ĐỘ DỐC (%)
- MID = ĐỘ LỆCH TỪ ĐỈNH ĐẾN ĐƯỜNG CÔNG ĐƯỜNG THEO PHƯƠNG HORIZONTAL
- X = KHOẢNG CÁCH THEO PHƯƠNG NGANG TỪ ĐIỂM ĐẦU HOẶC ĐIỂM CUỐI ĐẾN MỘT ĐIỂM TRÊN ĐƯỜNG CÔNG ĐƯỜNG
- Y = KHOẢNG CÁCH THEO PHƯƠNG ĐƯỜNG TỪ MỘT ĐIỂM TRÊN ĐƯỜNG CÔNG ĐƯỜNG ĐẾN CẠNH TANG

* VỚI ĐƯỜNG CÓNG ĐUNG PARABOL ĐỒ XÃNG:

$$k_{\text{cat}} = \frac{(31-32)L}{500} \quad v = \frac{(31-32)X}{200L}$$

1. 2. CHUYỂN TỪ BƯỞNG PARABOL DỐI XÔNG SANG BƯỚC CÔNG TRÒN

$$q = \frac{100 \text{ L}}{0.32 - 0.31} = 100 \text{ K}$$

$$L = (2n+1)N_{\text{c}}^{\text{crown}}$$

S_p = THE MAXIMUM OF SUPERELEVATION GRADE (%)
 R_0 = INITIAL CURVATURE
 n = 200 ~ 300 (RATE OF SUPERELEVATION RUNOFF)
 w = ROAD WIDTH IN STAGE 2

$$L = \{S_n + NC | n \in \mathbb{N}\}$$

SƠ ĐỒ DẠY: 500 (M)
 MỘT ĐỒ (M) NGANG MẶT ĐƯỜNG (M)
 1. 200 - 300 (M) LỀ NẮNG (M)
 M: BỀ DẠY PHÂN XE CHẠY ĐUA ĐOÀN GY HỒNH

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								1	FFB-2010	FINAL DRAWING	
											-

THE ELEMENTS OF HORIZONTAL ALIGNMENT CURVES CÁC YẾU TỐ ĐƯỜNG CONG

PI Name	NORTH	EAST	IA	Radius (m)	T (m)	P (m)	K (m)	Isc (%)	Ls in (m)	Ls out (m)	Type
KM0+600	1.180.814.43	586.533.93									
PI-01	1.179.855.78	587.418.15	9°48'34"	4.000	568.41	16.82	1.134.83	-	450	450	R GHT
PI-02	1.177.916.17	589.945.50	45°34'28"	4.500	2.141.52	383.52	4.078.63	-	500	500	R GHT
PI-03	1.178.695.48	595.438.95	7°35'28"	18.000	1.194.17	39.57	2.384.84				LEFT
PI-04	1.178.750.87	602.014.33	25°52'47"	4.000	1.144.51	106.39	2.256.75	-	450	450	R GHT
PI-05	1.180.090.62	604.717.57	45°16'7"	2.500	1.182.94	210.03	2.255.22	3	280	280	LEFT
PI-06	1.177.495.91	612.293.57	63°18'48"	2.200	1.482.17	385.95	2.681.06	3	250	250	R GHT
PI-07	1.181.236.34	616.112.19	54°18'33"	2.200	1.254.08	273.87	2.335.39	3	250	250	LEFT
PI-08	1.180.584.87	619.843.57	8°15'32"	10.000	722.00	25.03	1.441.49	-			R GHT
PI-09	1.180.490.35	623.136.10	18°11'17"	4.000	865.58	53.05	1.719.77		450	450	LEFT
PI-10	1.178.348.45	629.074.87	24°12'35"	4.000	1.083.30	93.12	2.140.15	-	450	450	R GHT
PI-11	1.178.550.78	631.717.79	23°41'13"	4.000	1.064.23	89.15	2.103.66	-	450	450	R GHT
PI-12	1.181.321.98	636.915.57	42°36'17"	3.000	1.344.93	221.65	2.579.91	2	350	350	LEFT
PI-13	1.180.552.84	639.880.94	27°41'52"	1.000	316.04	29.55	622.65	5	150	150	R GHT
KM58+500	1.180.750.15	640.767.96									

COORDINATE SYSTEM: - VN 2000
- 105°45' - CENTRAL MERIDIAN
- 3D - ZONE
- HON DAU ELEVATION SYSTEM

E:\Schematic & crossway\000_Plan Draft Drawing\Highway Engineering\015_Corner Drawing\RW CD-060.dwg

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TITLE				SIGNATURE							
PREPARED BY				Nguyen Thanh PHUONG							
CHECKED BY				Le Ngoc HIEU							
APPROVED BY				Timothy COLLETT							

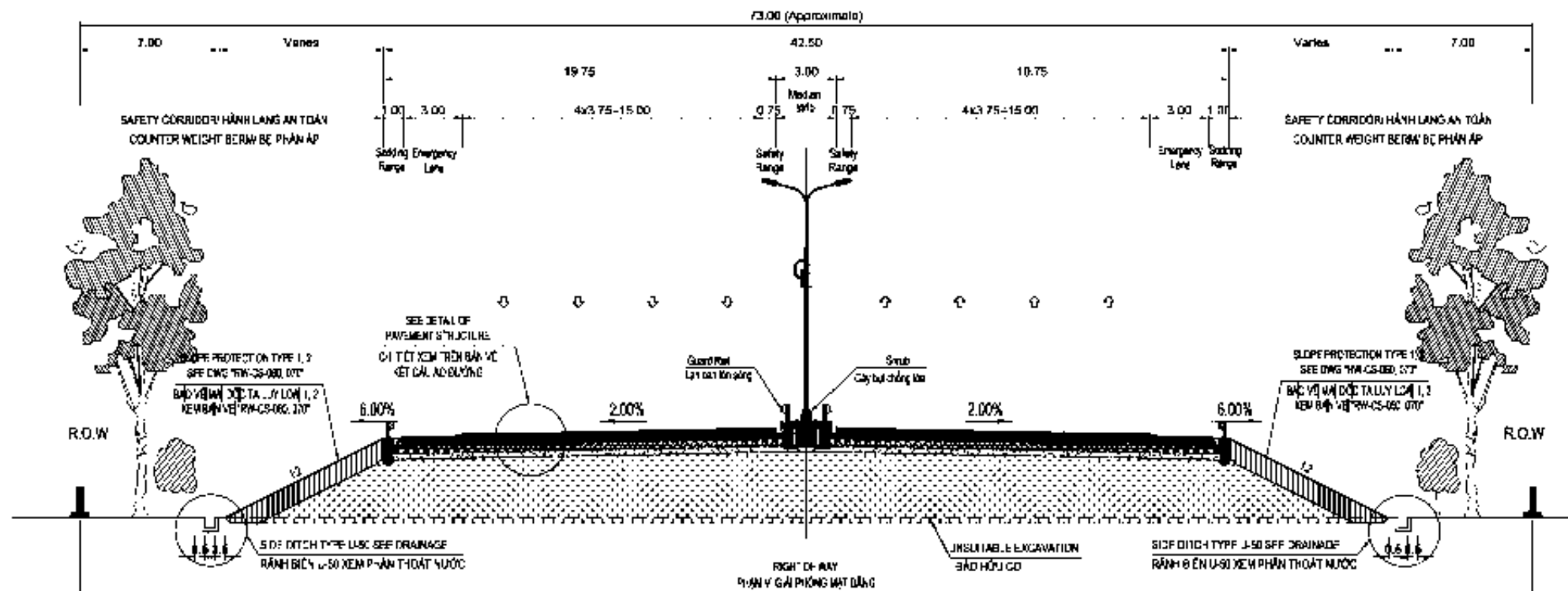
III: Plan and Profile

III: Bình đồ và Trắc dọc

TYPICAL CROSS SECTION MẶT CẮT NGANG ĐIỂN HÌNH

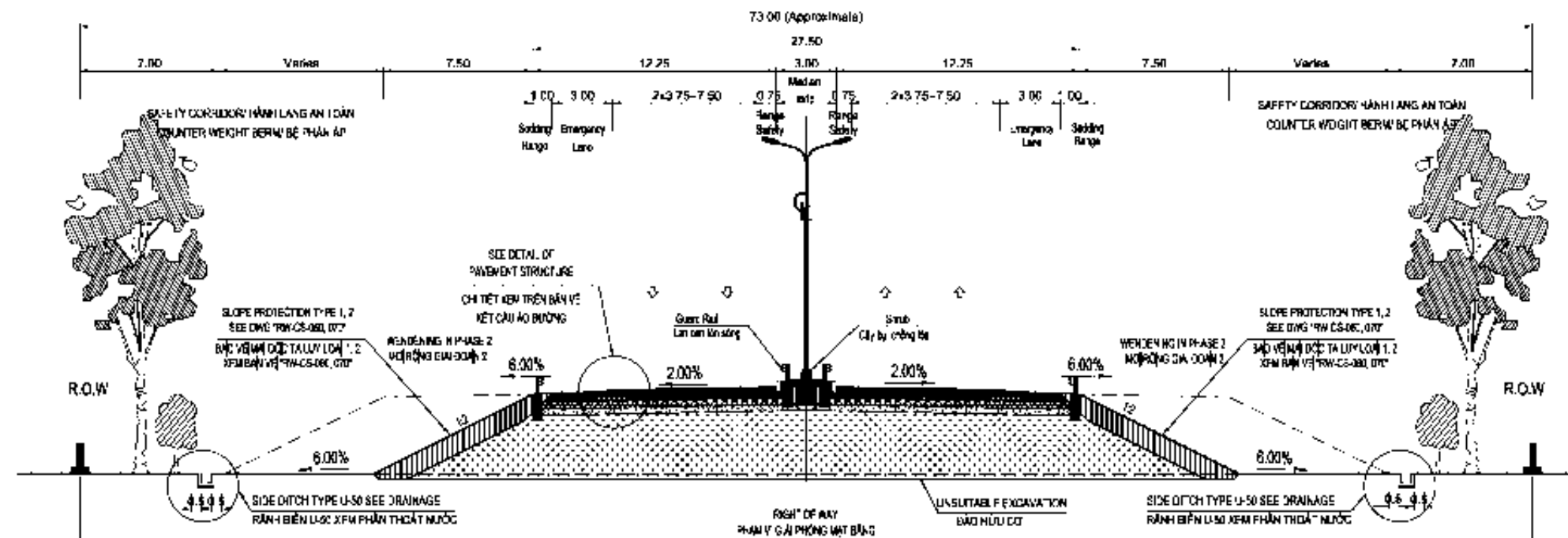
PLANNING STAGE GIAI ĐOẠN QUY HOẠCH

SCALE - TỶ LỆ 1:200



STAGE 1 GIAI ĐOẠN 1

SCALE - TỶ LỆ 1:300



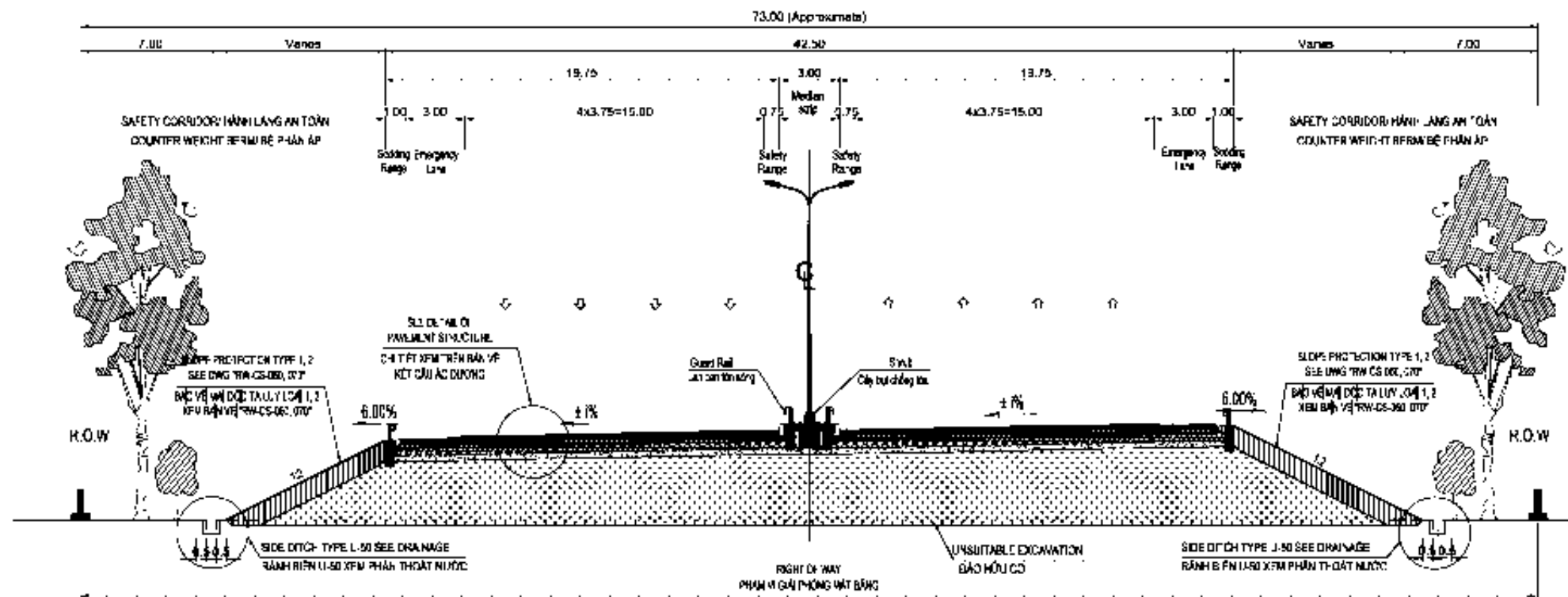
NOTES:
ALL DIMENSIONS ARE IN METERS
KÍCH THƯỚC BẢN VẼ ĐƠN VỊ LÀ MÉT

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								DRAWING TITLE:					SCALE: 1:300
								{1/3}	TYPICAL CROSS SECTION MẶT CẮT NGANG ĐIỂN HÌNH				
TITLE	NAME	SIGNATURE											
PREPARED BY	Nguyen Thanh PHUONG												
CHECKED BY	Le Ngoc HIEU												
APPROVED BY	Timothy COLLETT												

SUPERELEVATION - EMBANKMENT SECTION ĐOẠN MẶT CẮT CÓ BỐ TRÍ SIÊU CAO

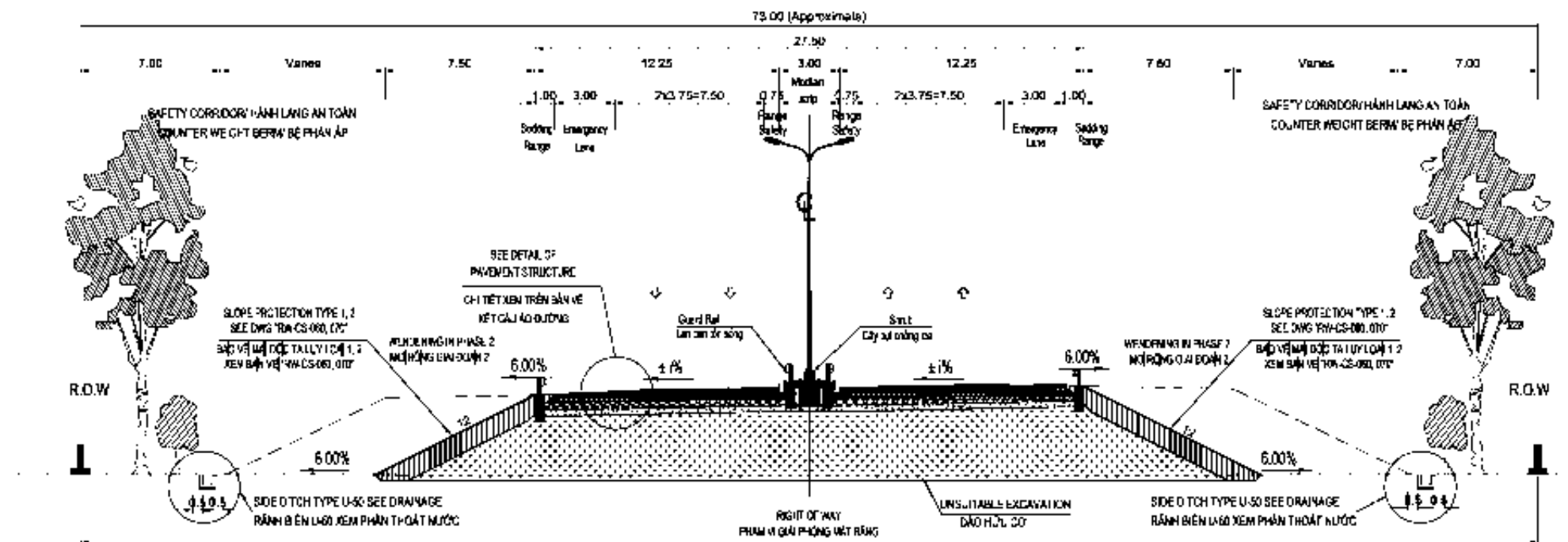
PLANNING STAGE GIAI ĐOẠN QUY HOẠCH

SCALE - 1:1500



STAGE 1 GIAI ĐOẠN 1

SCALE - 1:1500

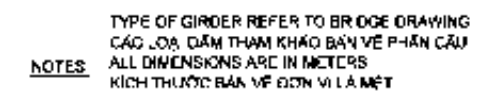




NOTES:
ALL DIMENSIONS ARE IN METERS
KÍCH THƯỚC BẢN VẼ ĐƠN VỊ LÀ MÉT

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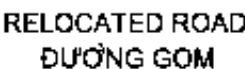
PLANNING STAGE
GIAI ĐOẠN QUY HOẠCH

SCALE - TỶ LỆ 1:300

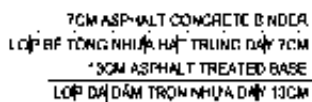


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				PREPARED BY	Nguyen Thanh PHUONG		VIETNAM EXPRESSWAY CORPORATION (VEC)		1	FEB-2010	FINAL DRAWING	
				CHECKED BY	Le Ngoc HIEU		DRAWING TITLE:					SCALE:
				APPROVED BY	Timothy COLLETT		{3/3} TYPICAL CROSS SECTION MẶT CẮT NGANG ĐIỂN HÌNH					1:300

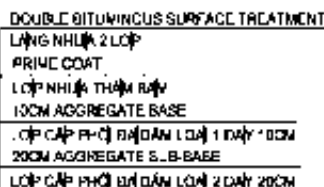
SCAF - TỶ LỆ 1:300



SCALE 1:60



SCALE 1:50



1. FRONTAGE ROAD CONSTRUCTION AT RESIDENT AREA WITH HIGH POPULATION AND RELOCATED EXISTING ROAD.
ĐƯỜNG GOM ĐƯỢC XÂY DỰNG Ở NHỮNG KHU VỰC CÓ DENSITY DÂN CƯ VÀ CHAI TẠO ĐƯỜNG H ẪN HƯU
2. ALL DIMENSIONS ARE IN METERS
KÍCH THƯỚC BÀN VẼ ĐƠN VỊ MÊT

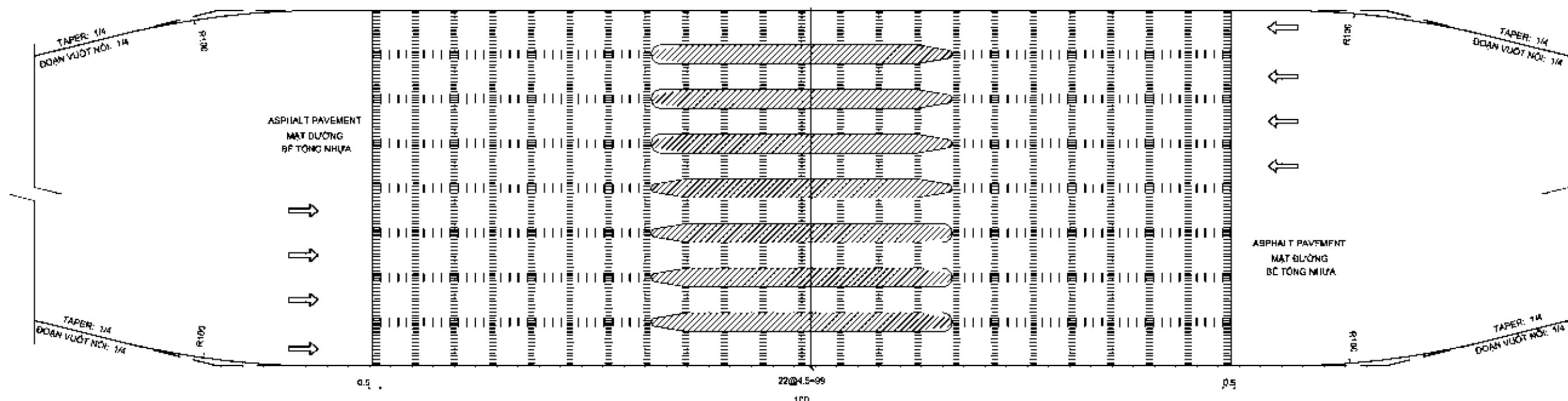
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CONCRETE PAVEMENT AT TOLL GATE / MẶT ĐƯỜNG BTXM TẠI TRẠM THU PHÍ

JOINT PLAN

MẶT BẰNG KHE NỐI

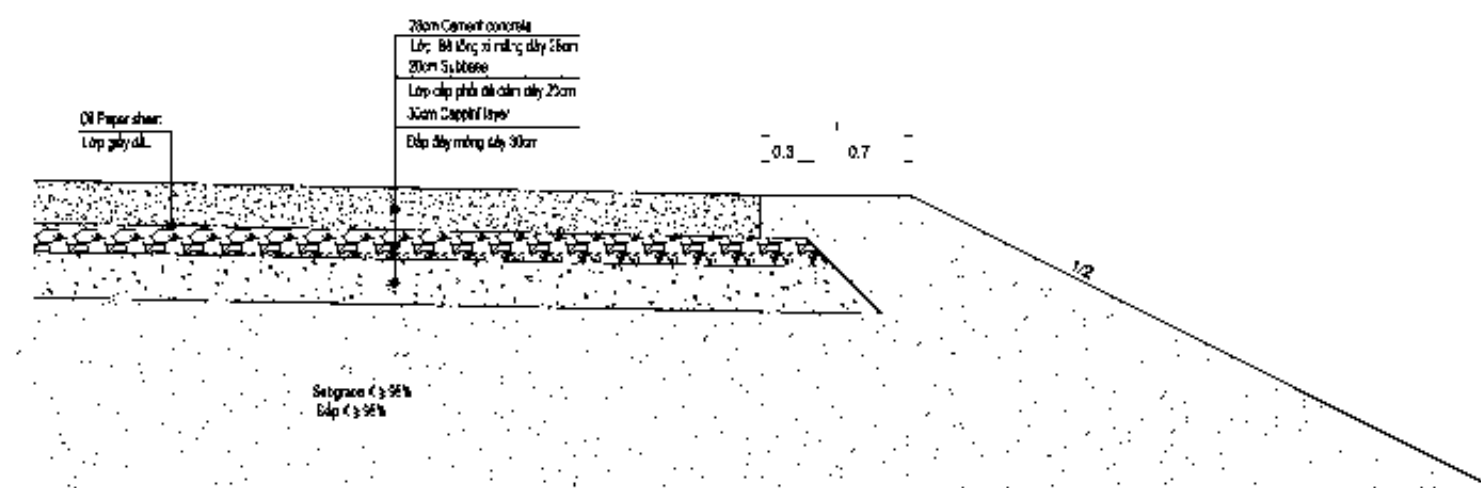
SCALE (TỈ LỆ): 1/50



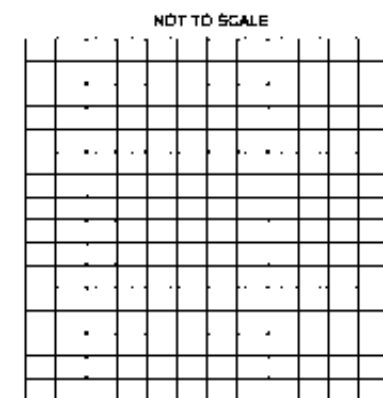
STEEL CONDUIT DIA. 32MM FOR ELECTRIC LINE
ỐNG THÉP ĐƯỜNG KÍNH 32MM CHO DÂY ĐIỆN

CONCRETE PAVEMENT STRUCTURE KẾT CẤU ÁO ĐƯỜNG BÊ TÔNG XI MĂNG

SCALE (TỈ LỆ): 1/50



STANDARD WIRE MESH LƯỚI THÉP TIÊU CHUẨN



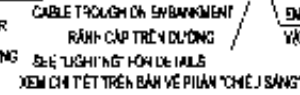
NOT TO SCALE
DIMENSION ARE IN MILLIMETER
BƯỚC CỐT THÉP VÀ ĐƯỜNG KÍNH CỐT THÉP LÀ MILLIMET

ALL DIMENSIONS ARE IN METER OR AS SHOWN
KÍCH THƯỚC BẢN VẼ ĐƠN VỊ LÀ MÉT TRỪNG XEM TRÊN BẢN VẼ

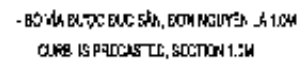
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KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-CS-050
								1	FEB-2010	FINAL DRAWING	
PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: La Ngoc HIEU APPROVED BY: Timothy COLLETT						DRAWING TITLE: CONCRETE PAVEMENT AT TOLL GATE MẶT ĐƯỜNG BTXM TẠI TRẠM THU PHÍ					SCALE: AS SHOWN

5CAL F.150

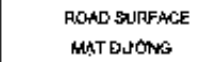


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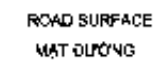


ENR/Schertel & Gerssamy/2001_Fine Draft: Drawing/Highway Engineering/02_Typical Cross Section/WH CS-080.dwg, Adobe PDF

SCALE - TITLE 1 10



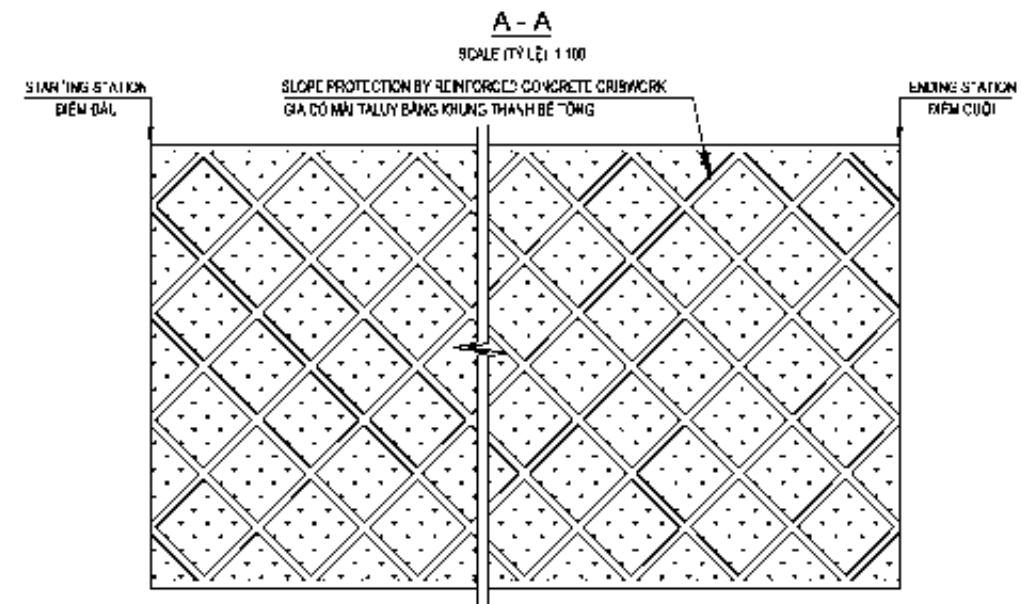
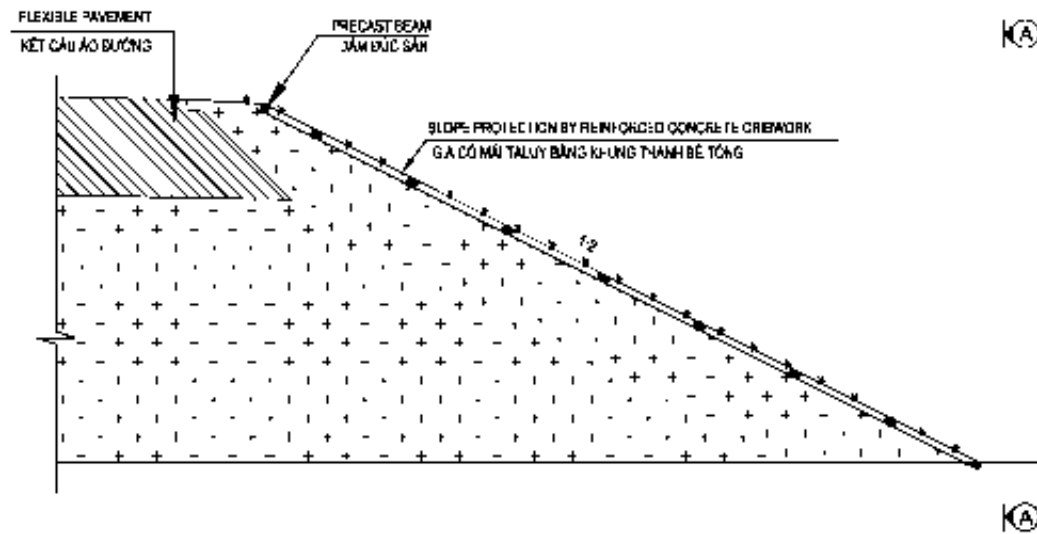
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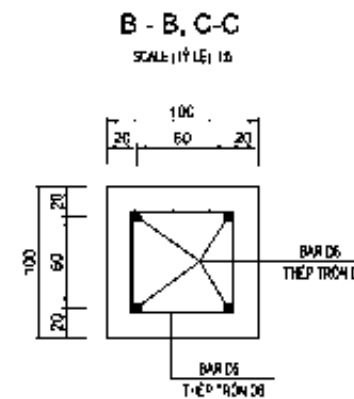
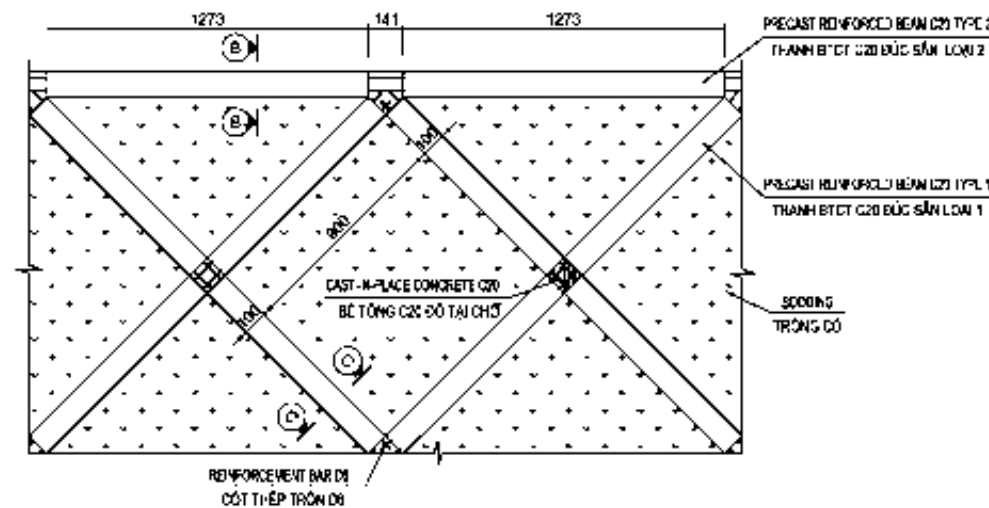
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM	ASIAN DEVELOPMENT BANK	REV. No	DATE	DESCRIPTION	DRAWING No.	
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO	TITLE	NAME	SIGNATURE	VIETNAM EXPRESSWAY CORPORATION (VEC)	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT	0	NOV-2009	DRAFT FINAL DRAWING	RW-CS-080	
	PREPARED BY	Nguyen Thanh PHUONG			1	FEB-2010	FINAL DRAWING			
	CHECKED BY	La Ngoc HUU			DRAWING TITLE:					SCALE :
	APPROVED BY	Theoeth COLLETT			DETAIL OF MEDIAN CURB CHI TIẾT BỜ VÍA					-

SLOPE PROTECTION BY REINFORCED CONCRETE CRIBWORK
GIA CỐ MÃI TALUY BẰNG KHUNG THANH BÊ TÔNG

CROSS SECTION AT SLOPE
MẶT CẮT NGANG TẠI TALUY
SCALE (TỶ LỆ) 1:100



DETAIL OF SLOPE PROTECTION REINFORCED CONCRETE CRIBWORK
CHI TIẾT THANH BÊ TÔNG GIA CỐ MÃI TALUY
SCALE (TỶ LỆ) 1:30



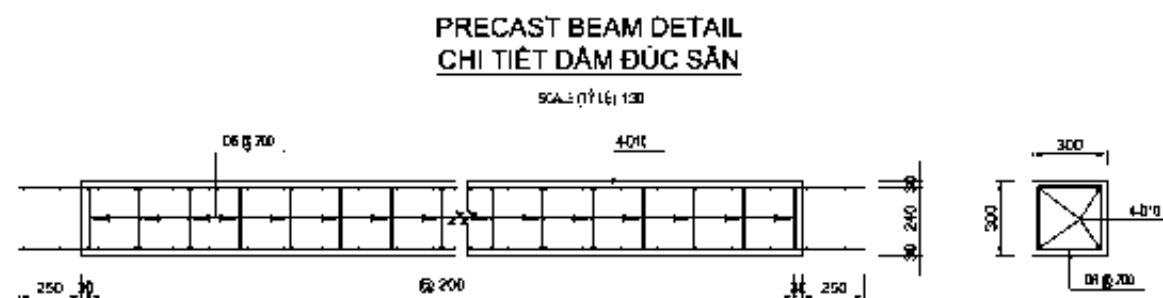
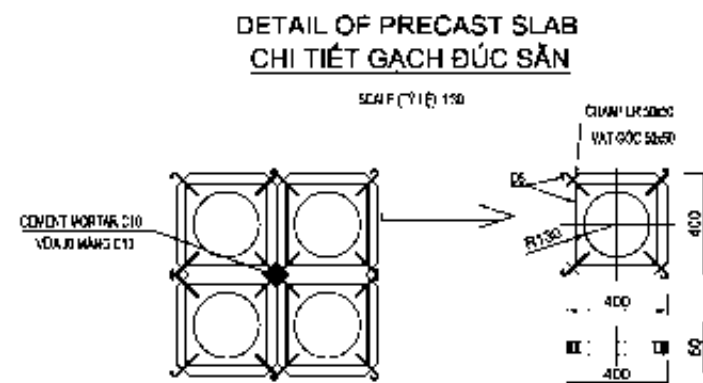
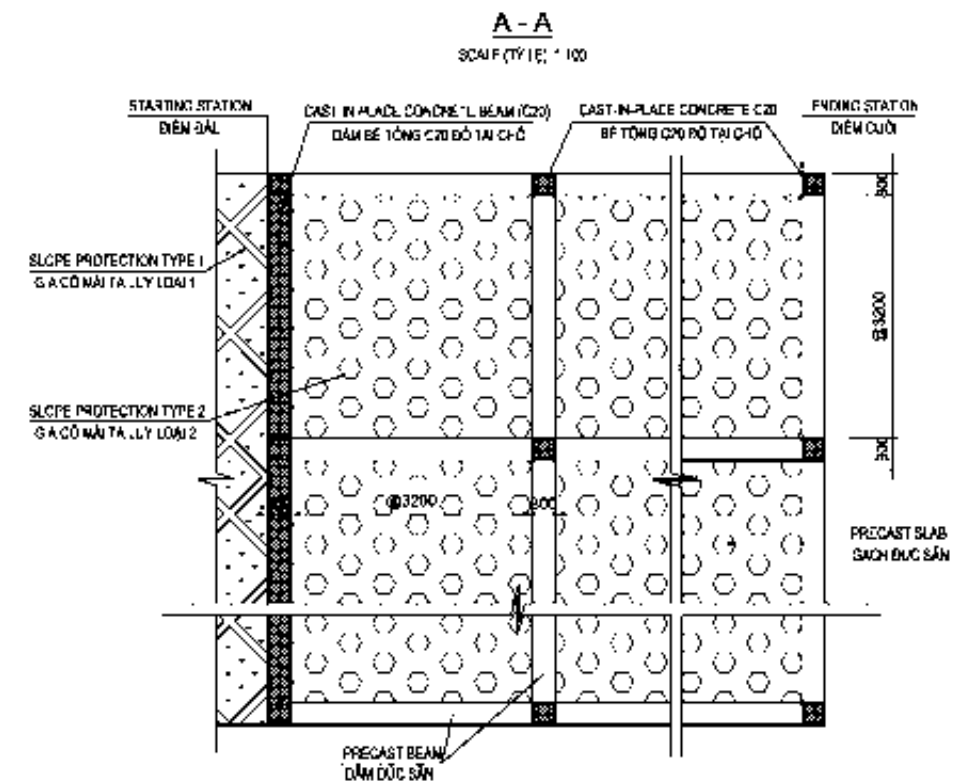
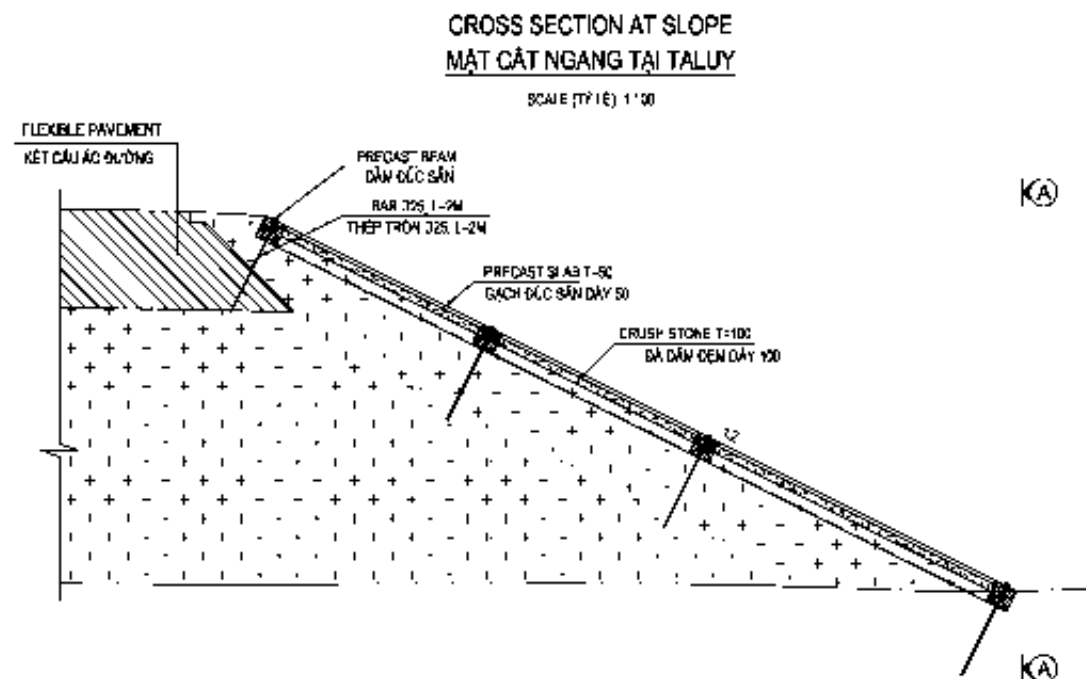
SLOPE PROTECTION TYPE 1 - CHI TIẾT GIA CỐ MÃI TALUY LOẠI 1

No. STT	Left Side/ Bên Trái			Right Side/ Bên Phải			Length Total Tổng (m)
	Starting Đầu Đầu	Ending Kết Thúc	Length Chiều Dài (m)	Starting Đầu Đầu	Ending Kết Thúc	Length Chiều Dài (m)	
1	KM0+800	KM2+080	1.280.00	KM0+800	KM2+080	1.280.00	2.560.00
2	KM2+080	KM6+040	3.960.00	KM2+360	KM6+040	3.680.00	7.640.00
3	KM6+040	KM7+980	1.940.00	KM6+040	KM7+980	1.940.00	3.880.00
4	KM9+575	KM12+115	2.540.00	KM9+575	KM12+115	2.540.00	5.080.00
5	KM13+085	KM15+680	2.595.00	KM13+085	KM15+680	2.595.00	5.190.00
6	KM32+321	KM34+295	1.974.00	KM32+321	KM34+295	1.974.00	3.948.00
7	KM35+500	KM42+600	7.100.00	KM35+500	KM42+600	7.100.00	14.200.00
8	KM43+600	KM45+000	1.400.00	KM43+600	KM45+000	1.400.00	2.800.00
9	KM45+300	KM47+340	2.040.00	KM45+300	KM47+340	2.040.00	4.080.00
10	KM47+600	KM50+210	2.610.00	KM47+600	KM50+210	2.610.00	5.220.00
11	KM50+840	KM52+450	1.610.00	KM50+840	KM52+450	1.610.00	3.220.00
12	KM56+140	KM56+740	600.00	KM56+140	KM56+740	600.00	1.200.00
13	KM56+820	KM57+500	680.00	KM56+820	KM57+500	680.00	1.360.00
Total - Tổng			29.848.00				59.696.00

ALL DIMENSIONS ARE IN MM
KÍCH THƯỚC TRONG BẢN VẼ ĐƠN VỊ LÀ MM

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		3	NOV-2008	DMK1 - FINAL DRAWING	RW-CS-070
Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO						DRAWING TITLE: SLOPE PROTECTION TYPE 1 CHI TIẾT BẢO VỆ MÃI TALUY LOẠI 1		1	FEB-2010	FINAL DRAWING	
											SCALE:
											-

SLOPE PROTECTION BY PRECAST SLAB GIA CỐ MÃI TALUY BẰNG GẠCH ĐÚC SẴN



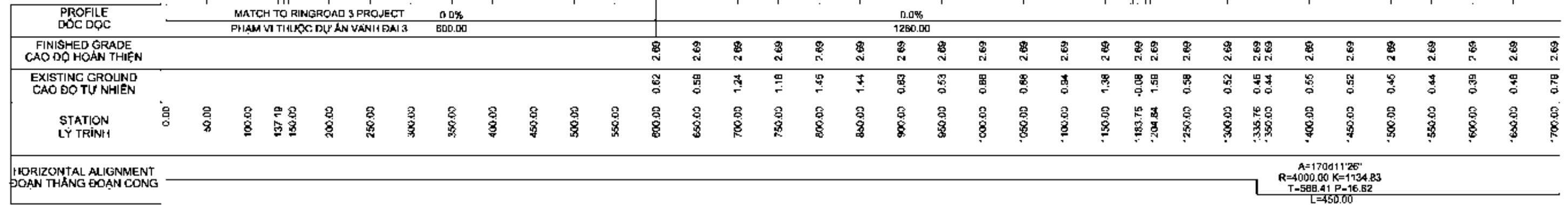
SLOPE PROTECTION TYPE 2- CHI TIẾT GIA CỐ MÃI TALUY LOẠI 2

No. STT	Left Side/ Bên Trái			Right Side/ Bên Phải			Length Total (m)
	Starting Bắt Đầu	Ending Kết Thúc	Length Chiều Dài (m)	Starting Bắt Đầu	Ending Kết Thúc	Length Chiều Dài (m)	
1	KM35+165	KM35+500	335.00	KM35+165	KM35+500	335.00	670.00
2	KM42+500	KM43+090	490.00	KM42+500	KM43+090	490.00	980.00
3	KM43+152	KM43+600	447.00	KM43+153	KM43+600	447.00	894.00
4	KM45+000	KM45+900	900.00	KM45+000	KM45+900	900.00	1,800.00
5	KM47+340	KM47+600	266.00	KM47+340	KM47+600	266.00	532.00
Total - Tổng			2,438.00				4,876.00

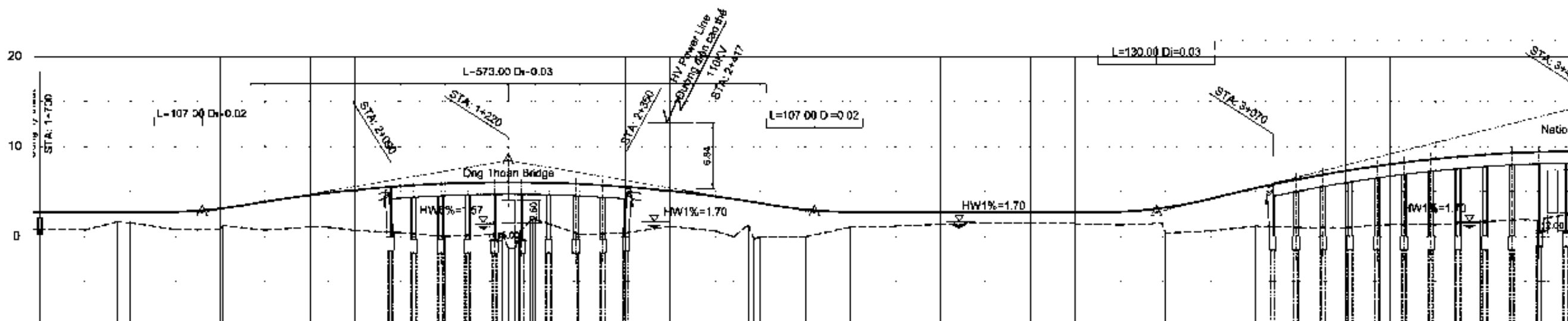
ALL DIMENSIONS ARE IN MM
KÍCH THƯỚC TRONG BẢN VẼ ĐƠN VỊ LÀ MM



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CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-CS-080
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: SLOPE PROTECTION TYPE 2 CHI TIẾT BẢO VỆ MÃI TALUY LOẠI 2			SCALE: -



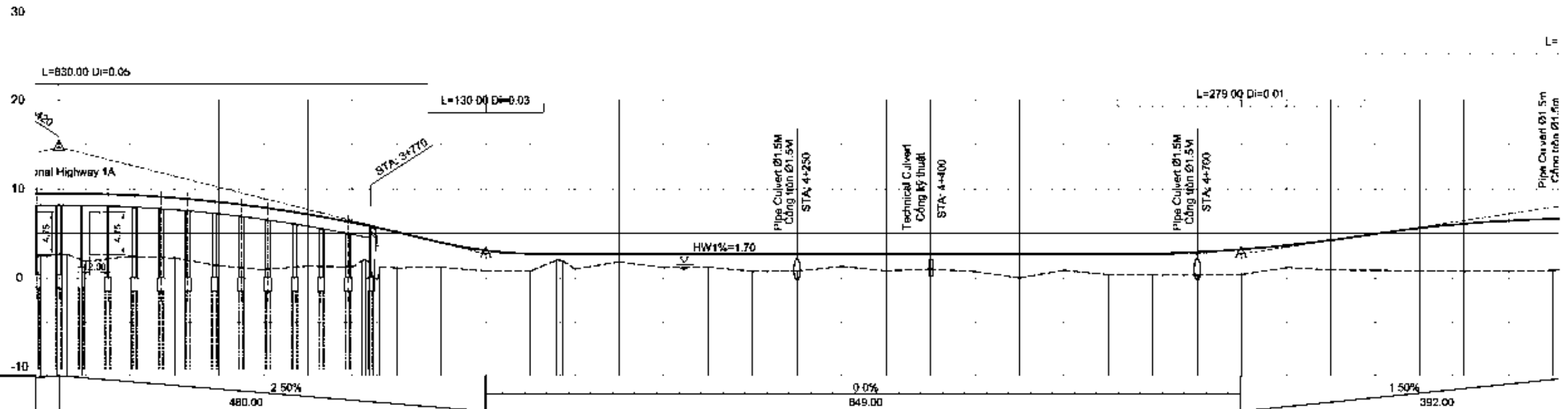
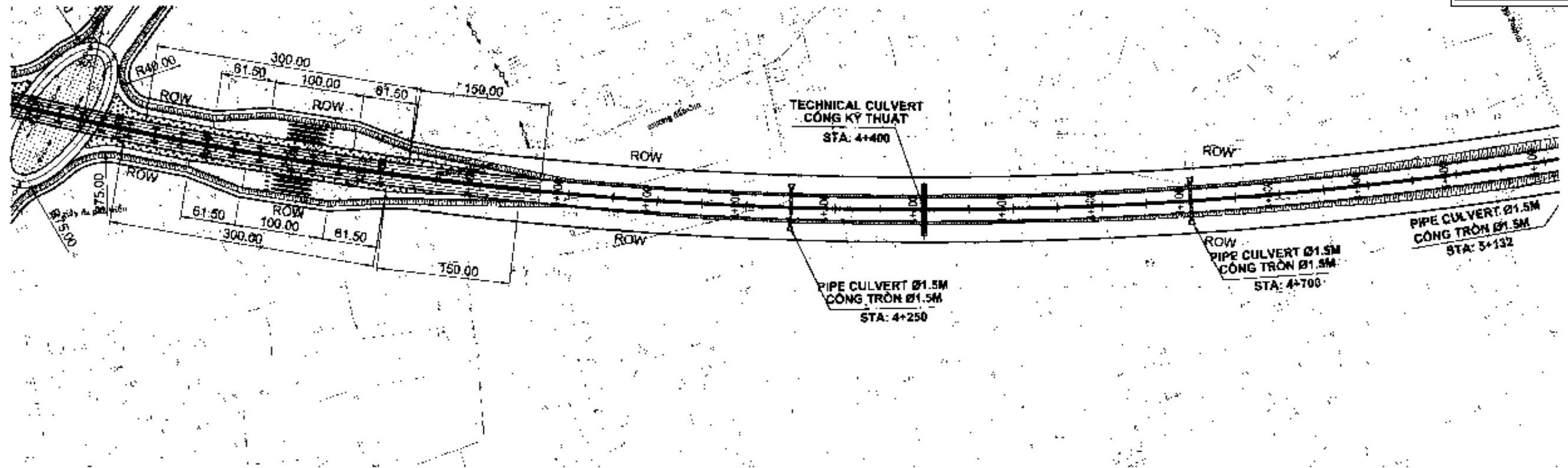
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		AŞIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-D10
								1	FFR-2010	FINAL DRAWING	
								DRAWING TITLE:		PLAN AND PROFILE KM0+600 - KM1+700 BÌNH DỒ VÀ TRẮC ĐỌC KM0+600 - KM1+700	
						PREPARED BY		Nguyen Thanh PHUONG			
CHECKED BY		Le Ngoc HIEU									
APPROVED BY		Timothy COLLETT									



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. NO	DATE	DESCRIPTION	DRAWING	
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				TITLE	NAME	SIGNATURE	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW
				PREPARED BY	Nguyen Thanh PHUONG				1	FEB-2010	FINAL DRAWING	
				CHECKED BY	Tran Ngoc HIEU							
				APPROVED BY	Timothy COLLETT		VIETNAM EXPRESSWAY CORPORATION (VEC)		DRAWING TITLE: PLAN AND PROFILE KM1+700 - KM3+400 BÌNH ĐỒ VÀ TRẮC DỌC KM1+700 - KM3+400			

TO BEN LUC

TO LONG THANH

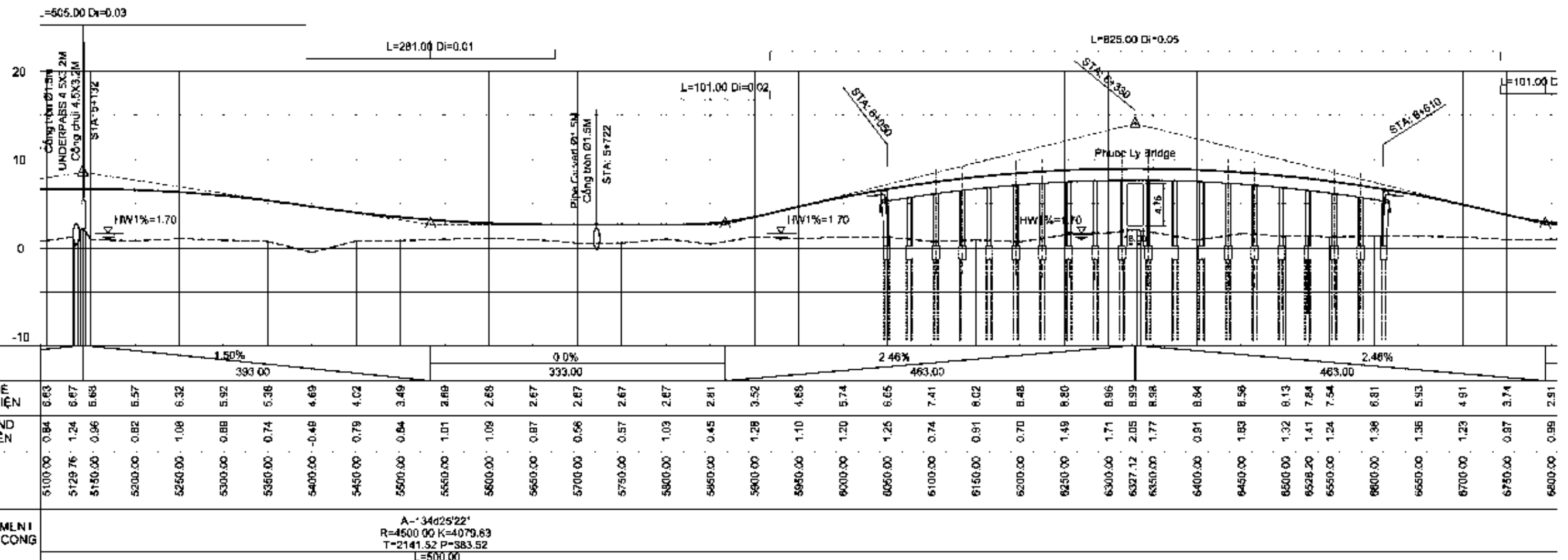
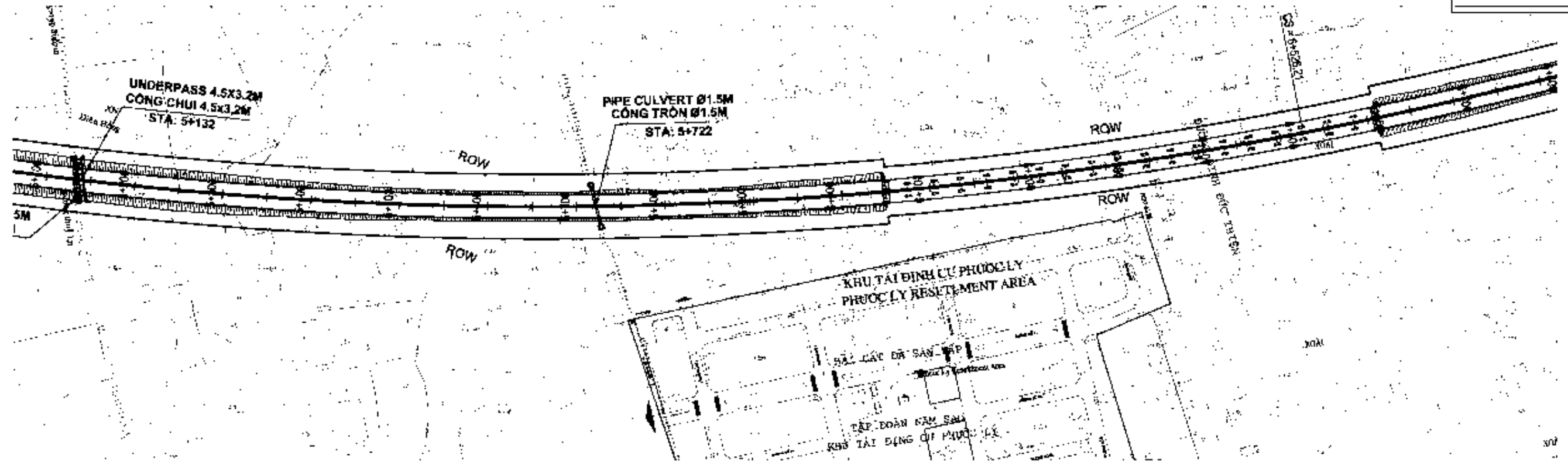


PROFILE DỐC ĐỘ																				
FINISHED GRADE CAO ĐỘ HOÀN THIÊN	8.49	9.50	9.47	9.31	8.99	8.33	7.91	7.14	6.22	5.74	5.15	3.95	3.10	2.71	2.69	2.69	2.69	2.69	2.69	2.69
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	2.50	2.66	1.85	2.43	2.24	1.37	0.92	1.33	1.21	-0.10	1.12	1.18	0.79	0.77	1.98	1.00	1.80	1.17	1.20	0.75
STATION LÝ TRÌNH	3400.00	3425.00	3450.00	3475.00	3500.00	3525.00	3550.00	3575.00	3600.00	3625.00	3650.00	3675.00	3700.00	3725.00	3750.00	3775.00	3800.00	3825.00	3850.00	3875.00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỎNG	A=13462522" R=4500.00 K=4079.83 L=2*41.52 P=383.52 L=500.00																			

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-030
								1	FFR-2010	FINAL DRAWING	
						DRAWING TITLE:					SCALE:
						PLAN AND PROFILE KM3+400 - KM5+100					H=1:5000; V=1:500
						BÌNH ĐỒ VÀ TRẮC ĐỌC KM3+400 - KM5+100					

TO BEN LUC

TO LONG THANH



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With
ORIENTAL CONSULTANTS CO., LTD

In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

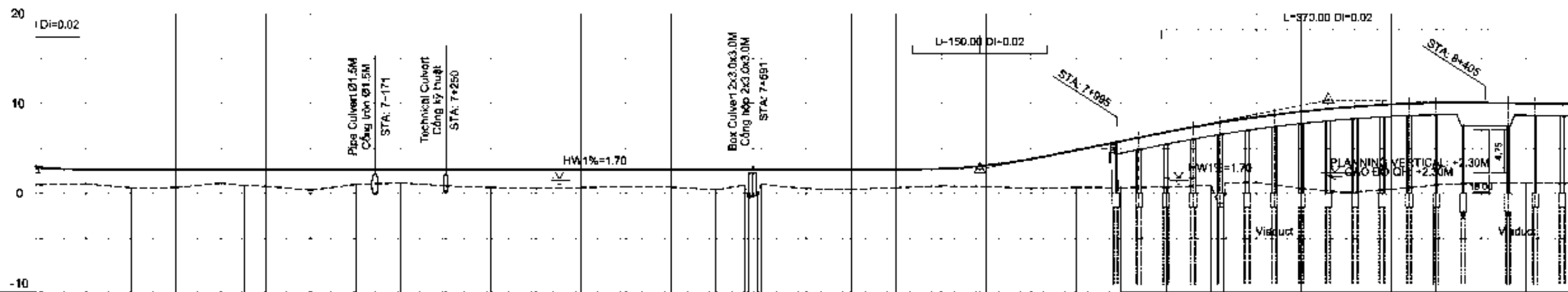
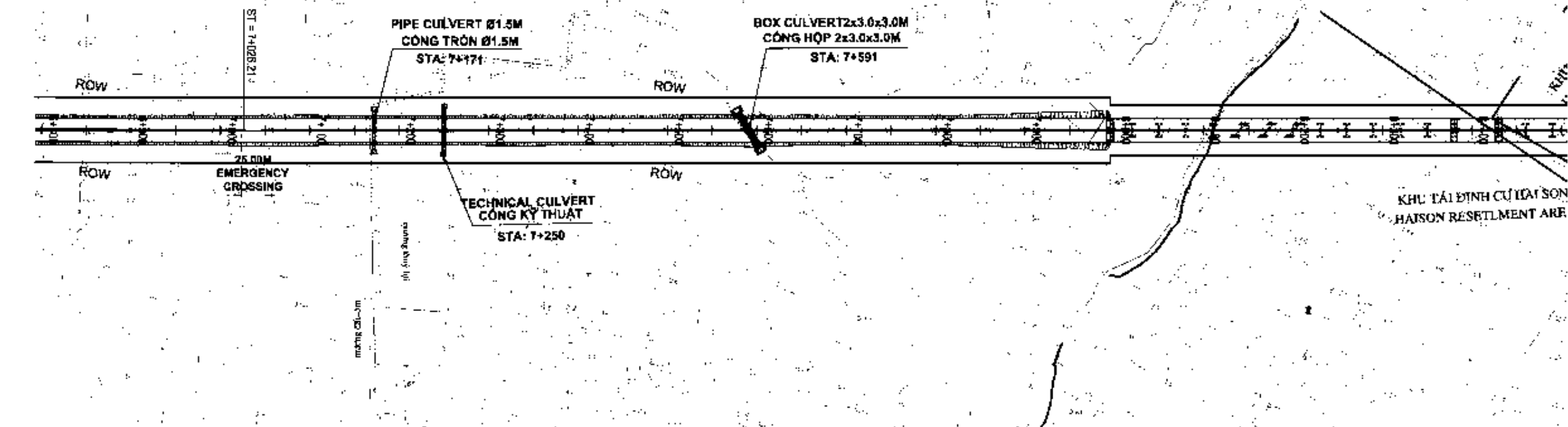
DRAWING TITLE:
PLAN AND PROFILE KM5+100 - KM6+800
BÌNH ĐỒ VÀ TRẮC ĐỌC KM5+100 - KM6+800

REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-040
1	FFR-2010	FINAL DRAWING	

SCALE:
H=1:5000; V=1:500

TO BEN LUC

TO LONG THANH



PROFILE DỌC QUỐC	0.0%																				2.00%																			
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	2.91	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.74	3.12	3.84	4.82	5.82	6.81	7.73	8.69	9.58	9.80	10.08	10.10	10.02	9.93						
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	0.99	1.05	0.64	0.66	1.14	0.90	0.80	0.37	1.01	1.16	0.96	0.66	0.58	0.65	0.75	0.70	0.40	0.93	0.48	1.02	0.54	0.45	0.84	0.83	0.79	0.53	0.68	0.64	0.72	0.88	0.88	1.23	1.21	0.57	0.12	0.46	0.34	1.20	1.20	1.13
STATION LY TRÌNH	6800.00	6850.00	6900.00	6950.00	7000.00	7026.20	7050.00	7100.00	7150.00	7200.00	7250.00	7300.00	7350.00	7400.00	7450.00	7500.00	7550.00	7581.41	7586.01	7600.00	7650.00	7700.00	7750.00	7800.00	7850.00	7900.00	8000.00	8050.00	8100.00	8107.43	8116.09	8150.00	8200.00	8250.00	8300.00	8350.00	8400.00	8450.00	8500.00	
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CUNG	A=134d25'22" R=4500.00 K=4079.63 T=2141.52 P=383.52 L=500.00																																							

CONSULTANT

SOCIALIST REPUBLIC OF VIETNAM

ASIAN DEVELOPMENT BANK

REV. No.

DATE

DESCRIPTION

DRAWING No.:

KATAHIRA & ENGINEERS INTERNATIONAL

TITLE

NAME

SIGNATURE

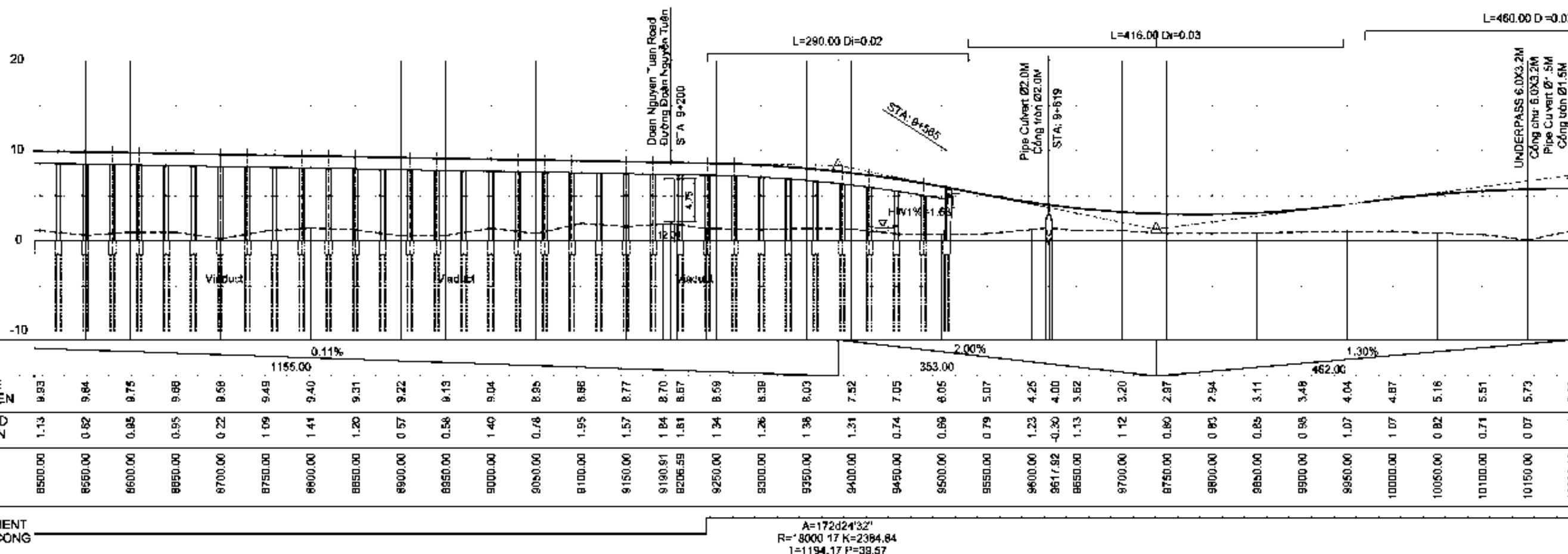
VIETNAM EXPRESSWAY CORPORATION (VEC)

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

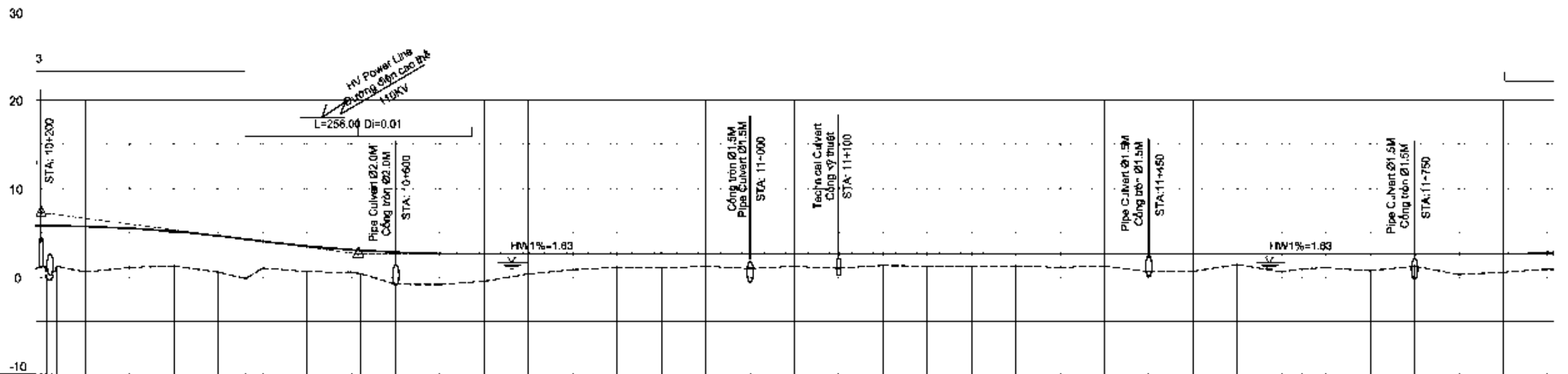
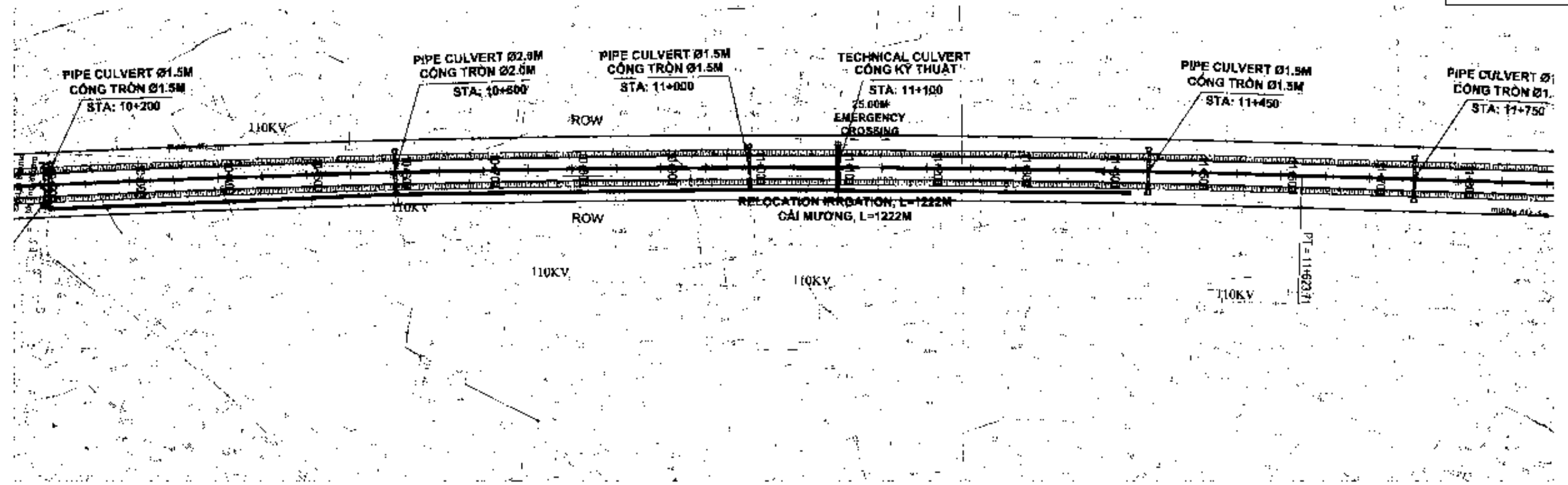
DRAFT FINAL DRAWING

RW-PP-050

DRAWING TITLE:
PLAN AND PROFILE KM6+600 - KM8+500
BÌNH ĐỒ VÀ TRẮC ĐỌC KM6+600 - KM8+500SCALE:
H=1:5000; V=1:500



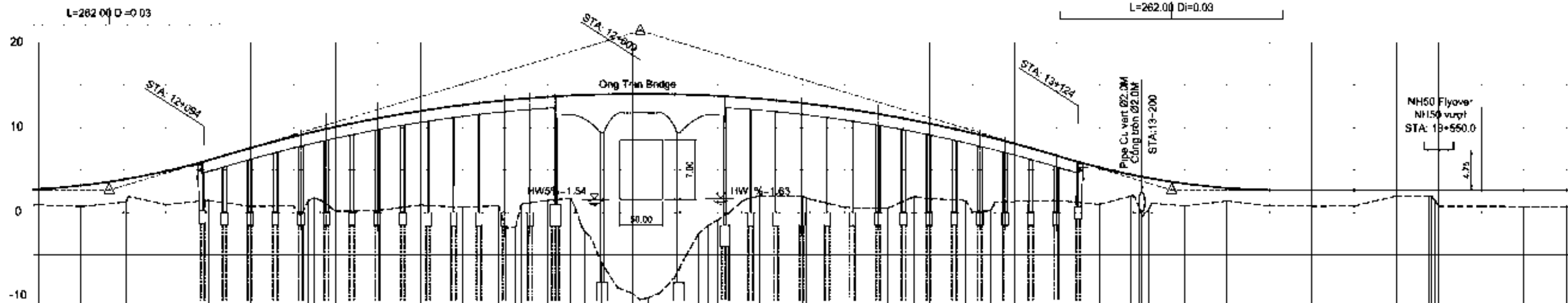
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:	
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				TITLE	NAME	SIGNATURE	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-080
				PREPARED BY	Nguyen Thanh PHUONG		VIETNAM EXPRESSWAY CORPORATION (VEC)		1	FFR-2010	FINAL DRAWING	
				CHECKED BY	Le Ngoc HIEU							
				APPROVED BY	Timothy COLLETT				DRAWING TITLE:			
						PLAN AND PROFILE KM8+500 - KM10+200 BÌNH ĐỒ VÀ TRẮC ĐỌC KM8+500 - KM10+200					H=1:5000; V=1:500	



PROFILE DỐC DỌC	1.35%										0.00%									
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	5.80	5.79	5.72	5.51	5.16	4.66	4.28	4.05	3.51	3.10	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	1.13	1.22	0.58	1.11	1.25	0.57	-0.18	1.03	0.62	0.58	-0.82	-0.46	0.37	0.84	1.12	1.05	1.22	0.98	1.21	1.28
STATION LY TRÌNH	10200.00	10217.79	10250.00	10300.00	10350.00	10400.00	10431.29	10450.00	10500.00	10550.00	10600.00	10650.00	10700.00	10750.00	10800.00	10850.00	10900.00	10950.00	11000.00	11050.00

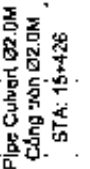
HORIZONTAL ALIGNMENT
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T=1194.17 P=30.57

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PLAN AND PROFILE KM10+200 - KM11+900 BÌNH ĐỒ VÀ TRẮC ĐỌC KM10+200 - KM11+900		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-070
								1	FFR-2010	FINAL DRAWING	
											SCALE: H=1:5000; V=1:500



PROJILL DỐC ĐỐC		3.00%										3.00%																													
FINISHED GRADE CAO ĐỘ HOÀN THIÊN	2.76	626.00										626.00																													
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	0.90 . 2.76 0.70 . 3.18 1.21 . 3.86 1.69 . 3.98 0.93 . 4.88 1.43 . 6.15 0.71 . 7.80 0.81 . 8.91 0.22 . 9.10 1.72 . 9.50 0.16 . 10.09 0.23 . 11.09 0.89 . 11.95 0.57 . 12.66 0.81 . 13.14 0.88 . 13.39 1.43 . 13.62 1.66 . 13.78 -5.91 . 13.92 -8.87 . 13.96 -10.25 . 13.98 -7.60 . 13.90 -2.49 . 13.84 -0.82 . 13.73 1.24 . 13.58 1.97 . 13.38 1.92 . 12.08 1.59 . 12.78 0.58 . 12.22 0.47 . 11.42 1.78 . 10.87 1.63 . 10.46 1.40 . 9.53 0.06 . 8.35 0.22 . 8.83 1.29 . 8.08 1.41 . 8.68 0.95 . 5.30 1.95 . 4.46 -0.46 . 4.21 1.08 . 3.99 0.78 . 3.40 1.34 . 2.68 0.79 . 2.69 0.74 . 2.63 0.75 . 2.63 1.95 . 2.63 1.90 . 2.63 0.70 . 2.63 0.74 . 2.63 0.66 . 2.63 0.85 . 2.63																																								
STATION LÝ TRÌNH	+1900.00 +1950.00 +2000.00 +2050.44 +2080.00 +2100.00 +2130.00 +2200.00 +2207.45 +2224.43 +2250.00 +2300.00 +2350.00 +2400.00 +2442.27 +2468.57 +2500.00 +2526.88 +2583.10 +2582.20 +2608.00 +2650.00 +2677.50 +2700.00 +2727.96 +2750.00 +2800.00 +2808.33 +2850.00 +2882.42 +3000.00 +3021.49 +3050.00 +3100.00 +3150.00 +3187.21 +3200.00 +3211.65 +3250.00 +3300.00 +3350.00 +3400.00 +3450.00 +3500.00 +3537.93 +3550.00 +3600.00 +3650.00 +3700.00																																								
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỒNG																																									

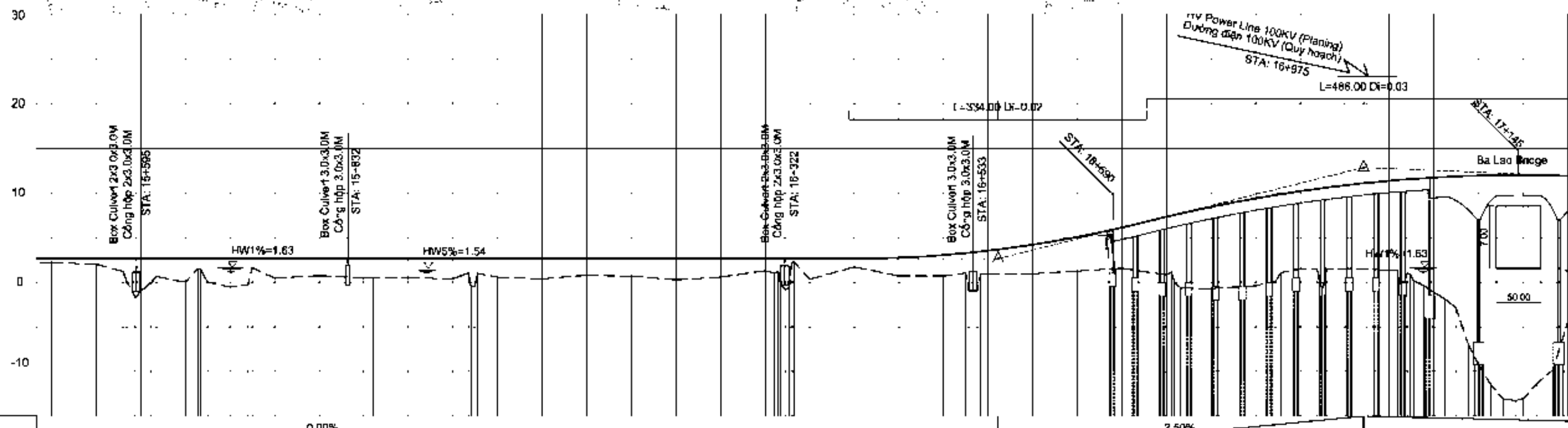
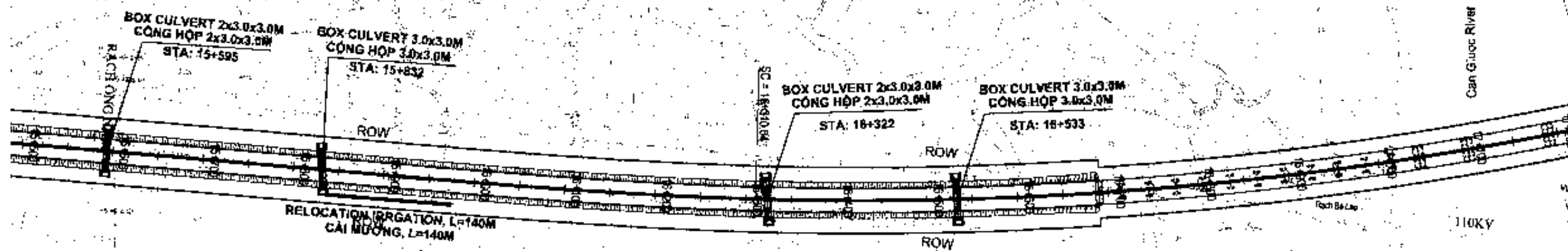
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-080
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: PLAN AND PROFILE KM11+900 - KM13+700 BÌNH DỒ VÀ TRẮC ĐỌC KM11+900 - KM13+700			
						TITLE	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG	



PROFILE DỐC DỌC	0.0%	
	3326.00	
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	2.63	
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	0.65	
STATION LY TRÌNH	13700.00	
HORIZONTAL ALIGNMENT		
	13750.00	
	13800.00	
	13850.00	
	13900.00	
	13950.00	
	14000.00	
	14050.00	
	14100.00	
	14150.00	
	14200.00	
	14250.00	
	14300.00	
	14350.00	
	14400.00	
	14450.00	
	14500.00	
	14550.00	
	14600.00	
	14650.00	
	14700.00	
	14750.00	
	14800.00	
	14850.00	
	14900.00	
	14950.00	
	15000.00	
	15050.00	
	15100.00	
	15150.00	
	15200.00	
	15250.00	
	15300.00	
	15350.00	
	15400.00	
	15450.00	
	15500.00	

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:					
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PLAN AND PROFILE KM13+700 - KM15+500 BÌNH DỒ VÀ TRẮC ĐỌC KM13+700 - KM15+500		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-090					
								1	FFB-2010	FINAL DRAWING						
								TITLE		NAME		SIGNATURE				SCALE: H=1:6000; V=1:500
								PREPARED BY		Nguyễn Thanh PHUONG						
CHECKED BY		Lê Ngọc HIỆU														
APPROVED BY		Timothy COLLETT														

CÂY XANH CÁCH LY (300 M)

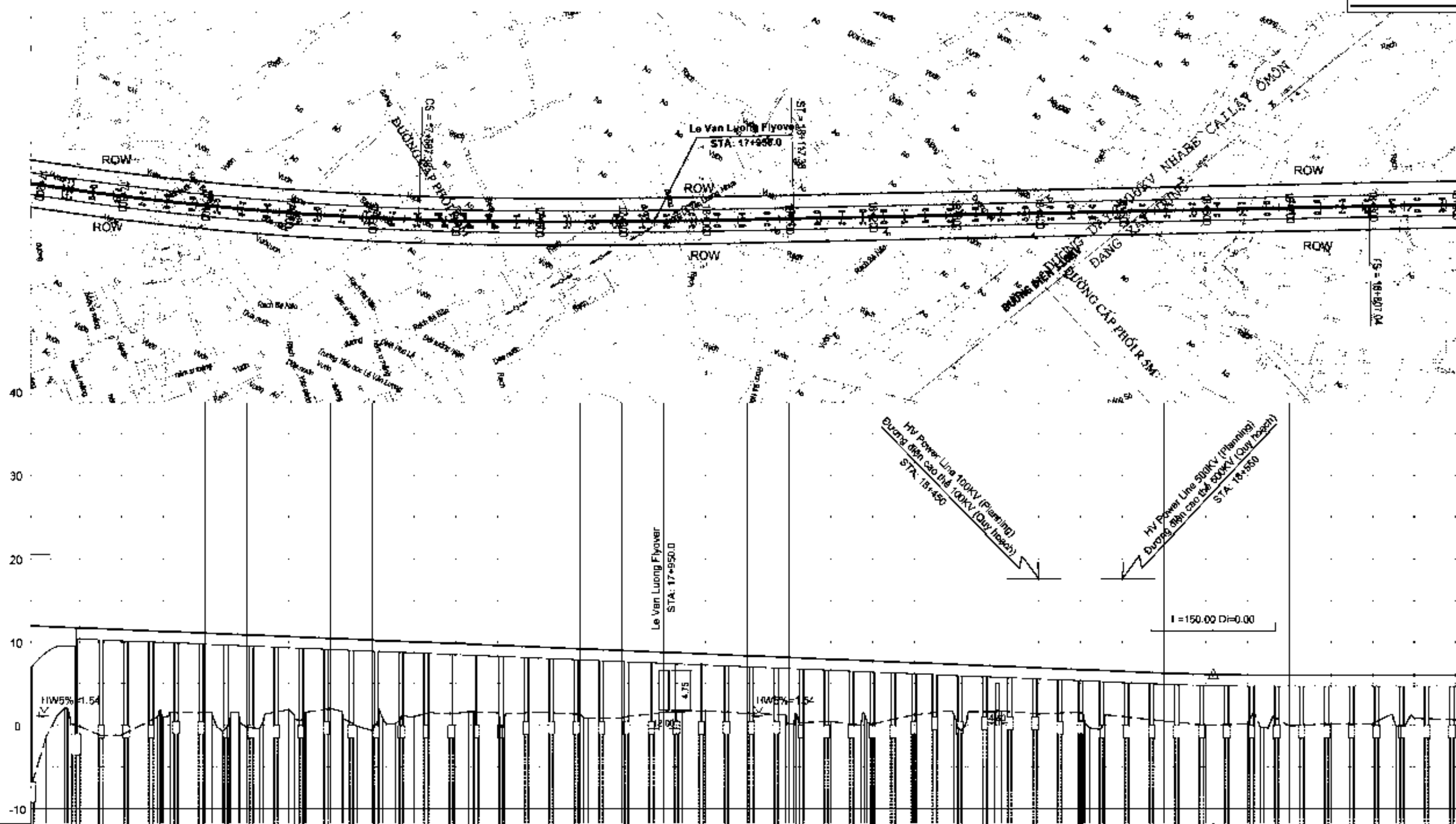


PROFILE DỐC ĐỘ	0.00% 3428.00																			
FINISHED GRADE CAO ĐỘ HOÀN THIÊN	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	2.22	2.02	1.23	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
STATION LÝ TRÌNH	15500.00	15550.00	15579.90	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00	15580.00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỎNG	A=154007.13 R=4000.00 K=2258.75 I=1144.51 P=106.38 L=450.00																			

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.	
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-100	
								-	FEB-2010	FINAL DRAWING		
								DRAWING TITLE: PLAN AND PROFILE KM15+500 - KM17+200 BÌNH ĐỘ VÀ TRẮC DỌC KM15+500 - KM17+200				
						PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: Le Ngoc HIEU APPROVED BY: Timothy COLLETT						

TO BEN LUC

TO LONG THANH



PROFILE DỌC DỌC	FINISHED GRADE CAO ĐỘ HOÀN THIÊN	EXISTING GROUND CAO ĐỘ TỰ NHIÊN
STATION LY TRÌNH	17200.00	4.44 11.91
	17222.28	-20 11.82
	17250.00	-0.12 11.70
	17273.90	-1.18 11.61
	17300.00	-1.13 11.50
	17342.79	0.00 11.32
	17360.00	0.99 11.29
	17400.00	0.52 11.08
	17420.88	-0.75 10.99
	17450.00	-0.23 10.87
	17471.35	0.36 10.78
	17500.00	0.91 10.66
	17517.50	0.39 10.59
	17550.00	2.02 10.45
	17563.68	1.72 10.40
	17582.10	-0.07 10.32
	17600.00	-0.62 10.25
	17623.88	0.25 10.13
	17650.00	0.05 10.04
	17667.38	0.52 9.96
	17700.00	0.43 9.83
	17716.27	0.57 9.75
	17750.00	0.54 9.62
	17756.14	-0.31 9.59
	17800.00	1.57 9.41
	17850.00	1.38 9.20
	17859.13	0.93 9.18
	17900.00	0.90 8.98
	17901.84	0.01 8.95
	17950.00	1.58 8.78
	17961.50	1.54 8.74
	17972.08	1.88 8.65
	18000.00	1.77 8.58
	18050.00	0.43 8.37
	18066.38	1.31 8.18
	18100.00	0.19 8.18
	18117.38	0.38 8.09
	18150.00	0.48 7.95
	18186.03	0.06 7.80
	18200.00	0.17 7.74
	18250.00	0.28 7.53
	18295.58	0.78 7.34
	18303.00	-0.31 7.31
	18315.08	0.83 7.25
	18350.00	0.74 7.12
	18400.00	0.40 6.91
	18450.00	0.58 6.70
	18473.68	-0.44 6.60
	18479.68	0.28 6.58
	18550.00	0.53 6.28
	18600.00	0.05 6.14
	18650.00	0.23 6.05
	18674.63	-0.35 6.04
	18700.00	-0.04 6.04
	18750.00	0.24 6.04
	18800.00	0.25 6.04
	18828.22	-0.08 6.04
	18850.00	0.86 6.04
	18900.00	0.70 6.04

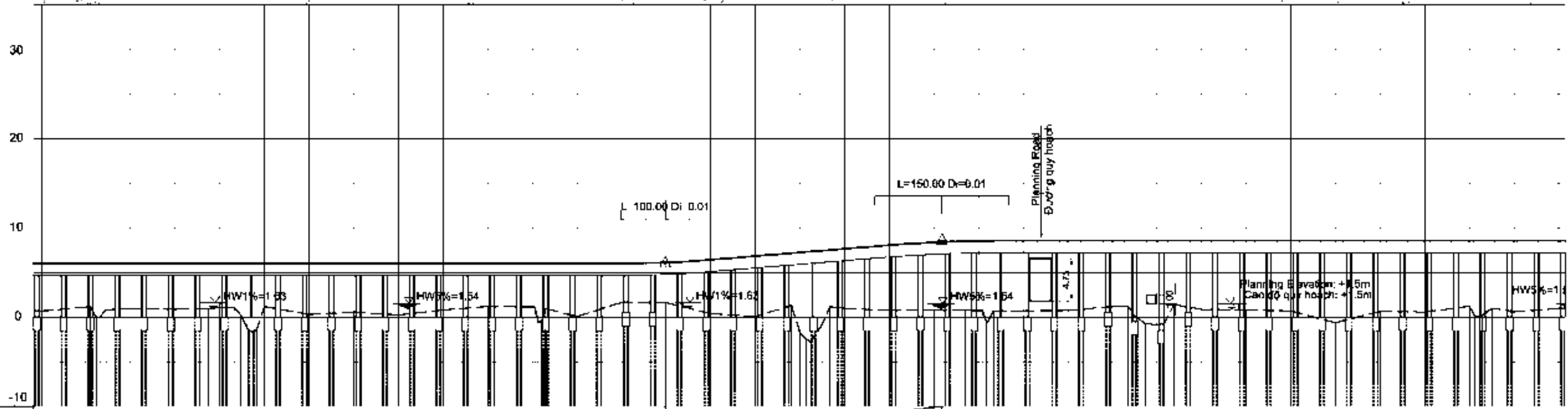
CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TYPE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

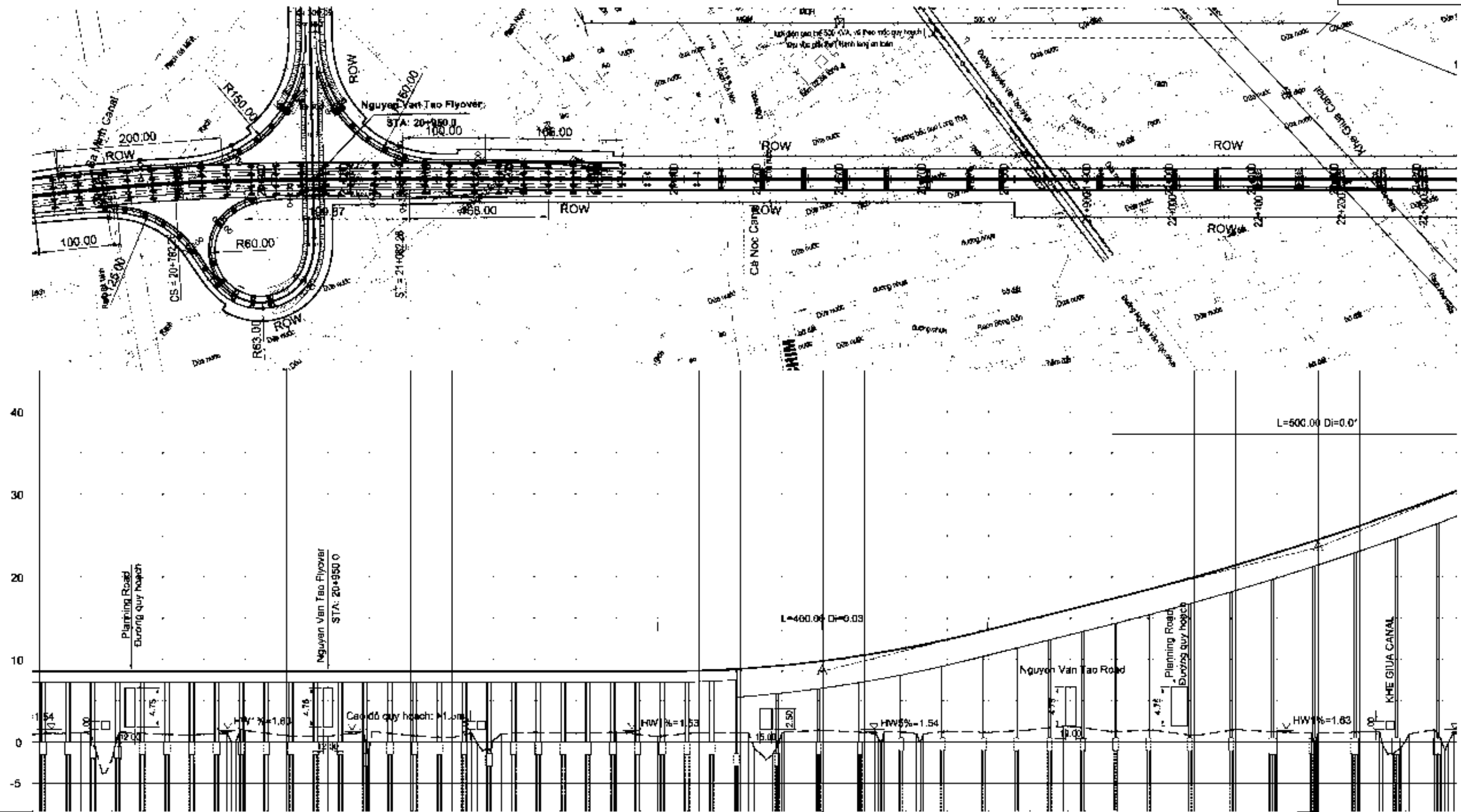
SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
 TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT
 DRAWING TITLE:
 PLAN AND PROFILE KM17+200 - KM18+900
 BÌNH ĐỒ VÀ TRẮC DỌC KM17+200 - KM18+900

REV. No	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-110
1	FEB-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-120
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: PLAN AND PROFILE KM18+900 - KM20+600 BÌNH ĐỒ VÀ TRẮC ĐỌC KM18+900 - KM20+600			
TITLE: _____ NAME: _____ SIGNATURE: _____ PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: Le Ngoc HIEU APPROVED BY: Timothy COLLETT											



PROFILE DỐC ĐỌC	0.0%																				2.50%																															
FINISHED GRADE CAO ĐỘ HOÀN THIÊN	1640.00																				601.00																															
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	0.97	1.13	0.97	1.20	0.97	0.82	0.97	1.05	0.71	0.53	1.12	1.07	0.14	1.17	1.11	1.18	0.68	1.17	1.13	2.13	1.05	1.43	1.16	0.10	1.19	0.06	1.31	1.18	1.47	1.91	1.93	1.26	1.46	0.77	1.53	1.22	1.13	1.07	1.22	1.26	-1.45	0.70	1.00	1.51	-1.07							
STATION LÝ TRÌNH	20800.00	20850.00	20876.40	20700.00	20750.00	20782.26	20800.00	20827.67	20852.56	20850.00	20900.00	20950.00	20982.87	21000.00	21050.00	21062.28	21100.00	21123.95	21137.30	21150.00	21200.00	21250.00	21300.00	21350.00	21400.00	21450.00	21490.95	21500.00	21550.00	21600.00	21619.41	21650.00	21668.30	21700.00	21750.00	21800.00	21841.33	21850.00	21900.00	21950.00	22000.00	22050.00	22100.00	22141.96	22150.00	22200.00	22224.28	22234.13	22250.00	22260.30	22290.62	22303.67
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỘNG	L=280.00 A=134d18'53" R=2500.00 K=2256.22, Isc=3% T=1182.94 P=210.03																																																			

CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TIME	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

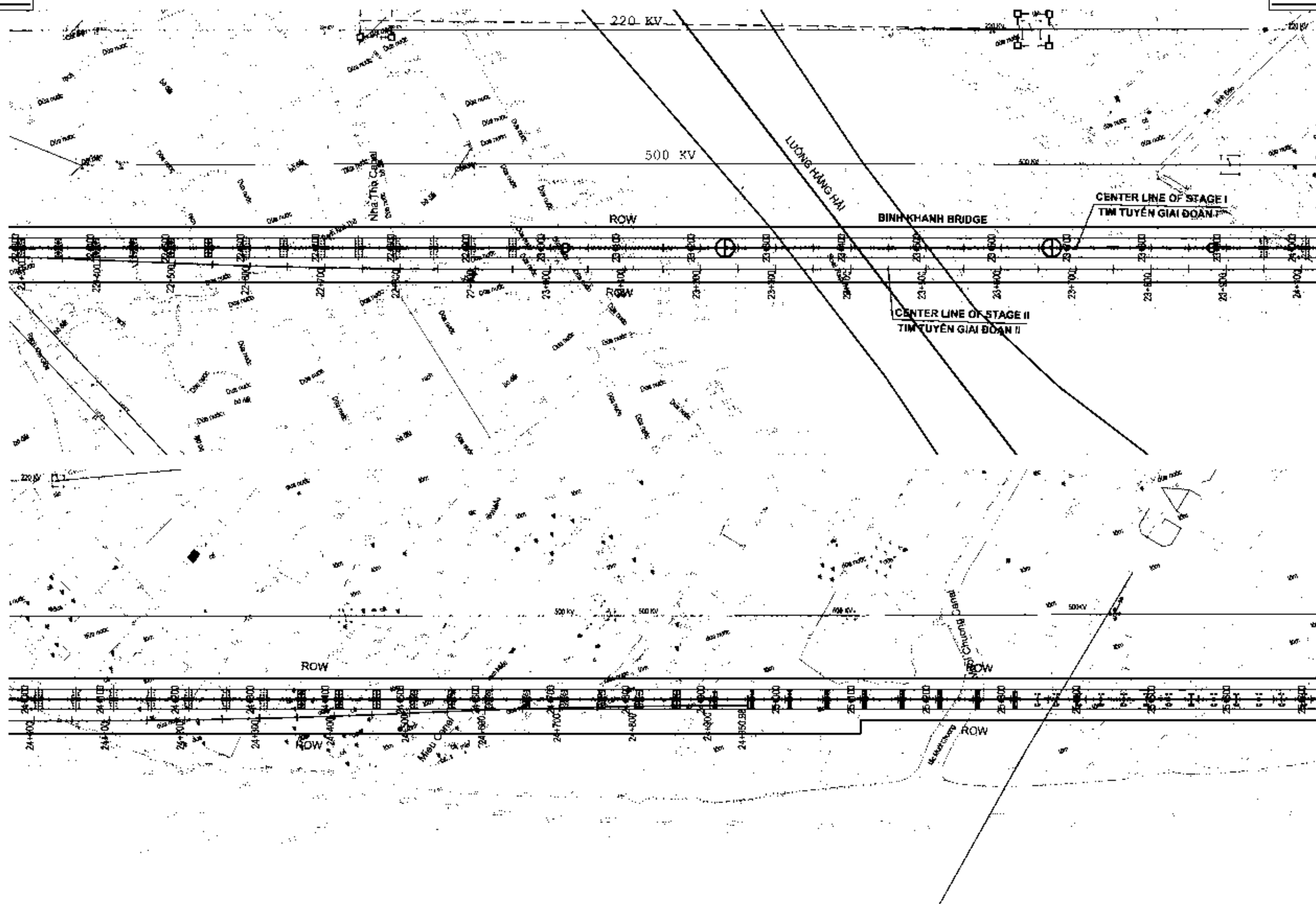
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE: PLAN AND PROFILE KM20+600 - KM22+300
BÌNH ĐỒ VÀ TRẮC ĐỌC KM20+600 - KM22+300

REV. No	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-130
1	FEB-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500

TO BEN LUC

TO LONG THANH



CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TYPE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

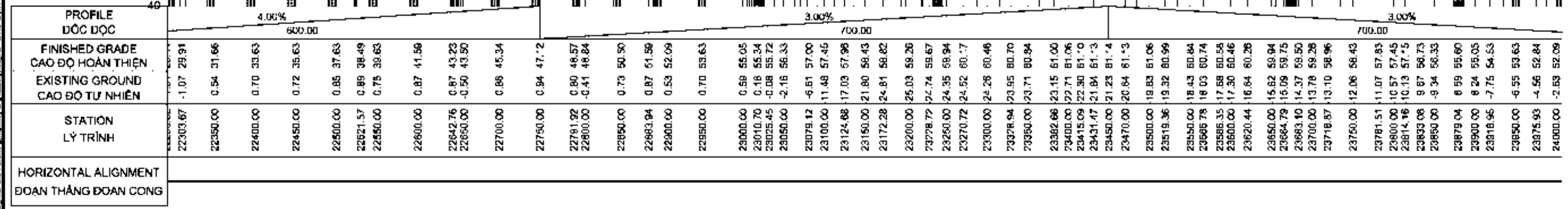
SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

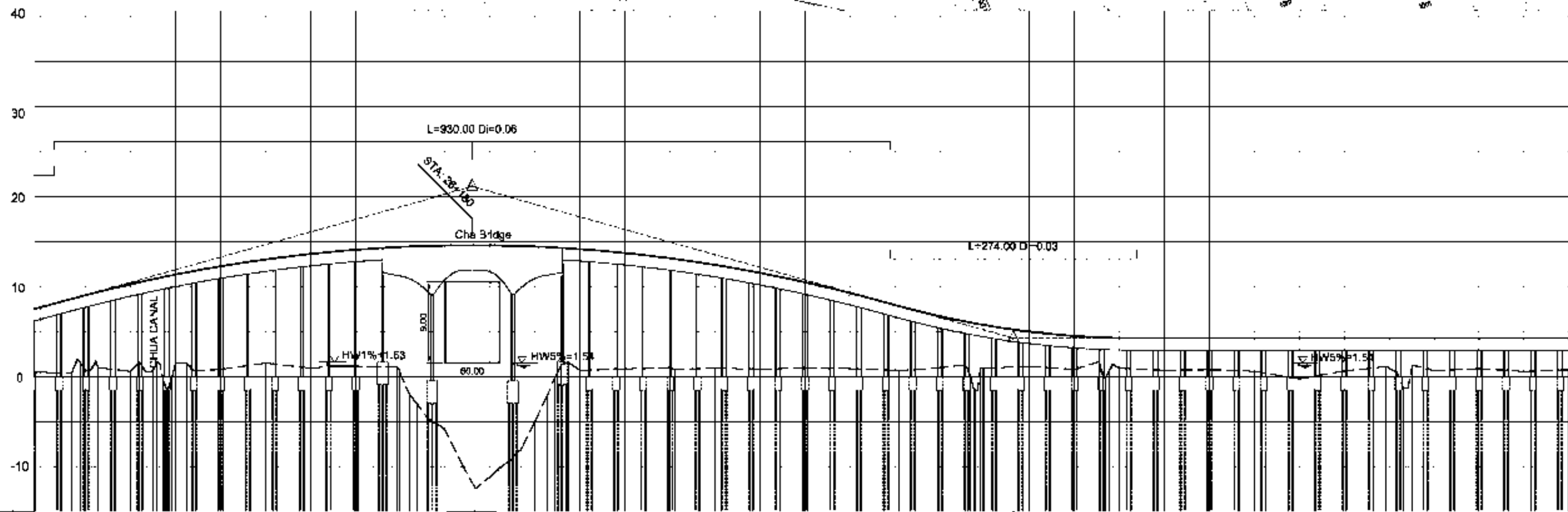
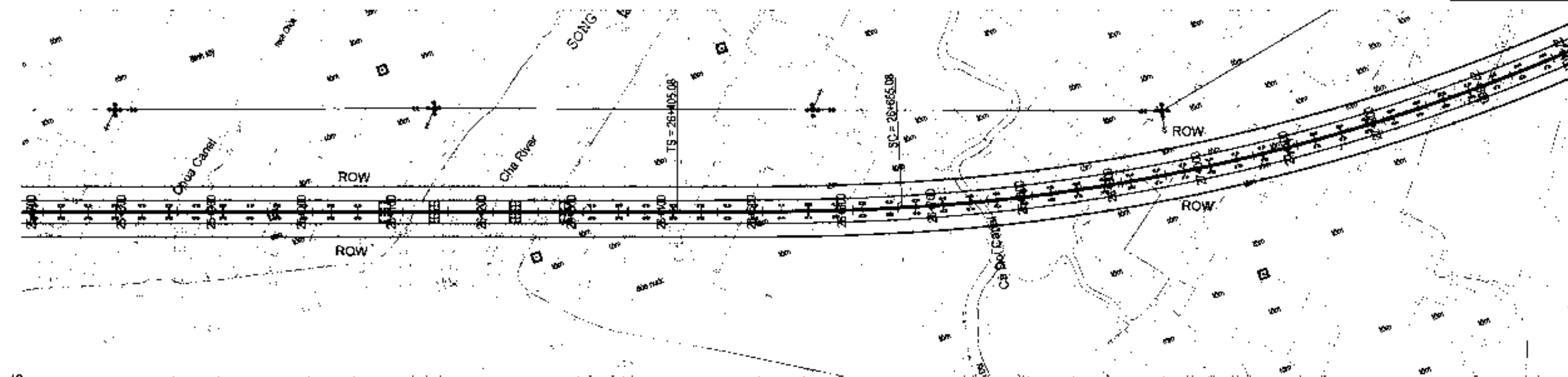
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT

DRAWING TITLE:
 PLAN AND PROFILE KM22+300 - KM25+700
 BÌNH DỒ VÀ TRẮC ĐỌC KM22+300 - KM25+700

REV. No	DATE	DESCRIPTION	DRAWING No.:
0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-140
1	FEB-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-150
								1	FEB-2010	FINAL DRAWING	
						DRAWING TITLE:					SCALE:
						PLAN AND PROFILE KM22+300 - KM24+000 BÌNH ĐỒ VÀ TRẮC ĐỌC KM22+300 - KM24+000					H=1:5000; V=1:500
TITLE	NAME	SIGNATURE									
PREPARED BY	Nguyen Thanh PHUONG										
CHECKED BY	Le Ngoc HIEU										
APPROVED BY	Timothy COLLETT										



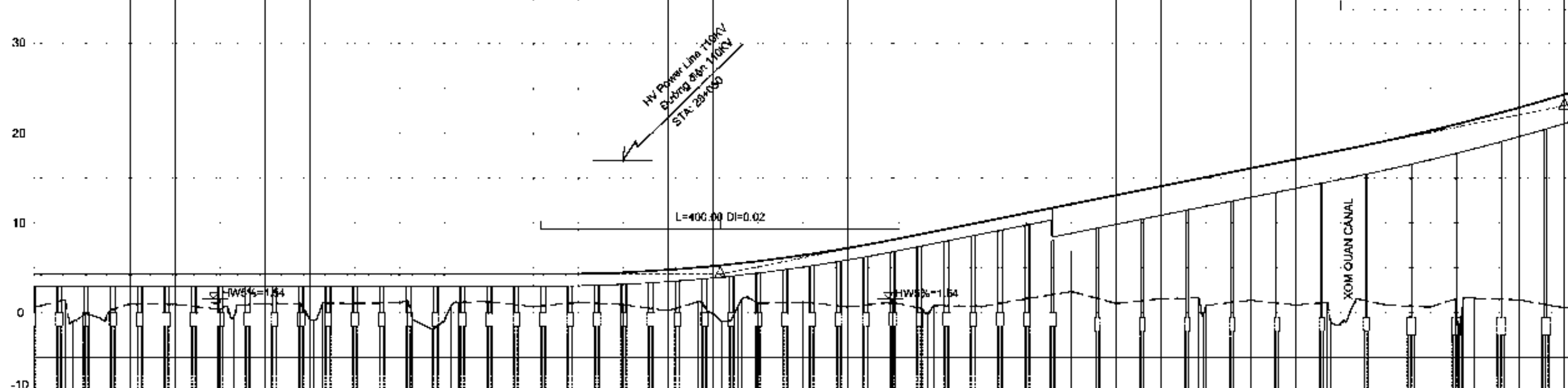
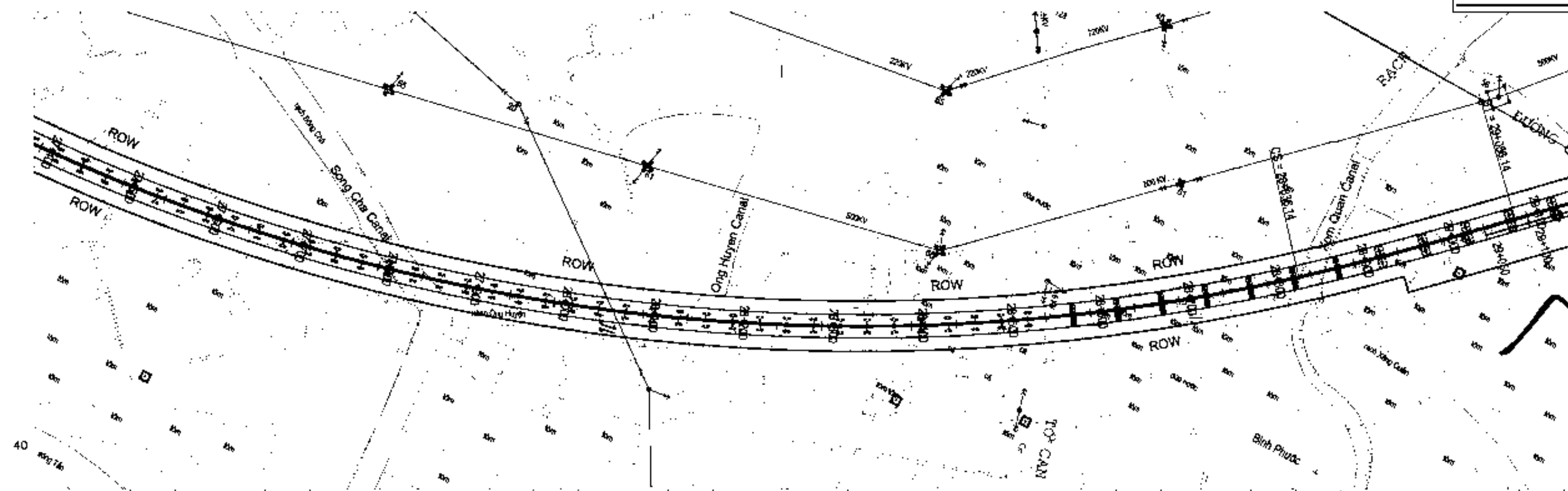
PROFILE DỘC DỌC	FINISHED GRADE CAO ĐỘ HOÀN THIÊN	EXISTING GROUND CAO ĐỘ TỰ NHIÊN	STATION LY TRÌNH	HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CÔNG
	7.73 8.14 8.67 9.07 9.43 10.29 10.68 11.08 11.36 11.74 12.28 13.04 13.66 13.97 14.13 14.27 14.40 14.49 14.56 14.80 14.93 14.82 14.57 14.48 14.38 14.20 13.76 13.17 12.44 11.55 10.51 9.32 7.89 7.85 6.74 6.21 5.86 5.75 5.01 4.53 4.36 4.31 4.29 4.29 4.29 4.29 4.28 4.28 4.29 4.29 4.28 4.28 4.28	0.52 0.43 0.44 0.63 1.02 0.58 0.52 -0.39 1.54 0.65 0.81 1.51 0.96 1.16 1.18 1.11 1.13 0.28 -4.71 -5.98 -12.48 -11.12 -9.12 -4.91 -0.04 0.69 0.88 1.01 0.95 0.84 0.97 0.90 0.70 0.88 0.97 1.31 -1.43 0.93 1.15 0.81 -0.06 0.95 0.71 0.79 0.59 -0.25 0.84 1.12 0.96 -1.27 0.67 0.91 0.57 0.77	25700.00 25715.30 25734.56 25750.00 25763.88 25800.00 25817.32 25836.27 25850.00 25869.81 25900.00 25950.00 26000.00 26031.86 26050.00 26070.43 26091.45 26100.00 26130.98 26150.00 26183.51 26200.00 26224.09 26250.00 26271.85 26300.00 26350.00 26400.00 26450.00 26500.00 26550.00 26600.00 26650.00 26655.08 26700.00 26725.21 26738.15 26750.00 26800.00 26850.00 26881.81 26900.00 26950.00 27000.00 27050.00 27100.00 27150.00 27196.75 27200.00 27221.08 27250.00 27300.00 27350.00 27400.00	

A=116341'12"
R=2200.00 K=2681.08, Inc=3%
T=1482.17 P=385.95
L=250.00

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-170
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: PLAN AND PROFILE KM25+700 - KM27+400 BÌNH ĐỒ VÀ TRẮC DỌC KM25+700 - KM27+400			SCALE:
								H=1:5000; V=1:500			

TO BEN LUC

TO LONG THANH

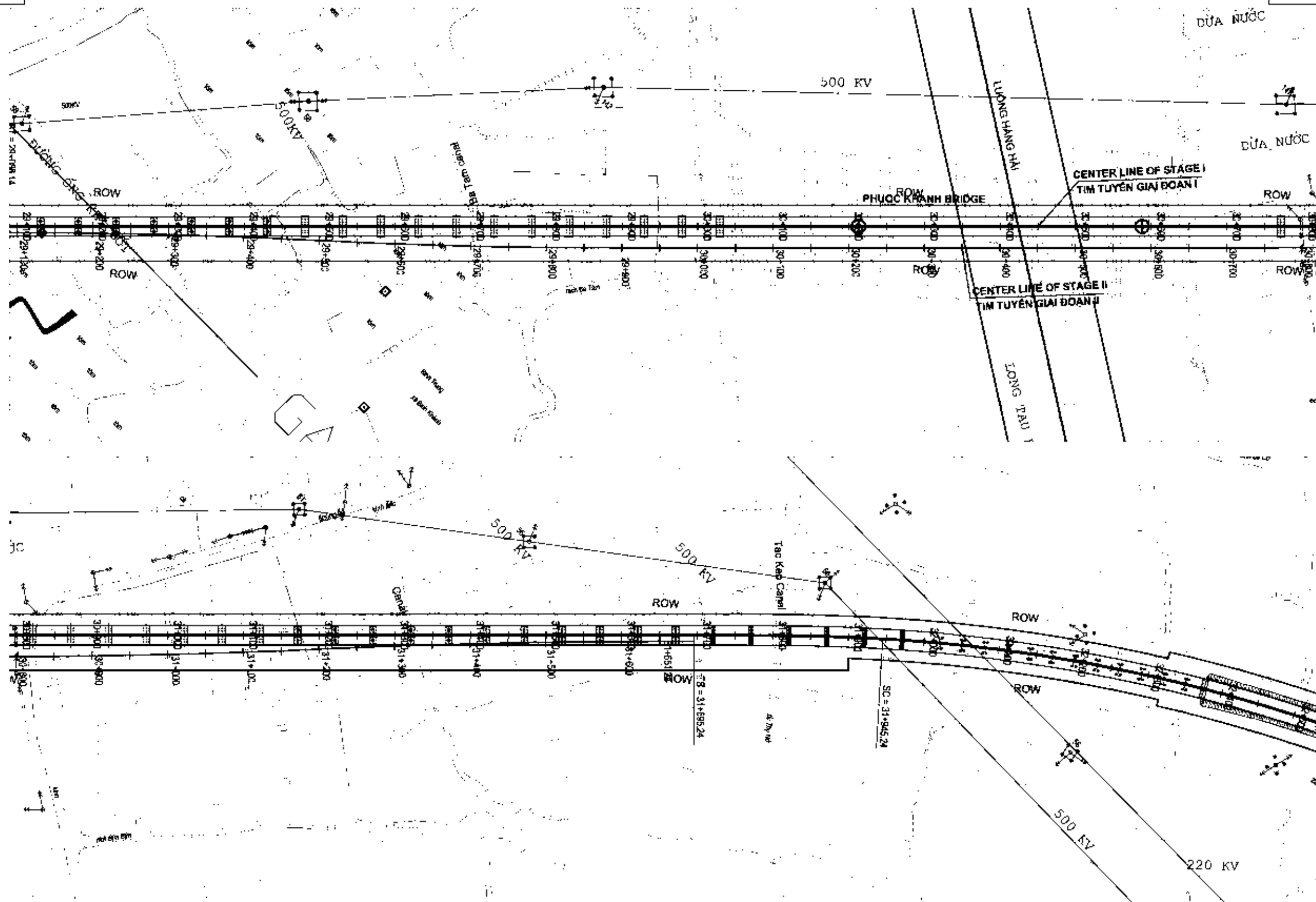


PROFILE DỐC ĐỘ	0.0%																												2.00%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
	1378.00																												942.00																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-180
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: PLAN AND PROFILE KM27+400 - KM29+100 BÌNH DỒ VÀ TRẮC ĐỌC KM27+400 - KM29+100			
PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: Le Ngoc HIEU APPROVED BY: Timothy COLLETT										SCALE:	H=1:5000; V=1:500

TO BEN LUC

TO LONG THANH



CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TYPE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT

DRAWING TITLE: PLAN AND PROFILE KM29+100 - KM32+500
 BÌNH ĐỒ VÀ TRẮC ĐỌC KM29+100 - KM32+500

REV. No	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	RW-PF-190
1	FEB-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500



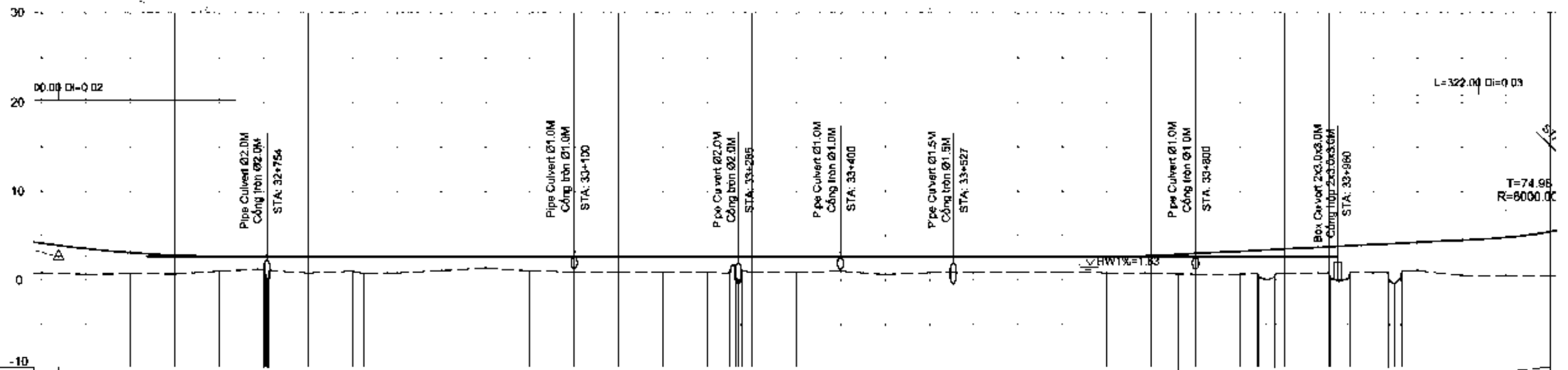
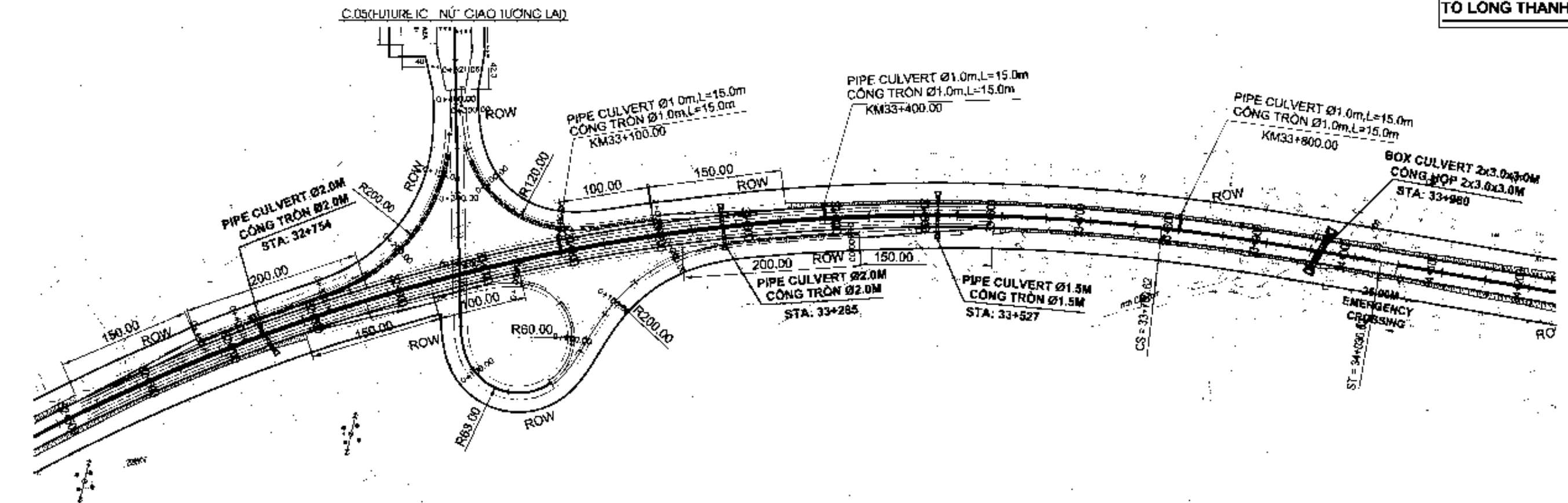
PROFILE DỐC DỌC																																																								
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	24.38	25.93	27.58	29.33	31.18	32.14	33.13	35.13	36.81	37.02	38.13	41.09	43.00	44.84	48.82	48.34	50.00	51.59	53.13	54.55	55.32	56.83	56.09	56.86	56.95	57.48	57.93	58.20	58.51	59.76	59.04	59.24	59.44	59.80	59.77	59.98	60.06	60.23	60.41	60.52	60.58	60.56	60.45	60.34	60.18	59.96	59.73	59.44	59.15	58.78	58.35	57.93	57.45	56.95	56.37	55.83
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	0.98	0.00	0.87	1.57	0.99	1.30	0.59	0.72	0.63	-0.24	1.65	0.92	0.78	0.90	0.49	0.90	0.99	0.78	0.91	1.26	1.14	-0.51	-2.81	-5.01	-9.13	-12.12	-12.41	-12.57	-12.64	-13.60	-13.94	-14.43	-15.27	-16.24	-16.96	-18.46	-16.13	-15.63	-15.24	-12.89	-13.58	-12.48	-11.98	-10.48	-7.34	-4.82	-3.16	-0.99	0.75	1.23	0.69	1.08	1.38	1.68		
STATION LÝ TRÌNH	29100.00	29150.00	29200.00	29250.00	29300.00	29319.99	29378.33	29390.00	29442.01	29450.00	29500.00	29550.00	29600.00	29660.00	29700.00	29750.00	29800.00	29850.00	29900.00	29950.00	30000.00	30036.60	30050.00	30075.95	30100.00	30134.00	30150.00	30168.23	30183.88	30200.00	30213.91	30230.00	30250.00	30264.18	30283.18	30313.26	30338.32	30350.00	30383.30	30400.00	30428.45	30450.00	30478.94	30500.00	30525.72	30550.00	30573.87	30600.00	30622.48	30650.00	30678.06	30700.00	30725.65	30750.00	30784.00	30800.00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỎNG																																																								

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM	ASIAN DEVELOPMENT BANK	REV. No	DATE	DESCRIPTION	DRAWING No.:				
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT	0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-200				
						-	FEB-2010	FINAL DRAWING					
									DRAWING TITLE:				SCALE :
									PLAN AND PROFILE KM29+100 - KM30+800 BÌNH ĐỒ VÀ TRẮC ĐỌC KM29+100 - KM30+800				H=1:5000; V=1:500
TITLE	NAME	SIGNATURE											
PREPARED BY	Nguyen Thanh PHUONG												
CHECKED BY	Le Ngoc HIEU												
APPROVED BY	Timothy COLLETT												



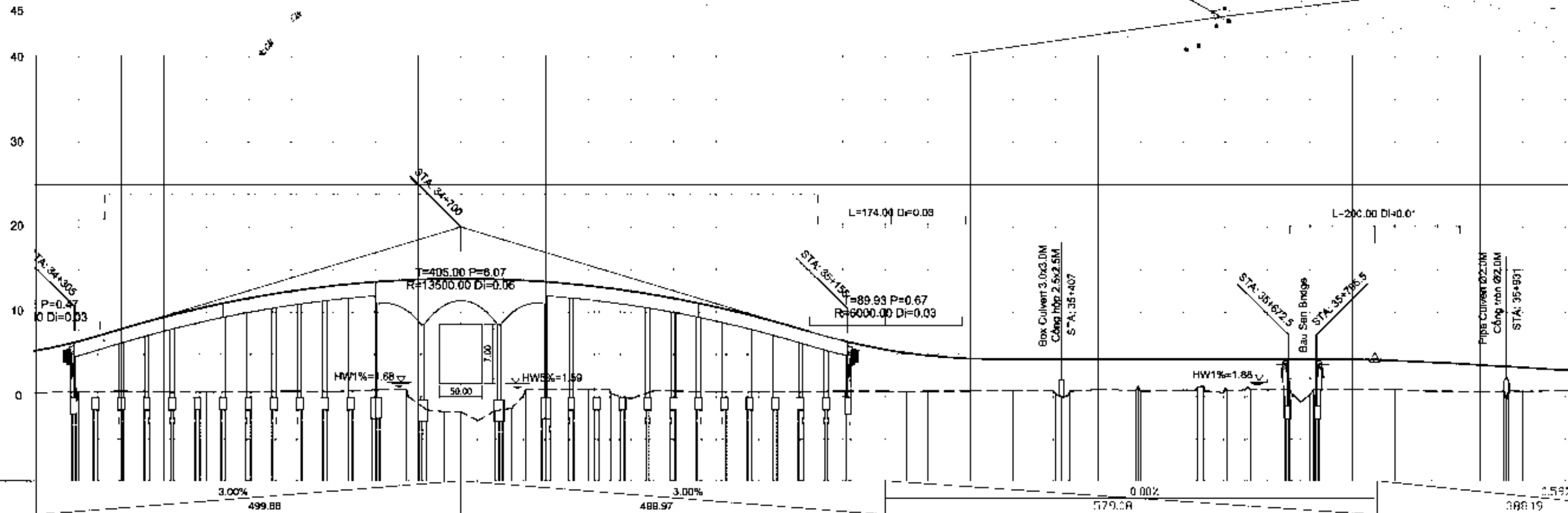
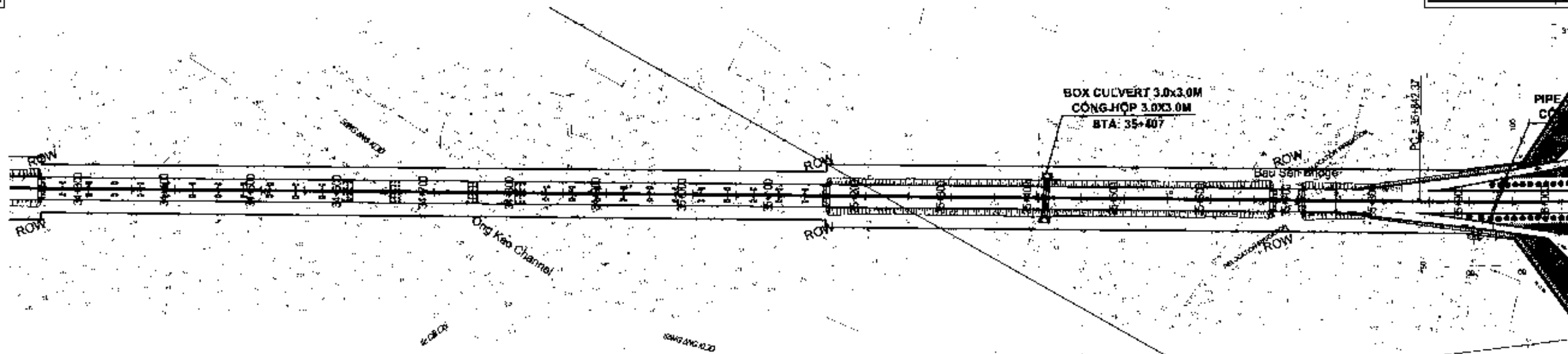
PROFILE DỌC DỌC																																												
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	55.93	55.83	55.34	54.55	53.13	51.59	50.00	48.34	46.62	44.84	43.00	41.00	39.13	38.33	37.98	37.13	35.13	33.13	31.16	28.28	27.46	25.73	24.86	22.48	20.99	20.88	20.29	19.68	18.68	18.16	17.00	16.88	15.63	14.38	13.13	11.88	10.63	9.38	8.13	7.41	6.94	5.84	4.92	4.15
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	1.38	0.98	-0.88	1.09	0.98	1.19	1.12	0.87	1.28	1.17	0.87	0.70	0.81	0.99	-0.10	0.78	0.87	0.79	0.84	0.88	0.88	1.05	1.07	1.06	0.85	-0.82	0.84	-0.99	1.48	0.78	0.78	1.02	0.78	0.85	0.86	0.92	0.80	0.82	0.72	-0.93	0.72	0.79	0.81	
STATION LY TRÌNH	307+00	308+00	309+00	310+00	311+00	312+00	313+00	314+00	315+00	316+00	317+00	318+00	319+00	320+00	321+00	322+00	323+00	324+00	325+00	326+00	327+00	328+00	329+00	330+00	331+00	332+00	333+00	334+00	335+00	336+00	337+00	338+00	339+00	340+00	341+00	342+00	343+00	344+00	345+00	346+00	347+00	348+00	349+00	350+00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỎNG	L=250.00 A=125.84121" R=2700.00 K=2335.39 h=3% T=1254.08 P=273.87																																											

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:		
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-210		
								-	FEB-2010	FINAL DRAWING			
						DRAWING TITLE:		PLAN AND PROFILE KM30+800 - KM32+500					SCALE :
								BÌNH ĐỒ VÀ TRẮC ĐỌC KM30+800 - KM32+500					H=1:5000; V=1:500
TITLE				NAME		SIGNATURE							
PREPARED BY				Nguyen Thanh PHUONG									
CHECKED BY				Le Ngoc HIEU									
APPROVED BY				Timothy COLLETT									



PROFILE DỌC DỌC	FINISHED GRADE CAO ĐỘ HOÀN TIỆN	EXISTING GROUND CAO ĐỘ TỰ NHIÊN	STATION LÝ TRÌNH	HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CÔNG
	4.15	0.81	32500.00	
	3.55	0.65	32550.00	
	3.10	0.74	32600.00	
	2.81	0.70	32650.00	
	2.65	0.00	32700.00	
	2.65	0.25	32750.00	
	2.65	-0.16	32754.00	
	2.65	0.81	32800.00	
	2.65	0.89	32850.00	
	2.65	0.78	32862.93	
	2.65	0.81	32900.00	
	2.65	0.08	32950.00	
	2.65	0.39	33000.00	
	2.65	0.03	33050.00	
	2.65	0.82	33100.00	
	2.65	0.95	33150.00	
	2.65	0.81	33200.00	
	2.65	0.89	33250.00	
	2.65	0.80	33275.00	
	2.65	-0.81	33300.00	
	2.65	0.86	33350.00	
	2.65	1.01	33400.00	
	2.65	0.83	33450.00	
	2.65	0.85	33500.00	
	2.65	0.87	33550.00	
	2.65	0.88	33600.00	
	2.65	0.81	33650.00	
	2.65	0.82	33700.00	
	2.65	0.81	33750.00	
	3.00	0.70	33780.62	
	3.06	0.66	33800.00	
	3.28	0.67	33850.00	
	3.33	0.04	33880.00	
	3.43	0.79	33900.00	
	3.78	0.81	33950.00	
	3.89	-0.15	33962.00	
	3.90	0.87	34000.00	
	4.12	-0.43	34024.00	
	4.22	0.06	34050.00	
	4.26	0.52	34100.00	
	4.53	0.54	34150.00	
	4.81	0.54	34200.00	
	5.50	0.54	34200.00	

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-220
								-	FEB-2010	FINAL DRAWING	
								DRAWING TITLE:		PLAN AND PROFILE KM32+500 - KM34+200	
										BÌNH ĐỒ VÀ TRẮC ĐỌC KM32+500 - KM34+200	SCALE:
											H=1:5000; V=1:500

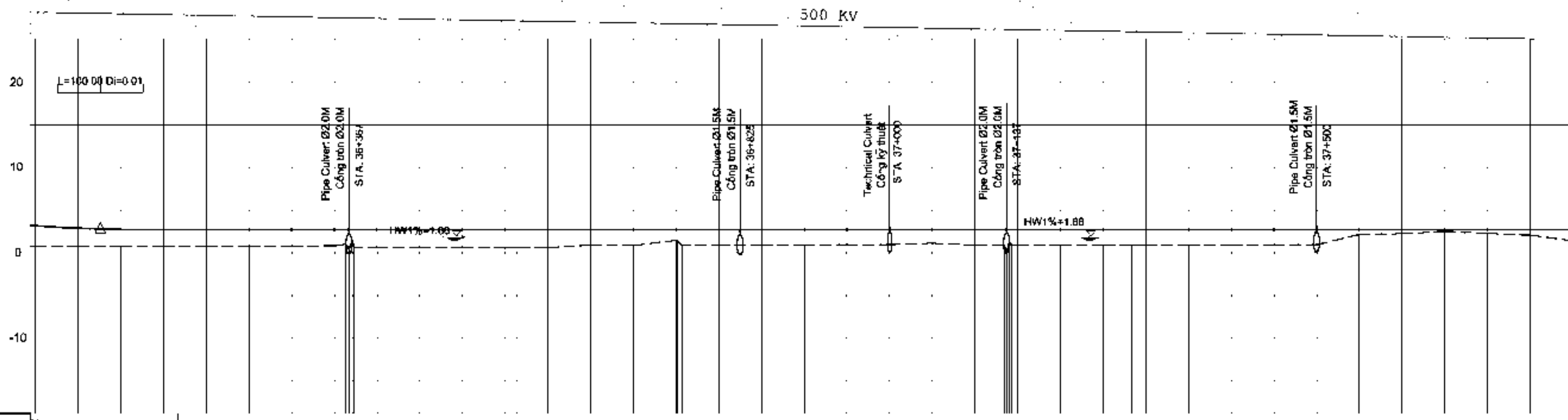
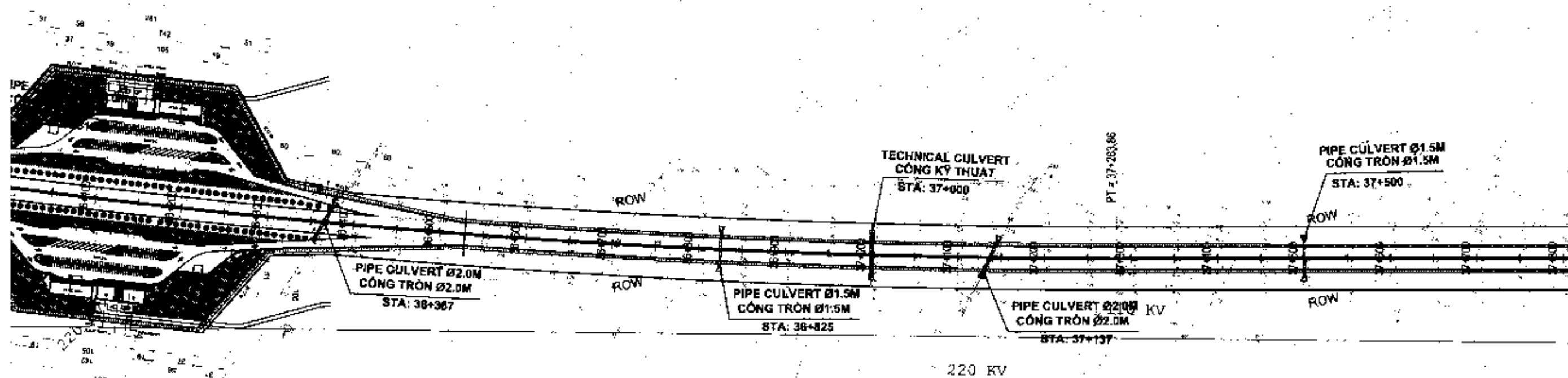


STATION LY TRINH	EXISTING GROUND CAO ĐỘ TỰ NHIÊN	FINISHED GRADE CAO ĐỘ HOÀN THIÊN
34200.00	0.54	5.50
34250.00	0.56	6.56
34300.00	0.69	6.03
34350.00	0.57	6.42
34400.00	0.59	10.62
34450.00	0.60	11.64
34500.00	0.69	12.47
34550.00	0.63	13.12
34600.00	0.66	13.56
34636.00	0.69	13.81
34650.00	-1.52	13.90
34680.00	-1.74	13.94
34700.00	-1.74	13.96
34720.00	-2.77	13.94
34740.00	-1.62	13.90
34760.00	-1.32	13.82
34775.00	0.91	13.75
34800.00	0.92	13.66
34850.00	0.92	13.12
34875.00	0.09	12.82
34900.00	-0.20	12.60
34925.00	0.73	12.07
34950.00	0.71	11.64
35000.00	0.60	10.82
35050.00	0.60	10.62
35100.00	0.61	8.03
35150.00	0.70	6.66
35200.00	0.69	5.71
35225.00	0.57	5.36
35250.00	0.70	5.16
35300.00	0.71	5.03
35350.00	0.73	5.03
35387.00	0.75	5.03
35400.00	-0.06	5.03
35417.00	0.68	5.03
35450.00	0.69	5.03
35500.00	0.78	5.03
35550.00	0.68	5.03
35550.00	0.79	5.03
35565.50	0.90	5.03
35575.00	0.72	5.03
35600.00	0.99	5.03
35625.50	1.24	5.03
35650.00	0.67	5.03
35675.00	0.69	5.03
35680.00	-0.58	5.03
35700.00	0.32	5.03
35750.00	0.66	5.01
35800.00	0.68	4.87
35842.37	0.68	4.65
35900.00	0.66	4.31
35931.00	-0.27	4.14
35950.00	0.65	4.12
36000.00	0.77	4.01

HORIZONTAL ALIGNMENT
ĐOẠN THẲNG ĐOẠN CONG

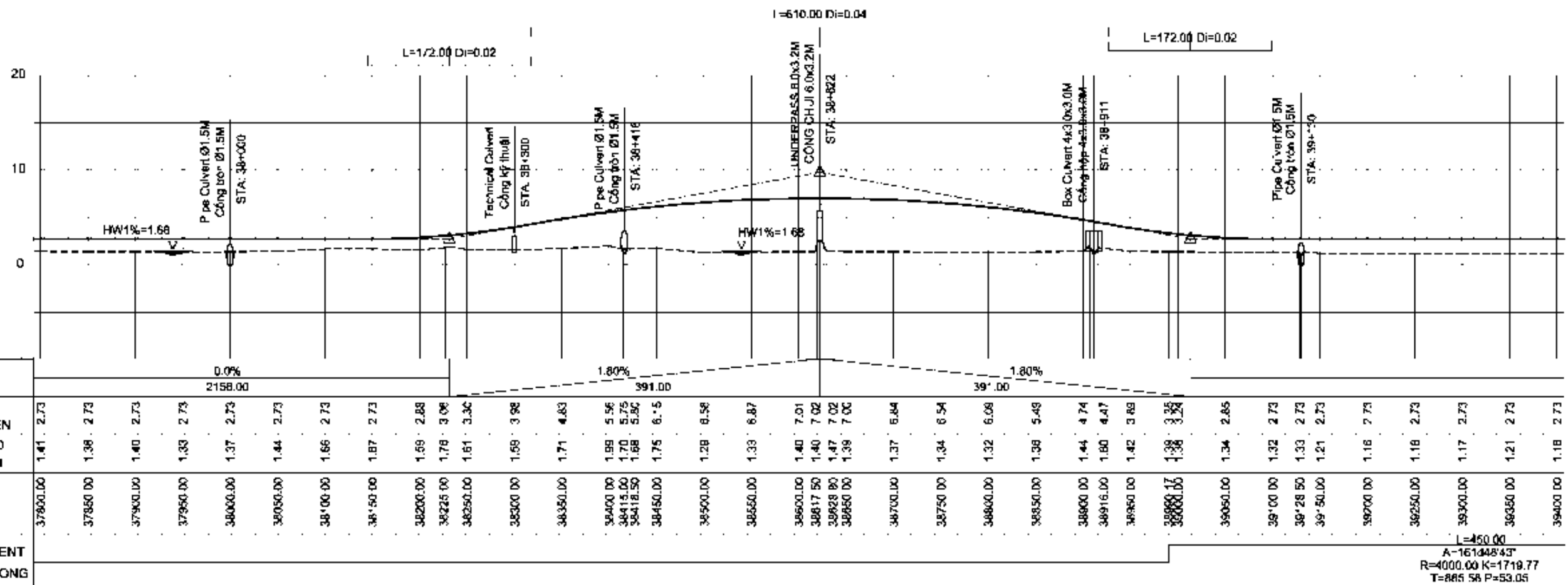
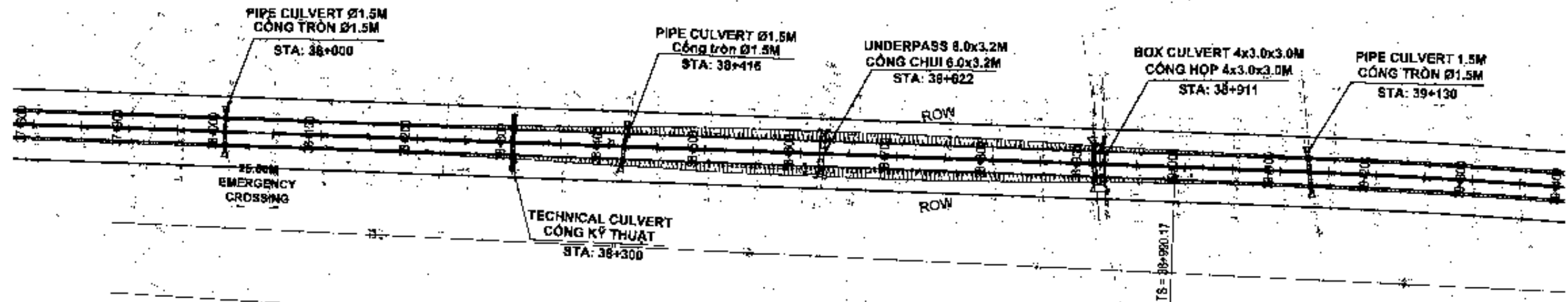
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=10000 K=1441.49
=722.00 P=26.03

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM	ASIAN DEVELOPMENT BANK	REV. No	DATE	DESCRIPTION	DRAWING No.:				
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT	0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-230				
						1	FEB-2010	FINAL DRAWING					
						DRAWING TITLE:							SCALE :
						PLAN AND PROFILE KM34+200 - KM36+000 BÌNH ĐỒ VÀ TRẮC DỤC KM34+200 - KM36+000							H=1:5000; V=1:500
TITLE	NAME	SIGNATURE											
PREPARED BY	Nguyen Thanh PHUONG												
CHECKED BY	Le Ngoc HIEU												
APPROVED BY	Timothy COLLETT												



PROFILE DỐC DỌC	0.0%																																								
	1832.76.00																																								
FINISHED GRADE CAO ĐỘ HOÀN THIÊN	1.71			2.96	2.80	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73					
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	0.77		0.76	0.76	0.78	0.74	0.79	0.81	0.82	0.49	0.68	0.66	0.65	0.63	0.61	0.61	0.94	0.86	1.48	0.86	0.88	0.91	0.94	0.98	0.97	1.13	0.90	0.93	0.92	0.91	0.89	0.89	0.90	0.94	0.95	2.16	2.25	2.49	2.29	2.07	1.41
STATION LÝ TRÌNH	36000.00	36050.00	36100.00	36150.00	36200.00	36250.00	36300.00	36350.00	36367.00	36400.00	36450.00	36500.00	36550.00	36600.00	36650.00	36700.00	36750.00	36758.00	36800.00	36850.00	36900.00	36950.00	37000.00	37050.00	37100.00	37134.00	37150.00	37200.00	37250.00	37283.86	37300.00	37350.00	37400.00	37450.00	37500.00	37550.00	37600.00	37650.00	37700.00	37750.00	37800.00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CÔNG	A=171d44'27" R=10000 K=1441.49 T=722.00 P=26.03																																								

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-PP-740
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: PLAN AND PROFILE KM36+000 - KM37+800 BÌNH ĐỒ VÀ TRẮC DỌC KM36+000 - KM37+800			SCALE:
								H=1:5000; V=1:500			



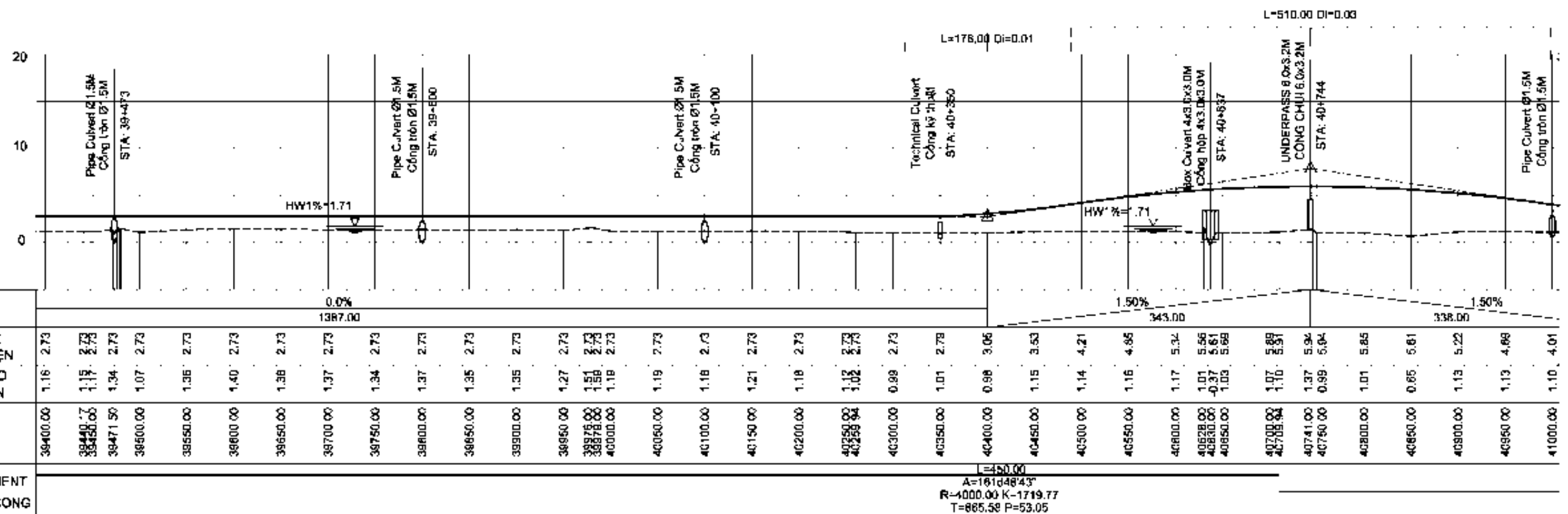
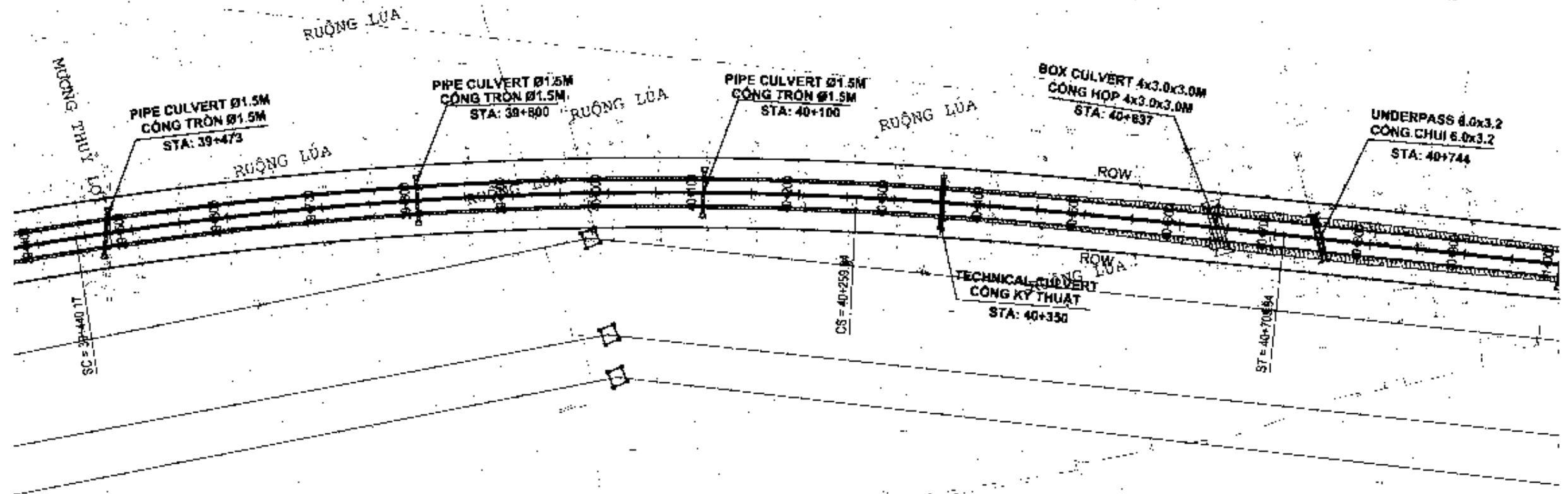
CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
 TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT
 DRAWING TITLE:
 PLAN AND PROFILE KM37+800 - KM39+400
 BÌNH ĐỒ VÀ TRẮC ĐỌC KM37+800 - KM39+400

REV. No.	DATE	DESCRIPTION	DRAWING No.
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1	FFR-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500



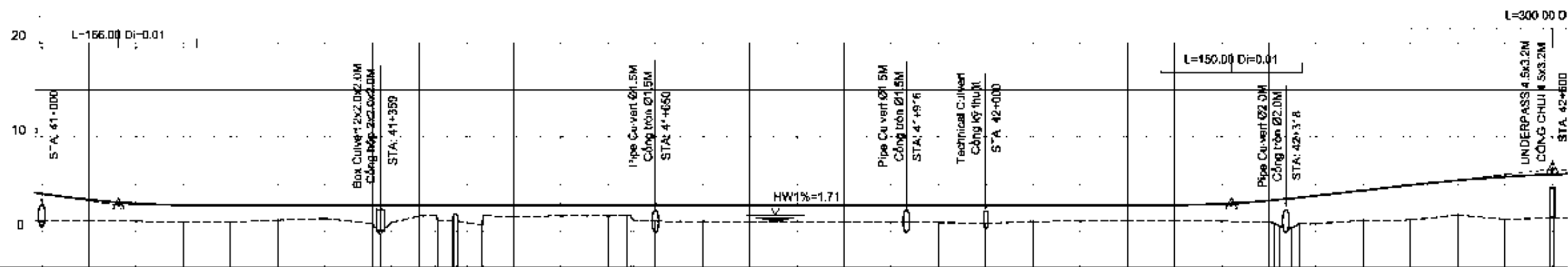
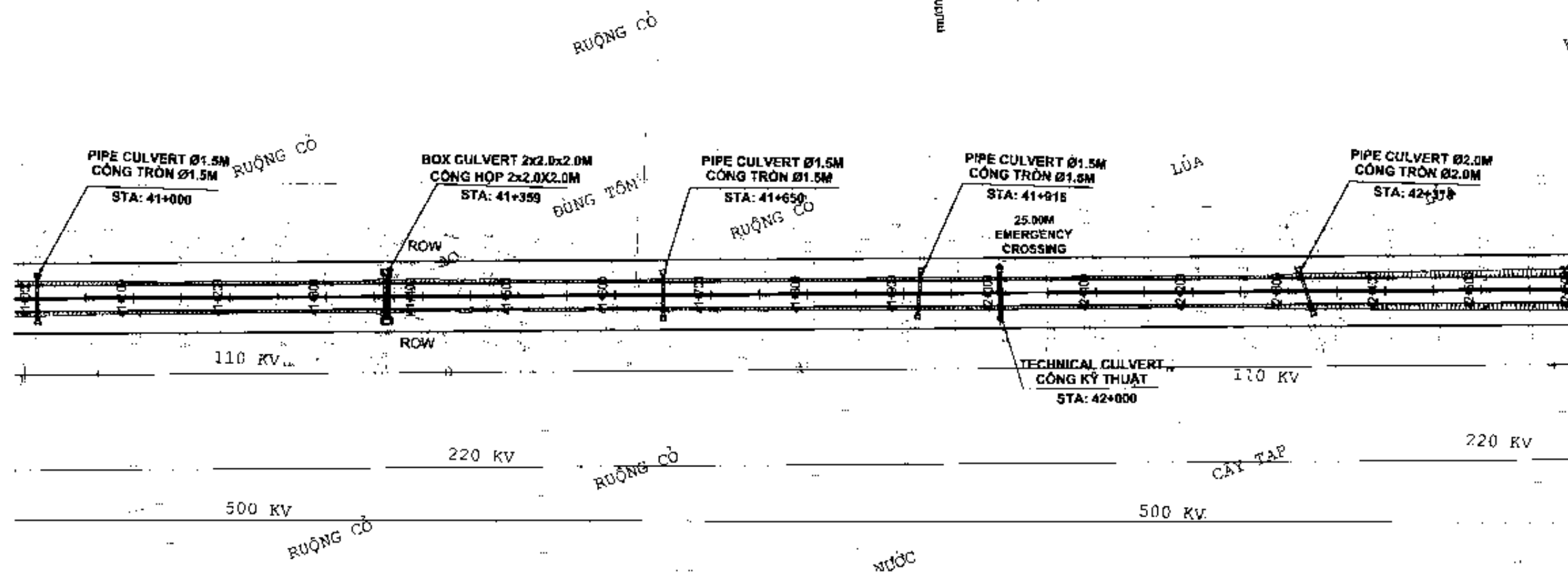
CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngọc HIU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

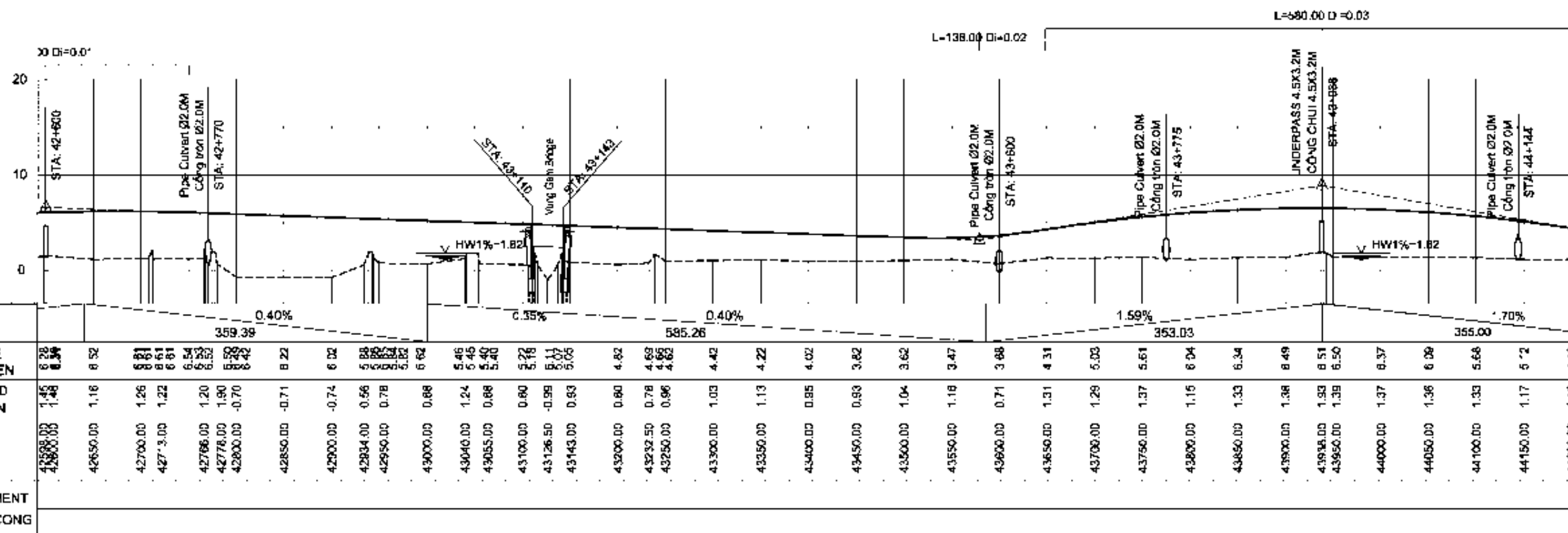
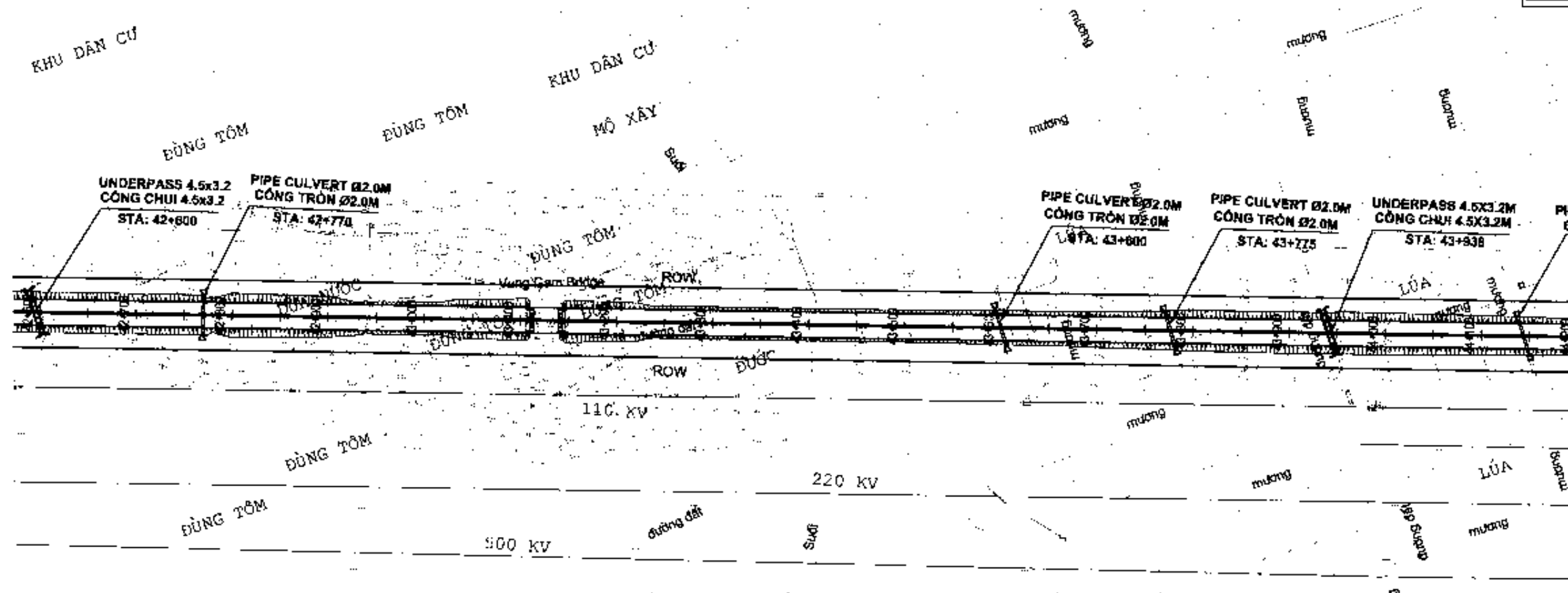
ASIAN DEVELOPMENT BANK
 TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT
 DRAWING TITLE: PLAN AND PROFILE KM39+400 - KM41+000
 BÌNH ĐỒ VÀ THẮC ĐỌC KM39+400 - KM41+000

REV. No.	DATE	DESCRIPTION	DRAWING No.
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1	FFR-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500

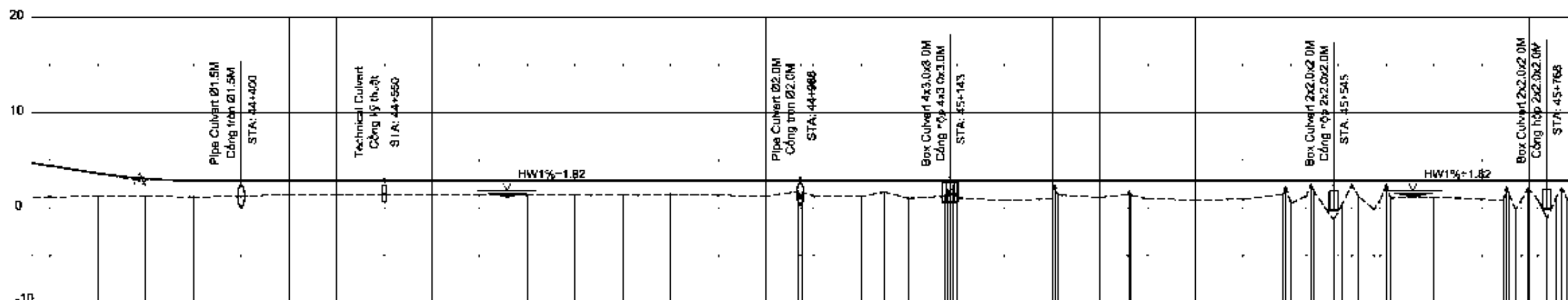
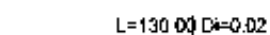


PROFILE DỌC DỌC																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										</
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CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM				ASIAN DEVELOPMENT BANK				REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)				TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PLAN AND PROFILE KM41+000 - KM42+600 BÌNH ĐỒ VÀ TRẮC ĐỌC KM41+000 - KM42+600				0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-270
												1	FFR-2010	FINAL DRAWING	
															SCALE: H=1:5000; V=1:500

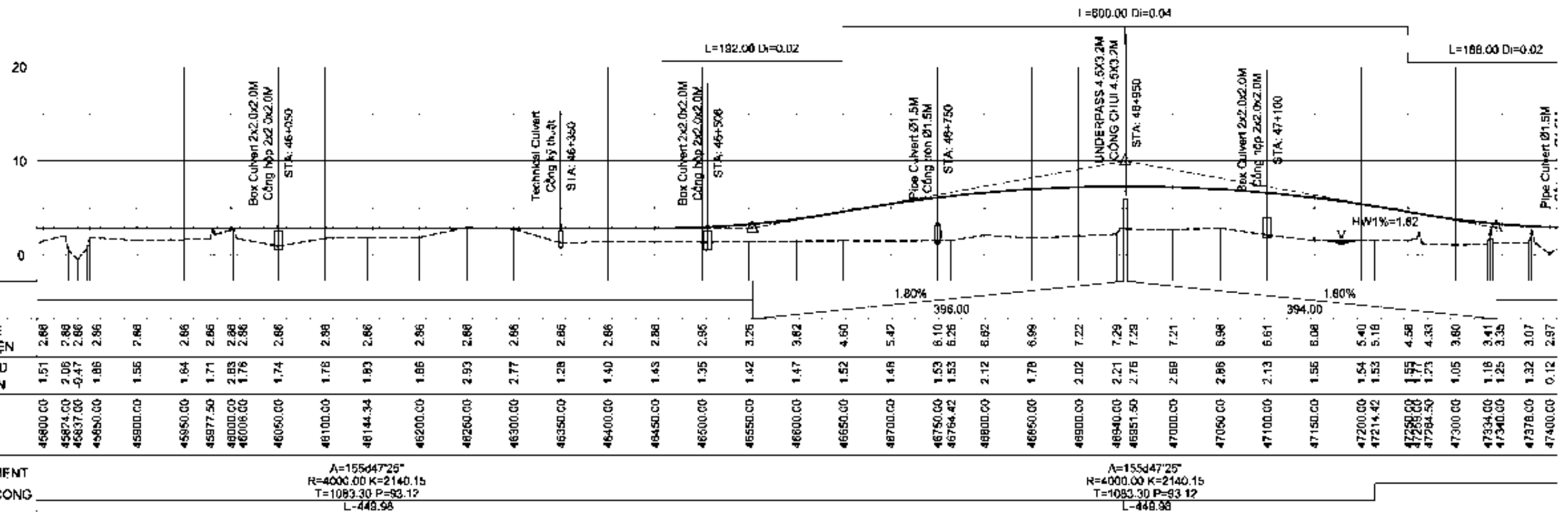
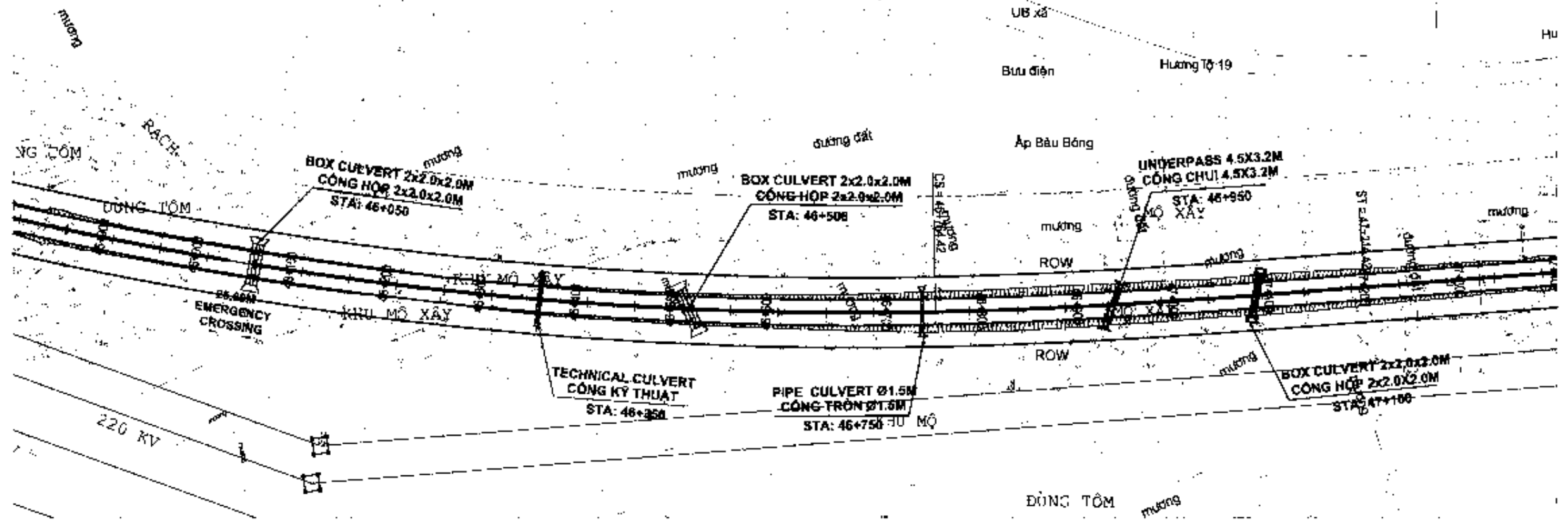


CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM				ASIAN DEVELOPMENT BANK				REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)				TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PLAN AND PROFILE KM42+600 - KM44+200 BÌNH ĐỒ VÀ TRẮC ĐỌC KM42+600 - KM44+200				0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-280
												1	FFR-2010	FINAL DRAWING	
															SCALE: H=1:5000; V=1:500
PREPARED BY: Nguyễn Thanh PHUONG CHECKED BY: Nguyễn HIU APPROVED BY: Timothy COLLETT															



A=155d47'25"
R=4000.00 K=2140.15
T=1083.30 P=93.12
L=449.98

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM	ASIAN DEVELOPMENT BANK	REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO	TITLE	NAME	SIGNATURE	VIETNAM EXPRESSWAY CORPORATION (VEC)	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT	0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-290
	PREPARED BY	Nguyen Thanh PHUONG			1	FFB-2010	FINAL DRAWING		
	CHECKED BY	Le Ngoc HIEU							
	APPROVED BY	Timothy COLLETT							
					DRAWING TITLE: PLAN AND PROFILE KM44+200 - KM45+800 BÌNH ĐỒ VÀ TRẮC DỤC KM44+200 - KM45+800				SCALE: H=1:5000; V=1:500



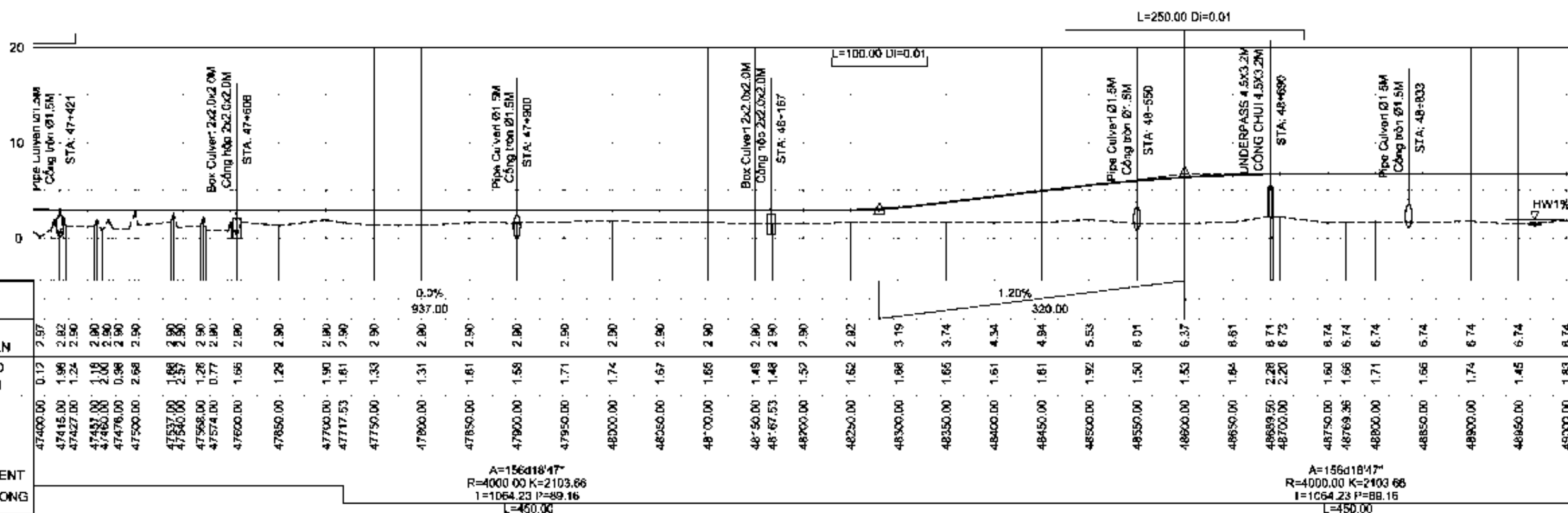
CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
 TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT
 DRAWING TITLE:
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 BÌNH ĐỒ VÀ TRẮC ĐỌC KM45+800 - KM47+400

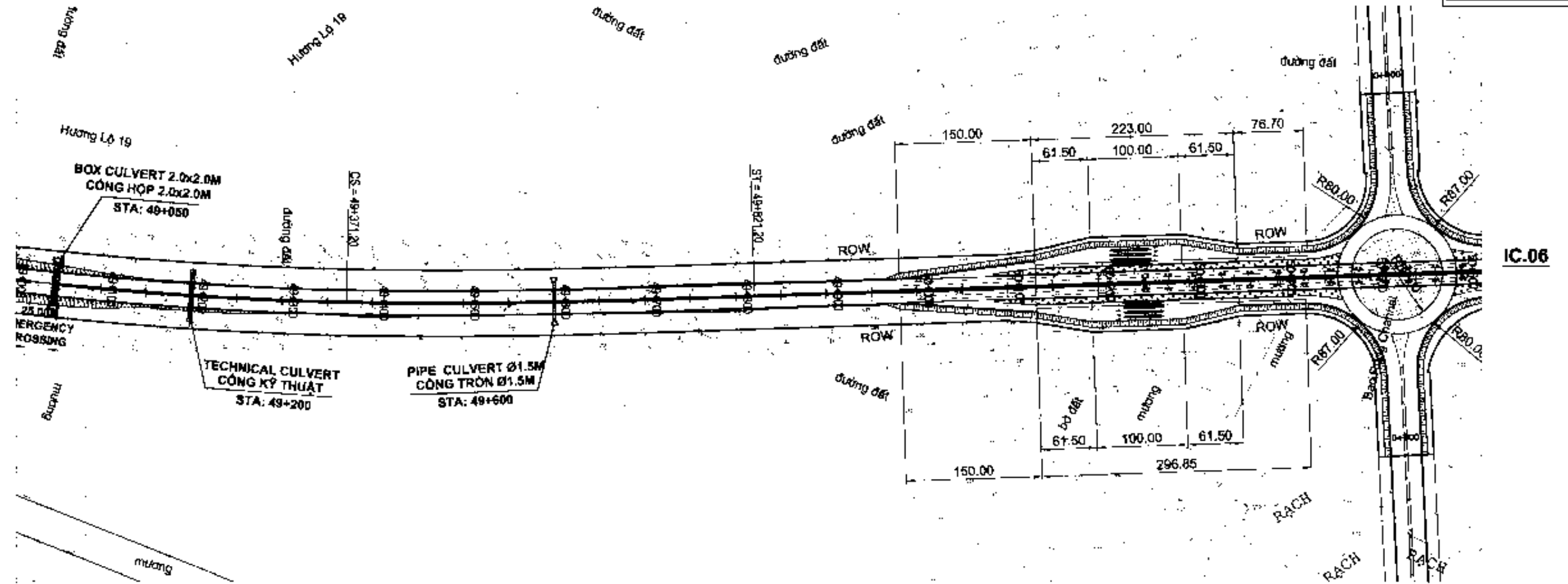
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1	FFR-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500



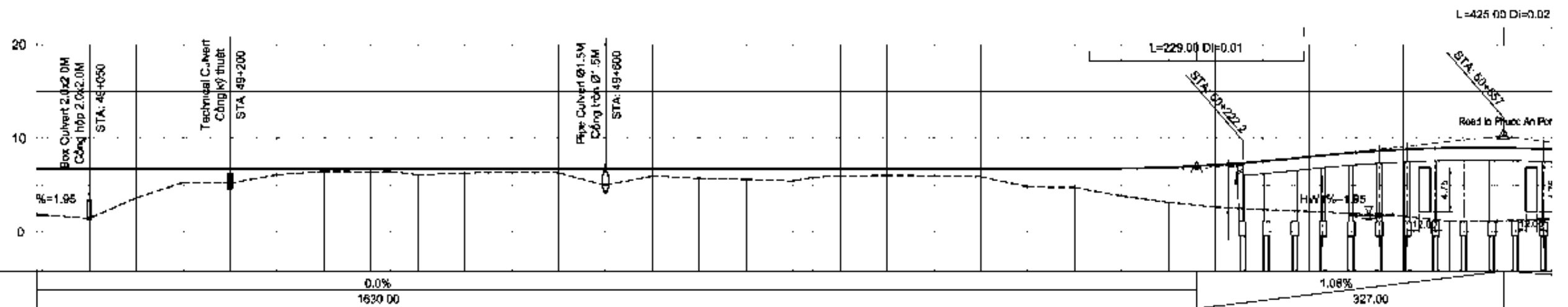
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL				TITLE	NAME	SIGNATURE	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT	0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-310
Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				PREPARED BY	Nguyen Thanh PHUONG		VIETNAM EXPRESSWAY CORPORATION (VEC)	1	FFB-2010	FINAL DRAWING	
				CHECKED BY	Tran NGOC HIEU			DRAWING TITLE:			SCALE:
				APPROVED BY	Timothy COLLETT			PLAN AND PROFILE KM47+400 - KM48+000			
							BÌNH ĐỒ VÀ TRẮC ĐỌC KM47+400 - KM48+000				H=1:5000; V=1:500

TO BEN LUC

TO LONG THANH

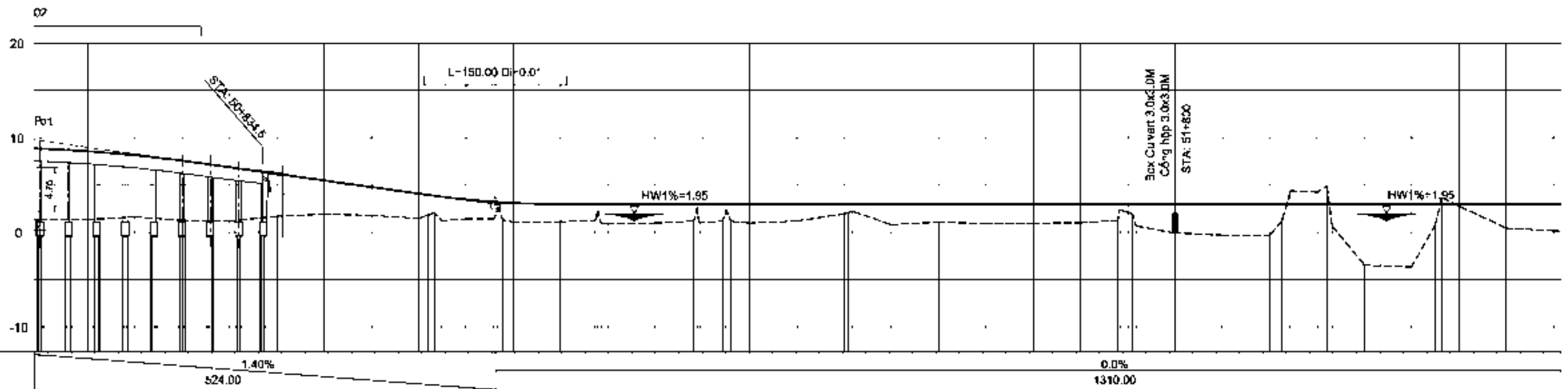
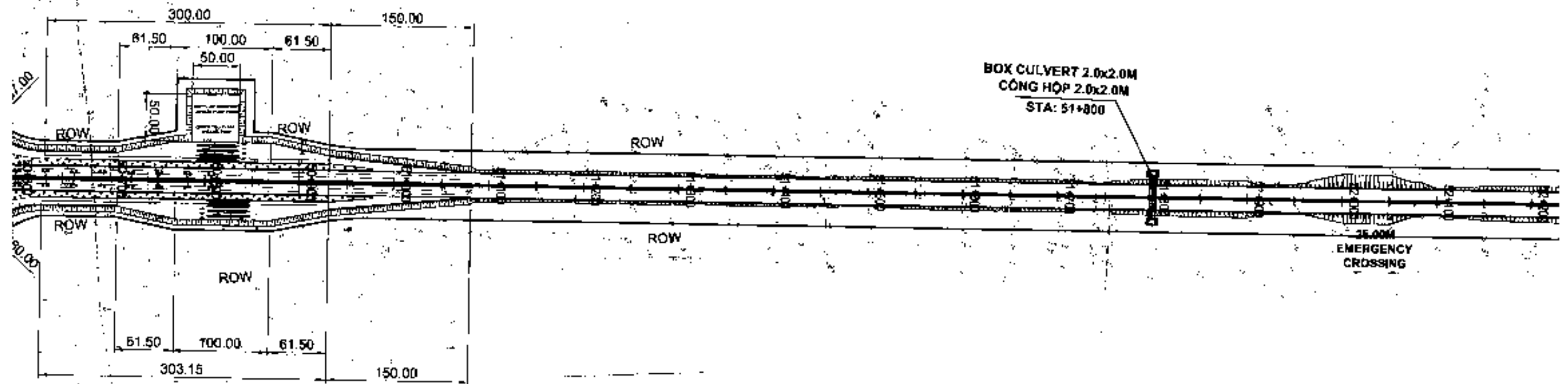


IC.06



PROFILE ĐỐC ĐỌC	0.0%																				1.08%				
	1630.00																				327.00				
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.77	6.81					
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	1.83	1.48	3.64	5.28	5.22	6.11	6.47	6.74	6.41	6.74	6.45	6.74	6.12	6.74	6.28	6.39	6.31	6.24	5.97	5.73					
STATION LÝ TRÌNH	49000.00	49050.00	49100.00	49150.00	49200.00	49250.00	49300.00	49350.00	49371.20	49400.00	49450.00	49500.00	49550.00	49600.00	49650.00	49700.00	49750.00	49800.00	49821.20	49850.00					
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỘNG	A=1'56d18'47" R=4000.00 K=2103.66 T=1064.23 P=89.18 L=450.00																								

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM				ASIAN DEVELOPMENT BANK				REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)				TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PLAN AND PROFILE KM49+000 - KM50+600 BÌNH ĐỒ VÀ TRẮC ĐỌC KM49+000 - KM50+600				0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-320
												1	FFR-2010	FINAL DRAWING	
															SCALE: H=1:5000; V=1:500



PROFILE DỌC DỌC	50+00	50+10	50+20	50+30	50+40	50+50	50+60	50+70	50+80	50+90	51+00	51+10	51+20	51+30	51+40	51+50	51+60	51+70	51+80	51+90	52+00
FINISHED GRADE CAO ĐỘ HOÀN THIÊN	8.84	8.56	8.14	7.57	6.88	6.18	5.48	4.78	4.08	3.78	3.47	3.22	3.10	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	1.39	1.36	1.62	1.27	1.18	1.68	1.92	1.78	1.48	1.24	1.40	1.42	1.07	1.12	1.26	0.90	0.98	1.18	1.01	1.18	1.01
STATION LÝ TRÌNH	50+00.00	50+10.00	50+20.00	50+30.00	50+40.00	50+50.00	50+60.00	50+70.00	50+80.00	50+90.00	51+00.00	51+10.00	51+20.00	51+30.00	51+40.00	51+50.00	51+60.00	51+70.00	51+80.00	51+90.00	52+00.00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN ĐỒNG																					

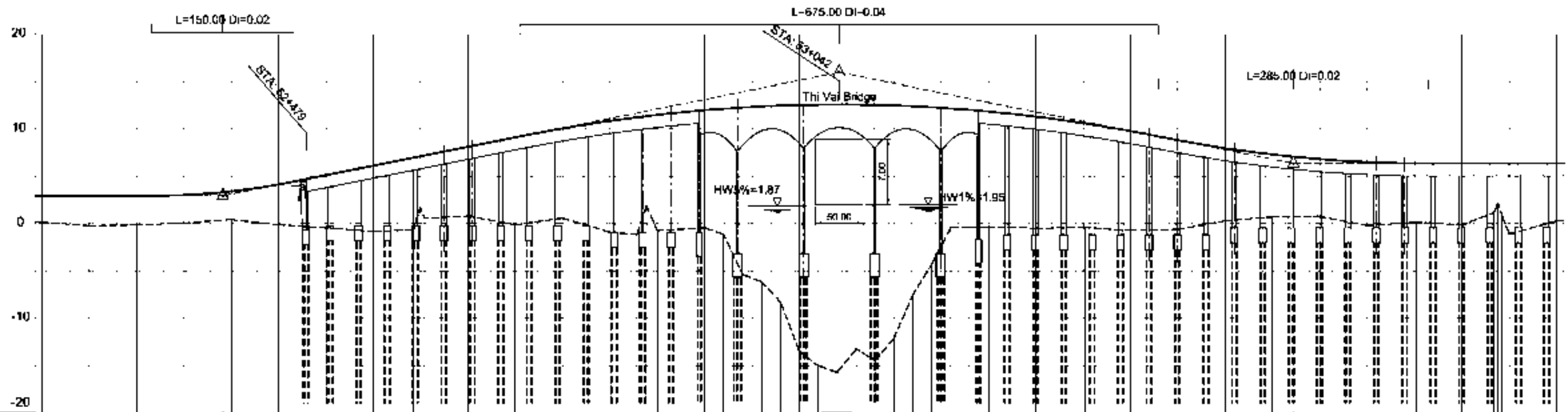
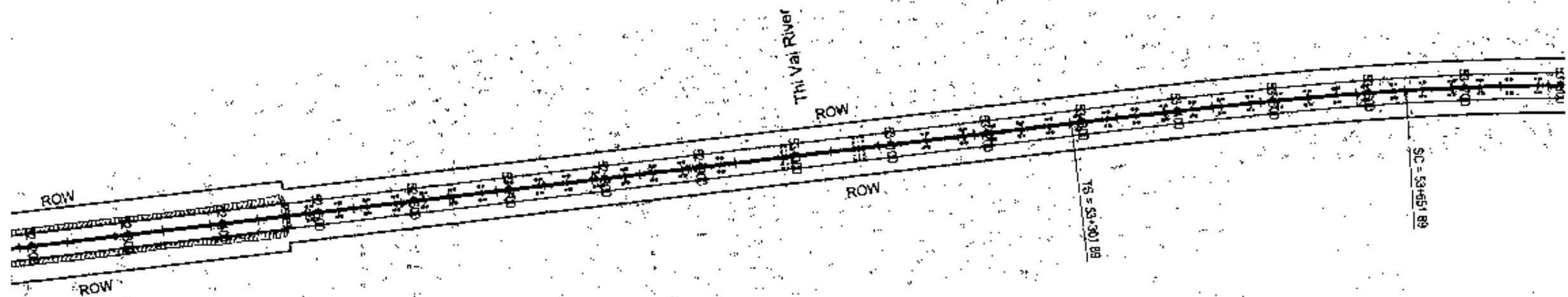
CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
 TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT
 DRAWING TITLE: PLAN AND PROFILE KM50+800 - KM52+200
 BÌNH ĐỒ VÀ TRẮC ĐỌC KM50+600 - KM52+200

REV. No.	DATE	DESCRIPTION	DRAWING No.
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1	FFR-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500



PROFILE DỌC ĐỌC																																														
FINISHED GRADE CAO ĐỘ HOÀN THIỆN	2.95	2.95	2.95	3.03	3.42	4.15	5.13	6.13	6.97	7.31	8.13	9.13	10.13	10.86	11.24	11.37	11.50	12.00	12.15	12.29	12.40	12.46	12.54	12.58	12.58	12.56	12.49	12.41	12.31	12.18	12.03	11.86	11.31	10.59	9.78	8.82	7.98	7.32	6.83	6.52	6.38	6.37	6.37	6.37		
LXISTING GROUND CAO ĐỘ TỰ NHIÊN	0.17	-0.22	-0.13	0.07	0.43	-0.13	-0.42	-0.86	-0.63	-0.57	0.80	-0.12	0.59	-0.8	-1.16	-1.88	-0.76	-0.44	-1.16	-5.37	-6.15	-8.28	-3.50	-5.03	-5.75	-3.25	-4.50	-2.10	-7.50	-4.80	-0.40	-0.35	-0.47	-0.40	-0.75	0.60	0.30	0.70	0.75	-0.20	0.16	-0.16	1.18	-1.10	0.27	
STATION LY TRÌNH	52200.00	52250.00	52300.00	52350.00	52400.00	52450.00	52500.00	52550.00	52592.00	52600.00	52650.00	52700.00	52750.00	52800.00	52828.50	52838.50	52850.00	52900.00	52920.00	52940.00	52960.00	52980.00	53000.00	53020.00	53040.00	53060.00	53080.00	53100.00	53120.00	53140.00	53160.00	53180.00	53200.00	53250.00	53301.89	53350.00	53400.00	53450.00	53500.00	53550.00	53600.00	53651.89	53700.00	53734.00	53750.00	53800.00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CỎNG	L=350.00 A=137d24'43" R=3000.00 K=2579.91, Ixc=2% T=1344.93 P=221.85																																													

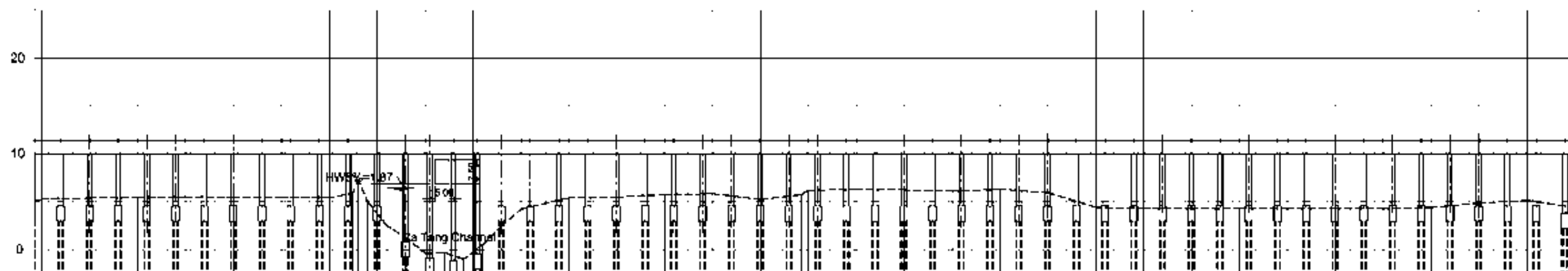
CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngoc HIEU	
APPROVED BY	Timothy COLLETT	


SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
 TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT
 DRAWING TITLE:
 PLAN AND PROFILE KM52+200 - KM53+800
 BÌNH ĐỒ VÀ TRẮC ĐỌC KM52+200 - KM53+800

REV. No.	DATE	DESCRIPTION	DRAWING No.
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1	FFB-2010	FINAL DRAWING	
SCALE:			H=1:5000; V=1:500

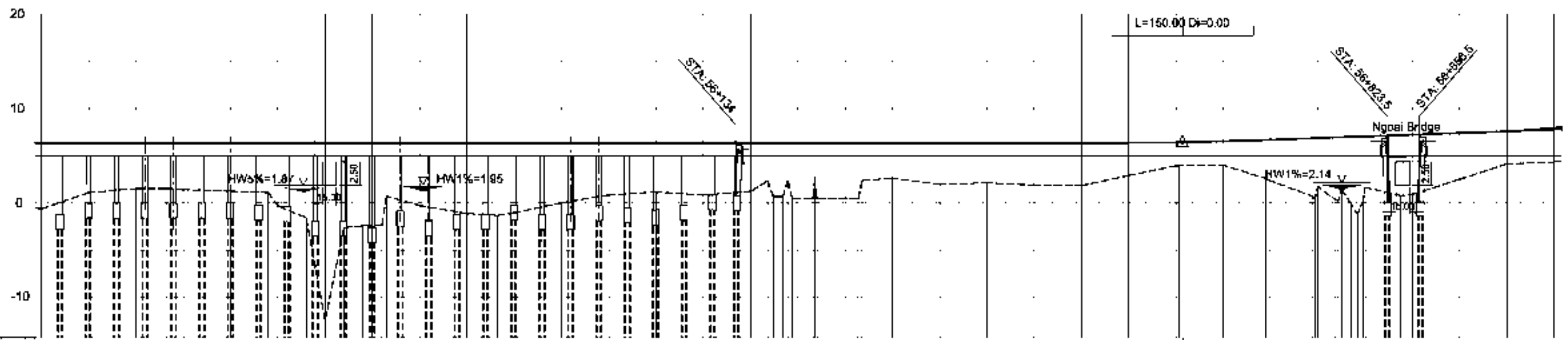
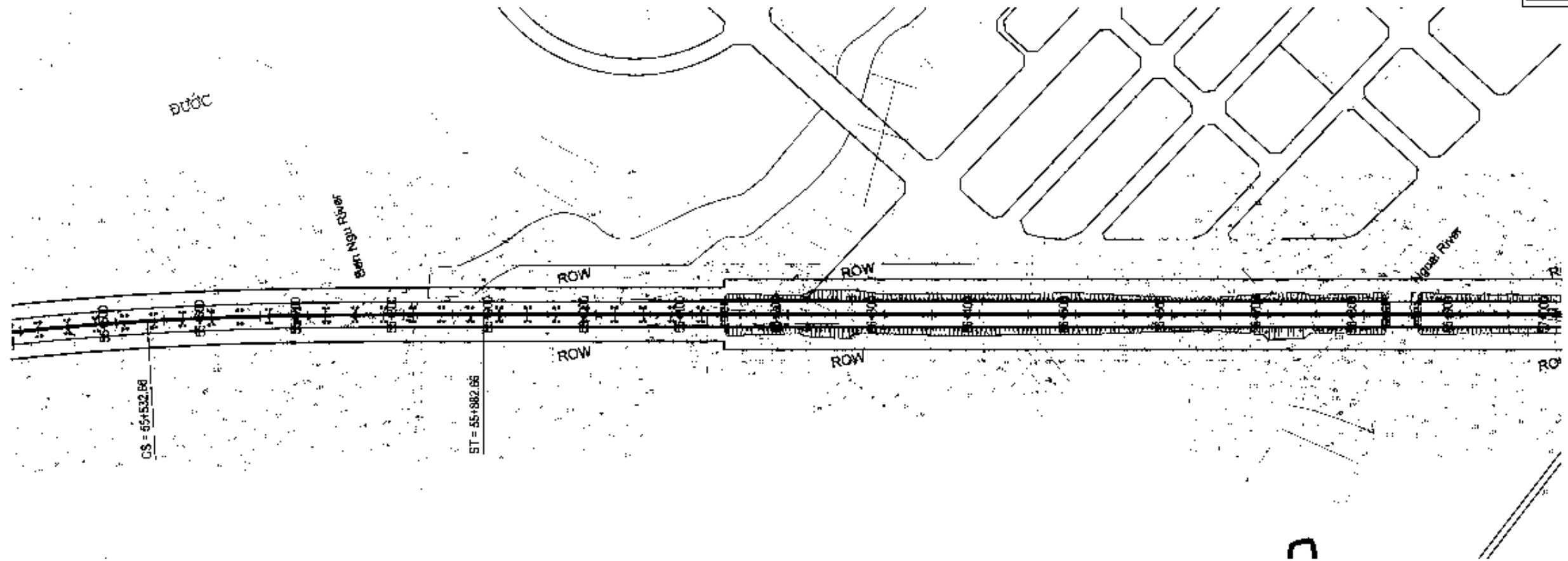


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A=37d24'43"
R=9000.00 K=2579.91, Isc=2%
T=1344.93 P=221.65

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:	
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				TITLE	NAME	SIGNATURE	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-350
				PREPARED BY	Nguyen Thanh PHUONG		VIETNAM EXPRESSWAY CORPORATION (VEC)		1	FFB-2010	FINAL DRAWING	
				CHECKED BY	Ngoc HIEU		DRAWING TITLE:					
				APPROVED BY	Timothy COLLETT		PLAN AND PROFILE KM53+800 - KM55+400 BÌNH ĐỒ VÀ TRẮC ĐỌC KM53+800 - KM55+400					H=1:5000; V=1:500

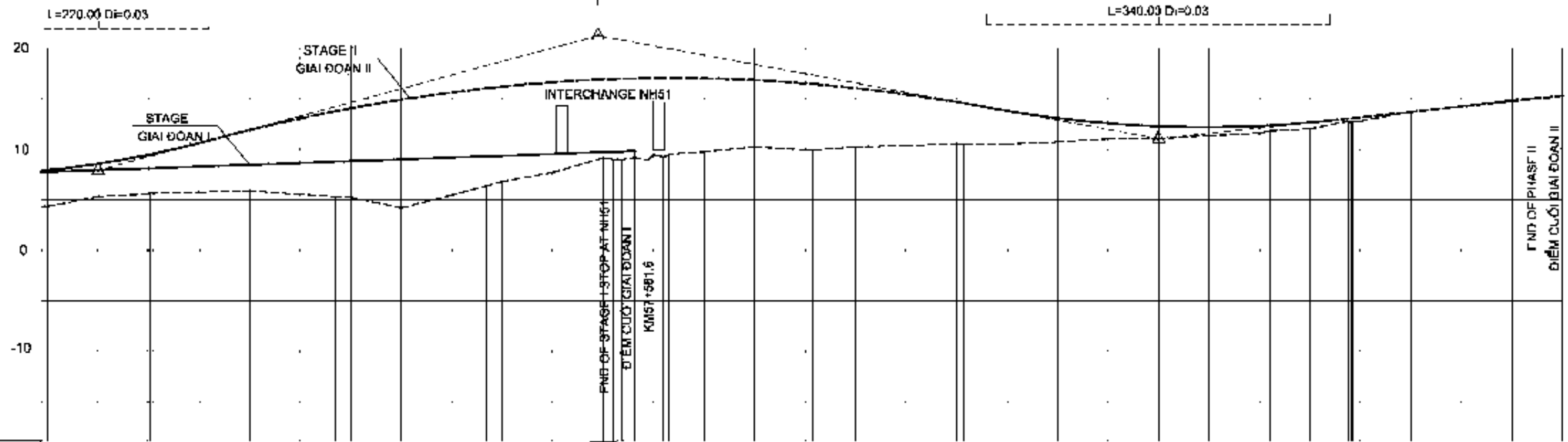
TO BEN LUC

TO LONG THANH



PROFILE DỌC DỌC																			
FINISHED GRADE CAO ĐỘ HOÀN THIÊN	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37
EXISTING GROUND CAO ĐỘ TỰ NHIÊN	-0.62	1.12	1.52	1.53	1.41	1.28	1.11	-0.36	-1.56	12.46	-2.00	-2.40	-2.35	-0.72	-0.26	-1.12	-1.30	1.05	0.03
STATION LÝ TRÌNH	55400.00	55450.00	55500.00	55532.67	55550.00	55600.00	55640.00	55650.00	55680.00	55700.00	55720.00	55740.00	55760.00	55765.00	55800.00	55850.00	55882.67	55900.00	55950.00
HORIZONTAL ALIGNMENT ĐOẠN THẲNG ĐOẠN CONG	L=350.00 A=137d24'43" R=3000.00 K=2579.91, lsc=2% T=1344.93 P=221.65																		

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PLAN AND PROFILE KM55+400 - KM57+000 BÌNH ĐỒ VÀ TRẮC DỌC KM55+400 - KM57+000		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-360
								1	FFR-2010	FINAL DRAWING	
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TITLE PREPARED BY: Nguyễn Thanh PHUONG CHECKED BY: Nguyễn HIU APPROVED BY: Timothy COLLETT											



A=152.55'8"
R=1000.00 K=622.65, I_{sc}=5%
T=316.04 P=29.55
L=150.00

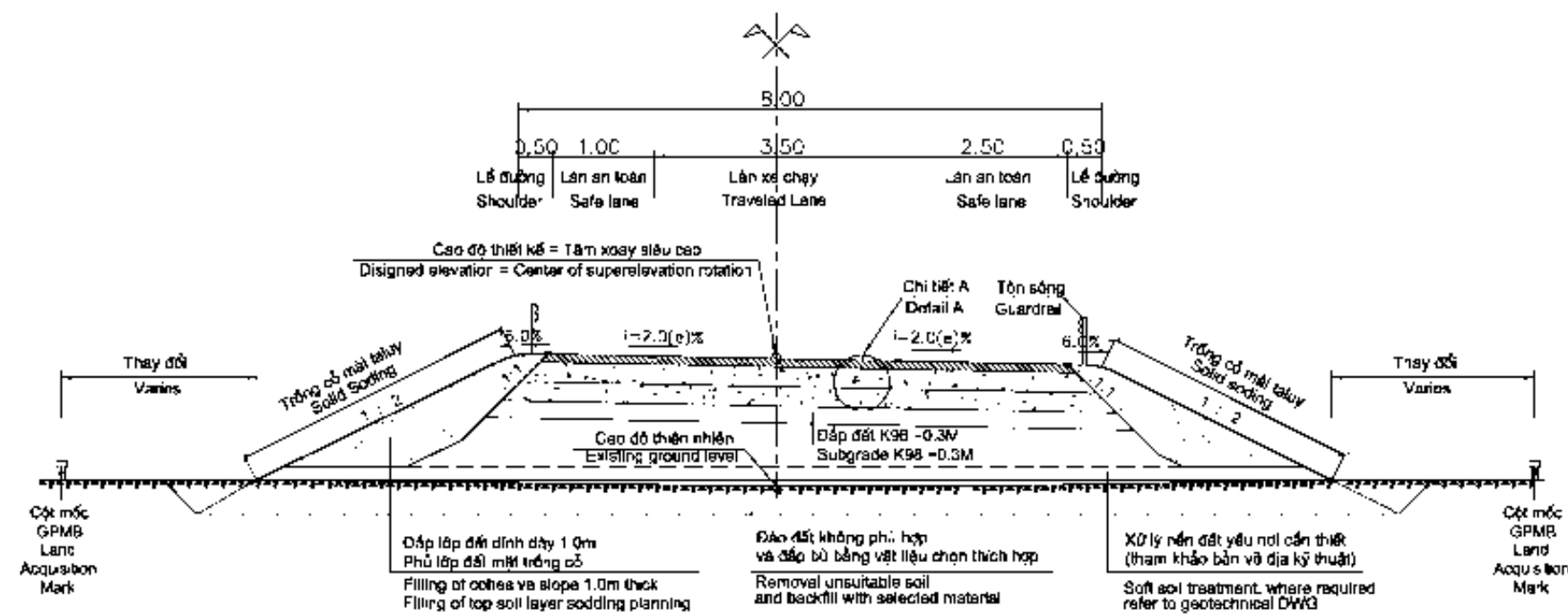
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:					
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-PP-370					
								1	FFB-2010	FINAL DRAWING						
								DRAWING TITLE:		PLAN AND PROFILE KM57+000 - KM57+700		BÌNH ĐỒ VÀ TRẮC DỤC KM57+000 - KM57+700		SCALE:		H=1:5000; V=1:500
TITLE				NAME		SIGNATURE										
PREPARED BY				Nguyễn Thanh PHUONG												
CHECKED BY				Đ. Ngọc HIEU												
APPROVED BY				Timothy COLLETT												

IV: Interchange

IV: Nút Giao

MẶT CẮT NGANG ĐIỂN HÌNH ĐƯỜNG NHÁNH NÚT GIAO (1/2) TYPICAL CROSS SECTION OF INTERCHANGE RAMPWAY (1/2)

MẶT CẮT LOẠI 1: 1 CHIỀU - 1 LÀN SECTION 1: ONE WAY - ONE LANE

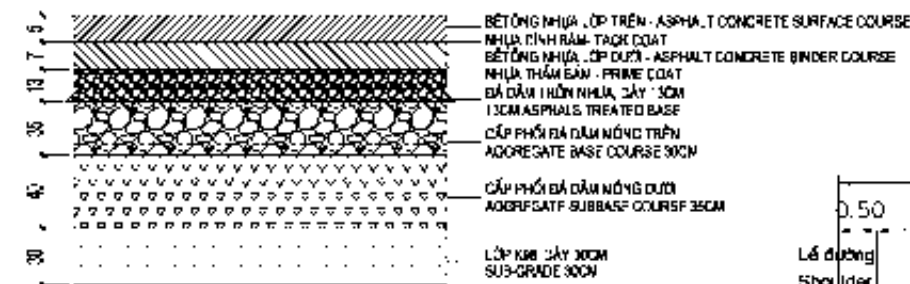


CHI TIẾT A

(KẾT CẤU MẶT ĐƯỜNG TRÊN CÁC NHÁNH NÚT GIAO)

DETAIL A

(PAVEMENT STRUCTURE OF RAMP AND LOOP IN INTERCHANGE)



MẶT CẮT 2: 2 CHIỀU - 2 LÀN SECTION 2: TWO WAY - TWO LANE

GHI CHÚ - NOTE:

- Đơn vị trong bản vẽ là mét, trừ trường hợp có chỉ định khác.
Dimension in drawing is in meters, unless otherwise indicated.
- Độ dốc ngang mặt đường đoạn thẳng thường là 2.0%.
Cross fall of rampway's in normal section is 2.0%.
- Độ dốc ngang mặt đường đoạn có siêu cao "a" lấy theo giá trị trong bảng trong bản vẽ bình diện và thống kê tuyến đường chính.
Cross fall "a" of super-elevated section shown in table in Alignment Layout and Geometrics of Rampway Interchange drawings.

CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

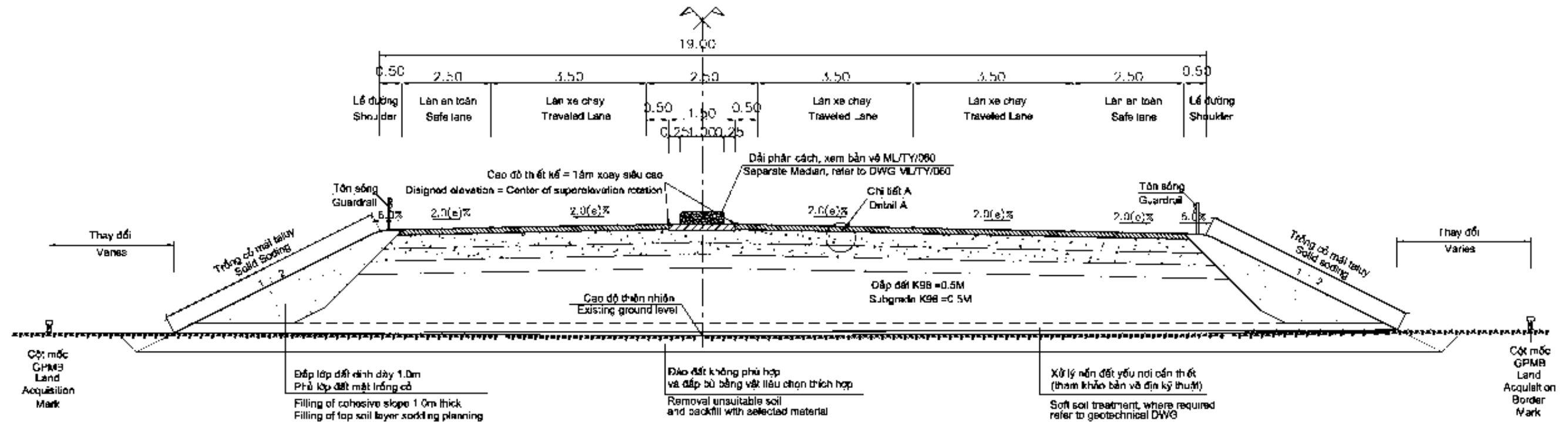
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE:
TYPICAL CROSS SECTION OF INTERCHANGE RAMPWAY (1/2)
MẶT CẮT NGANG ĐIỂN HÌNH ĐƯỜNG NHÁNH NÚT GIAO (1/2)

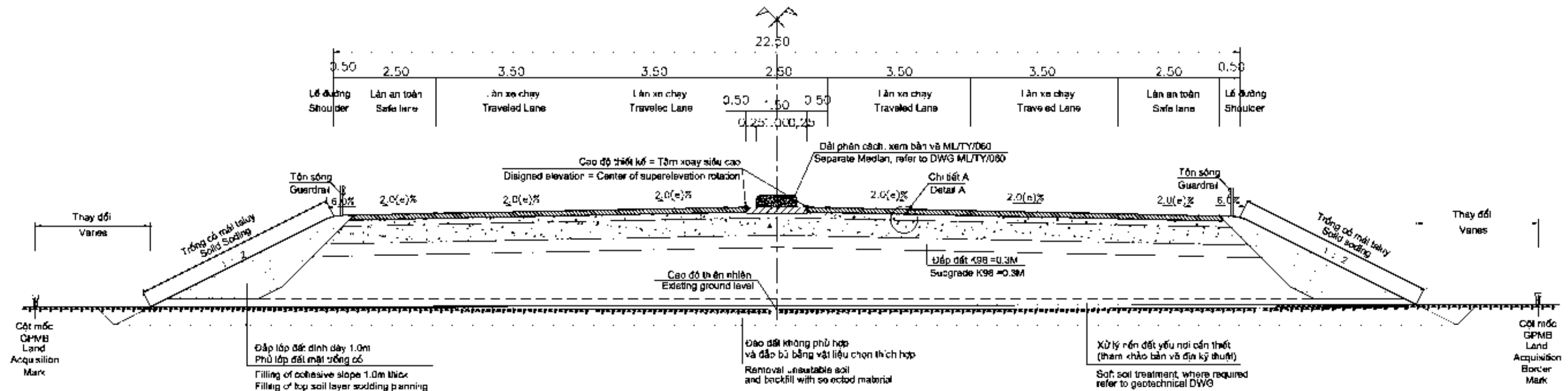
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1	FEB-2010	FINAL DRAWING	
			SCALE:

MẶT CẮT NGANG ĐIỂN HÌNH ĐƯỜNG NHÁNH NÚT GIAO (2/2) TYPICAL CROSS SECTION OF INTERCHANGE RAMPWAY (2/2)

MẶT CẮT 3: 2 CHIỀU - 3 LÀN SECTION 3: TWO WAY - THREE LANE

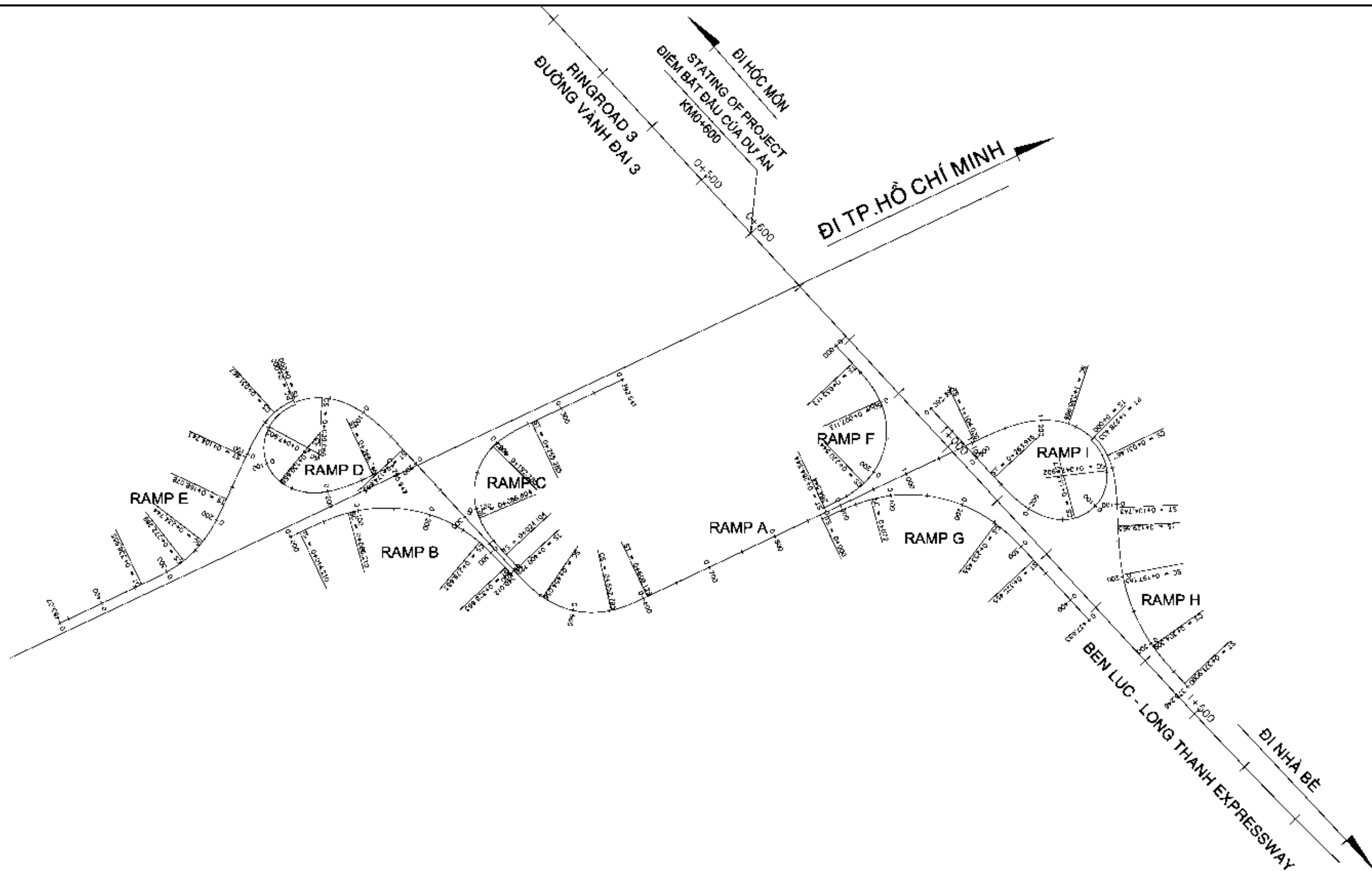


MẶT CẮT 4: 2 CHIỀU - 4 LÀN SECTION 4: TWO WAY - FOUR LANE



2:2000_Fixed Draft Drawing/Highway Engineering/054_ Interchange/054-IC-020-210.thw, Author: POC

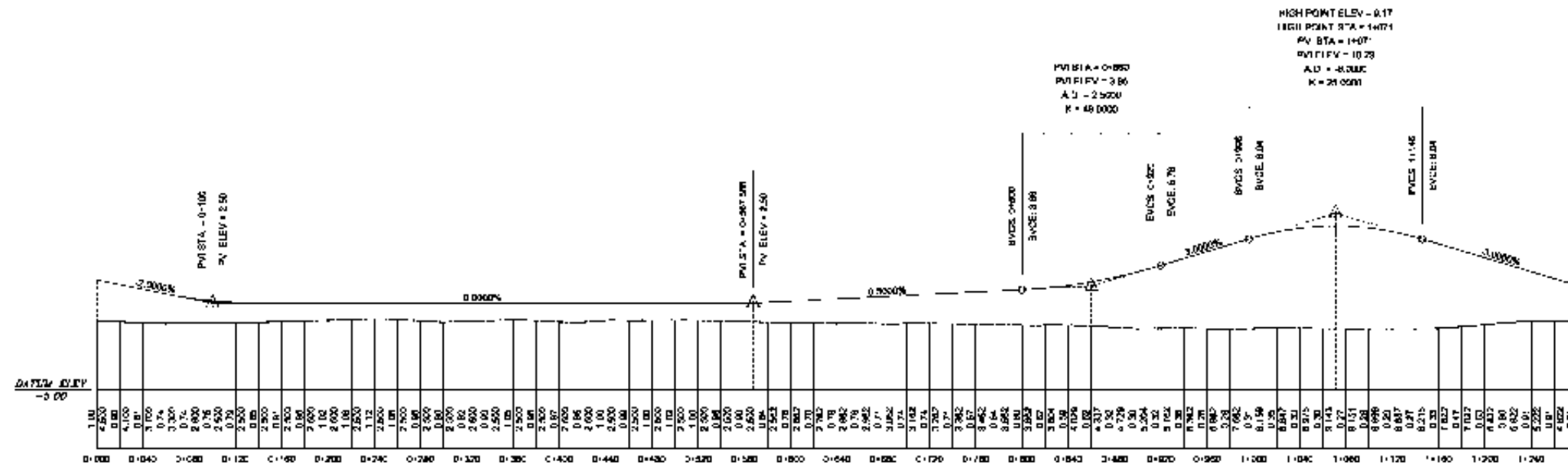
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-IC-020
								1	FEB-2010	FINAL DRAWING	
PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: La Ngoc HIEU APPROVED BY: Timothy COLLETT						DRAWING TITLE: TYPICAL CROSS SECTION OF INTERCHANGE RAMPWAY (2/2) MẶT CẮT NGANG ĐIỂN HÌNH ĐƯỜNG NHÁNH NÚT GIAO (2/2)					SCALE:



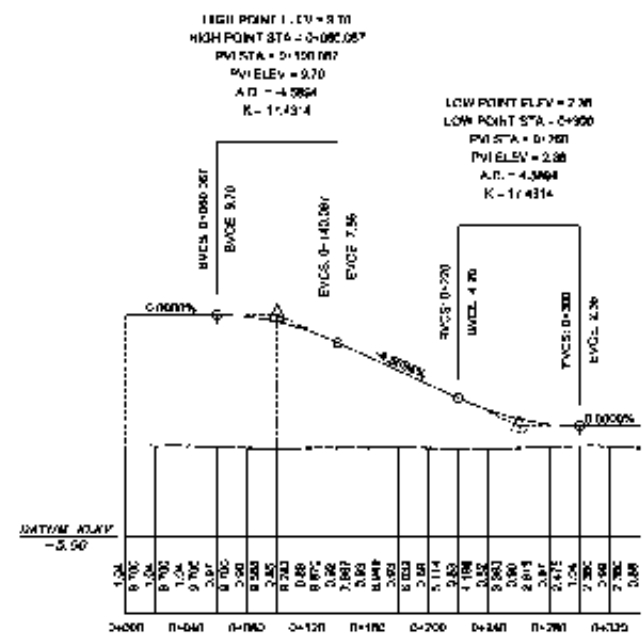
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No
KATAHIRA & ENGINEERS INTERNATIONAL <small>Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO</small>				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-IC-040
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE:			
										ALIGNMENT OF INTERCHANGE NO.1 YẾU TỐ HÌNH HỌC NÚT GIAO SỐ 1	

PROFILE OF RAMP A,B,C,D OF INTERCHANGE NO.1 MẶT CẮT DỌC NHÁNH A,B,C,D CỦA NÚT GIAO SỐ 1

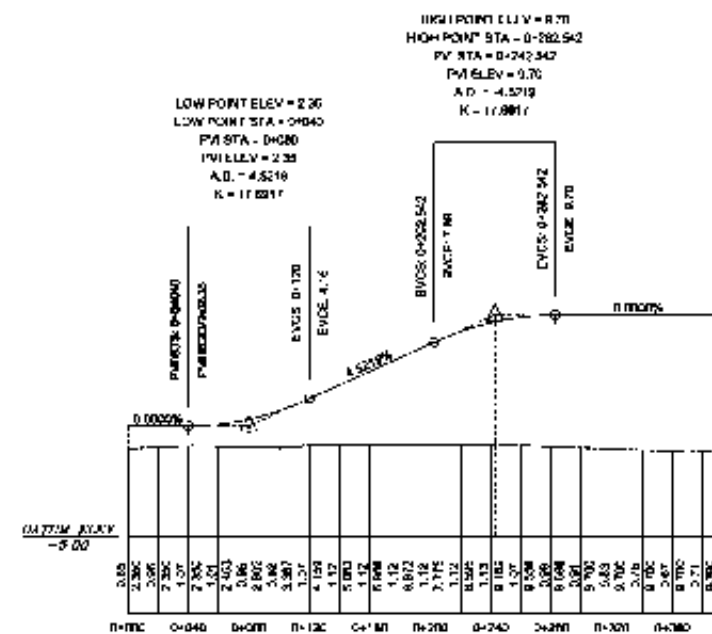
RAMPA



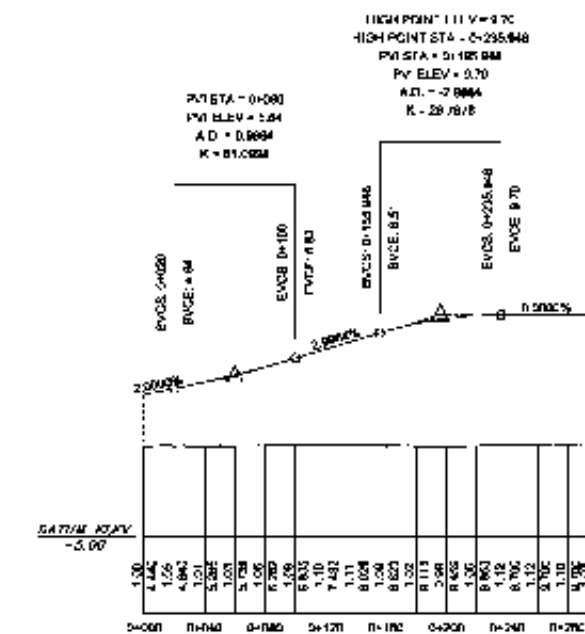
RAMPB



RAMPC



RAMPD



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

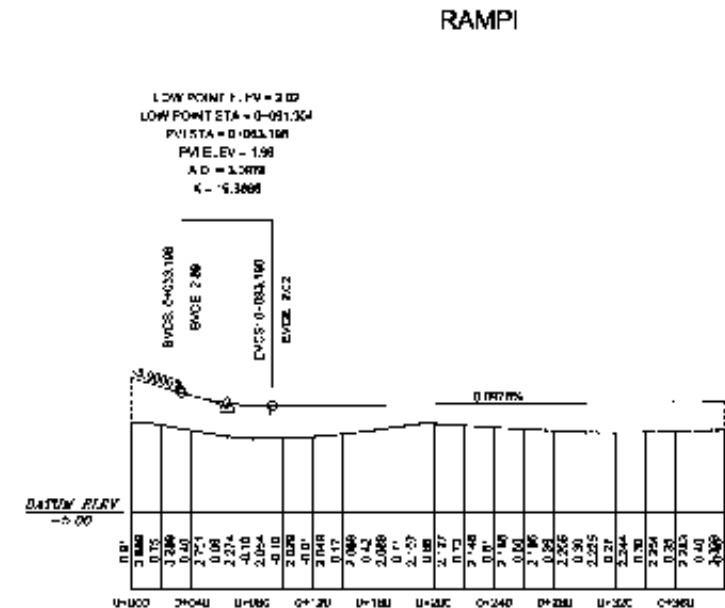
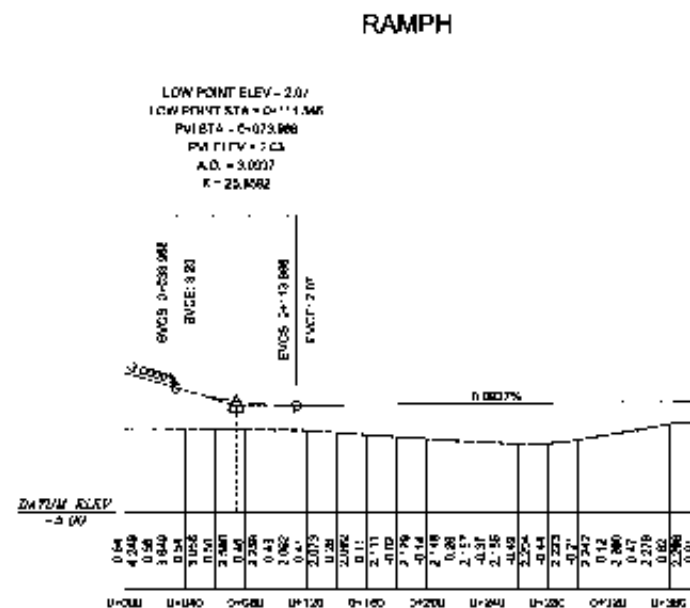
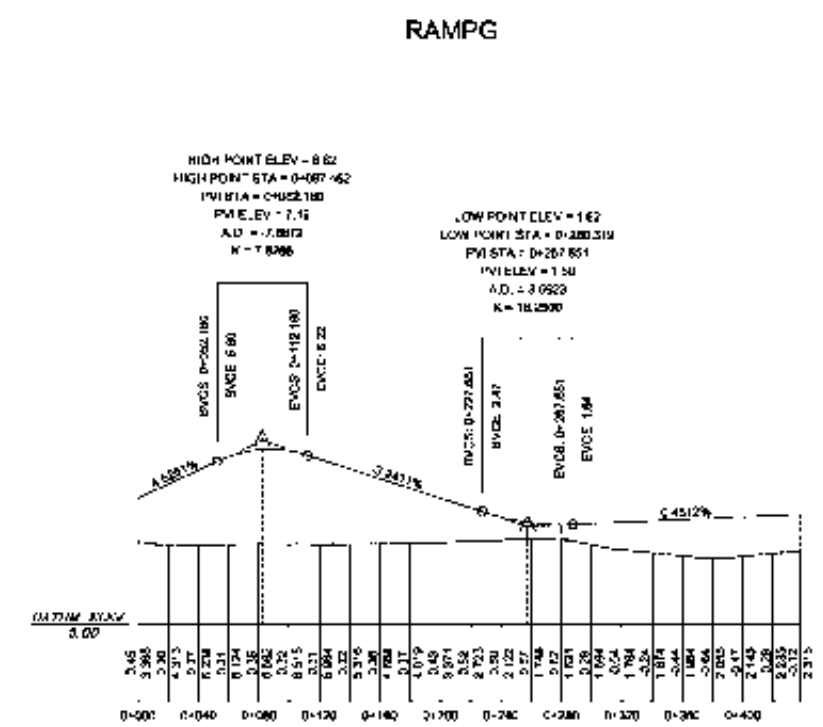
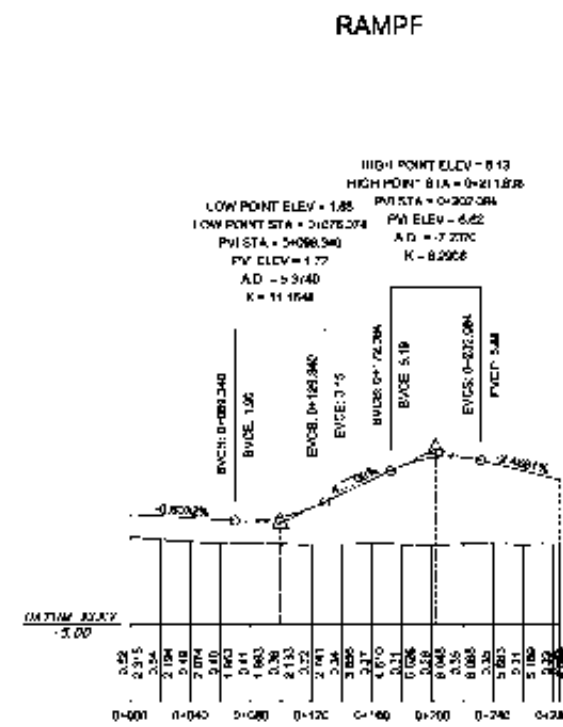
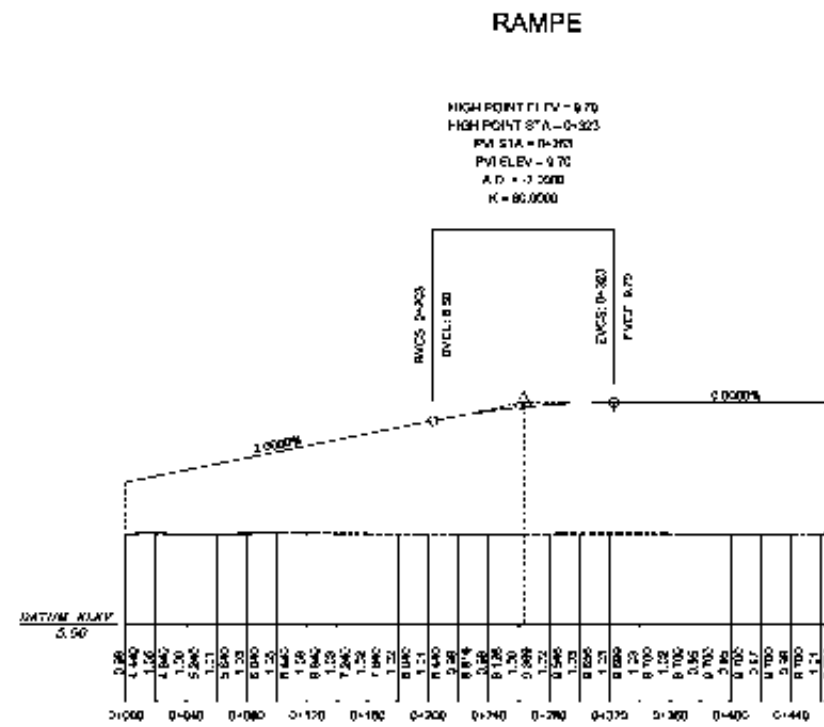
ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

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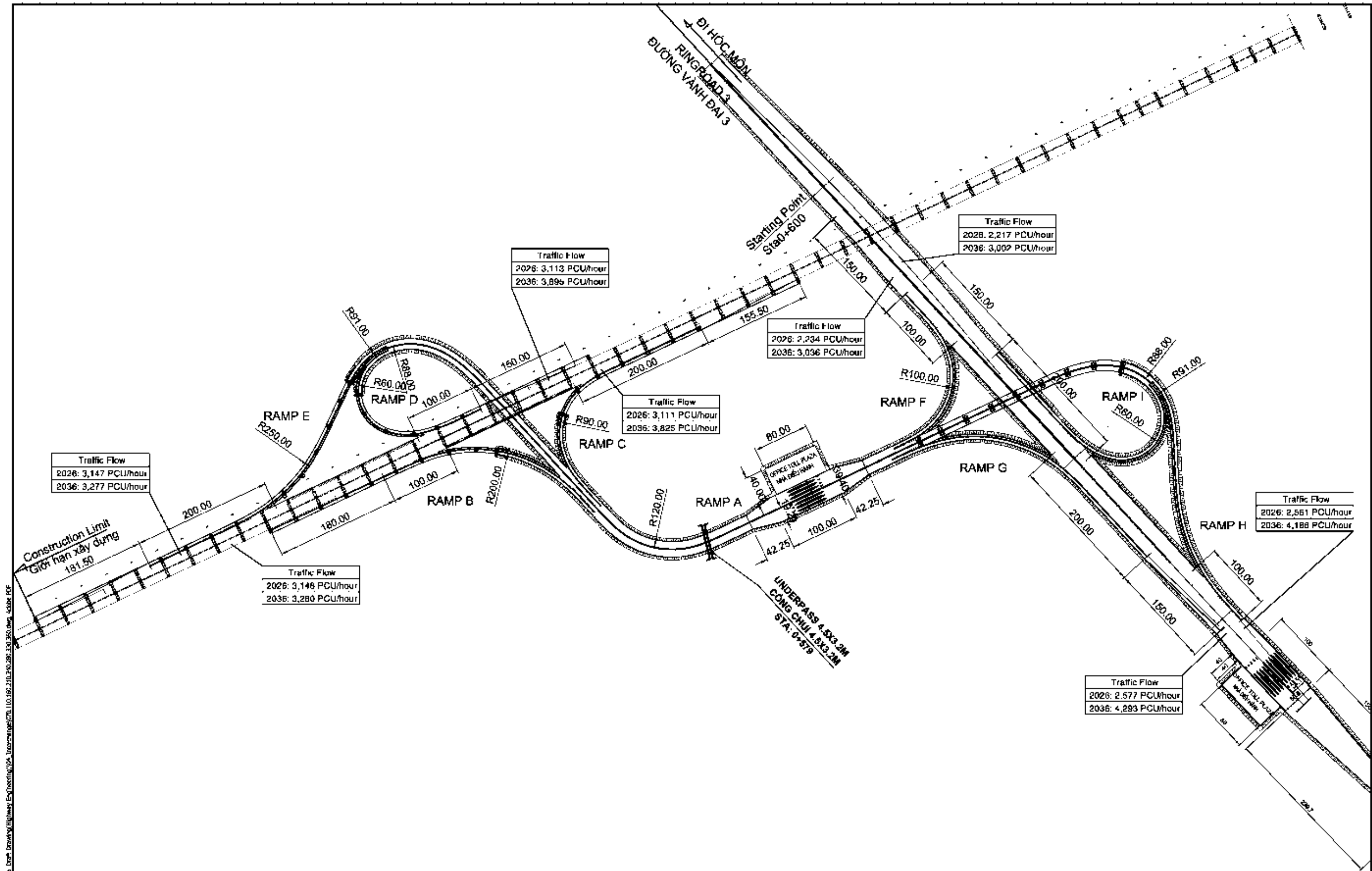
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PROFILE OF RAMP E,F,G,H,I OF INTERCHANGE NO.1 MẶT CẮT DỌC NHÁNH E,F,G,H,I CỦA NÚT GIAO SỐ 1












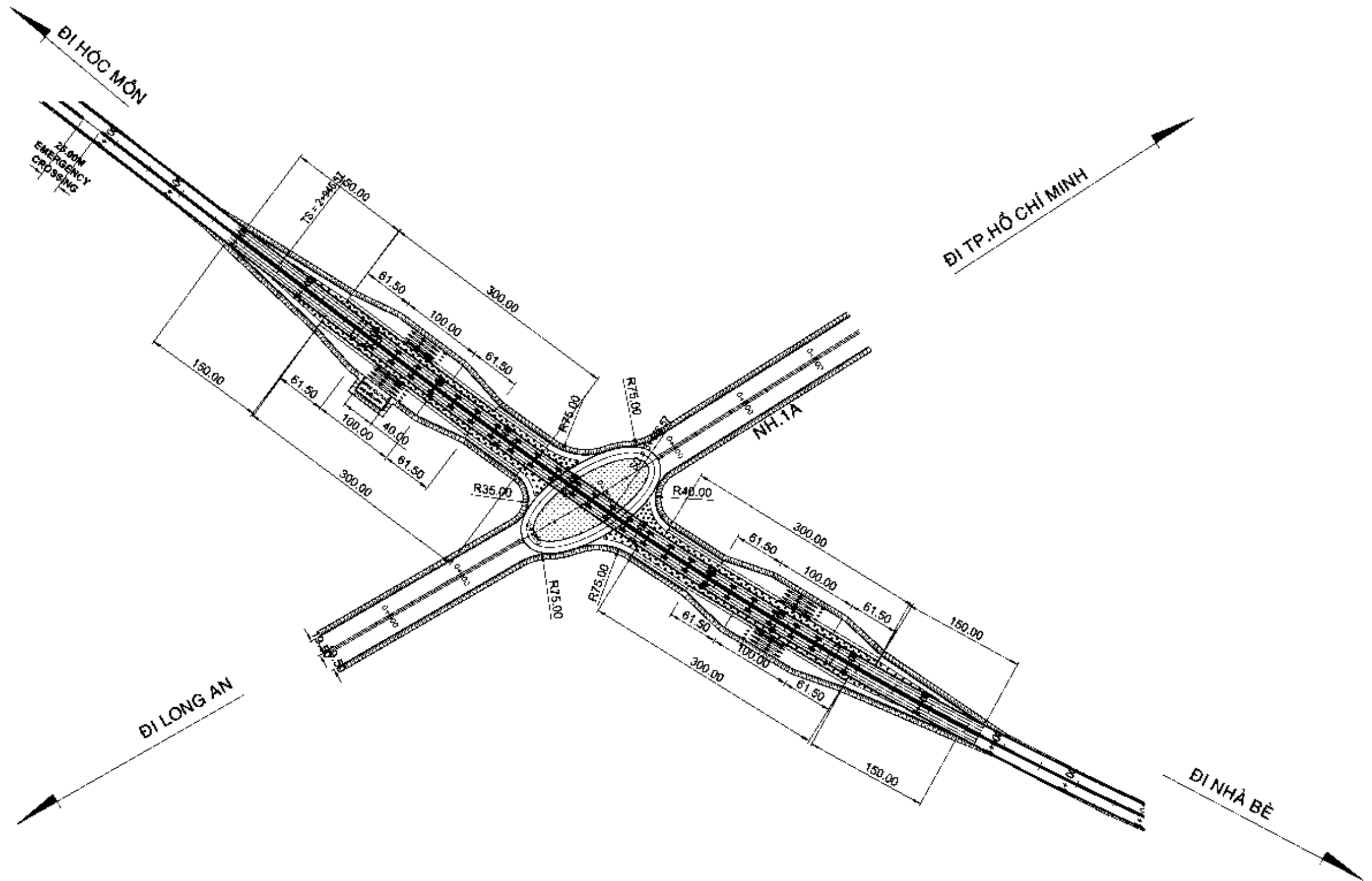
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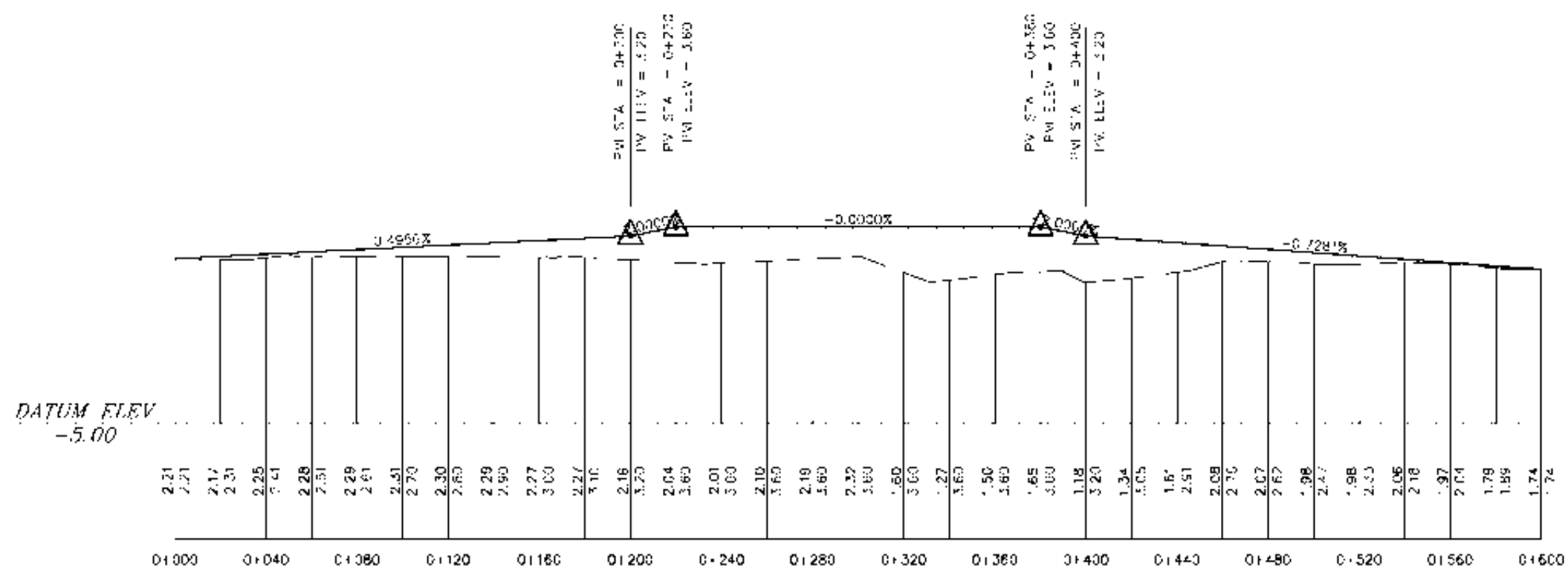
Engineering & Construction

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CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
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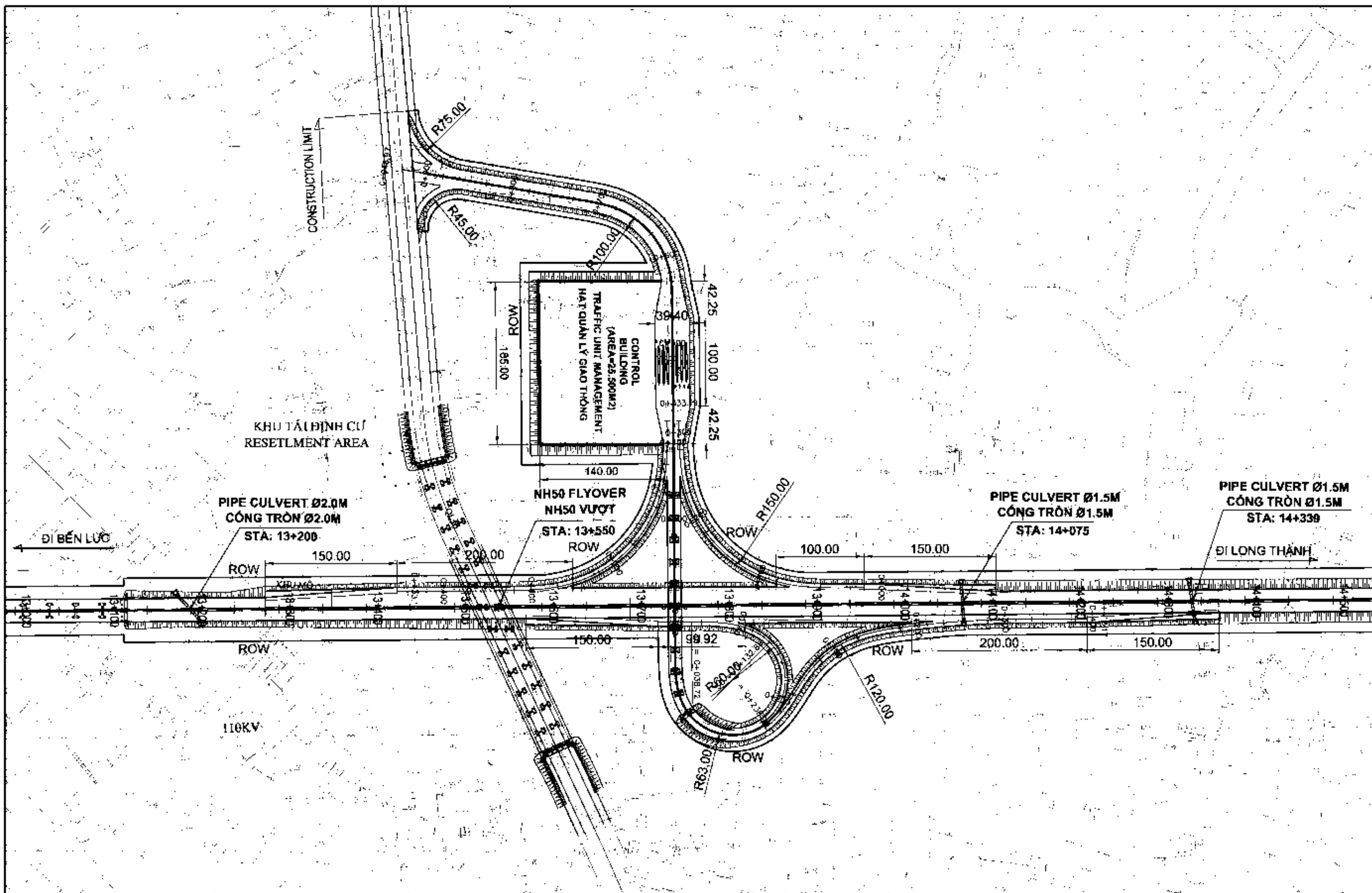
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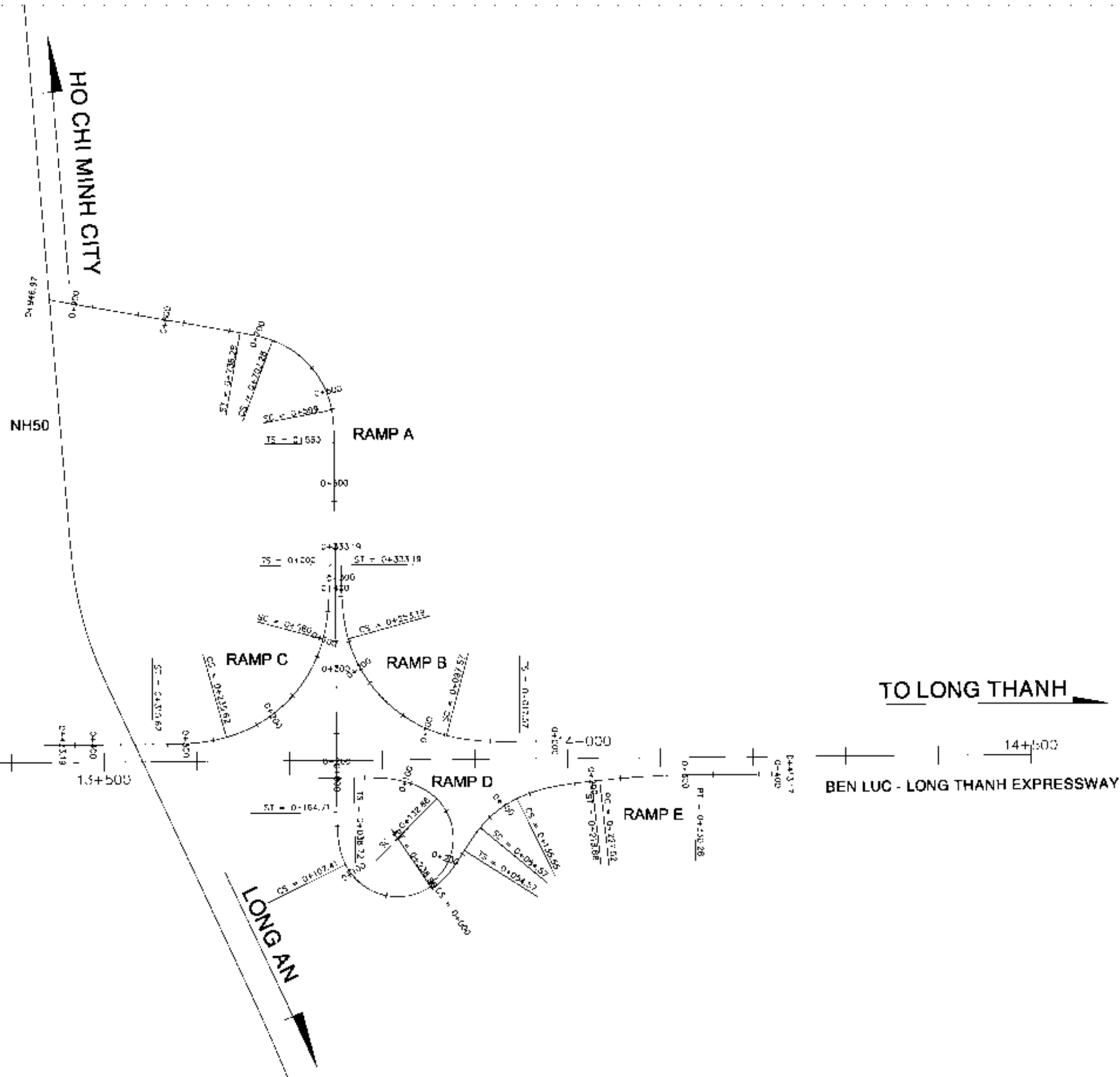
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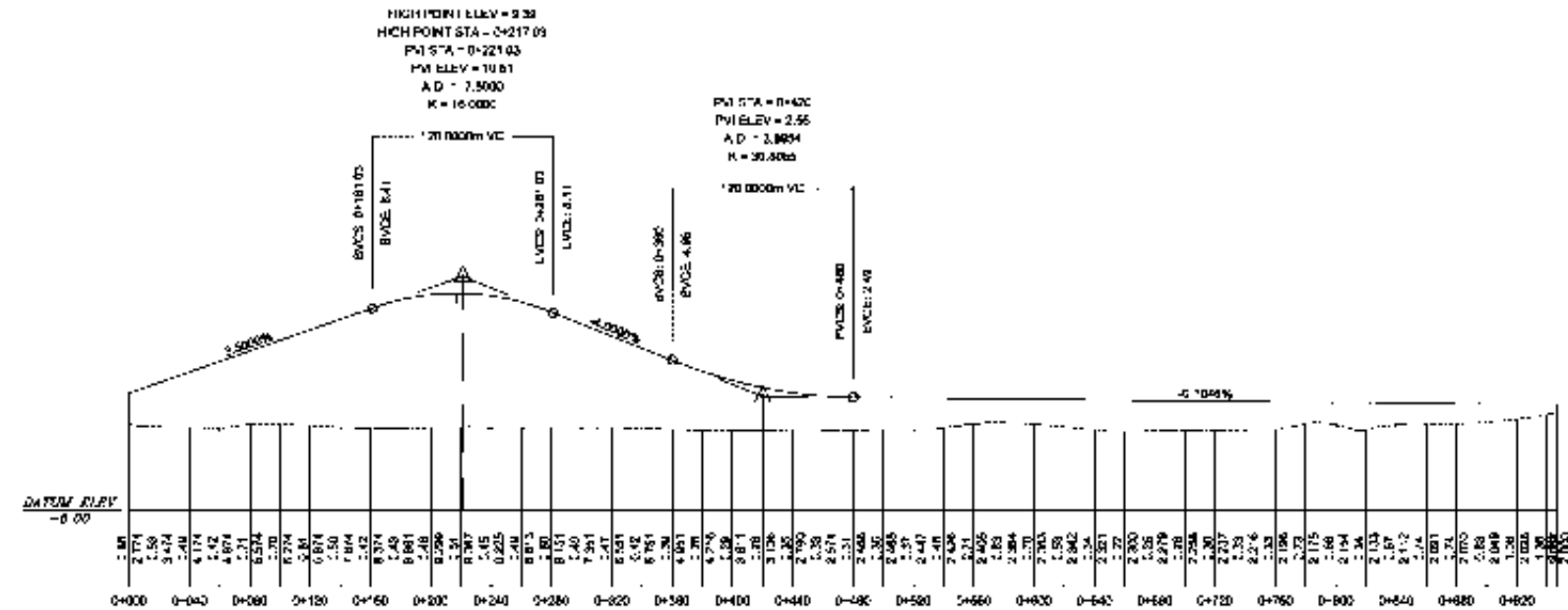


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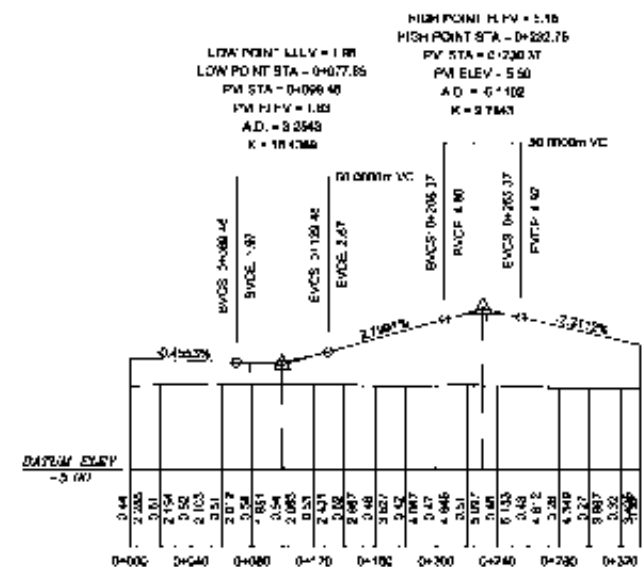
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PREPARED BY				NGUYEN THANH PHUONG							
CHECKED BY				LE NGOC HIEU							
APPROVED BY				TIMOTHY COLLETT							

PROFILE OF RAMP A & B OF INTERCHANGE NO.3 MẶT CẮT DỌC NHẢNH A,B CỦA NÚT GIAO SỐ 3

RAMPA



RAMPB

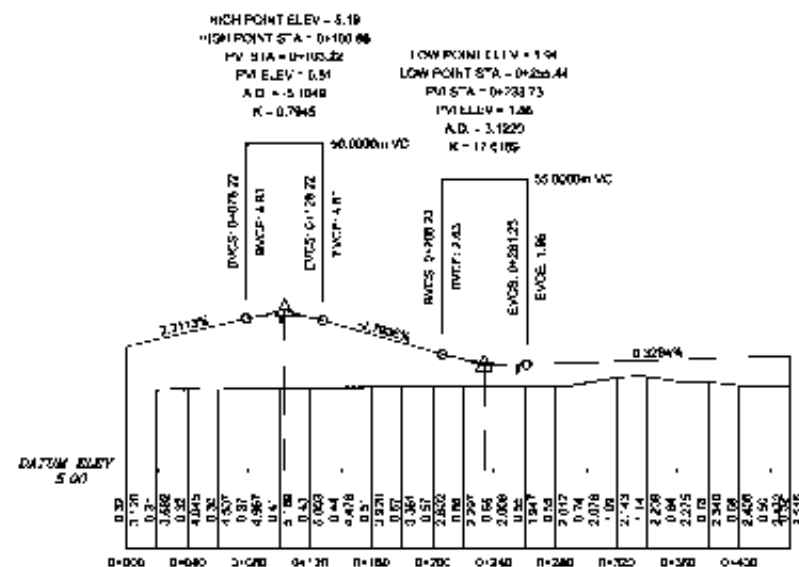


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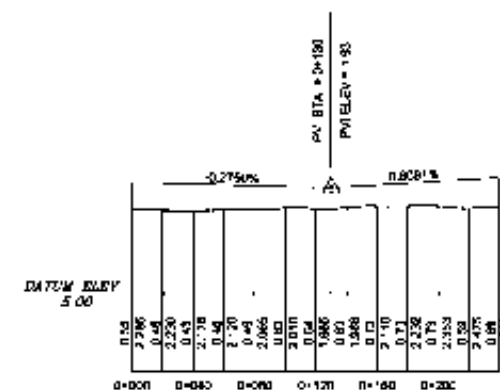
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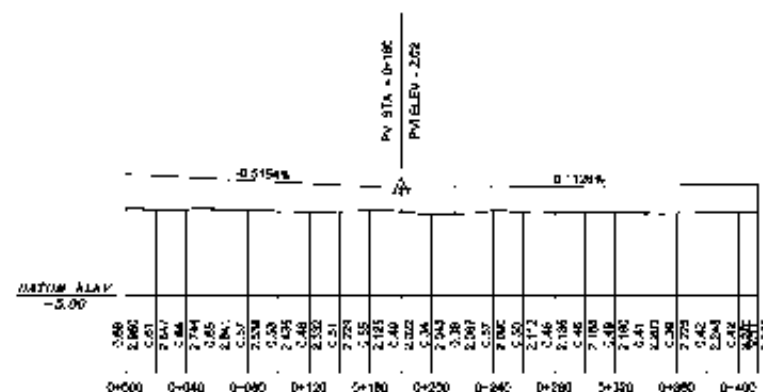
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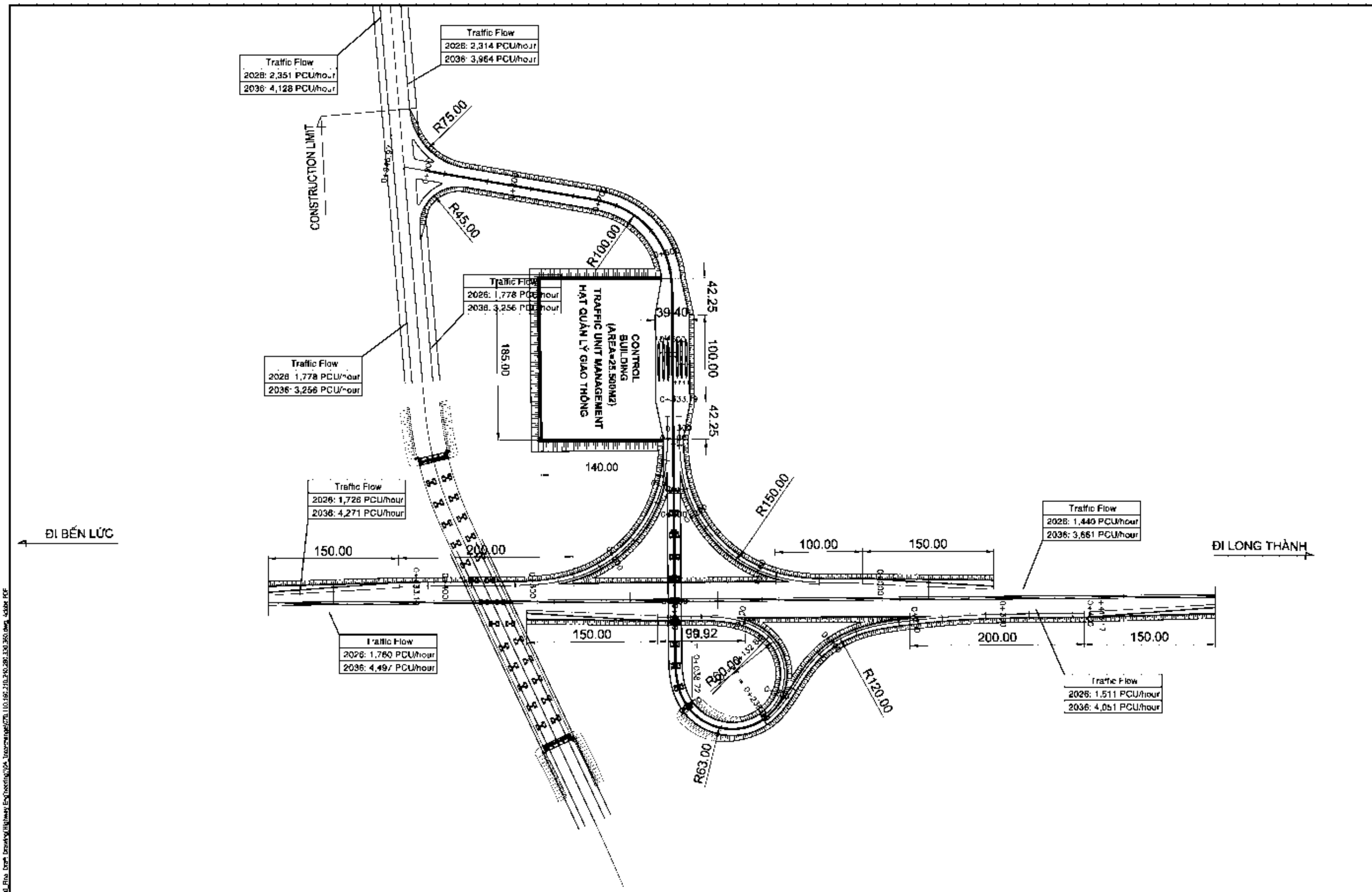


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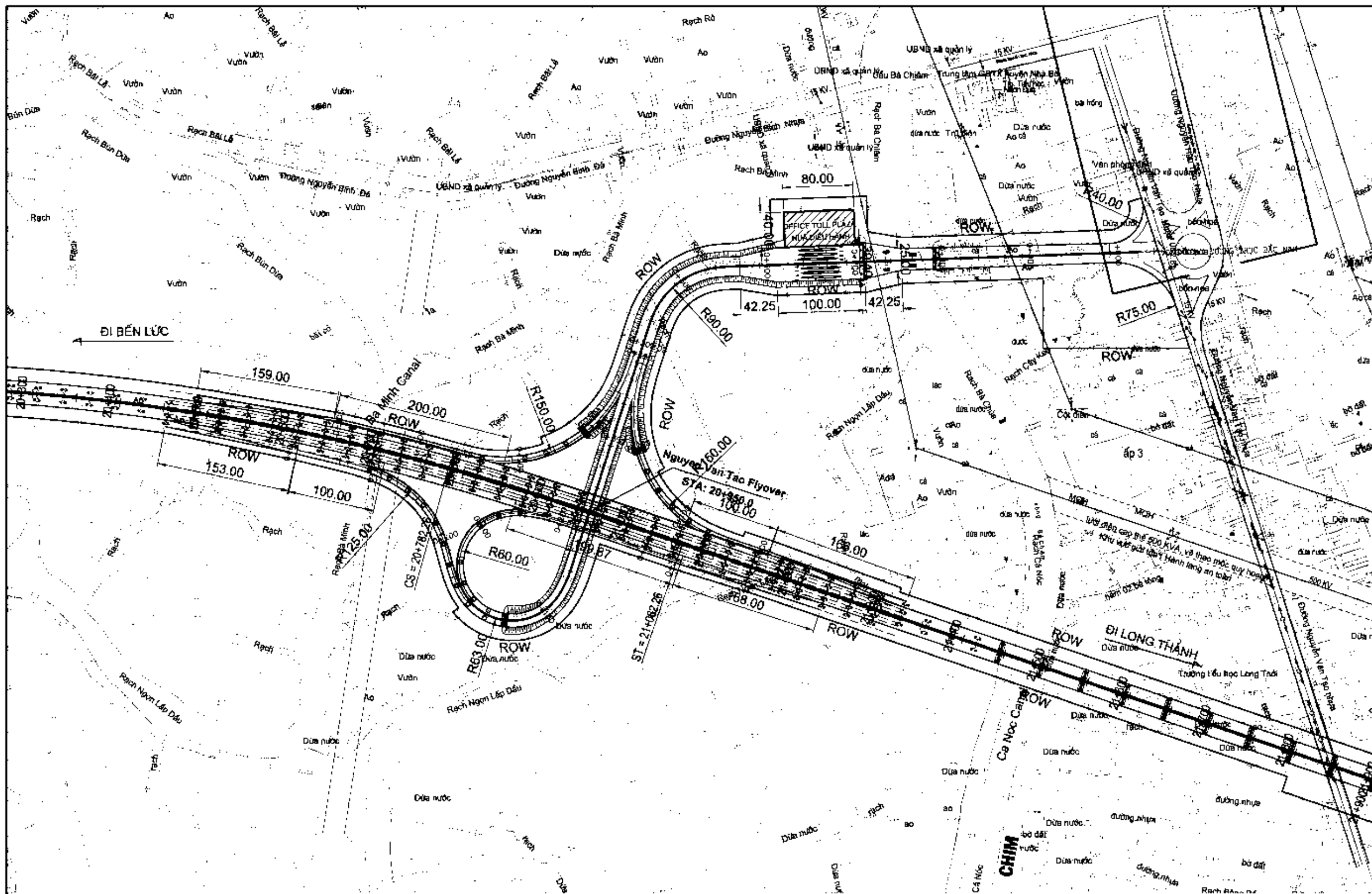
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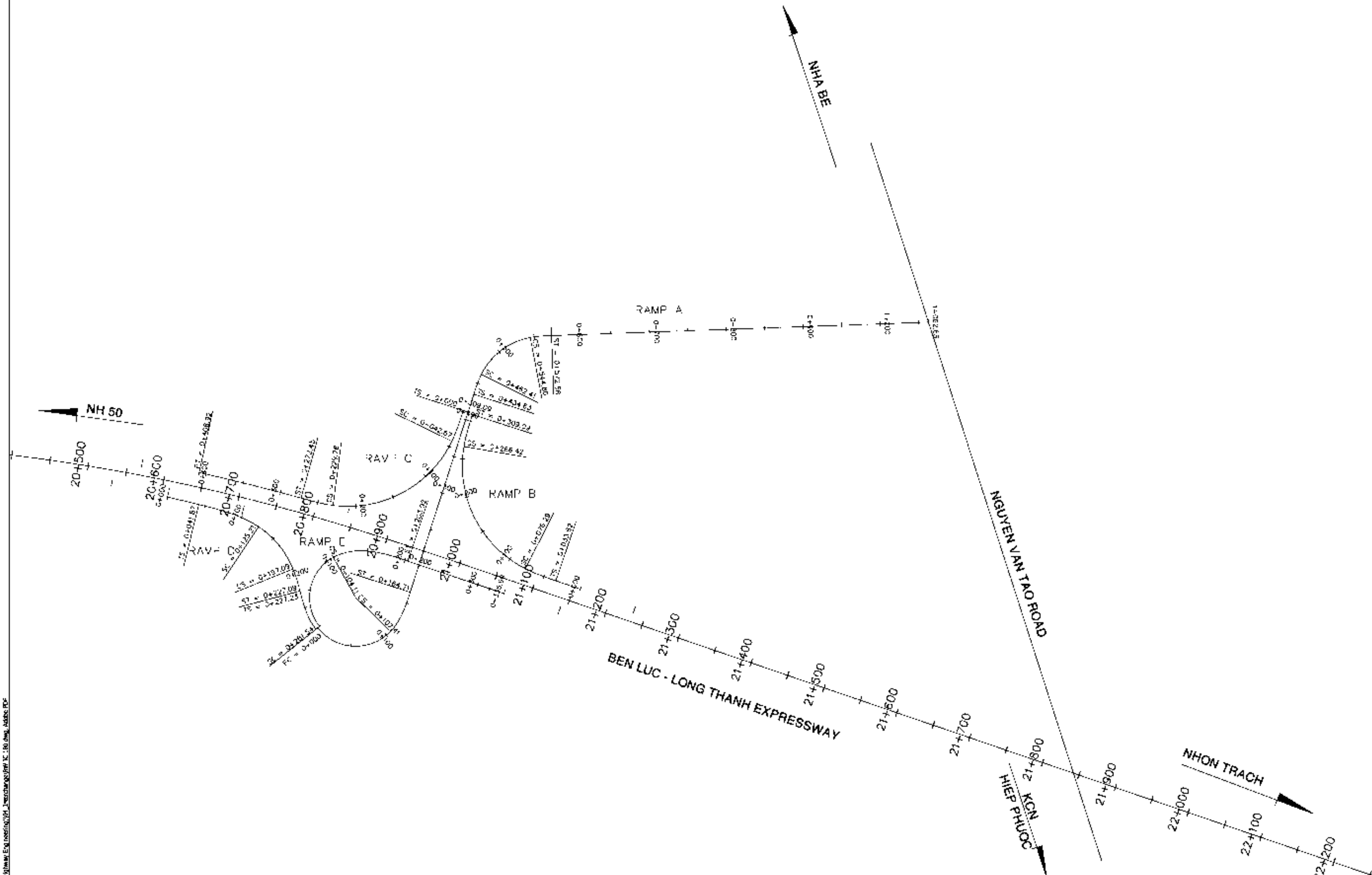


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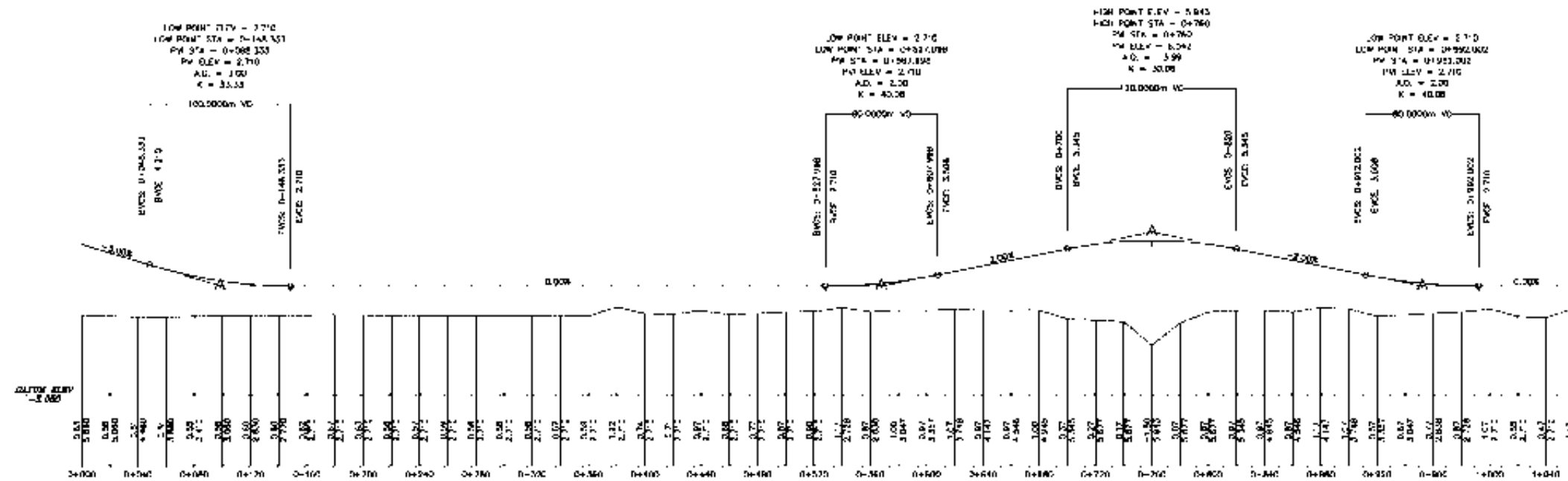
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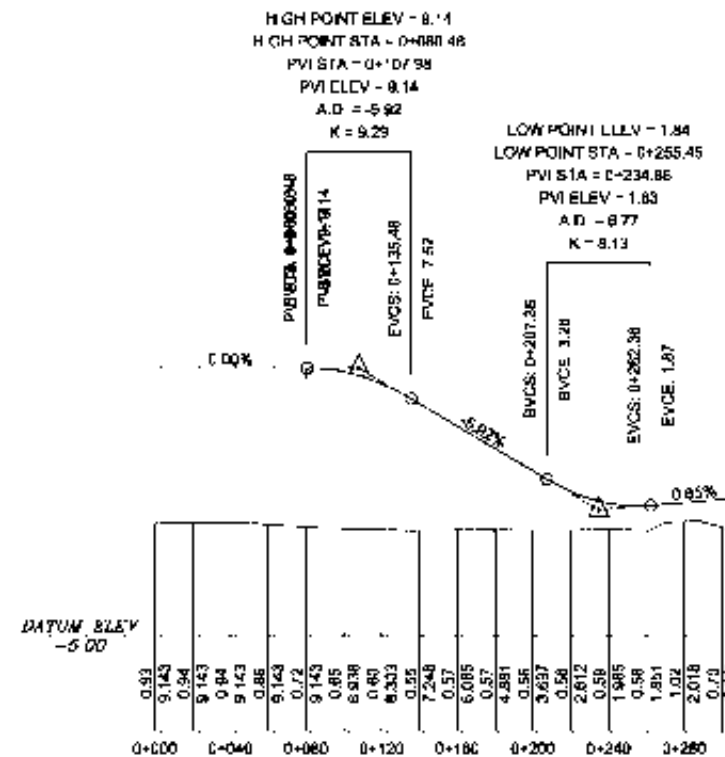
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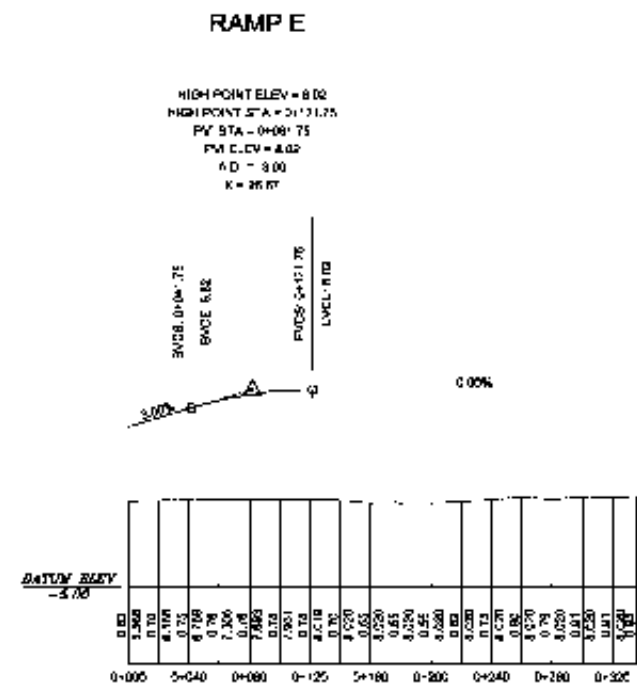
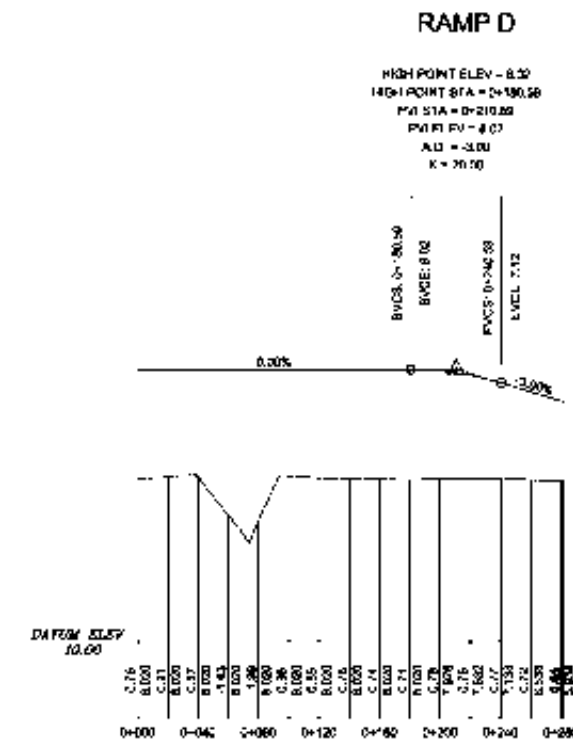
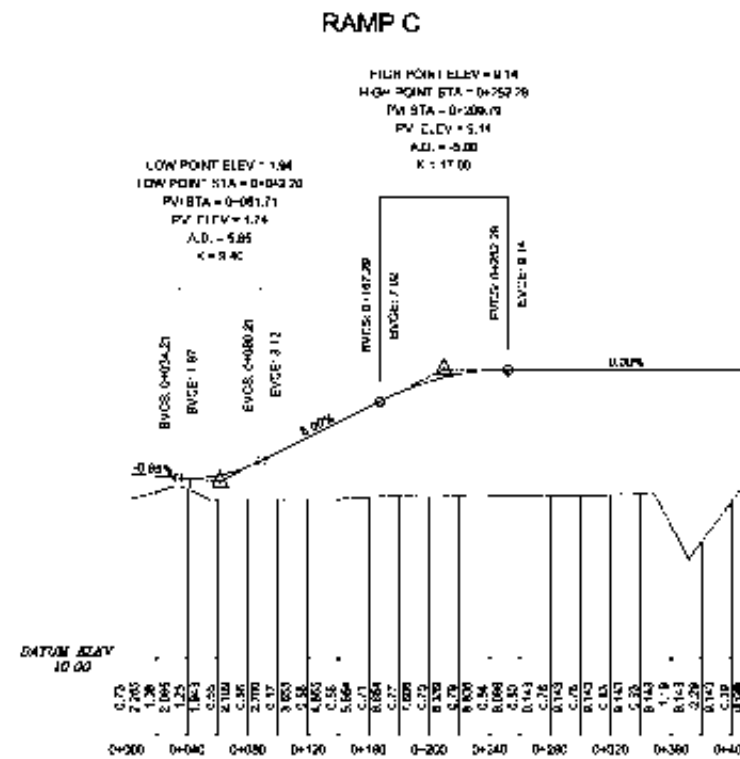


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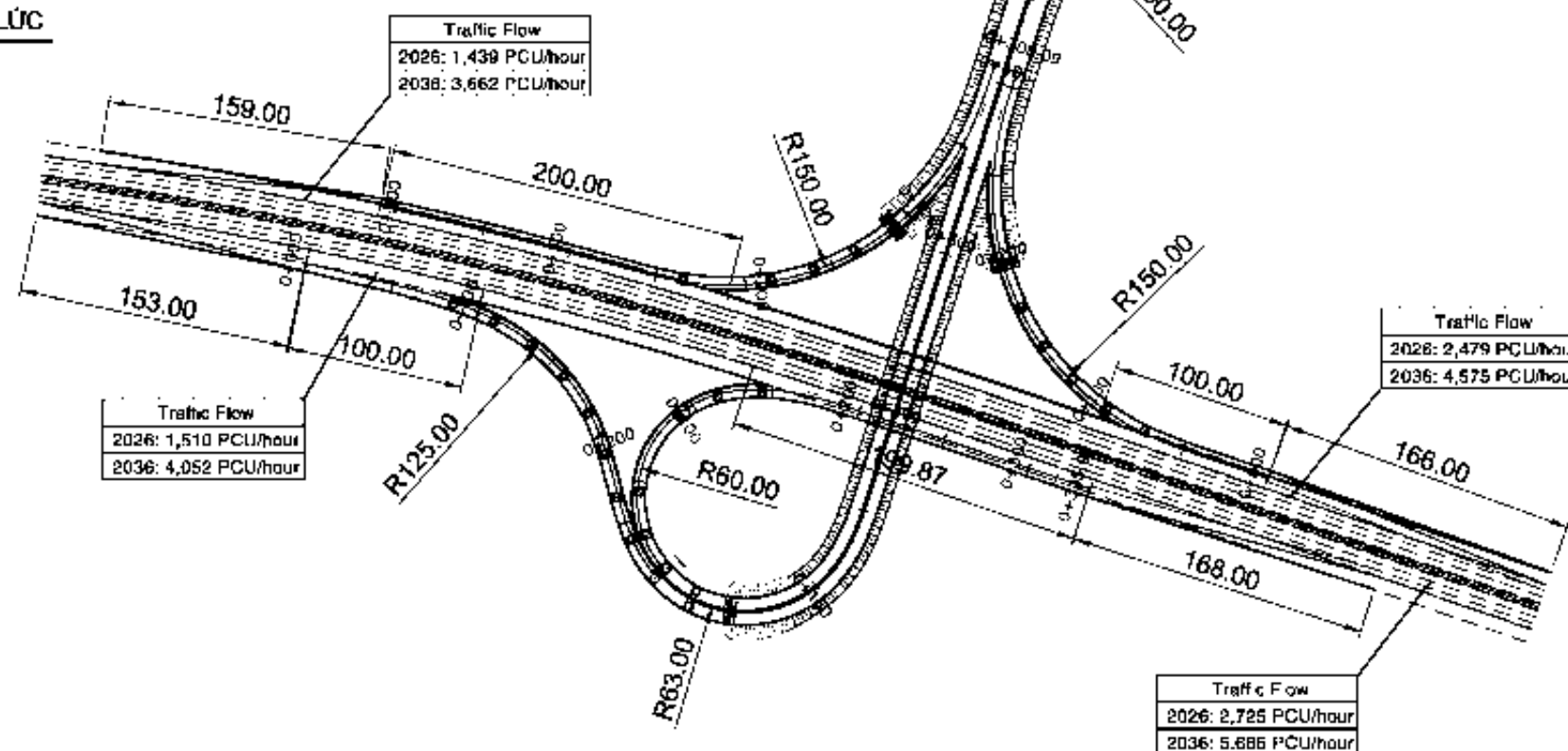
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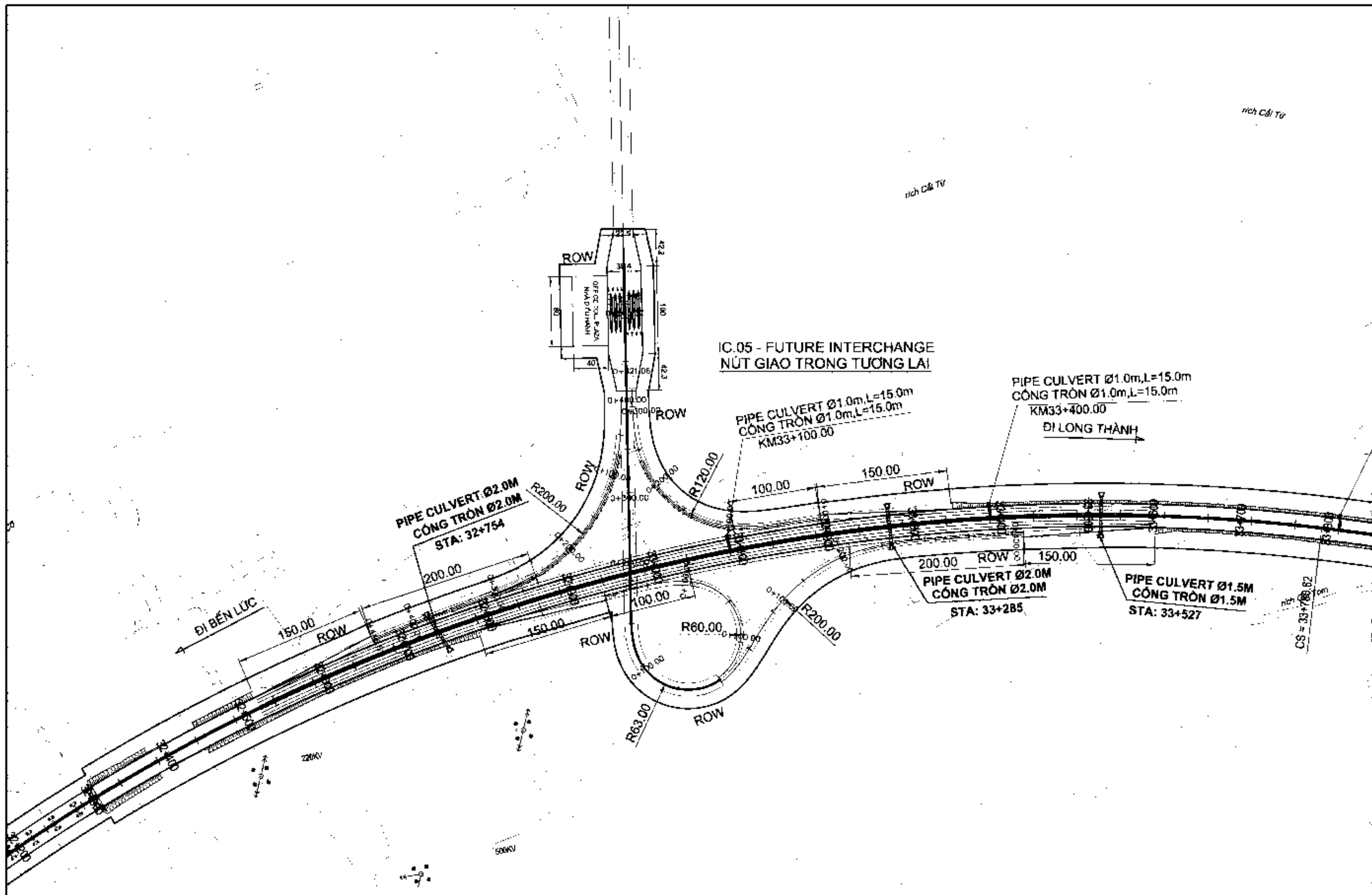
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ĐI BẾN LÚC



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APPROVED BY				TIMOTHY COLLETT							



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.				
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PREPARED BY				Nguyen Thanh PHUONG											
CHECKED BY				Le Ngoc HIEU											
APPROVED BY				Timothy COLLETT											

ĐI BIÊN HÒA

ĐƯỜNG QUY HOẠCH

ĐI LONG THÀNH

BEN LUC - LONG THANH EXPRESSWAY

ĐI BẾN LÚC

CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

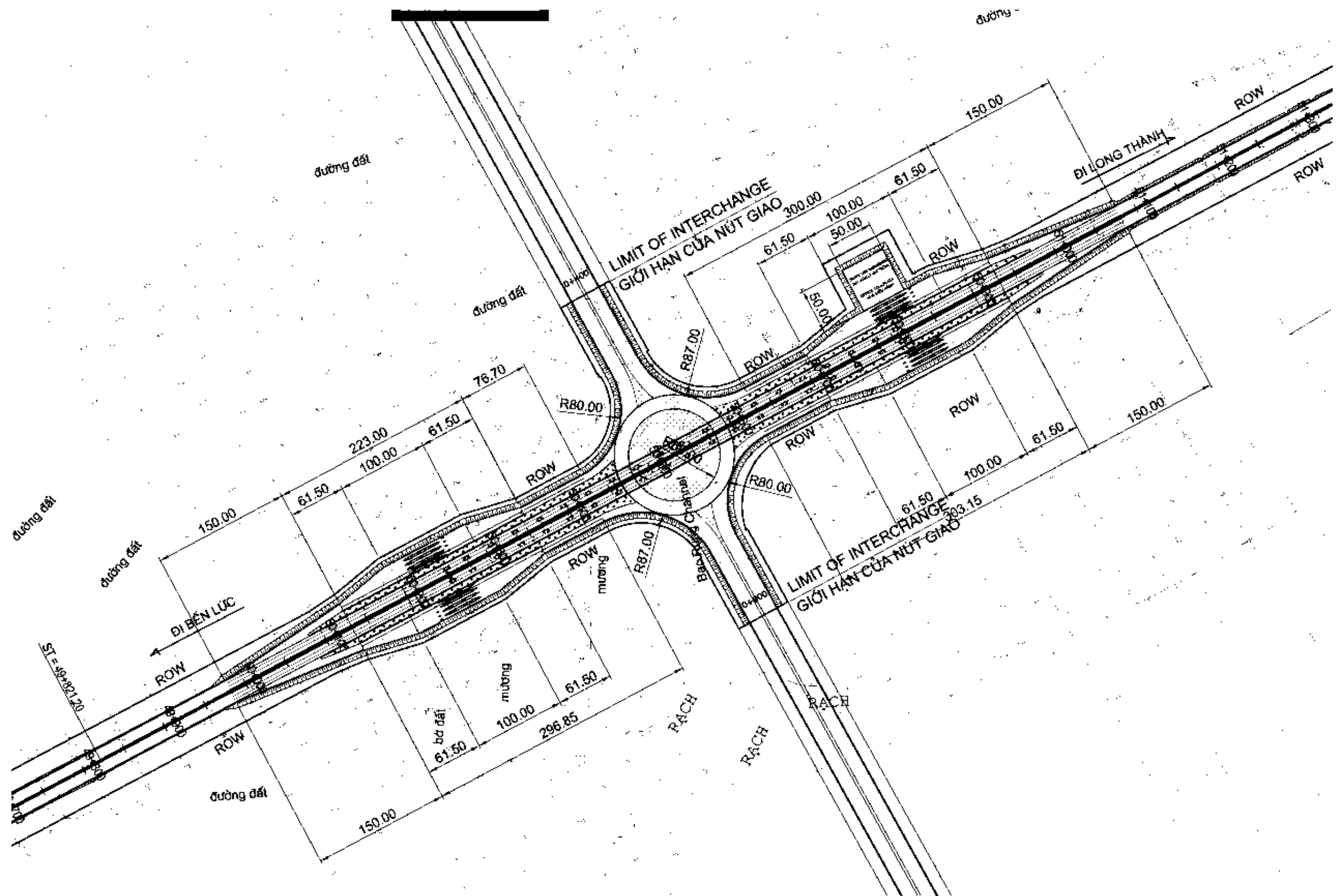
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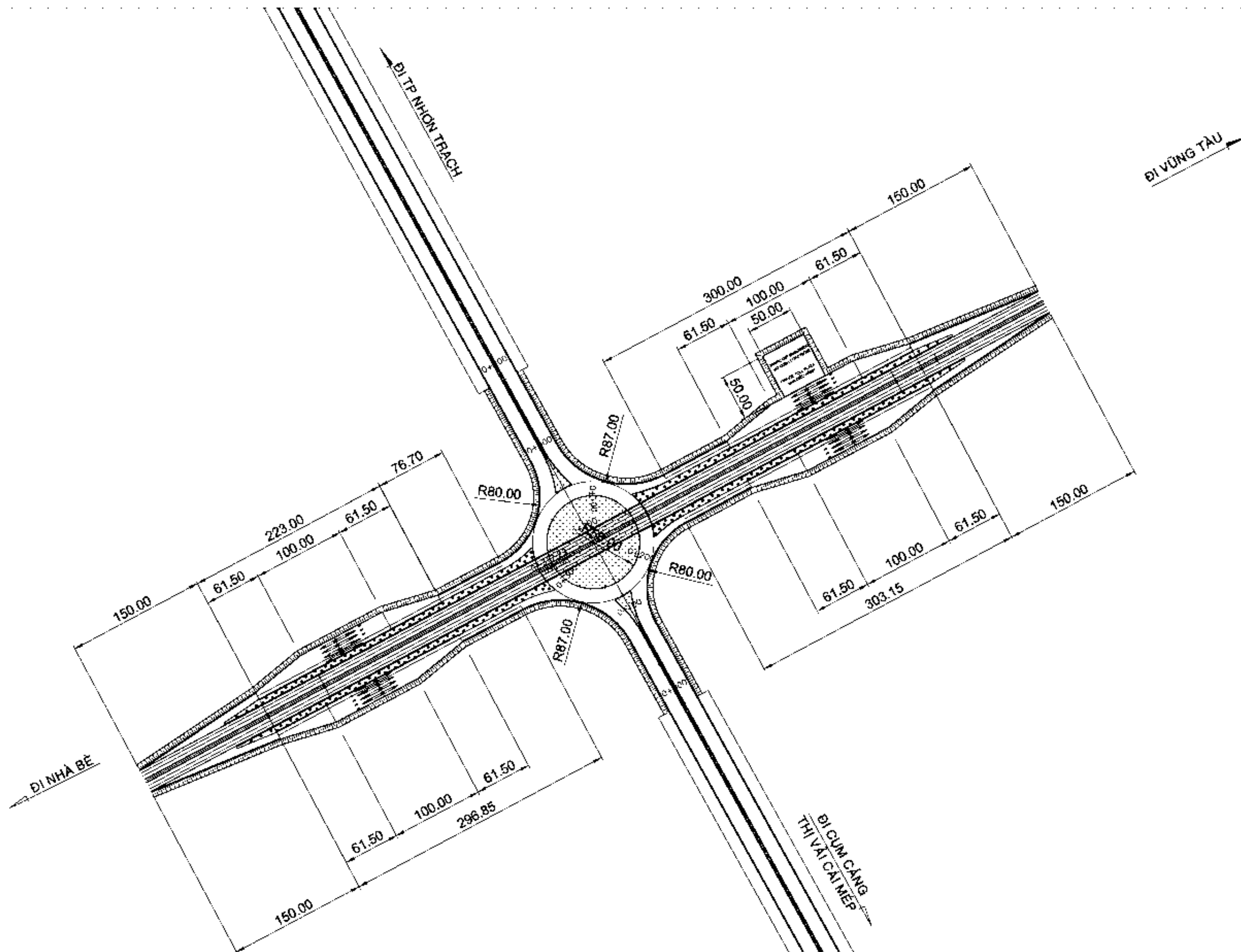
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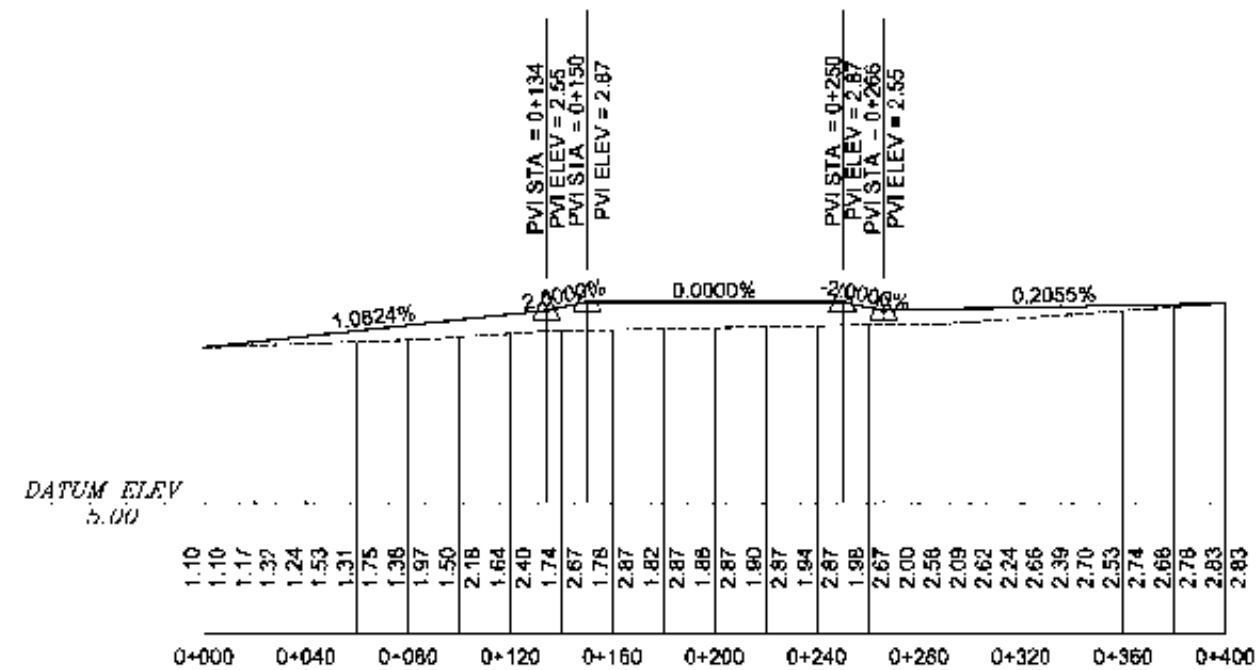
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				VIETNAM EXPRESSWAY CORPORATION (VEC)								



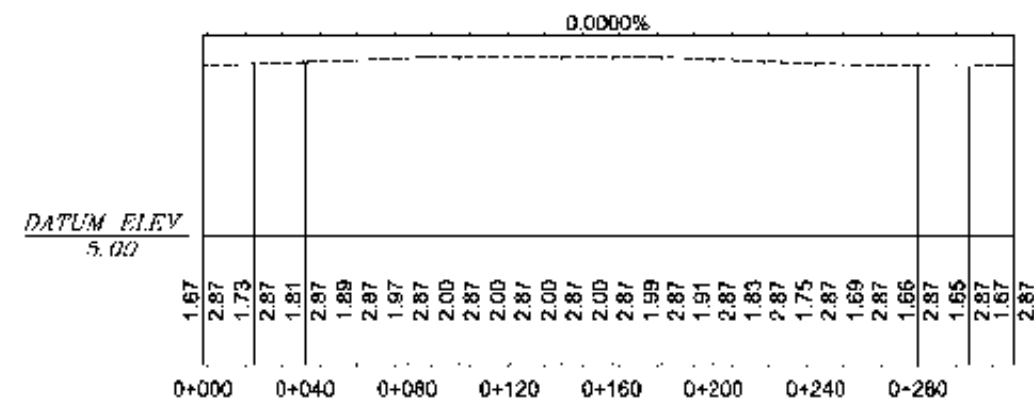
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PROFILE OF INTERCHANGE NO.6 MẶT CẮT DỌC NÚT GIAO SỐ 6

PHUOC AN ROAD

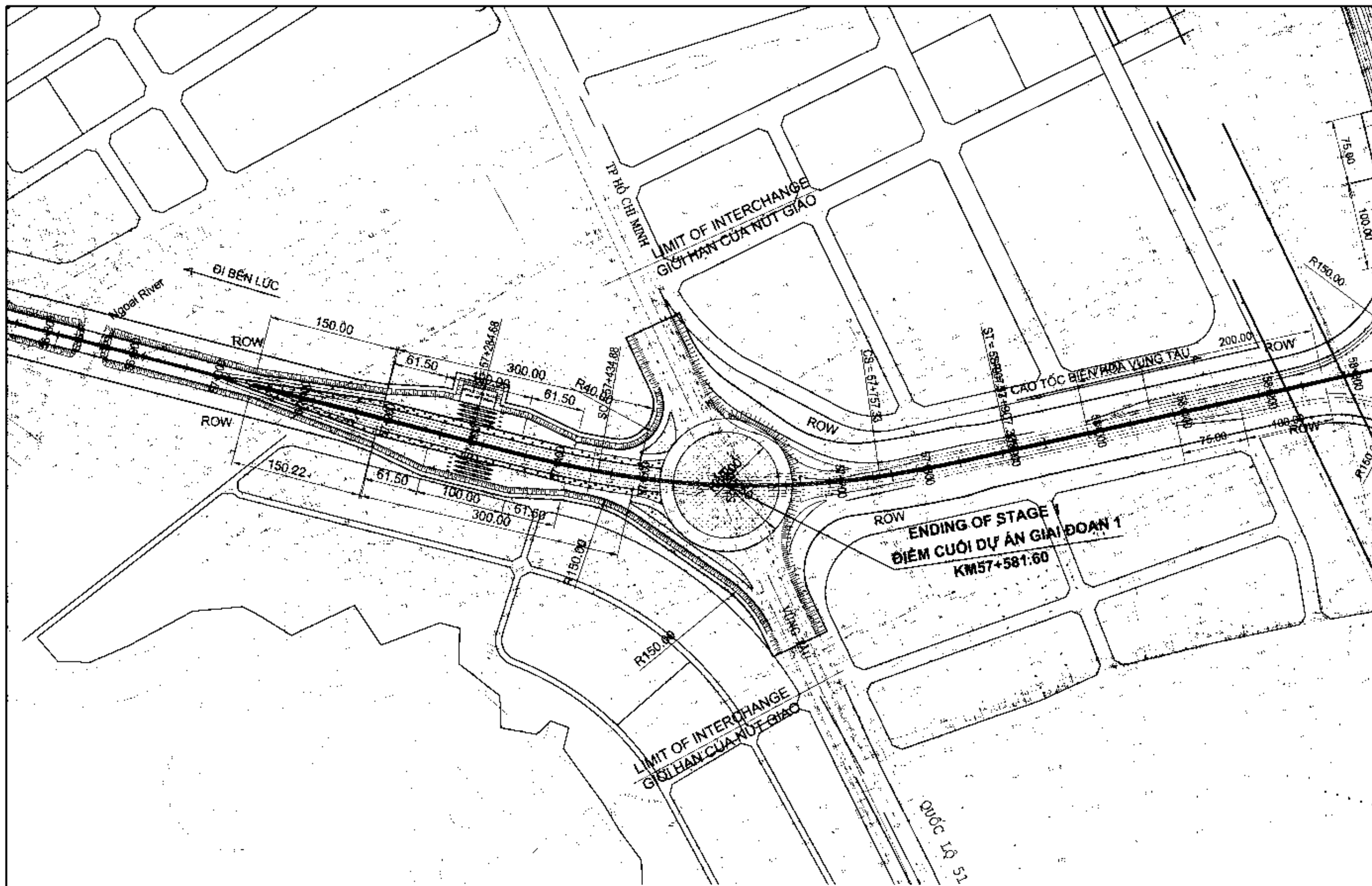


ROUNDBOUT

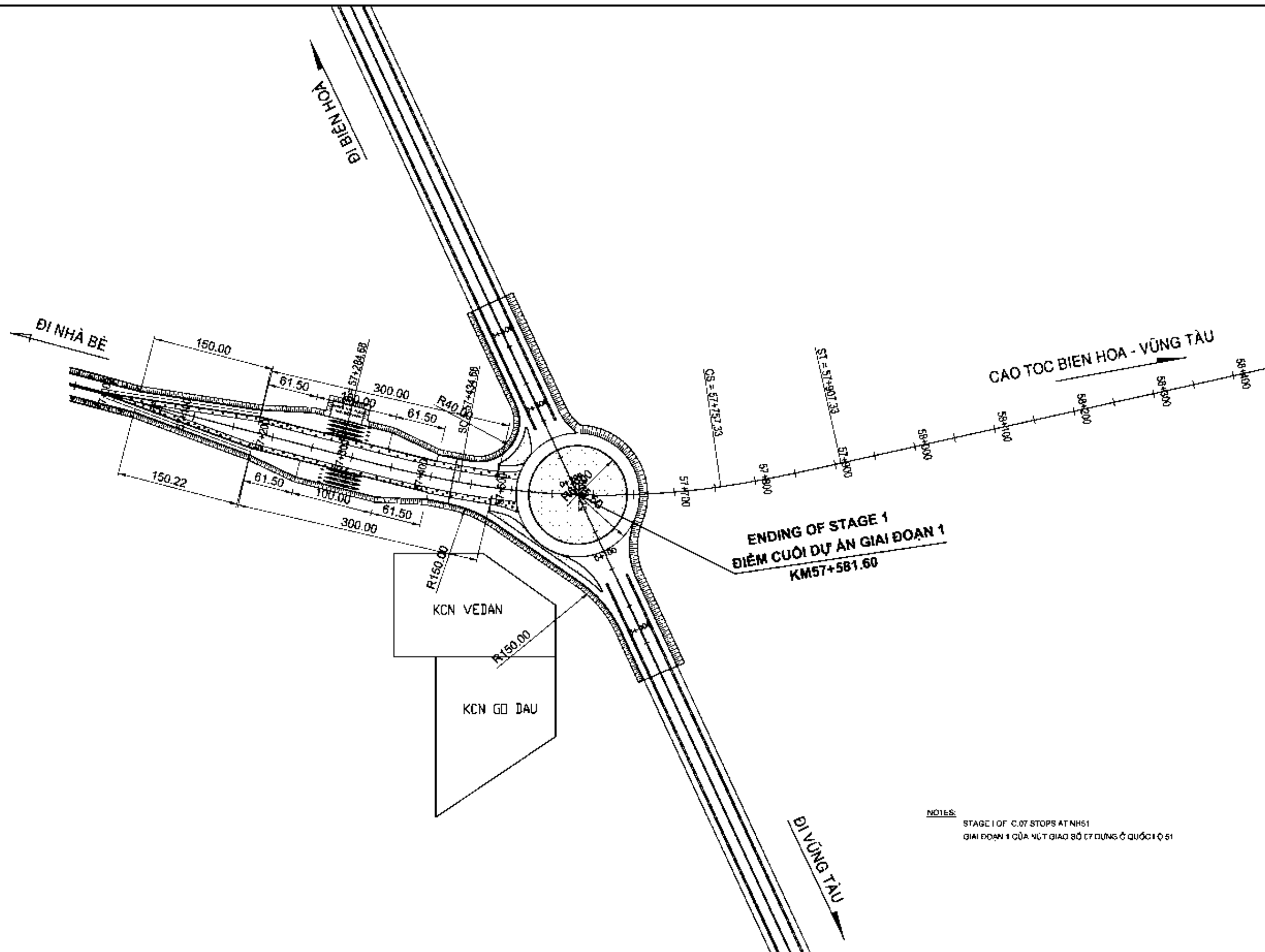


2/1/2010 Final Draft Drawing (Highway Engineering)\\04_Drawing\\01\\04_270.dwg Author: POC

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PROFILE OF INTERCHANGE NO.6 MẶT CẮT DỌC NÚT GIAO SỐ 6		0	NOV-2009	DRAFT FINAL DRAWING	RW-IC-270
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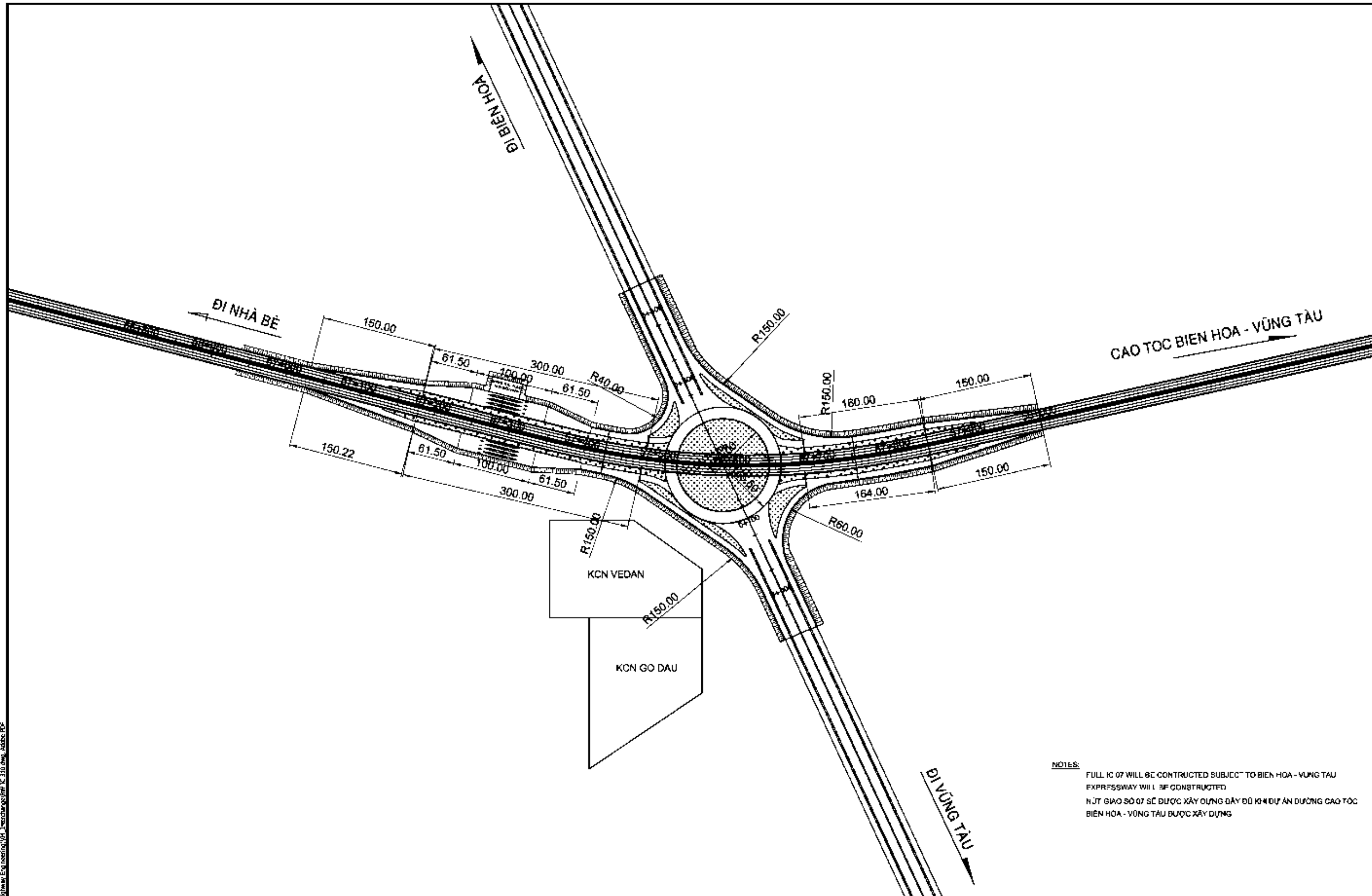


CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.		
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-IC-290		
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NOTES:
STAGE I OF C.07 STOPS AT NH51
GIAI ĐOẠN I CỦA NÚT GIAO SỔ 17 DÙNG Ở QUỐC LỘ 51

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
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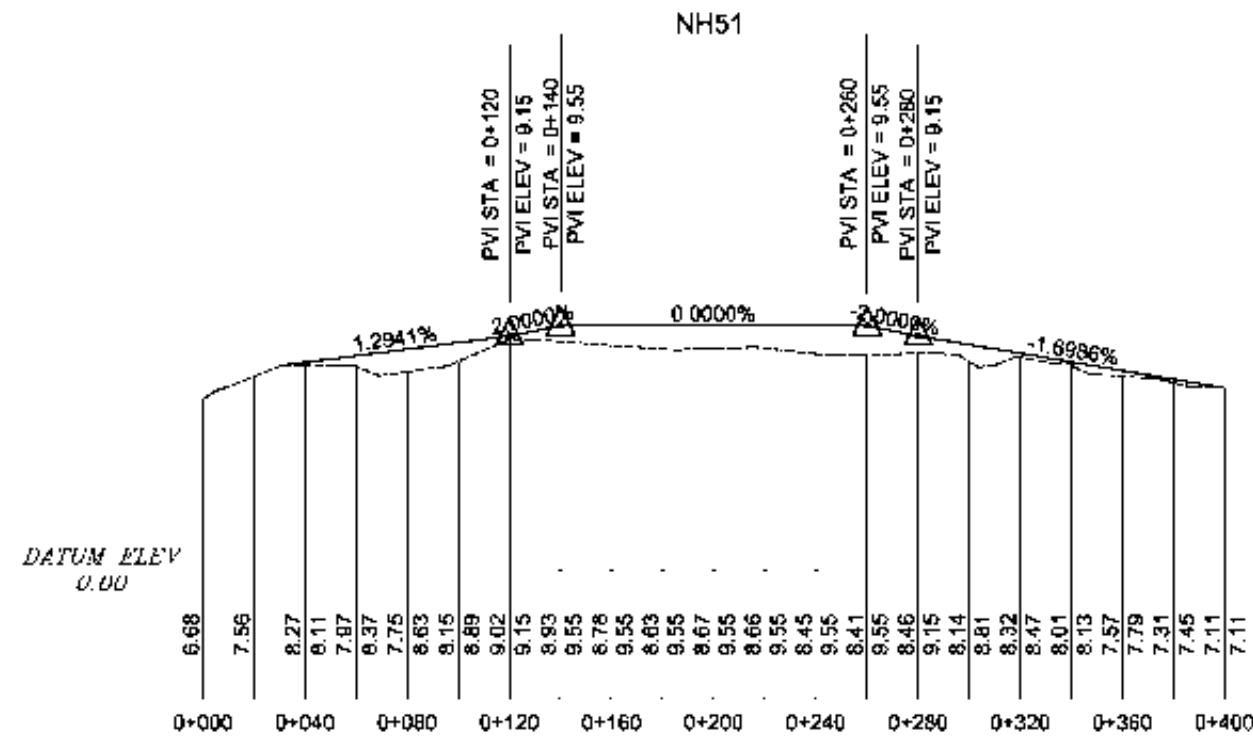


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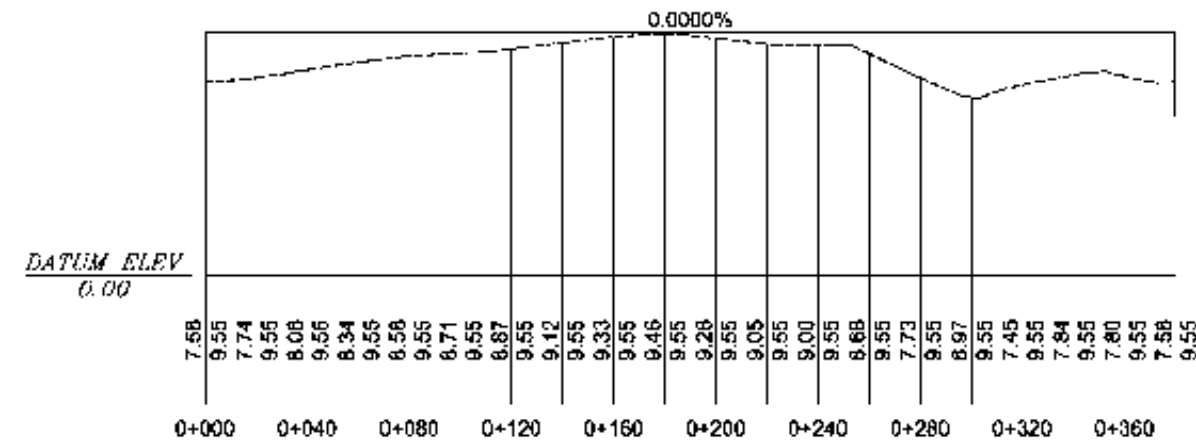
FULL IC 07 WILL BE CONSTRUCTED SUBJECT TO BIEN HOA - VUNG TAU EXPRESSWAY WILL BE CONSTRUCTED
 NÚT GIAO SỐ 07 SẼ ĐƯỢC XÂY DỰNG ĐẦY ĐỦ KHI DỰ ÁN DƯỚI CAO TỐC BIÊN HOA - VŨNG TÁU ĐƯỢC XÂY DỰNG

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
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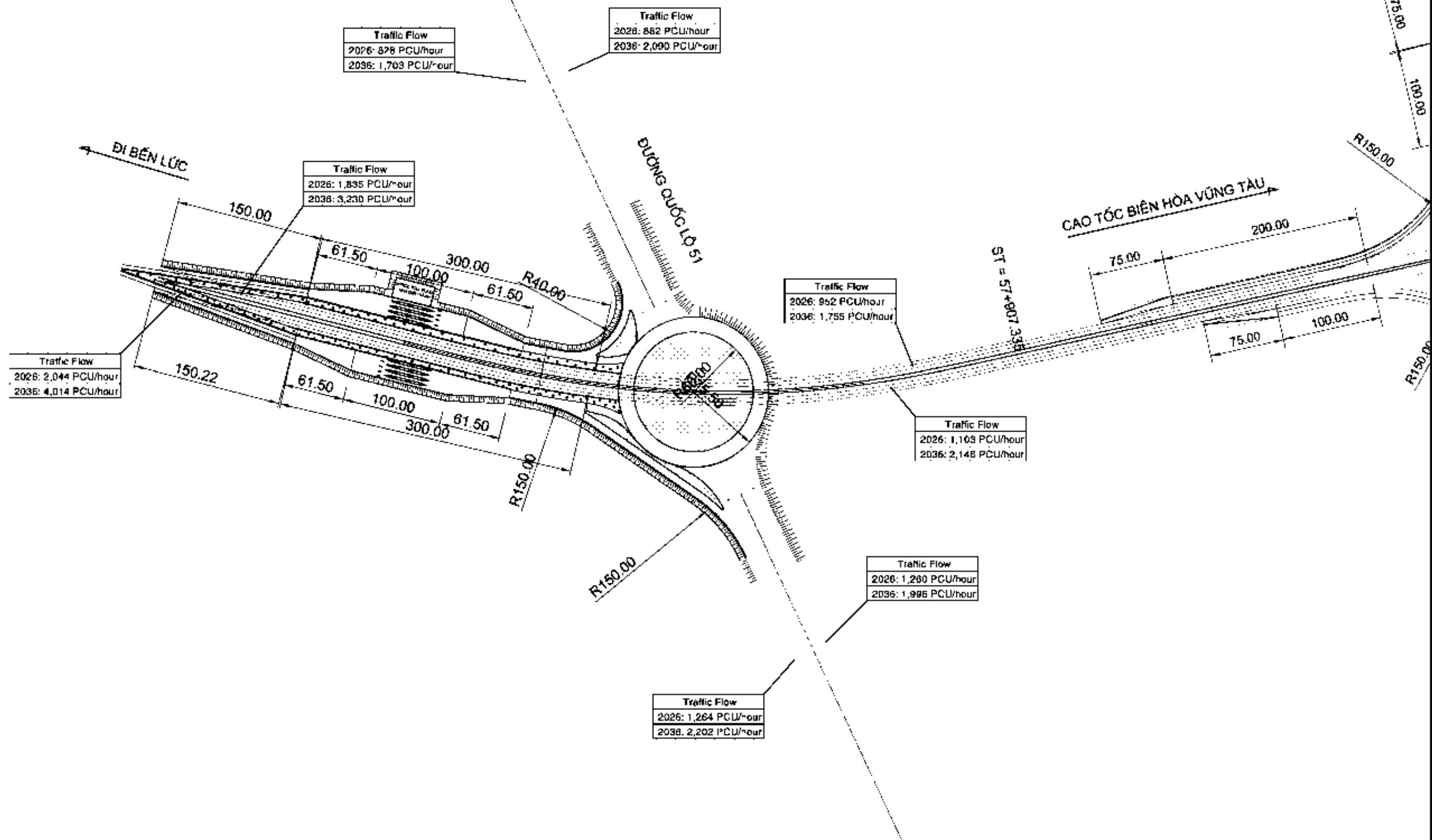
PROFILE OF NH51












ROUNDBOUT



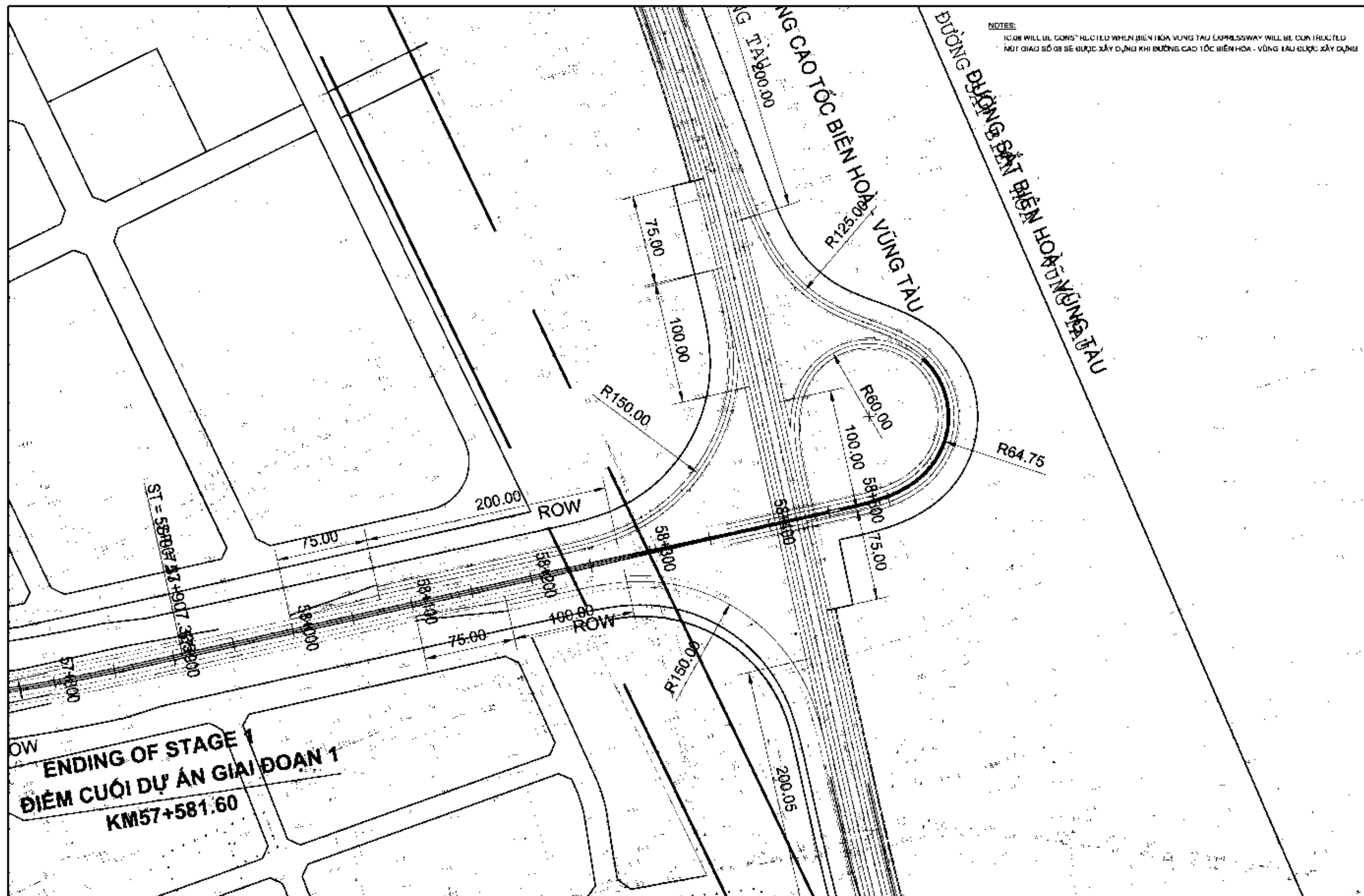
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PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: Le Ngoc HIEU APPROVED BY: Timothy COLLETT											



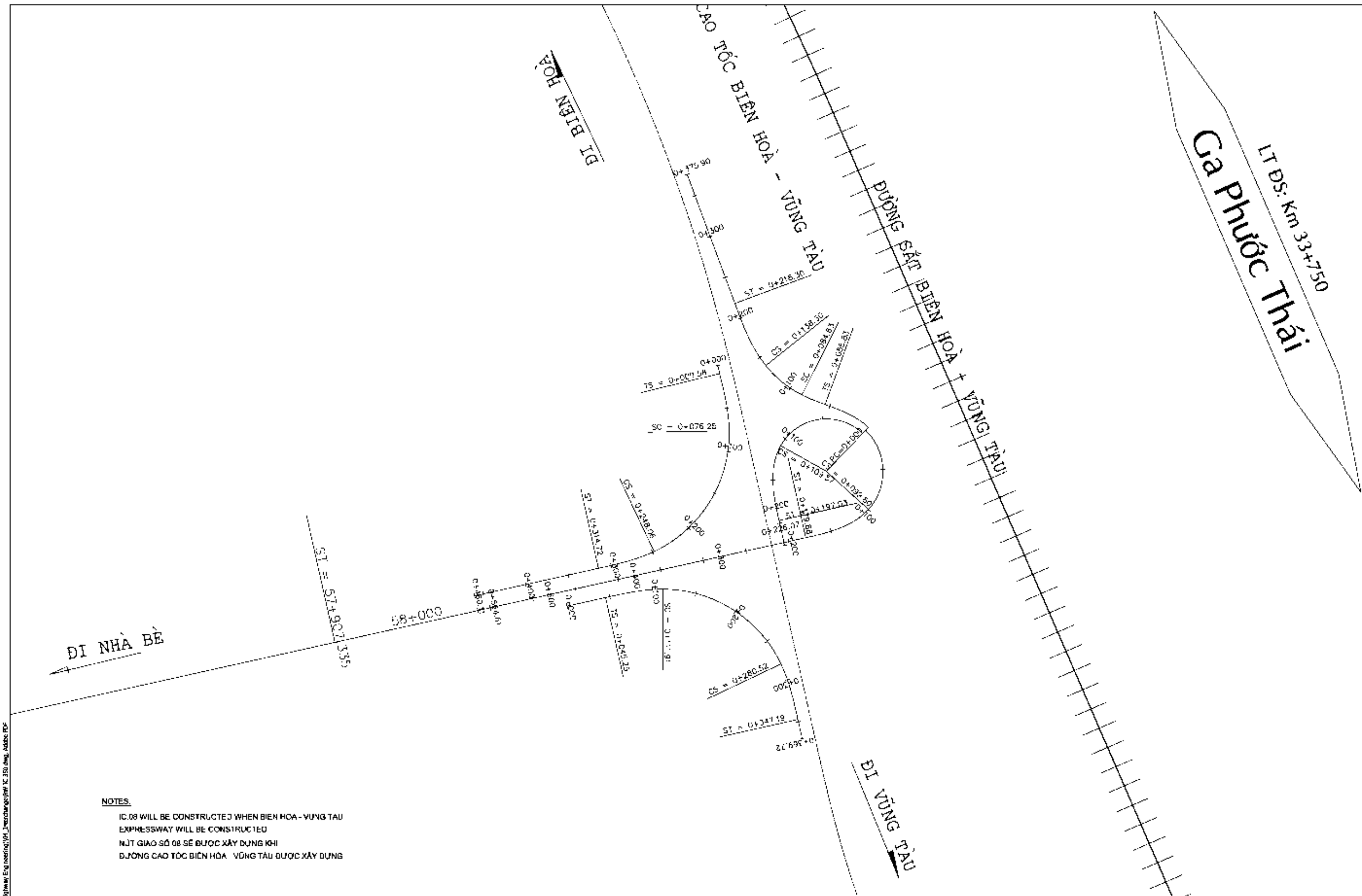
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<table><tr><th>TITLE</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>Lu Ngoc HUU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TITLE	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	Lu Ngoc HUU		APPROVED BY	Timothy COLLETT									
TITLE	NAME	SIGNATURE																					
PREPARED BY	Nguyen Thanh PHUONG																						
CHECKED BY	Lu Ngoc HUU																						
APPROVED BY	Timothy COLLETT																						

NOTES:

IC08 WILL BE CONSTRUCTED WHEN BIEN HOA VUNG TAU EXPRESSWAY WILL BE CONSTRUCTED
 NÚT GIAO SỐ 08 SẼ ĐƯỢC XÂY DỰNG KHI ĐƯỜNG CAO TỐC BIÊN HOA - VÙNG TAU ĐƯỢC XÂY DỰNG



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No	
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-IC-340	
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						TITLE		NAME		SIGNATURE		
PREPARED BY		Nguyen Thanh PHUONG										
CHECKED BY		La Ngoc HIEU										
APPROVED BY		Timothy COLLETT										



NOTES

IC.08 WILL BE CONSTRUCTED WHEN BIEN HOA - VUNG TAU EXPRESSWAY WILL BE CONSTRUCTED
 NÚT GIAO SỐ 08 SẼ ĐƯỢC XÂY DỰNG KHI ĐƯỜNG CAO TỐC BIÊN HOA - VŨNG TÀU ĐƯỢC XÂY DỰNG

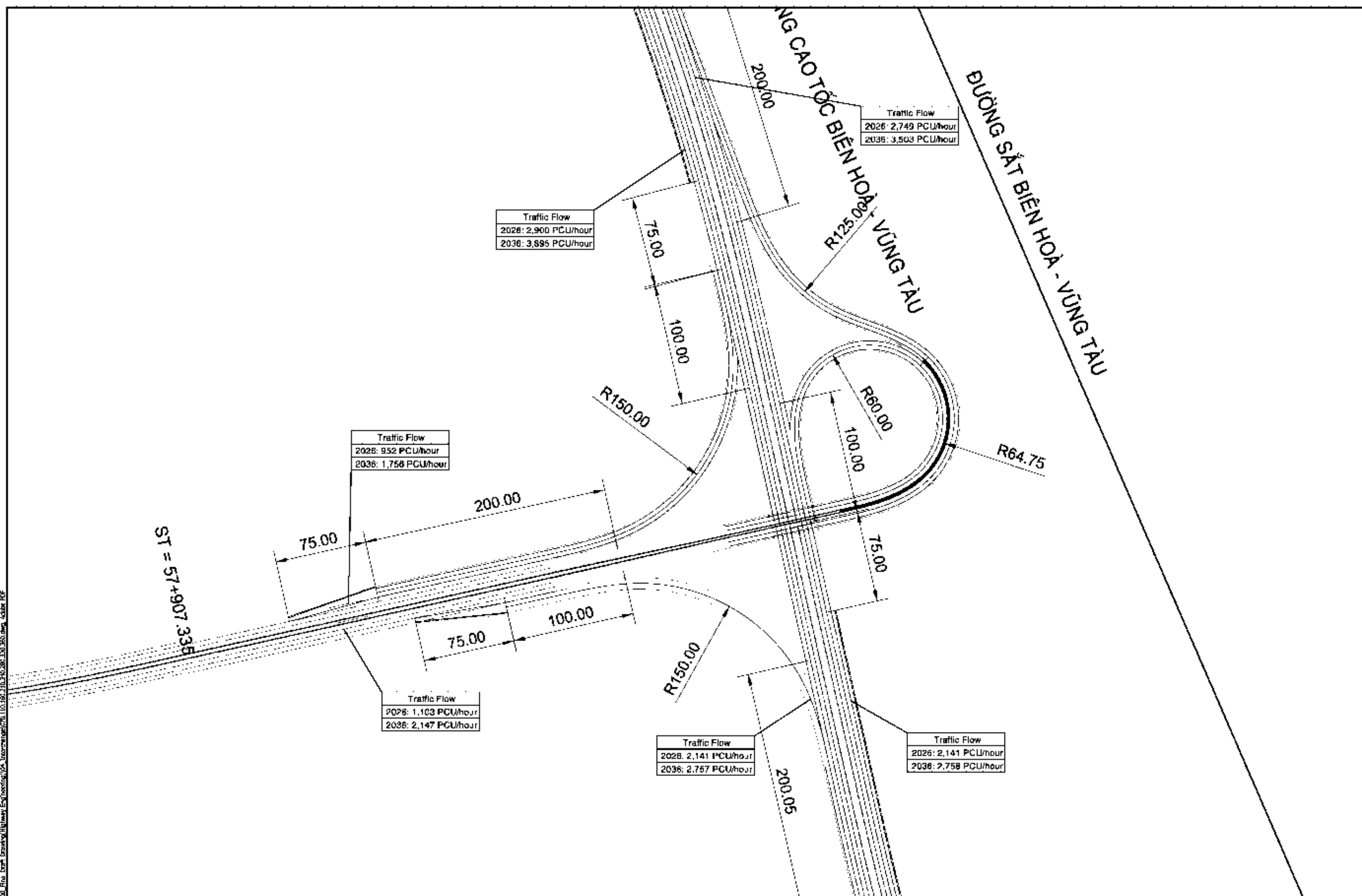
CONSULTANT		
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO		
TIME	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE: ALIGNMENT OF INTERCHANGE NO.8 YÊU TỐ HÌNH HỌC NÚT GIAO SỐ 8

REV. No	DATE	DESCRIPTION	DRAWING No.
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CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: TRAFFIC FORECAST AT INTERCHANGE NO.8 DỰ BÁO LƯU LƯỢNG GIAO THÔNG TẠI NÚT GIAO SỐ 8		0	NOV 2009	DRAFT FINAL DRAWING	RW-IC-360
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TITLE	NAME	SIGNATURE									
PREPARED BY	Nguyen Thanh PHUONG										
CHECKED BY	Lu Ngoc HUU										
APPROVED BY	Timothy COLLETT										

V: Drainages and Technical culverts
V: Hệ thống thoát nước và Cống kỹ thuật

CULVERT INVENTORY DANH MỤC CÔNG

No. STT	Station Lý trình	Proposal Dimension Kích thước (m)	Length Chiều dài công (m)	Skew angle Góc chéo (độ)	Ghi chú	Remark
1	Km 1+187.00	φ2.0	31.00	3°	Mương thủy lợi	Irrigation
2	Km 1+700.00	2.0x2.0	31.00	40°	Cống kỹ thuật	Technical Culvert
3	Km 4+250.00	φ1.5	31.00	90°	Cầu tạo	Structure
4	Km 4+400.00	2.0x2.0	31.00	40°	Cống kỹ thuật	Technical Culvert
5	Km 4+700.00	φ1.5	31.00	40°	Cầu tạo	Structure
6	Km 5+132.00	φ1.5	31.00	80°	Mương thủy lợi	Irrigation
7	Km 5+722.00	φ1.5	31.00	80°	Mương thủy lợi	Irrigation
8	Km 7+171.00	φ1.5	31.00	40°	Mương thủy lợi	Irrigation
9	Km 7+250.00	2.0x2.0	31.00	40°	Cống kỹ thuật	Technical Culvert
10	Km 7+591.00	2x3.0x3.0	31.00	0°	Mương tự nhiên	Channel
11	Km 9+619.00	φ2.0	31.00	40°	Mương thủy lợi	Irrigation
12	Km 10+200.00	φ1.5	31.00	40°	Mương thủy lợi	Irrigation
13	Km 10+600.00	φ2.0	31.00	40°	Mương thủy lợi	Irrigation
14	Km 11+000.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
15	Km 11+100.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
16	Km 11+450.00	φ1.5	31.00	90°	Cầu tạo	Structure
17	Km 11+750.00	φ1.5	31.00	90°	Cầu tạo	Structure
18	Km 13+200.00	φ2.0	31.00	8°	Mương thủy lợi	Irrigation
19	Km 14+075.00	φ1.5	31.00	90°	Cầu tạo	Structure
20	Km 14+335.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
21	Km 14+600.00	2x3.0x3.0	31.00	40°	Mương tự nhiên	Channel
22	Km 14+950.00	φ1.5	31.00	90°	Cầu tạo	Structure
23	Km 15+000.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
24	Km 15+426.00	φ2.0	31.00	90°	Cầu tạo	Structure
25	Km 15+595.00	2x3.0x3.0	31.00	90°	Mương tự nhiên	Channel
26	Km 15+832.00	3.0x3.0	31.00	90°	Mương tự nhiên	Channel
27	Km 16+322.00	2x3.0x3.0	31.00	90°	Mương tự nhiên	Channel
28	Km 16+533.00	3.0x3.0	31.00	90°	Mương tự nhiên	Channel
29	Km 32+754.00	φ2.0	31.00	80°	Mương thủy lợi	Irrigation
30	Km 33+100.00	φ1.0	15.00	-	Cống siêu cao	Super-elevation Pipe
31	Km 33+285.00	φ2.0	31.00	7°	Cầu tạo	Structure
32	Km 33+400.00	φ1.0	15.00	-	Cống siêu cao	Super-elevation Pipe
33	Km 33+627.00	φ1.5	31.00	90°	Cầu tạo	Structure
34	Km 33+800.00	φ1.0	15.00	-	Cống siêu cao	Super-elevation Pipe
35	Km 33+960.00	2x3.0x3.0	31.00	7°	Mương tự nhiên	Channel
36	Km 36+407.00	3.0x3.0	31.00	90°	Mương tự nhiên	Channel
37	Km 36+931.00	φ2.0	31.00	7°	Mương thủy lợi	Irrigation
38	Km 36+367.00	φ2.0	31.00	7°	Mương thủy lợi	Irrigation
39	Km 36+825.00	φ1.5	31.00	40°	Cầu tạo	Structure
40	Km 37+000.00	2.0x2.0	31.00	40°	Cống kỹ thuật	Technical Culvert
41	Km 37+137.00	φ2.0	31.00	7°	Mương thủy lợi	Irrigation
42	Km 37+500.00	φ1.5	31.00	90°	Cầu tạo	Structure

No. STT	Station Lý trình	Proposal Dimension Kích thước (m)	Length Chiều dài công (m)	Skew angle Góc chéo (độ)	Ghi chú	Remark
43	Km 38+000.00	φ1.5	31.00	90°	Cầu tạo	Structure
44	Km 38+300.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
45	Km 38+416.00	φ1.5	31.00	90°	Cầu tạo	Structure
46	Km 39+911.00	4x3.0x3.0	31.00	90°	Đại Thang	Da Thang Canal
47	Km 39+130.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
48	Km 39+473.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
49	Km 39+600.00	φ1.5	31.00	90°	Cầu tạo	Structure
50	Km 40+100.00	φ1.5	31.00	90°	Cầu tạo	Structure
51	Km 40+350.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
52	Km 40+537.00	4x3.0x3.0	31.00	90°	Suối Nhâm	Suoi Nam Canal
53	Km 41+000.00	φ1.5	31.00	90°	Cầu tạo	Structure
54	Km 41+359.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
55	Km 41+650.00	2x2.0x2.0	31.00	90°	Mương tự nhiên	Channel
56	Km 41+916.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
57	Km 42+000.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
58	Km 42+318.00	φ2.0	31.00	7°	Mương thủy lợi	Irrigation
59	Km 42+770.00	φ2.0	31.00	90°	Cầu tạo	Structure
60	Km 43+600.00	φ2.0	31.00	7°	Cầu tạo	Structure
61	Km 43+775.00	φ2.0	31.00	7°	Mương thủy lợi	Irrigation
62	Km 44+144.00	φ2.0	31.00	7°	Mương thủy lợi	Irrigation
63	Km 44+400.00	φ1.5	31.00	80°	Mương thủy lợi	Irrigation
64	Km 44+650.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
65	Km 44+886.00	φ2.0	31.00	6°	Mương thủy lợi	Irrigation
66	Km 45+143.00	4x3.0x3.0	31.00	90°	Bà Bồng	Ba Bong Canal
67	Km 45+545.00	2x2.0x2.0	31.00	6°	Mương tự nhiên	Channel
68	Km 45+798.00	2x2.0x2.0	31.00	90°	Mương tự nhiên	Channel
69	Km 46+050.00	2x2.0x2.0	31.00	90°	Mương tự nhiên	Channel
70	Km 46+350.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
71	Km 46+506.00	2x2.0x2.0	31.00	6°	Mương tự nhiên	Channel
72	Km 46+750.00	φ1.5	31.00	90°	Cầu tạo	Structure
73	Km 47+100.00	2x2.0x2.0	31.00	7°	Mương tự nhiên	Channel
74	Km 47+421.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
75	Km 47+606.00	2x2.0x2.0	31.00	90°	Mương tự nhiên	Channel
76	Km 47+900.00	φ1.5	31.00	90°	Cầu tạo	Structure
77	Km 48+157.00	2x2.0x2.0	31.00	90°	Mương tự nhiên	Channel
78	Km 48+550.00	φ1.5	31.00	90°	Cầu tạo	Structure
79	Km 48+833.00	φ1.5	31.00	90°	Mương thủy lợi	Irrigation
80	Km 49+050.00	2.0x2.0	31.00	90°	Mương tự nhiên	Channel
81	Km 49+200.00	2.0x2.0	31.00	90°	Cống kỹ thuật	Technical Culvert
82	Km 49+600.00	φ1.5	31.00	90°	Cầu tạo	Structure
83	Km 51+600.00	3.0x3.0	31.00	90°	Mương tự nhiên	Channel

2/2/2020 Final Draft Drawing Highway Engineering\US Drawings are Technical Culvert\DWG 07-RW-D01.dwg Acetate PDF

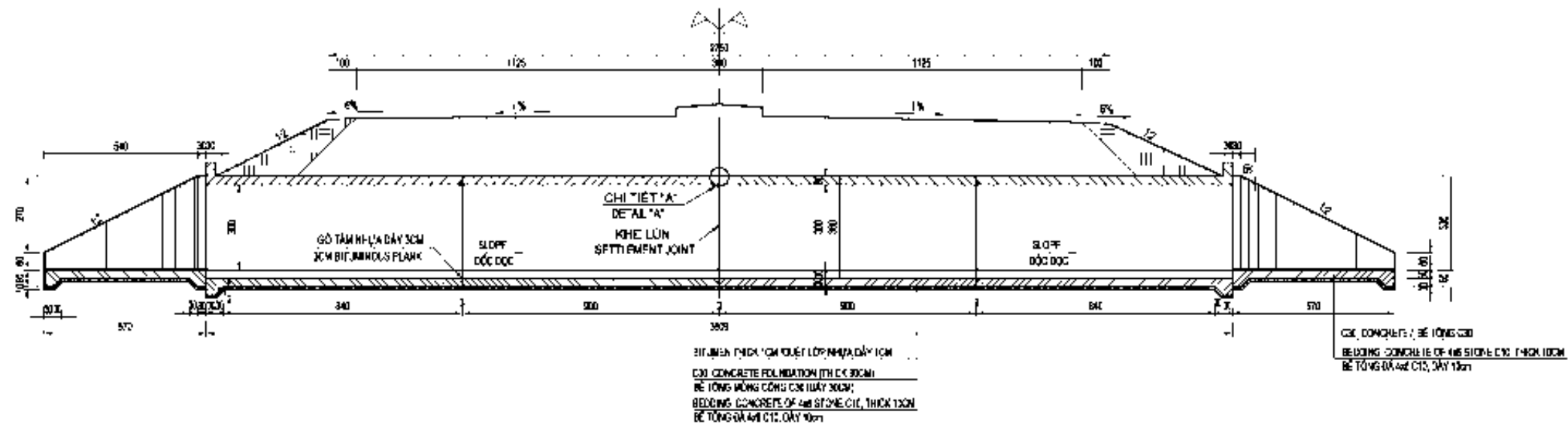
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GENERAL VIEW OF BOX CULVERT - 4x(3.0x3.0)M

BỐ TRÍ CHUNG CÔNG HỢP - 4x(3.0x3.0)M

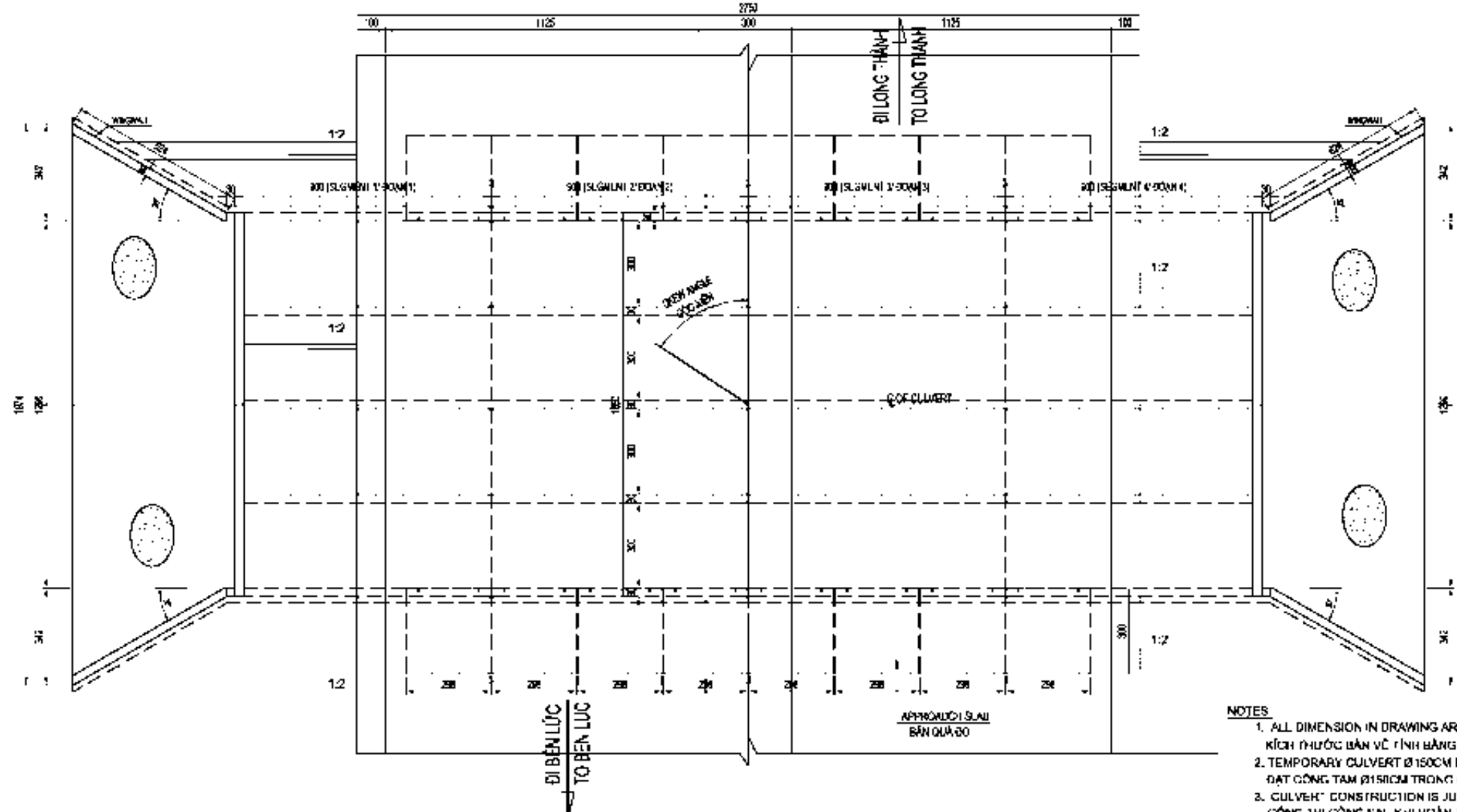
CULVERT PROFILE/ CẮT DỌC CÔNG

SCALE 1:200



CULVERT PLAN (MẶT BẰNG CÔNG)

SCALE 1:200



NOTES

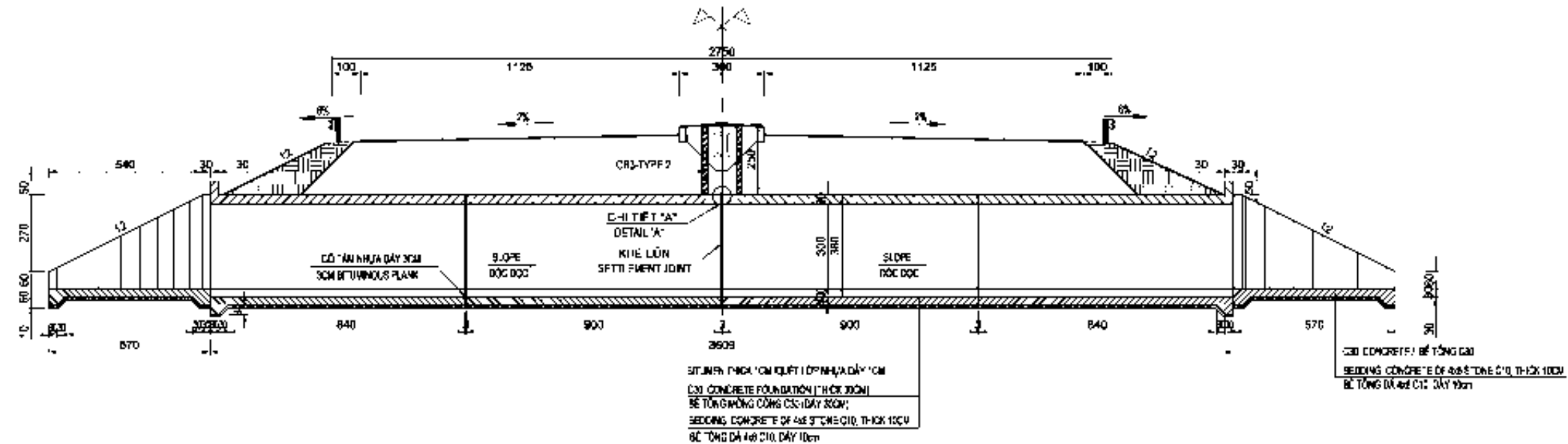
1. ALL DIMENSION IN DRAWING ARE CENTIMETERS
2. TEMPORARY CULVERT Ø150CM IS INSTALLED IN PROCESS LOADING
3. CULVERT CONSTRUCTION IS JUST ONLY EXECUTED AFTER COMPLETING GROUND IMPROVEMENT.
4. CÔNG THỊ CÔNG SÁI KHI HOÀN THÀNH GIAI ĐOẠN XỬ LÝ NỀN ĐƯỜNG

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-020
								1	FFR-2010	FINAL DRAWING	
								DRAWING TITLE:			SCALE
								GENERAL VIEW OF BOX CULVERT 4x(3.0x3.0)M			1:200
								BỐ TRÍ CHUNG CÔNG HỢP 4x(3.0x3.0)M			

GENERAL VIEW OF BOX CULVERT - 2x(3.0x3.0)M BỐ TRÍ CHUNG CÔNG HỢP - 2x(3.0x3.0)M

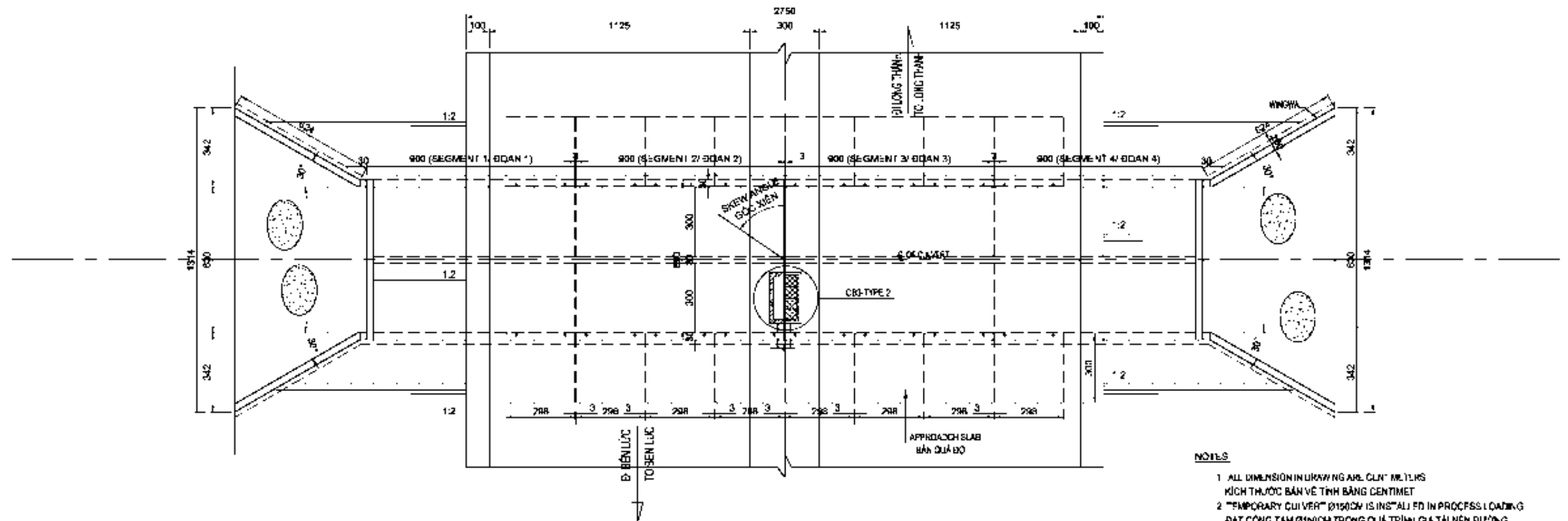
CULVERT PROFILE/ CẮT DỌC CÔNG

SCALE 1:200



CULVERT PLAN (MẶT BẰNG CÔNG)

SCALE 1:200

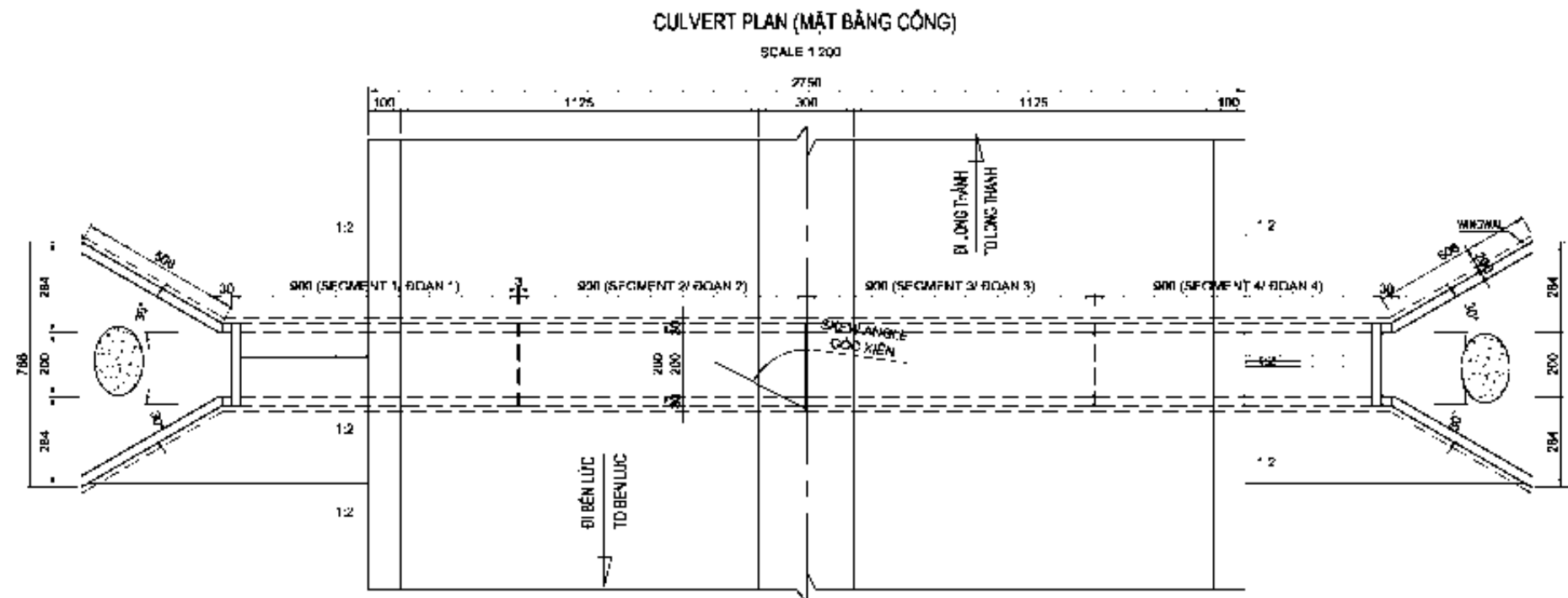
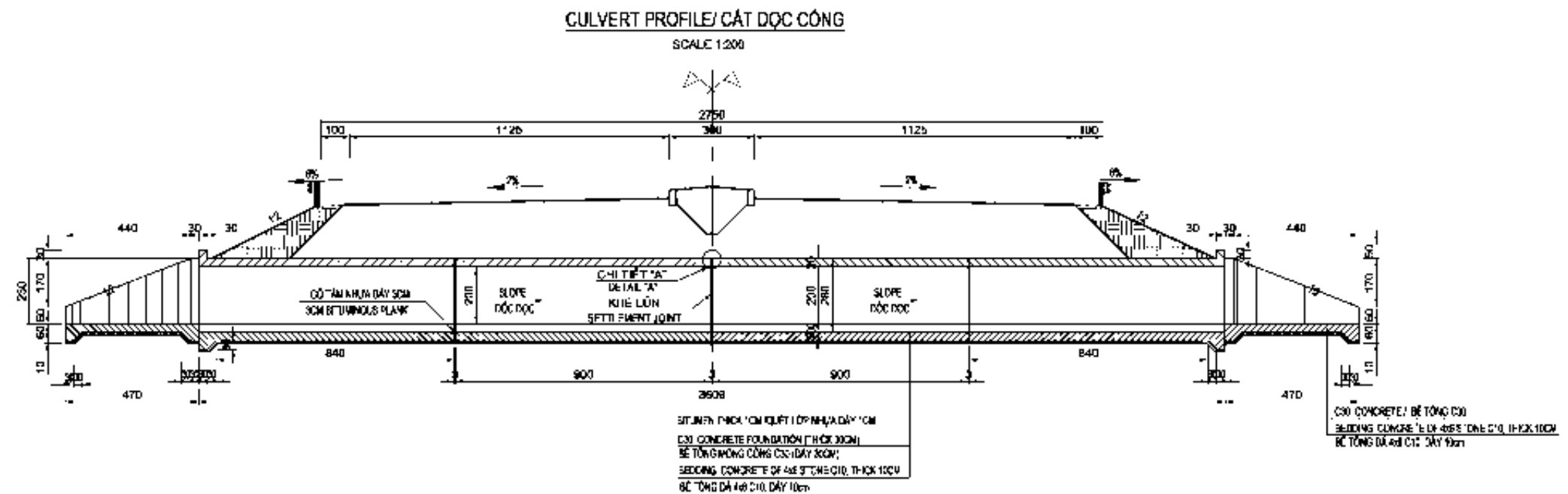


NOTES

1. ALL DIMENSION IN DRAWING ARE CLIN* METERS
KÍCH THƯỚC BẢN VẼ TÍNH BẰNG CENTIMET
2. "EMPORARY CULVERT" Ø1500CM IS INST* ALL FD IN PROCESS LOADING
ĐẶT CÔNG TẮM Ø1500CM TRONG QUÁ TRÌNH GIA TẢI NỀN ĐƯỜNG
3. CULVERT CONSTRUCTION IS JUST ONLY EXCUTED AFTER COMPLETING GROUND IMPROVEMENT.
CÔNG THÍ CÔNG SÁU KHI HOÀN THÀNH GIAI ĐOẠN XỬ LÝ NỀN ĐƯỜNG

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: GENERAL VIEW OF BOX CULVERT 2x(3.0x3.0)M BỐ TRÍ CHUNG CÔNG HỢP 2x(3.0x3.0)M		0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-030
								1	FFR-2010	FINAL DRAWING	
											SCALE: 1:200

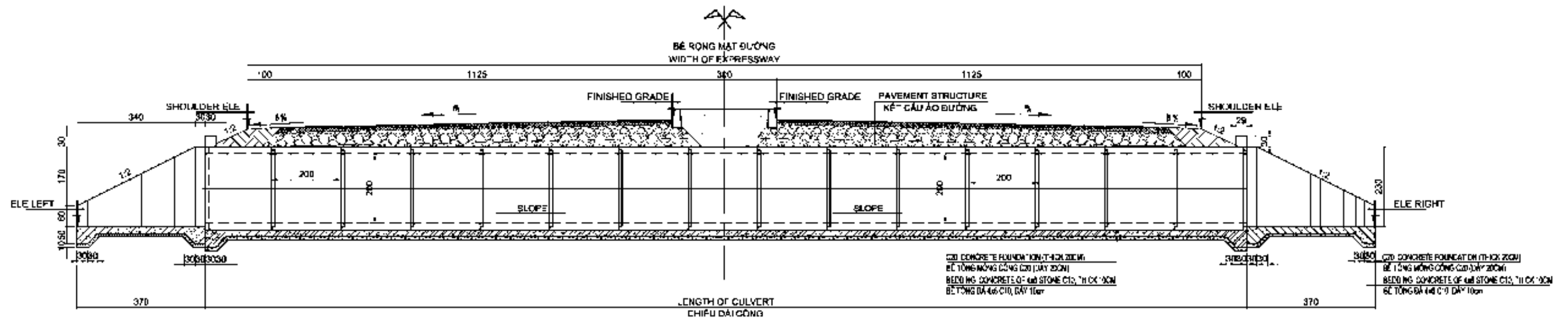
GENERAL VIEW OF BOX CULVERT - 2.0Mx2.0M BỐ TRÍ CHUNG CÔNG HỢP - 2.0Mx2.0M



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: GENERAL VIEW OF BOX CULVERT 2.5Mx2.5M BỐ TRÍ CHUNG CÔNG HỢP 2.5Mx2.5M		0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-050
								1	FFR-2010	FINAL DRAWING	
											SCALE: 1:200
TITLE PREPARED BY CHECKED BY APPROVED BY		NAME Nguyen Thanh PHUONG A. Ngoc HIEU Timothy COLLETT		SIGNATURE 							

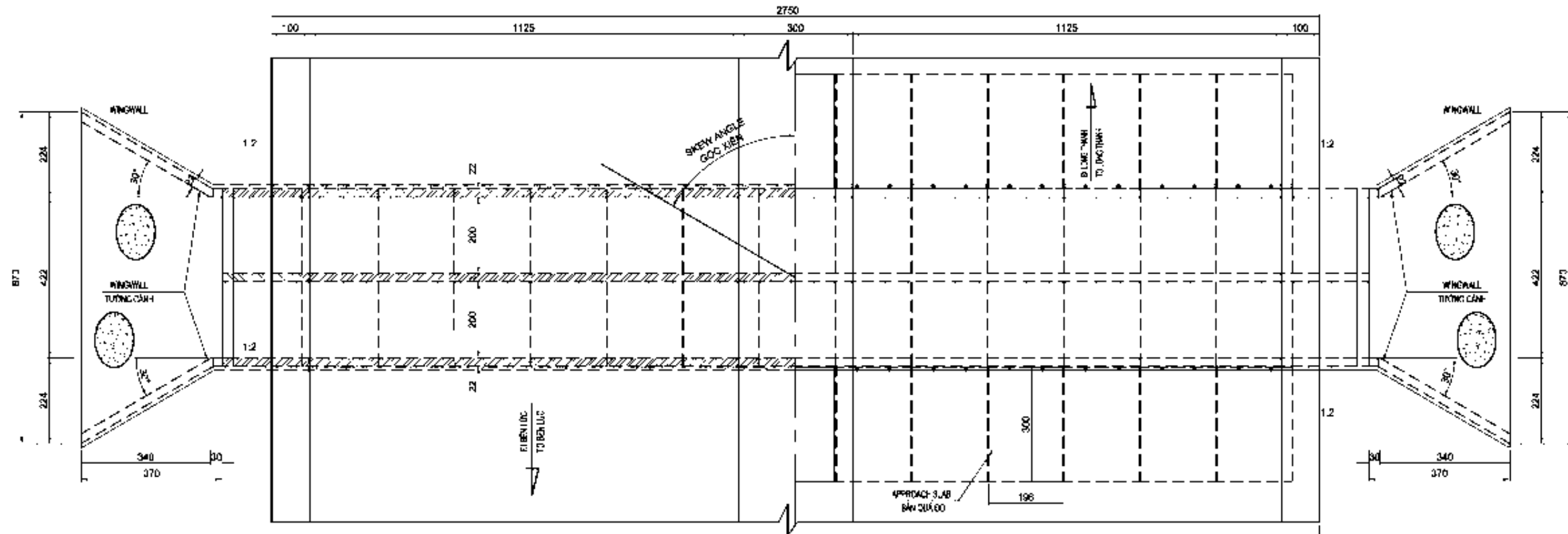
GENERAL VIEW OF BOX CULVERT 2x(2.0x2.0)M BỘ TRÍ CHUNG CÔNG HỢP 2x(2.0x2.0)M

CULVERT PROFILE/ CẮT DỌC CÔNG
SCALE 1:125



1/2 A-A
SCALE 1:125

1/2 PLAN (MẶT BẰNG)
SCALE 1:125



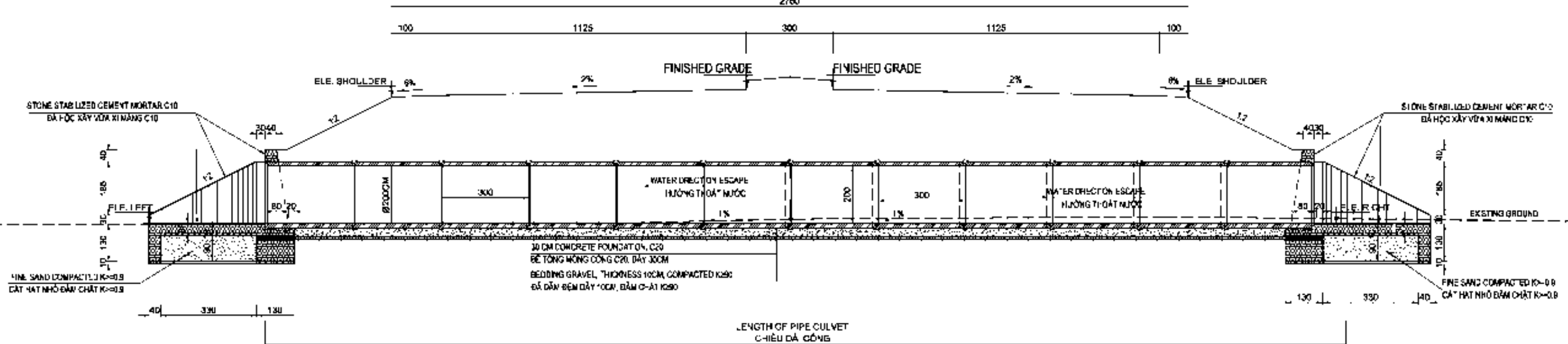
NOTES

1. ALL DIMENSION DRAWING ARE IN CENTIMETERS
KẾ THUỘC BẢN VẼ TÍNH BẰNG CENTIMET
2. CULVERT CONSTRUCTION IS JUST ONLY EXECUTED AFTER COMPLETING GROUND IMPROVEMENT
CÔNG TH. CÔNG SÁU KHI HOÀN THÀNH GIAI ĐOẠN X. LÝ NỀN ĐƯỜNG

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-060
								1	FFR-2010	FINAL DRAWING	
								DRAWING TITLE: GENERAL VIEW OF BOX CULVERT - 2x(2.0x2.0)M BỘ TRÍ CHUNG CÔNG HỢP - 2x(2.0x2.0)M			SCALE: 1:125
TITLE	NAME	SIGNATURE									
PREPARED BY	Nguyen Thanh PHUONG										
CHECKED BY	A. Ngoc HIEU										
APPROVED BY	Timothy COLLETT										

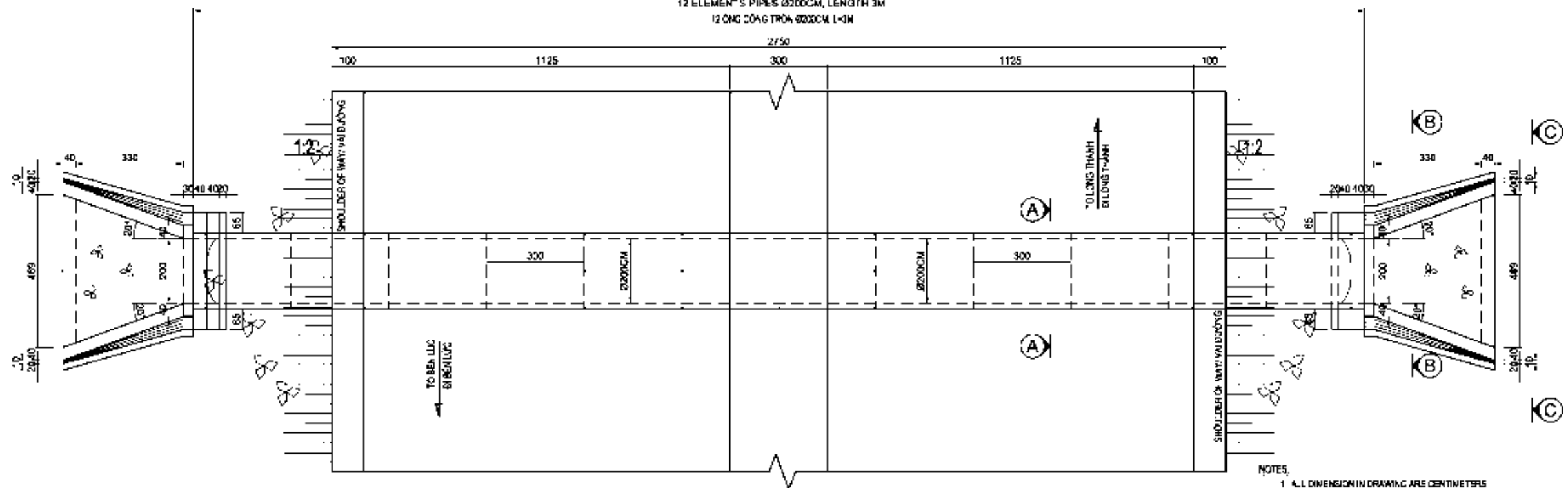
GENERAL OF VIEW PIPE CULVERT Ø2M BỐ TRÍ CHUNG CÔNG TRƠN Ø2M

PROFILE OF CULVERT
CẮT ĐỌC CÔNG
SCALE 1:150



PLAN OF CULVERT
MẶT BẰNG CÔNG
SCALE 1:150

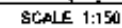
12 ELEMENTS PIPES Ø2000CM, LENGTH 3M
12 ống công tròn Ø2000CM L=3M



- NOTES:
1. ALL DIMENSION IN DRAWING ARE CENTIMETERS
TẤT CẢ THƯỚC BẢN VẼ TÍNH BẰNG CENTIMET
 2. HIGH LEVEL IN DRAWING ARE METERS
CAO ĐỘ TÍNH BẰNG MÊT
 3. CULVERT CONSTRUCTION IS JUST ONLY EXECUTED AFTER COMPLETING GROUND IMPROVEMENT
CÔNG THỨC CÔNG SÁU NHƯ HOÀN THÀNH GIẢI QUYẾT XỬ LÝ NỀN ĐƯỜNG

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-070
								1	FFR-2010	FINAL DRAWING	
											SCALE: 1:150
TITLE NAME SIGNATURE				DRAWING TITLE: GENERAL OF VIEW PIPE CULVERT Ø2M BỐ TRÍ CHUNG CÔNG TRƠN Ø2M							
PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: A. Ngọc HIEU APPROVED BY: Timothy COLLETT											

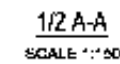
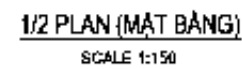
SCALE 1 150



1. ALL DIMENSION IN DRAWING ARE CENTIMETERS
KÍCH THƯỚC BẢN VẼ THÌ BẰNG CUNTIMET
2. CIVILFT CONSTRUCTION IS JUST ONLY EXECUTED AFTER COMPLETING GROUND IMPROVEMENT.
CÔNG THÌ CÔNG SÁU KHÍ HOÀN THÁNH GIAO BAN XỬ LÝ NỀN BƯỜNG

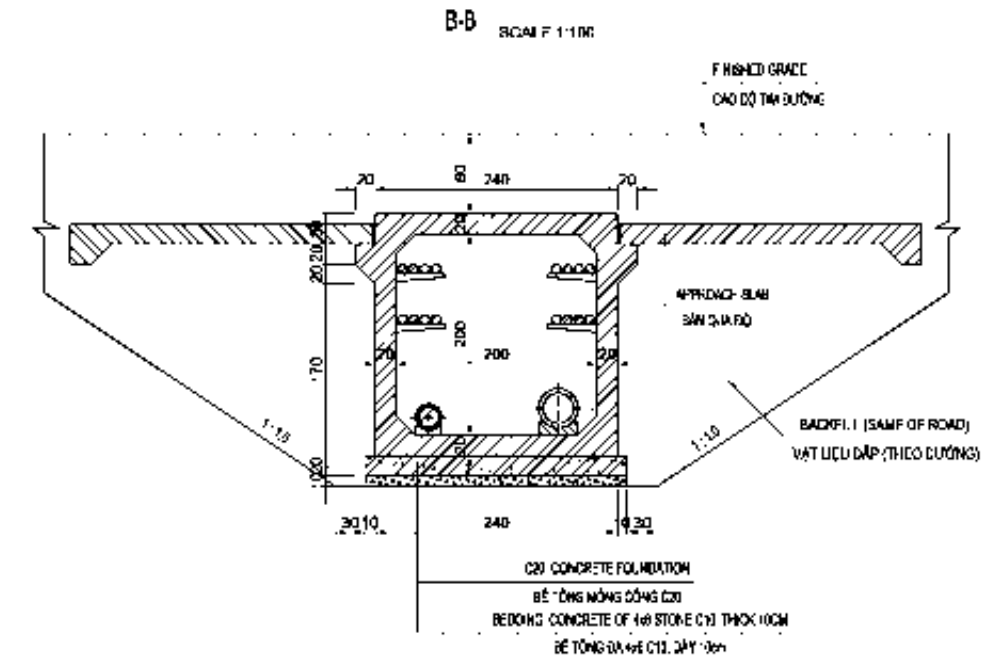
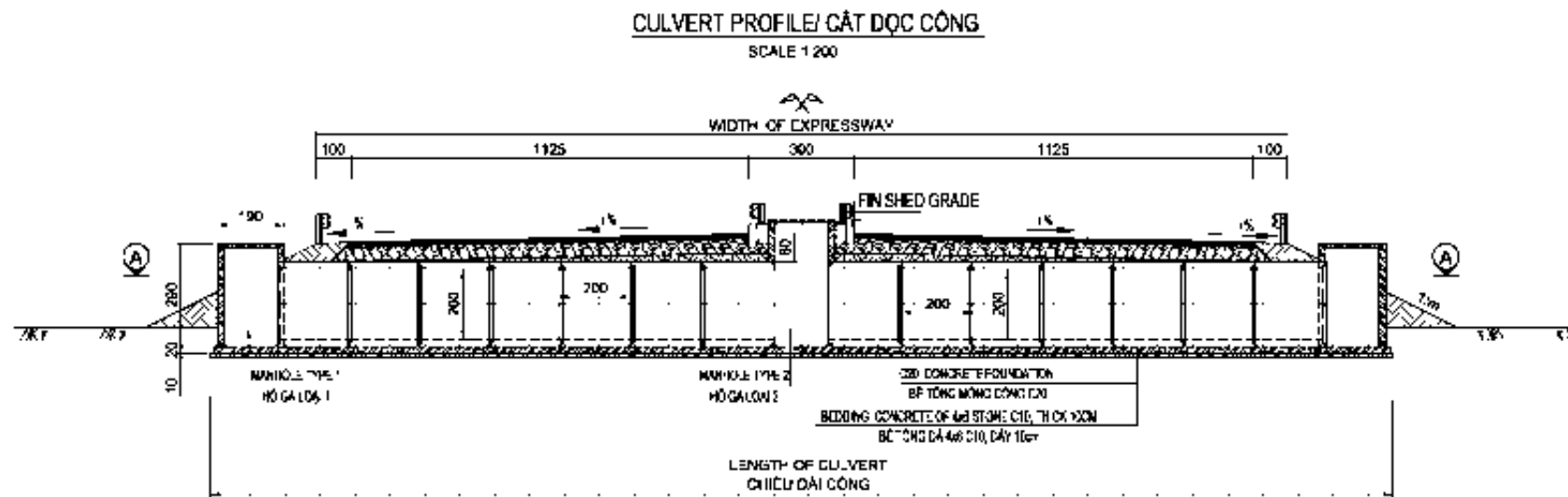
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:			
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				TITLE	NAME	SIGNATURE	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-080		
				PREPARED BY	Nguyen Thanh PHUONG		VIETNAM EXPRESSWAY CORPORATION (VEC)		1	FFB-2010	FINAL DRAWING			
				CHECKED BY	A. Ngoc HIEU		DRAWING TITLE:		GENERAL VIEW OF PIPE CULVERT Ø1.5M BỘ TRÍ CHUNG CỘNG Ø1.5M					SCALE :
				APPROVED BY	Timothy COLLETT									1:150

SCALE - 150

2:1000_Final Draft Drawing\Highway Eng\needing\105_Drainage and Technical\Custom\HW D7 D80.dwg, Acrobat PDF

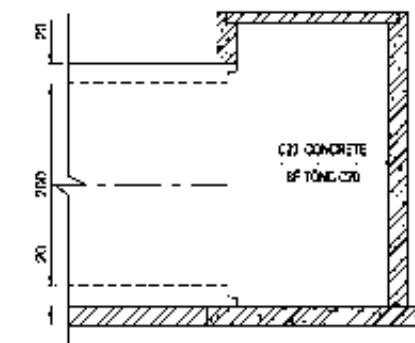
GENERAL LAYOUT OF TECHNICAL CULVERT 2.0x2.0M

BỘ TRÍ CHUNG CÔNG KỸ THUẬT 2.0x2.0M



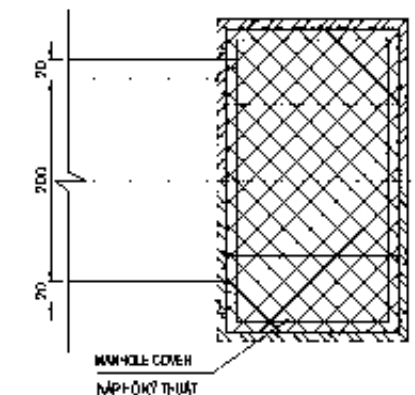
MANHOLE TYPE 1 / HỒ GA LOẠI 1

SCALE 1:100



PLAN / MẶT BẰNG

SCALE 1:100

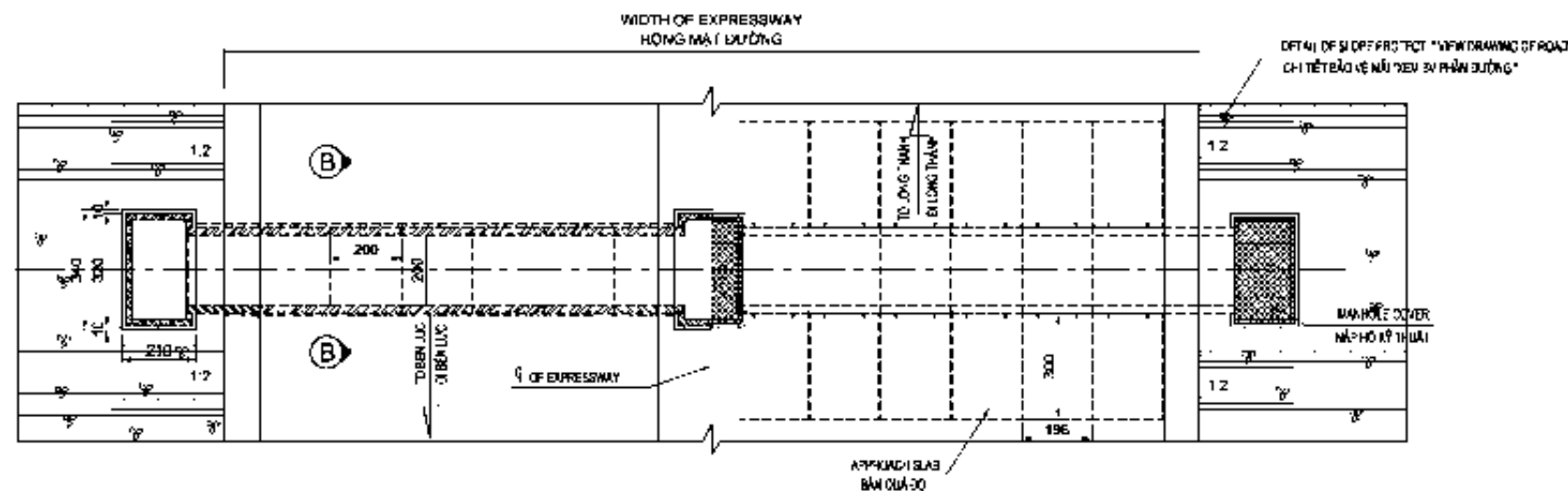


NOTES:

1. ALL DIMENSIONS ON DRAWING ARE IN CENTIMETERS
KÍCH THƯỚC BẢN VẼ "MẶT BẰNG" CENTIMETERS
2. CULVERT CONSTRUCTION IS JUST ONLY EXECUTED AFTER COMPLETING GROUND IMPROVEMENT
CÔNG THỨC SAU KHI HOÀN THÀNH CÔNG VIỆC LƯU DƯỜNG

1/2 A-A
SCALE 1:200

1/2 PLAN / MẶT BẰNG
SCALE 1:200



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	A. Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE:

GENERAL LAYOUT OF TECHNICAL CULVERT 2.0x2.0M
BỘ TRÍ CHUNG CÔNG KỸ THUẬT 2.0x2.0M

REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-100
1	FFR-2010	FINAL DRAWING	
			SCALE: AS SHOWN

TYPICAL IRRIGATION CROSS SECTION CẮT NGANG ĐẠI DIỆN MƯƠNG CẢI

NON-SCALE



TABLE OF QUANTITIES RELOCATED CHANNEL - BẢNG TỔNG HỢP KHỐI LƯỢNG ĐÀO CẢI MƯƠNG

No. STT	Left Station/ Lý trình trái		Length Chiều dài (m)	Right Station/ Lý trình phải		Length Chiều dài (m)	Total length Tổng chiều dài (m)	Width Chiều rộng (m)	Deep Chiều sâu (m)	Quantity Khối lượng (m ³)	Notes Ghi chú
	From	To		From	To						
(A)	(1)	(2)	(3)=(2)-(1)	(4)	(5)	(6)=(5)-(4)	(7)=(6)+(3)	(8)	(9)	(10)=(7)*(9)*(8)	(11)
1	KM2+350	KM2+560	210	KM13+200	KM1+422	1222	1222	5.8	1.5	1575.00	Đoạt canal - Mương Cải
2				KM15+830	KM15+970	140	140	7.1	1.5	1437.00	Đoạt canal - Mương Cải
Total quantity - Tổng khối lượng										13680.70	

NOTES

- B & H OF RELOCATED CHANNEL IS DEPENDENT ON CHANNEL ACTUALITY
- CHIỀU RỘNG (B) VÀ CHIỀU SÂU (H) CỦA . ỜNG MƯƠNG CẢI PHỤ THUỘC VÀO MƯƠNG HIỆN TRẠNG.

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-DT-110
								1	FFB-2010	FINAL DRAWING	
						DRAWING TITLE:			SCALE		
						TYPICAL IRRIGATION CROSS SECTION CẮT NGANG ĐẠI DIỆN MƯƠNG CẢI					

VI: Underpass and Overpass

VI: Cổng chui và Cầu vượt

LIST OF PROPOSAL SCALE OF UNDERPASS AND OVERPASS/ BẢNG THÔNG KÊ CÔNG CHUI VÀ CẦU

No. STT	Station-Lý trình From Km...	Size-Kích thước B (m) H (m)	Length Chiều dài (m)	Skew-Góc (đ-m-s)	Remark	Ghi chú
1	Km 0+579.00	6 3.2	28.5	90-00-00	Underpass at Ramp A of IC 01	Công chui tại nhánh A của nút giao số 01
2	Km 5+132.00	4.5 3.2	29.2	77-00-00	Underpass	Công chui dân sinh
2	Km 10+200.00	6 3.2	28.5	90-00-00	Underpass	Công chui dân sinh
3	Km 13+550.00				Overpass of NH50	Cầu vượt cao Quốc lộ 50
3	Km 38+622.00	6 3.2	28.5	90-00-00	Underpass	Công chui dân sinh
4	Km 40+744.00	6 3.2	30.3	70-00-00	Underpass	Công chui dân sinh
4	Km 42+600.00	4.5 3.2	30.1	71-00-00	Underpass	Công chui dân sinh
5	Km 43+938.00	4.5 3.2	30.3	70-00-00	Underpass	Công chui dân sinh
5	Km 46+950.00	4.5 3.2	31	113-00-00	Underpass	Công chui dân sinh
6	Km 48+690.00	4.5 3.2	28.5	90-00-00	Underpass	Công chui dân sinh

TABLE OF RELOCATED ROAD/ BẢNG THÔNG KÊ ĐƯỜNG GOM DÂN SINH

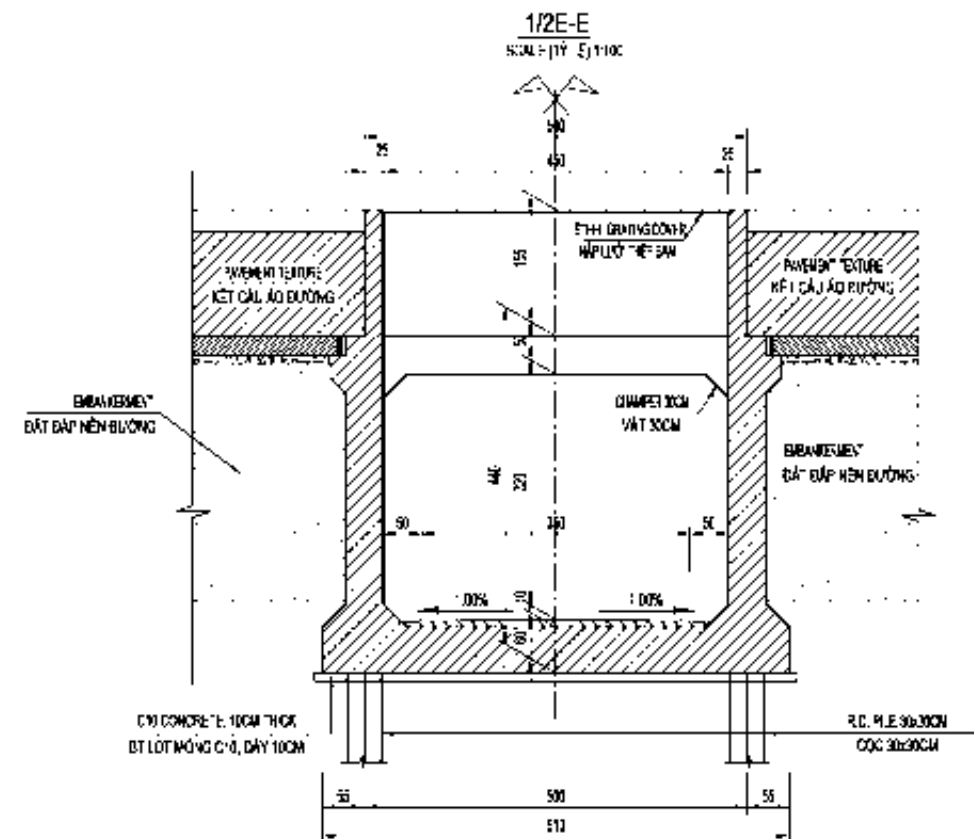
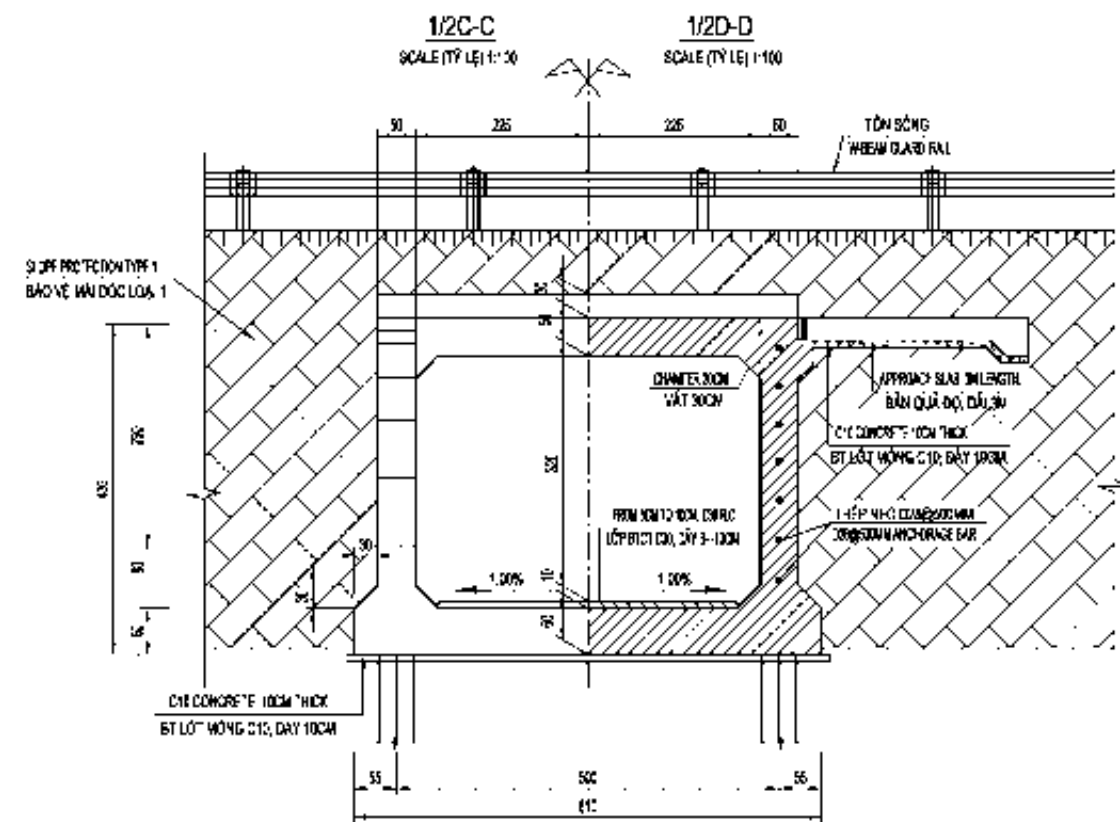
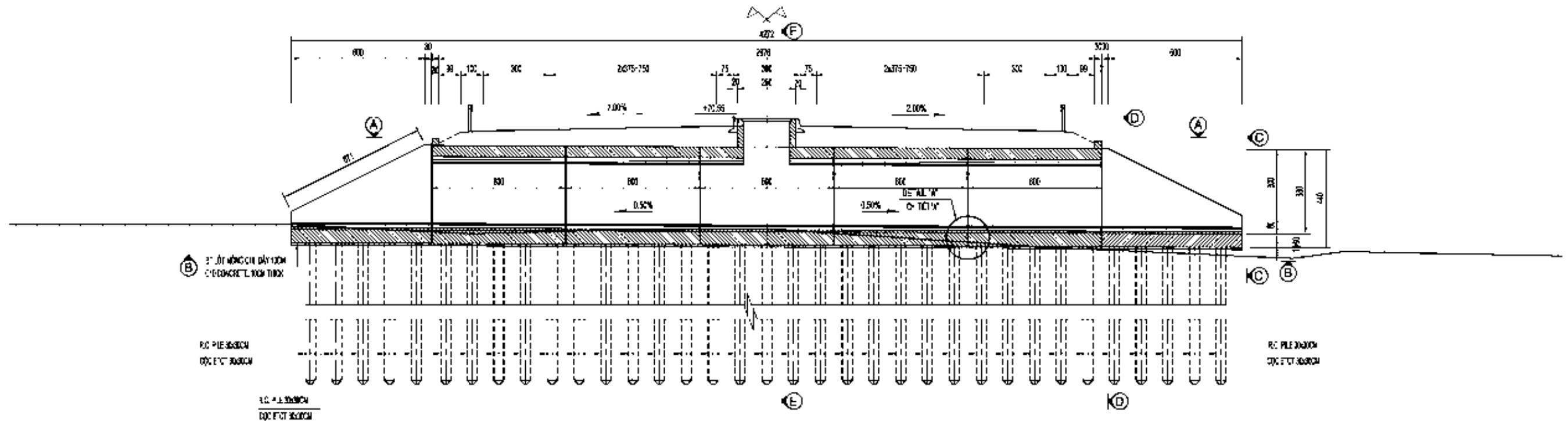
No. STT	Side Left Trái tuyến	Length Chiều dài (m)	Side Right Phải tuyến	Length Chiều dài (m)	Total Length Tổng chiều dài (m)	Remark Ghi chú
1	KM1+400 KV1+800	400	KM1+300 <N1+950	650	1 050	
2	KM2+400 KV3+300	900	KM2+400 <N3+100	700	1.600	
3	KM3+420 KV5+132	1 712	KM3+420 <N5+132	1 712	3 424	
4	KM5+132 KV6+300	1.168	KM5+132 <N6+300	1.168	2.336	
5	KM6+300 KV7+200	900	KM6+300 <N7+150	850	1 750	
6	KM9+600 KV10+200	600	KM9+600 <N10+200	600	1.200	
7	KM10+200 KV12+200	2 000	KM10+200 <N11+700	1 500	3.500	
8	KM14+200 KV18+300	2.100	KM14+200 <N18+300	2.100	4.200	
9	KM36+000 KV38+630	2 630	KM36+000 <N38+630	2.630	5.260	
10	KM38+630 KV40+750	2.120	KM38+630 <N40+750	2.120	4.240	
11	KM40+750 KV42+600	1 850	KM40+750 <N42+600	1.850	3.700	
12	KM43+950 KV45+250	1 300	KM43+950 <N45+250	1 300	2 600	
13	KM45+900 KV46+950	1.050	KM45+900 <N46+950	1.050	2.100	
Total - Tổng cộng					36,960	

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:						
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		3	NOV-2008	DRAWING - FINAL DRAWING	RW-UO-000						
								1	FEB-2010	FINAL DRAWING							
								DRAWING TITLE:				TABLE OF U.O AND RELOCATED ROAD					SCALE:
												BẢNG THÔNG KẾ CÔNG CHUI, CẦU VƯỢT VÀ ĐƯỜNG GOM DÂN SINH					
TITLE				NAME		SIGNATURE											
PREPARED BY				Nguyễn Thanh PHUONG													
CHECKED BY				Lê Ngọc HIEU													
APPROVED BY				Timothy COLLETT													

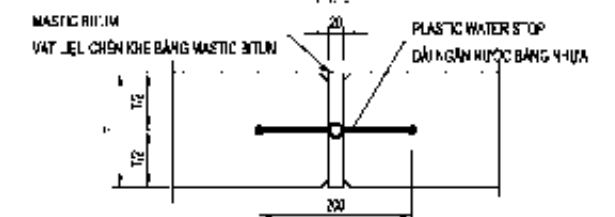
GENERAL VIEW OF UNDERPASS CULVERT (4.5x3.2)M

BỘ TRƯỞNG CÔNG CHUỖ (4.5x3.2)M

SCALE (TỶ LỆ) 1:200



CHI TIẾT "A"

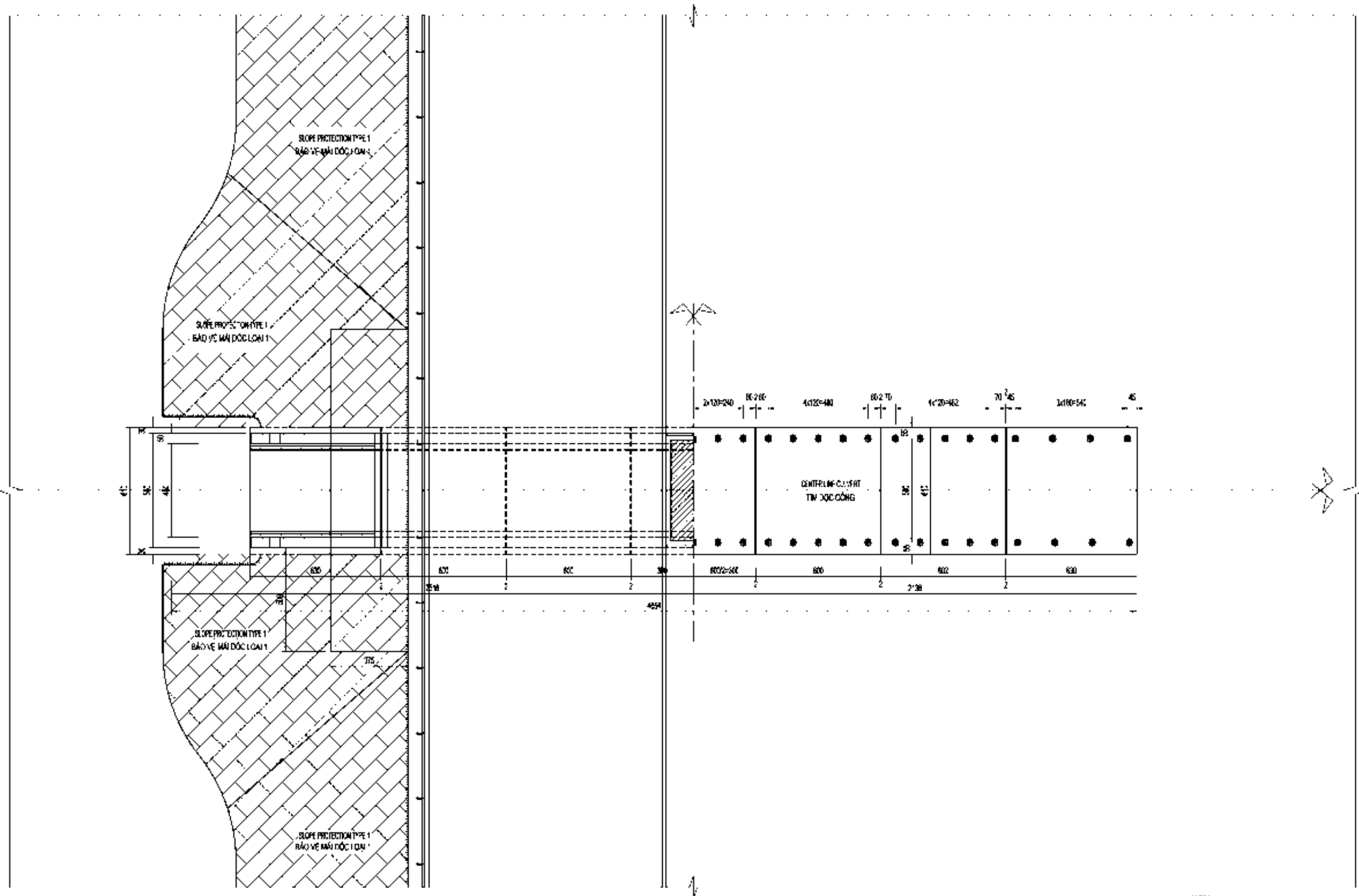


- ALL DIMENSIONS ARE IN CM
- LENGTH OF PIPE WILL BE CHOSEN BASE ON THE RESULT OF TEST LOADING
- THE NUMBER OF PIPE CONNECTION IS NOT MORE THAN 50% ON THE SAME SECTION

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:		
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-UO-010		
								-	FEB-2010	FINAL DRAWING			
								DRAWING TITLE: GENERAL VIEW OF UNDERPASS CULVERT (4.5x3.2)M (1/2) BỒ TRƯỞNG CÔNG CHUỖ (4.5x3.2)M					
						DATE: NAME: SIGNATURE:							
PREPARED BY: Nguyen Thanh PHUONG													
CHECKED BY: Le Ngoc HIEU													
APPROVED BY: Timothy COLLETT													

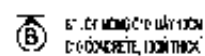
1/2A - A
SCALE (1/2" = 1' 0") 1/200

1/2B - B
SCALE (1/2" = 1' 0") 1/200



- NOTES:
1. ALL DIMENSIONS ARE IN CM
KÍCH THƯỚC TRONG BẢN VẼ CHỈ BẰNG CM
 2. LENGTH OF PIPE WILL BE CHOSEN BASE ON THE RESULT OF TEST LOADING
CHIỀU DÀI CỌC ĐƯỢC QUYẾT ĐỊNH KHI CÓ KẾT QUẢ THỬ TẢI NGỌN HIỆN TRƯỜNG
 3. THE NUMBER OF PIPE CONNECTION IS NOT MORE THAN 50% ON THE SAME SECTION
SỐ CỌC ĐƯỢC HỖ TRỢ BẮT KHÔNG QUÁ 50% MỖI MẶT TRÊN CÙNG 1 MẶT DÂY

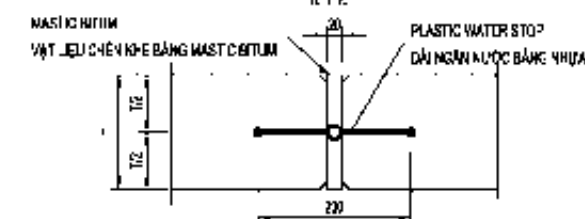
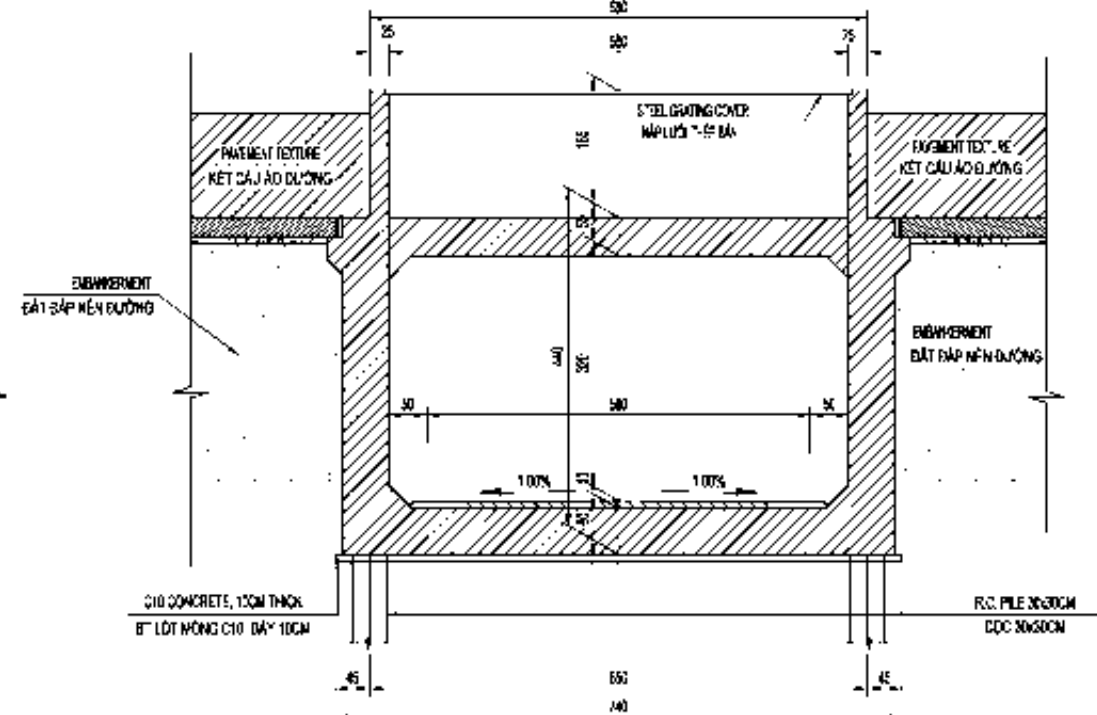
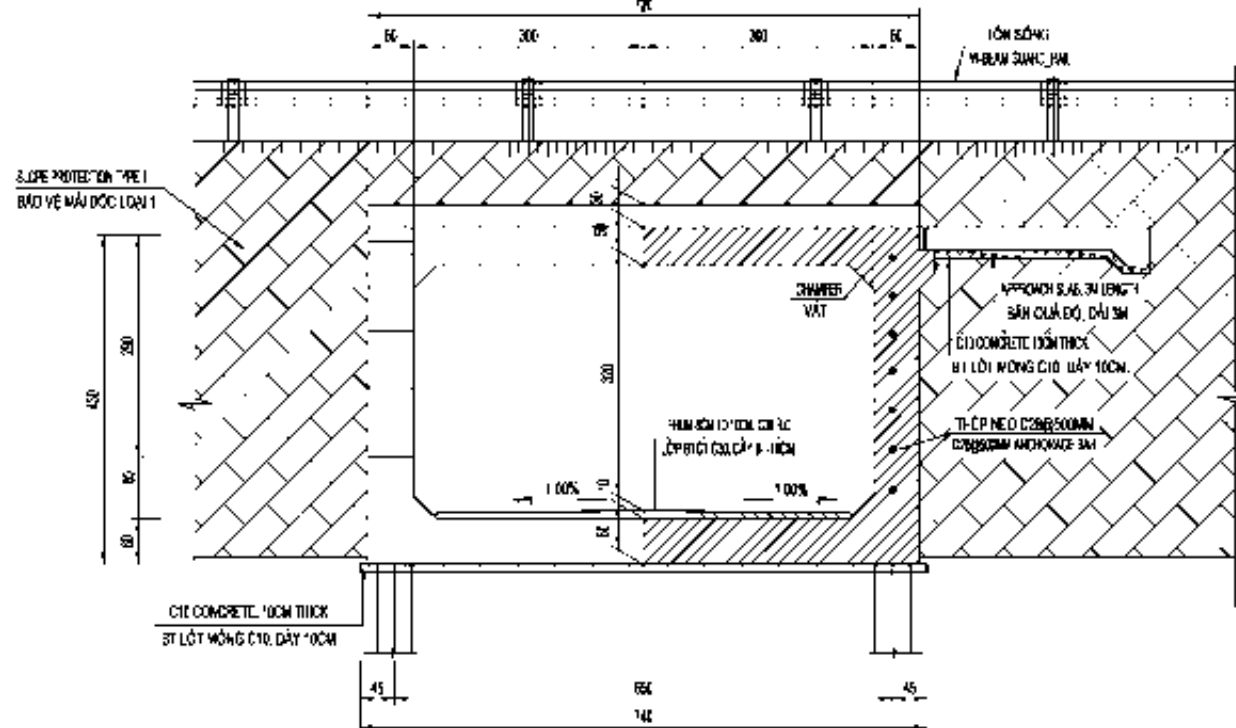
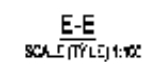
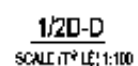
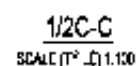
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-UO-020
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: GENERAL VIEW OF UNDERPASS CULVERT (4.5x3.2)M BỐ TRÍ CHUNG CÔNG CHUI (4.5x3.2)M			SCALE:
											AS SHOWN

50A.E (T² L²) 1:200

U.S. FILE NUMBER
DATE FILED


FILE NO. 100-100000
DATE OF REVISION

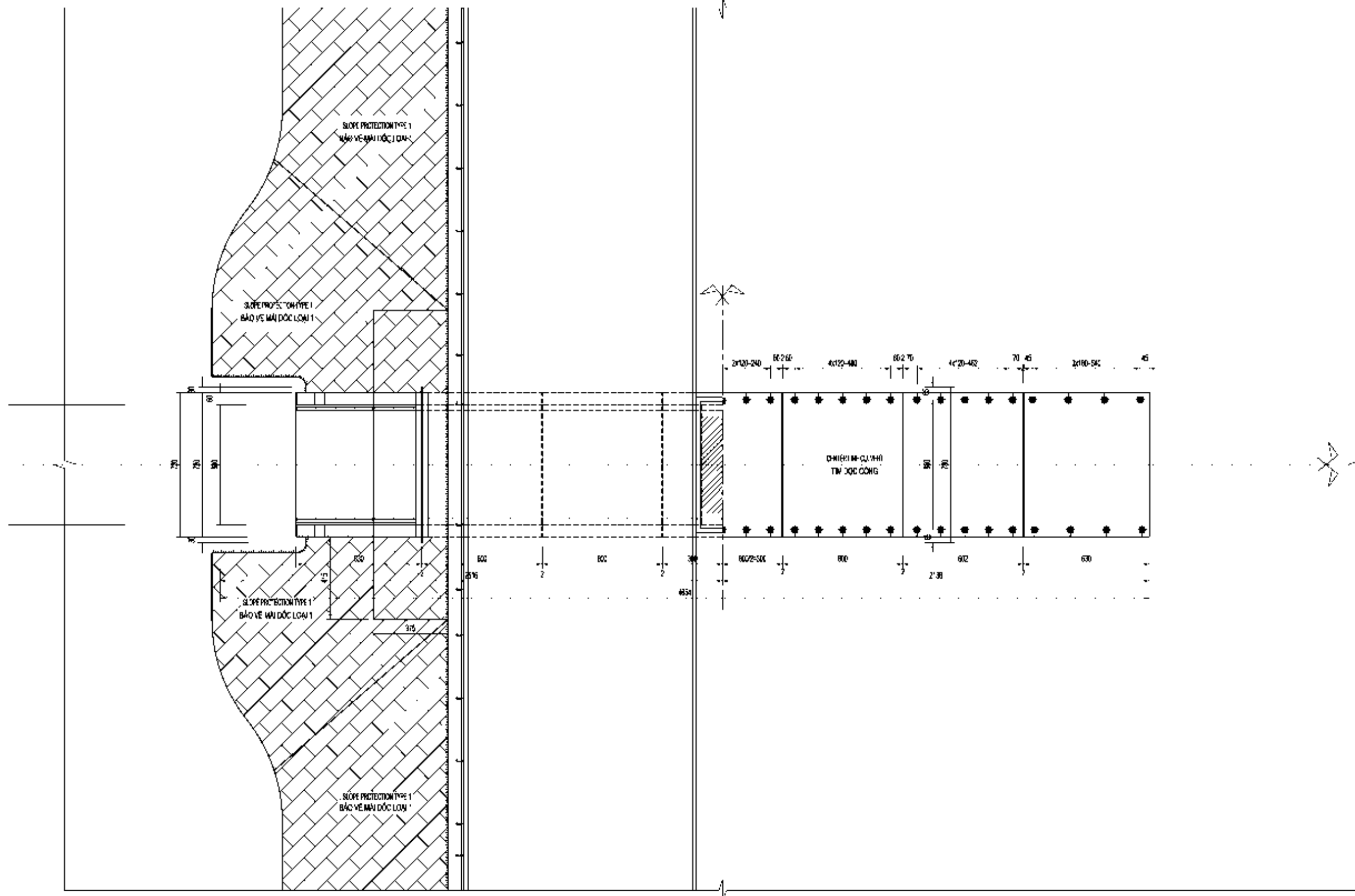
RC FILE NUMBER
CONTINUATION



MC1E9

1. ALL DIMENSIONS ARE IN CM
KÍCH THƯỚC TRONG BẢN VẼ CHỈ RA SỐ CM
2. LENGTH OF PIPE SHALL BE CHOSN BASED ON THE RESULT OF TEST LOADING
CHIỀU DÀI CỌC ĐƯỢC CHỌN DỰA VÀO KẾT QUẢ THỬ TẢI NGỒA HIỆN TRƯỜNG
3. THE NUMBER OF P.P.PE CONNECTIONS IS NOT MORE THAN 50% ON THE SAME SECTION
CỌC ĐƯỢC BẮT TRÙNG HỢNG CẦN SỐNG NƠI TRÊN GIỚI 1 MẶT CẮT

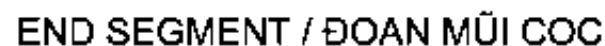
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-UQ-0300
								1	FEB-2010	FINAL DRAWING	
						DRAWING TITLE:				SCALE :	
						(1/2) GENERAL VIEW OF UNDERPASS CULVERT (6.0x3.2)M BỐ TRÍ CHUNG CÔNG CHUI (6.0x3.2)M				AS SHOWN	
TITLE:	NAME:	SIGNATURE:									
PREPARED BY:	Nguyen Thanh PHUONG										
CHECKED BY:	Le Ngoc HIEU										
APPROVED BY:	Timothy COLLETT										

1/2A - A
SCALE (TỶ LỆ) 1:2001/2B - B
SCALE (TỶ LỆ) 1:200

- NOTES:
1. ALL DIMENSIONS ARE IN CM
 2. LENGTH OF PIPE SHALL BE CHOSEN BASED ON THE RESULT OF TEST LOADING
 3. THE NUMBER OF PIPE CONNECTION IS NOT MORE THAN 50% ON THE SAME SECTION

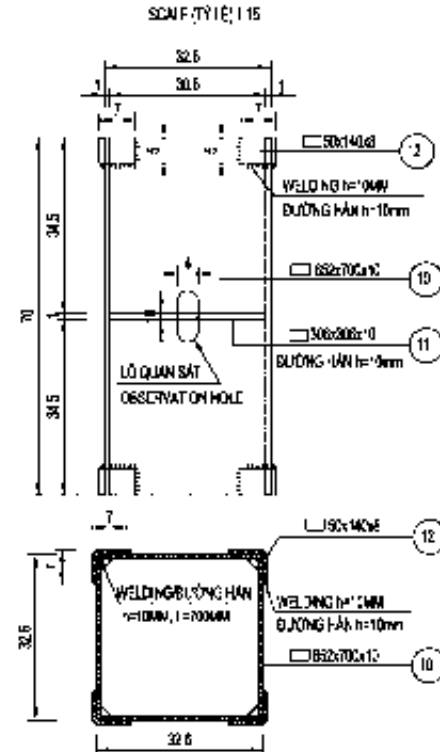
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KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-UO-040
								1	FEB-2010	FINAL DRAWING	
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								(2/2)		BỘ TRÍ CHUNG CÔNG CHUI (6.0x3.2)M	SCALE:
											AS SHOWN

934 E. P. LEE ET AL.

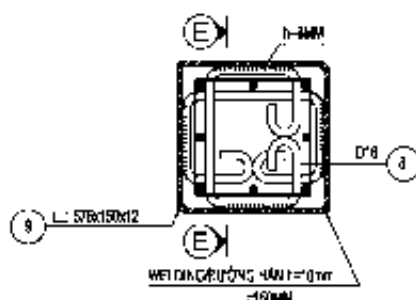


904E 71 125

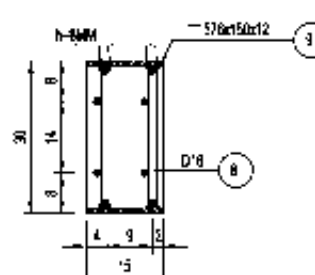
JOINTING PILE BOX
CHI TIẾT HỘP NỐI CỌC



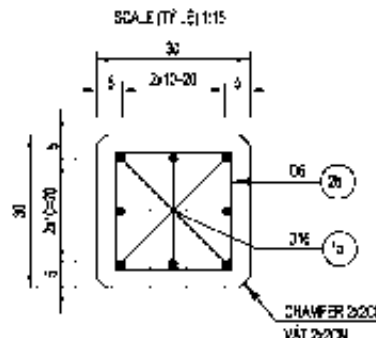
A - A₁ C - C₁
SCALE 1/4" = 1'-0"



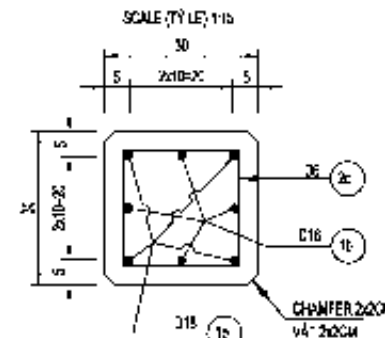
E - E
SCA.E(T)?(E)1+1



B - B



D - D



PARAMETER TABLE/THÔNG SỐ CÁC ĐÓT CỌC

TYPE / GATEWAY CODE	LENGTH OF SEGMENT L	.1	.2	P
	KOM	COM	KPM	
FIRST SEGMENT / DOT (DAI)	550	114	322	2
	650	135	380	7
	750	156	440	12
	850	176	498	17
	950	197	556	22
END SEGMENT / DOT (DAI)	550	114	322	3
	650	135	380	9
	750	156	440	13
	850	176	498	18
	950	197	556	23

FILE COMPÔMENT / SƠ ĐỒ NỘI CỘC

FILE COMPONENT / SƠ ĐỒ NỘI CỘT	
Pile Length / Chiều dài cọc	Pile component / Tổ hợp
12.0m	5.5m+6.5m 6.5m+5.5m
15.0m	6.5m+6.5m 8.5m+6.5m
16.0m	7.5m+6.5m 8.5m+7.5m
17.0m	7.5m+9.5m 9.5m+7.5m
18.0m	8.5m+9.5m 9.5m+8.5m

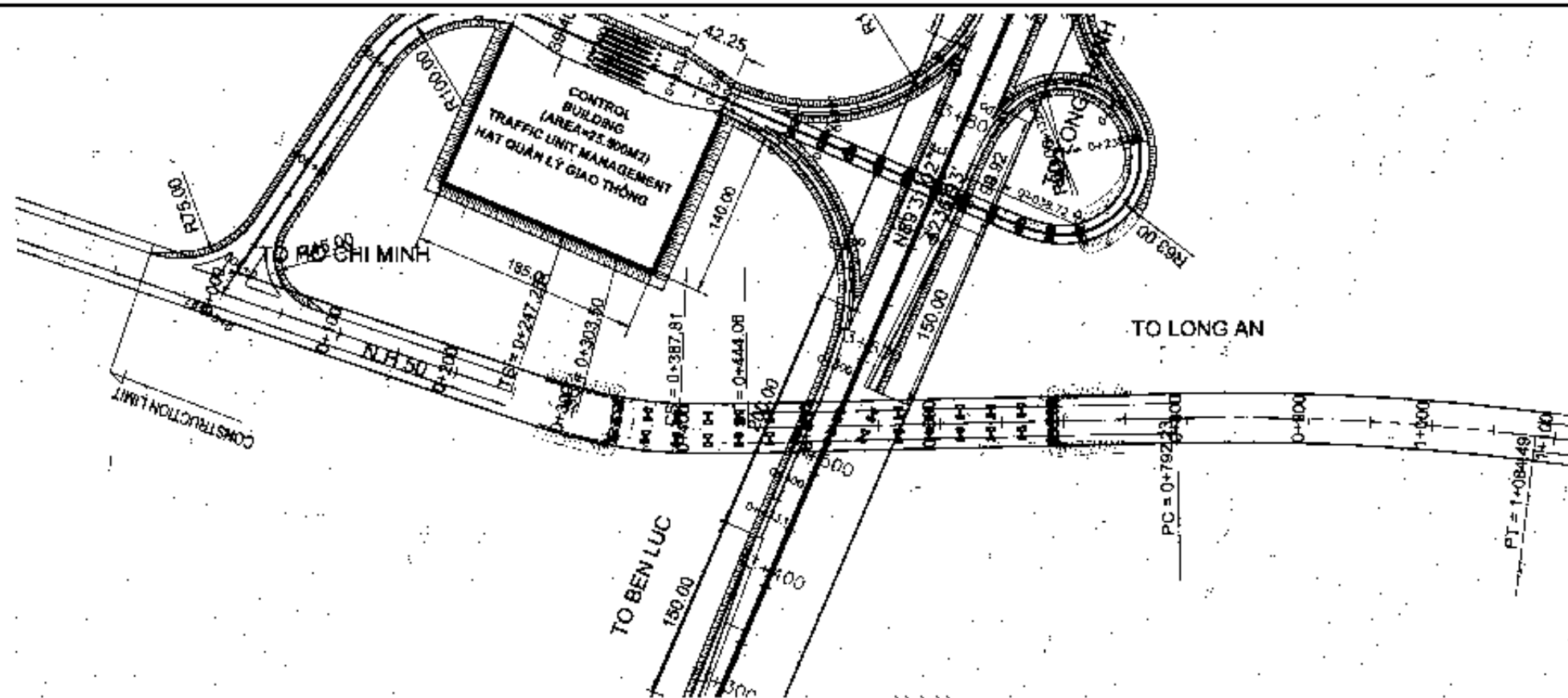
NOTES / GHI CHÚ :

ALL DIMENSIONS ARE IN CM. STEEL SHAPES ARE IN MM

KÍCH THƯỚC THÔNG DỤNG GIỮ BẰNG CM, QUY CÁCH TIẾP GIỮ BẰNG MM.

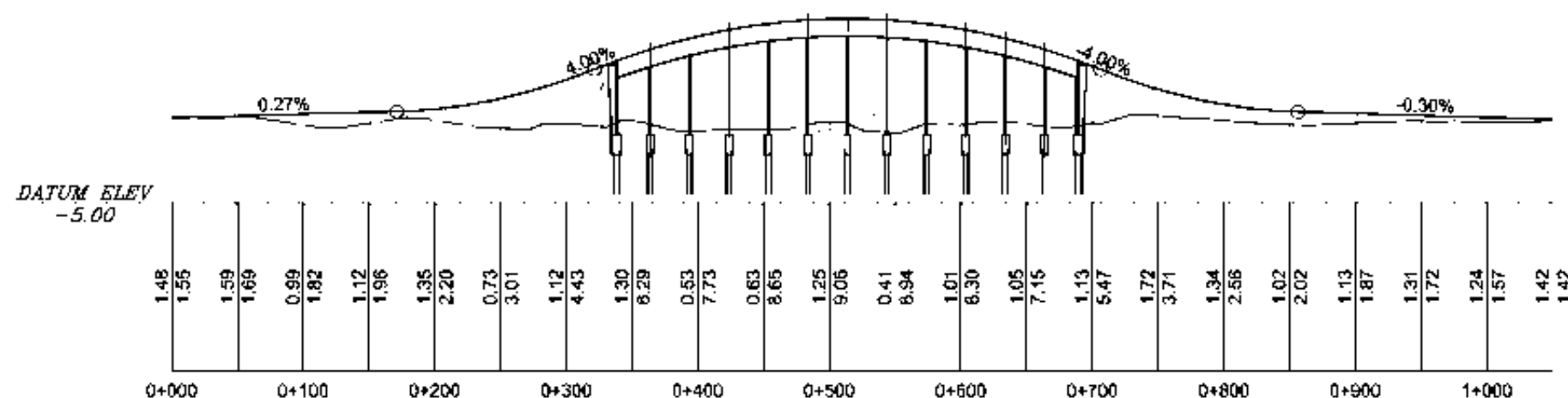
ALL DIMENSIONS ARE IN CENTIMETER OR AS SHOWN
KÍCH THƯỚC TRONG BẢN VẼ LÀ CM HOẶC ĐƯỢC THỂ HIỆN BẰNG

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:		
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-UO-050		
								1	FEB-2010	FINAL DRAWING			
						DRAWING TITLE:		DETAIL OF R.C PILE (30X30)CM					SCALE : AS SHOWN
								CÁU TẠO CỌC BÊ TÔNG CỘT THÉP (30X30)CM					



PVI STA = 0+246.23 PVI ELEV = 2.23 A.D. = 3.73 K = 40.27 150.00m VC	HIGH POINT ELEV = 9.08 HIGH POINT STA = 0+513.73 PVI STA = 0+513.73 PVI ELEV = 12.83 A.D. = -8.00 K = 48.13 385.00m VC	PVI STA = 0+781.23 PVI ELEV = 2.23 A.D. = 3.70 K = 40.54 150.00m VC
---	--	---

BVCS: 0+171.23 BVCE: 2.02	BVCS: 0+321.23 BVCE: 5.23	BVCS: 0+706.23 BVCE: 5.23	EVCS: 0+856.23 EVCE: 2.00
------------------------------	------------------------------	------------------------------	------------------------------



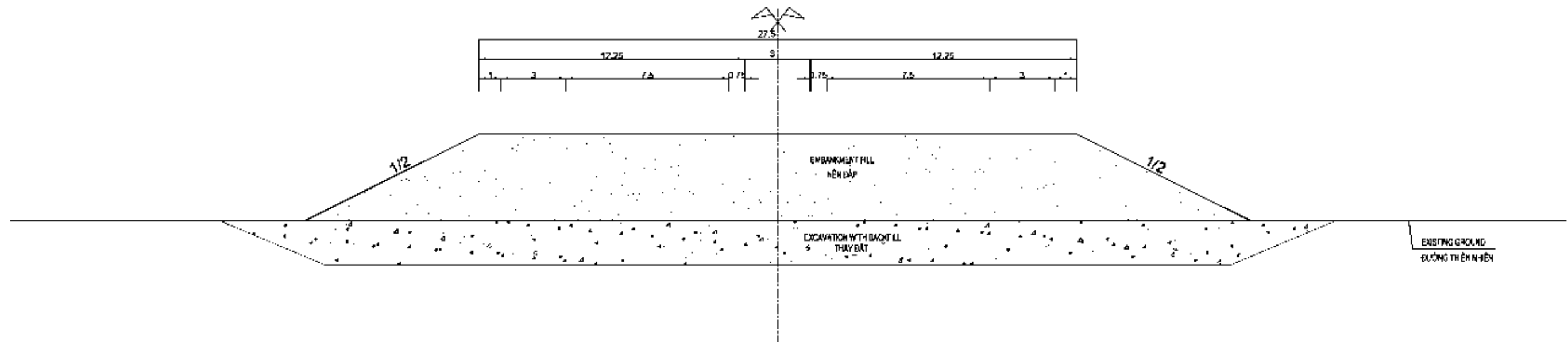
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: PLAN AND PROFILE OF N.H 50 FLYOVER BÌNH ĐỘ VÀ TRẮC ĐỌC CẦU VƯỢT QUỐC LỘ 50		0	NOV-2008	DRAFT FINAL DRAWING	RW-UO-060
								1	FEB-2010	FINAL DRAWING	
											SCALE:
											H=1:5000, V=500

VII: Soft Soil Treatment

VII: Xử lý đất yếu

TYPICAL CROSS SECTION OF SOIL REPLACEMENT METHOD
MẶT CẮT NGANG ĐIỂN HÌNH XỬ LÝ ĐẤT YẾU BẰNG PHƯƠNG PHÁP THAY ĐẤT

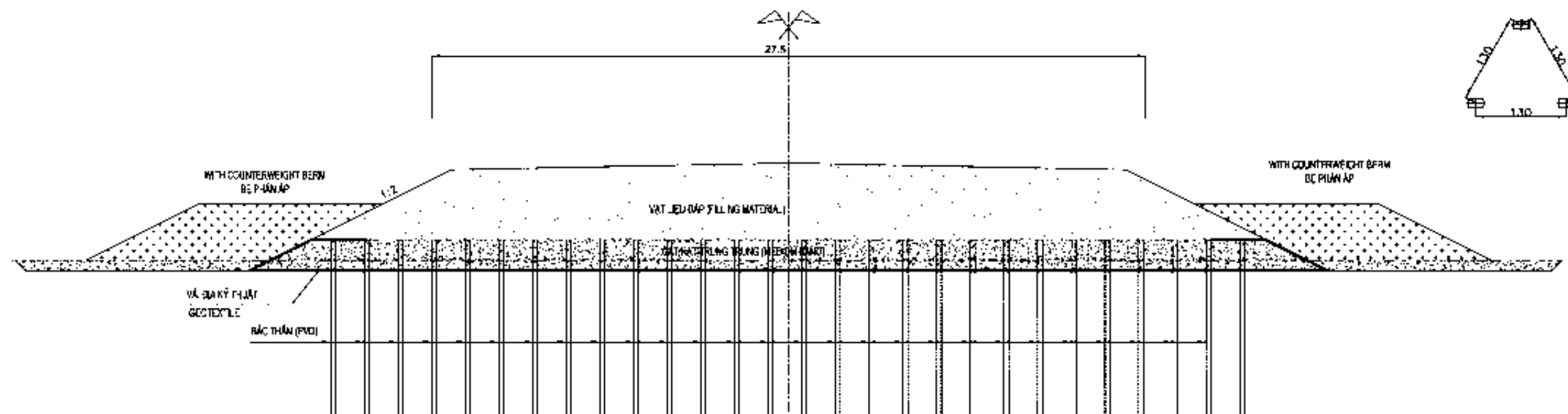
SCALE - TỶ LỆ 1:200



TYPICAL CROSS SECTION OF VACUUM CONSOLIDATION METHOD
MẶT CẮT NGANG ĐIỂN HÌNH XỬ LÝ ĐẤT YẾU BẰNG PHƯƠNG PHÁP HÚT CÓ KẾT CHẶN KHÔNG

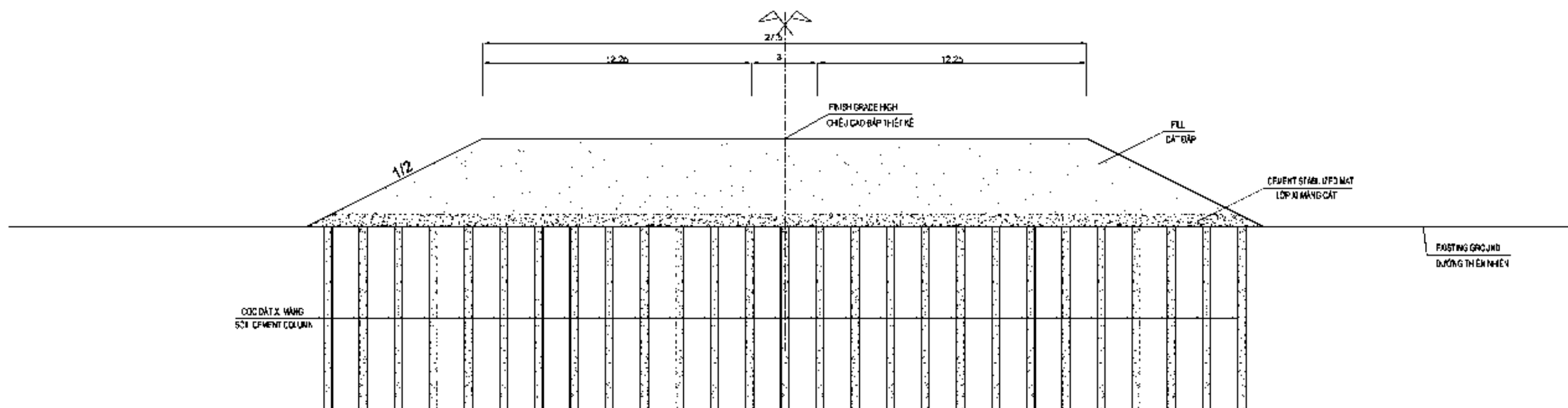
SCALE - TỶ LỆ 1:200

SƠ ĐỒ BỐ TRÍ BẮC THÂM
PVD ARRANGEMENT MODEL

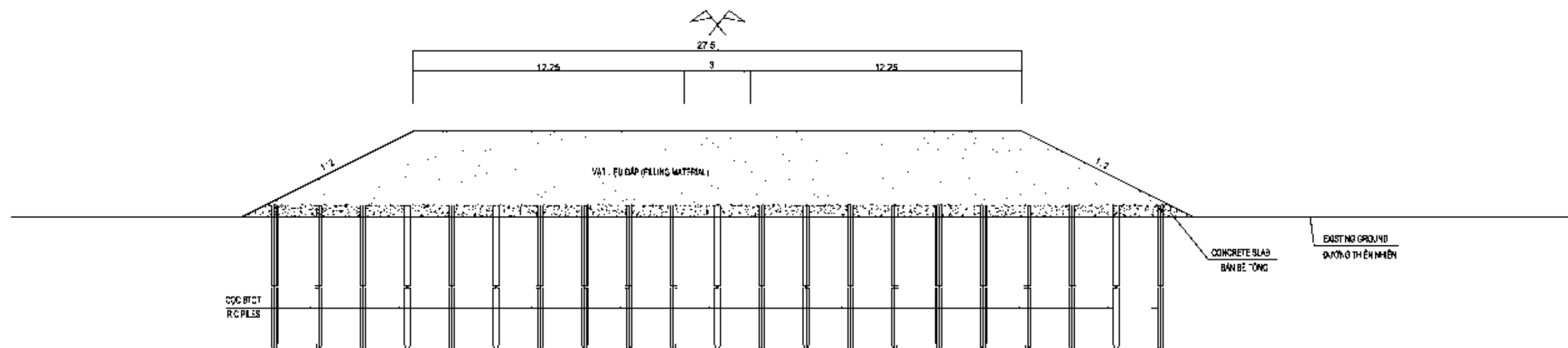





CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:			
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-GT-010			
								1	FFB-2010	FINNAL DRAWING				
								DRAWING TITLE:						SCALE:
								(1/2) TYPICAL CROSS-SECTION OF GROUND IMPROVEMENT MẶT CẮT NGANG ĐẠI DIỆN XỬ LÝ NỀN ĐẤT YẾU				1:200		
TITLE				NAME		SIGNATURE								
PREPARED BY				Nguyen Cao SON										
CHECKED BY				A. Ngoc HIEU										
APPROVED BY				Timothy COLLETT										

SCALE - 7 LE 1.200

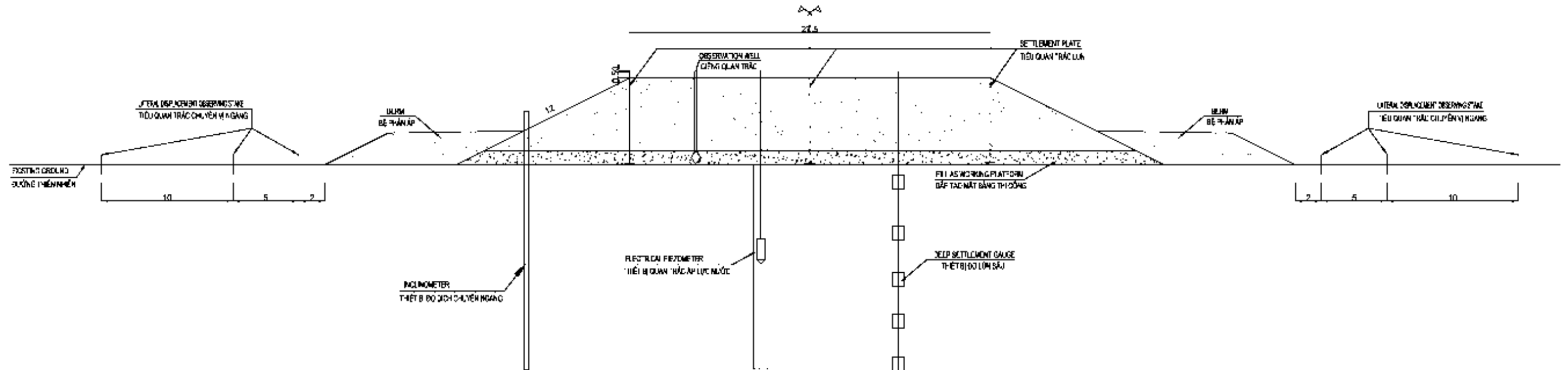


SCALE 1/4" = 1'-0"



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.	
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				TITLE	NAME	SIGNATURE	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-GT-020
				PREPARED BY	Nguyen Cao SON		VIETNAM EXPRESSWAY CORPORATION (VEC)		1	FFB-2010	FINAL DRAWING	
				CHECKED BY	Tr. Ngoc HIEU		DRAWING TITLE:					SCALE :
				APPROVED BY	Timothy COLLETT		(2/2) TYPICAL CROSS-SECTION OF GROUND IMPROVEMENT					1:200
							MẶT CẮT NGANG ĐẠI DIỆN XỬ LÝ NỀN ĐẤT YẾU					

TYPICAL CROSS SECTION OF MONITORING INSTRUMENT FOR VACUUM CONSOLIDATION METHOD
MẶT CẮT NGANG ĐIỂN HÌNH BỘ TRÍ THIẾT BỊ QUAN TRẮC CHO PHƯƠNG PHÁP HÚT CÔ KẾT CHÂN KHÔNG



CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO	TITLE	NAME	SIGNATURE	VIETNAM EXPRESSWAY CORPORATION (VEC)	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT	TYPICAL CROSS-SECTION OF INSTRUMENT LAYOUT CẮT NGANG ĐẠI DIỆN BỘ TRÍ THIẾT BỊ QUAN TRẮC		0	NOV-2009	DRAFT FINAL DRAWING	RW-GT-030
	PREPARED BY	Nguyen Cao SON						1	FFB-2010	FINAL DRAWING	
	CHECKED BY	Ngoc HIEU									SCALE: 1:200
	APPROVED BY	Timothy COLLETT									

VIII: Traffic Safety

VIII: An Toàn Giao Thông

Technical drawing of a road cross-section showing lane widths, shoulder widths, and various types of drainage ditches (VẠCH SỐ 1, VẠCH SỐ 2, VẠCH SỐ 4) and a central drainage structure. The drawing includes dimensions in meters and a note about a drainage structure for bus resistance.

Dimensions (m):

- Total width: 27.50
- Shoulder width (left): 3.00
- Shoulder width (right): 3.00
- Lane width (left): 11.75
- Lane width (right): 11.75
- Central drainage structure width: 2.00
- Distance from shoulder to central structure (left): 2.00
- Distance from shoulder to central structure (right): 2.00

Notes:

- SHOULDER FOR DAZZLING RESISTANCE: 3M TREE WITH BUS-10.40 BM
- CÂY BỤI CHỐNG LÒA: 3M CÂY BỤI CÂY RỒNG 0.40 BM

Labels for drainage ditches:

- TYPE 4 VẠCH SỐ 4
- TYPE 2 VẠCH SỐ 2
- TYPE 4 VẠCH SỐ 4
- TYPE 4 VẠCH SỐ 4
- TYPE 2 VẠCH SỐ 2
- TYPE 4 VẠCH SỐ 4

Gradients: 4.00%, 2.00%, 4.00%

Scale: 1:200

Technical drawing of a road cross-section showing two lanes with shoulders, grass, and guard rails. The drawing includes dimensions in meters and labels for various components.

Left Side (from outside in):

- FENCE
- MANG NAO
- DECK
- SHOULDER
- REINFORCED SHOULDER
- GRASS
- GUARD RAIL
- LA CAN TON SONG

Right Side (from outside in):

- SHOULDER
- REINFORCED SHOULDER
- GRASS
- GUARD RAIL
- LA CAN TON SONG

Dimensions (meters):

- Left Lane: 3.000
- Left Shoulder: 0.750
- Grass: 0.750
- Right Lane: 3.000
- Right Shoulder: 0.750
- Grass: 0.750
- Guard Rail: 0.750
- La Can Ton Song: 0.750

ALL DIMENSIONS ARE IN MM
KÍCH THƯỚC BÀN VẼ 11NH BẰNG MM
DETAIL PAVEMENT MARKING FIXED IN 22TON237-01 THICK OF DETAIL ROAD MARKING FIXED : 3MM
QUI GẠCH VẠCH SƠN THEO 22TON 237-01 CHỈU DÂY VẠCH SƠN : 3MM
PAVEMENT MARKING : RETRO - REFLECTIVE MATERIAL (MARKED THERMOPLASTIC PAINT FIXED IN 22TON 282-02)
VẠCH SƠN : SƠN BĂNG VẬT LIỆU PHẢN QUANG (SƠN NHẬT DẪO THEO 22TON 282-02)

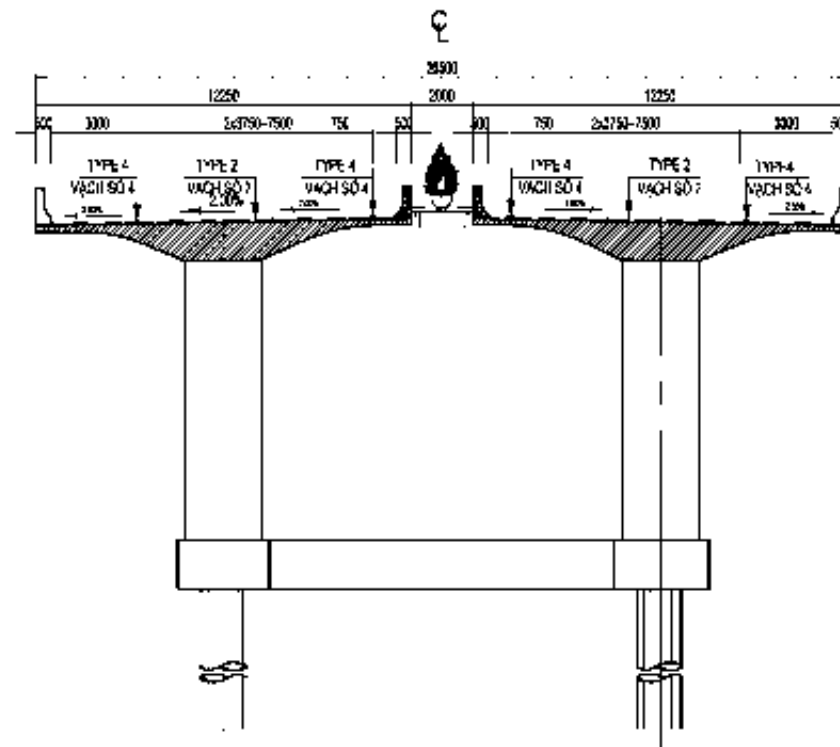
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KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-TS-010			
								1	FEB-2010	FINAL DRAWING				
						PREPARED BY		Nguyen Thanh PHUONG		DRAWING TITLE:		DETAILS OF PAVEMENT MARKING (1/3) CHI TIẾT VẠCH SƠN (1/3)		SCALE :
						CHECKED BY		Le Ngoc HIEU						1:250
APPROVED BY		Timothy COLLETT												

DETAILS OF ROAD MARKING CHI TIẾT VẠCH SƠN

TYPICAL SECTION
MẶT CẮT ĐẠI DIỆN

SCALE 1:250

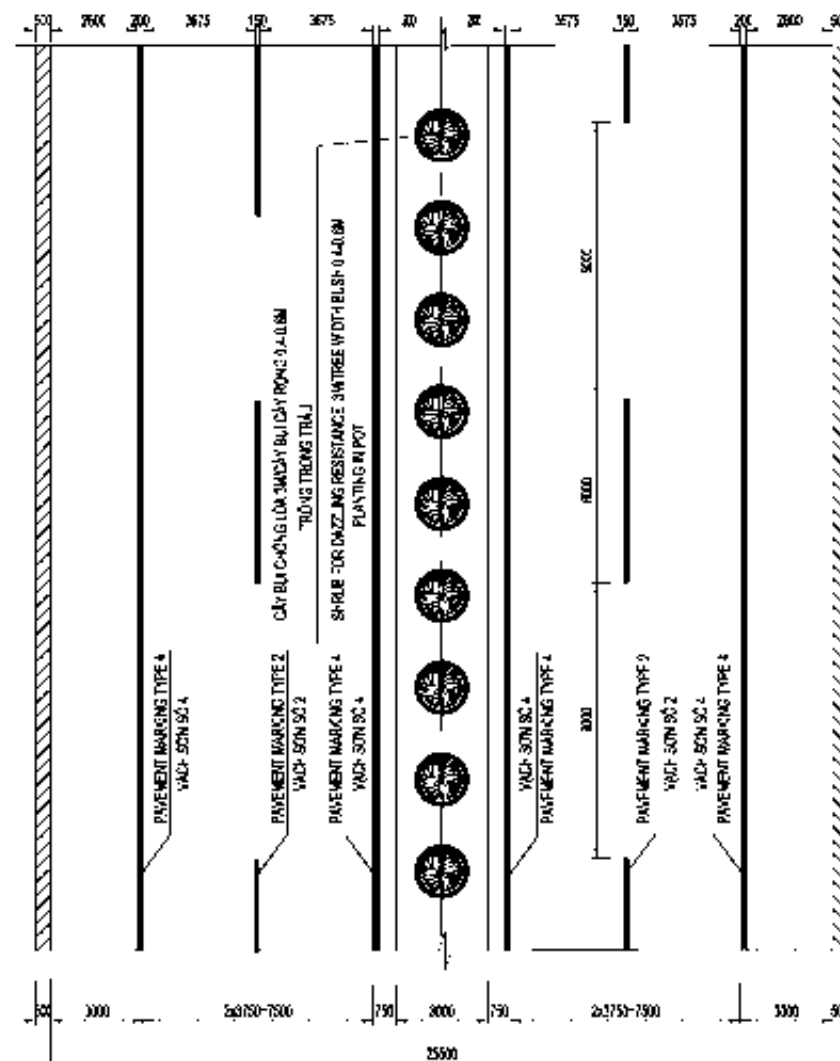
TỶ LỆ 1:250



PLAN
MẶT BẰNG

SCALE 1:250

TỶ LỆ 1:250



NOTES:

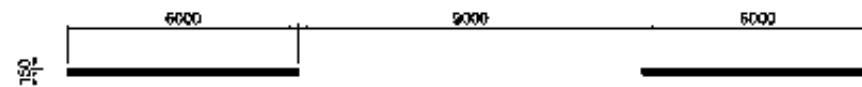
- ALL DIMENSIONS ARE IN MM
- KÍCH THƯỚC RẪN VẪ TÍNH RẰNG MM
- DETAIL PAVEMENT MARKING FIXED IN 22TCN 237-01. THICK OF DETAIL ROAD MARKING FIXED : 3MM
- QUI CÁCH VẠCH SƠN THEO 22TCN 237-01. CHIỀU DÀY VẠCH SƠN : 3MM
- PAVEMENT MARKING: RETRO REFLECTIVE MATERIAL (MARKED THERMOPLASTIC PAINT FIXED IN 22TCN 282-02)
- VẠCH SƠN: SƠN BĂNG VẬT LIỆU PHẢN QUANG (SƠN NHIỆT DẪO THEO 22TCN 282-02)

2:1000 Final Draft Drawing (Highway Engineering) / 28 Traffic Safety / RW-TS-020.dwg, AutoCAD

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: DETAILS OF PAVEMENT MARKING (2/3) CHI TIẾT VẠCH SƠN(2/3)		0	NOV-2009	DRAFT FINAL DRAWING	RW-TS-020
								1	FEB-2010	FINAL DRAWING	
										SCALE:	1:250

DETAILS OF PAVEMENT MARKING

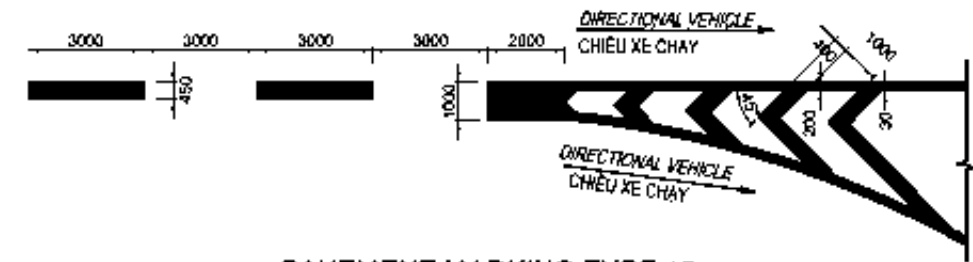
CHI TIẾT VẠCH SƠN



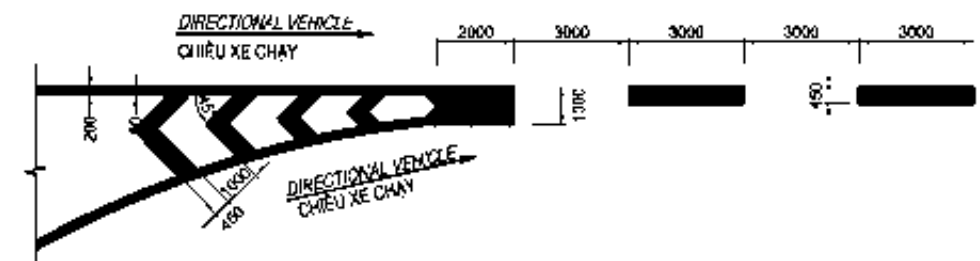
PAVEMENT MARKING TYPE 2
WHITE BROKEN LINES
VẠCH SỐ 2 - VẠCH PHÂN TUYẾN CÁC LÀN XE
VẠCH ĐỨT QUẢNG MÀU TRẮNG
SCALE 1:20



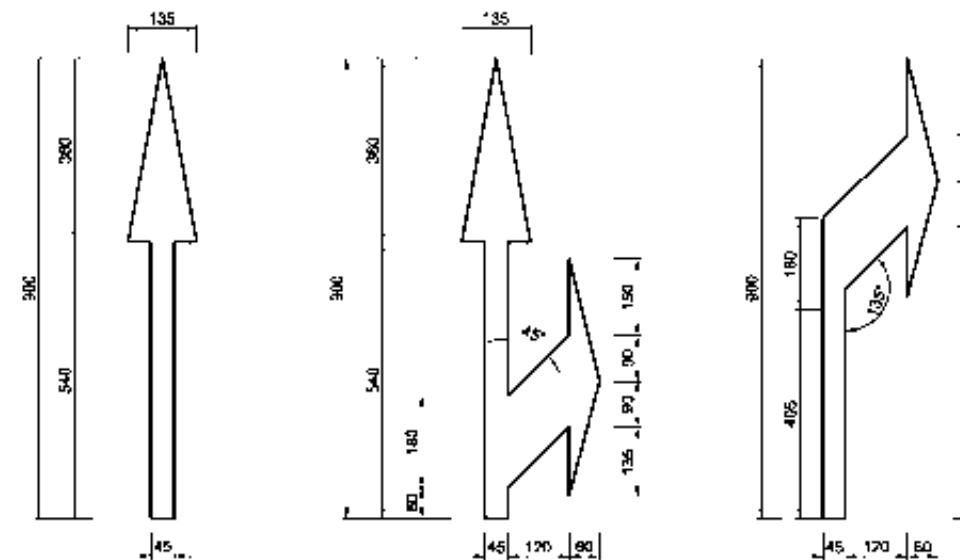
PAVEMENT MARKING TYPE 4
OUTSIDE SOLID LINES (WHITE)
VẠCH SỐ 4 - VẠCH MỀP NGOÀI LÀN XE
VẠCH ĐƠN LIỀN NÉT MÀU TRẮNG
SCALE 1:20



PAVEMENT MARKING TYPE 15
VẠCH SỐ 15 - VẠCH TÁCH DÒNG (SƠN MÀU TRẮNG)
SCALE 1:20



PAVEMENT MARKING TYPE 17
VẠCH SỐ 17 - VẠCH NHẬP DÒNG
SCALE 1:20



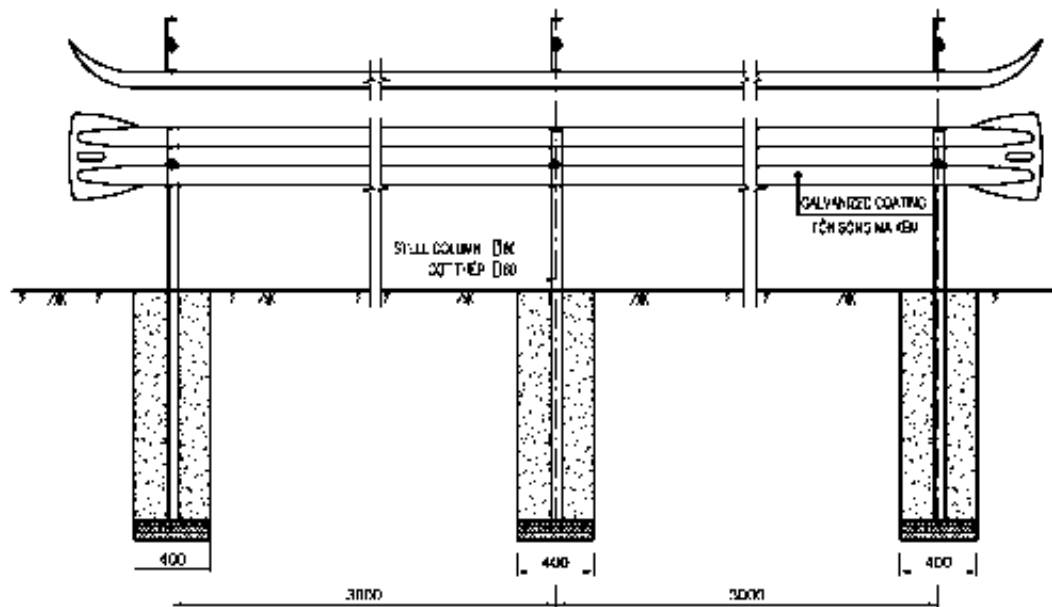
PAVEMENT MARKING TYPE 26
DIRECTIONAL ARROW (WHITE)
VẠCH SỐ 26 - MŨI TÊN CHỈ HƯỚNG (SƠN MÀU TRẮNG)
SCALE 1:15

NOTES

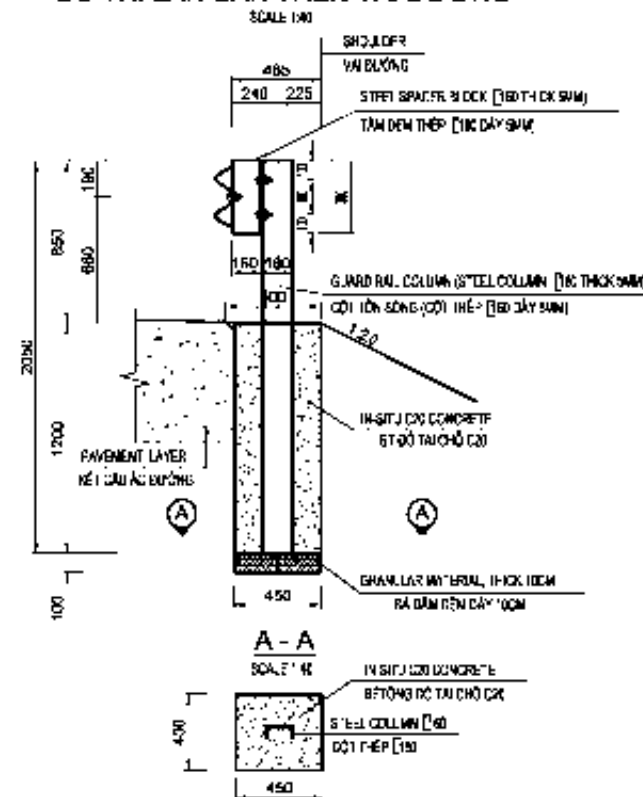
DETAIL ROAD MARKING FIXED IN 22TCN237-01
QUY CÁCH VẠCH SƠN ĐƯỢC QUY ĐỊNH THEO ĐIỀU LỆ BẮC HIỆU DƯỠNG BỘ 22TCN 237-01
ALL DIMENSION IN DRAWING ARE IN MM
KÍCH THƯỚC TRONG BẢN VẼ ĐỀU ĐƠN VỊ MM

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-TS-030
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE:		DETAILS OF PAVEMENT MARKING (3/3) CHI TIẾT VẠCH SƠN (3/3)	SCALE:
										AS SHOWN	

GENERAL GUARD RAIL
BỘ TRÍ CHUNG LAN CAN TÔN SÔNG

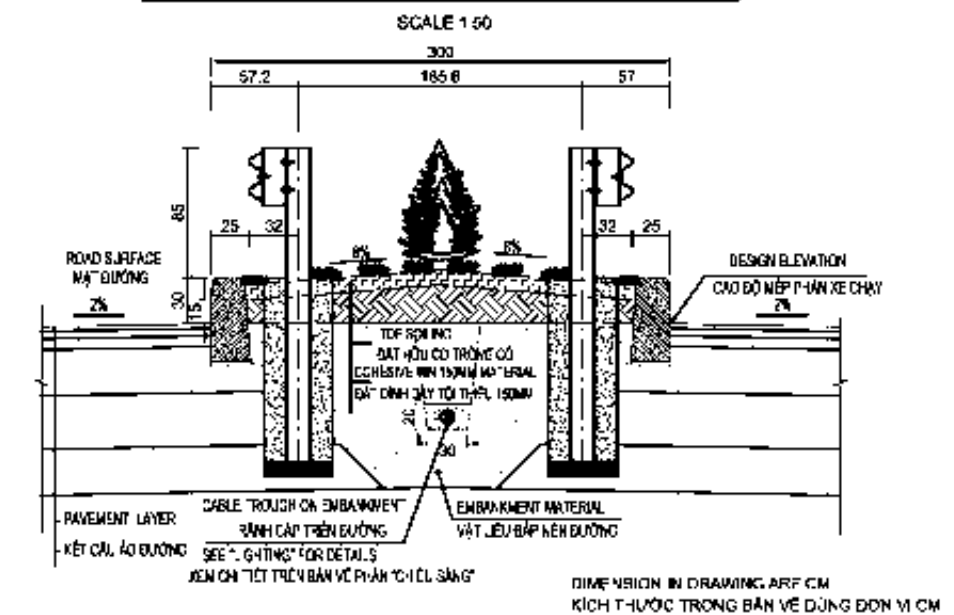


ARRANGEMENT GUARD RAIL (IN SHOULDER)
BỘ TRÍ LAN CAN TRÊN VAI ĐƯỜNG

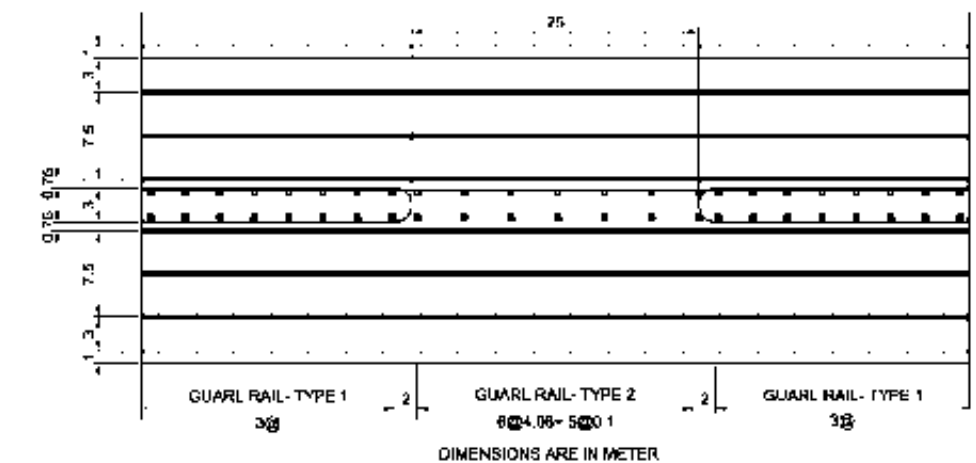


DETAILS OF GUARD RAIL- TYPE 1
CHI TIẾT LAN CAN TÔN SÔNG- LOẠI 1

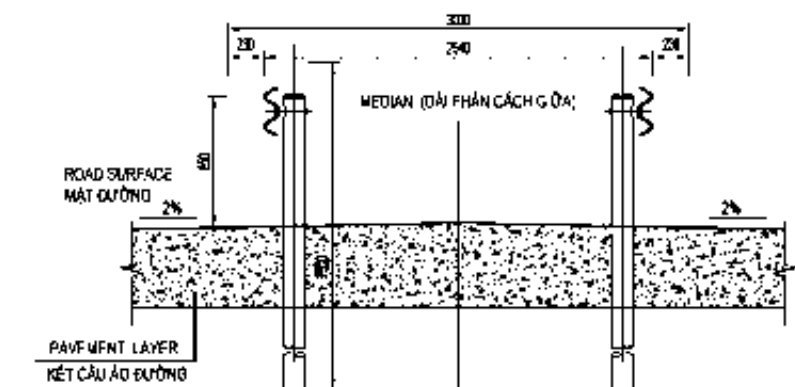
ARRANGEMENT GUARDRAIL (IN MEDIAN)
BỘ TRÍ LAN CAN TÔN SÔNG (DÀI PHÂN CÁCH)



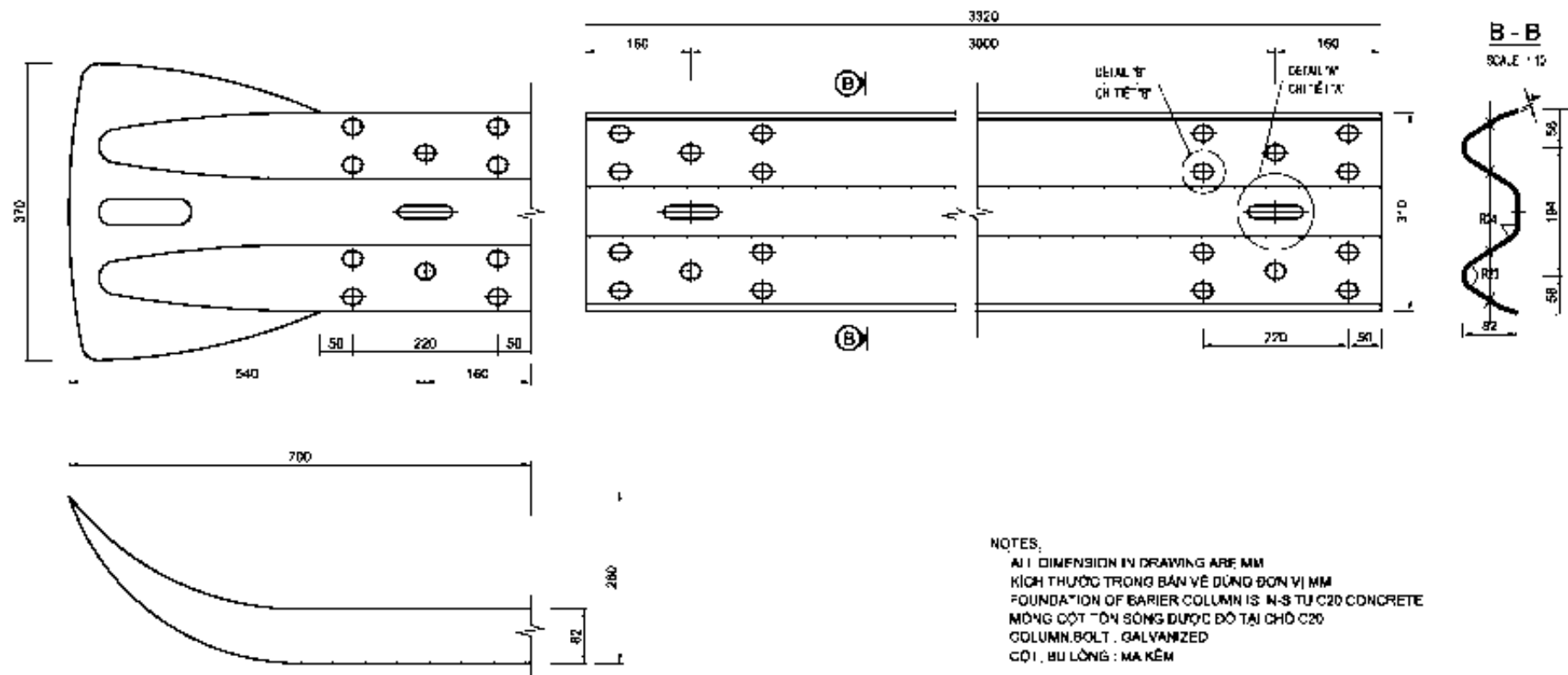
DETAIL FOR EMERGENCY CROSSING
BỘ TRÍ CHỖ QUAY ĐẦU XE KHẨN CẤP



ARRANGEMENT GUARD RAIL (IN MEDIAN)
BỘ TRÍ LAN CAN TRÊN DẢI PHÂN CÁCH



DETAIL OF FITTING
CHI TIẾT THANH LAN CAN TÔN SÔNG



NOTES:
ALL DIMENSION IN DRAWING ARE MM
KÍCH THƯỚC TRONG BẢN VẼ DÙNG ĐƠN VỊ MM
FOUNDATION OF BARRIER COLUMN IS M-S TỰ C20 CONCRETE
MÔNG CỘT TÔN SÔNG ĐƯỢC ĐÓ TẠI CHỖ C20
COLUMN BOLT : GALVANIZED
CỘT, BU LÔNG : MÀ KÉM

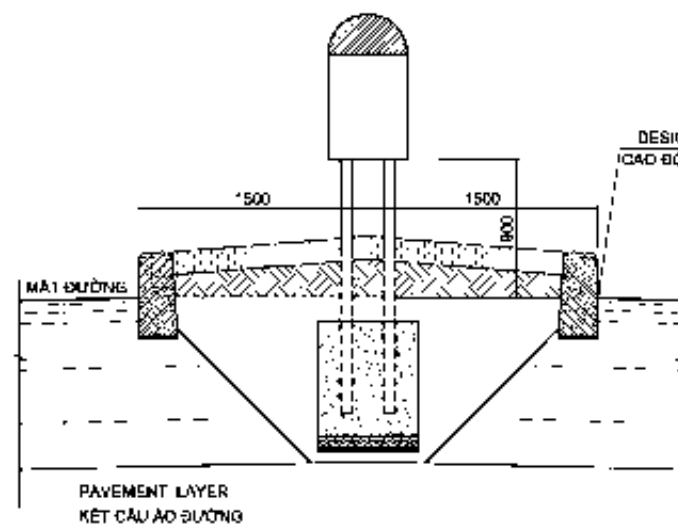
21/10/2010 Final Draft Drawing (Highway Engineering) 028 Traffic Safety/04 TS-040.dwg, A40x6, P05

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-TS-040
								1	FEB-2010	FINAL DRAWING	
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT				VIETNAM EXPRESSWAY CORPORATION (VEC)		ASIAN DEVELOPMENT BANK		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		DETAILS OF GUARD RAIL CHI TIẾT LAN CAN TÔN SÔNG	SCALE: AS SHOWN

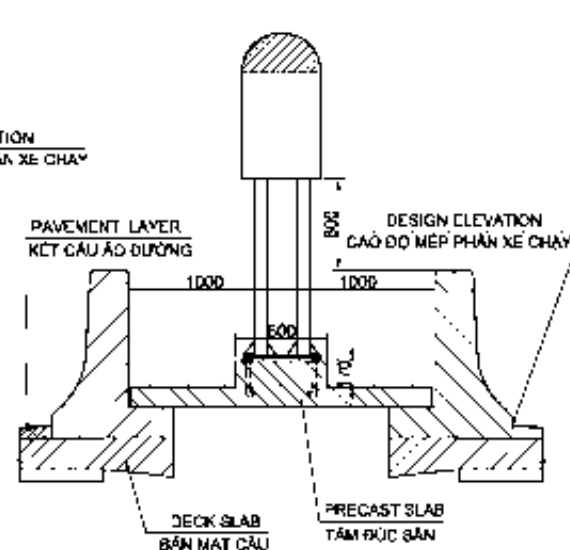
DETAILS OF KM POST AND LANDMARK CHI TIẾT CỘT LÝ TRÌNH VÀ MỐC LỘ GIỚI

QUANTITY FOR 01 KM POST
KHỐI LƯỢNG CHO 1 CỘT KM

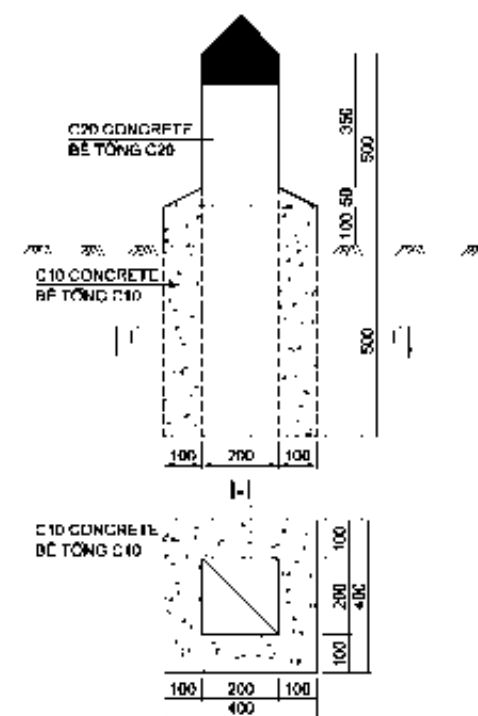
ARRANGEMENT KM POST (ON ROAD)
BỐ TRÍ CỘT KM (TRÊN ĐƯỜNG)



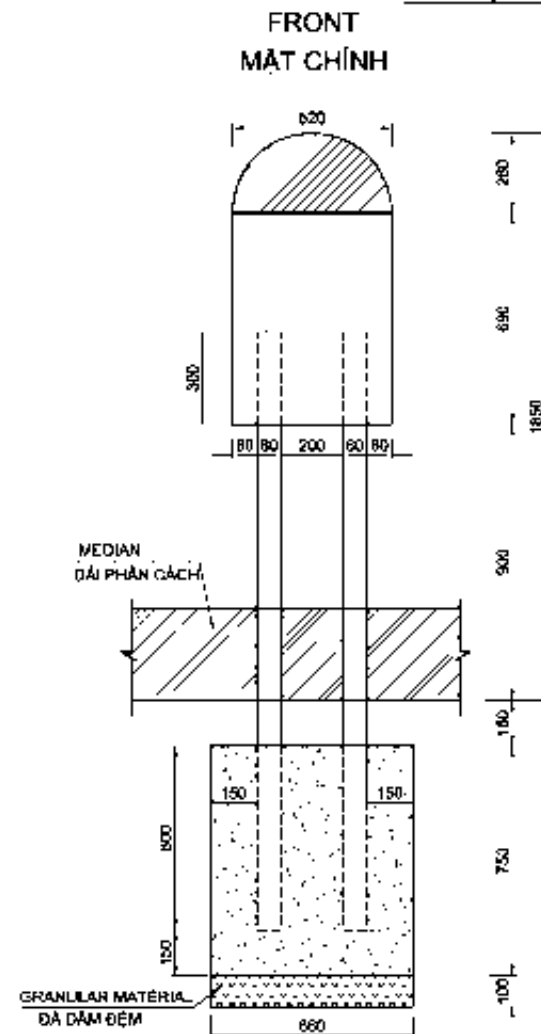
ARRANGEMENT KM POST (ON BRIDGE)
BỐ TRÍ CỘT KM (TRÊN CẦU)



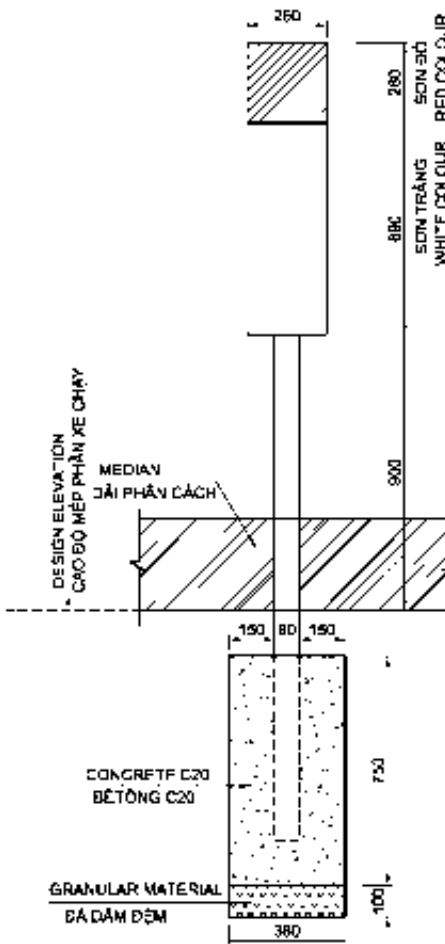
LANDMARK
MỐC LỘ GIỚI
SCALE 1:20



DETAIL KM POLE (ON ROAD)
CẤU TẠO CỘT KM (TRÊN ĐƯỜNG)

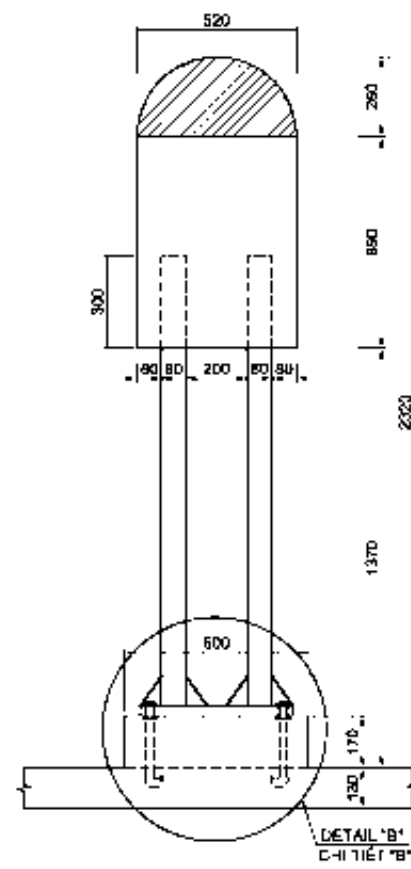


SIDE
MẶT BÊN

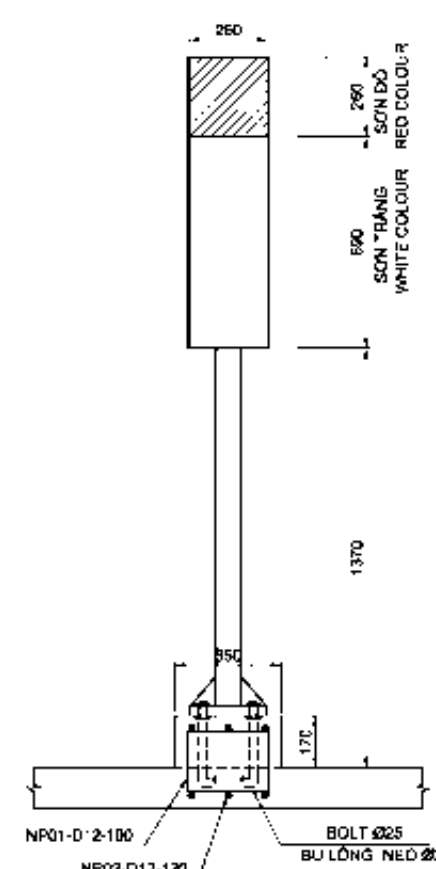


DETAIL KM POLE (ON BRIDGE)
CẤU TẠO CỘT KM (TRÊN CẦU)

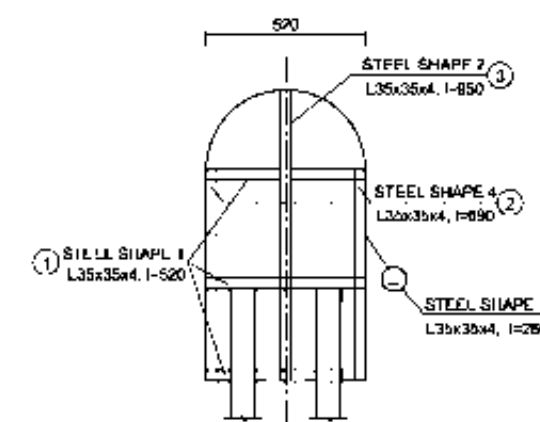
FRONT - MẶT CHÍNH



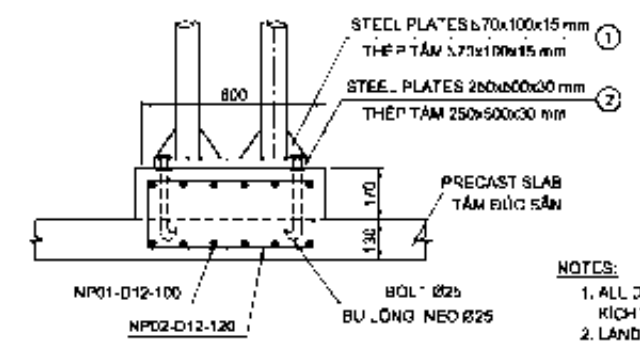
SIDE - MẶT BÊN



DETAIL FRONT SCALE 1:25
MẶT ĐỪNG CẤU TẠO



DETAIL "B"
CHI TIẾT "B"
SCALE 1:25



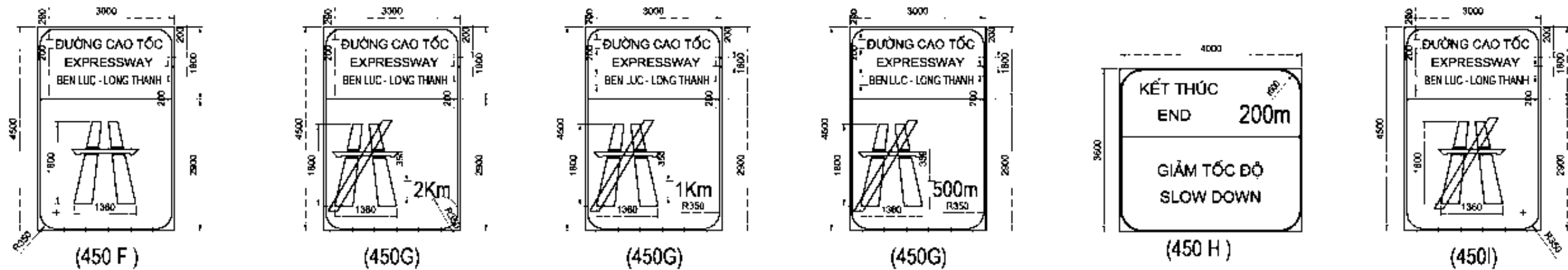
NOTES:
1. ALL DIMENSIONS ARE MM
KÍCH THƯỚC: TẤT CẢ ĐƠN VỊ: MM
2. LANDMARK: 100M/1POST
MỐC LỘ GIỚI: 100M/1 MỐC

No. STT	Structural member name	Tên cấu kiện	Unit Đơn vị	Component số bộ phận	Quantity Khối lượng
I	Box KM Post	Hộp KM			
1	Steel shape L35x35x4 L=520mm	Thép hình L35x35x4 L=520mm	Kg	5	5 452.60
2	Steel shape L35x35x4 L=690mm	Thép hình L35x35x4 L=690mm	Kg	4	5 795.2 76
3	Steel shape L35x35x4 L=950mm	Thép hình L35x35x4 L=950mm	Kg	2	3 993.1 90
4	Steel shape L35x35x4 L=250mm	Thép hình L35x35x4 L=250mm	Kg	17	5 282.4 42
	Total (on Road)	Tổng cộng (Trên Đường)			24 528.11.68
5	Paint: reflective light	Tấm dạ 2mm sơn phản quang	M2	1	1 636
II	Column KM post	Cột KM			
1	Steel pipe Ø60mm L=1.95m thick 3mm	Thép ống Ø60mm L=1.95m dày 3mm	M	2	3 9
2	Paint: reflective light (on Bridge)	Sơn phản quang (Trên Cầu)	M	2	3 94
III	Foundation KM post	Móng cột KM			
a	On Road	Trên Đường			
1	Concrete C20	Bê tông C20	M3	1	3 19
2	Rock Foundation	Đá dăm đệm	M3	1	0 025
3	Formwork	Ván khuôn	M2	1	1 50
4	Excavation	Đào đất	M3	1	3 24
b	On Bridge	Trên Cầu			
1	Steel plates 170x100x15mm	Thép tấm 170x100x15mm	Kg	9	6 594
2	Steel plates 250x500x30mm	Thép tấm 250x500x30mm	Kg	1	29 436
3	Steel bar Ø12	Thép tròn Ø12	Kg	1	10 891
iv	Steel bars are connect by weld 5mm all of length	Các thanh thép liên kết bằng đường hàn 5mm trên suốt chiều dài	M		11.68
v	Plastic pipe cap Ø90x5	Ống chụp nhựa Ø90x5	Cái		1
VI	Bu lông M12	Bu lông M12	Cái		2
VII	Bu lông neo Ø25, dài 50cm, trên cầu	Bu lông Ø25	Cái		4

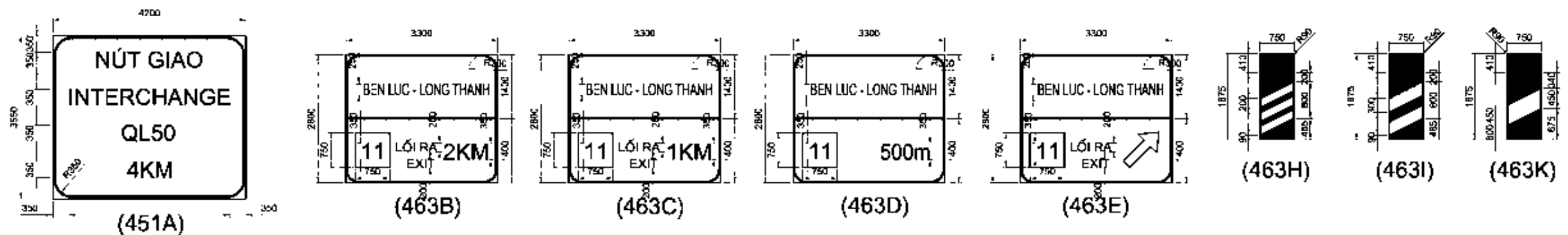
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	DW-TS-050
								-	FEB-2010	FINAL DRAWING	
								DRAWING TITLE: DETAILS OF KM POST AND LANDMARK CHI TIẾT CỘT LÝ TRÌNH VÀ MỐC LỘ GIỚI			SCALE: AS SHOWN
PREPARED BY	NAME	SIGNATURE									
CHECKED BY	NAME	SIGNATURE									
APPROVED BY	NAME	SIGNATURE									

KÍCH THƯỚC BIỂN BÁO DIMENSION OF BOARD SIGN

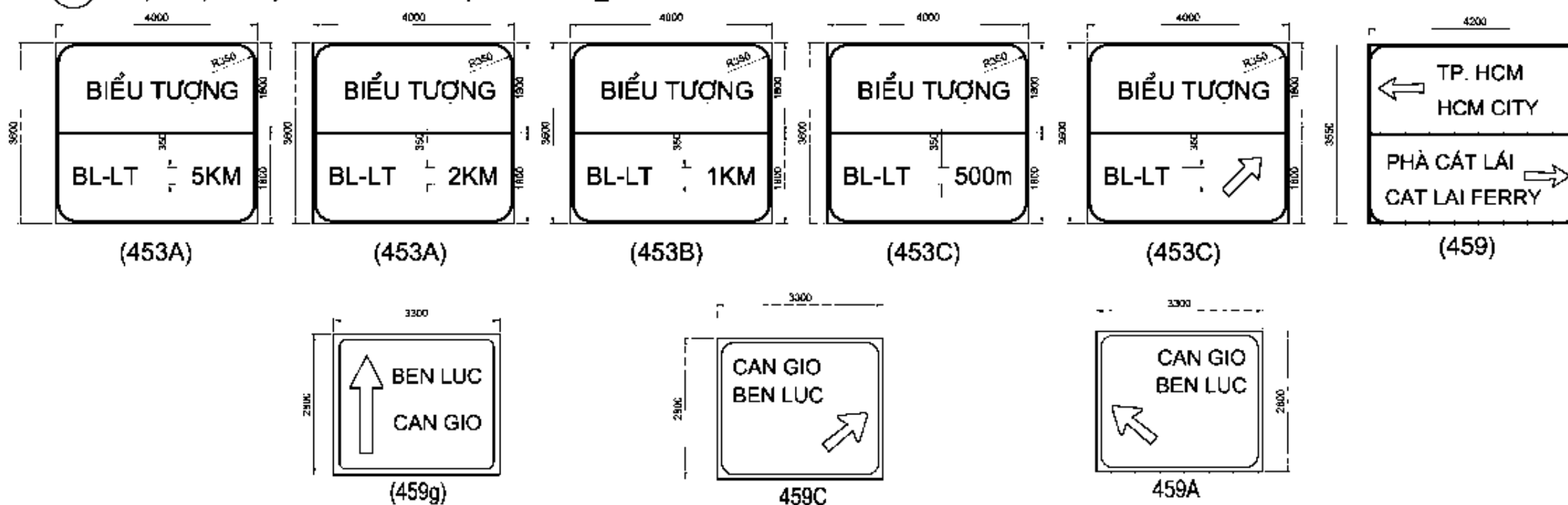
1 CỬA VÀO VÀ RA ĐƯỜNG CAO TỐC _ ENTERANCE AND END OF EXPRESSWAY



2 NÚT GIAO PHÍA TRƯỚC _ INTERCHANGE AHEAD



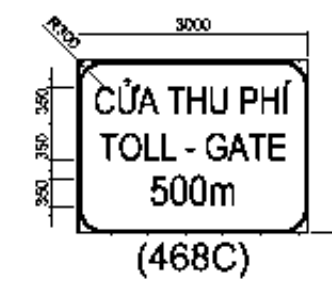
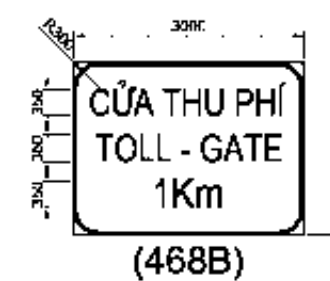
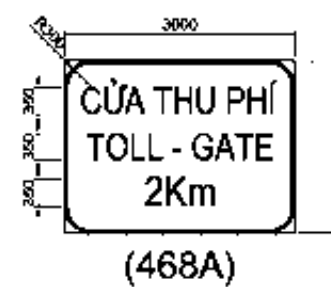
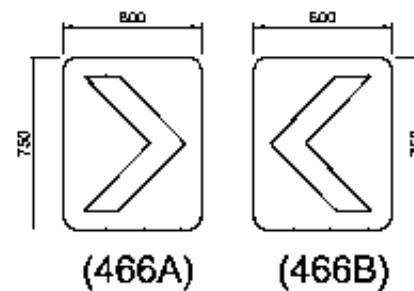
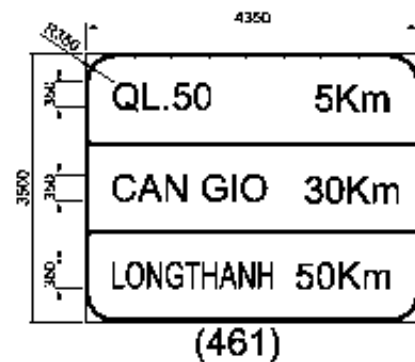
3 TRẠM DỊCH VỤ CHUNG VÀ TRẠM ĐỖ XE _ GENERAL SERVICE REST AND CAR PARK AREA



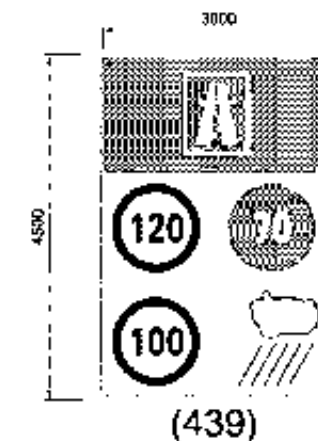
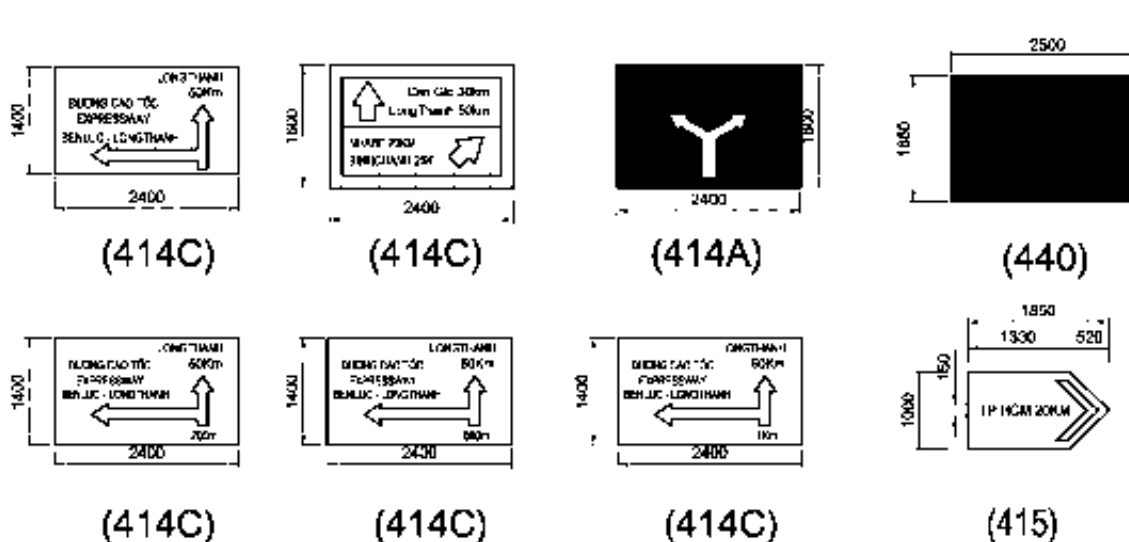
NOTES
ALL DIMENSIONS ARE IN MM
KÍCH THƯỚC BẢN VẼ ĐƠN VỊ LÀ MM

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-TS-060
								-	FEB-2010	FINAL DRAWING	
								DRAWING TITLE:		DIMENSION OF BOARD SIGNS KÍCH THƯỚC CÁC LOẠI BIỂN BÁO	
										SCALE:	

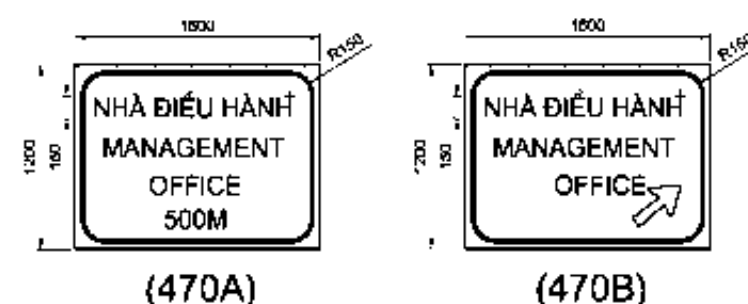
4 BIỂN DẪN HƯỚNG VÀ KHÁC _ CHEVRON SIGN AND OTHERS



5 CHỈ DẪN 2 HƯỚNG ĐI, TÊN CẦU VÀ BIỂN GIỚI HẠN TỐC ĐỘ _ 2 DESTINATION POINTS, BRIDGE NAME, AND LIMITED OF SPEEDS.



CỘT KILOMET KILOMET POSTS



6 BIỂN CẢNH BÁO _ TRAFFIC SIGN



DIVISION	A	B	C	D	E	F	G	H	J	K	L	V
455a	300	600	10	75	125	70	220	80	109.5	40	122	
455b	300	900	10	75	125	70	250	70	70	130.5	40	122.5

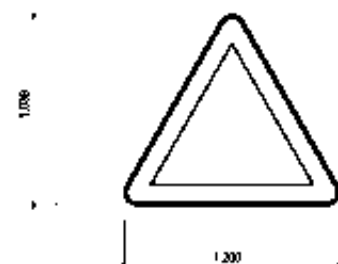
NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS
BASE ON THE QCVN 31: 2008/BGTVT SPECIFICATION AND REGULATION OF TRAFFIC SAFETY NO 22/TCN 237 01

21/10/2010 Final Draft Drawing Highway Engineering/026 Traffic Safety/01 TS 016 001 Rev. 001 Addn. PDF

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-TS-0/0
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE:		DIMENSION OF BOARD SIGNS KÍCH THƯỚC CÁC LOẠI BIỂN BÁO	SCALE:
						(2/2)					

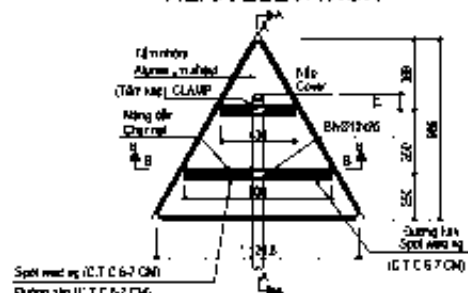
TRAFFIC SIGN 1 - POST (TYPE 1)

CẤU TẠO CỘT BIỂN BÁO (1 CỘT) KIỂU 1

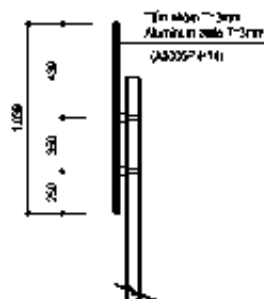


CẤU TẠO MẶT TRƯỚC
FRONT ELEVATION

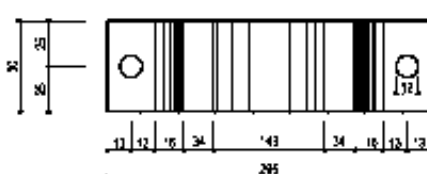
MẶT SAU
REAR ELEVATION



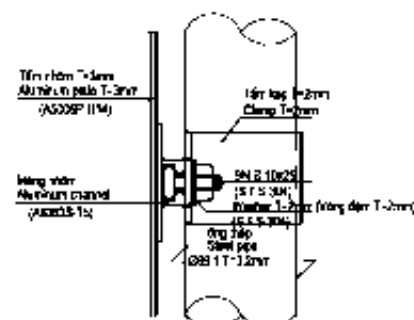
CẤU TẠO MẶT BÊN
SIDE ELEVATION



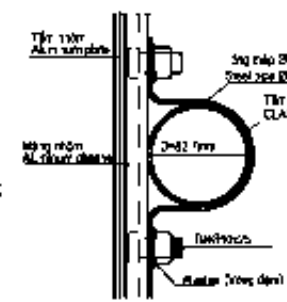
CHI TIẾT CẤU TẠO GÁ KÉP
CLAMP DETAIL DRAWING



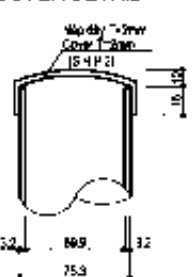
MẶT CẮT A-A
SECTION A - A



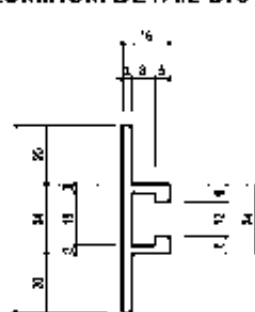
MẶT CẮT B-B
SECTION B - B



CHI TIẾT NẮP
COVER DETAIL



CHI TIẾT MĂNG DẪN
ALUMINUM DETAIL DRAWING



BẢNG TỔNG HỢP KHỐI LƯỢNG
TABLE OF QUANTITIES

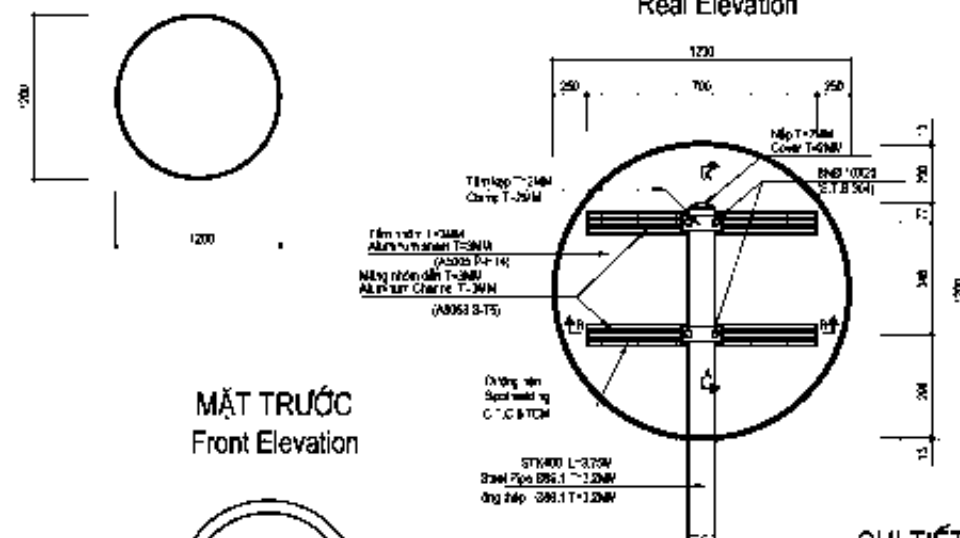
Loại vật	Division	Kích thước	Dimension	T.L. Riêng	Weight	Khối lượng	Quantity	Ghi chú	Remarks
Thép ống Steel pipe	40x6	Ø89 x T=3.2mm	6.77kg/m		3.53m, 25.86kg		57K 426		
Nắp nhôm Cover	40x6	1000mm					17A		
Bê tông Concrete	40x6					0.773m³			Class 3
Khuôn Mold form	40x6					3.343m³			

*NOTE: 1. Sign board quantity exception
2. Chưa tính đến khối lượng tấm biển

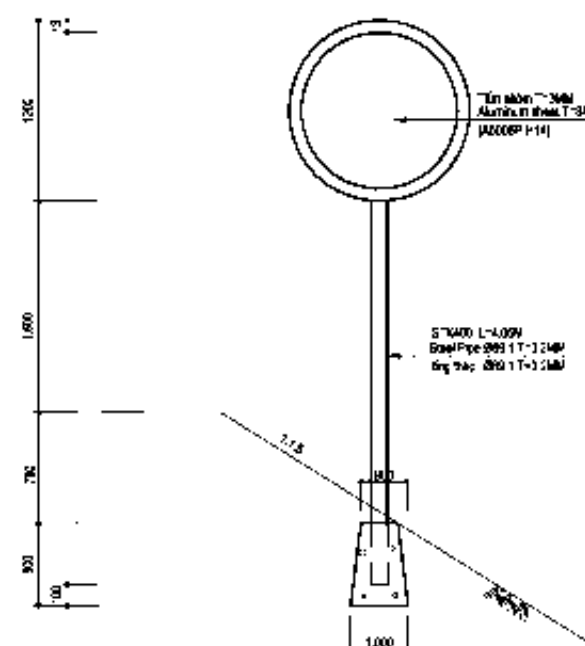
TRAFIC SIGN 1-POST (TYPE 2)

CẤU TẠO CỘT BIỂN BÁO (1 CỘT) KIỂU 2

MẶT SAU
Rear Elevation



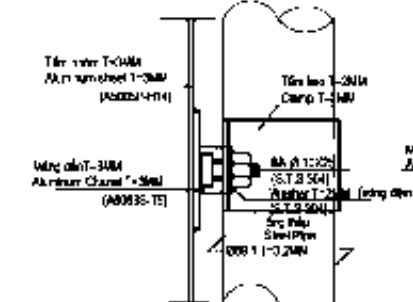
MẶT TRƯỚC
Front Elevation



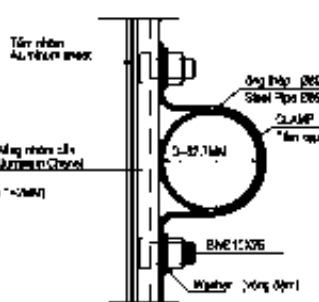
CHI TIẾT TẮM KÉP
Clamp Detail



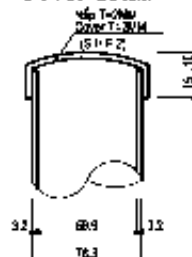
MẶT CẮT A-A
Section A - A



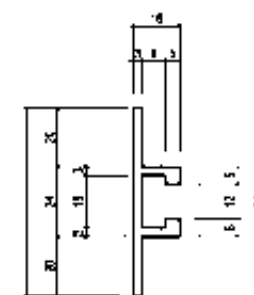
MẶT CẮT B-B
Section B - B



CHI TIẾT NẮP
Cover detail



CHI TIẾT MĂNG DẪN
Aluminum Channel detail



BẢNG TỔNG HỢP KHỐI LƯỢNG
TABLE OF QUANTITIES

Loại vật	Division	Kích thước	Dimension	T.L. Riêng	Weight	Khối lượng	Quantity	Ghi chú	Remarks
Thép ống Steel pipe	40x6	Ø89 x T=3.2mm	6.77kg/m		3.53m, 25.86kg		57K 426		
Nắp nhôm Cover	40x6	1000mm					17A		
Bê tông Concrete	40x6					0.773m³			Class 3
Khuôn Mold form	40x6					3.343m³			

*NOTE: 1. SIGN BOARD QUANTITY EXCEPTION
2. CHƯA TÍNH ĐẾN K-CH LƯỢNG TẤM BIỂN
3. ALL DIMENSIONS ARE IN MM
4. KÍCH THƯỚC BÀN VẼ ĐƠN VỊ LA MM

CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TYPE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

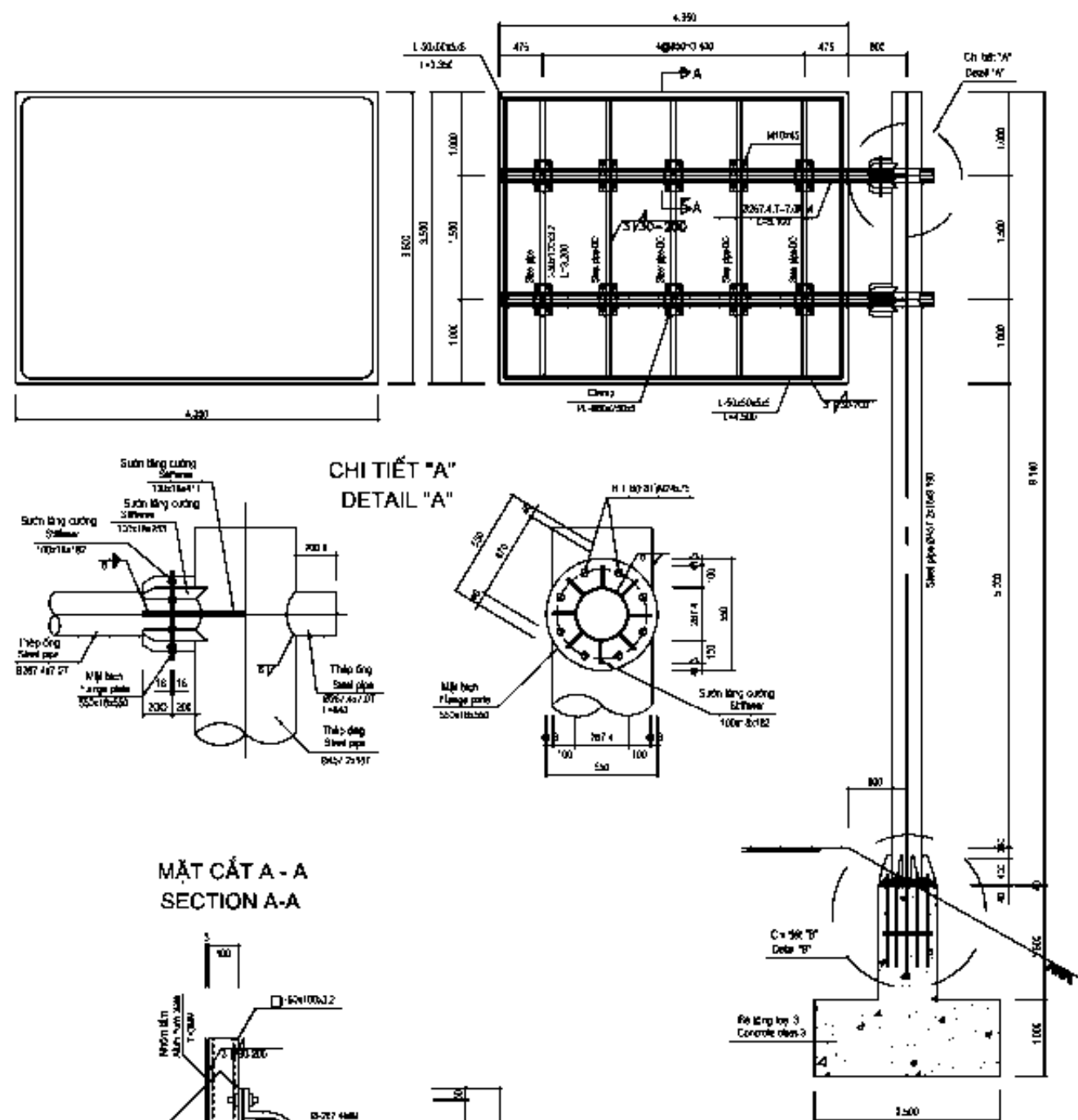
ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

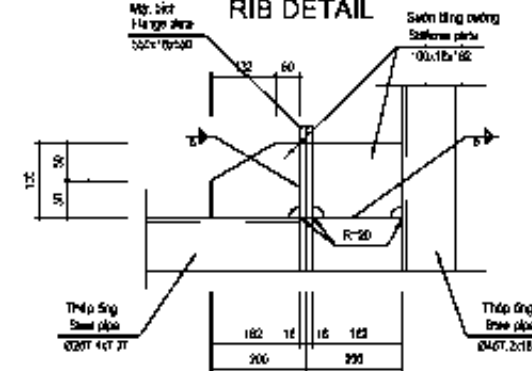
DRAWING TITLE: TRAFFIC SIGN ONE POST TYPE 1 AND 2
CẤU TẠO CỘT BIỂN BÁO (1 CỘT) KIỂU 1 VÀ 2

REV. No	DATE	DESCRIPTION	DRAWING No.:
0	NOV-2009	DRAFT FINAL DRAWING	RW-TS-080
1	FEB-2010	FINAL DRAWING	
			SCALE:

CANTILEVER SIGN 16T-3(461)
CẤU TẠO DẠNG NGÀM, 16T-3(461)

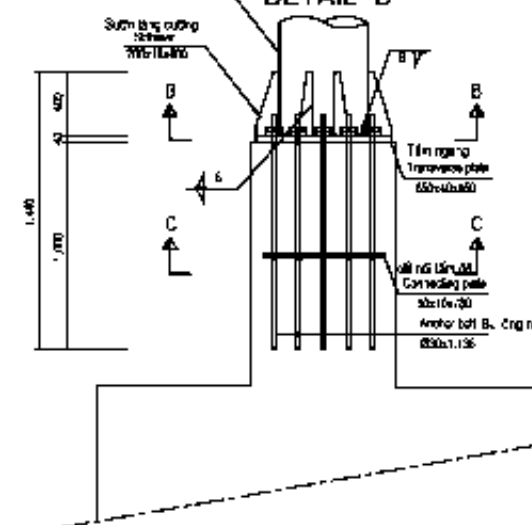


CHI TIẾT RIB
RIB DETAIL

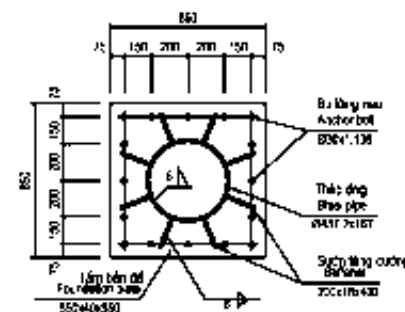


- In case of under stress, neck thickness of ball need to 4mm
- Winding axis is
 - 1. The centre of main vertical toward 2 inside (mm)
 - 2. The centre of main vertical toward 2 outside (mm)
 - 3. Ball (mm)

CHI TIẾT "B"
DETAIL "B"



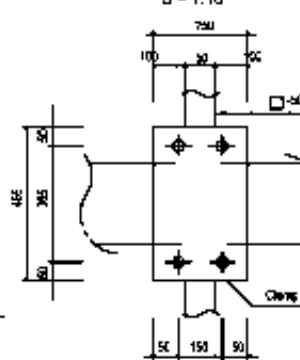
MẶT CẮT B - B
SECTION B-B



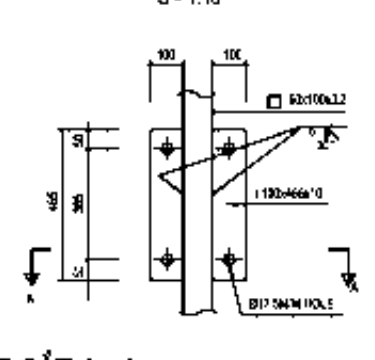
BẢNG KHỐI LƯỢNG
TABLE OF QUANTITIES

Rolling No.	Item	Item Code	Dimension	T. Weight	3rd Party Quantity	Typical Weight /kg	Qty. cum. remark
Thap Sing Steel pro		2457.2x.0T	1.14kg/m	9.1990	1999.1	56.4'	
		Total			1999.1		
		2527.4x2.0T	4.57kg/m	9.4430	454.8	35.4'	
		2527.4x2.0T		1.7290	77.4	-	
		Total			522.2		
Thap Sen Steel plate		255x255x4.0	776 kg/m ²	1.04	226.9	55.4'	
		Total			226.9		
		255x255x3.0	42.7kg/m ²	4.00	171.8	55.4'	
		255x400x3.0	11.3kg/m ²	8.00	30.4		
		125x111x1.0	5.3kg/m ²	4.00	23.2		
		125x250x3.0	3.5kg/m ²	6.00	28.6		
		150x150x3.0	2.5kg/m ²	20.00	5.4		
		Total			364.4		
		750x321x1.0	4.30kg/m ²	4.00	15.6	-	
		800x90x1.0	3.80kg/m ²	4.00	15.6	-	
		Total			31.2		
Thap Sing reinforcement bar:		3.30x1.148		8.00			
H.T.B H.T.B		402x75		6.00		59'	
Hap city Cover		33x49x2		1.00			
		33x39x2		4.00			

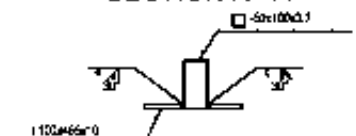
CHI TIẾT NẮP
CLAMP DETAIL
S = 1:10



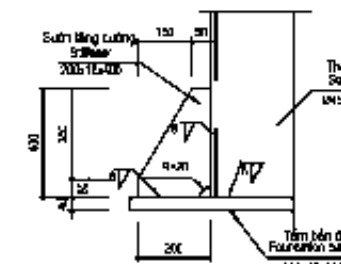
CHI SUỐN TĂNG CƯỜNG
STIFFENER DETAIL
S = 1:10



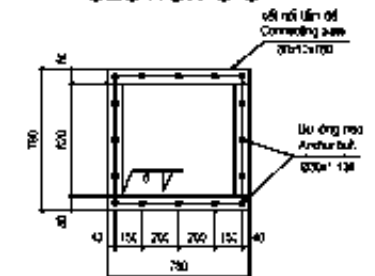
MẶT CẮT A - A
SECTION A - A



CHI TIẾT RIB
RIB DETAIL
S = 1:10



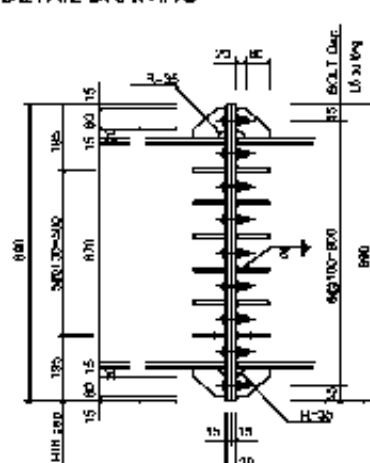
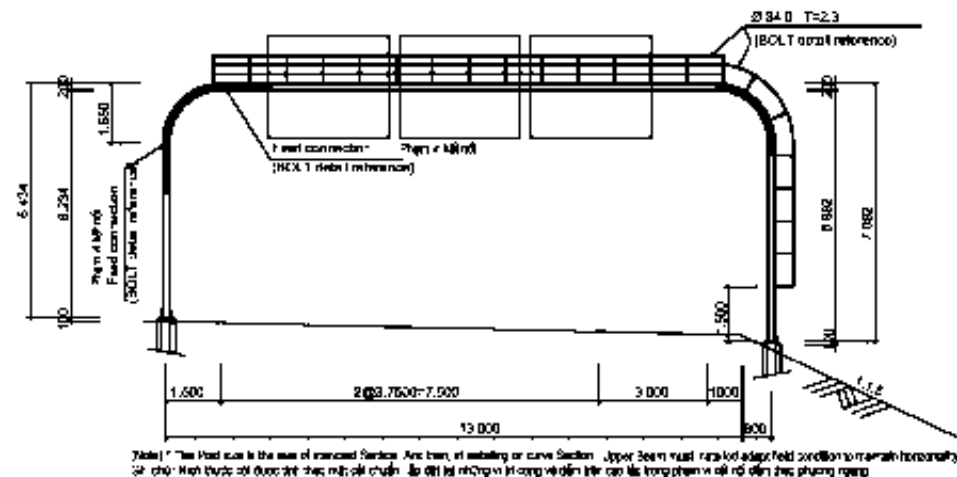
MẶT CẮT C - C
SECTION C-C



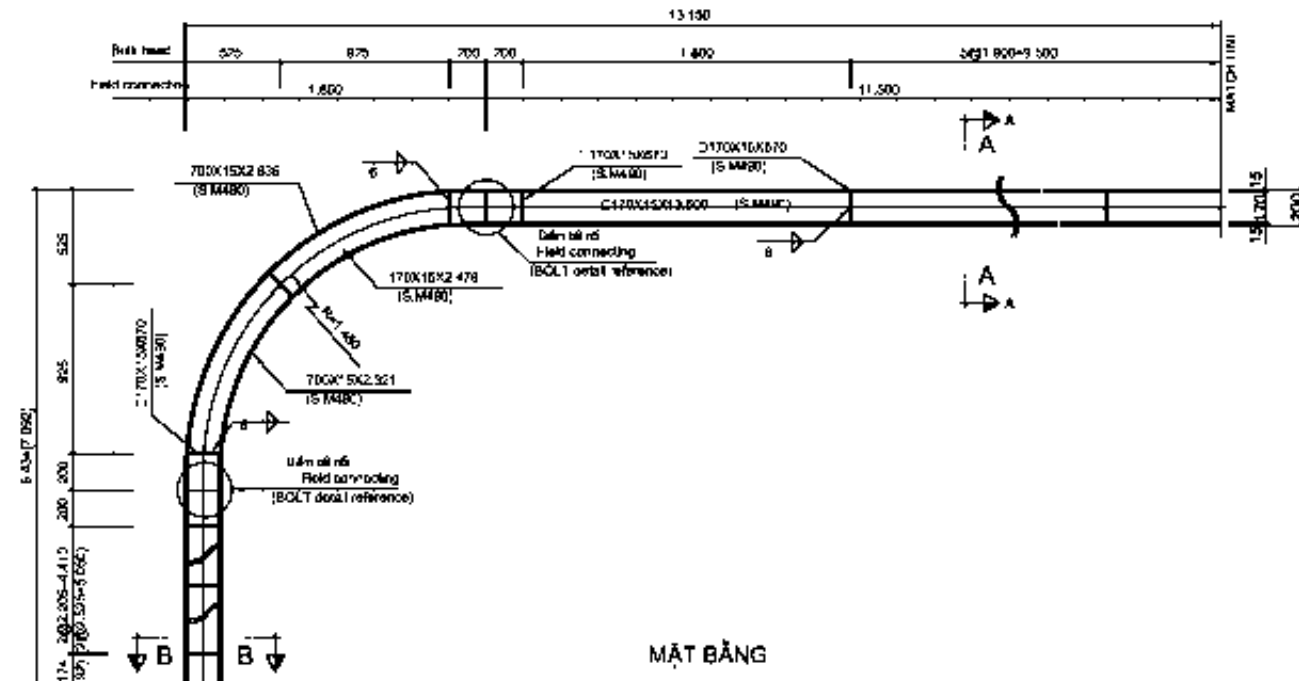
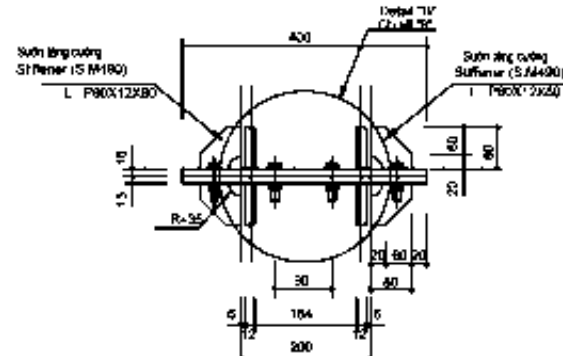
- * Welding connecting with angle pipe and sign board, welding of stiffener must obtain approval by supervisor because there is gap tolerance and accuracy
- * Embedded anchor bolt must have keeping by covering CAP
- * The head spur of anchor bolt must over 20mm.
- * Anchor bolt must installed inside of main reinforcement bar.
- * At the foundation construction, bearing capacity of foundation must have over 3.2MPa
- * All dimensions are in mm

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-T S-090
Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO								1	FEB-2010	FINAL DRAWING	
TITLE						DRAWING TITLE:					SCALE :
NAME											
SIGNATURE											
PREPARED BY				Nguyen Thanh PHUONG							
CHECKED BY				Le Ngoc HIEU							
APPROVED BY				TIMOTHY COLLETT							

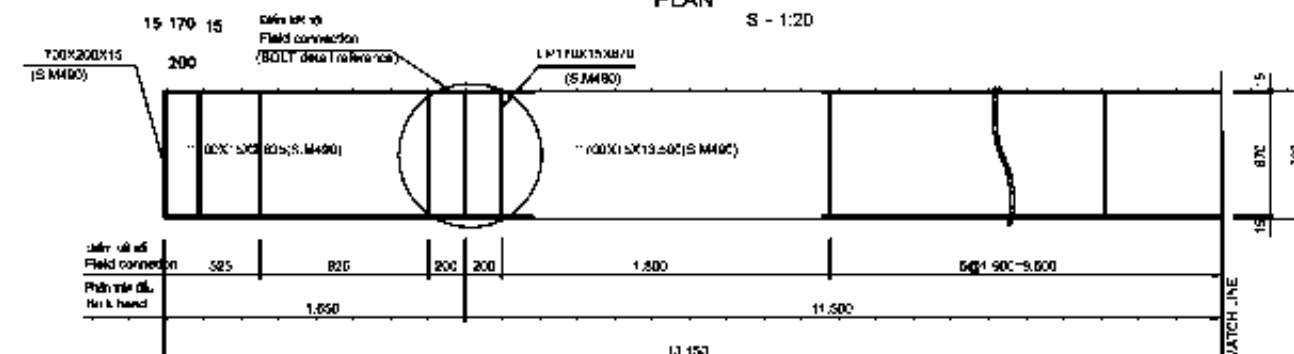
MẶT TRƯỚC
FRONT ELEVATION
S = 1:20



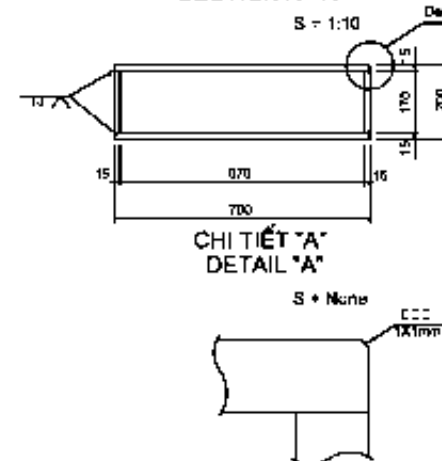
Technical drawing of a circular component. The drawing shows a cross-section of a cylinder with a diameter of 178. The height of the cylinder is 10. The distance from the center to the edge of the top flange is 43. The distance from the center to the edge of the bottom flange is 43. The distance between the two flanges is 90. The drawing is labeled with '422X70 22EA' and 'H'.



MẶT BẰNG
PLAN
S - 1:20

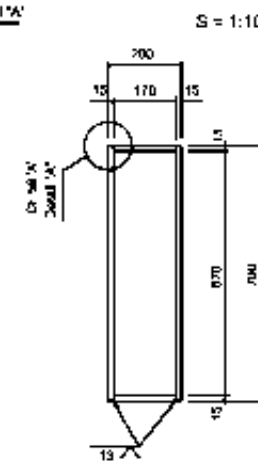


MẶT CẮT A - A
SECTION A - A

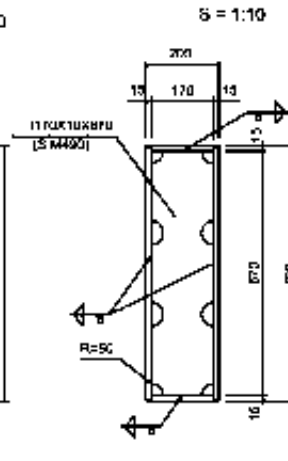


CHI TIẾT "A"
DETAIL "A"

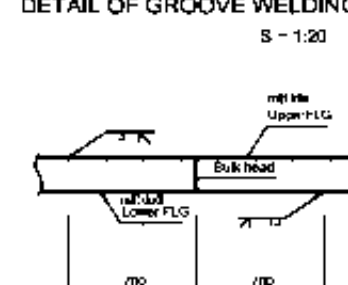
MẶT CẮT B - B
SECTION B - B



**KHỐI TRÊN
BULK HEAD**



CHI TIẾT RÀNH ĐƯỜNG HÀN
DETAIL OF GROOVE WELDING



- But welding SECTION must enforce steel bedding.
- Especially, joint Section must maintain joint interval.
- Planning for welding and construction must obtain approval by Supervisor.
- Position must have "rolling" in every place.
- An acute angle Section must become about 1mm of smooth cutting for avoidance of peeling.
- At groove welding by factory method, connection location of upper and lower F/G and partition must become double layer.
- Welding Section by factory method must manage thickness by grinder and become max 500g/m² of re-coating.
- All details are in (100)

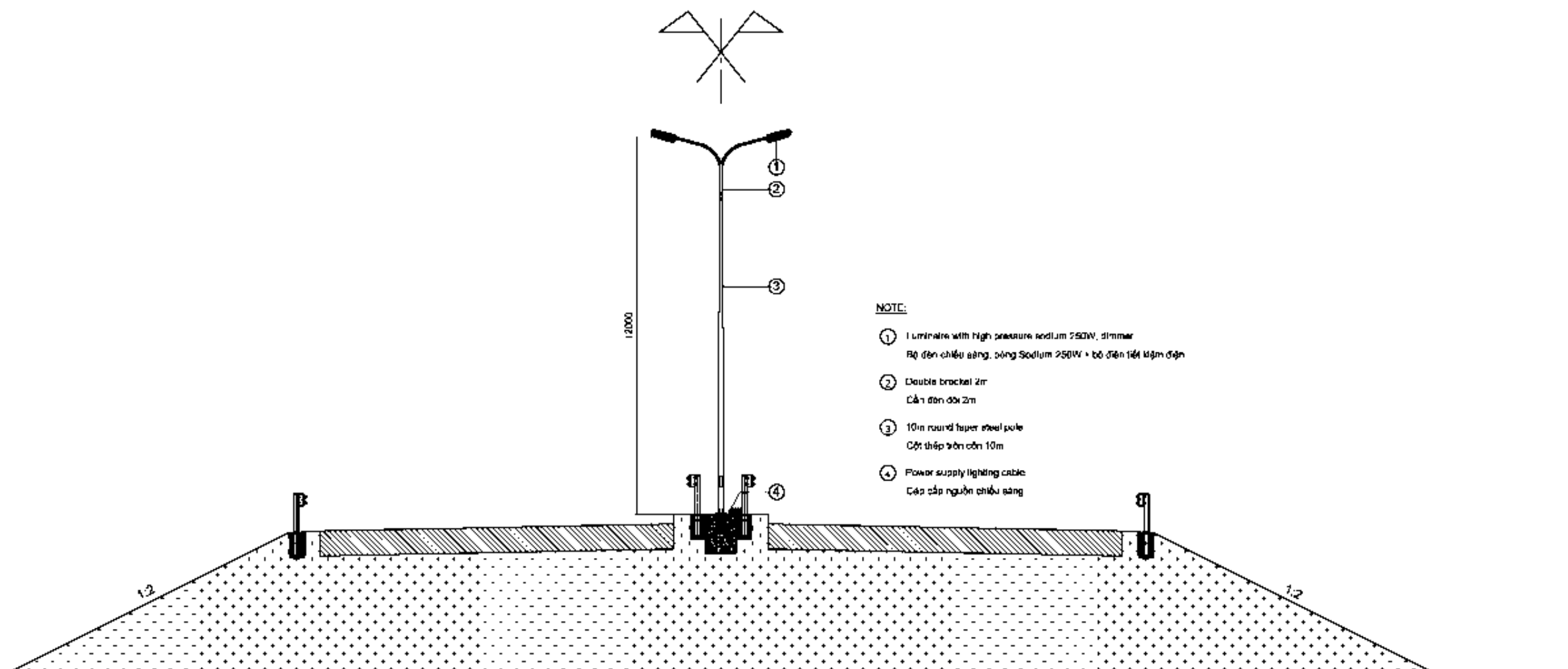
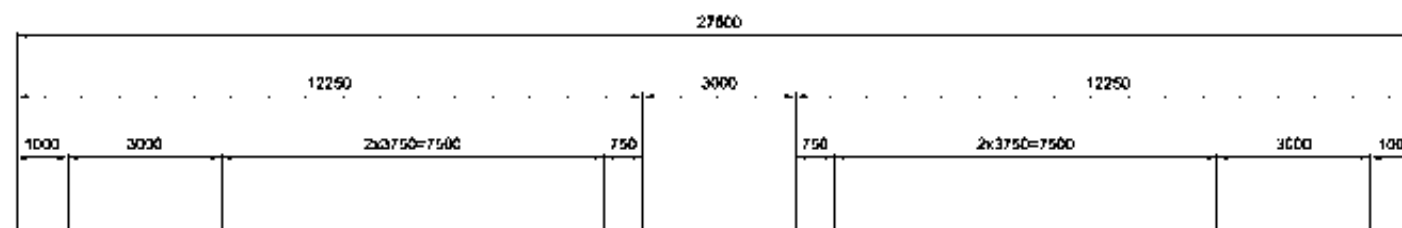
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:		
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-TS-100		
								1	FEB-2010	FINAL DRAWING			
						DRAWING TITLE:		OVERHEAD SIGN (ZI AND/ONFWAY)					SCALE :
								DANG TRFO TRÊN CAO (2. ANH1 CHIẾU) (45KG, 463B, 463C)					
TITLE				NAME		SIGNATURE							
PREPARED BY				Nguyen Thanh PHUONG									
CHECKED BY				Le Nguec HIEU									
APPROVED BY				TIMOTHY COLLETT									

IX: Lighting And Power Supply

IX: Hệ Thống Chiếu Sáng Và Cấp Nguồn

TYPICAL CROSS SECTION / MẶT CẮT NGANG ĐIỀN HÌNH

SCALE 1:150



NOTE:

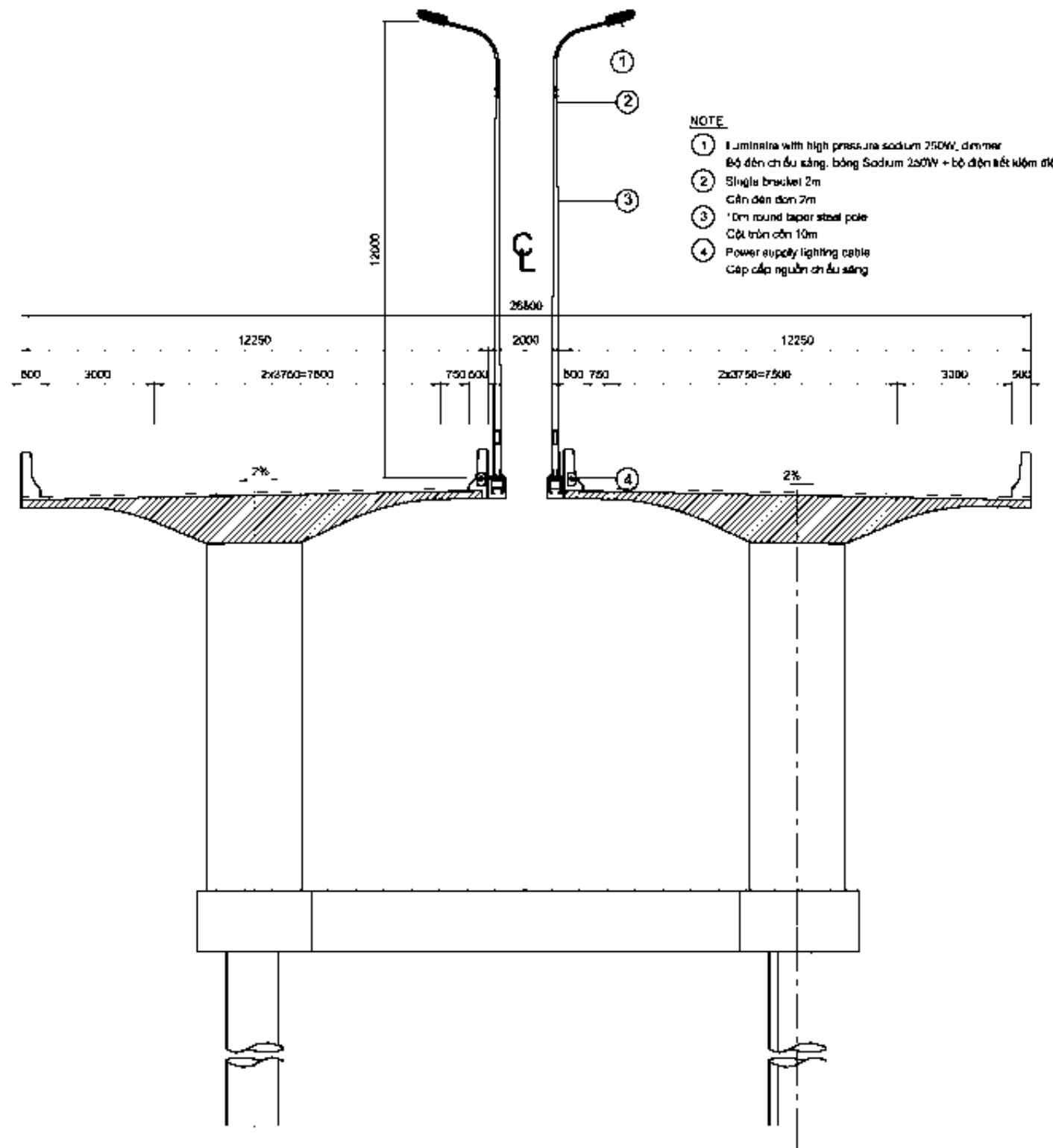
- ① Luminaire with high pressure sodium 250W, dimmer
Bộ đèn chiếu sáng, công Sodium 250W + bộ điện tiết kiệm điện
- ② Double bracket 2m
Cán đèn đôi 2m
- ③ 10m round taper steel pole
Cột thép tròn côn 10m
- ④ Power supply lighting cable
Cáp cấp nguồn chiếu sáng

ALL DIMENSIONS ARE IN MM
KÍCH THƯỚC BẢN VẼ LÀ MM

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: EMBANKMENT CROSS SECTION MẶT CẮT NGANG ĐƯỜNG		0	NOV-2008	DRAFT FINAL DRAWING	RW-1 P-010
								1	FEB-2010	FINAL DRAWING	
											SCALE:
PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: Le Ngoc HIEU APPROVED BY: Timothy COLLETT											

BRIDGE CROSS SECTION / MẶT CẮT NGANG PHẦN CẦU

SCALE 1:100

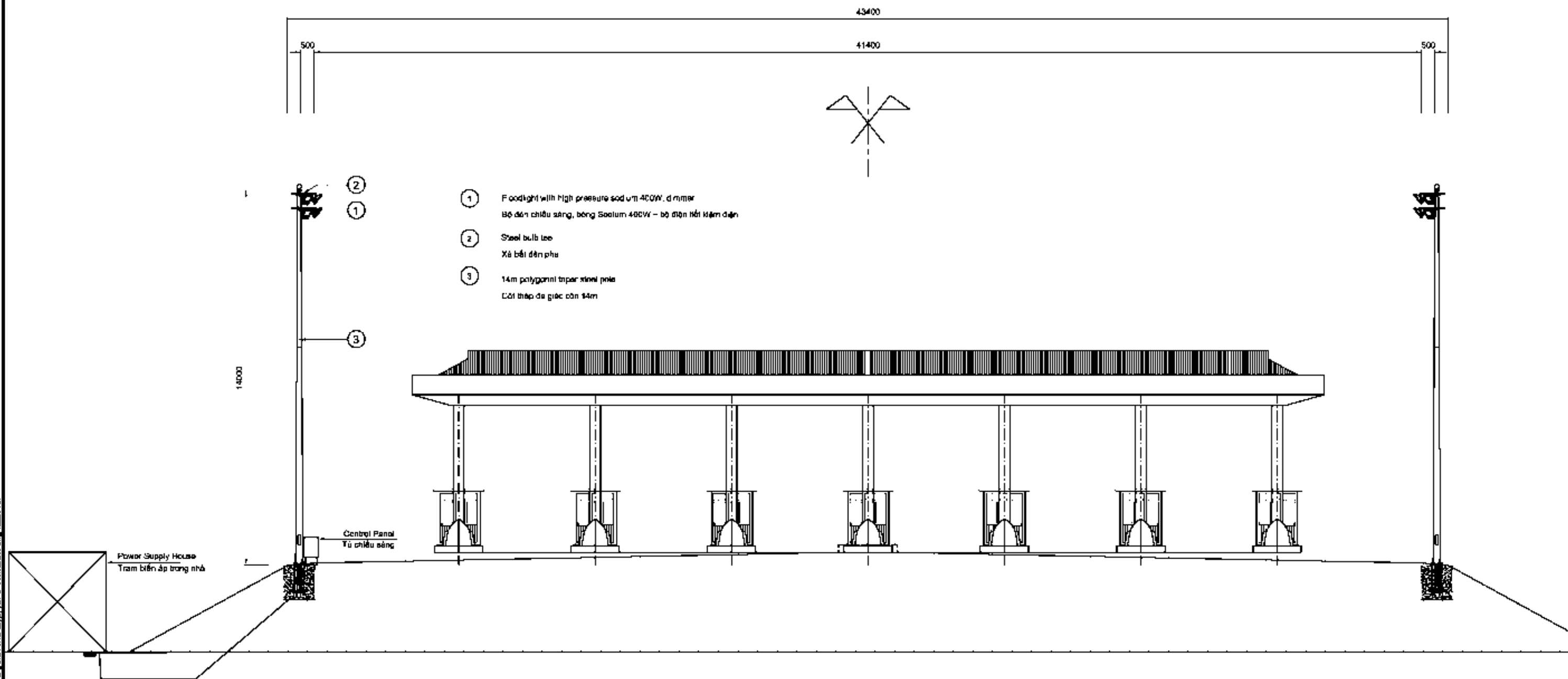


ALL DIMENSIONS ARE IN MM
KÍCH THƯỚC BẢN VẼ LÀ MM

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:												
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-1 P-020												
								1	FEB-2010	FINAL DRAWING													
														DRAWING TITLE: CROSS SECTION OF BRIDGE MẶT CẮT NGANG CẦU				SCALE :					
<table><tr><th>TITLE</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>Le Ngoc HIEU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TITLE	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	Le Ngoc HIEU		APPROVED BY	Timothy COLLETT									
TITLE	NAME	SIGNATURE																					
PREPARED BY	Nguyen Thanh PHUONG																						
CHECKED BY	Le Ngoc HIEU																						
APPROVED BY	Timothy COLLETT																						

LIGHTING SYSTEM OF TOLLGATES / BỐ TRÍ ĐIỆN CHIẾU SÁNG TẠI TRẠM THU PHÍ

SCALE 1:150



ALL DIMENSIONS ARE IN MM
KÍCH THƯỚC BẢN VẼ LÀ MM

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: TOLL PLAZA CROSS SECTION MẶT CẮT NGANG TRẠM THU PHÍ		0	NOV-2008	DRAFT FINAL DRAWING	RW-1 P-030
								1	FEB-2010	FINAL DRAWING	
											SCALE:
PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: Le Ngoc HIEU APPROVED BY: Timothy COLLETT											

Technical drawing of a street lighting pole showing two views: a side elevation and a front elevation.

Side Elevation:

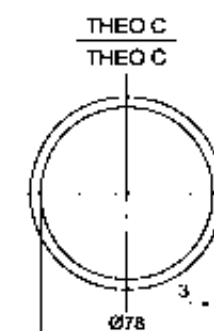
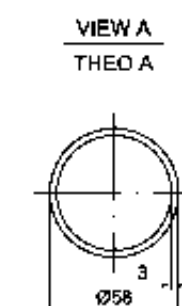
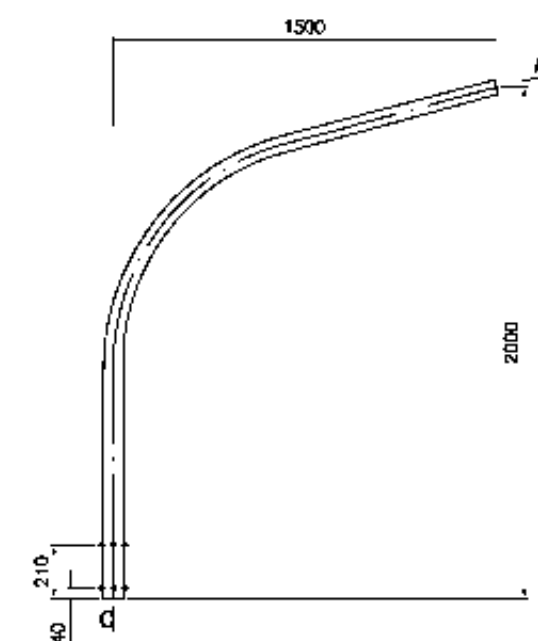
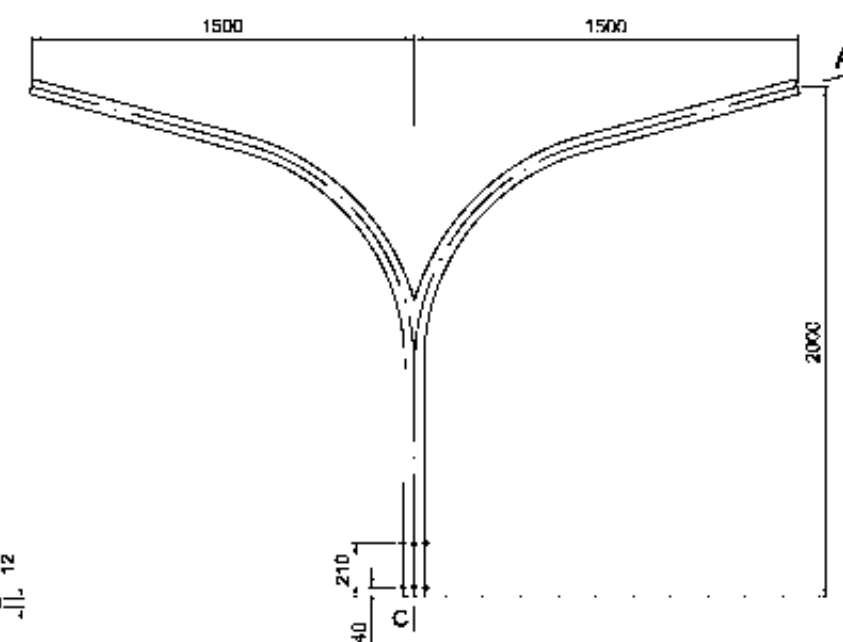
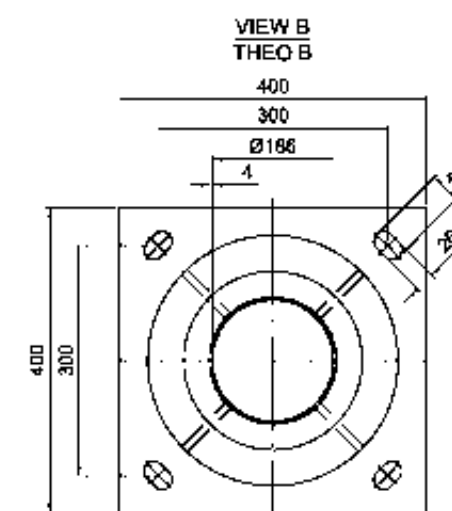
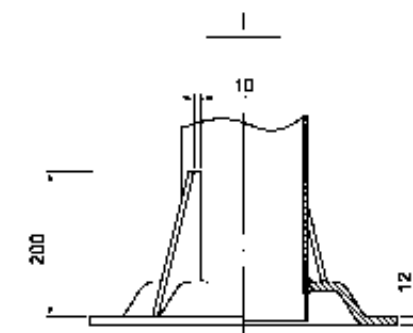
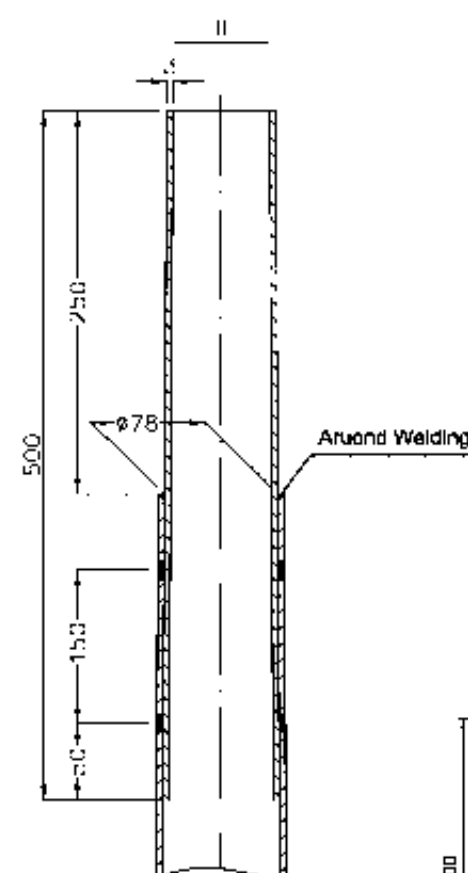
- Total height: 10000
- Top arm length: 1500
- Top light fixture height: 2000
- Base height: 900
- Base width: 350
- Base diameter: 100

Front Elevation:

- Total height: 10000
- Top arm length: 1500
- Top light fixture height: 2000
- Base height: 900
- Base width: 350
- Base diameter: 100

Table:

SPECIFICATIONS	
1. Material	Vật liệu
2. Poles	Toàn bộ
3. All dimensions	Kích thước

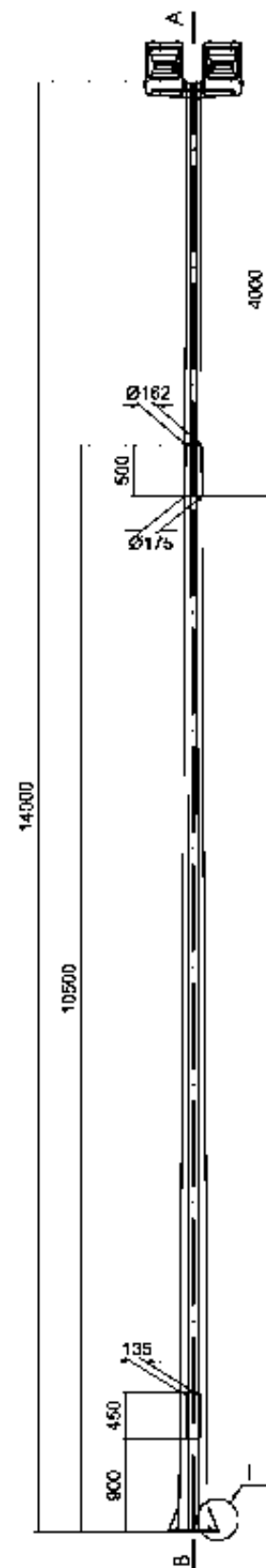


1. Materials used for poles and arms comply with JIS G3101 SS400 or equivalent
Vật liệu sử dụng cho cột và cần phải hợp với tiêu chuẩn JIS G3101 SS400 hoặc tương đương
2. Poles are anti-corroded by hot dip galvanized, compliance to galvanizing standard ASTM A123
Toàn bộ cột được mạ nhúng kẽm nóng, phù hợp với tiêu chuẩn ASTM A123
3. All dimensions are in mm
Kích thước bản vẽ đơn vị là mm

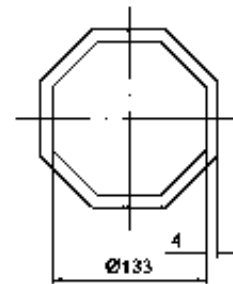
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-LP-040
								1	FEB-2010	FINAL DRAWING	
						DRAWING TITLE: DETAIL OF 10M POLE CHI TIẾT CỘT 10M					

DETAIL OF 14M POLES AND CROSS ARM

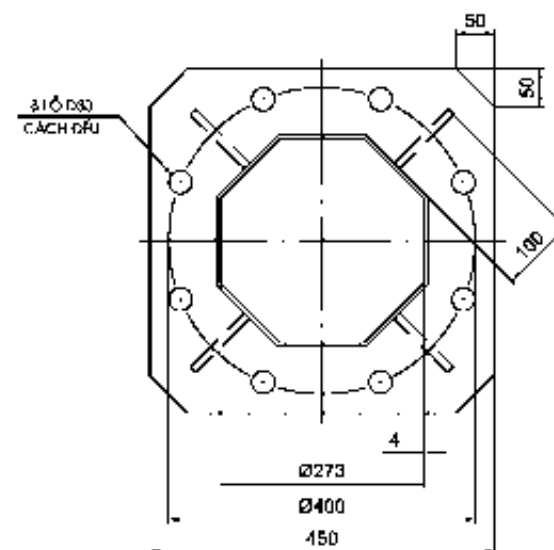
CHI TIẾT CỘT 14M VÀ XÀ ĐỖ PHA



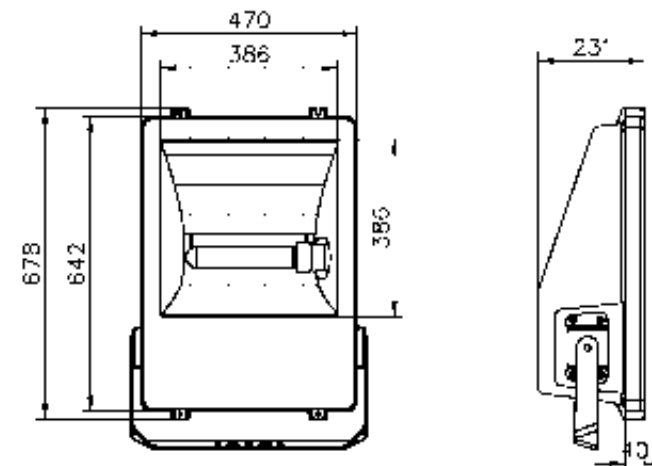
VIEW A
THEO A



VIEW B
THEO B



FOODLIGHT ĐÈN PHA CHIẾU RỘNG IP55 - CLASS II



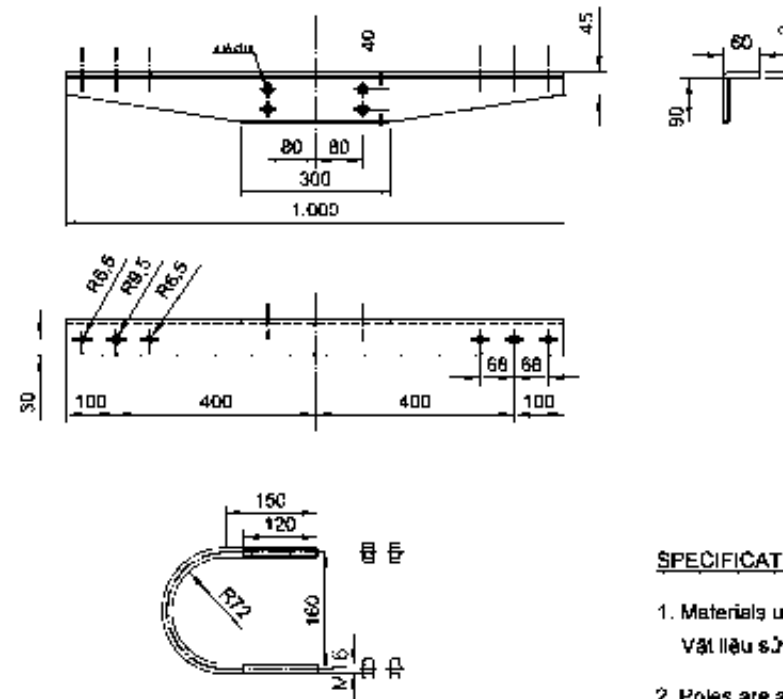
SPECIFICATION / YÊU CẦU KỸ THUẬT

- Corresponding standard IEC 598
Đèn phù hợp tiêu chuẩn IEC 598
- Voltage: 220V-50Hz
Điện áp làm việc: 220V-50Hz
- Lamp: High pressure sodium 400W
Sử dụng bóng Sodium 400W
- The body and frame made of glass fiber reinforced polyester
Thân và nắp đèn được làm bằng vật liệu polyester có gia cường sợi thủy tinh
- Toughened front glass, shock-and heat-resistant
Sử dụng nắp kính bảo vệ, có khả năng chịu va đập và nhiệt

APPLICATION / ỨNG DỤNG

Lighting of car park, large areas, industrial...
Chiếu sáng bãi đỗ xe, không gian rộng, chiếu sáng công nghiệp...

CROSS ARM XÀ ĐỖ PHA



SPECIFICATION / YÊU CẦU KỸ THUẬT

- Materials used for poles comply with JIS G3101 SS400 or equivalent
Vật liệu sử dụng cho cột phù hợp với tiêu chuẩn JIS G3101 SS400 hoặc tương đương
- Poles are anti-corroded by hot dip gavanized, compliance to gavanizing standard ASTM A123
Toàn bộ cột được mạ nhúng kẽm nóng, phù hợp với tiêu chuẩn ASTM A123
- Cross arm material is SS 400, cross arm material shall be anti-corroded by hot dip gavanized
Vật liệu làm xà đỡ là SS400, toàn bộ được mạ kẽm
- All dimensions are in mm
Kích thước bản vẽ đơn vị là mm

CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TYPE	NAME	SIGNATURE
PREPARED BY	Nguyen Thanh PHUONG	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Timothy COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

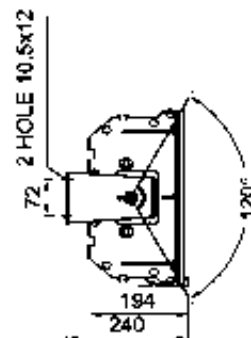
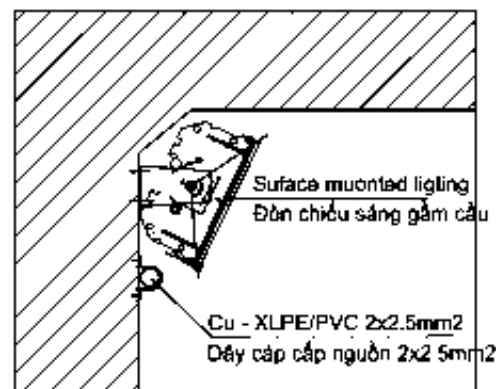
ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

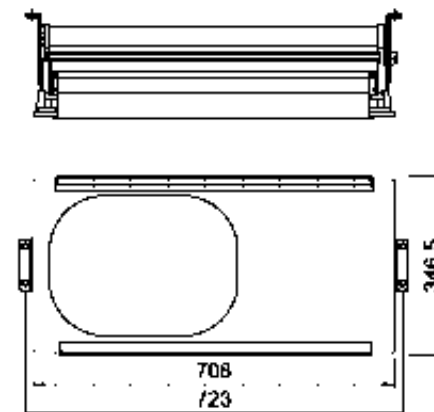
DRAWING TITLE: DETAIL OF 14M POLE
CHI TIẾT CỘT 14M

REV. No	DATE	DESCRIPTION	DRAWING No.:
0	NOV-2008	DRAFT FINAL DRAWING	RW-LP-050
1	FEB-2010	FINAL DRAWING	
			SCALE:

INSTALL SURFACE MOUNTED LIGHTING
GÁ LẮP ĐÈN CHIẾU SÁNG GẮM CẦU



SURFACE MOUNTED LIGHTING
ĐÈN CHIẾU SÁNG GẮM CẦU
IP65 - CLASS I



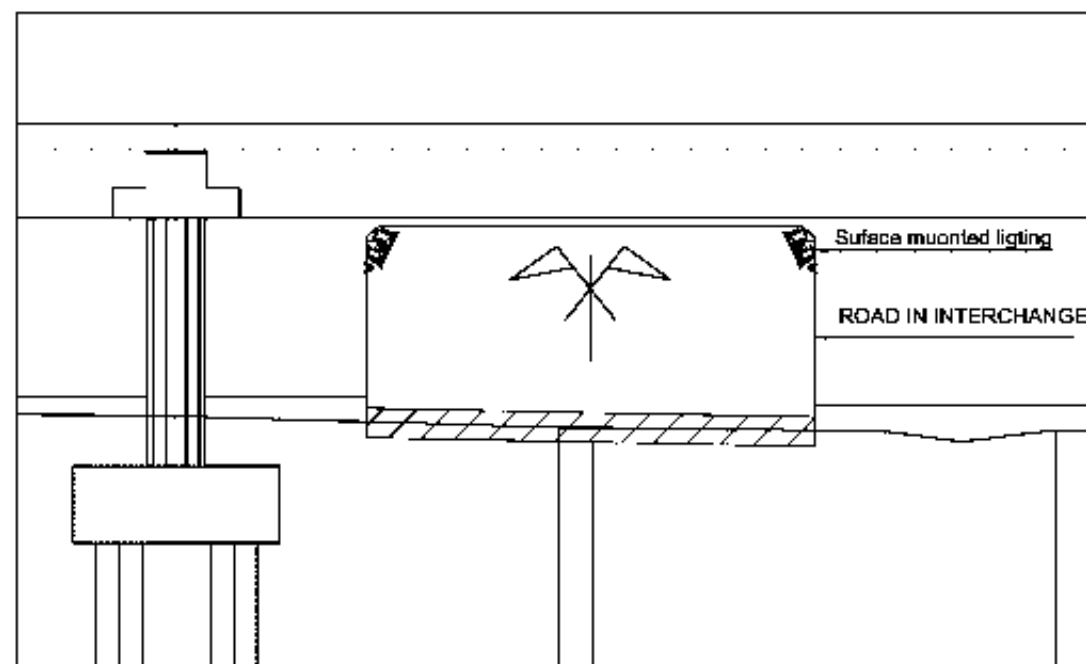
SPECIFICATION / YÊU CẦU KỸ THUẬT

1. Corresponding standard IEC 598
Đèn phù hợp tiêu chuẩn IEC 598
2. Voltage: 220V-50Hz
Điện áp làm việc: 220V-50Hz
3. Power: High pressure sodium 250W
Sử dụng bóng Sodium 250W
4. The body lamp made of high purity aluminium,
Thân và nắp đèn được làm bằng nhôm
5. Toughened front glass, shock and heat resistant
Sử dụng nắp kính bảo vệ, có khả năng chịu va đập và nhiệt

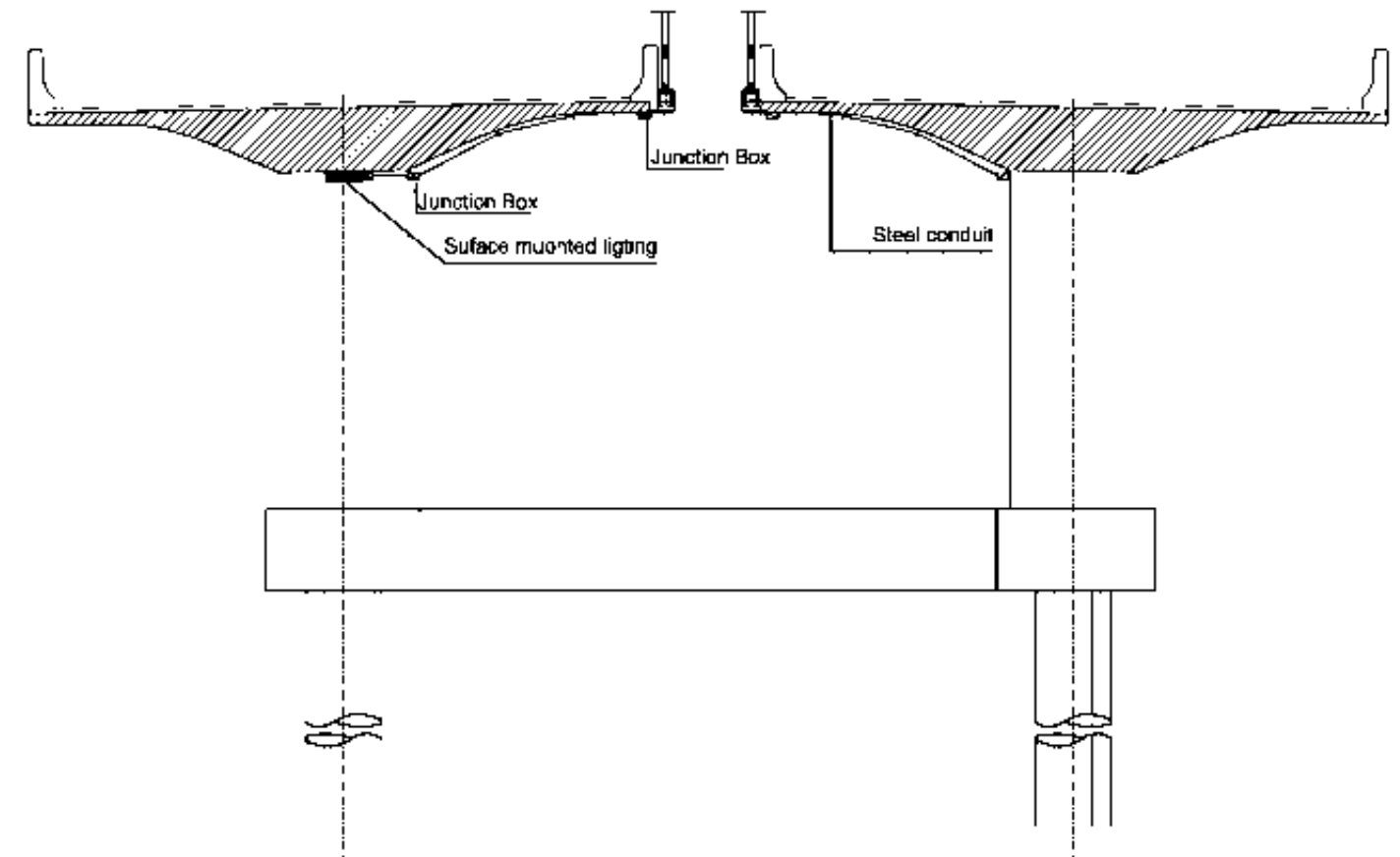
APPLICATION / ỨNG DỤNG

Lighting of tunnel, boxculvert, space under bridges..
Chiếu sáng đường hầm, không gian dưới cầu...

CROSS SECTION OF ROAD UNDER BRIDGE
MẶT CẮT NGANG ĐƯỜNG DƯỚI GẦM CẦU



LENGTHWISE SECTION OF ROAD UNDER BRIDGE
MẶT CẮT DỌC ĐƯỜNG DƯỚI GẦM CẦU

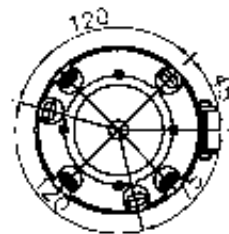
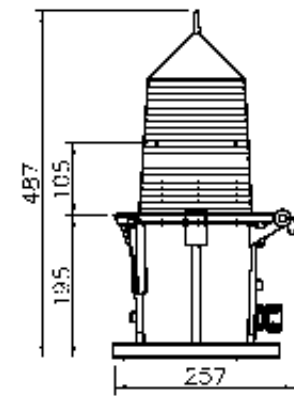


All dimensions are in mm
Kích thước bản vẽ đơn vị là mm

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:												
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-LP-060												
								1	FEB-2010	FINAL DRAWING													
						DRAWING TITLE:		UNDER BRIDGE LIGHT			SCALE : -												
								ĐÈN DƯỚI GẦM CẦU															
<table><tr><th>TIME</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>Le Ngoc HIEU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TIME	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	Le Ngoc HIEU		APPROVED BY	Timothy COLLETT									
TIME	NAME	SIGNATURE																					
PREPARED BY	Nguyen Thanh PHUONG																						
CHECKED BY	Le Ngoc HIEU																						
APPROVED BY	Timothy COLLETT																						

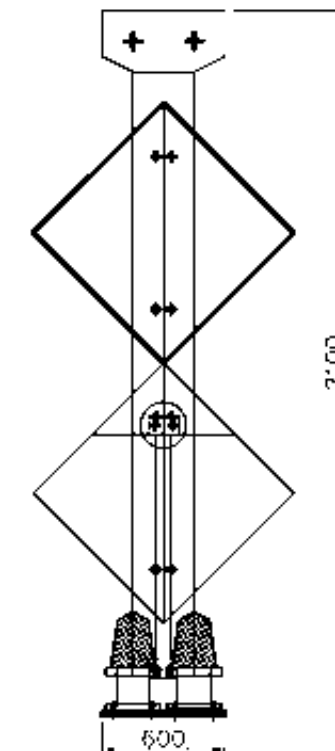
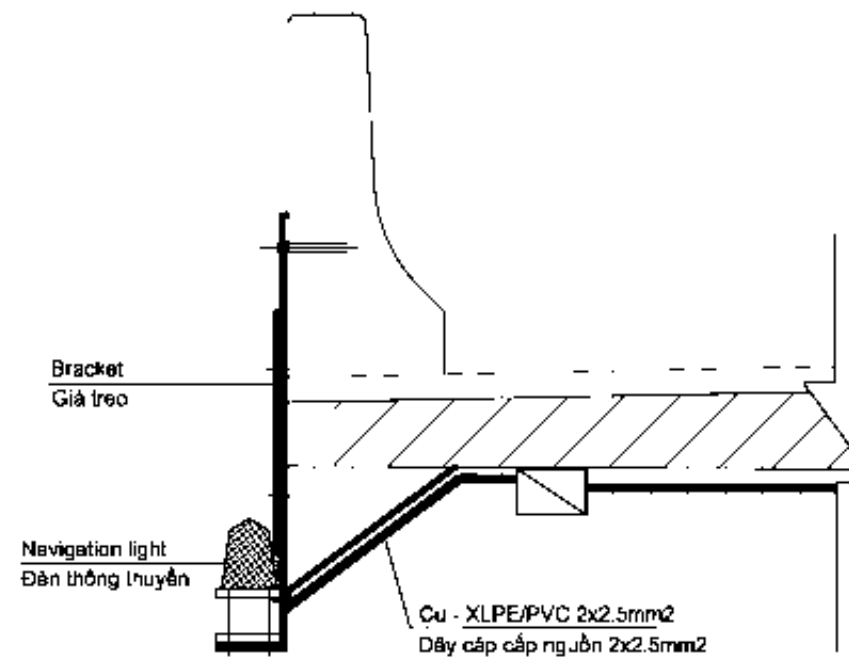
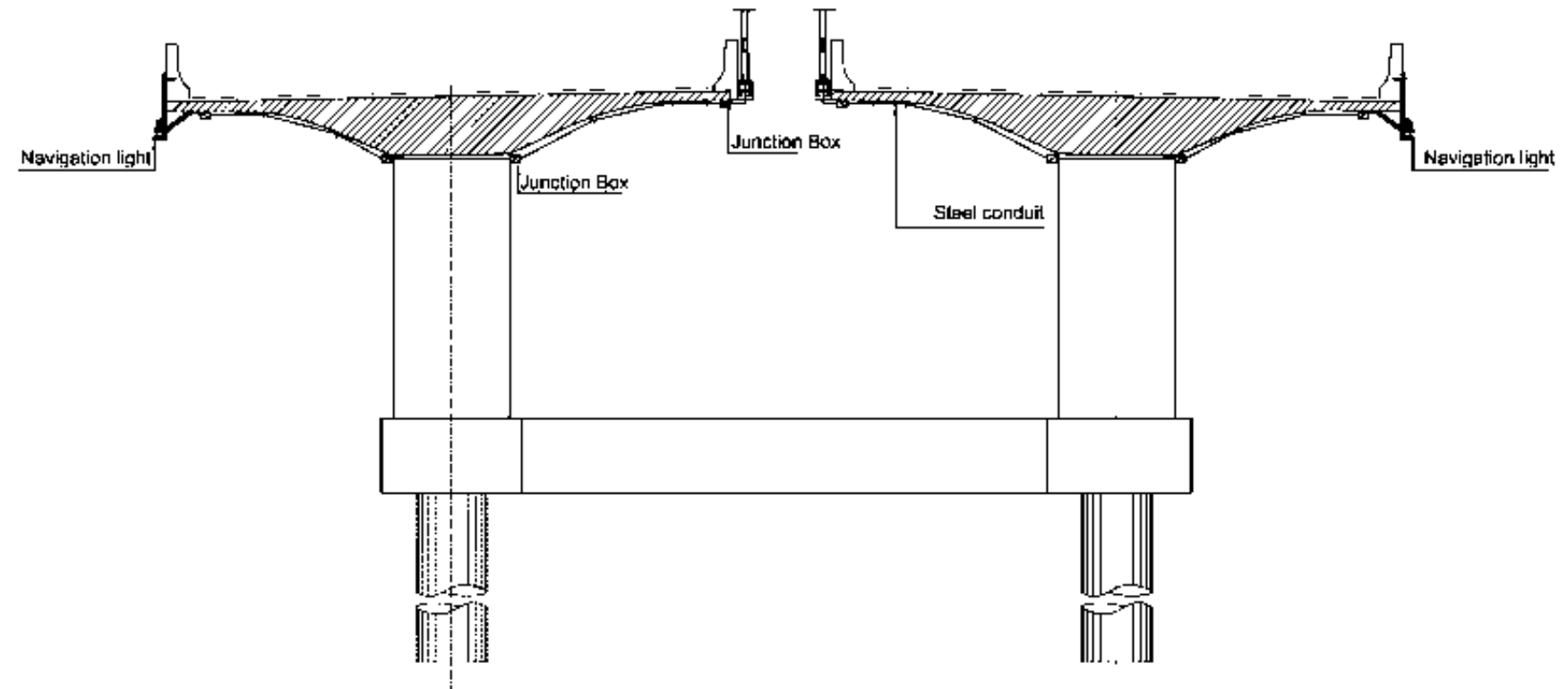
CROSS SECTION OF POSITION INSTALL NAVIGATION
MẶT CẮT NGANG ĐOẠN BỘ TRÍ ĐÈN THÔNG THUYỀN

NAVIGATION LIGHT
ĐÈN THÔNG THUYỀN



SPECIFICATION / YÊU CẦU KỸ THUẬT

1. Corresponding standard IEC 598
Đèn phù hợp tiêu chuẩn IEC 598
2. Voltage: 220V-50Hz
Điện áp làm việc: 220V-50Hz

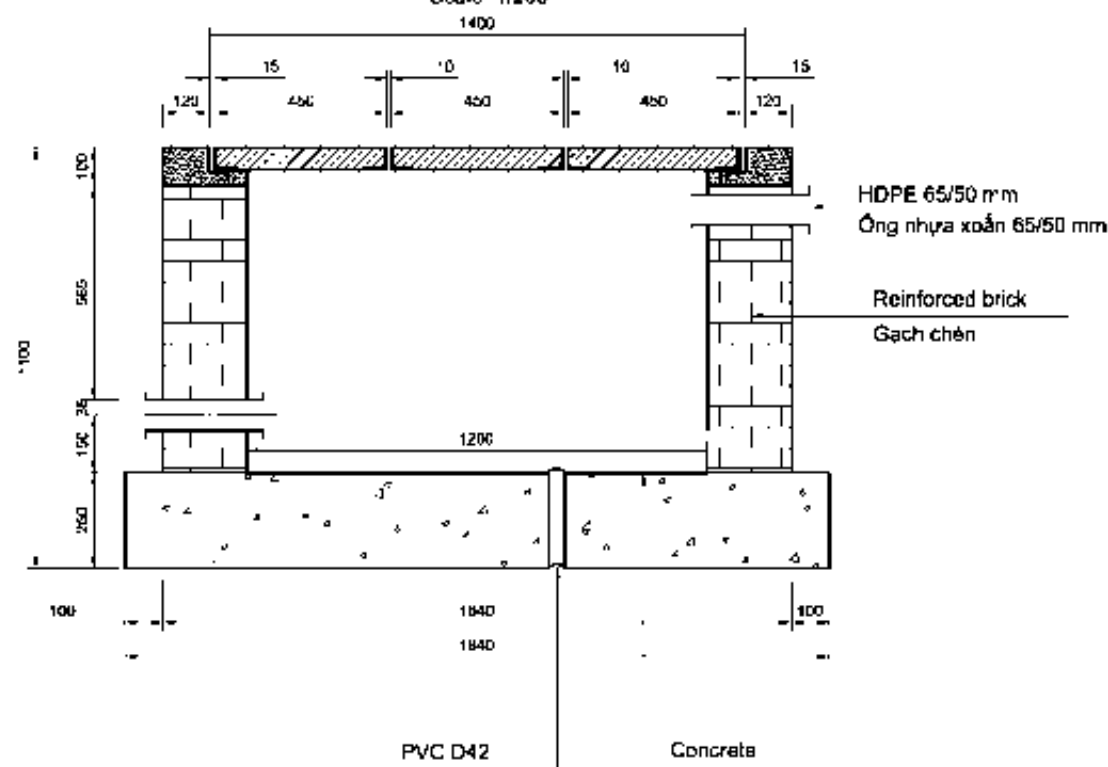


All dimensions are in mm
Kích thước bản vẽ đơn vị là mm

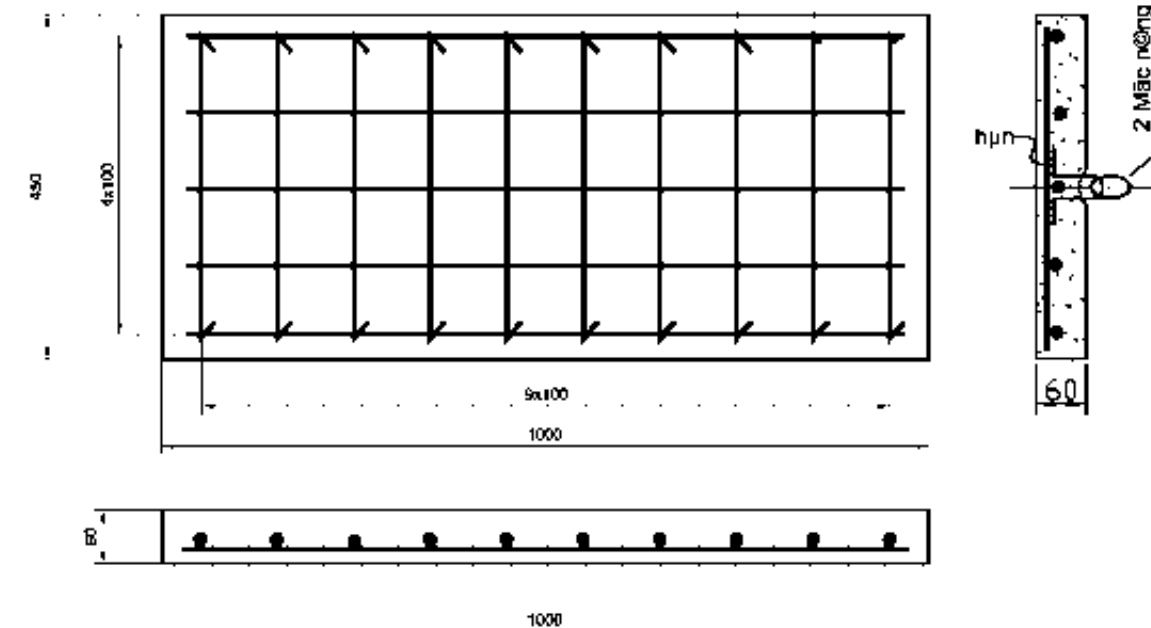
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:												
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-LP-070												
								1	FEB-2010	FINAL DRAWING													
						DRAWING TITLE:		NAVIGATION LIGHT ĐÈN THÔNG THUYỀN					SCALE :										
													-										
<table><tr><th>TIME</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>Le Ngoc HIEU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TIME	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	Le Ngoc HIEU		APPROVED BY	Timothy COLLETT									
TIME	NAME	SIGNATURE																					
PREPARED BY	Nguyen Thanh PHUONG																						
CHECKED BY	Le Ngoc HIEU																						
APPROVED BY	Timothy COLLETT																						

MANHOLE / HỒ LUỒN CÁP

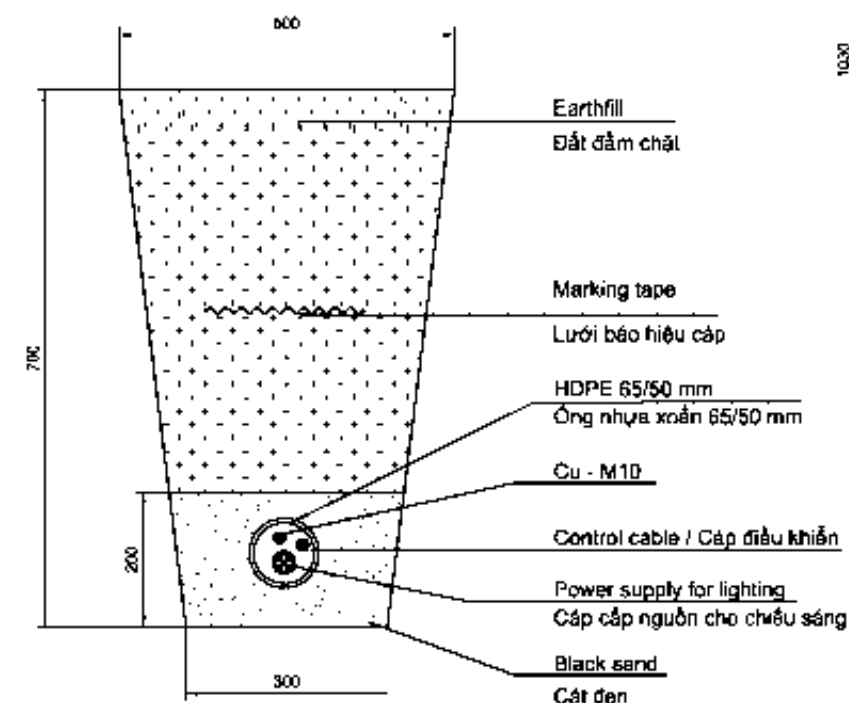
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**NẮP ĐẠY HỒ GA**

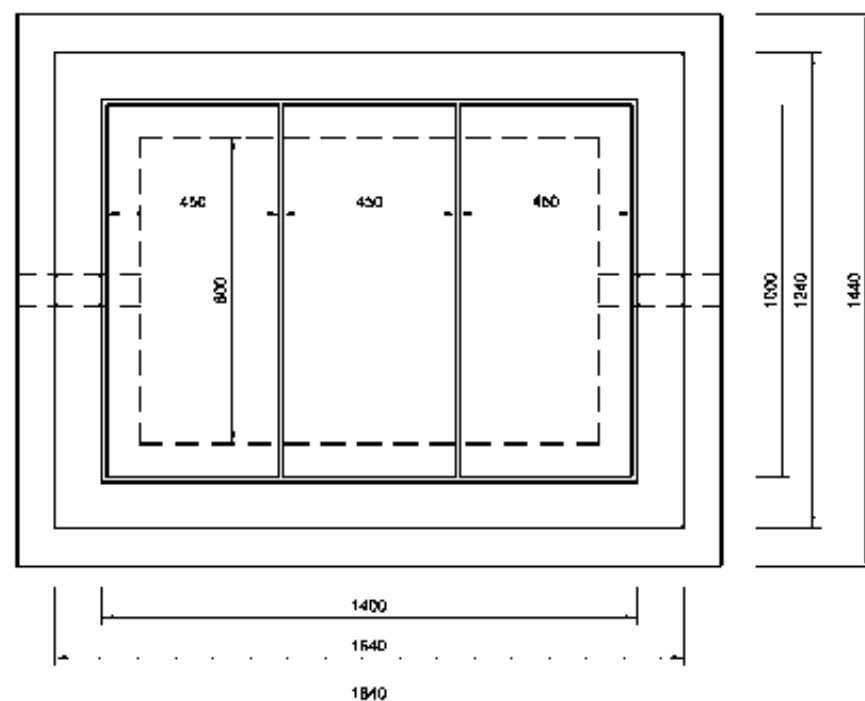
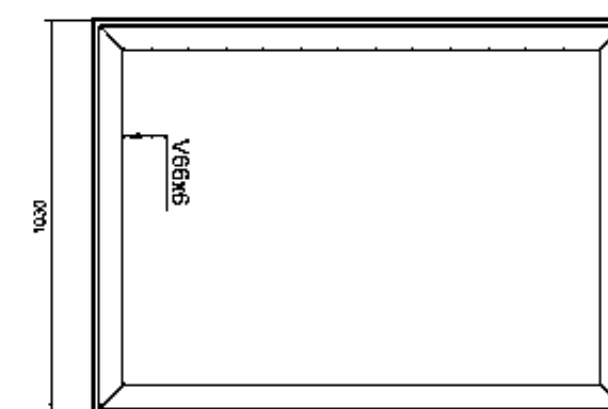
ø=90

**CABLE TROUGH ON EMBANKMENT****RÃNH CÁP TRÊN ĐƯỜNG**

Scale: 1/100

**KHUNG THÉP GIA CƯỜNG****MIỆNG HỒ GA**

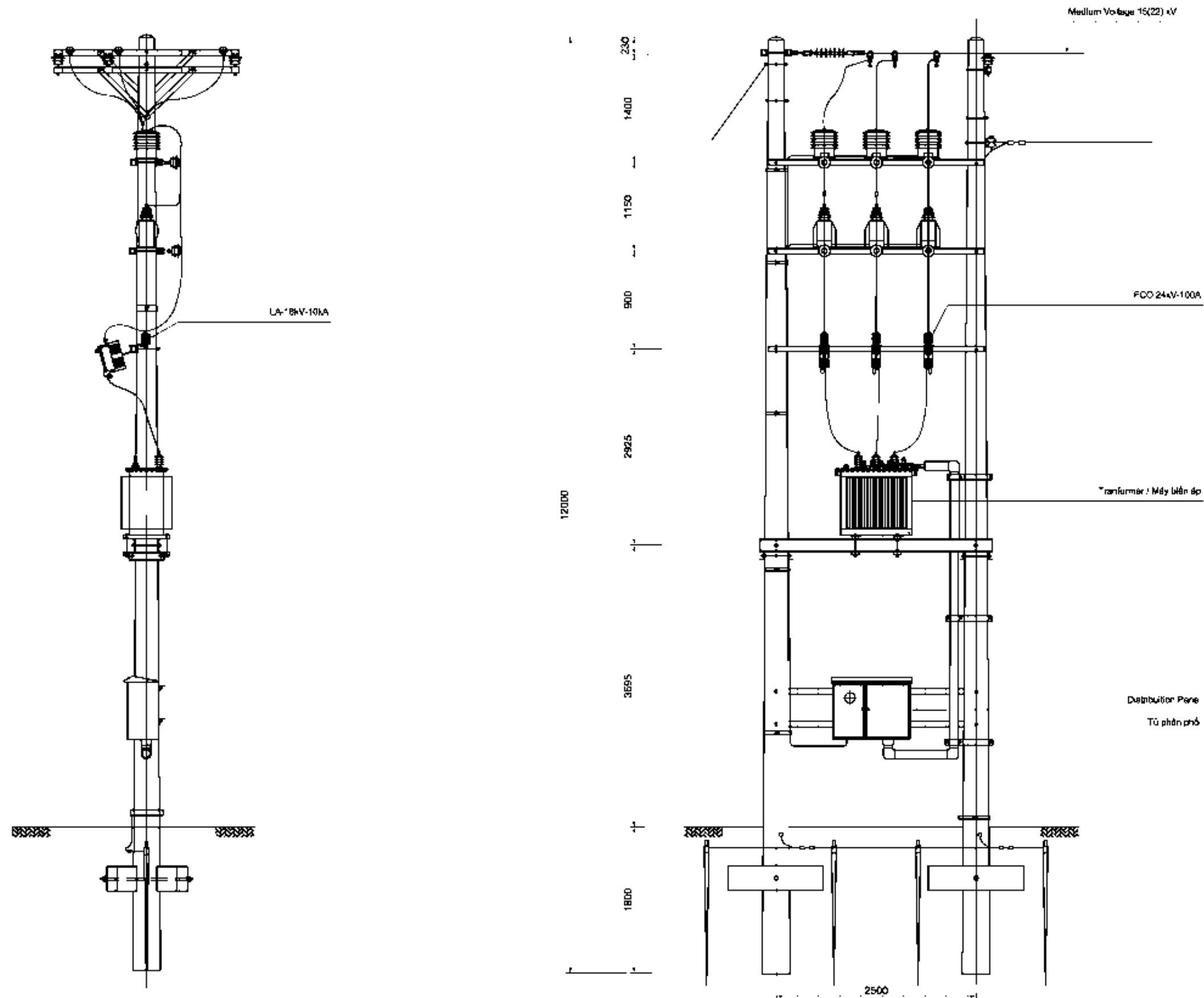
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CONSULTANT			
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO			
TYPE	NAME	SIGNATURE	
PREPARED BY	Nguyen Thanh PHUONG		
CHECKED BY	Le Ngoc HIEU		
APPROVED BY	Timothy COLLETT		

SOCIALIST REPUBLIC OF VIETNAM	
VIETNAM EXPRESSWAY CORPORATION (VEC)	

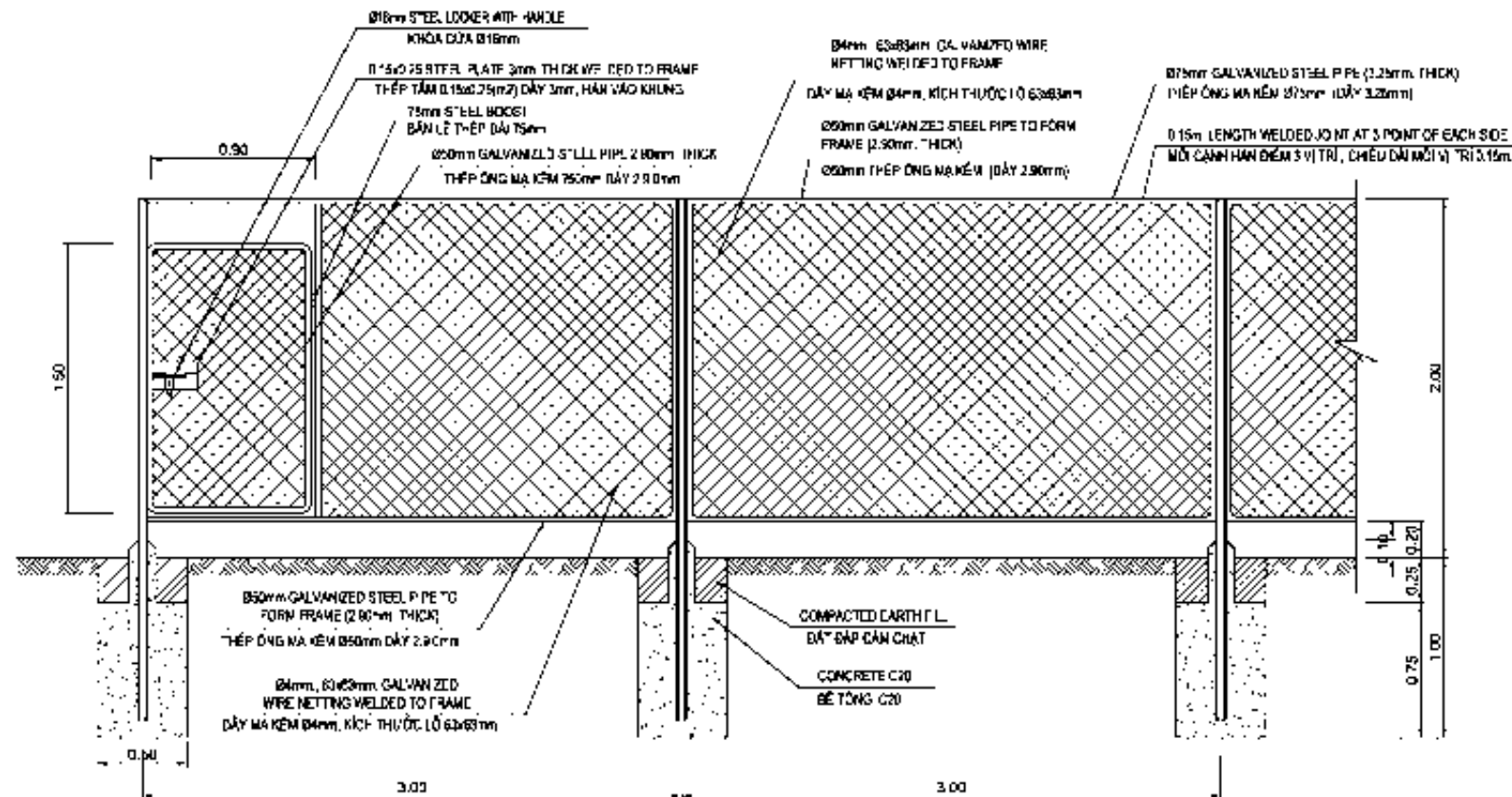
ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
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		1	FEB-2010	FINAL DRAWING	
DRAWING TITLE:					SCALE:
MANHOLE AND CABLE TROUGH					
HỒ GA LUỒN CÁP VÀ RÃNH CÁP					



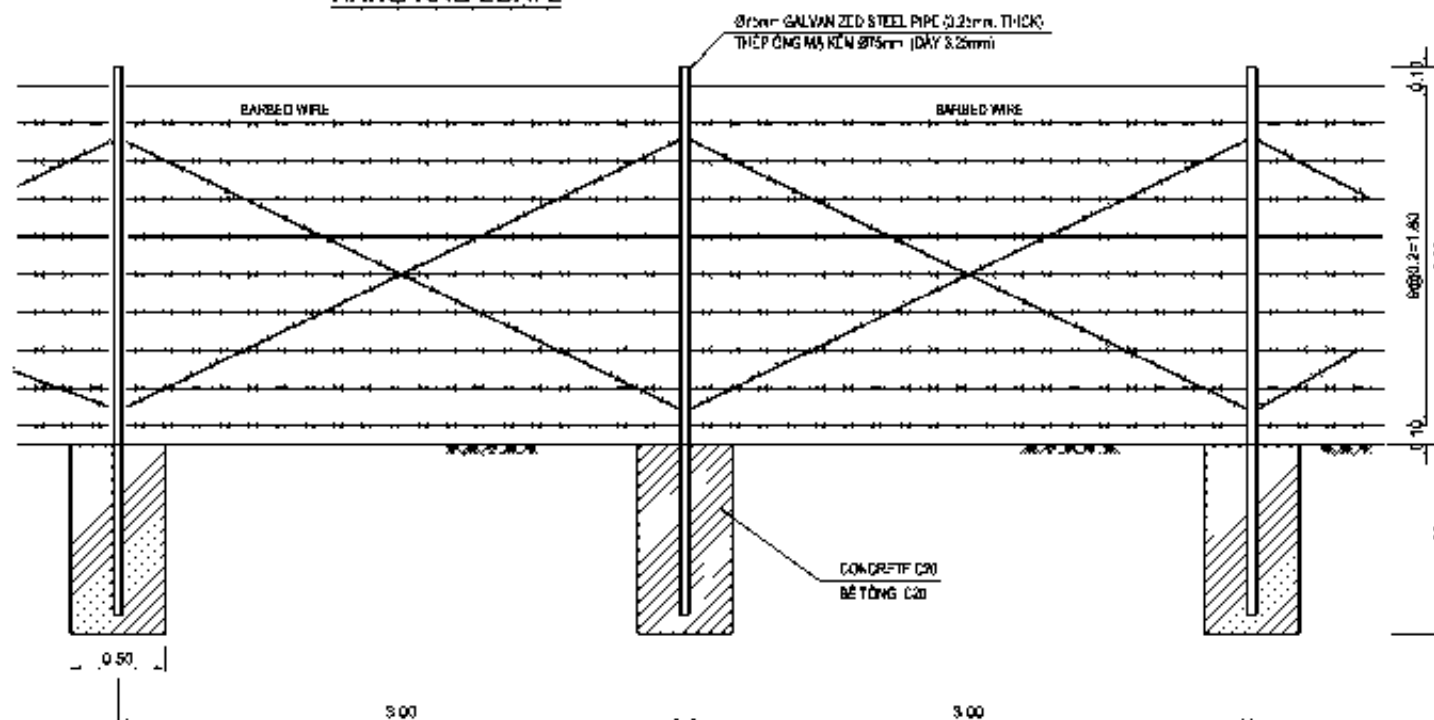
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						DRAWING TITLE:					
						SUBSTATION					
						TRAM BIEN AP					

X: Miscellaneous
X: Các chi tiết khác

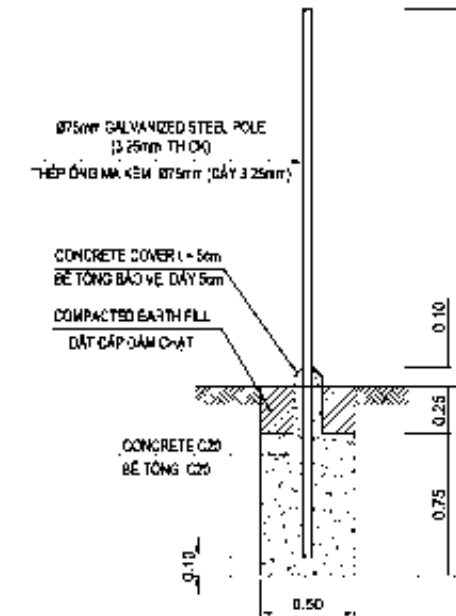
GUARD FENCE - TYPE 1 HÀNG RÀO LOẠI 1



GUARD FENCE - TYPE 2 HÀNG RÀO LOẠI 2

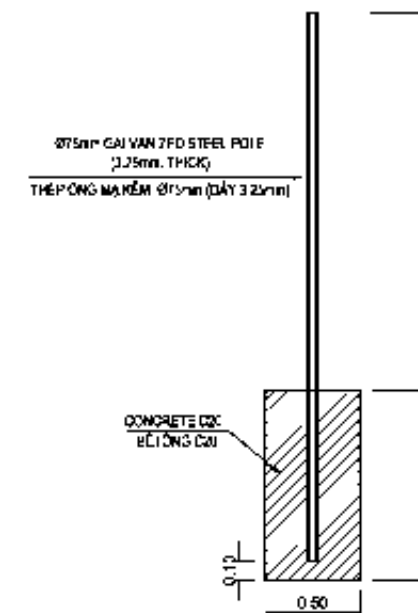


STRUCTURE SECTION POST KẾT CẤU TRỤ CHÔNG



GUARD FENCE TYPE 1 - HÀNG RÀO LOẠI 1						
No. STT	Left Side - Bên trái			Right Side - Bên phải		
	Starting Bắt đầu	Ending Kết thúc	Length Chiều dài (m)	Starting Bắt đầu	Ending Kết thúc	Length Chiều dài (m)
1	KM0+600	KM0+050	1,450.00	KM0+600	KM0+050	1,493.00
2	KM0+350	KM0+050	3,700.00	KM0+350	KM0+050	3,700.00
3	KM0+610	KM0+995	1,385.00	KM0+610	KM0+995	1,385.00
4	KM0+555	KM0+1125	2,560.00	KM0+555	KM0+1125	2,560.00
5	KM0+150	KM0+750	600.00	KM0+150	KM0+750	600.00
6	KM0+520	KM0+500	580.00	KM0+520	KM0+500	580.00
Total - Tổng			10,315.00			10,315.00

STRUCTURE SECTION POST KẾT CẤU TRỤ CHÔNG



GUARD FENCE TYPE 2 - HÀNG RÀO LOẠI 2						
No. STT	Left Side - Bên trái			Right Side - Bên phải		
	Starting Bắt đầu	Ending Kết thúc	Length Chiều dài (m)	Starting Bắt đầu	Ending Kết thúc	Length Chiều dài (m)
1	KM13+085	KM16+580	3,595.00	KM13+085	KM16+580	3,595.00
2	KM32+321	KM34+305	1,984.00	KM32+321	KM34+305	1,984.00
3	KM35+155	KM43+110	7,955.00	KM35+155	KM43+110	7,955.00
4	KM43+143	KM52+467	9,324.00	KM43+143	KM52+467	9,324.00
Total - Tổng			22,858.00			22,858.00

NOTES

- ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED
- 0.15m AND 0.15m GALVANIZED STEEL PIPE SHALL BE GALVANIZED
- LOCATION OF EXIT ENTRANCE OF FENCE GATE SHALL BE AS DIRECTED BY THE ENGINEER
- GUARD FENCE TYPE 2 IS USED IN SECTION WHERE LOCAL PEOPLE LIVING NEARBY, OTHER SECTIONS USE TYPE 1

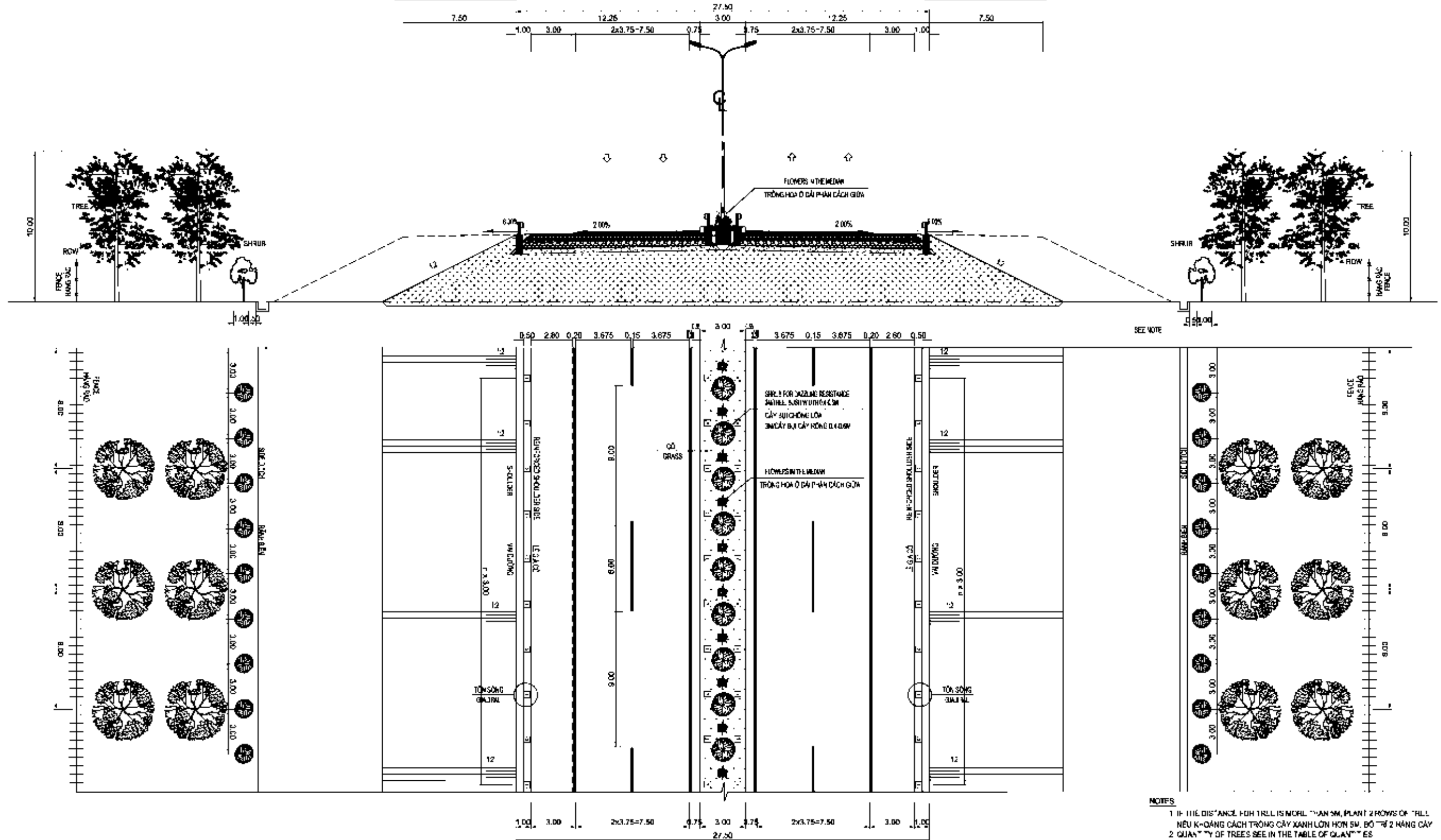
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-MI-010
								1	FFR-2010	FINAL DRAWING	
											SCALE: 1:40
						DRAWING TITLE: GUARD FENCE DETAILS CHI TIẾT HÀNG RÀO BẢO VỆ					

DETAILS OF TREES PLANNING CHI TIẾT QUY HOẠCH CÂY XANH

PLANNING STAGE
GIAI ĐOẠN QUY HOẠCH

STAGE 1 - GIAI ĐOẠN 1

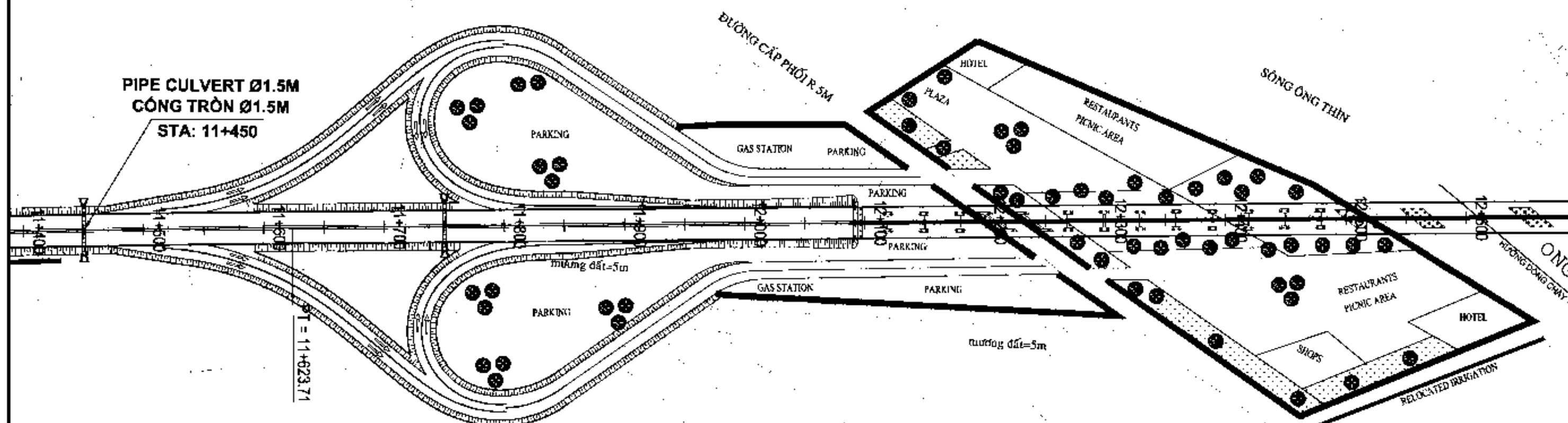
PLANNING STAGE
GIAI ĐOẠN QUY HOẠCH



NOTES

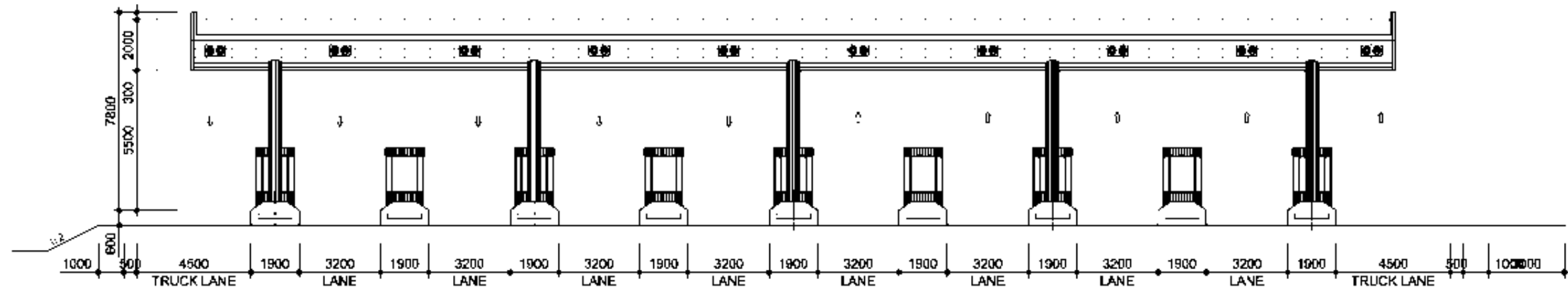
1. IF THE DISTANCE FOR TREE IS MORE THAN 5M, PLANT 2 ROWS OF TREES. IF THE DISTANCE IS LESS THAN 5M, PLANT 1 ROW OF TREES.
2. QUANTITY OF TREES SEE IN THE TABLE OF QUANTITIES.
3. KHỐI LƯỢNG CÂY XANH XEM TRONG BẢNG TÍNH KHỐI LƯỢNG.
4. ALL DIMENSIONS ARE IN METERS.
5. KÍCH THƯỚC BẢN VẼ TÍNH BẰNG MÊT.

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		AŞIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:												
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-MI-020												
								1	FFR-2010	FINAL DRAWING													
								DRAWING TITLE:		DETAILS OF TREES PLANNING CHI TIẾT QUY HOẠCH CÂY XANH					SCALE : 1 : 250								
						<table><tr><th>TITLE</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>A. Ngoc HIEU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TITLE	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	A. Ngoc HIEU		APPROVED BY	Timothy COLLETT			
TITLE	NAME	SIGNATURE																					
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CHECKED BY	A. Ngoc HIEU																						
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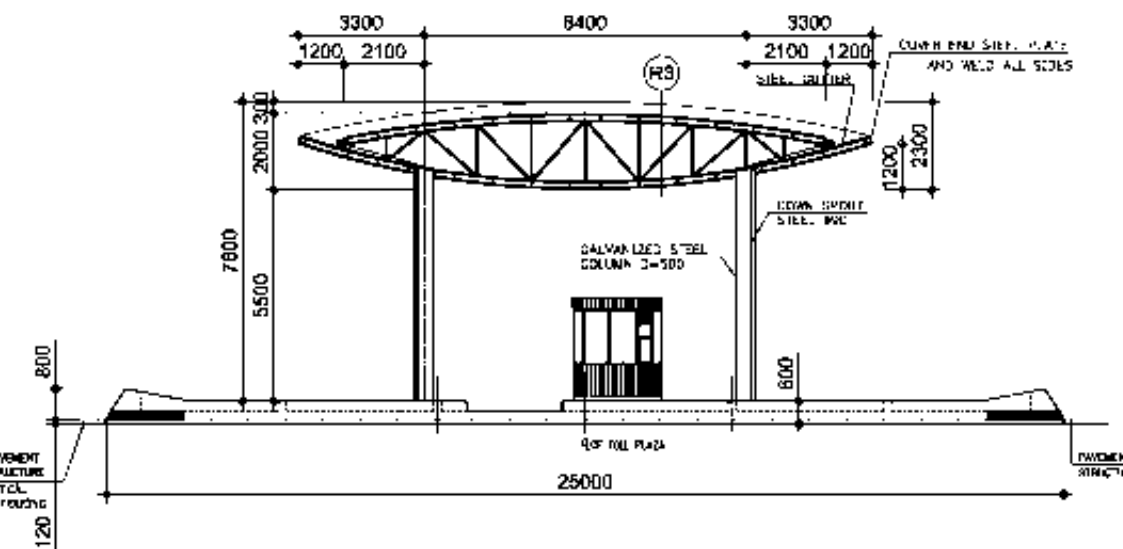
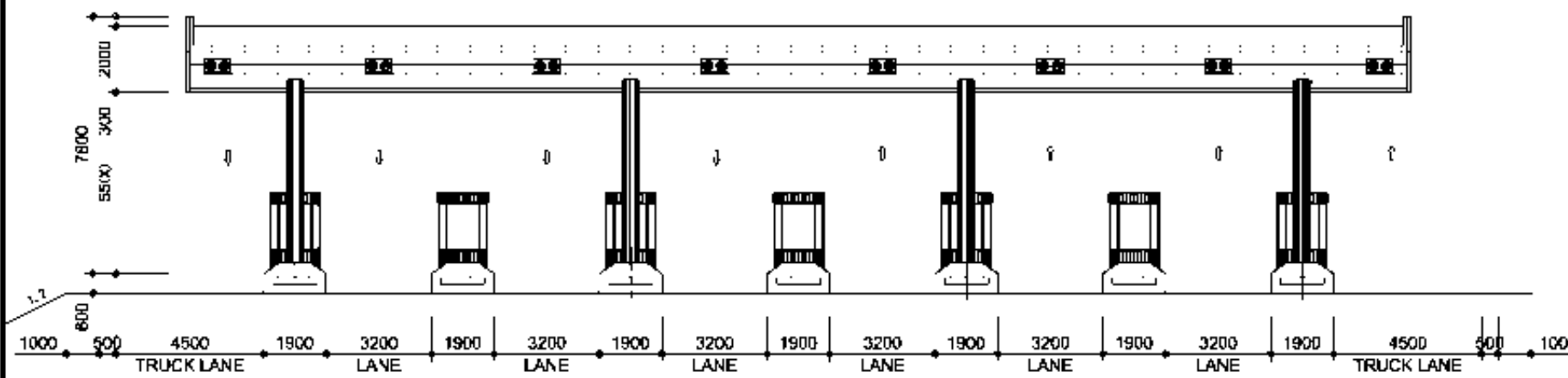


CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:												
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<table><tr><th>TITLE</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>A. Ngoc HIEU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TITLE	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	A. Ngoc HIEU		APPROVED BY	Timothy COLLETT									
TITLE	NAME	SIGNATURE																					
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CHECKED BY	A. Ngoc HIEU																						
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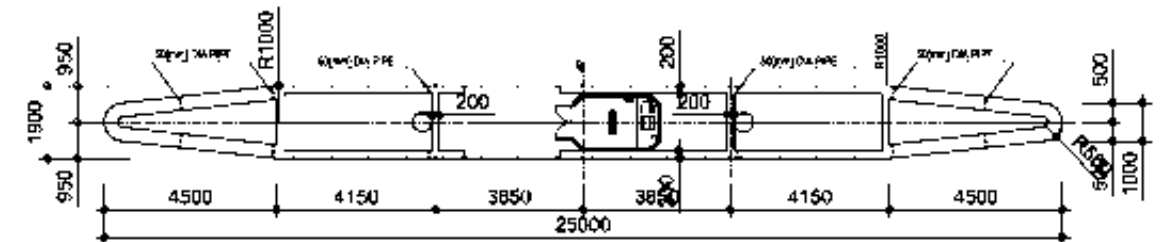
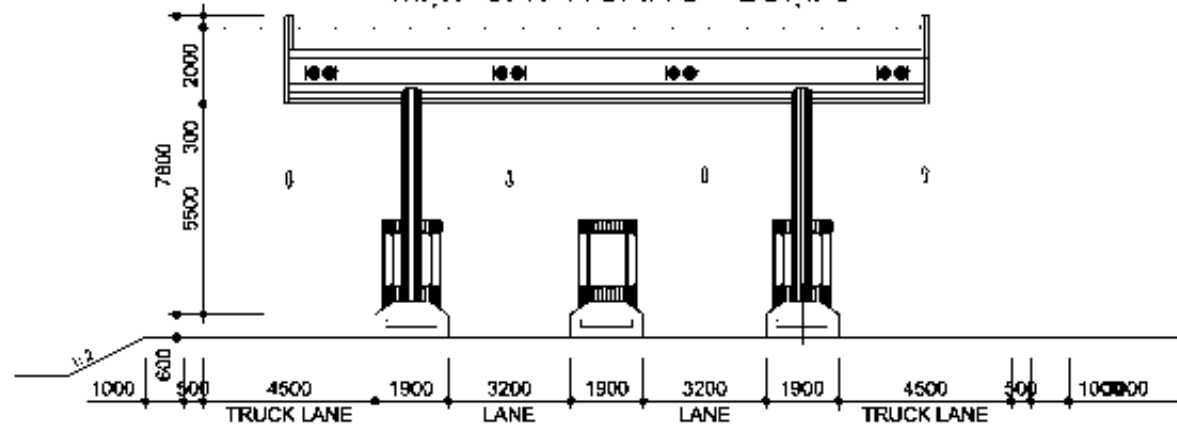
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CROSS SECTION - TYPE2 MẶT CẮT NGANG - LOẠI 2



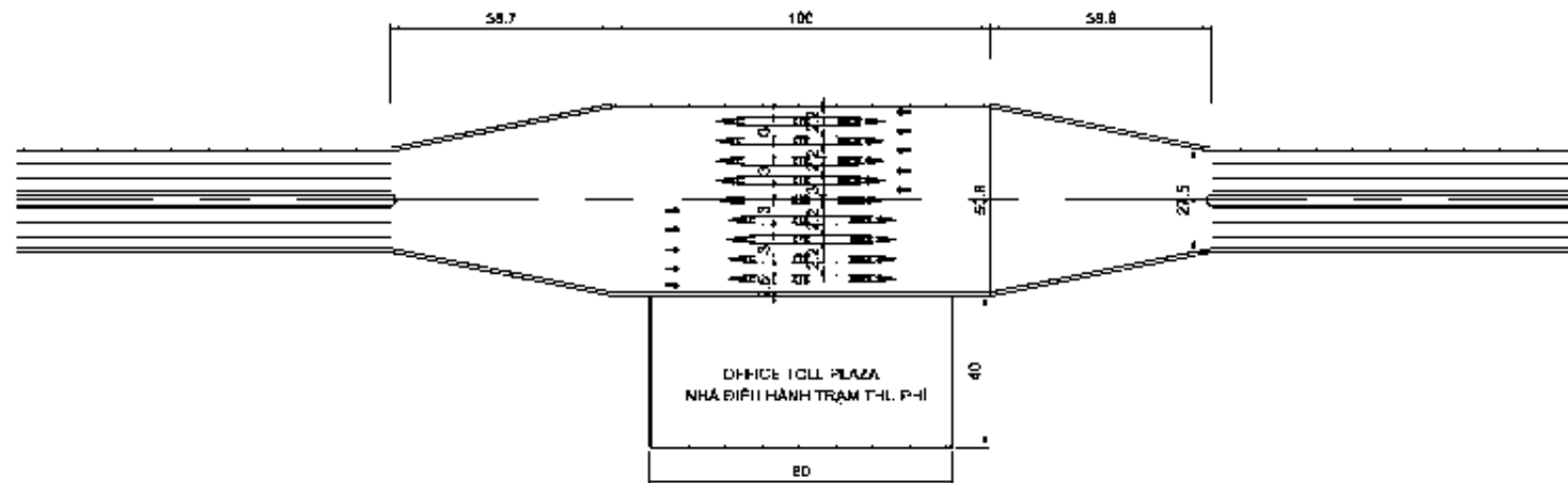
CROSS SECTION - TYPE3 MẶT CẮT NGANG - LOẠI 3



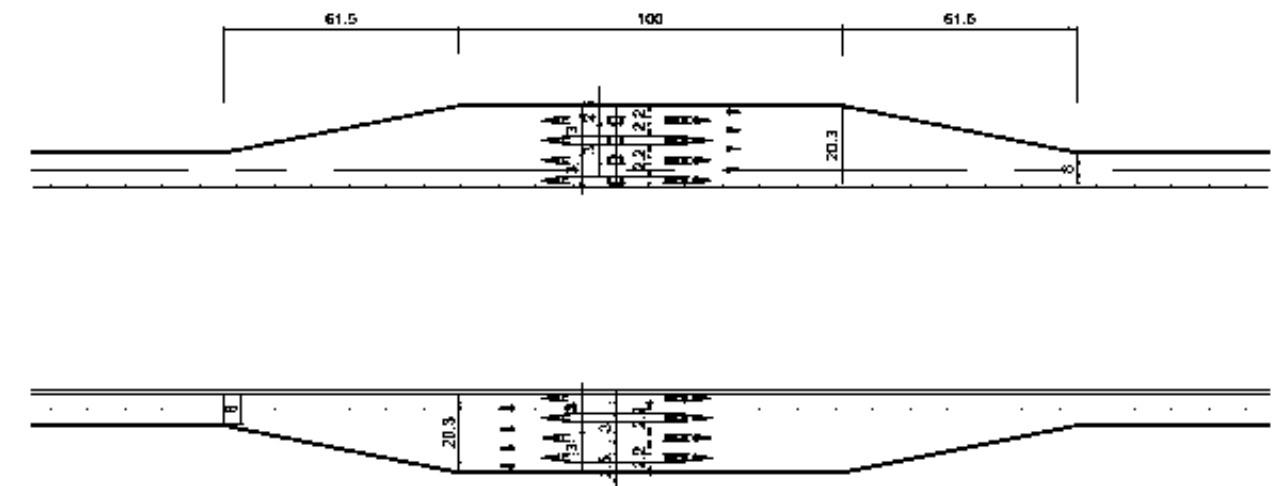
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KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2008	DRAFT FINAL DRAWING	RW-MI-040
								-	FEB-2010	FINAL DRAWING	
								DRAWING TITLE:		CROSS SECTION OF TOLL GATE CÁC KIỂU CẮT NGANG TRẠM THU PHÍ	
						PREPARED BY		Nguyen Thanh PHUONG			
CHECKED BY		Le Ngoc HIEU									
APPROVED BY		Timothy COLLETT									

PLAN OF TOLL PLAZA MẶT BẰNG TRẠM THU PHÍ

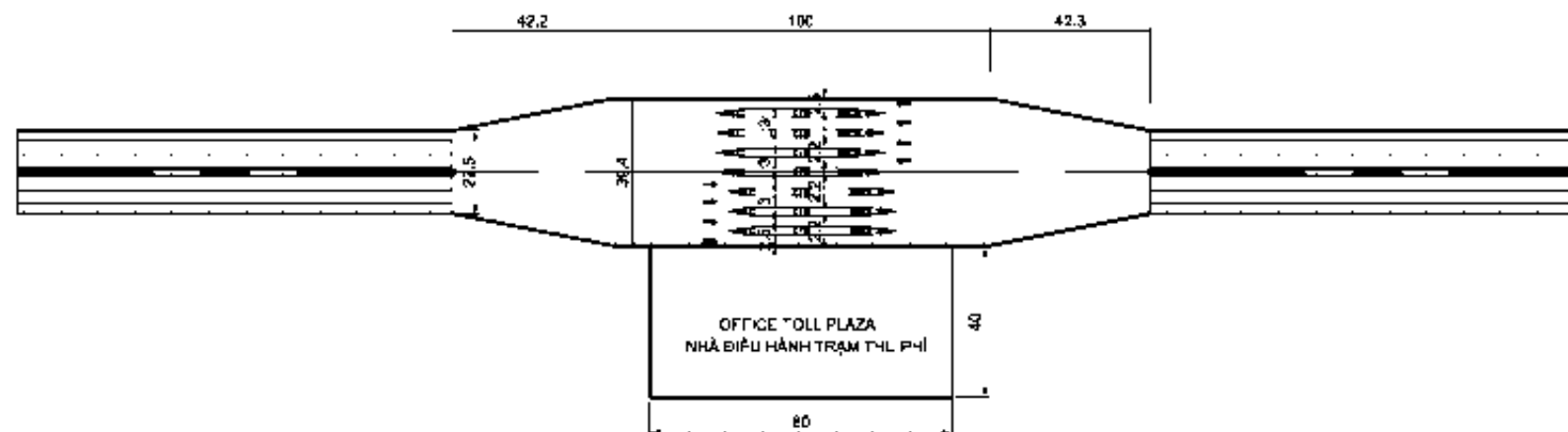
TOLL PLAZA OF THE MAIN LINE
TRẠM THU PHÍ TRÊN ĐƯỜNG CAO TỐC



TOLL PLAZA OF DIAMOND INTERCHANGES
TRẠM THU PHÍ TẠI NÚT GIAO KIM CƯƠNG



TOLL PLAZA OF INTERCHANGES
TRẠM THU PHÍ TRÊN NÚT GIAO



ALL DIMENSIONS ARE IN M
KÍCH THƯỚC BẢN VẼ ĐƠN VỊ LÀ M

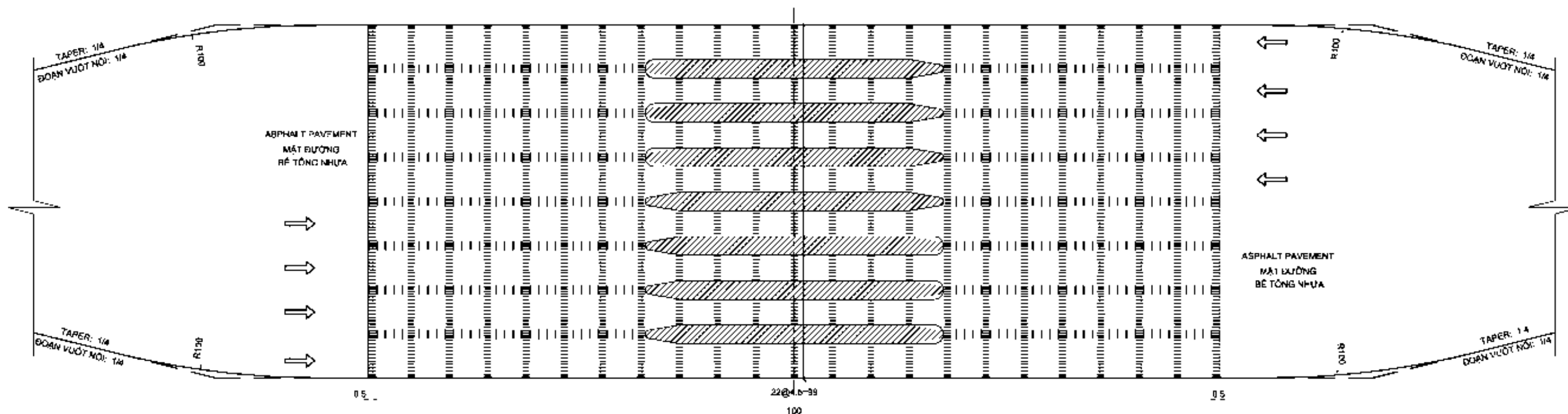
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													-										
<table><tr><th>TYPE</th><th>NAME</th><th>SIGNATURE</th></tr><tr><td>PREPARED BY</td><td>Nguyen Thanh PHUONG</td><td></td></tr><tr><td>CHECKED BY</td><td>Le Ngoc HIEU</td><td></td></tr><tr><td>APPROVED BY</td><td>Timothy COLLETT</td><td></td></tr></table>				TYPE	NAME	SIGNATURE	PREPARED BY	Nguyen Thanh PHUONG		CHECKED BY	Le Ngoc HIEU		APPROVED BY	Timothy COLLETT									
TYPE	NAME	SIGNATURE																					
PREPARED BY	Nguyen Thanh PHUONG																						
CHECKED BY	Le Ngoc HIEU																						
APPROVED BY	Timothy COLLETT																						

CONCRETE PAVEMENT AT TOLL GATE / MẶT ĐƯỜNG BTXM TẠI TRẠM THU PHÍ

JOINT PLAN

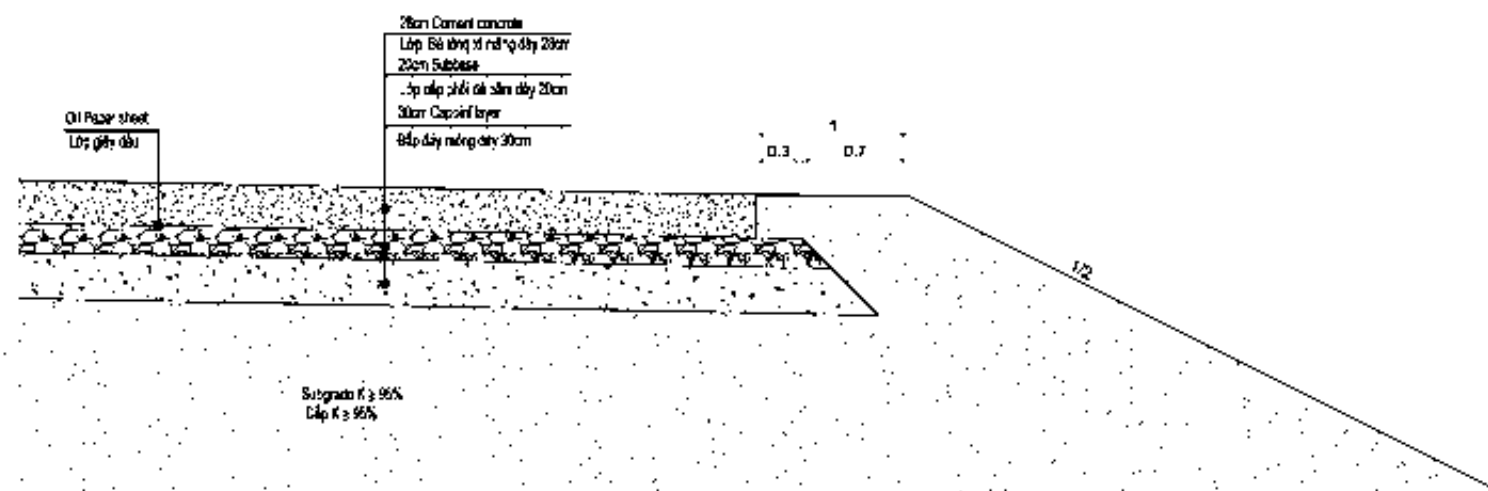
MẶT BẰNG KHE NỐI

SCALE (TỈ LỆ): 1/50



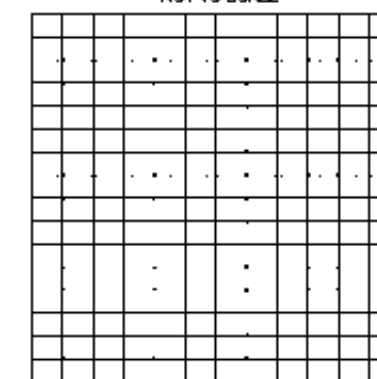
CONCRETE PAVEMENT STRUCTURE KẾT CẤU ÁO ĐƯỜNG BÊ TÔNG XI MĂNG

SCALE (TỈ LỆ): 1/50



STANDARD WIRE MESH LƯỚI THÉP TIÊU CHUẨN

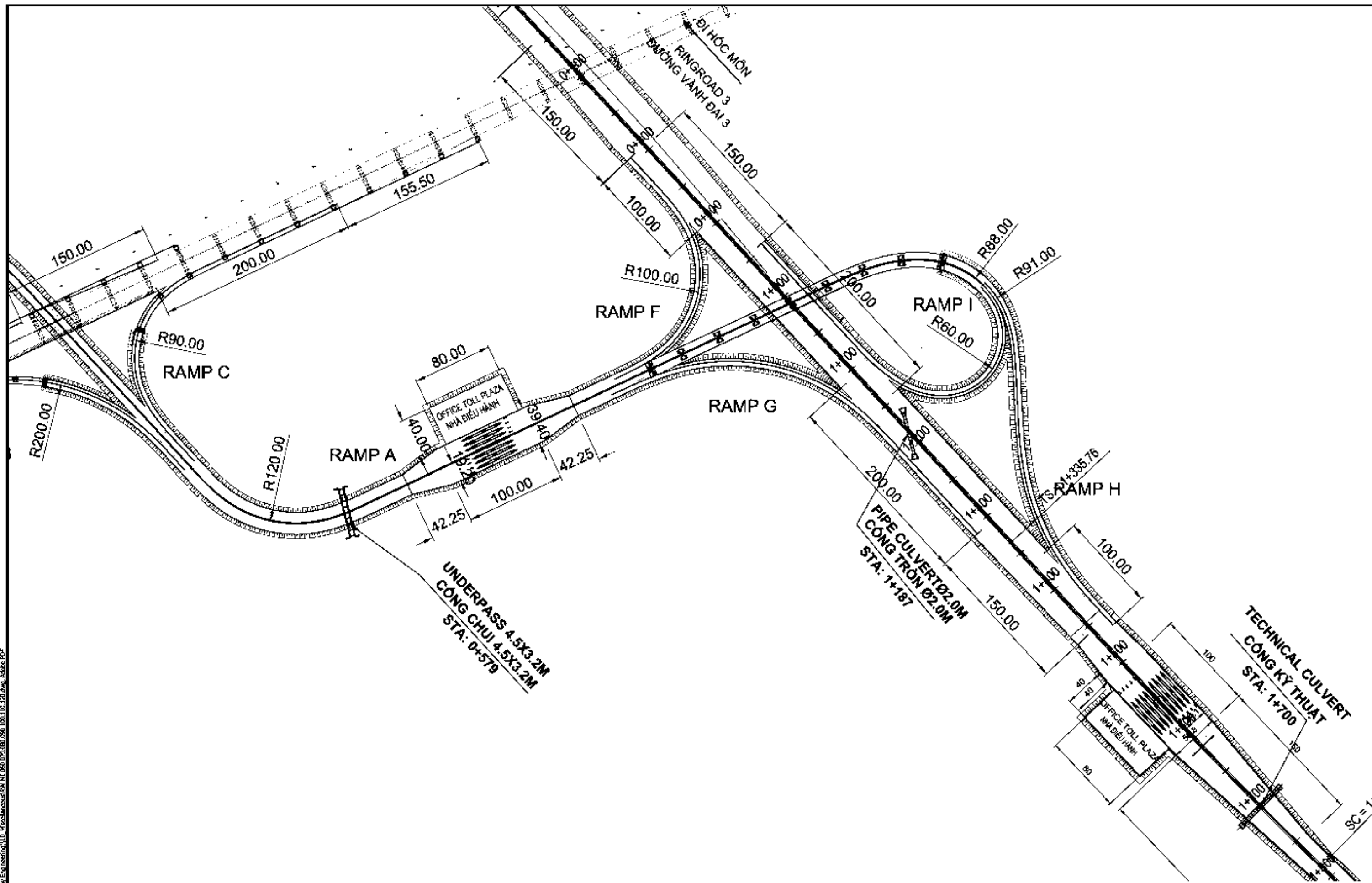
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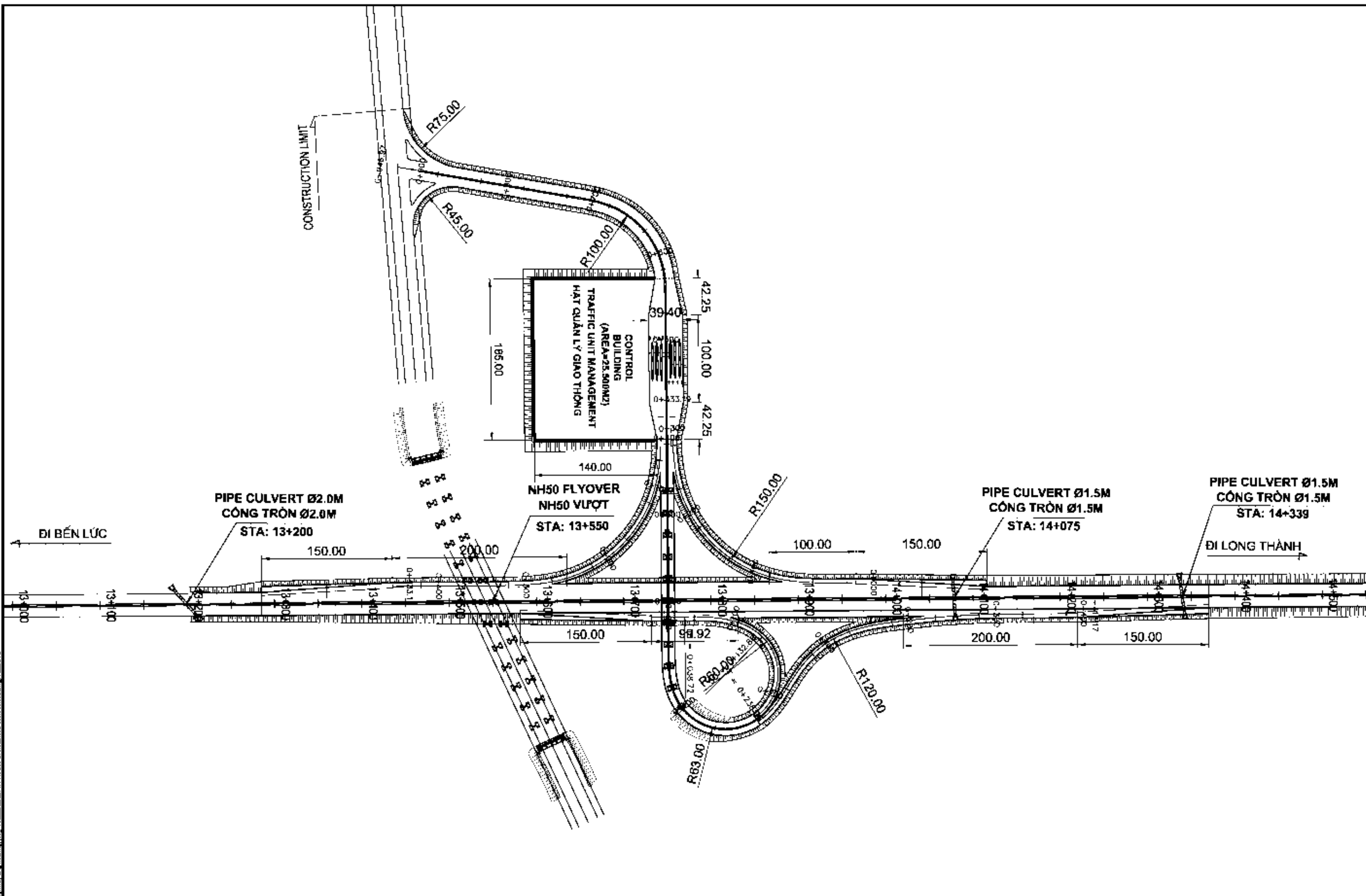
DIMENSION ARE IN MILLIMETER
BƯỚC CỐT THÉP VÀ ĐƯỜNG KÍNH CỐT THÉP LÀ MILIMET

ALL DIMENSIONS ARE IN METER OR AS SHOWN
KÍCH THƯỚC BẢN VẼ ĐƠN VỊ LÀ MÉT TRỪNG KÉM TRÊN BẢN VẼ

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	RW-MI-051
								1	FEB-2010	FINAL DRAWING	
								DRAWING TITLE:		CONCRETE PAVEMENT AT TOLL GATE MẶT ĐƯỜNG BTXM TẠI TRẠM THU PHÍ	SCALE: AS SHOWN
PREPARED BY: Nguyen Thanh PHUONG CHECKED BY: Le Ngoc HIEU APPROVED BY: Timothy COLLETT											

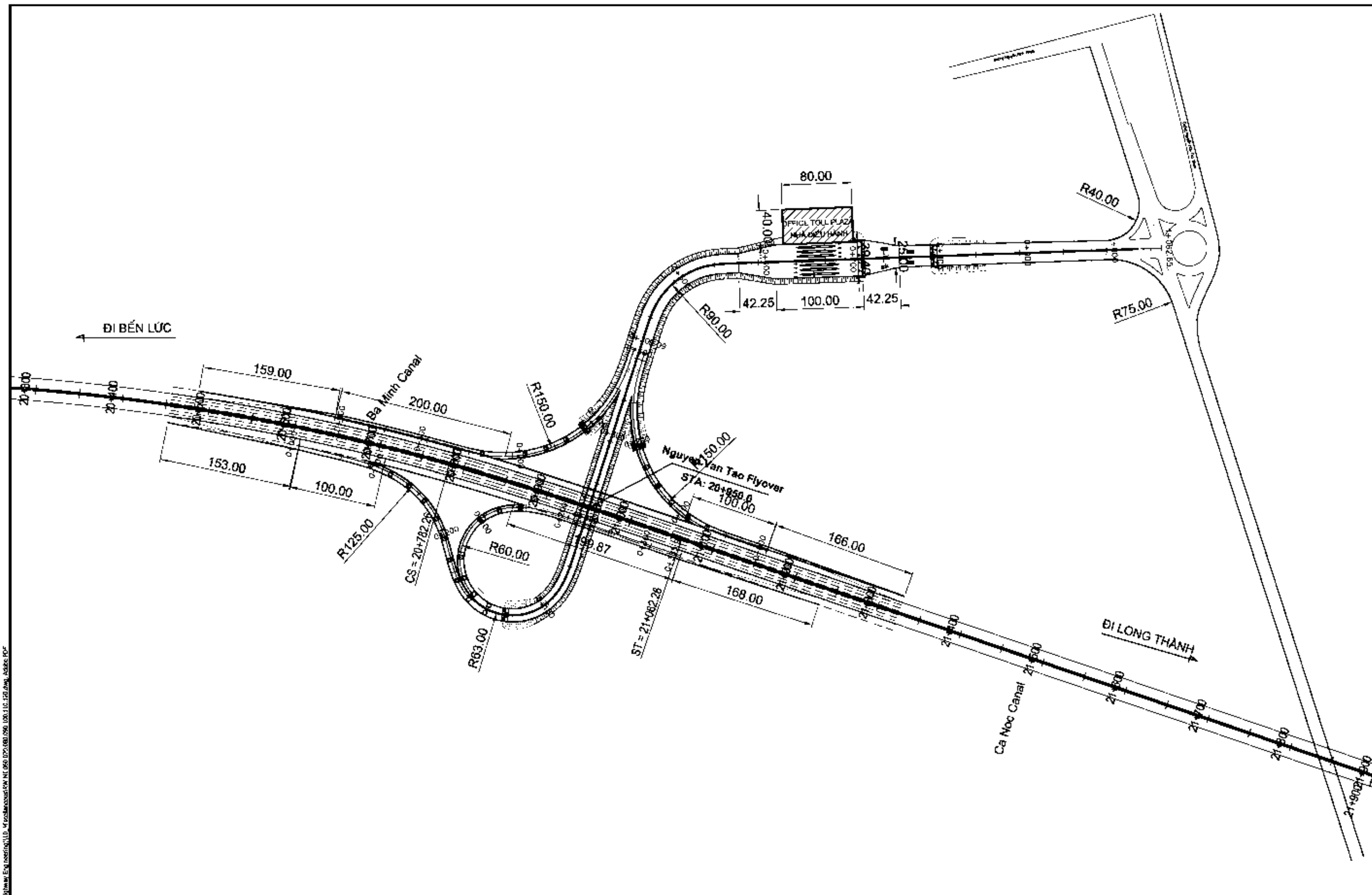


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								1	FEB-2010	FINAL DRAWING	
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						GENERAL VIEW OF TOLL PLAZA OF IC NO.1 BỐ TRÍ CHUNG TRAM THU PHÍ TẠI NÚT GIAO SỐ 1					-



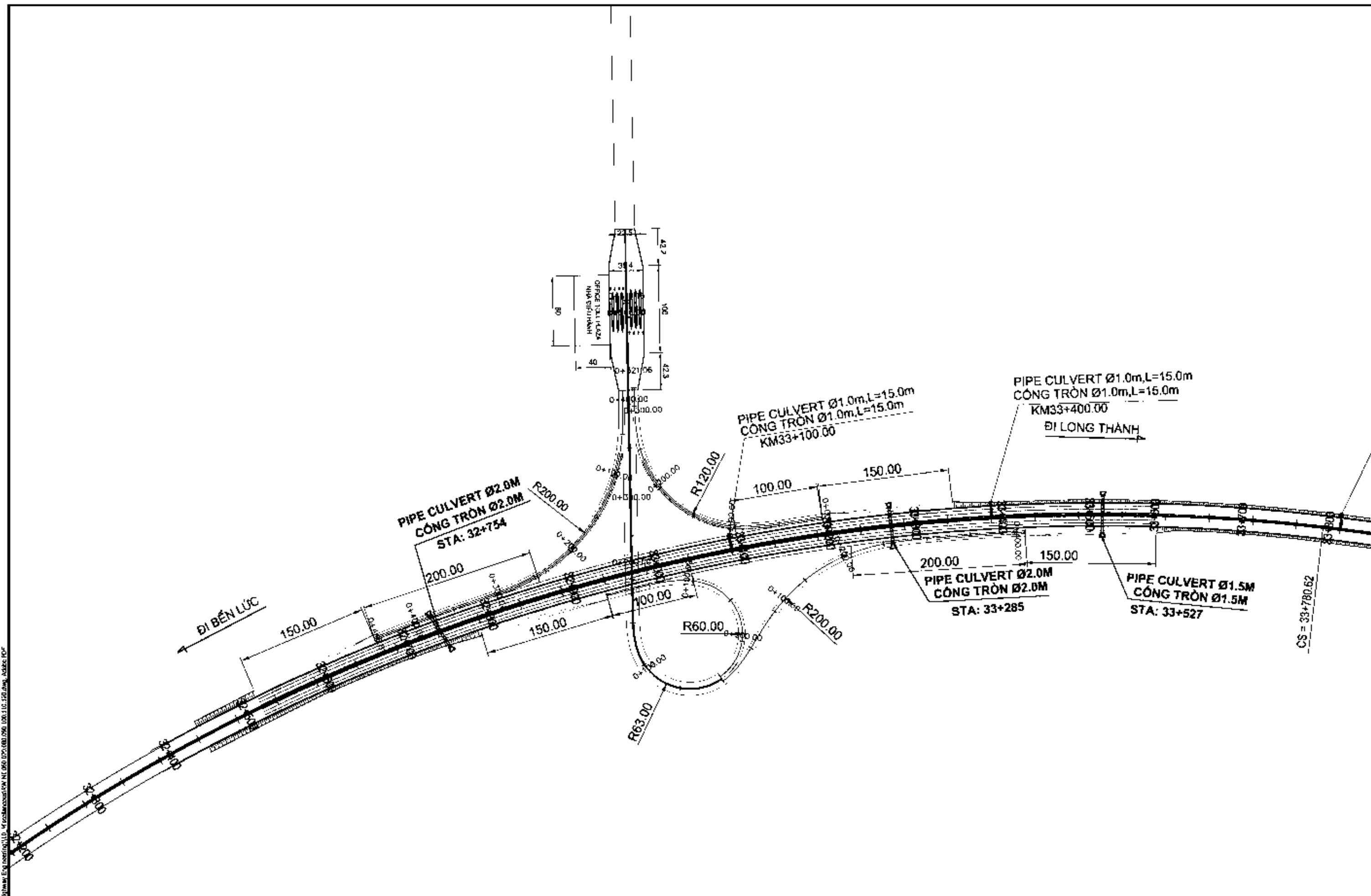
CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: GENERAL VIEW OF TOLL PLAZA OF IC NO.3 BỘ TRÍ CHUNG TRẠM THU PHÍ TẠI NÚT GIAO SỐ 3		0	NOV-2009	DRAFT FINAL DRAWING	RW MI 080
								-	FEB-2010	FINAL DRAWING	
											SCALE:
											-

2:1000 Final Draft Drawing Highway Engineering\110_Vietnam Expressway\TA 7155-VIE\TA 7155-VIE.dwg, Author: POC

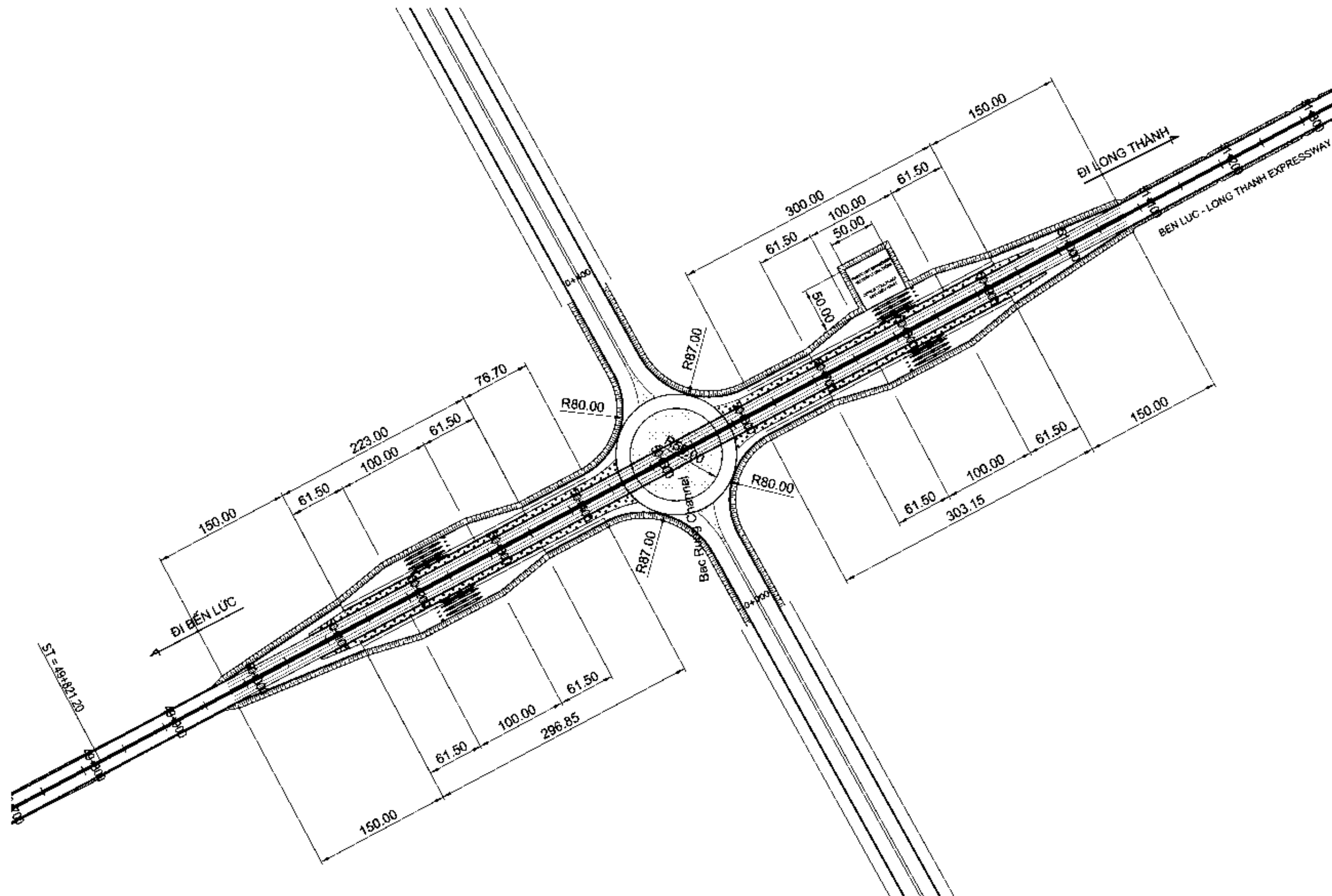


2:0000 Final Draft Drawing Highway Engineering\1111_Vietnam\SSS\TA MI 090.DWG (00110120.DWG, Add: 100)

CONSULTANT				SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.:
KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: GENERAL VIEW OF TOLL PLAZA OF IC NO.4 BỒ TRÍ CHUNG TRẠM THU PHÍ TẠI NÚT GIAO SỞ 4		0	NOV-2008	DRAFT FINAL DRAWING	RW MI 090
								1	FEB-2010	FINAL DRAWING	
											SCALE:



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											SCALE:



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KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO				VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE: GENERAL VIEW OF TOLL PLAZA OF IC NO.6 BỘ TRÍ CHUNG TRẠM THU PHÍ TẠI NÚT GIAO SỐ 6		0	NOV-2009	DRAFT FINAL DRAWING	RW MI 110
								1	FEB-2010	FINAL DRAWING	
											SCALE:

APPENDIX C2:

BRIDGE

DRAWINGS

GENERAL NOTES

1. GENERAL

- 1.1 UNLESS OTHERWISE NOTED THESE NOTES ARE APPLIED TO ALL DRAWINGS
1.2 ALL CHAINAGE COORDINATES ELEVATIONS ARE IN METERS DIMENSIONS ARE IN METERS
1.3 THE COORDINATE SYSTEM IS ACCORDING TO THE NATIONAL COORDINATE SYSTEM
1.4 THE SCALE INDICATED IN THE DRAWINGS IS FOR TABLE 2F

2. DESIGN SPECIFICATION & LOADS

2.1 TECHNICAL SPECIFICATIONS

- 2.1.1 CONSTRUCTION SCALE - PERMANENT
2.1.2 WIDTH OF BRIDGE

+ STAGE 1		+ STAGE 2	
TRAFFIC LANE	2X2X3.75 = 15.0 M	TRAFFIC LANE	2X4X3.75 = 30.0 M
PARKING STRIP OF FAST LANE	2X3.0 = 6.0 M	PARKING STRIP OF FAST LANE	2X3.0 = 6.0 M
SAFETY STRIP	2X0.75 = 1.50 M	SAFETY STRIP	2X0.75 = 1.50 M
RAKAPIT	4X0.10 = 2.00 M	RAKAPIT	4X0.10 = 2.00 M
SPACING OF 2 BRIDGES	= 2.00 M	SPACING OF 2 BRIDGES	= 2.00 M
TOTAL	= 28.5 M	TOTAL	= 47.5 M

1.1.3 ROAD DESIGNING REQUEST TOWN 5759-97 REFERENCE TO TOWN 4354-2005
DESIGN SPECIFICATION OF BRIDGES - 27/01/2012-05

2.2 DESIGN LOADS

2.2.1 DEAD LOADS

PLAIN CONCRETE	24 T/M3
REINFORCED CONCRETE	25 T/M3
ASPHALTIC CONCRETE	2.25 T/M3

2.2.2 LIVE LOADS

DESIGN VEHICLE LIVE LOADS - H-100

2.2.3 OTHER LOADS

1. TYPE OF EARTHQUAKE - TABLE OF SEISMIC ZONES IN VIETNAM - TOWN 575-2005
ACCELERATION COEFFICIENT - COMPLIANCE WITH VIETNAM TOWN 575-2005
BASIC WIND VELOCITY - 45 M/S FOR NORMAL BRIDGE
SOIL PROFILE TYPE - II
UNIFORM TEMPERATURE CONCRETE BRIDGE - +10 C - +47 C

3. CONCRETE

- 3.1 CONCRETE GRADES BASED ON SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS
CYLINDER SPECIMEN 150MM DIA X 300MM HIGH

CONCRETE CLASS	STRENGTH (CUMPA)	STRUCTURAL ELEMENTS IN USE
C50	50	PRECAST CONCRETE (SUPERHILL)
C40	40	BOX GIRDER
C35	35	TOP DECK SLAB AND LINK SLAB, CROSSBEAM OF SUPERHILL, SOLID SLAB
C30	30	ABUTMENT FIRST HORIZONTAL PRECAST CONCRETE PLANK FOR SUPERHILL
C25	25	PARAPET, PEDESTAL OF LAMP POST, APPROACH SLAB
C20	20	SEALING CONCRETE - PRECAST SLAB FOR SLOPE PROTECTION
C10	10	BLINDING CONCRETE

- 3.2 THE CAP CONCRETE SHALL BE PLACED ON 100MM MINIMUM THICKNESS OF BLINDING CONCRETE
3.3 BLINDING STONE SHOWN IN THE DRAWINGS IS INDICATIVE ONLY THE CONTRACTOR SHALL PROVIDE BLINDING STONE WHEN APPROVED OR INSTRUCTED BY THE ENGINEER
3.4 ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 20X20MM UNLESS OTHERWISE SPECIFIED

4. REINFORCEMENT

- 4.1 REINFORCEMENT INCLUDE 2 TYPES AS FOLLOWS (ACCORDING TO TOWN 1651-85)

TYPE	SYMBOL	YIELD STRENGTH (MPA)	TENSILE STRENGTH (MPA)	ELASTIC MODULUS (MPA)
ROUND BAR	Ø	240	500	200 000
DEFORMED BAR	ØII	400	600	200 000

5. PRESTRESSED REINFORCEMENT AND CONFINEMENT ANCHORAGE

- 5.1 STANDARD DIMENSION, TENSILE STRENGTH AND YIELD STRENGTH OF PRESTRESSING STRANDS SHALL BE AS FOLLOWS

DIMENSION (MM)	TENSILE STRENGTH (MPA)	YIELD STRENGTH (MPA)	ELASTIC MODULUS (MPA)
15.2	1850	1570	185 000

- 5.2 THE PRESTRESSING TENDONS SHALL BE MADE OF LOW RELAXATION STRAND GRADE 270 AND SHALL CONFORM TO ASTM A418-99

6. ACCESSORIES

- 6.1 THE FOLLOWING ACCESSORIES SHOWN IN THE DRAWINGS ARE TO BE USED SUBJECT TO THE ENGINEER'S APPROVAL
• COARINGS
• EXPANSION JOINTS
• HANDRAILS
• ROAD LIGHTING

ALTERNATIVE 1 - PHƯƠNG ÁN 1
(RECOMENDATION - PHƯƠNG ÁN CHỌN)

1.ONG THOAN BRIDGE
1.CẦU ÔNG THOAN
KM 2+220

PROFILE OF BRIDGE 1 - MẶT CHÍNH CẦU

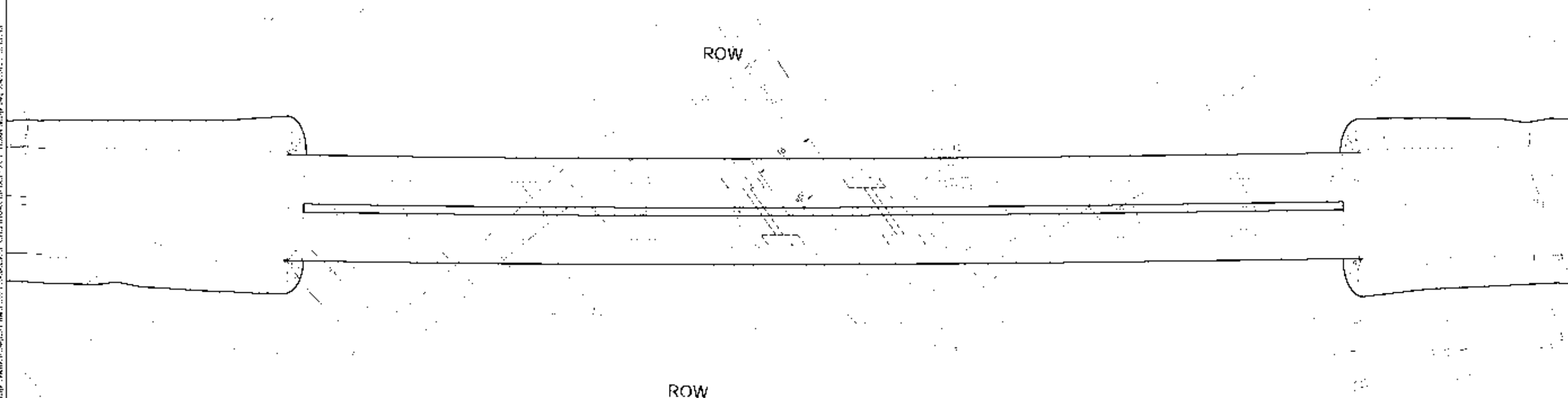
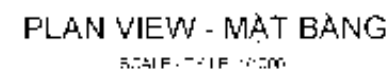
PHẦN CẦU ĐƯỜNG CẦU 1 - 36000

SCALE: 1:10,000




STATIONING: 0+000, 0+100, 0+200, 0+300, 0+400, 0+500, 0+574

ELEVATION: 15.526, 15.600, 15.674, 15.964, 16.000, 16.020, 16.030, 16.000, 15.960, 15.880, 15.800, 15.674, 15.574

CURVE DATA: R=1000, L=100.00



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TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Tim COLLETT	

VIETNAM EXPRESSWAY CORPORATION (VEC)

DRAWING TITLE: HƯỚNG DẪN THIẾT KẾ VÀ THI CÔNG HỆ THỐNG
ĐÓNG CHUNG CẢM ỨNG THUYỀN

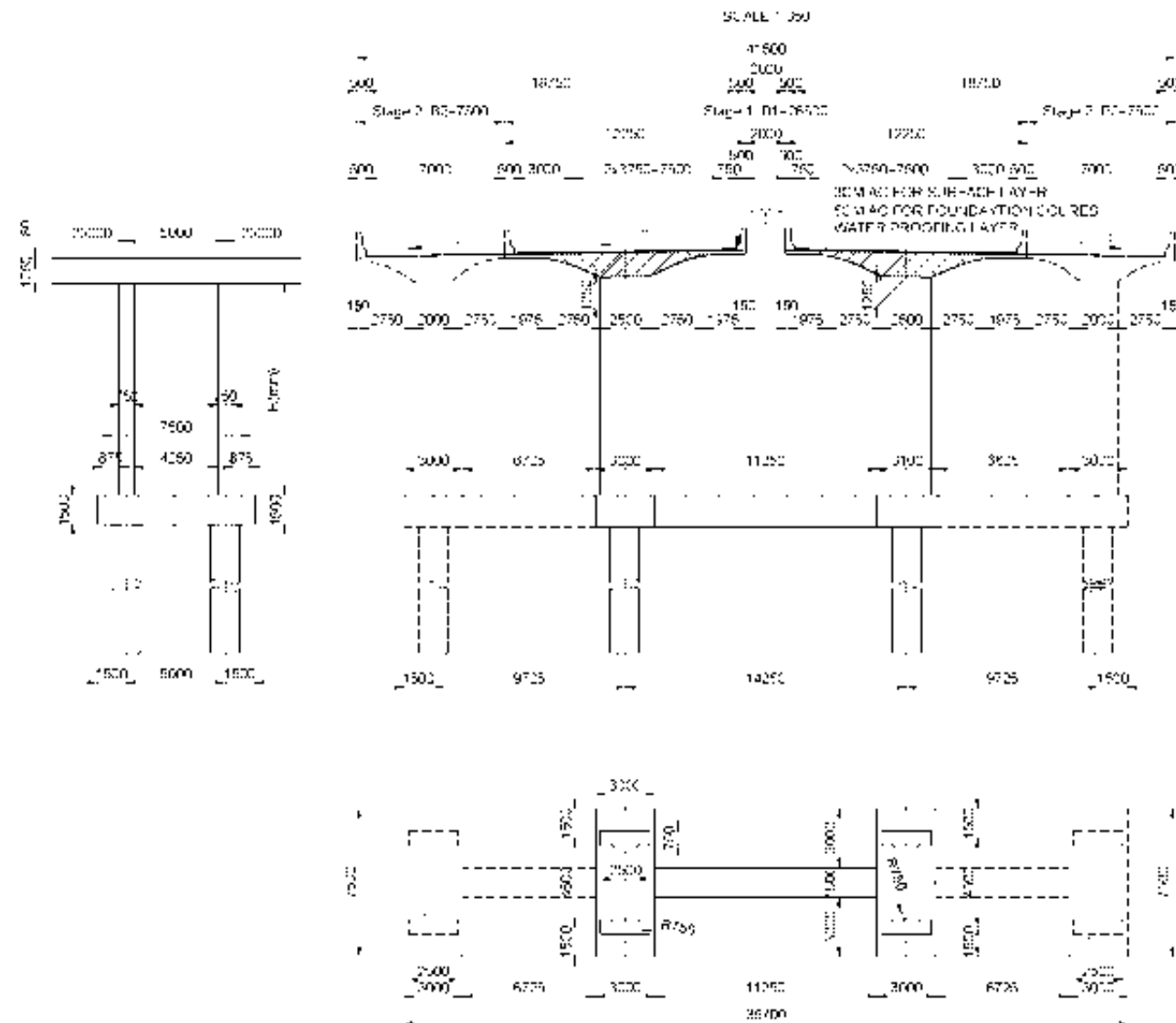
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1	FEB-2010	FINAL DRAWING	

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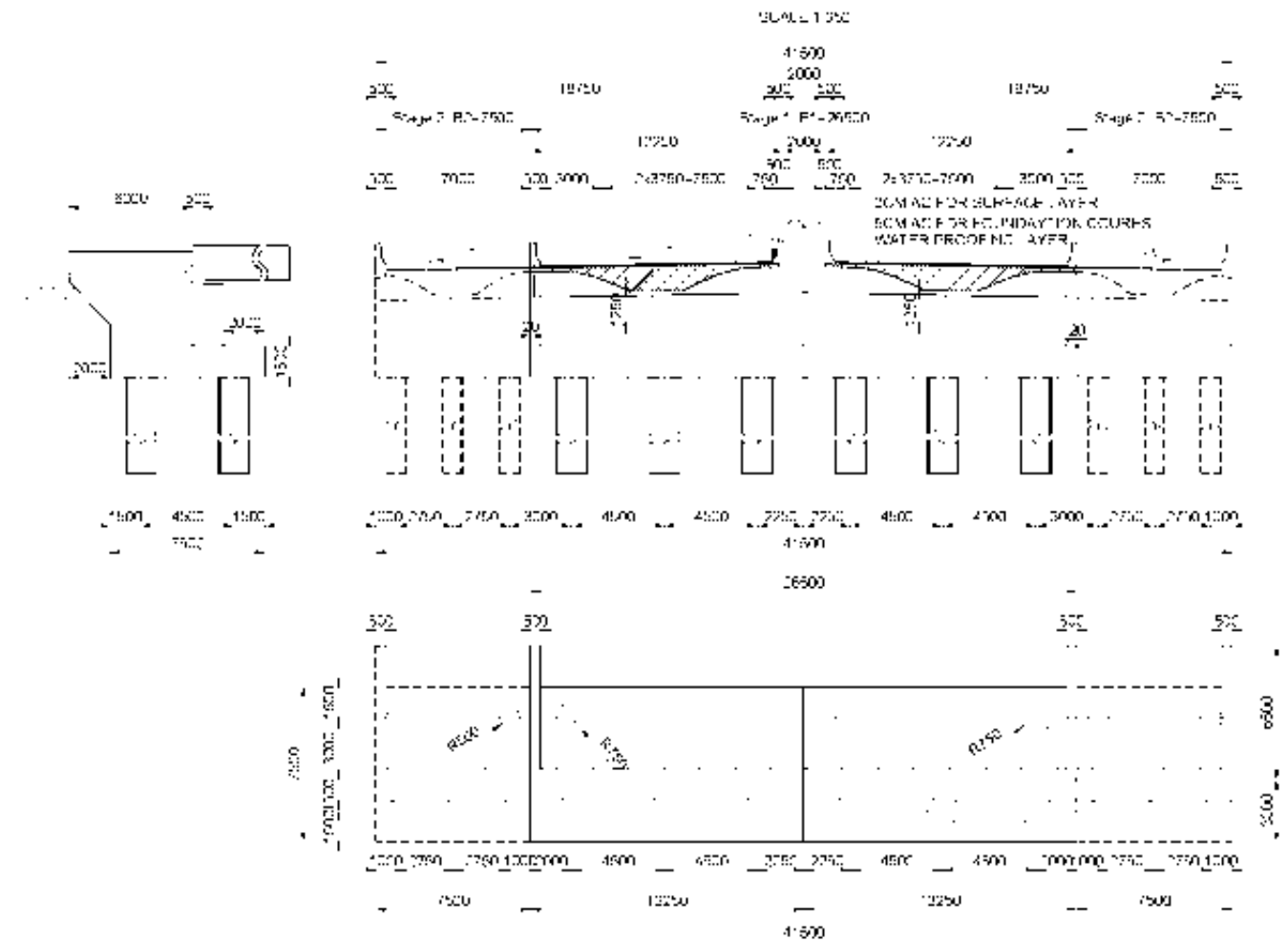
TYPICAL CROSSECTION OF BRIDGE

MẶT CẮT NGANG ĐIỂN HÌNH CẦU

SECTION A-A - MẶT CẮT A-A



SECTION B-B - MẶT CẮT B-B



Ước tính hiệu quả kinh tế của dự án và các yếu tố khác liên quan đến dự án, bao gồm các yếu tố kinh tế, xã hội, môi trường, và các yếu tố khác.

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 In Association With
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TITLE NAME SIGNATURE
 PREPARED BY Đặng Vũ TUYẾN
 CHECKED BY Lê Ngọc HIEU
 APPROVED BY Trần COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

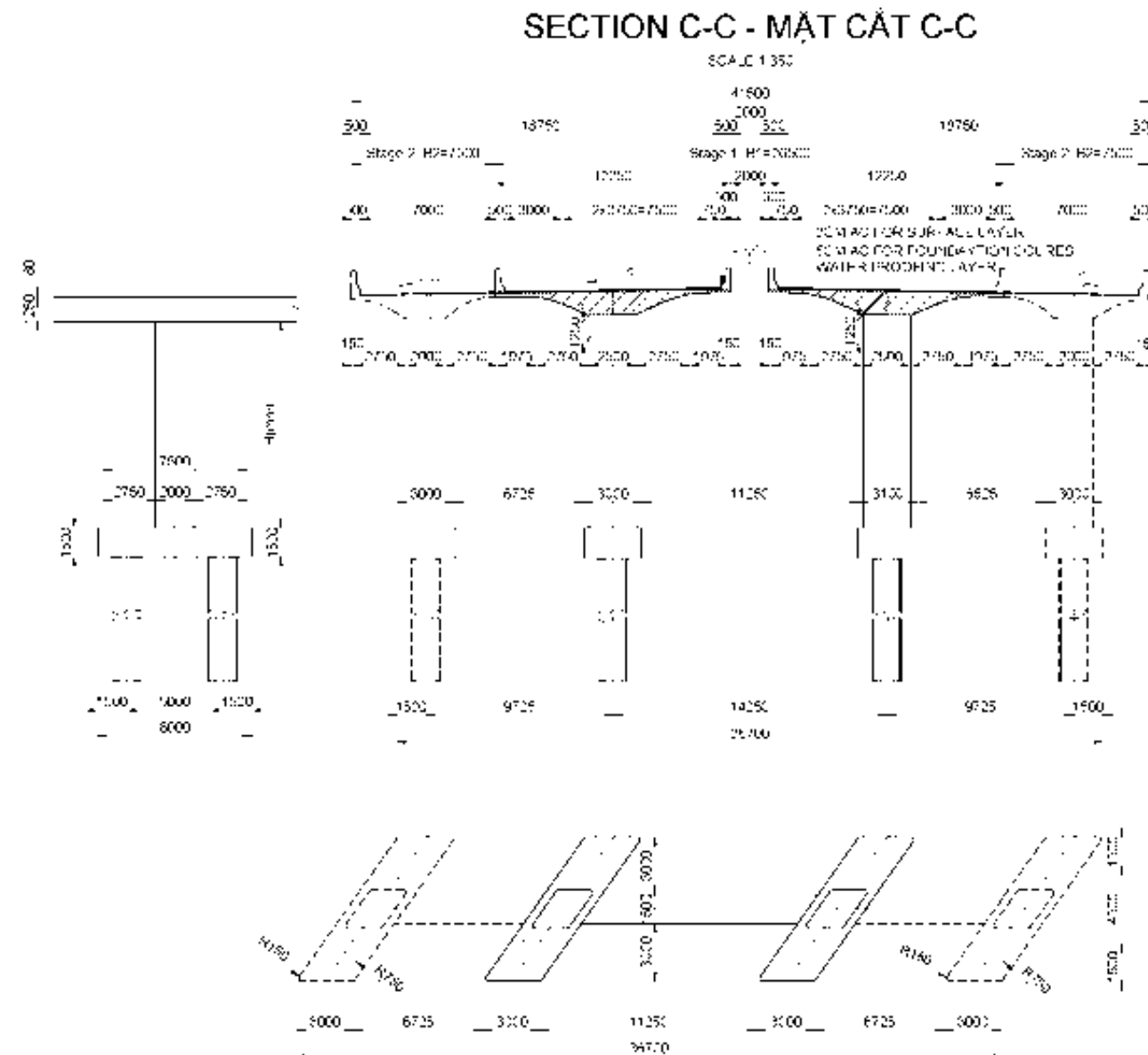
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
 TYPICAL CROSSECTION OF PREPARED BRIDGE
 MẶT CẮT NGANG ĐIỂN HÌNH CẦU SẴN THẠM

REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAWING DRAWING	DR-02
1	FEB-2010	FINAL DRAWING	

SCALE: 1:200

TYPICAL CROSSECTION OF BRIDGE MẶT CẮT NGANG ĐIỂN HÌNH CẦU



VEP 01/2010: HƯỚNG DẪN THIẾT KẾ VÀ THI CÔNG CÁC CÔNG TRÌNH GIAO THÔNG, BƯỞI ĐÀO VÀ CÁC CÔNG TRÌNH KỸ THUẬT KHÁC TRONG CÁC CÔNG TRÌNH GIAO THÔNG

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	PREPARED BY	Dang Vu TUYEN	
	CHECKED BY	La Ngoc HIEU	
	APPROVED BY	Tim COLLETT	

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK		REV No	DATE	DESCRIPTION	DRAWING No
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT DRAWING TITLE TYPICAL CROSS-SECTION OF DRETHON BRIDGE- MẶT CẮT NGANG ĐIỂN HÌNH CẦU DRETHON		0	NOV-2009	DRAFT FINAL DRAWING	DR-03
		1	FEB-2010	FINAL DRAWING	
SCALE: 1:350					AS SHOWN

2.NH 1A FLYOVER BRIDGE
2.CẦU VƯỢT QUỐC LỘ 1A
KM 3+420

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/2000

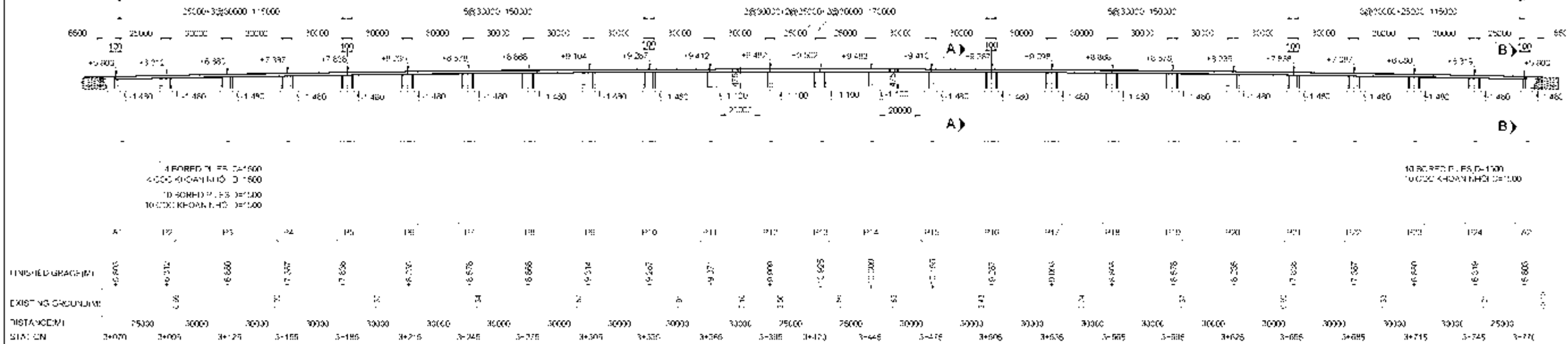
LONG THANH

STA 3+720

BEN LUC

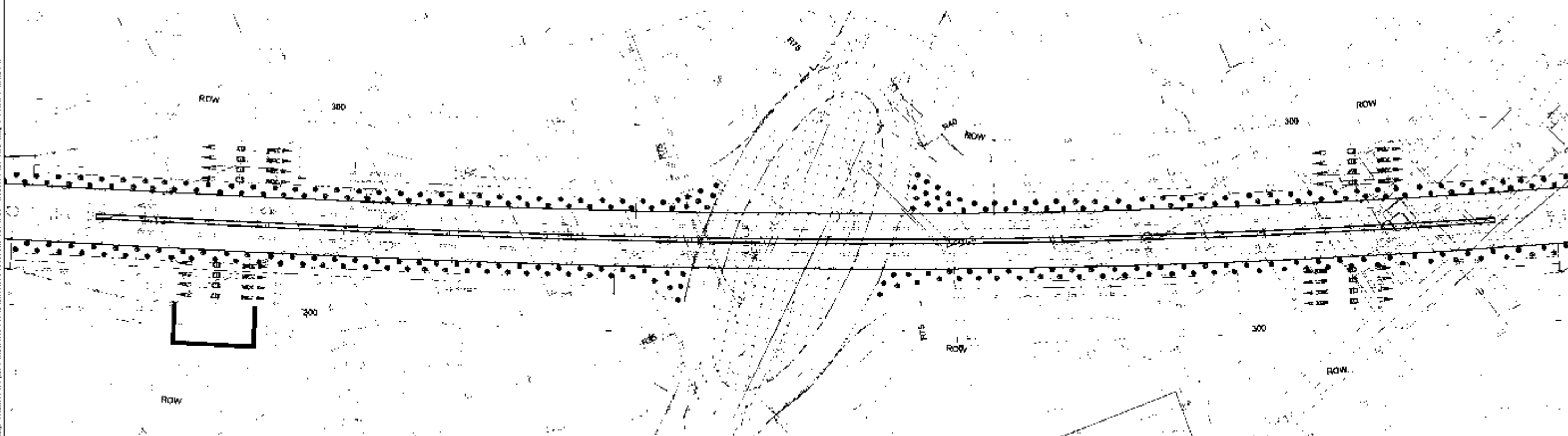
STA 3+000

LENGTH OF BRIDGE: 720.000 - CHỈ DẪN DẠNG CẦU: 1 - 720.000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/2000

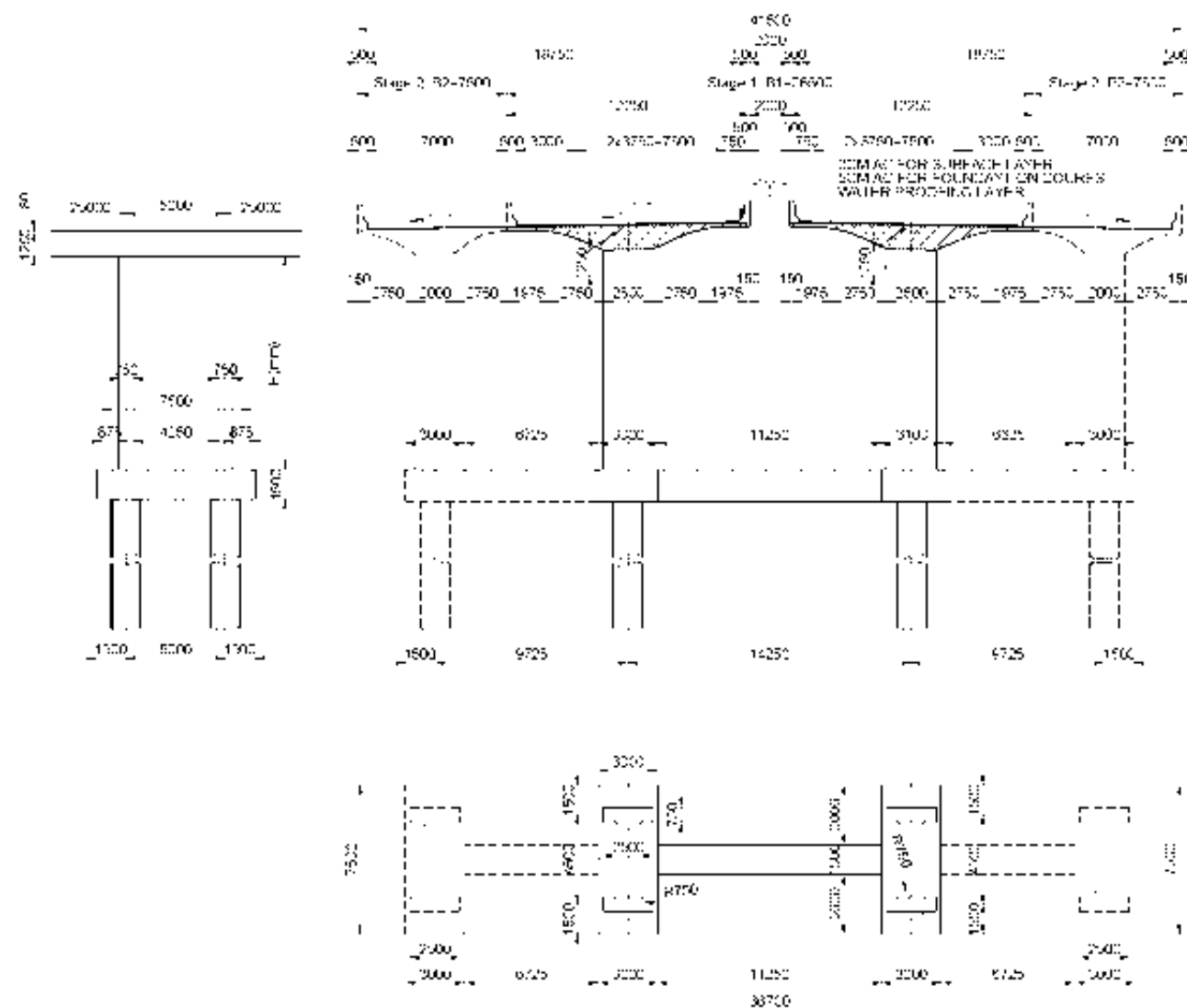


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Oriental Consultants Co., Ltd							1	FEB-2010	FINAL DRAWING	
In Association With APECO							DRAWING TITLE: KATAHIRA & ENGINEERS INTERNATIONAL CÔNG TY TNHH MẶT GIỚI QUỐC LỘ 1A			
							SCALE: AS SHOWN			

VIỆN KỸ THUẬT KINH TẾ VÀ KỸ THUẬT CÔNG TRÌNH (VITECT) - CÔNG TY TNHH KỸ THUẬT KINH TẾ VÀ KỸ THUẬT CÔNG TRÌNH (VITECT) - CÔNG TY TNHH KỸ THUẬT KINH TẾ VÀ KỸ THUẬT CÔNG TRÌNH (VITECT)

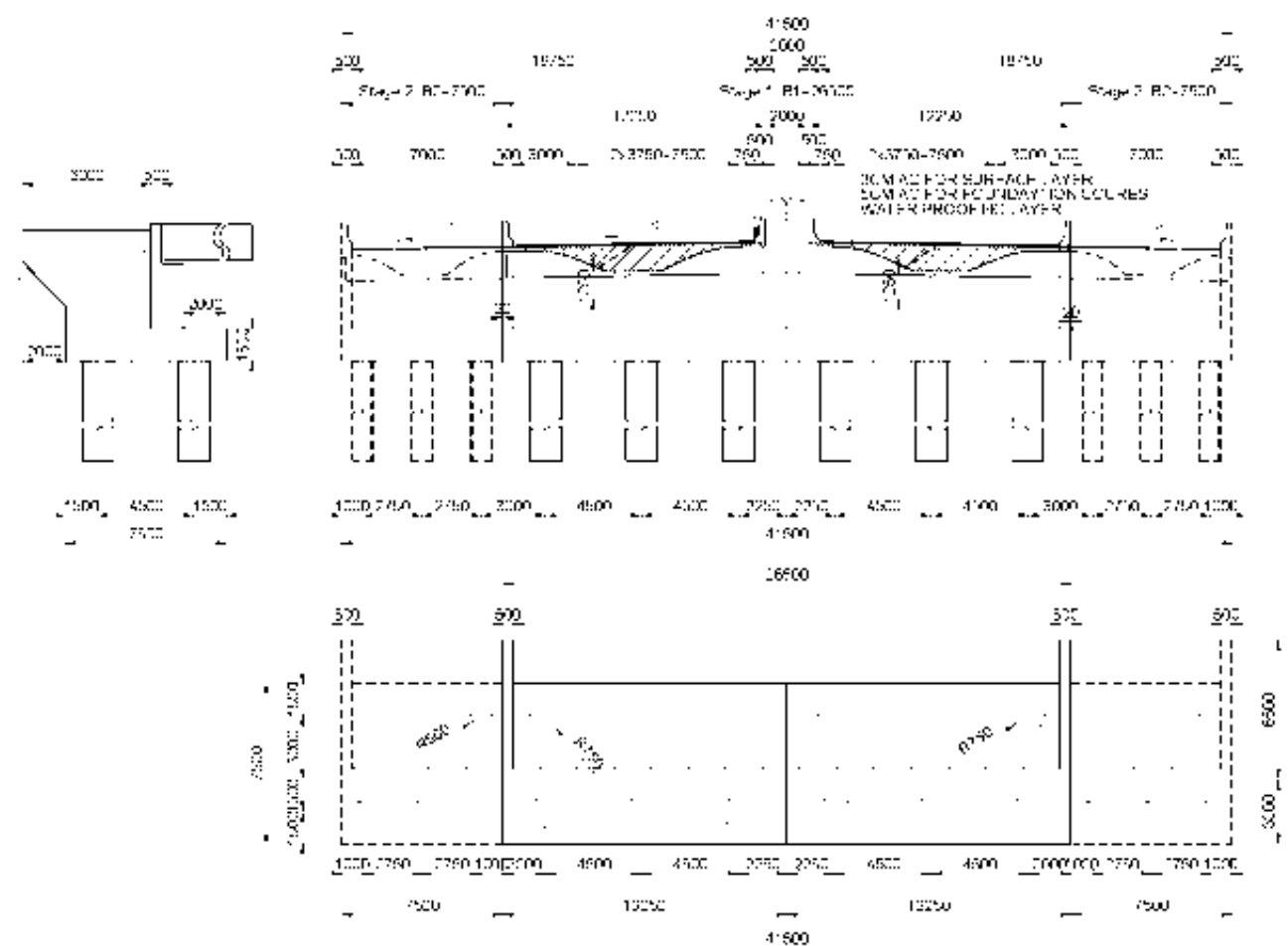
SECTION A-A - MẶT CẮT A-A

SCALE: 1:500



SECTION B-B - MẶT CẮT B-B

SCALE: 1:500



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NAME

SIGNATURE

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CHECKED BY **La Ngoc HIEU**

APPROVED BY **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

**TYPICAL CROSS SECTION OF BRIDGE
MẶT CẮT NGANG ĐIỂN - MẶT CẮT**

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING NO.

FINAL DRAWING

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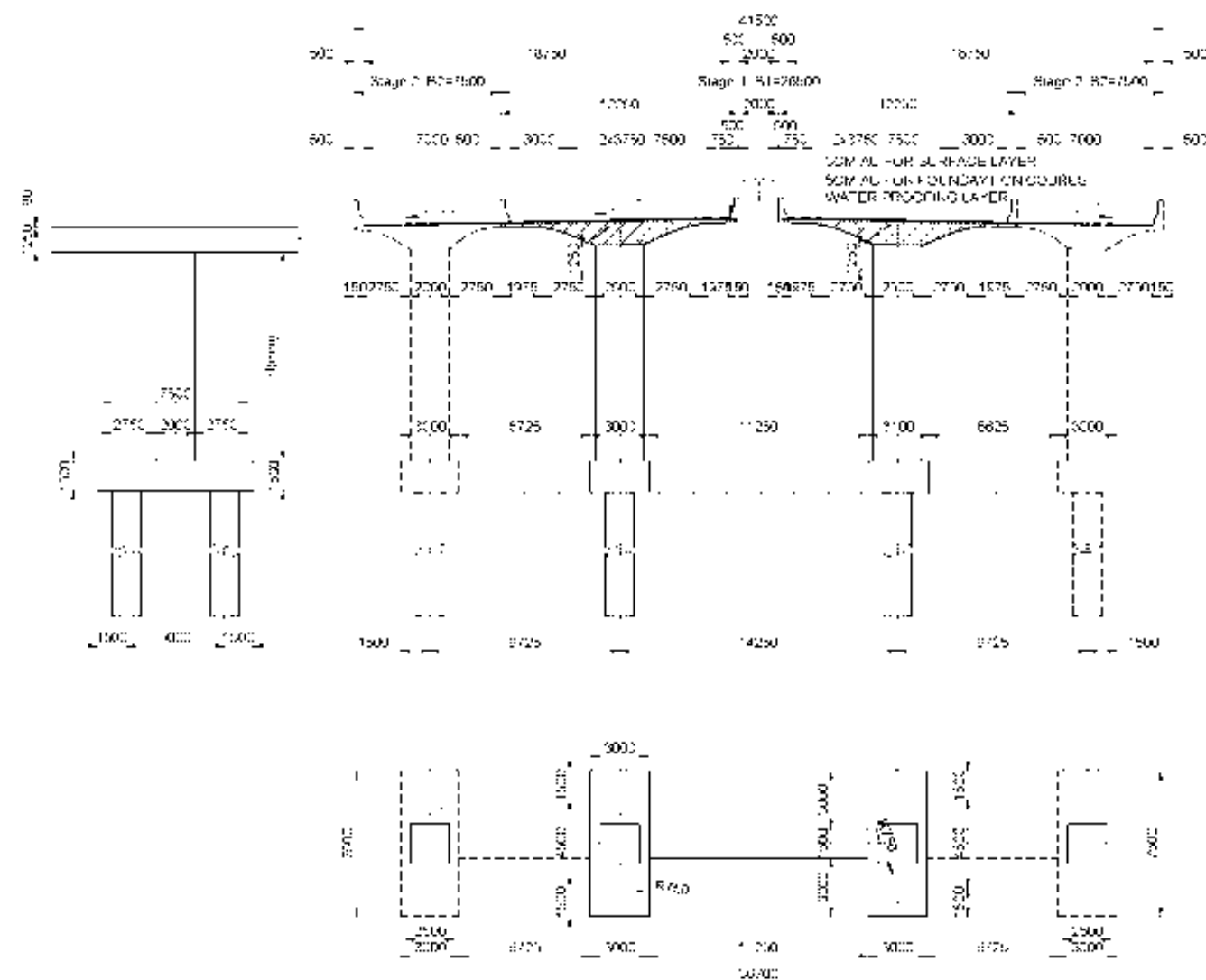
BR2-02

SCALE:

AS SHOWN

SECTION C-C - MẶT CẮT C-C

SCALE - 950



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APPROXIMATELY Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

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DRAWING TITLE

TIPOLOGICAL CROSS-SECTION OF BRIDGE
MẶT CÁT NGANG CỦA CẦU

REF No	DATE
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6 NOV-2006

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

DRAWING No.

352-22

SCALE :
AS SHOWN

3.PHUOC LY FLYOVER BRIDGE
3.CẦU VƯỢT PHƯỚC LÝ
KM 6+330

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

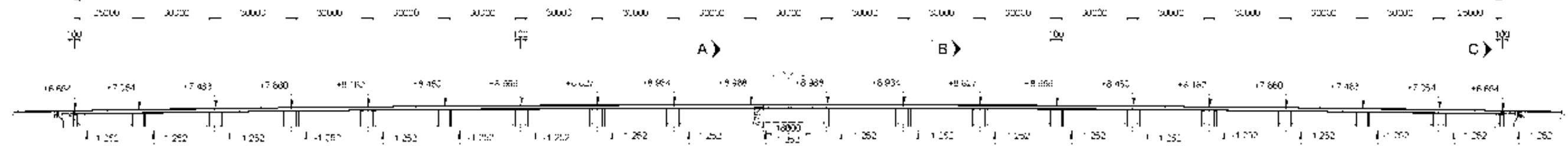
SCALE : 1/500

STA 6+100

LONG THANH

STA 6+850

LENGTH OF BRIDGE : 150000 CHỈ DẠY TOÀN CẦU : 150000



A

B

C

A

B

C

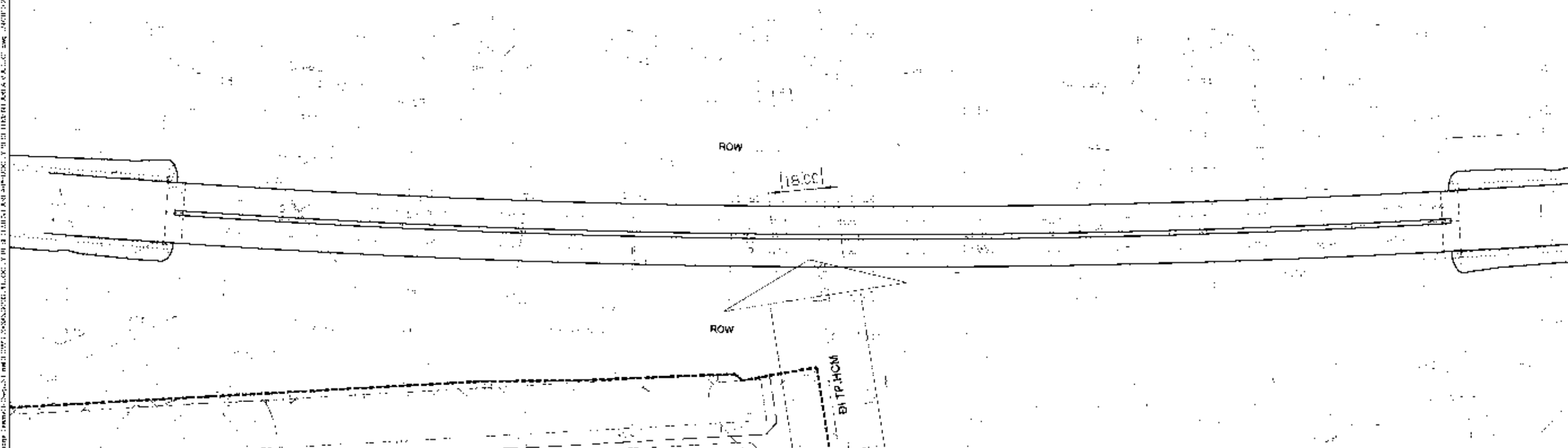
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10 CỌC KHOAN L=40M D=1500
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4 CỌC KHOAN L=40M D=1500

10 BORER PILES D=1500
10 CỌC KHOAN L=40M D=1500

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1.250	1.250	1.250	1.250	1.475	1.250	1.475	1.475	1.250	1.250	1.250	1.350	1.250	1.250	1.250	1.250	1.475	1.250	1.475	1.250
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
16.600	17.164	17.483	17.600	18.110	18.460	18.668	19.000	19.564	19.908	19.989	19.934	19.647	19.888	19.450	18.187	17.660	17.463	17.254	16.664
1.250	1.250	1.250	1.250	1.475	1.250	1.475	1.475	1.250	1.250	1.250	1.350	1.250	1.250	1.250	1.250	1.475	1.250	1.475	1.250
6+350	6+375	6+400	6+425	6+450	6+475	6+500	6+525	6+550	6+575	6+600	6+625	6+650	6+675	6+700	6+725	6+750	6+775	6+800	6+825

PLAN VIEW - MẶT BẰNG CẦU

SCALE : 1/500



ROW

ROW

BT TP.HCM

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PREPARED BY Đặng Vũ TUYẾN

CHECKED BY Lê Ngọc HIEU

APPROVED BY Trần COLLETT

NAME

SIGNATURE

SOCIALIST REPUBLIC OF VIETNAM

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ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF PHUOC LY FLYOVER
BỘ TRƯỞNG CẦU VƯỢT PHUỐC LY

REV No DATE

1 NOV-2009

2 FEB-2010

DESCRIPTION

DRAWING NO

FINAL DRAWING

SCALE :

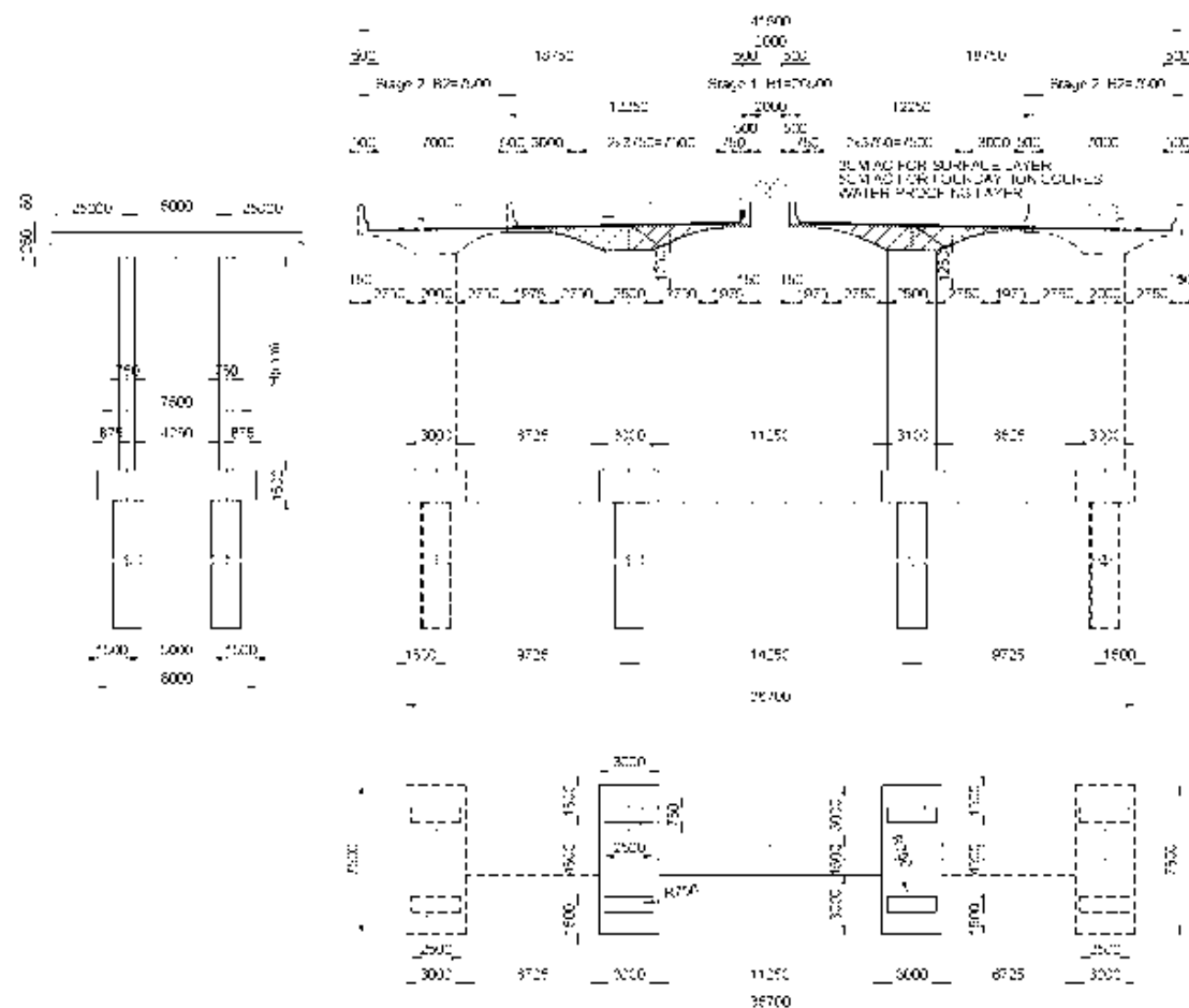
AS SHOWN

DRAWING No

DE 3.2

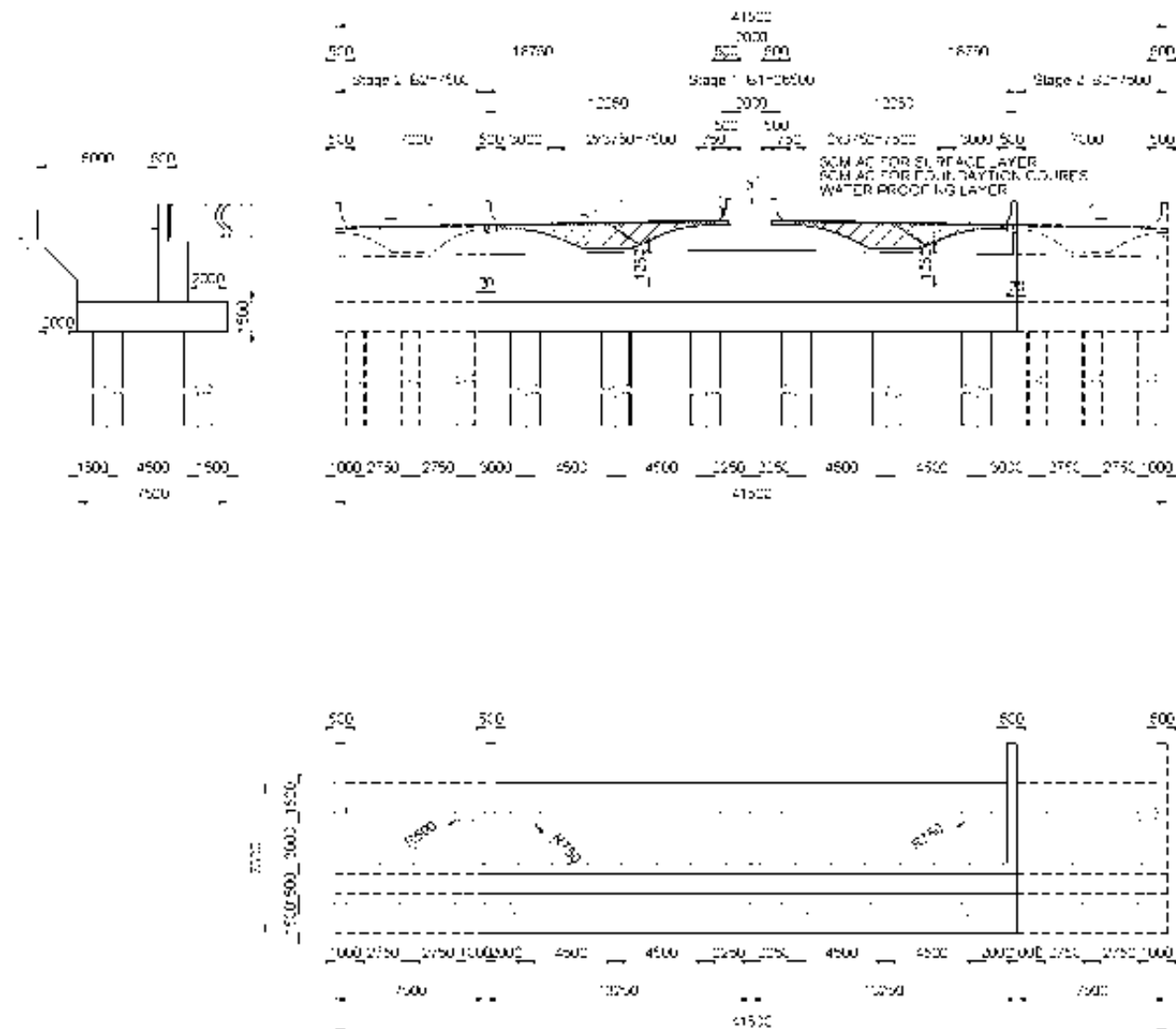
SECTION B-B - MẶT CẮT B-B

SCALE - 357



SECTION C-C - MẶT CẮT C-C

50.417 + 390



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TITLE

NAME _____

SIGNATURE

PREPARED BY **Lim Yu Tzer**

CHECKED BY: La Ngoc HIEU

APPROVED BY **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TILE

TYPICAL CROSSSECTION OF BRIDGE
MATERIALS AND DIMENSIONS (mm)

FILE No.	DATE
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c NOV-2006

1 FEB-2010

DESCRIPTION

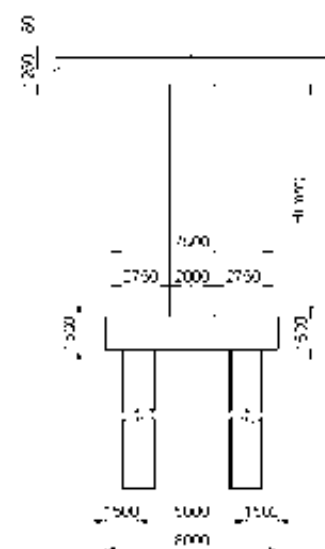
DRAFT FINAL DRAWING

FINAL DRAWING

PLANTING No.

DEF 22

SCALE :
A5 5" x 7 1/2"



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Je at Vancou With			PREPARED BY		TYPICAL CROSSSECTION OF BRIDGE		I	FEB-2010	F NAL DRAW NG	SCALE :
ORIENTAL CONSULTANTS CO., LTD			CHECKED BY		MẶT CẮT NGANG CẦU THƯỜNG CẦU		AS SHOWN			
In Association With			APPROVED BY							
APECO			Tim COLLETT							

[illegible]

4.HAI SON RESETLMENT AREA VIADUCT
4.CẦU CẠN KHU TÁI ĐỊNH CƯ HẢI SƠN
KM 8+405

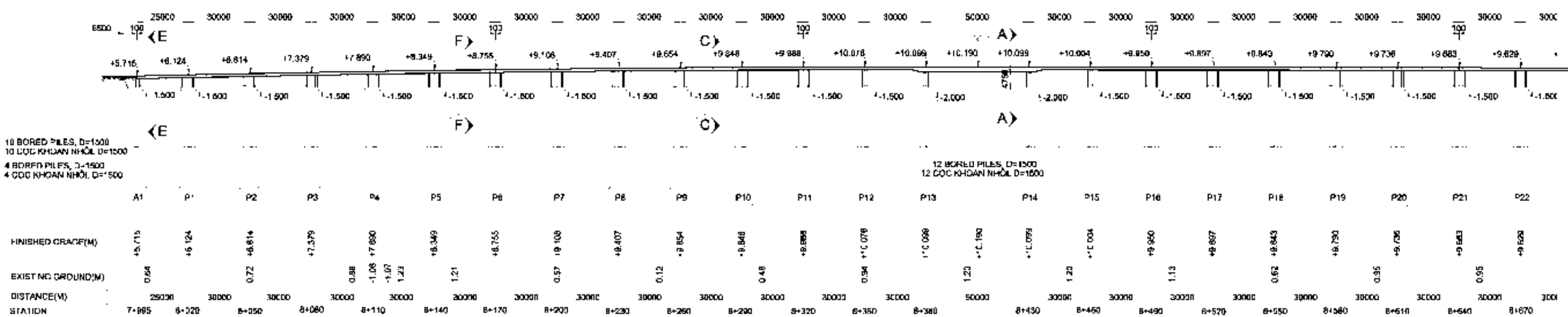
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE - TỶ LỆ: 1/2000

LENGTH OF BRIDGE L=1510000, CHỈ SỐ DÀI TOÀN CẦU L=1510000

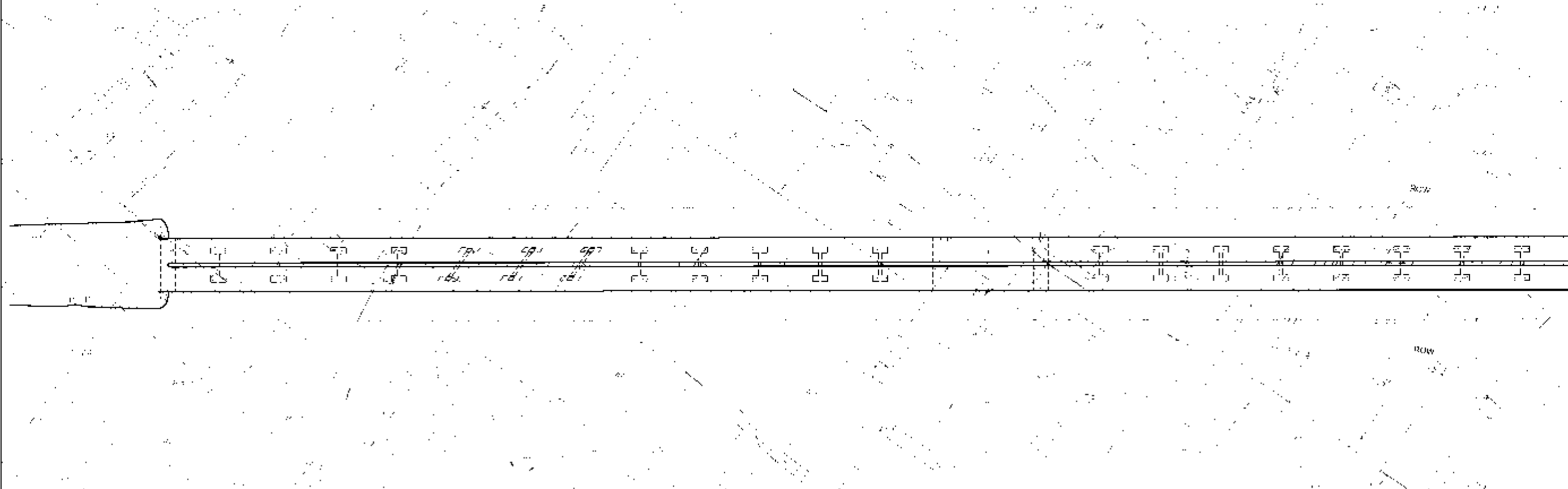
BEN LUC
STA: 7+995

STA: 8+405



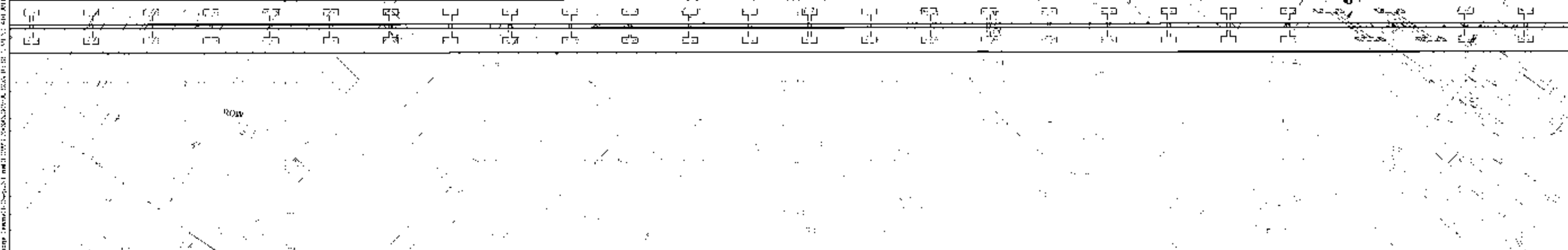
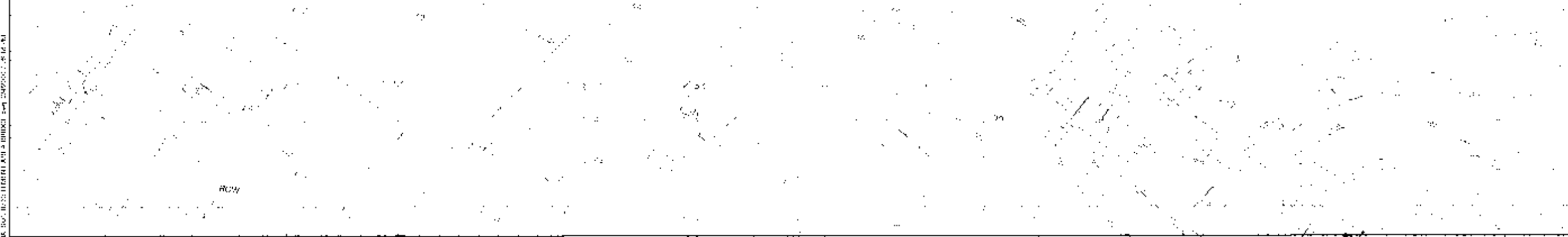
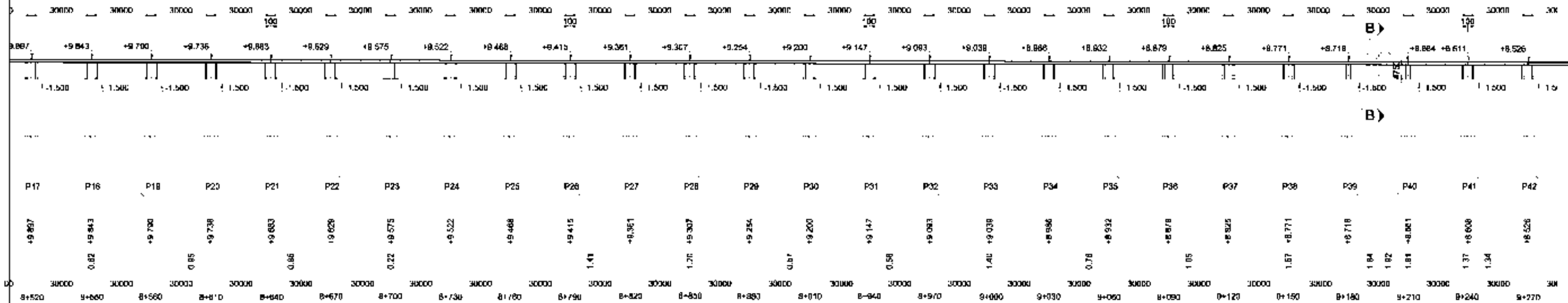
PLAN VIEW - MẶT BẰNG CẦU

SCALE - TỶ LỆ: 1/2000



CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM			ASIAN DEVELOPMENT BANK			REV. No	DATE	DESCRIPTION	DRAWING No
KATAHIRA & ENGINEERS INTERNATIONAL						TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT			0	NOV-2009	DRAWING NO	BRE-01
Oriental Consultants Co., Ltd									1	FEB-2010	FINAL DRAWING	
In Association With APECO												
TITLE	NAME	SIGNATURE	VIETNAM EXPRESSWAY CORPORATION (VEC)			DRAWING TITLE			SCALE: AS SHOWN			
PREPARED BY	Đang Vũ TUYEN					GENERAL VIEW OF THE BRIDGE AND APPROACHES						
CHECKED BY	La Ngoc HIEU					BỘ TRƯỞNG CẦU CÁN KHU TÀI CHÍNH HẢI SƠN						
APPROVED BY	Tên COLLETT											

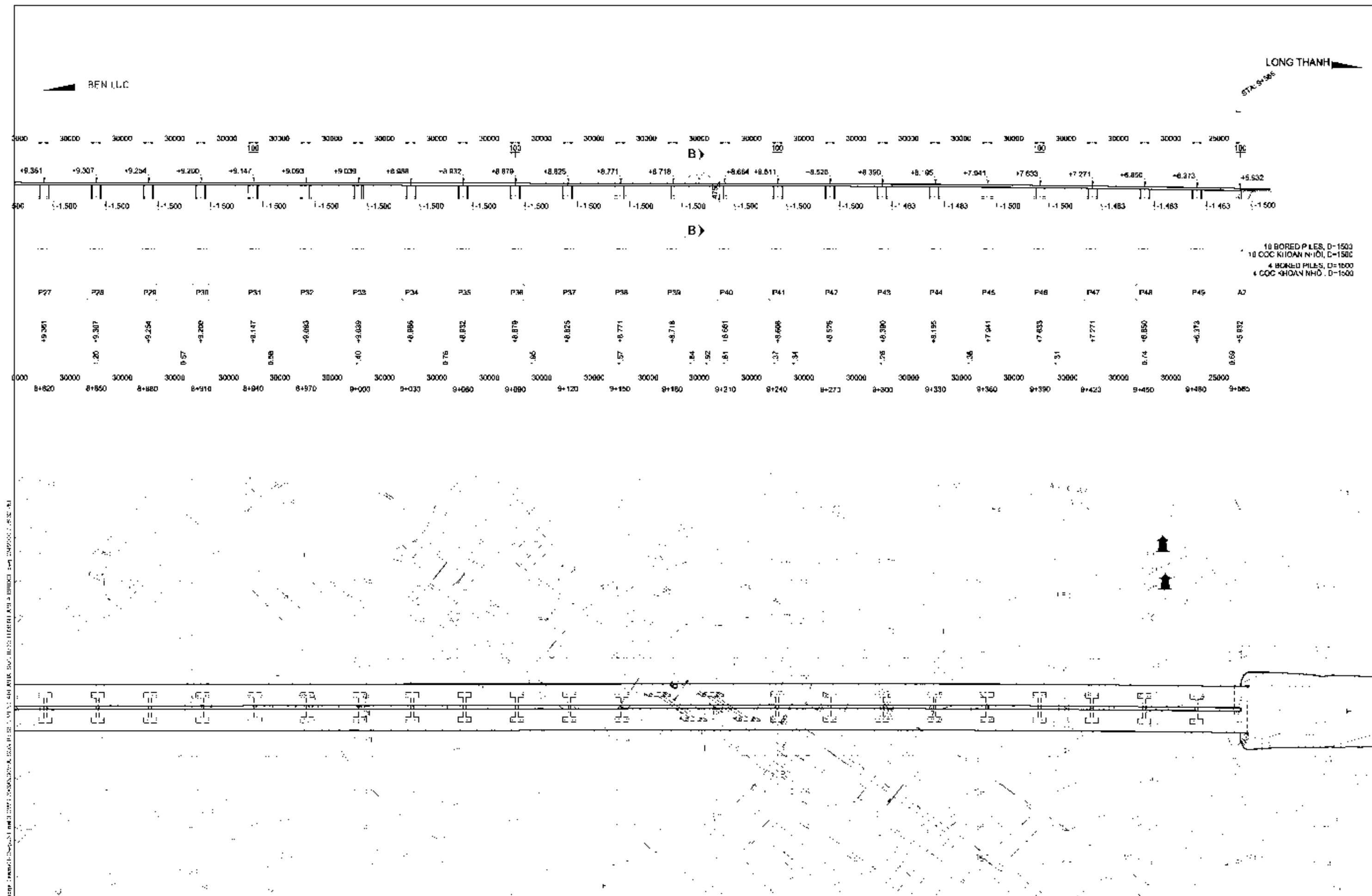
LONG THANH

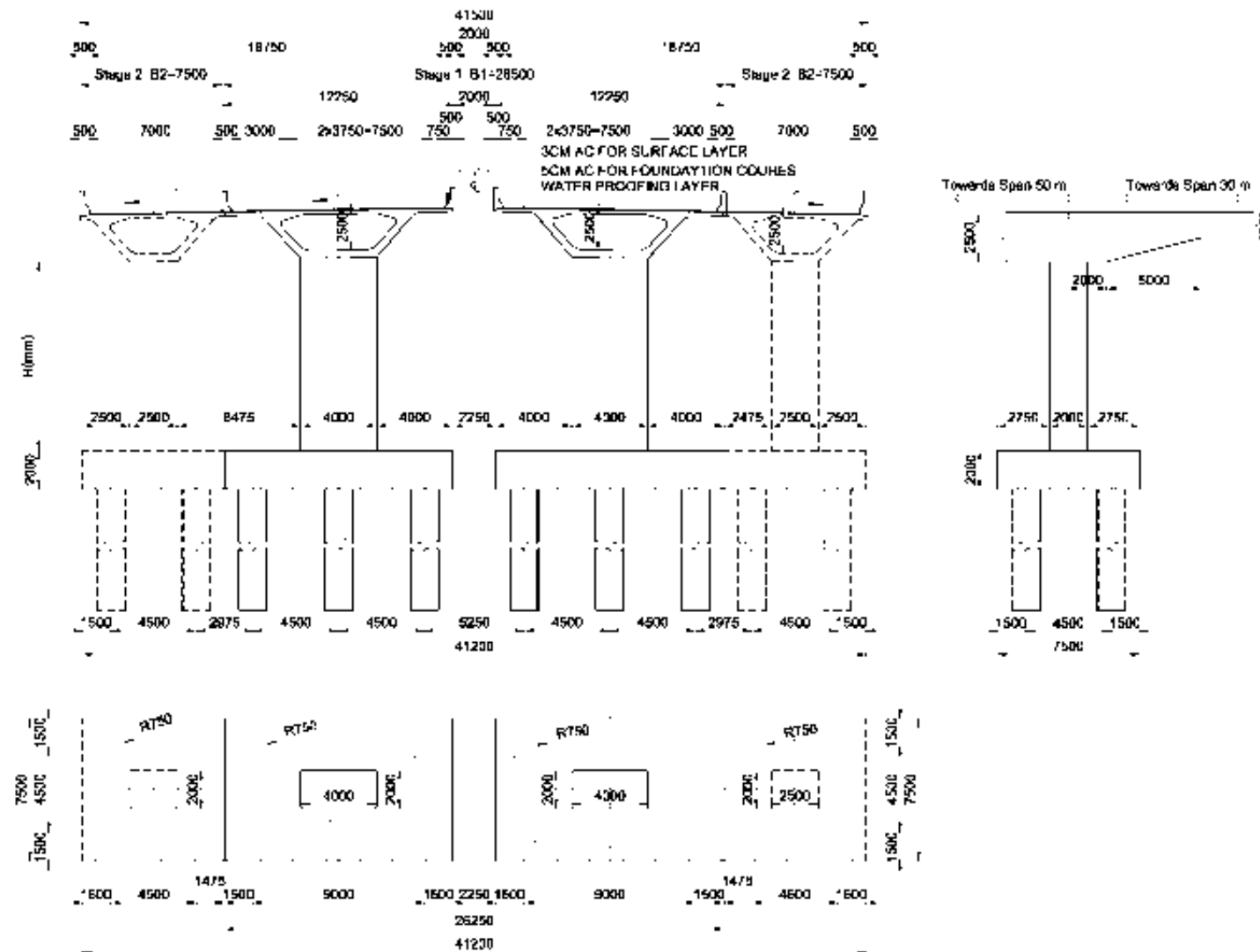


CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.		
KATAHIRA & ENGINEERS INTERNATIONAL			VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	BRE-107		
Joint Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING			
In Association With APECO										SCALE: AS SHOWN		
TITLE	NAME	SIGNATURE										
PREPARED BY	Dang Vu TUYEN											
CHECKED BY	La Ngoc HIEU											
APPROVED BY	Tien COLLETT											

0.02 0.85 0.86 0.22 0.41 1.41 1.26 0.67 0.58 1.40 0.78 1.05 1.67 1.84 1.92 1.81 1.37 1.34

DRAWING TITLE
GENERAL VIEW OF HAIPHONG REGIONAL AREA
BỘ TRƯỞNG CẦU CÁN KHU TAI BINH CƯ - HÀ NỘI



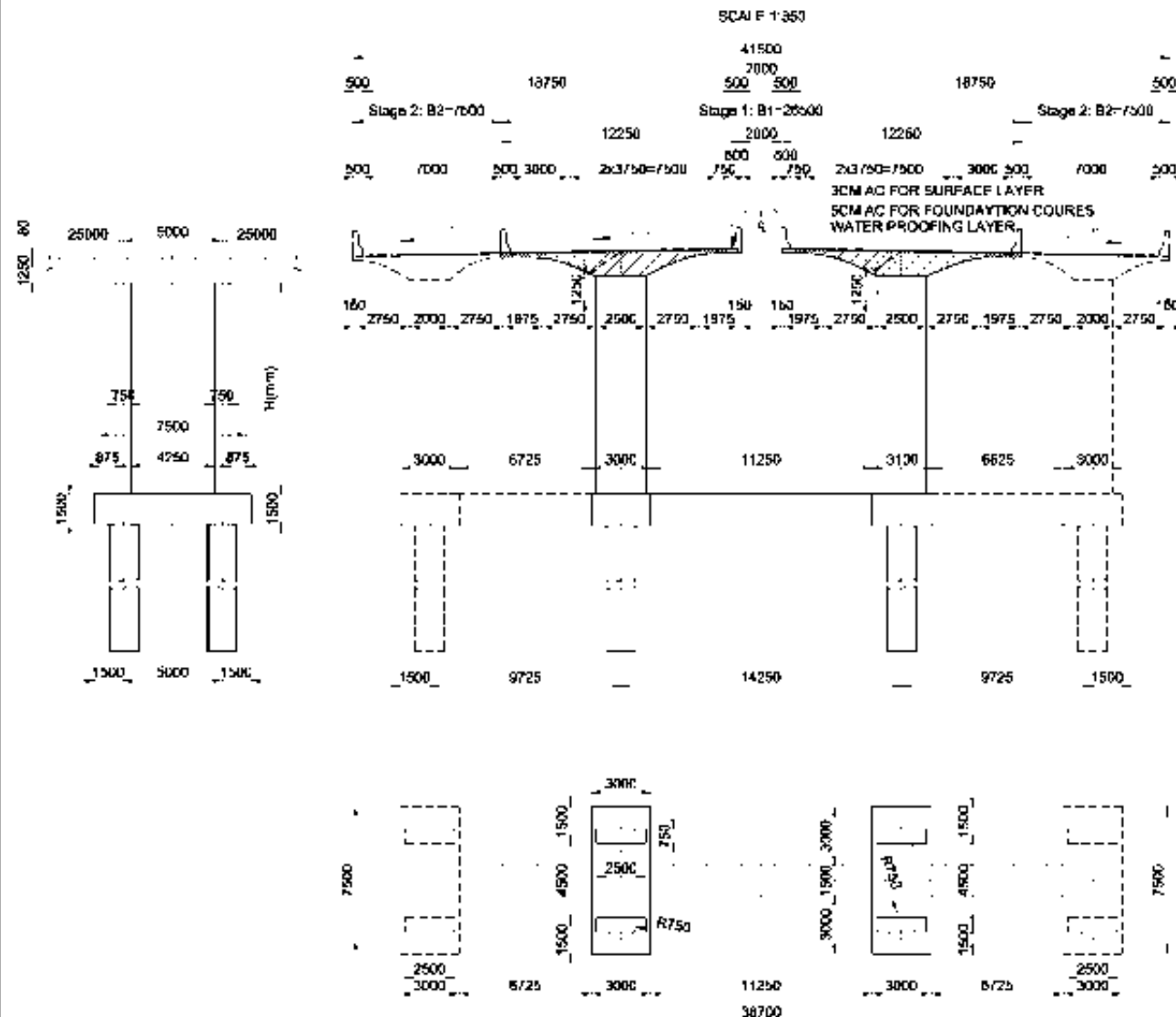


bioRxiv preprint doi: <https://doi.org/10.1101/200646>; this version posted May 1, 2017. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under aCC-BY-NC-ND 4.0 International license.

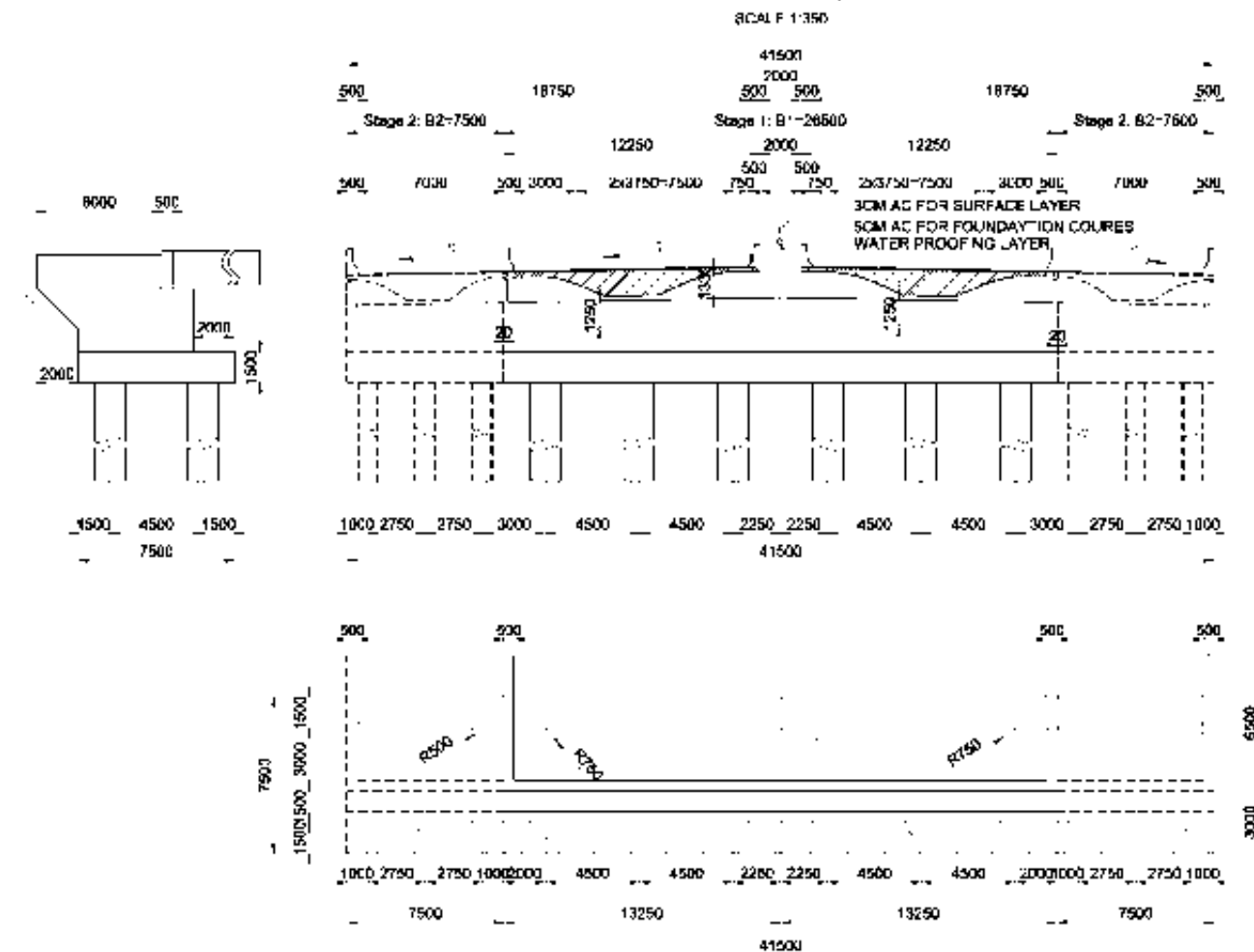
SCALE :
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TYPICAL CROSECTION OF RESETLMENT AREA VIADUCT MẶT CẮT NGANG ĐIỂN HÌNH CẦU CẠN KHU VỰC TÁI ĐỊNH CƯ

SECTION C-C - MẶT CẮT C-C



SECTION E-E - MẶT CẮT E-E



VIỆN KỸ THUẬT THIẾT KẾ VÀ XÂY DỰNG CÁC CÔNG TRÌNH GIAO THÔNG VÀ CÔNG TRÌNH CÔNG NGHIỆP VÀ MÔI TRƯỜNG - KATAHIRA & ENGINEERS INTERNATIONAL

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KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE NAME SIGNATURE
PREPARED BY Đặng Vũ TUYẾN
CHECKED BY Lê Ngọc HIEU
APPROVED BY Trần COLLETT

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE
TYPICAL CROSSSECTION OF LA SON RESETLMENT AREA VIADUCT
CẮT NGANG ĐIỂN HÌNH CẦU CẠN KHU VỰC TÁI ĐỊNH CƯ

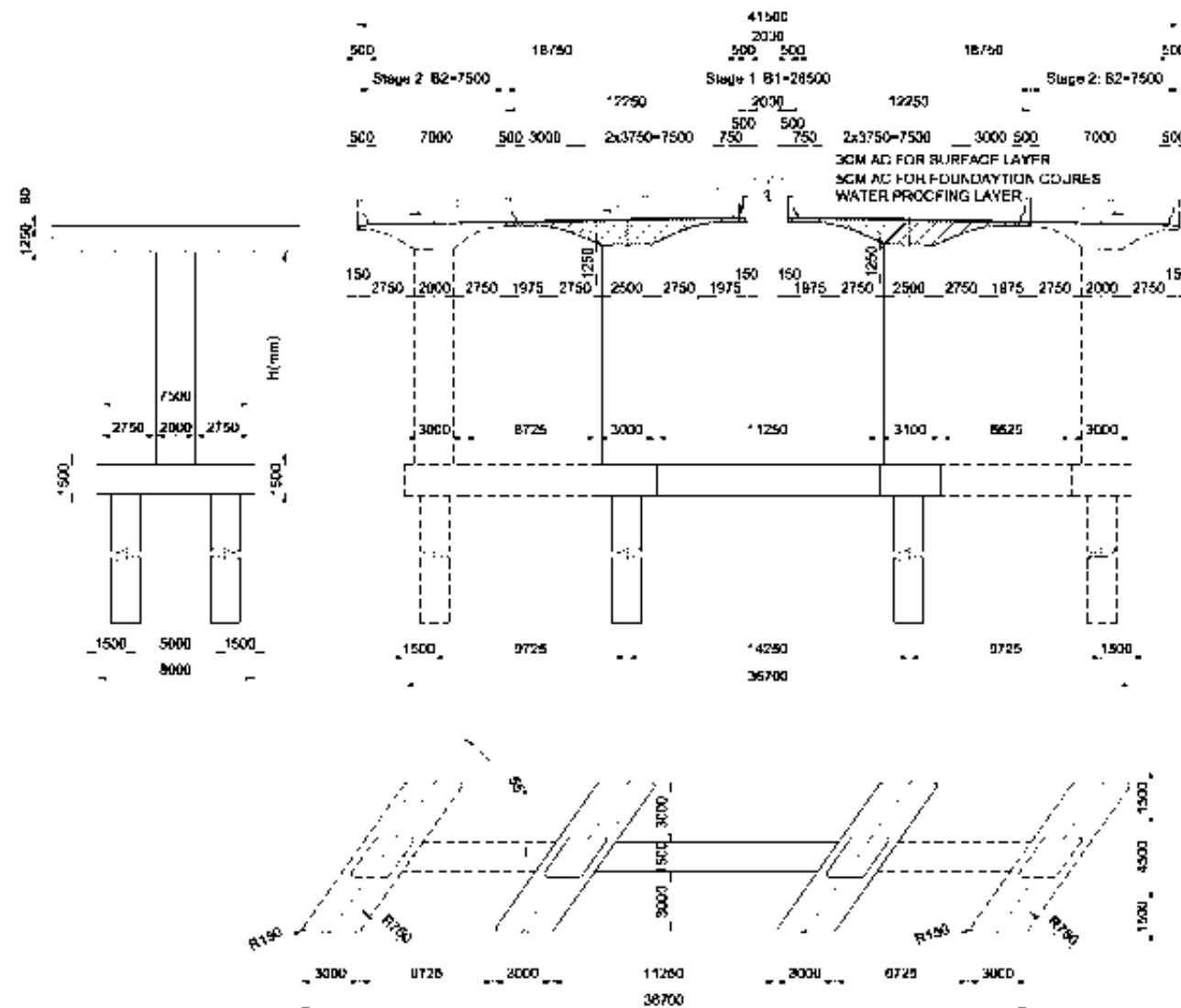
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1	FEB-2010	FINAL DRAWING	

SCALE: AS SHOWN

TYPICAL CROSECTION OF RESETLMENT AREA VIADUCT MẶT CẮT NGANG ĐIỂN HÌNH CẦU CẠN KHU VỰC TÁI ĐỊNH CƯ

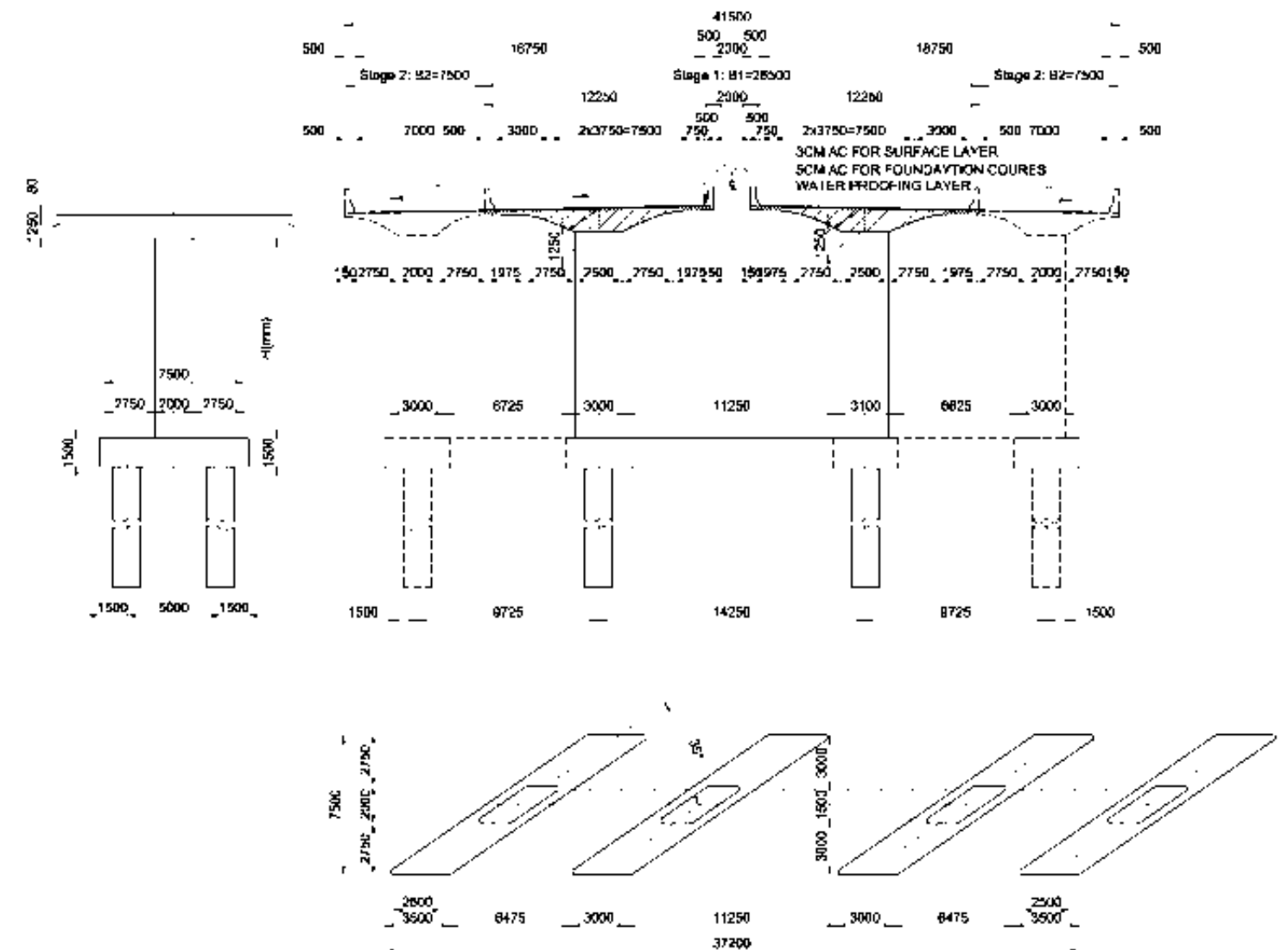
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SCALE 1:200



SECTION B-B - MẶT CẮT B-B

SCALE 1:350



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TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tien COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
TYPICAL CROSSSECTION OF LA SON RESETLMENT AREA VIADUCT
CẮT NGANG ĐIỂN HÌNH CẦU CẠN KHU VỰC TÁI ĐỊNH CƯ

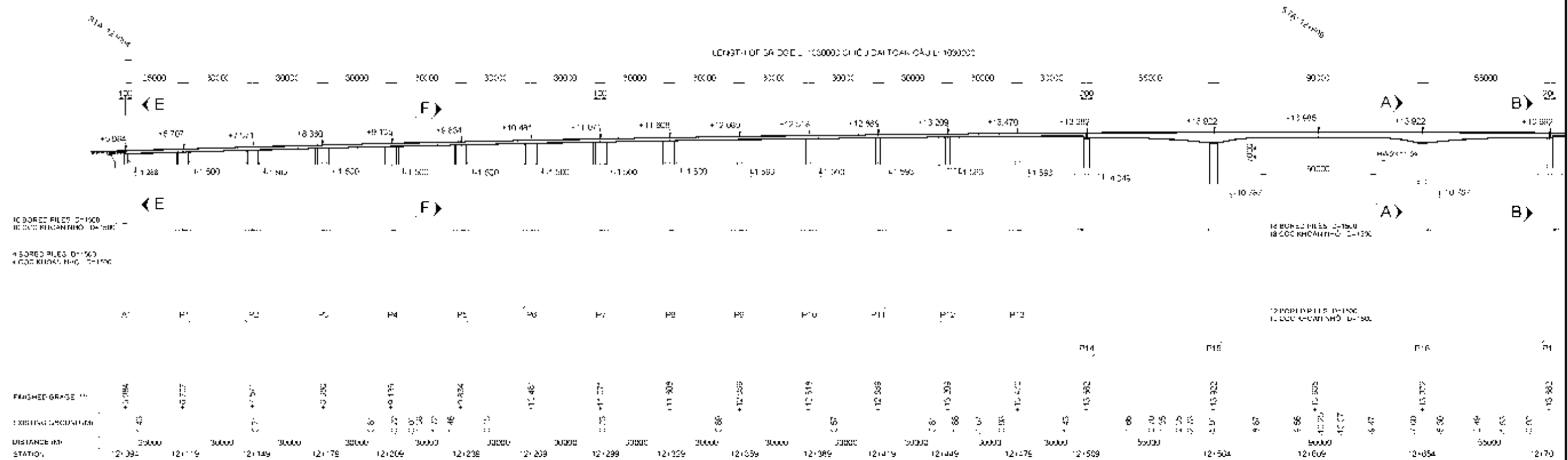
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0	NOV-2009	DRAWING DRAWING	BRE-1A1
1	FEB-2010	FINAL DRAWING	

SCALE: AS SHOWN

5.ONG THIN BRIDGE
5.CẦU ÔNG THÌN
KM 12+609
(OPTION 1)

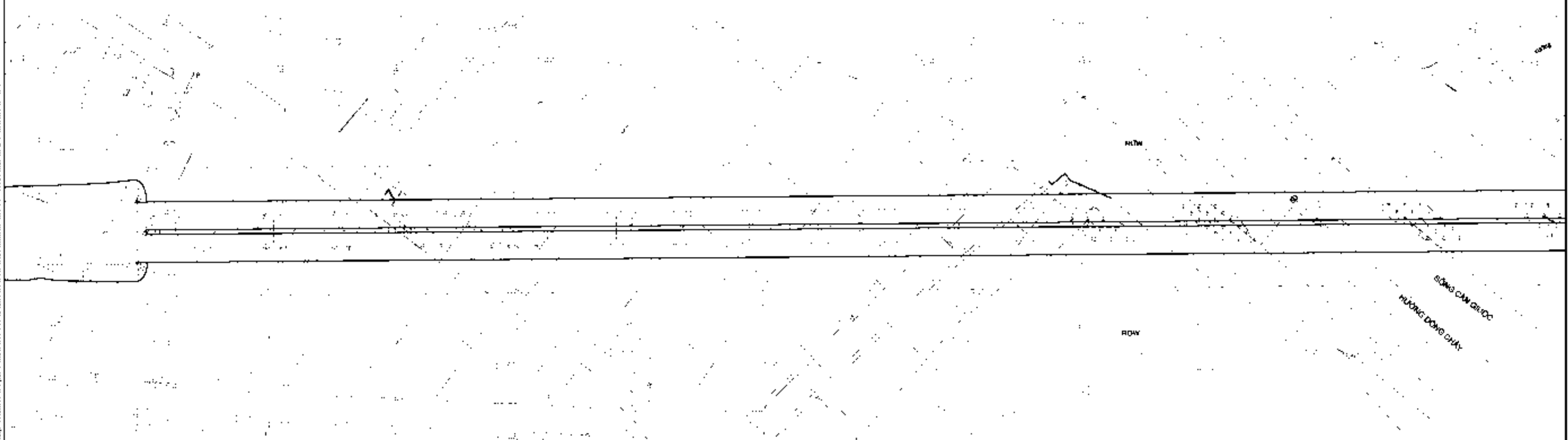
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

Scale: 1/500



PLAN VIEW - MẶT BẰNG CẦU

Scale: 1/500



VIETNAM EXPRESSWAY CORPORATION (VEC) - 105000.00 M. J. D. T. C. A. N. C. A. U. L. 105000.00 M.

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TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tien COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

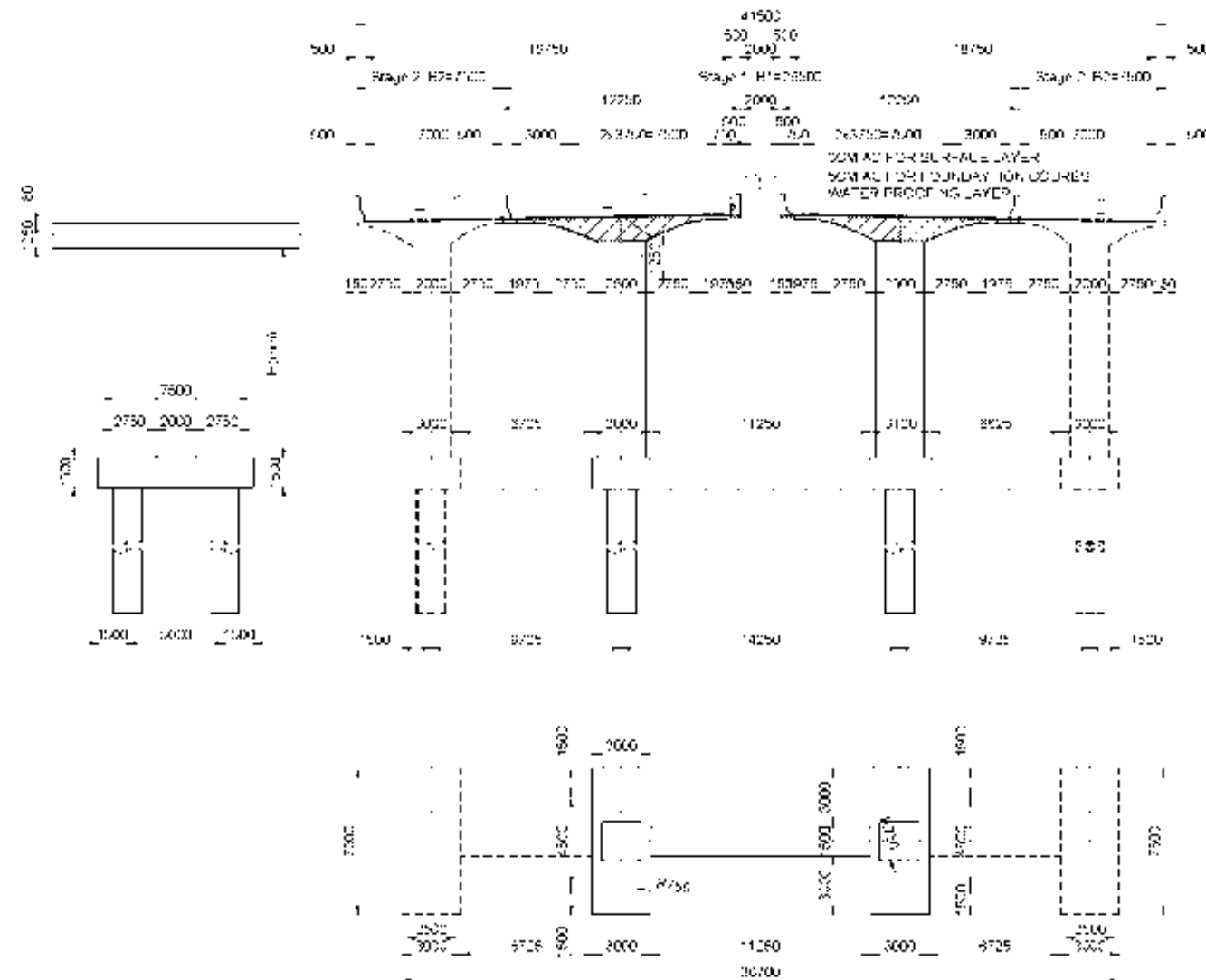
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE: GENERAL VIEW OF LONG THIN BRIDGE
 BỐ KÊ CHUNG: ALL OVER THE

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING NO	REV.01
1	FEB-2010	FINAL DRAWING	SCALE: AS SHOWN

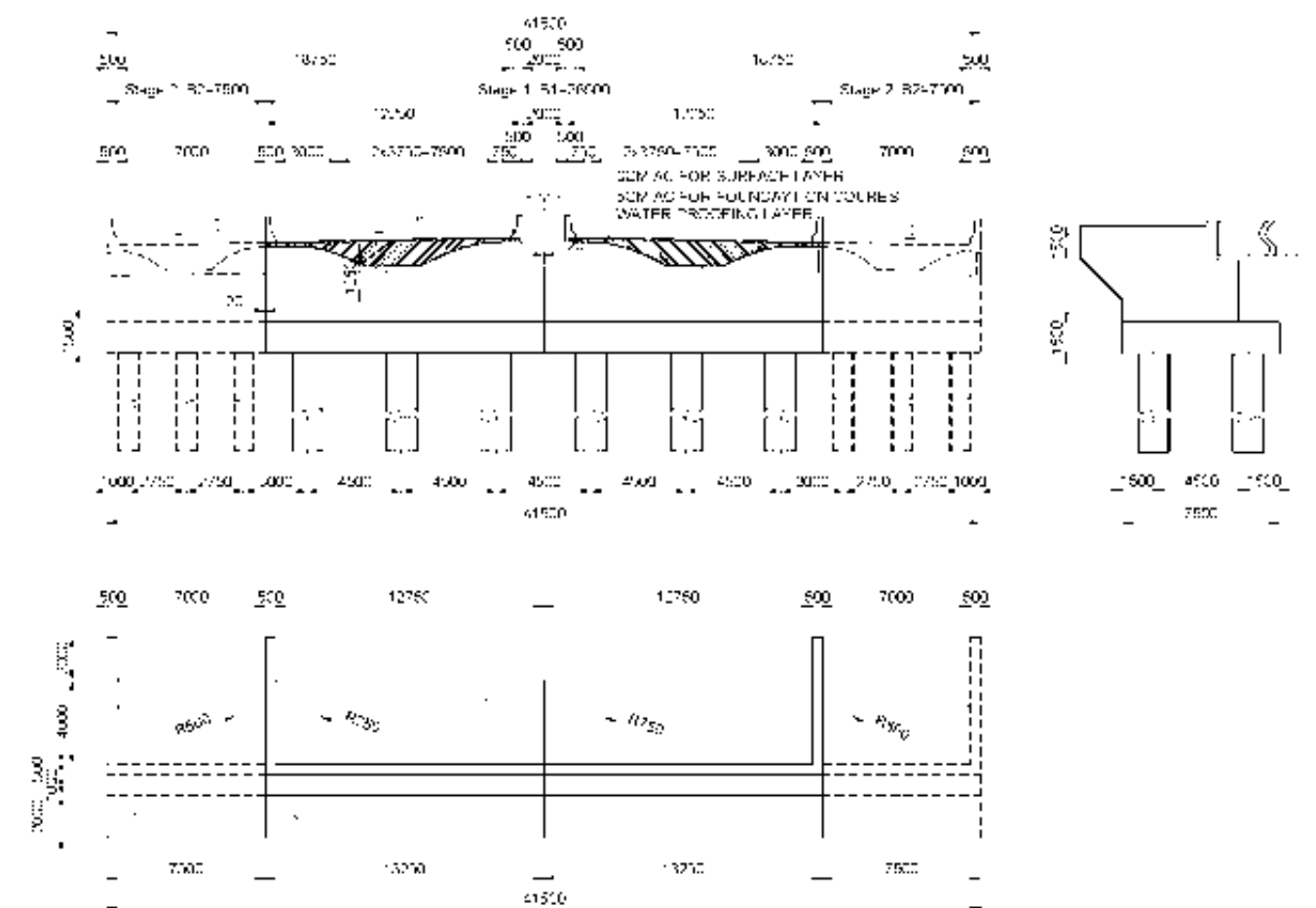
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SCALE: 1/30



SECTION E-E - MẶT CẮT E-E

SCALE: 1/30



VECI 001: HƯỚNG DẪN THI CÔNG VÀ BẢO DƯỠNG CÁC CÔNG TRÌNH GIAO THÔNG VÀ CÁC CÔNG TRÌNH KỸ THUẬT

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TITLE NAME SIGNATURE
PREPARED BY **Dang Vu TUYEN**
CHECKED BY **La Ngoc HIEU**
APPROVED BY **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

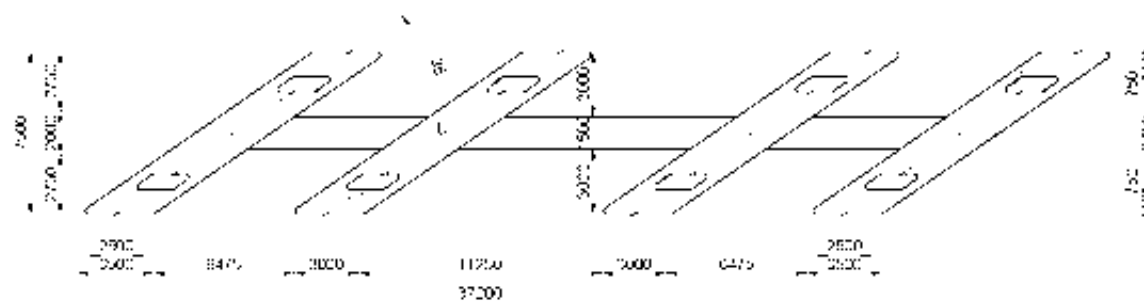
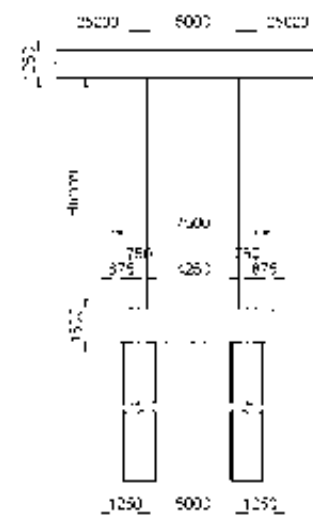
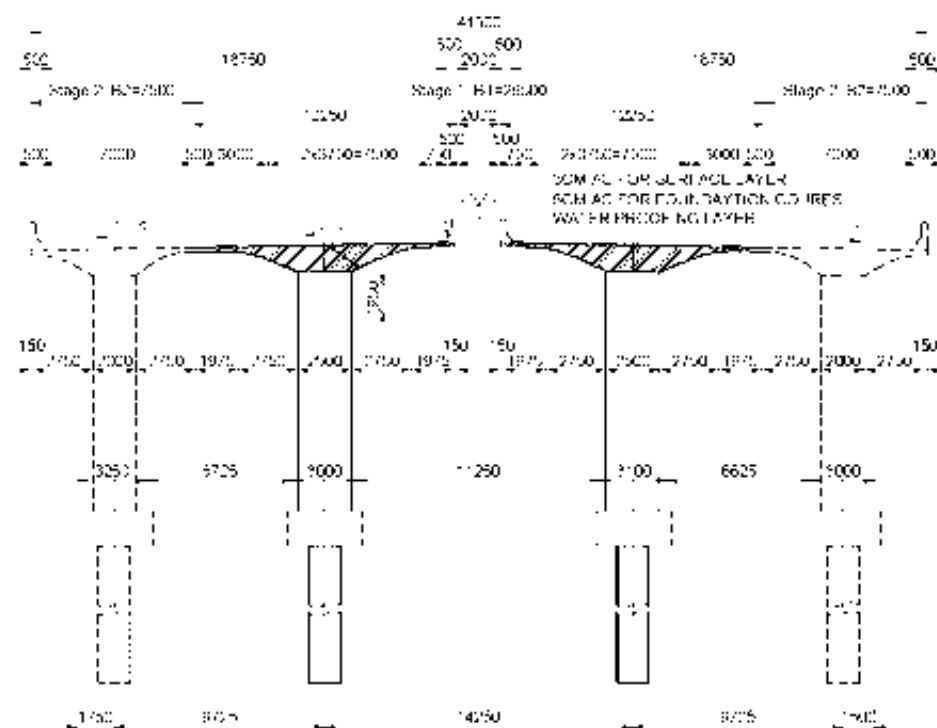
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
TYPICAL CROSSSECTION OF BRIDGE
MẶT CẮT NGANG ĐỂ HÌNH TÀI

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAFT FINAL DRAWING	REV. 001
1	FEB-2010	FINAL DRAWING	REV. 002
SCALE:			AS SHOWN

SECTION F-F - MẶT CẮT F-F

SO2_E 1.9%



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NAME

SIGNATURE

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CHECKED BY: La Ngoc HIEU

APPROVED BY Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE TYPICAL CROSS SECTION OF BRIDGE
MOUNTAIN GANGE BRIDGE WITH A...

FILE No.	DATE
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NOV-2005

1 FEB-2010

DESCRIPTION

DRAFT NAL DRAWING

FINAL DRAWING

DRAWING No.

442

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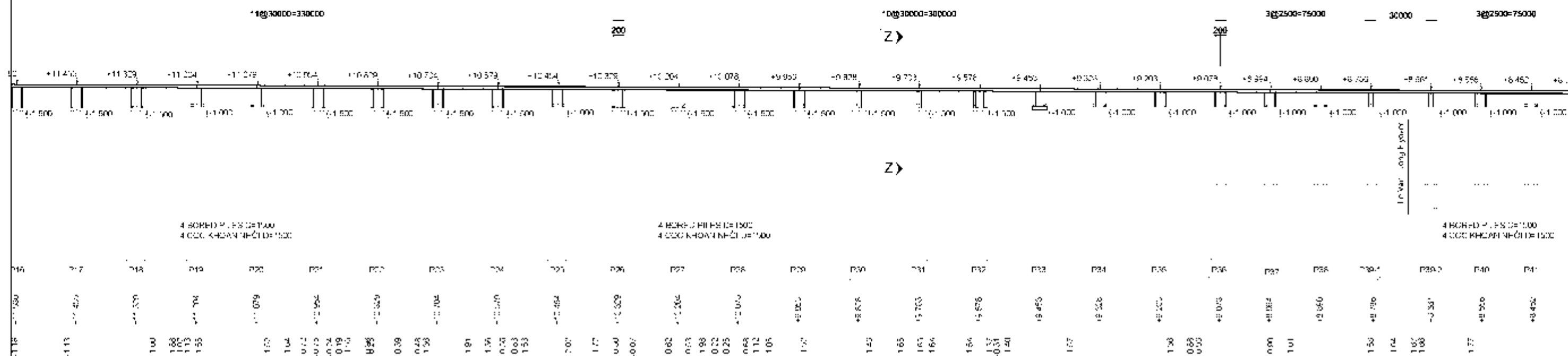
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6.CẦU BÀ LÀO, BÌNH KHÁNH, SÔNG CHÀ VÀ PHƯỚC KHÁNH
KM 16+690 - KM 32+322(OPTION 1)

BEN LUC

LONG THANH

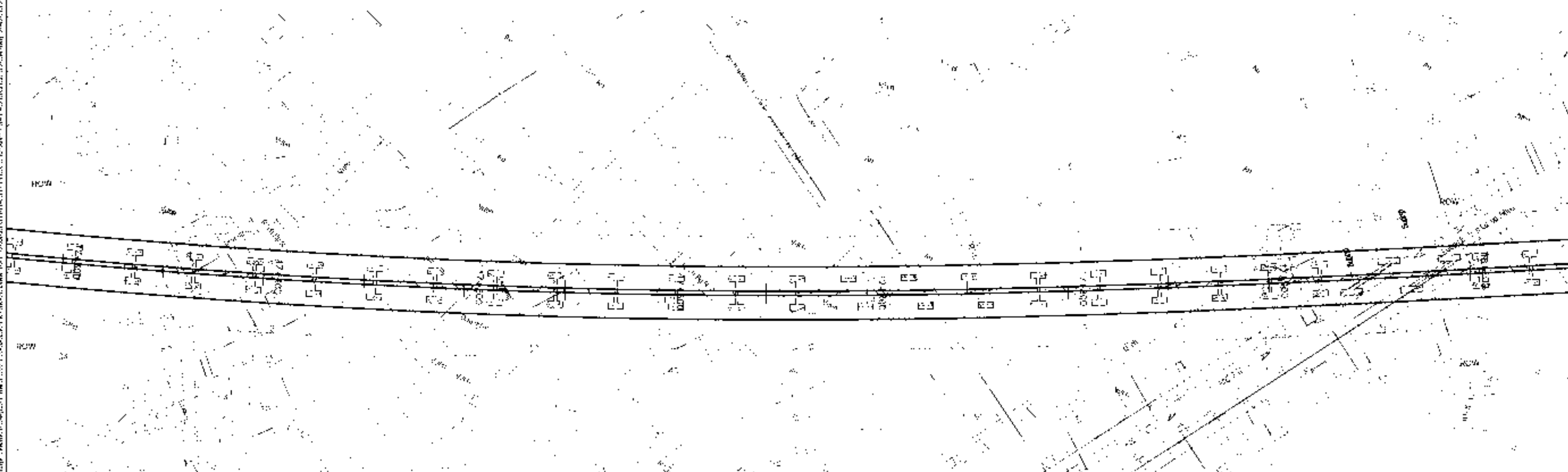
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1"=1000'



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1"=1000'



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TITLE

NAME

SIGNATURE

PREPARED BY: Dang Vu TUYEN

CHECKED BY: La Ngoc HIEU

APPROVED BY: Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU ĐÁY VẮNG BÌNH KHANH VÀ PHƯỚC KHANH

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING NAME

GENERAL DRAWING

GENERAL DRAWING

DRAWING No.

40 BK-PK-02

ALTERNATIVE

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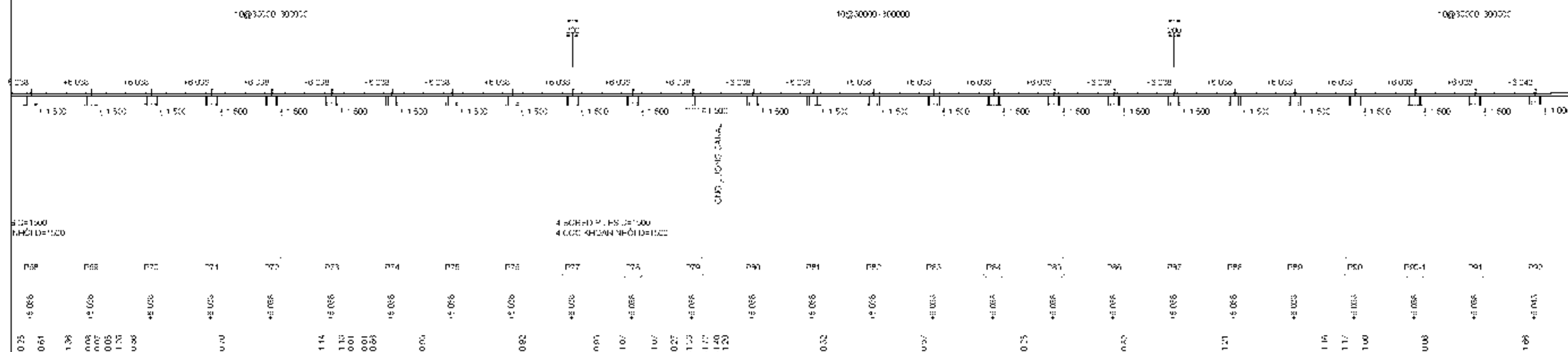
AS SHOWN

BEN LUC

LONG THANH

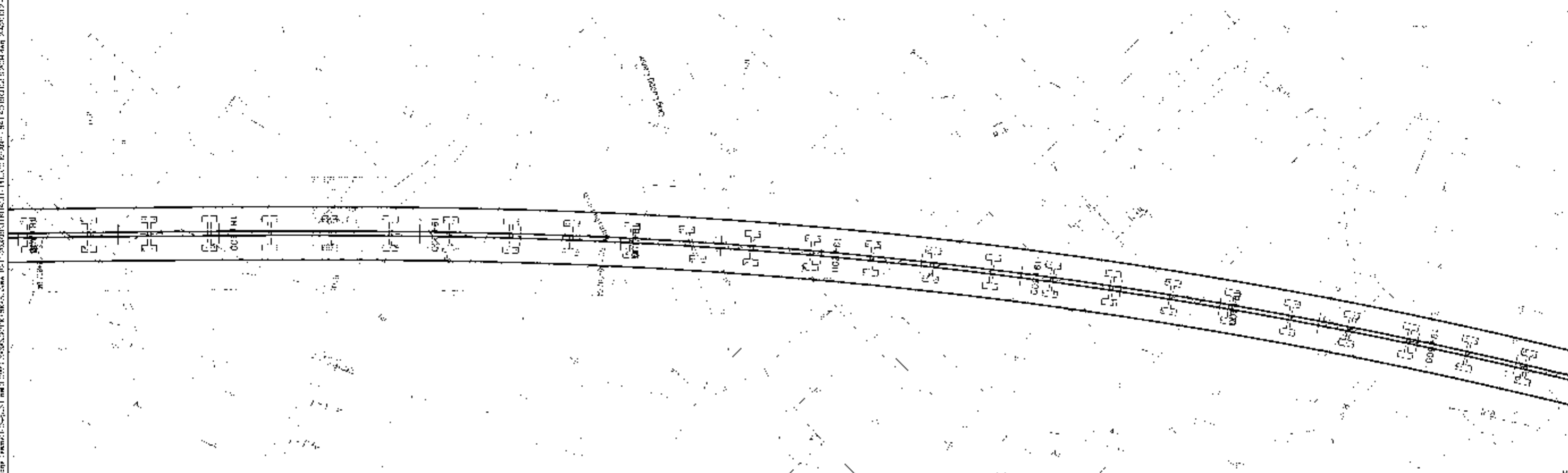
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SCALE: 1/1000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/10000



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In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY Đặng Vũ TUYỀN

CHECKED BY Lê Ngọc HIEU

APPROVED BY Trần COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU CAY VANG BINH KHANH VÀ PHUOC KHANH

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

DRAWING No.

-D3 BK-PK-114

ALTERNATIVE 1

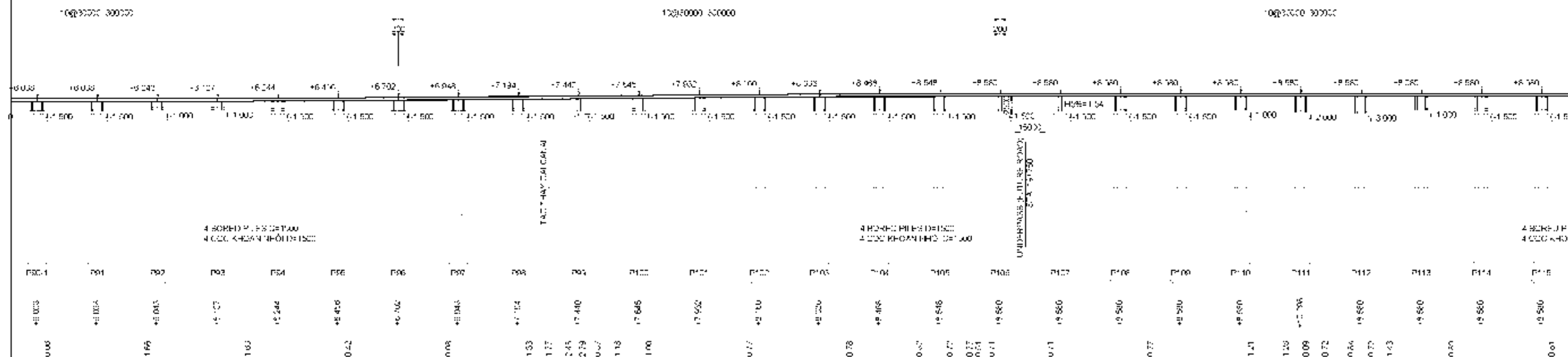
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BEN LUC

LONG THANH

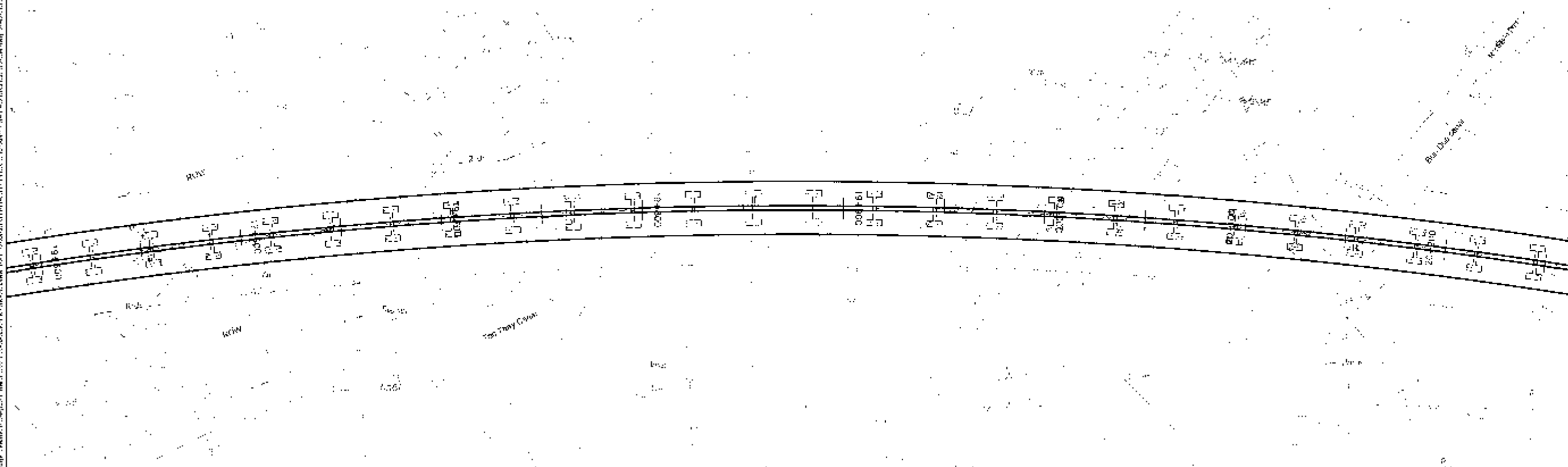
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SCALE: 1:1000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1:1000



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TITLE

NAME

SIGNATURE

PREPARED BY: Đặng Vũ TUYỀN

CHECKED BY: Lê Ngọc HIEU

APPROVED BY: Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU DÂY VẮNG Ở BÌNH KHANH VÀ PHƯỚC KHANH

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

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FINAL DRAWING

DRAWING No.

40 BK-PK-01

ALTERNATIVE

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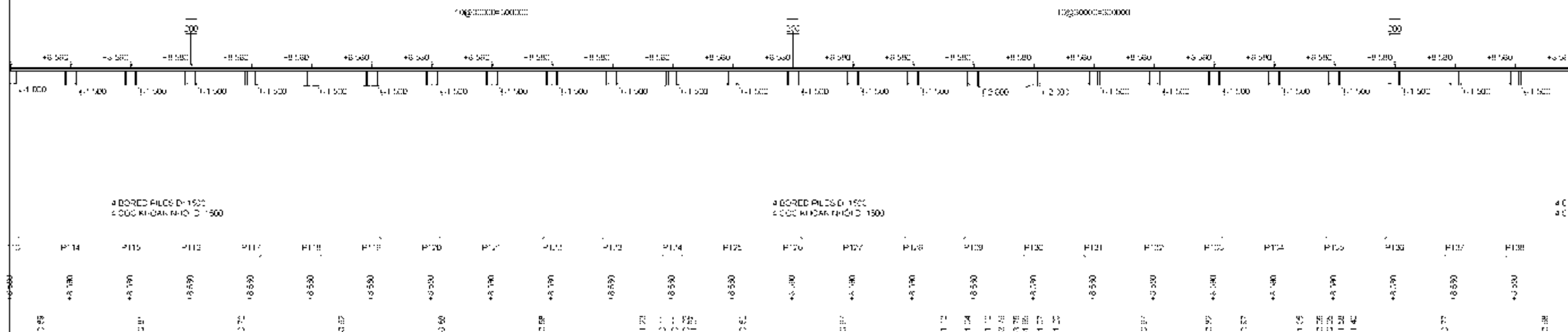
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BEN LUC

LONG THANH

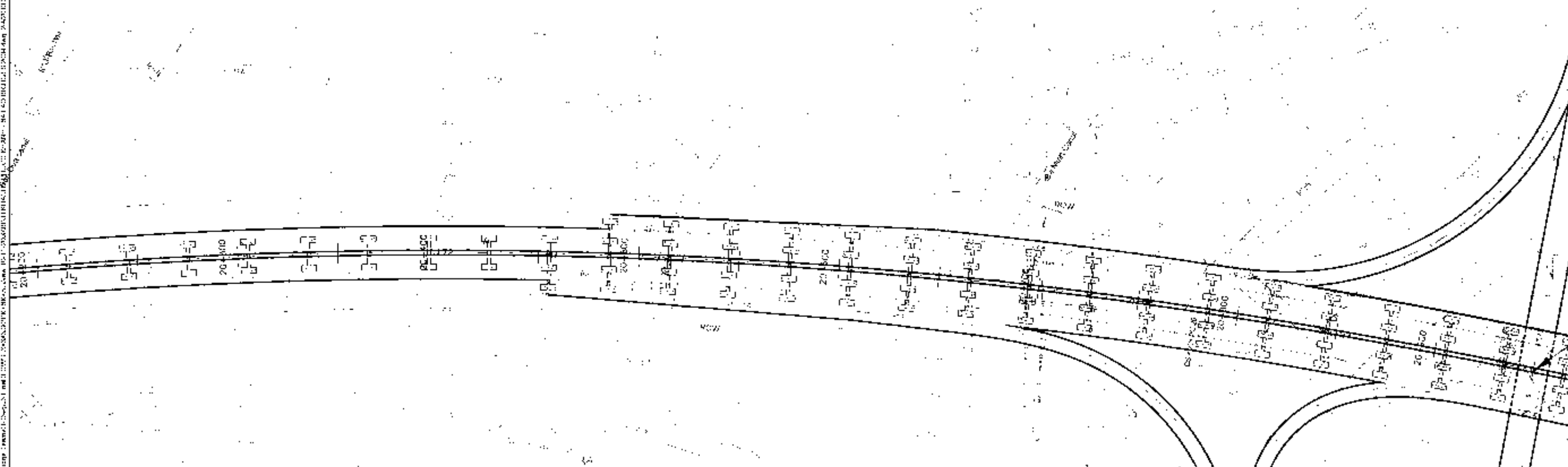
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SCALE: 1/1000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With

ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY: Đặng Vũ TUYẾN

CHECKED BY: Lê Ngọc HIEU

APPROVED BY: Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU DÂY VẮNG Ở BÌNH KHANH VÀ PHƯỚC KHANH

REV. No.

DATE

DESCRIPTION

DRAWING No.

0 NOV-2009

DRAFT FINAL DRAWING

40 BK-PK - DE

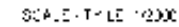
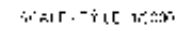
1 FEB-2010

FINAL DRAWING

ALTERNATIVE

SCALE:

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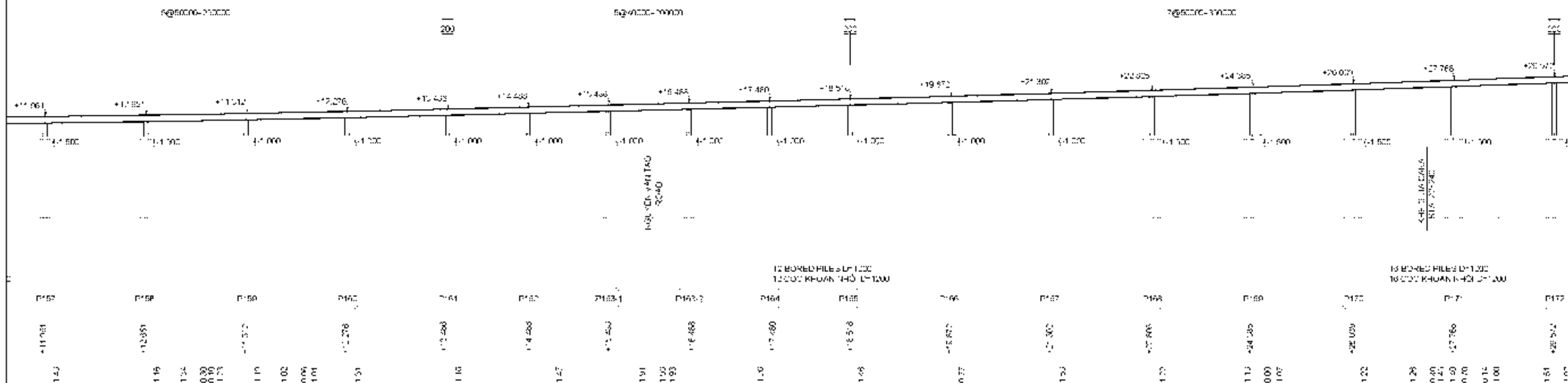


BEN LUC

LONG THANH

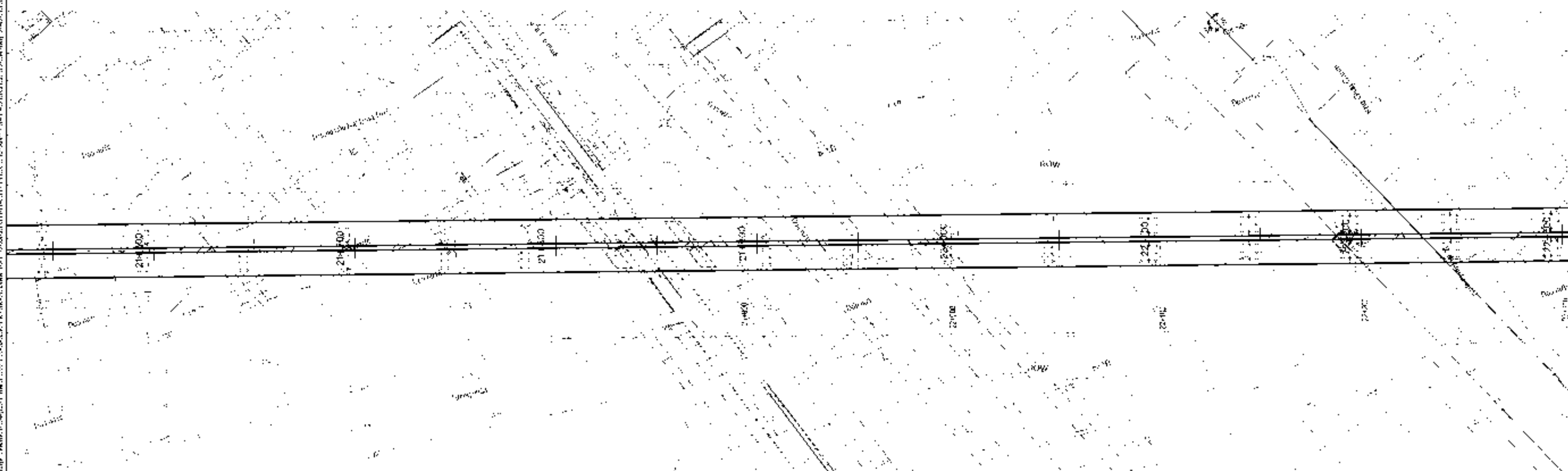
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/500



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/500



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TITLE

NAME

SIGNATURE

PREPARED BY Đặng Vũ TUYẾN

CHECKED BY Lê Ngọc HIEU

APPROVED BY Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF BEN KHANH AND PHUOC KHANH BRIDGE
BỘ TRƯỞNG CẦU ĐƯỜNG VÀNG BÍNH KHANH VÀ PHUOC KHANH

REV No DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

DRAWING No.

BTHK-PK - 00

ALTERNATIVE 1

SCALE:

AS SHOWN

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE - TỶ LỆ 1:1000

4/2007

21320%

21320%

STA 21+400

←A

HS1 102

BINH KHANH BRIDGE
STA 23+450
100000

←A

HPN-104

+59.7-8

+59.7-8

2187

2188

+24.74

+41.14

+38.74

23+232.5

23+450

23+667.5

-3.93
-0.18
-3.61
-3.21
-1.48
-4.47
-1.03
-4.41
-2.90
-24.61
-25.06
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-24.10
-23.95
-23.71
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-23.15
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-22.30
-21.84
-21.23
-20.64
-20.22
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-18.10
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-12.06
-11.58
-11.07
-10.57
-10.13
-9.67

Shipping channel

BINH KHANH BRIDGE

STAGE I
GIAI ĐOẠN I

STAGE II
GIAI ĐOẠN II

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REV. No DATE DESCRIPTION DRAWING No.

KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
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In Association With
APECO

TITLE NAME SIGNATURE
PREPARED BY **Dang Vu TUYEN**
CHECKED BY **Le Ngoc HIEU**
APPROVED BY **Tim COLLETT**

VIETNAM EXPRESSWAY CORPORATION (VEC)

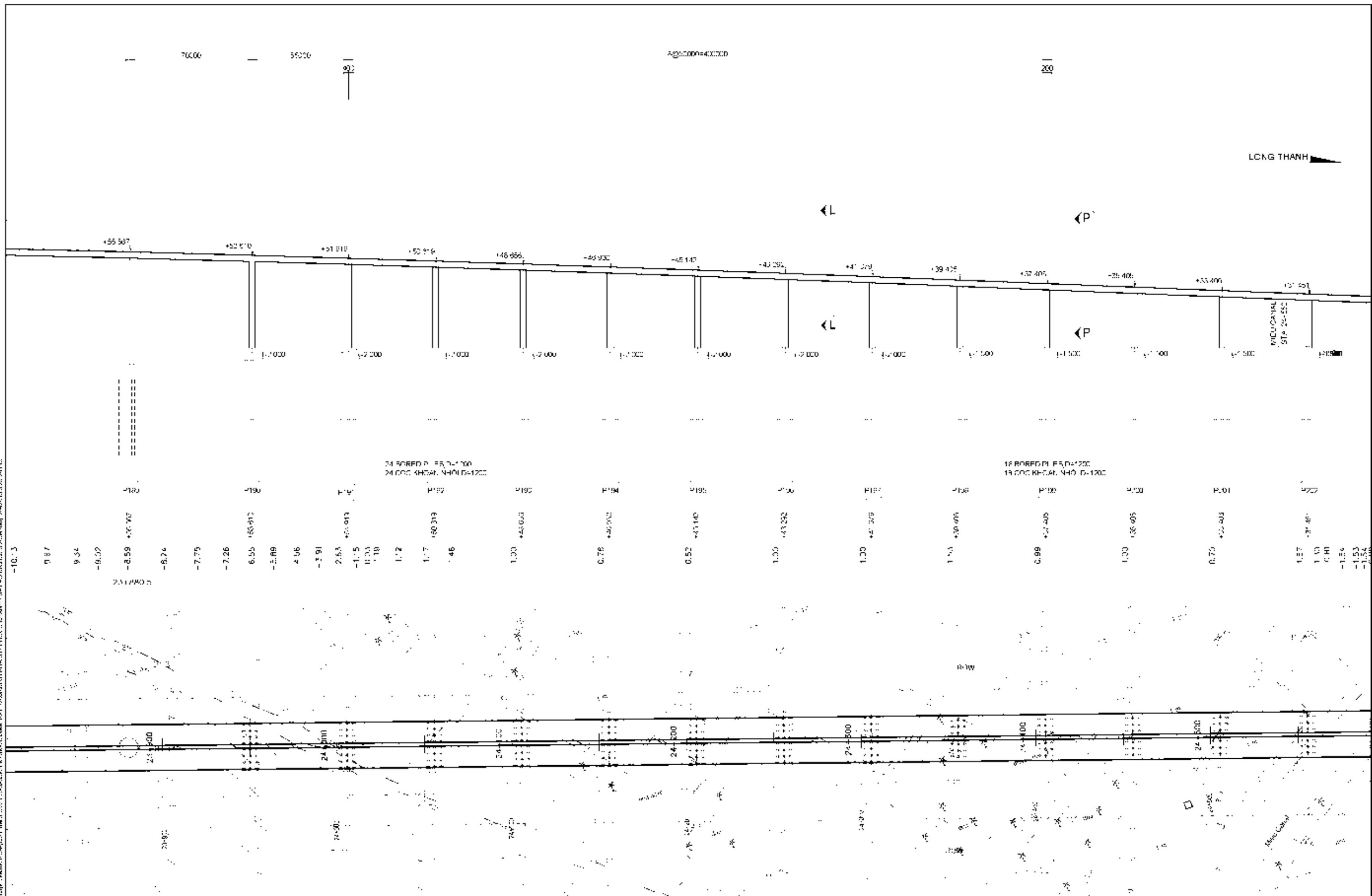
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE:
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU CÂY VÀNG BÌNH KHANH VÀ PHƯỚC KHANH

REV. No	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAW FINAL DRAWING	BD HK-HK-002
1	FEB-2010	FINAL DRAWING	ALTERNATIVE

SCALE: 1:1000

VIỆN KỸ THUẬT KINH TẾ VÀ KỸ THUẬT XÂY DỰNG - KINH TẾ VÀ KỸ THUẬT XÂY DỰNG - KINH TẾ VÀ KỸ THUẬT XÂY DỰNG - KINH TẾ VÀ KỸ THUẬT XÂY DỰNG - KINH TẾ VÀ KỸ THUẬT XÂY DỰNG



CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL			VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAWING NO.	50-KK-KK-001
Joints Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING	ALTERNATIVE
In Association With APECO							DRAWING TITLE			
							GENERAL VIEW OF DINH KIANG AND PHUOC KIANG BRIDGE			
							ĐỒ THỊ CHUNG CẦU CAY VẮNG BẾN LÚC VÀ ĐƯỜNG KINH			
							SCALE:			
							AS 1:1000			

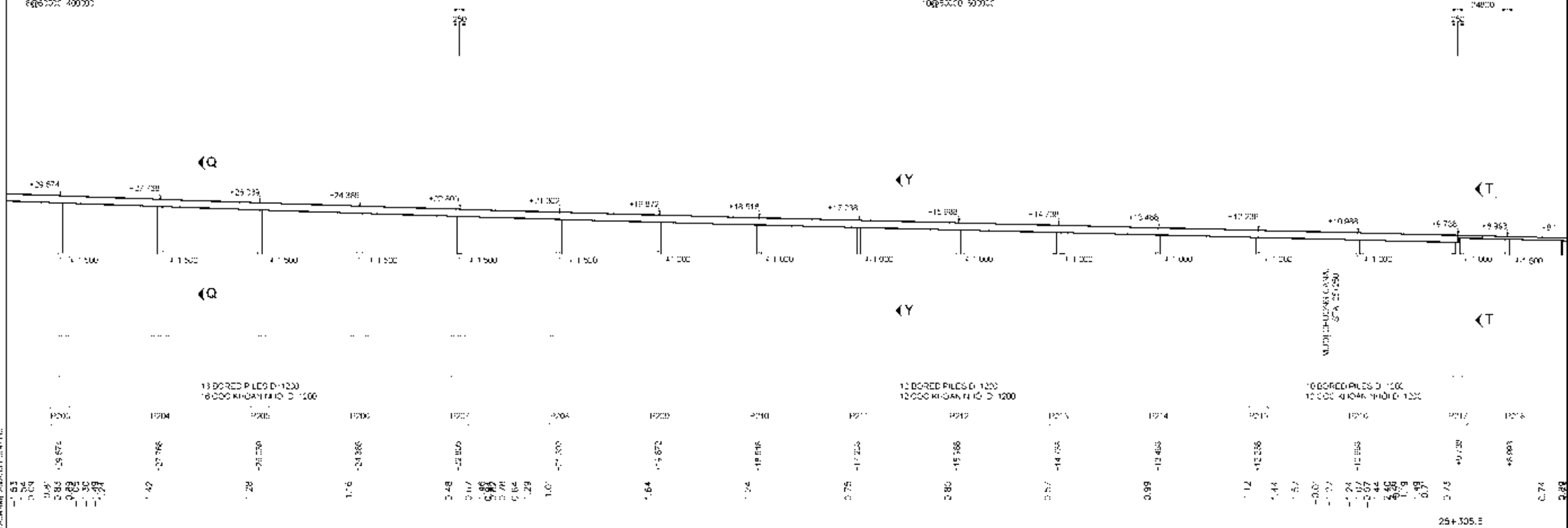
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/1000

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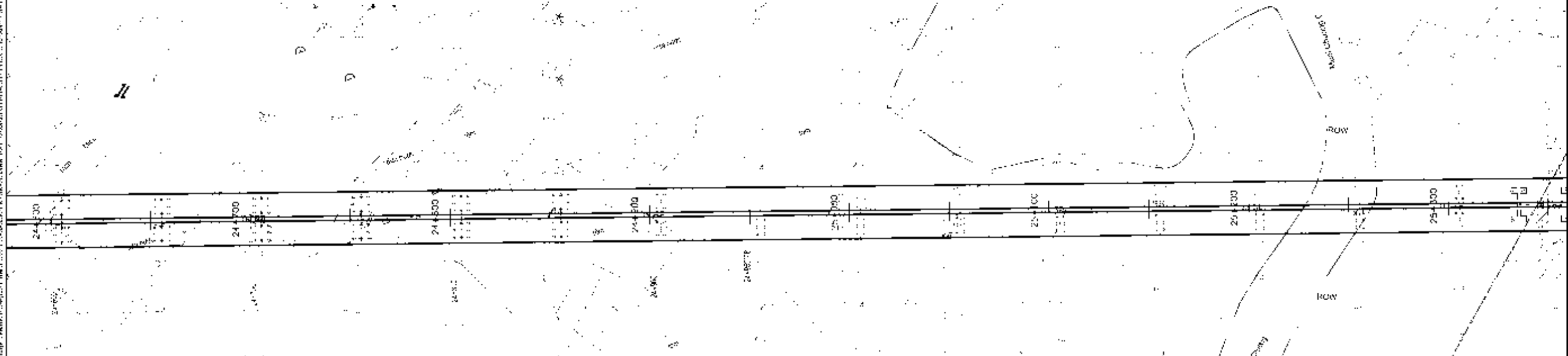
LONG THANH

60 6000 40000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
 Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
 In Association With
APECO

TITLE NAME SIGNATURE
 PREPARED BY **Dang Vu TUYEN**
 CHECKED BY **La Ngoc HIEU**
 APPROVED BY **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

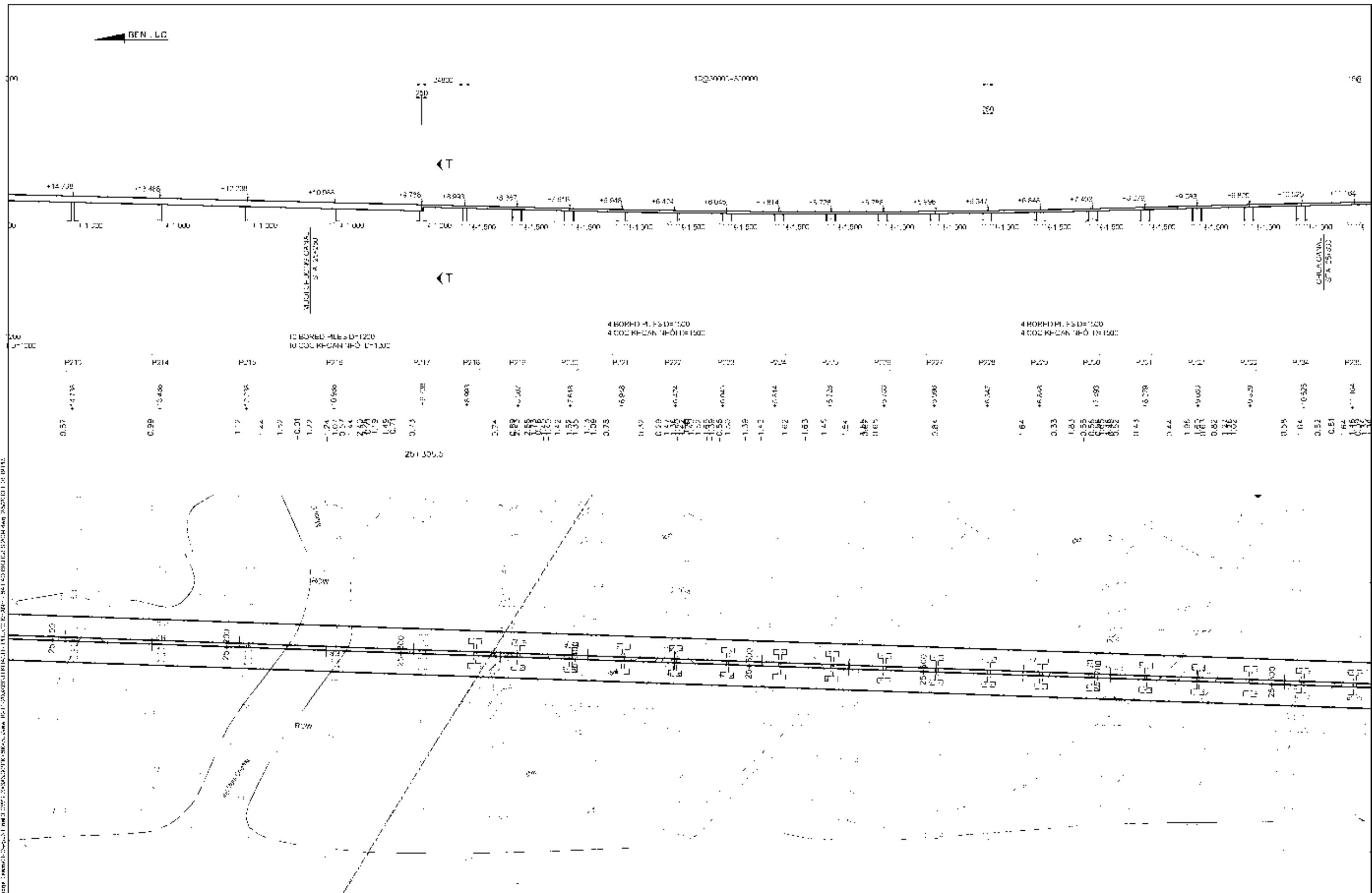
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
 GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
 ĐỒ THỊ CHUNG CẦU DÂY VĂNG BÌNH KHANH VÀ PHƯỚC KHANH

REV No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING DRAWING	40 BK-PK - 0
1	FEB-2010	FINAL DRAWING	AT 7155-VIE

SCALE: 1/1000

Ước tính khối lượng công việc và chi phí dự kiến cho dự án xây dựng và vận hành đường cao tốc Bến Lức - Long Thành, giai đoạn 1, từ năm 2011 đến năm 2015.



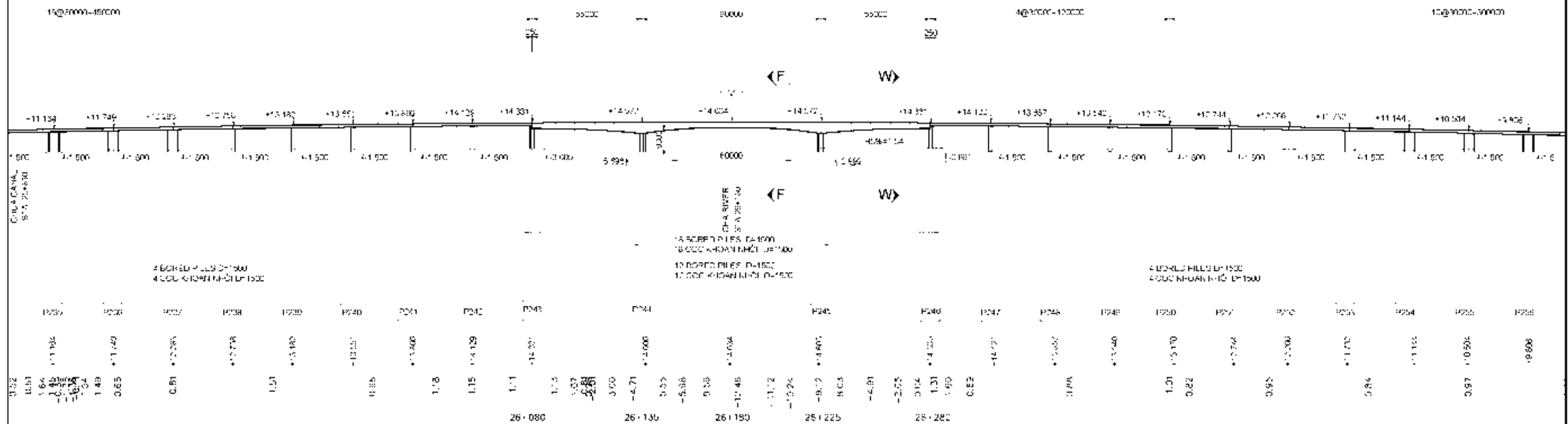
CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.		
KATAHIRA & ENGINEERS INTERNATIONAL					TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	40 BK-PK - 1		
Joint Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING	ALTERNATE 1		
In Association With APECO										SCALE: AS SHOWN		
TITLE	NAME	SIGNATURE										
PREPARED BY	Dang Vu TUYEN											
CHECKED BY	Le Ngoc HIEU											
APPROVED BY	Tim COLLETT											

VIETNAM EXPRESSWAY CORPORATION (VEC)

DRAWING TITLE
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU DÂY VĂNG BÌNH KHANH VÀ PHƯỚC KHANH

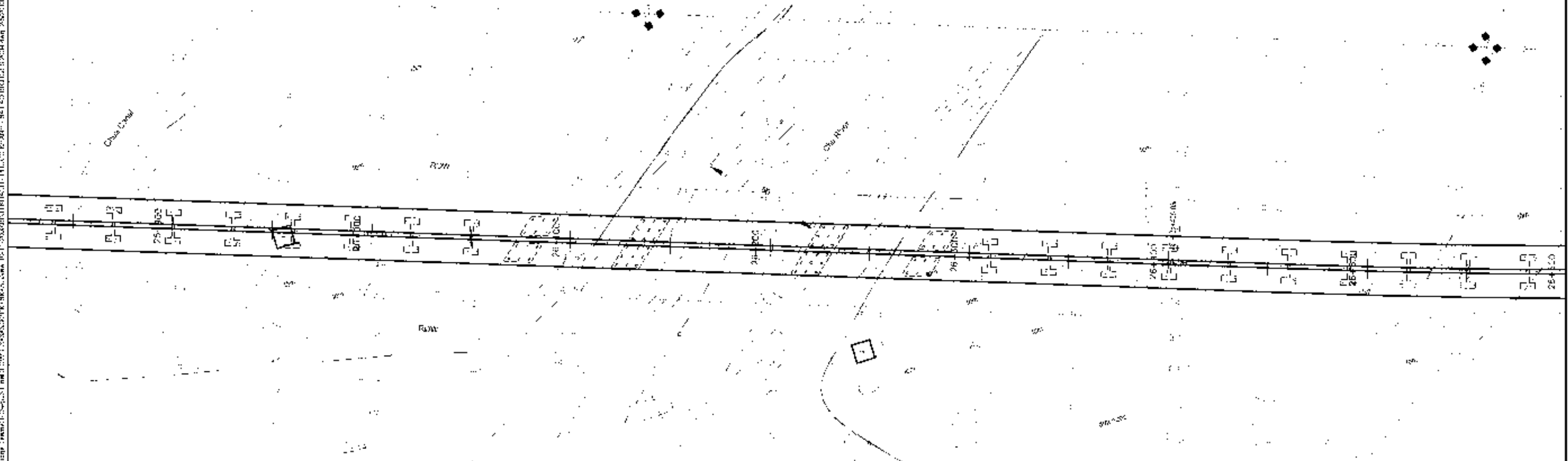
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/1000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
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 In Association With
APECO

TITLE NAME SIGNATURE
 PREPARED BY Đặng Vũ TUYẾN
 CHECKED BY Lê Ngọc HUY
 APPROVED BY Trần COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

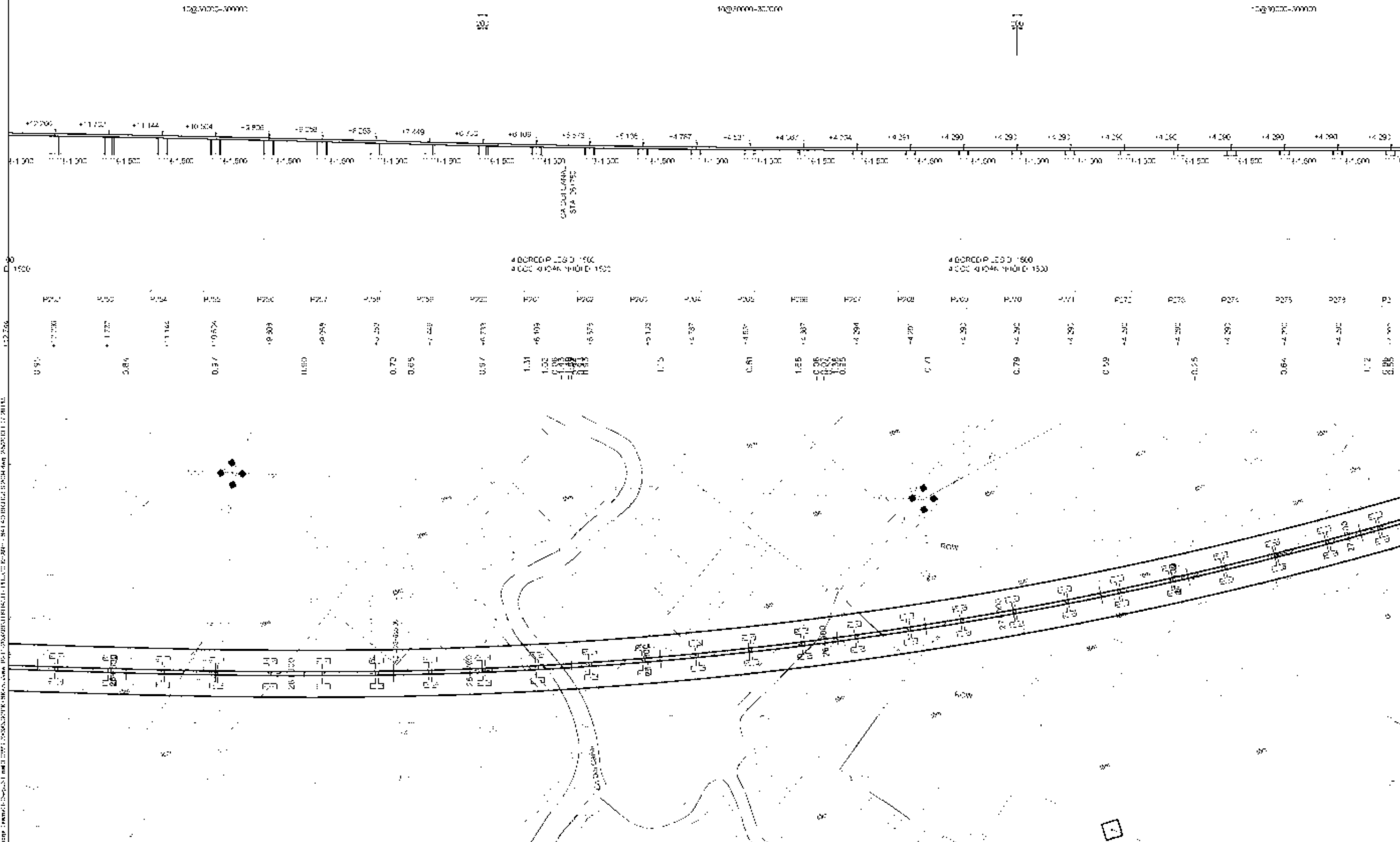
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT

DRAWING TITLE
 GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
 ĐỒ THỊ CHUNG CẦU ĐÁY VẮNG B. NH. KH. ANH VÀ PH. KH. KH. ANH

REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	40 BK-PK - 2
1	FEB-2010	FINAL DRAWING	AT 7155-VIE

SCALE: 1/1000

LONG THANH



1:2500

CONSULTANT		SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No
KATAHIRA & ENGINEERS INTERNATIONAL		VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAWING NO.	40 BK-PK - 1
Oriental Consultants Co., Ltd						1	FEB-2010	FINAL DRAWING	ALTERNATE 1
In Association With APECO						SCALE: 1:2500			

PREPARED BY: Dang Vu TUYEN

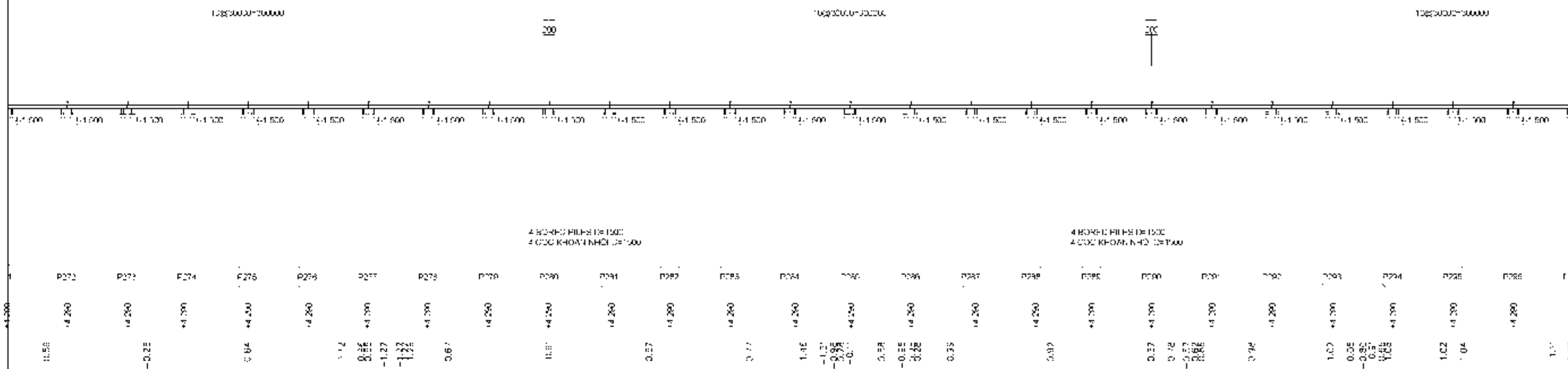
CHECKED BY: La Ngoc HIEU

APPROVED BY: Tim COLLETT

DRAWING TITLE

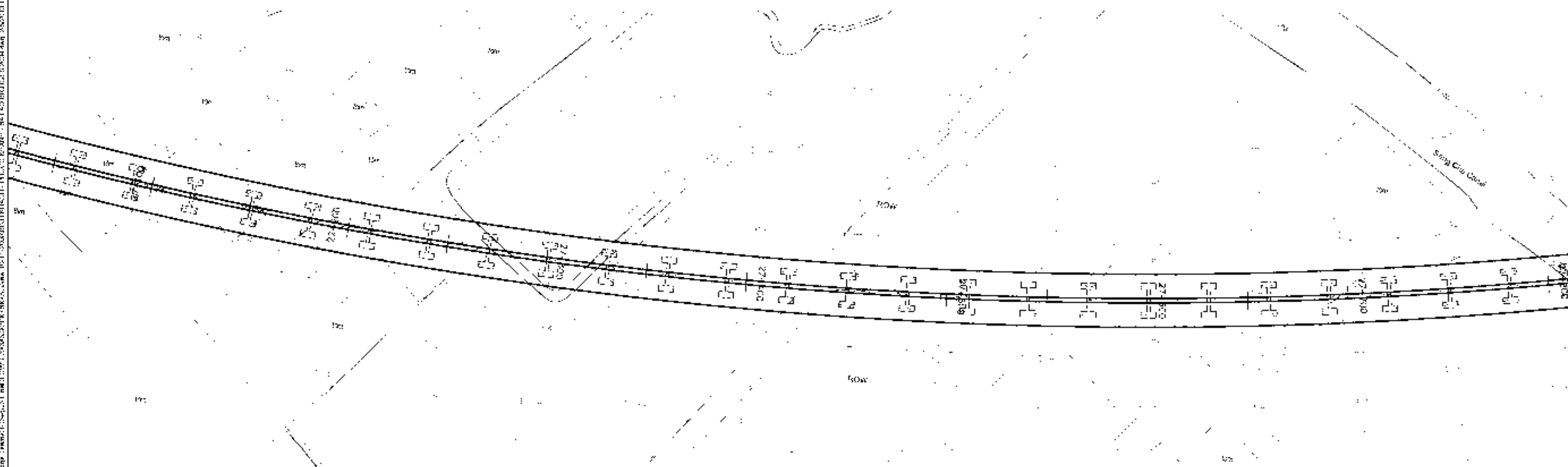
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE

ĐỒ THỊ CHUNG CẦU ĐAY VẮNG B. NH. KH. ANH VÀ PH. KH. ANH

[illegible]

PLAN VIEW - MAT BẢNG CẦU

SCA 2.7-15 (2011)



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Joint Venture With

ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPRENTICE BY TIM COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TITLE

GENERAL YU OF BINH KHANH AND DO JOO KHANH BRIDGE
ĐỐC TRỊ CHƯNG CẦU CAY VĨNG Ở N. KH. KHANH VÀ PH. ĐỐC KHANH

FILE No.	DATE
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NOV. 2005

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

F N&L DRAWING

PLANTING No. _____

15. 7-12, 1712

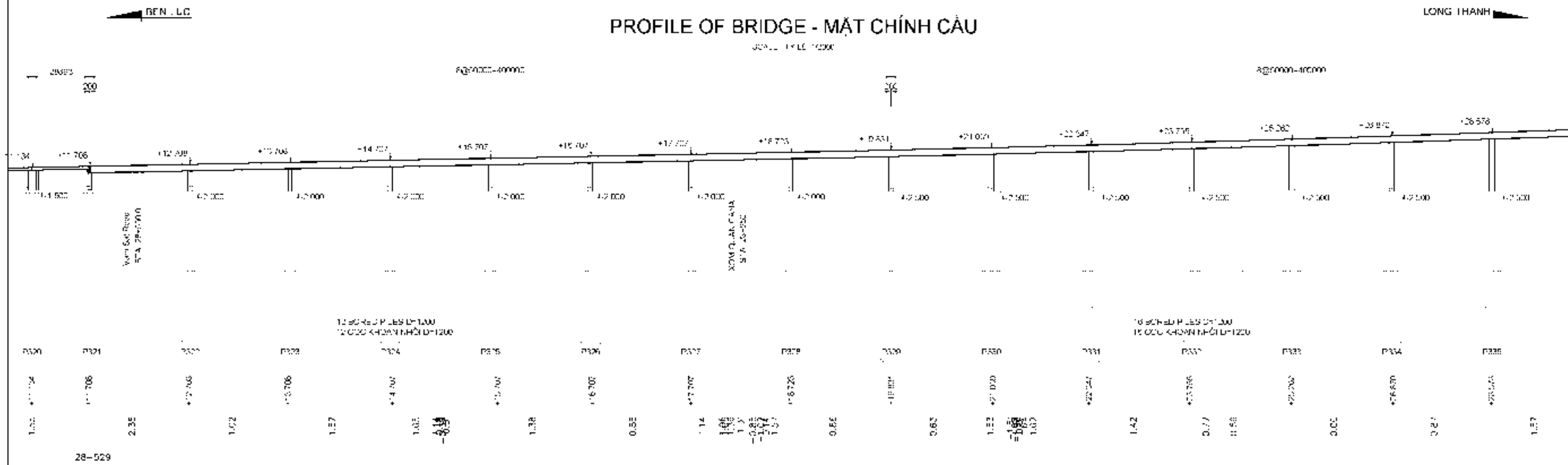
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SCALE :

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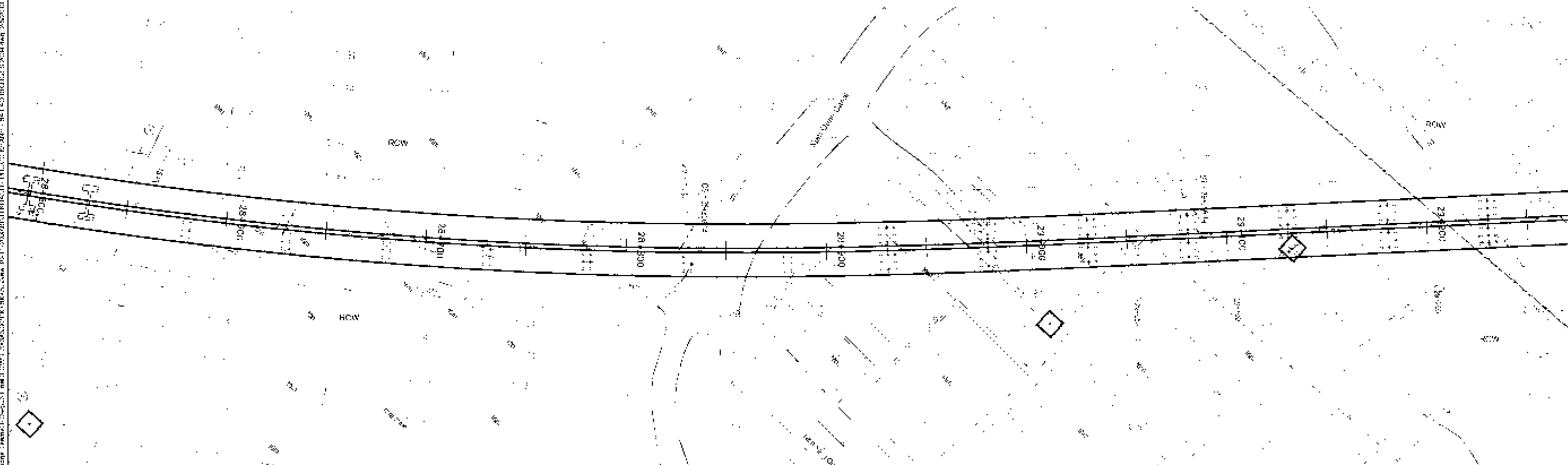
PROFILE OF BRIDGE - MẶT CHÍNH CẦU


SCALE: 1" = 10'000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1" = 10'000

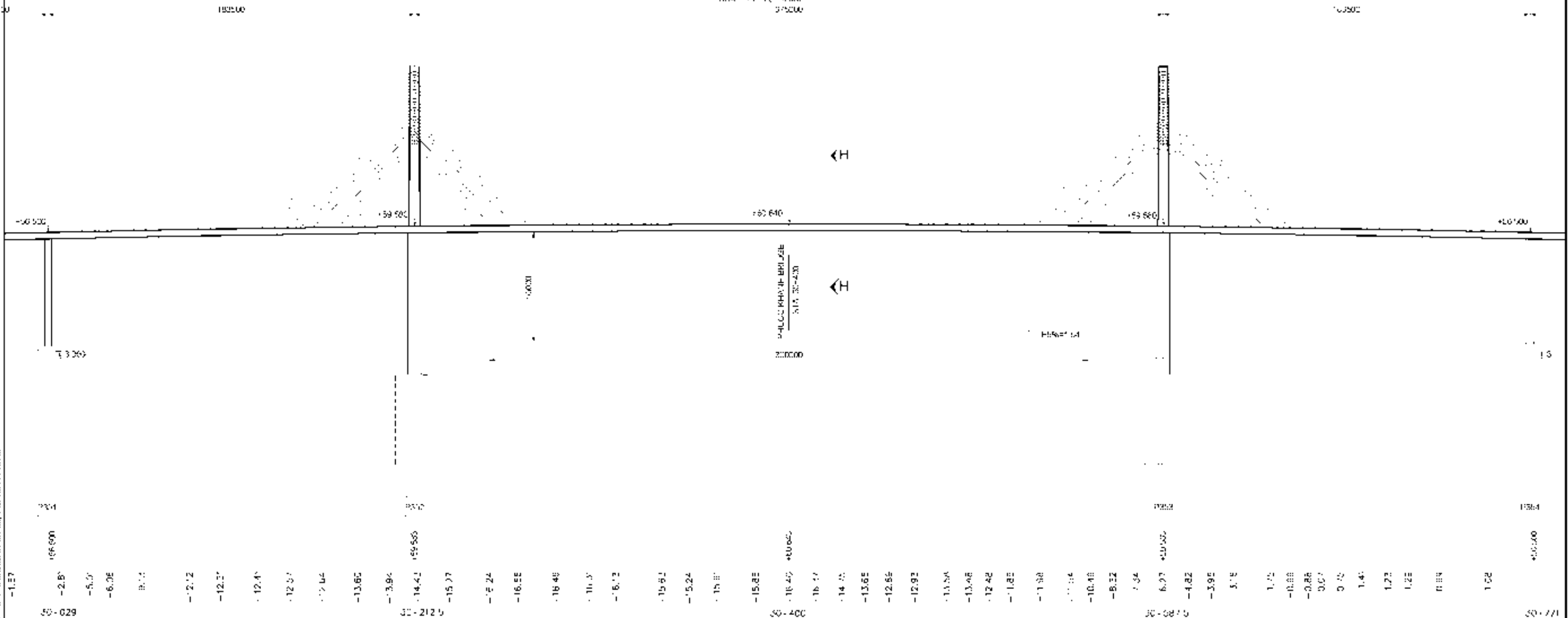


CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No		
KATAHIRA & ENGINEERS INTERNATIONAL			VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAW F I N A L D R A W I N G	40 BK-PK - E		
Joint Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	F I N A L D R A W I N G	AT THINHAT VP		
In Association With APECO					Drawing TITLE GENERAL VIEW OF BINH KHANH AND PHU LOC KHANH BRIDGE ĐỒ THẺ CHUNG CẦU GAY KÍNH BÌNH KHANH VÀ PHU LOC KHANH					SCALE: AS SHOWN		
TITLE	NAME	SIGNATURE										
PREPARED BY	Dang Vu TUYEN											
CHECKED BY	La Ngoc HIEU											
APPROVED BY	Tien COLLETT											

DRAWING TITLE
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU ĐÁY VẮNG Ở BÌNH KHANH VÀ PHƯỚC KHANH

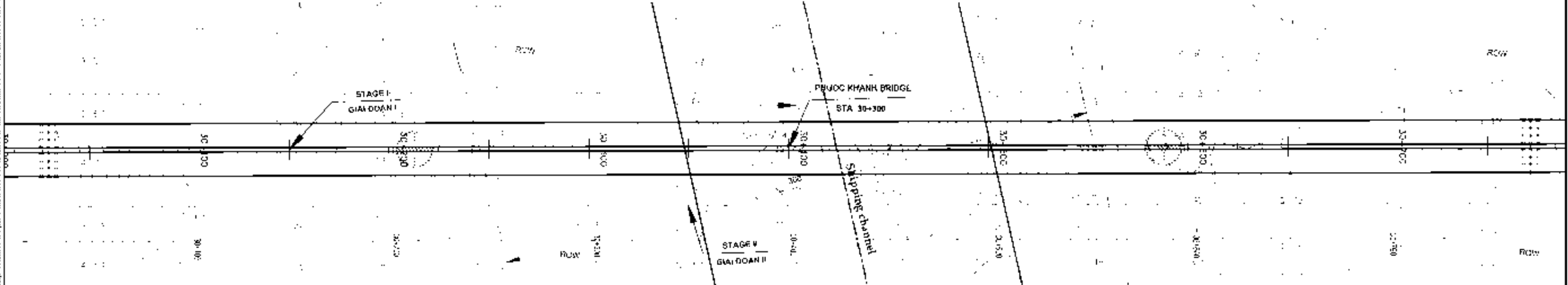
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1:1000
DATE: 07/2010



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1:1000



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APECO

TITLE
PREPARED BY: **Dang Vu TUYEN**
CHECKED BY: **La Ngoc HIEU**
APPROVED BY: **Tien COLLETT**

NAME
La Ngoc HIEU

SIGNATURE

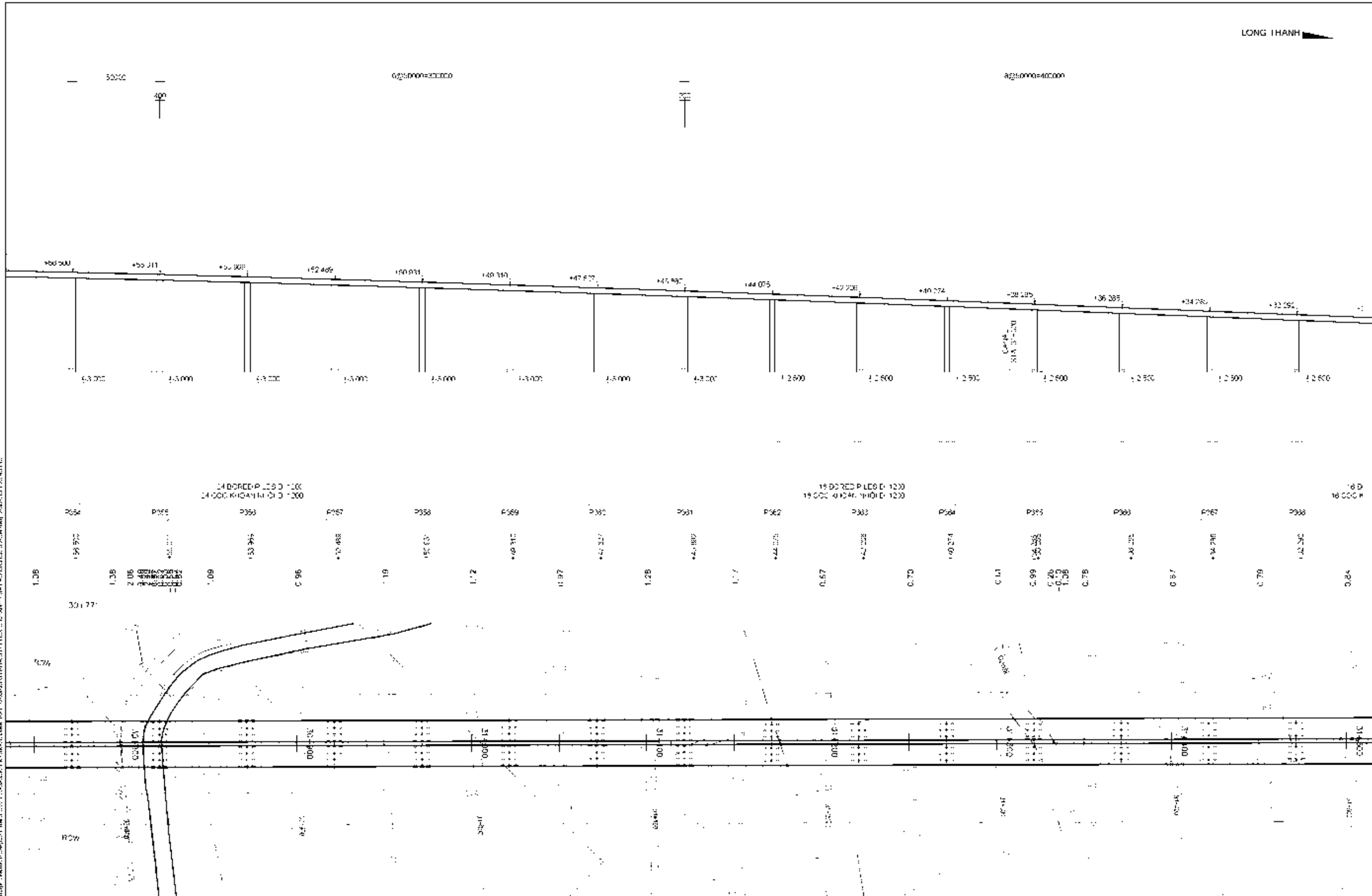
SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU ĐAY VẮNG BÌNH KHANH VÀ PHƯỚC KHANH

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING	40-BK-PK-100
1	FEB-2010	FINAL DRAWING	ALTERNATIVE

SCALE: 1:1000



CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL							0	NOV-2009	DRAWING NO.	40-BK-PK-01
Joints Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING	ALTERNATE
In Association With APECO										SCALE: 1:500
TITLE	NAME	SIGNATURE	VIETNAM EXPRESSWAY CORPORATION (VEC)		DRAWING TITLE GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE ĐỒ TRỌNG CẢM CẦU DÂY VẮNG BÌNH KHANH VÀ PHƯỚC KHANH					
PREPARED BY	Dang Vu TUYEN									
CHECKED BY	La Ngoc HIEU									
APPROVED BY	Tim COLLETT									

BEN LUC

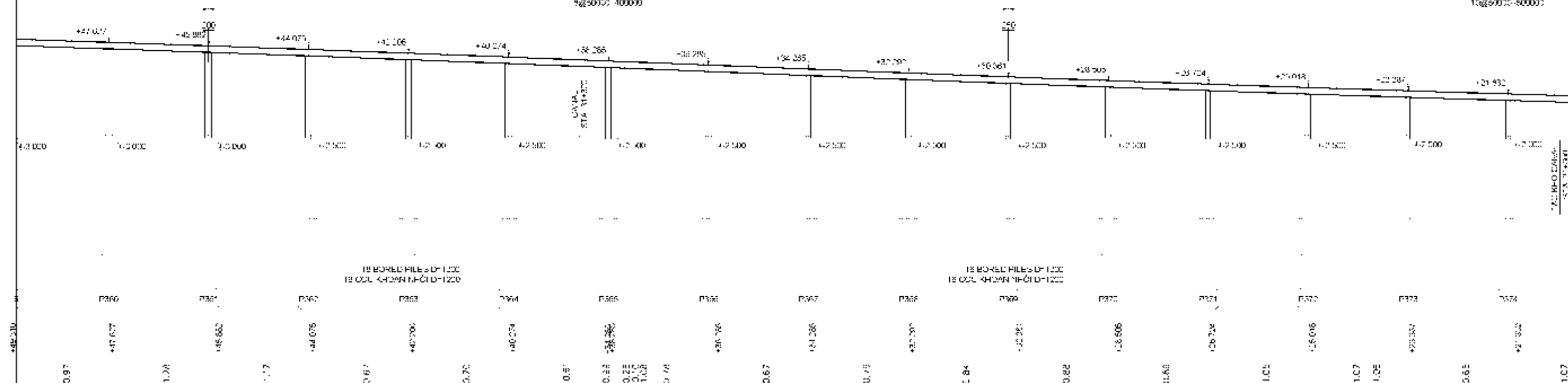
LONG THANH

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

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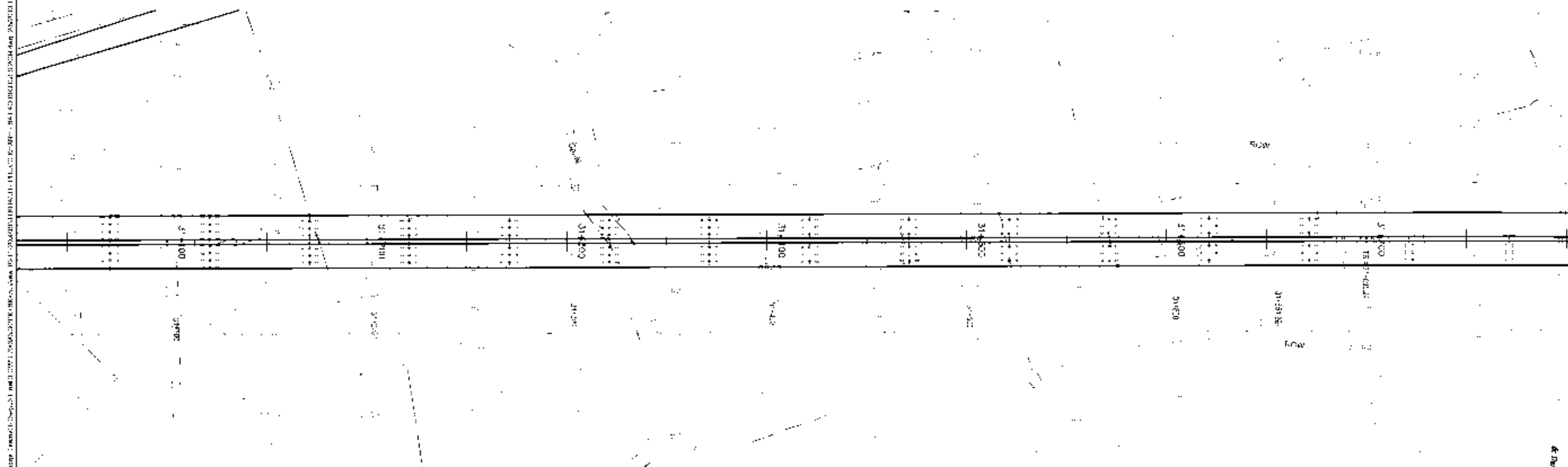
SCALE: 1/1000

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PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



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TITLE NAME SIGNATURE
 PREPARED BY **Dang Vu TUYEN**
 CHECKED BY **La Ngoc HIEU**
 APPROVED BY **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
 GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
 ĐỒ THỊ CẦU LƯNG CẦU ĐÁY VÀNG Ở NHỊ KHÁNH VÀ PHƯỚC KHÁNH

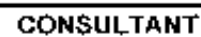
REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING DRAWING	40 BK-PK 1P
1	FEB-2010	FINAL DRAWING	ALTERNATE
SCALE:			AS SHOWN

Ước tính khối lượng công việc: 1.000.000.000 VNĐ (Một tỷ đồng). Dự kiến thời gian hoàn thành: 12 tháng. Đơn vị thi công: Công ty TNHH Xây dựng và Thương mại Bến Lức - Long Thành.

$$S.C.A. = .7415 + 0.006$$


SCA.L-15-0000

SCA.L-15-0000



Joint Venture With

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPROVED BY: Tim COLLETT

VIETNAM EXPRESSWAY CORPORATION (VEC)

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TITLE

GENERAL YU OF BINH KHANH AND DO JOO KHANH BRIDGE
ĐỐC TRỊ CHUNG CẦU ĐAY VÔNG BẾN KH. KH. KH. VÀ PH. Đ. KH.

FILE No.	DATE
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NOV. 2006

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

PLANTING No.

© 1995 by Blackwell Publishers Ltd.

SCALE :

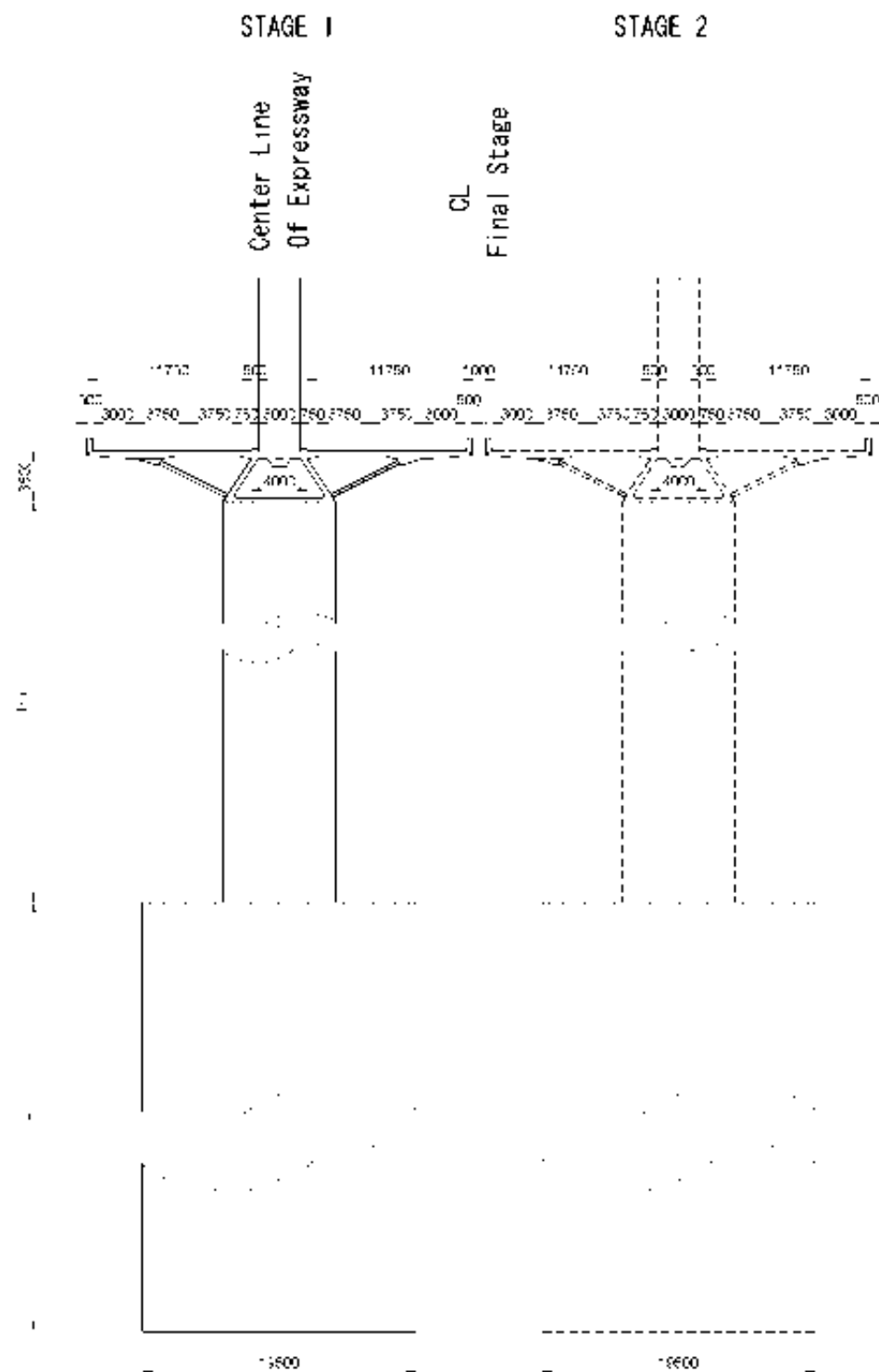
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SECTION A-A - MẶT CẮT A-A

SCALE: 1:100

BINH KHANH CABLE STAYED BRIDGE CROSS SECTION

MẶT CẮT NGANG CẦU DÂY VĂNG BÌNH KHANH

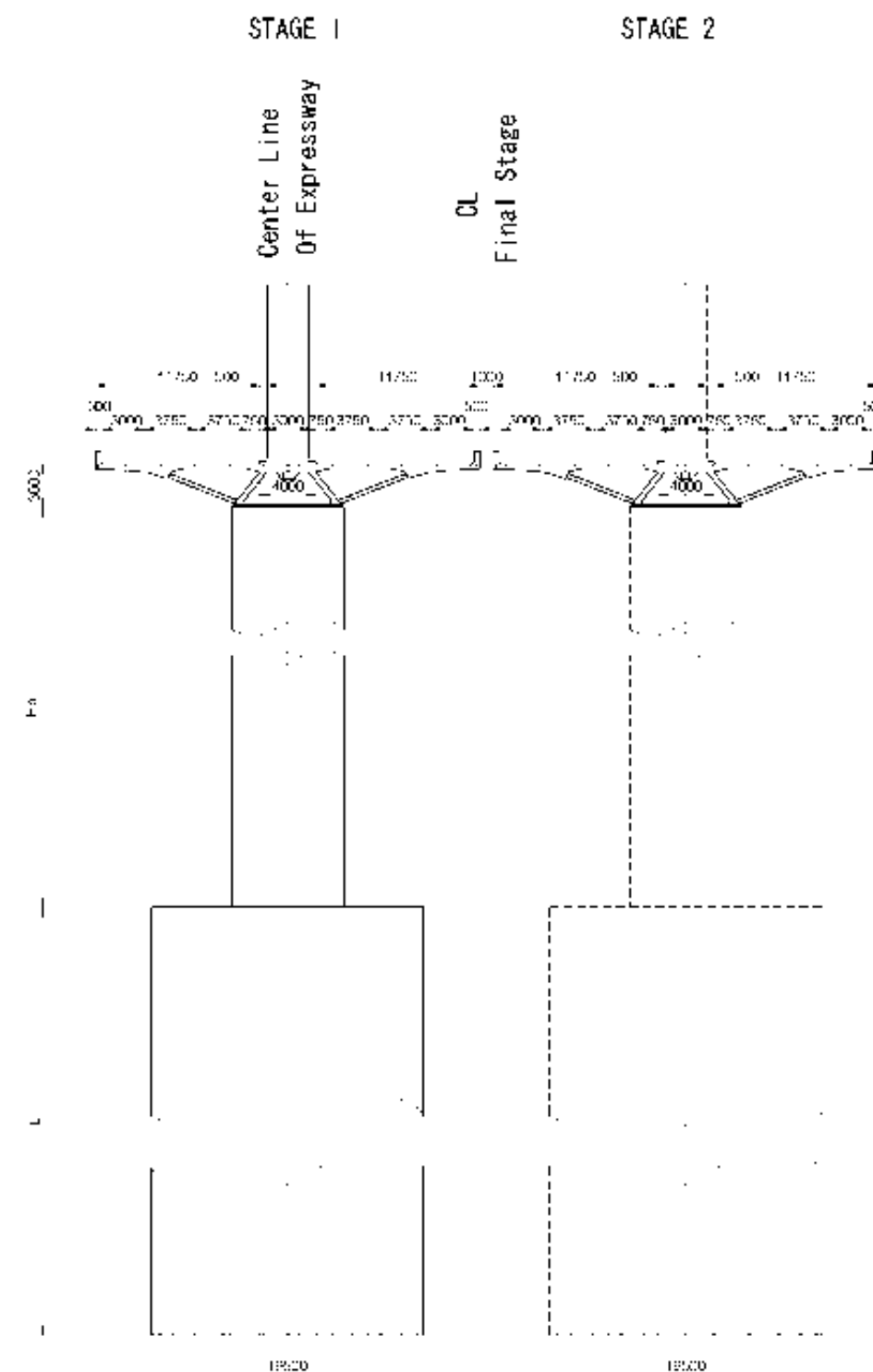


SECTION H-H - MẶT CẮT H-H

SCALE: 1:100

PHUOC KHANH CABLE STAYED BRIDGE CROSS SECTION

MẶT CẮT NGANG CẦU DÂY VĂNG PHƯỚC KHANH



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TITLE

NAME

SIGNATURE

PREPARED BY Đặng Vũ TUYỀN

CHECKED BY Lê Ngọc HIỆU

APPROVED BY Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE

TYPICAL CROSS SECTION OF BK - PK - BL BRIDGES
MẶT CẮT NGANG ĐÌNH HẠNH CẦU BK - PK - BL

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

DRAWING No.

ED 64-PK-20

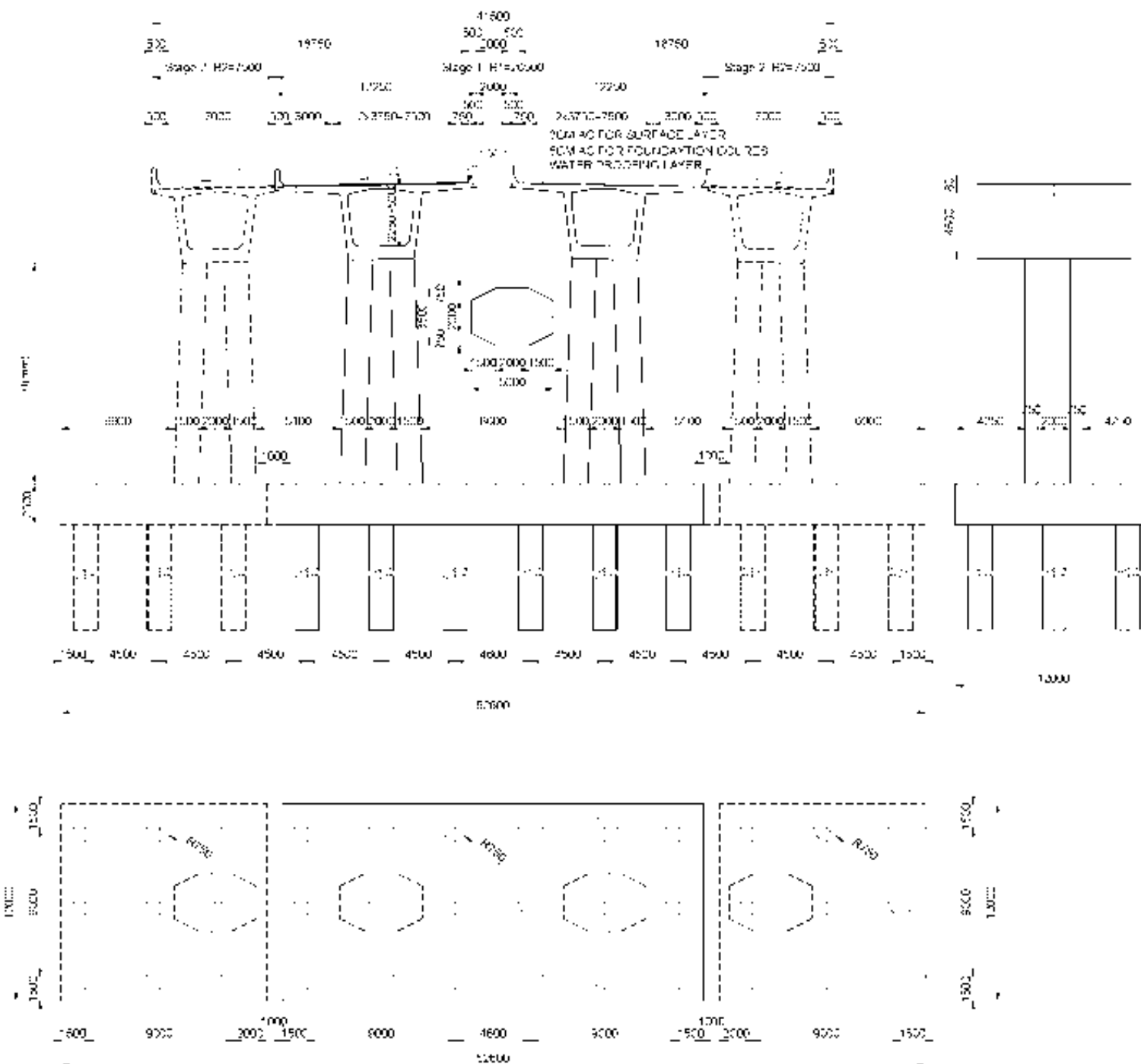
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SCALE:

AS B-DWG

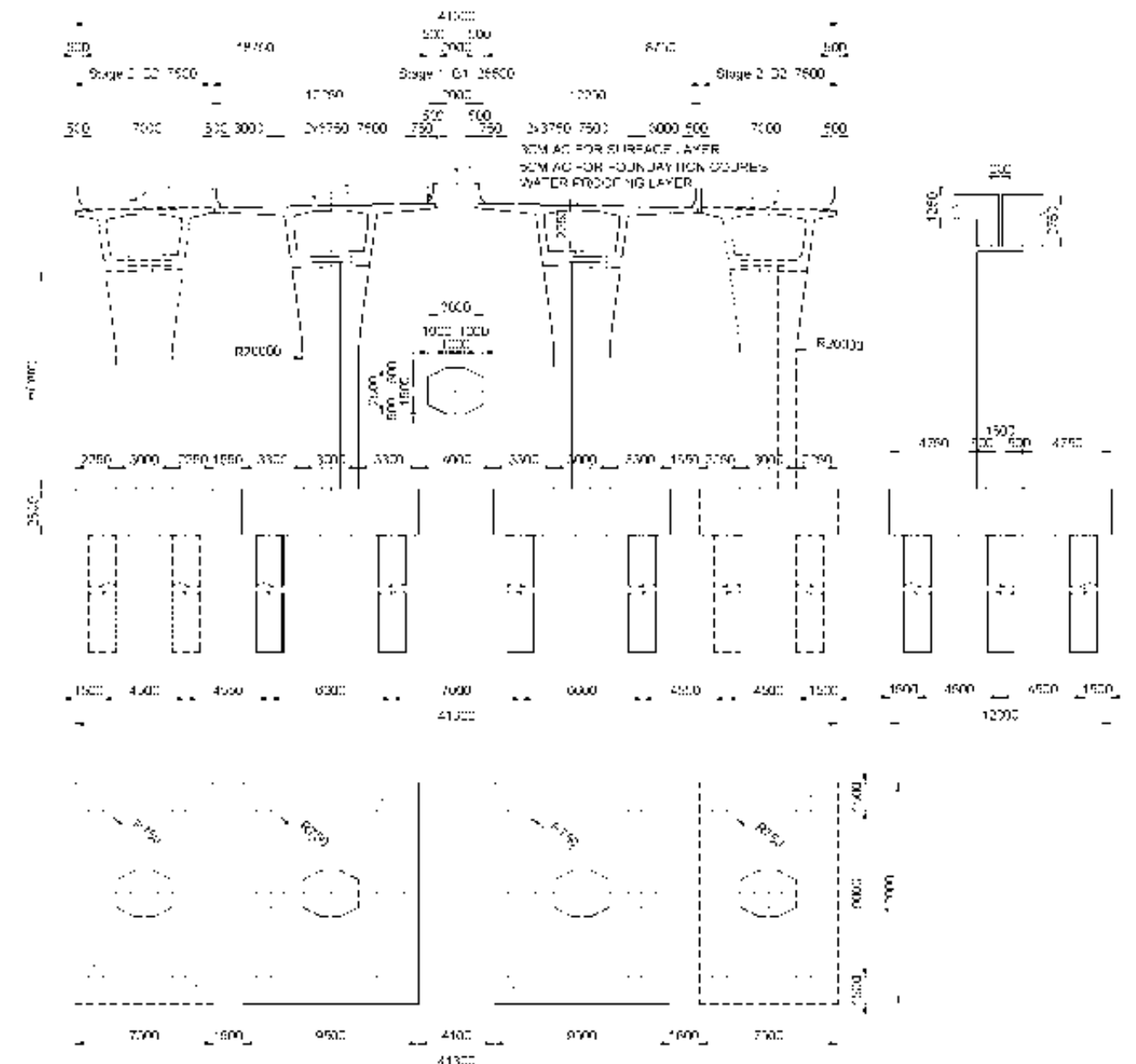
SECTION (MẶT CÁT): H

SCALE: 1:1000



SECTION (MẶT CÁT): K-K

SCALE: 1:1000



VEI 001: HƯỚNG DẪN THI CÔNG VÀ BẢO DƯỠNG CÁC CÔNG TRÌNH GIAO THÔNG VÀ CÁC CÔNG TRÌNH KỸ THUẬT KHÁC TRONG DỰ ÁN - 1.001.1163

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TITLE
NAME
SIGNATURE
PREPARED BY: **Dang Vu TUYEN**
CHECKED BY: **La Ngoc HIEU**
APPROVED BY: **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

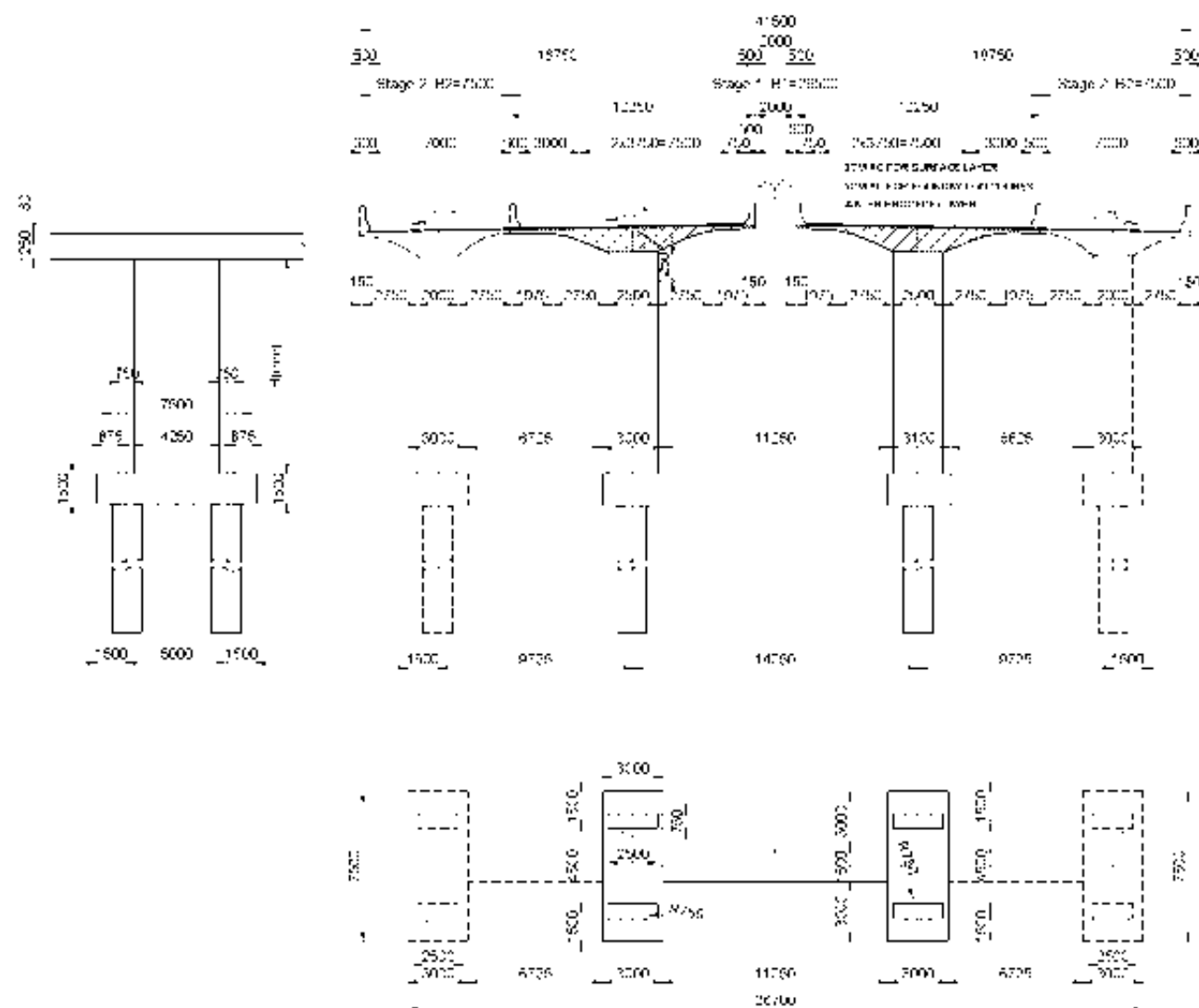
DRAWING TITLE
TYPICAL CROSS SECTION OF BK - PK - BL BRIDGES
MẶT CÁT NGANG ĐIỂN HÌNH CẦU BK - PK - BL

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING FOR DRAWING	BD BK-PK - 2
1	FEB-2010	FINAL DRAWING	ALTERNATIVE

SCALE: AS SHOWN

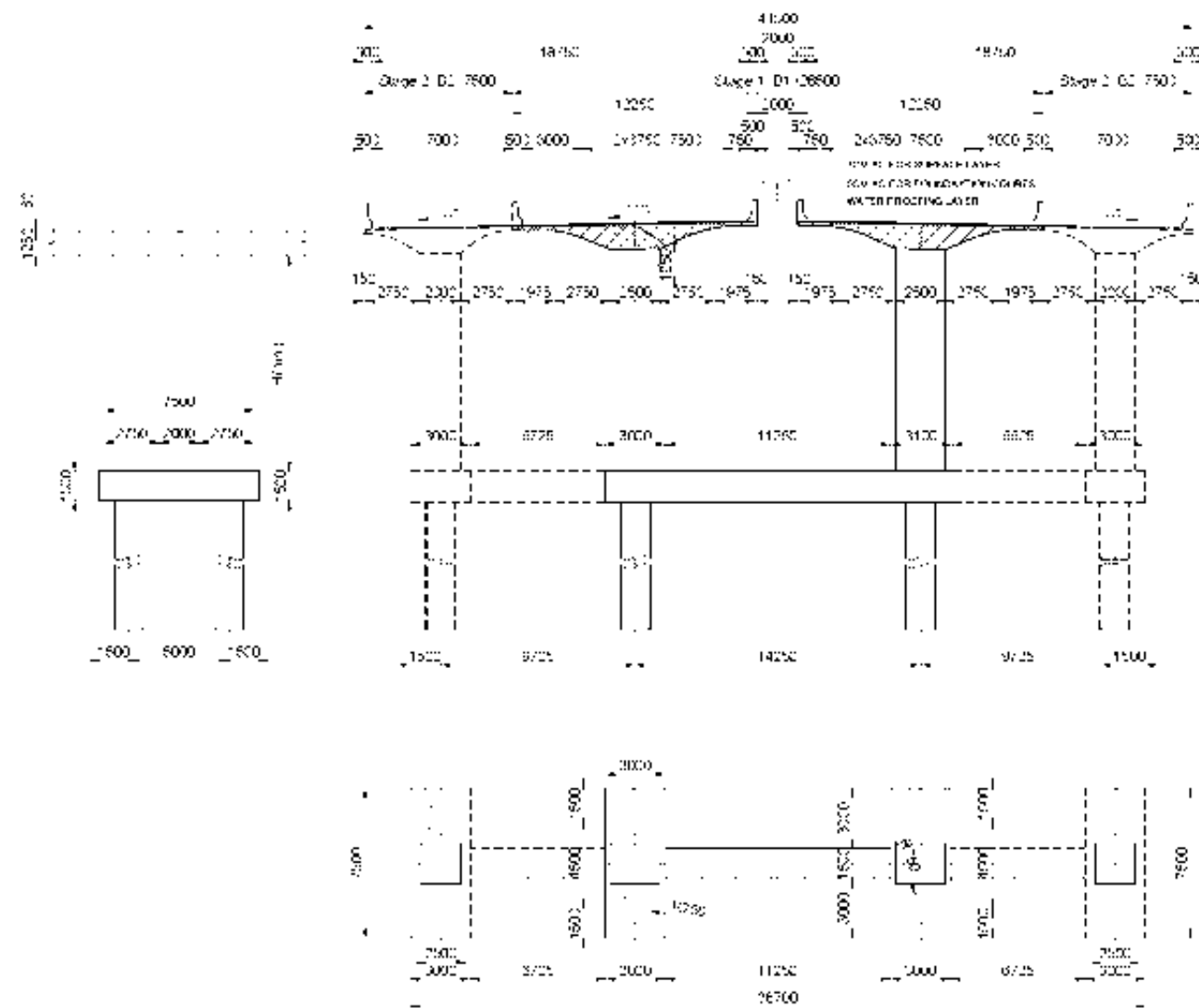
SECTION B-B - MẶT CẮT B-B

SCALE: 1:350



SECTION Z-Z - MẶT CẮT Z-Z

SCALE: 1:350



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In Association With

APECO

TITLE

PREPARED BY

CHECKED BY

APPROVED BY

NAME

Dang Vu TUYEN

La Ngoc HIEU

Tim COLLETT

SIGNATURE

[Signature]

[Signature]

[Signature]

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

TYPICAL CROSS-SECTION OF BK+PK+BL BRIDGES
MẶT CẮT NGANG ĐIỂN HÌNH CẦU BK+PK+BL

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING NO.

FINAL DRAWING

ALTERNATIVE

DRAWING No.

DD-0000-02

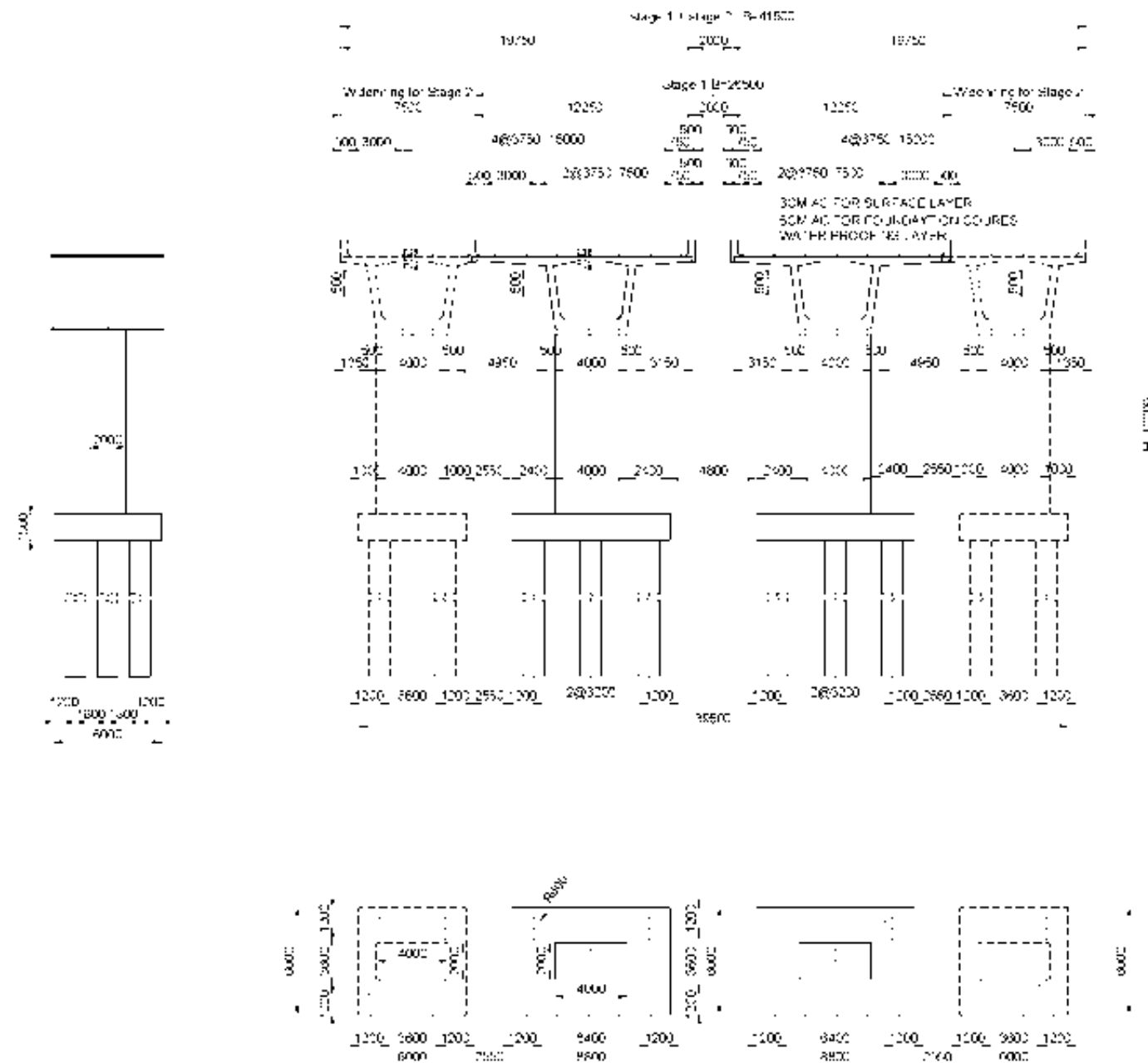
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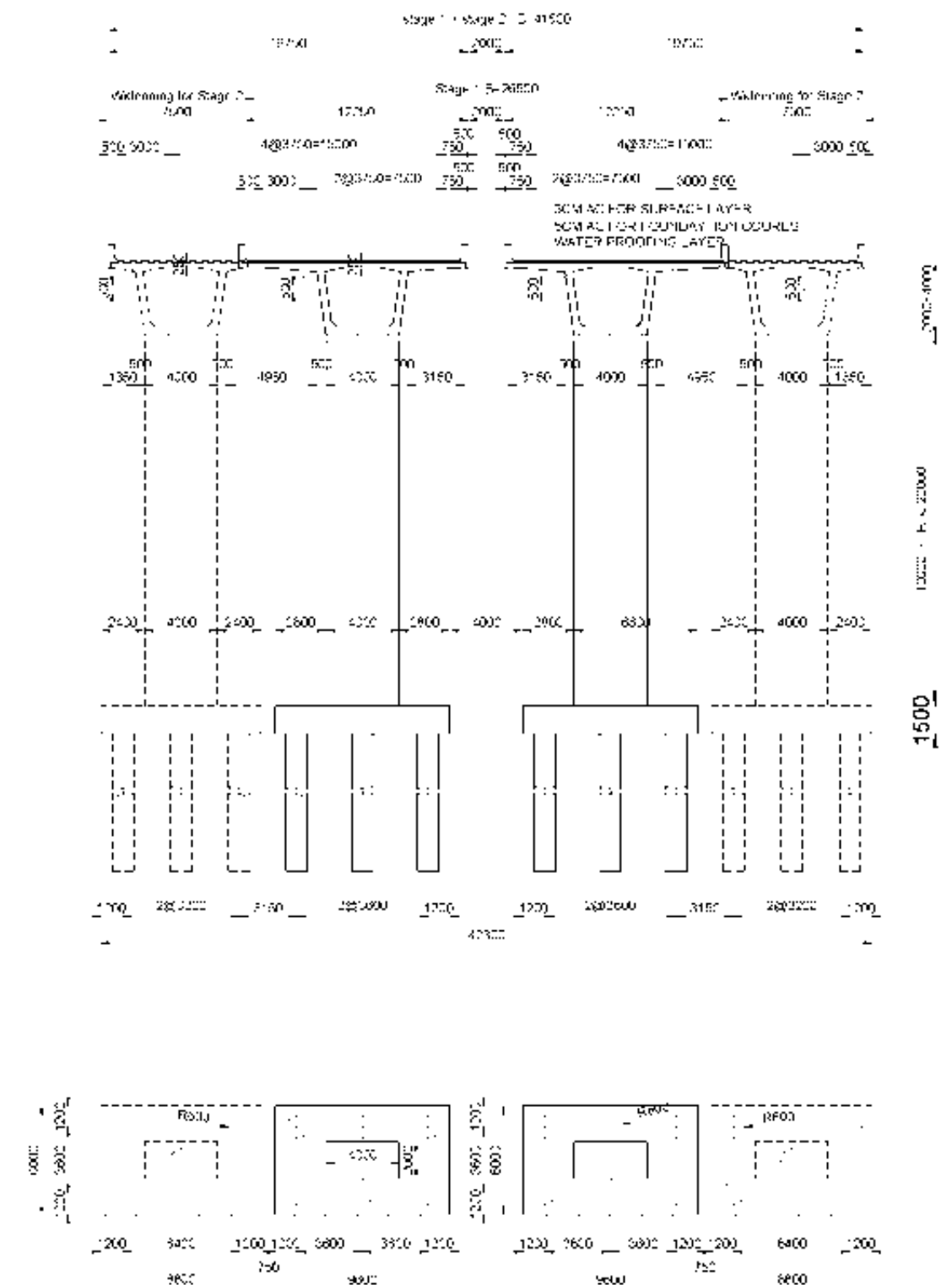
SECTION T-T - MẶT CẮT T-T

SCALE: 1:250



SECTION Y-Y - MẶT CẮT Y-Y

SCALE: 1:350



SEE THE NEXT DRAWING FOR THE TYPICAL CROSS-SECTION OF THE BRIDGE DECK AND THE TYPICAL CROSS-SECTION OF THE BRIDGE PIER AND THE TYPICAL CROSS-SECTION OF THE BRIDGE ABUTMENT.

CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With

ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY: **Đang Vũ TUYẾN**

CHECKED BY: **Le Ngoc HIEU**

APPROVED BY: **Tên COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

TYPICAL CROSS-SECTION OF BK + PK - BL BRIDGES
MẶT CẮT NGANG ĐIỂM HỖ CHỖ K + PK - BL

REV. NO.

DATE

DESCRIPTION

DRAWING NO.

0 NOV-2009

DRAWING DRAWING

SD BK-PK - 23

1 FEB-2010

FINAL DRAWING

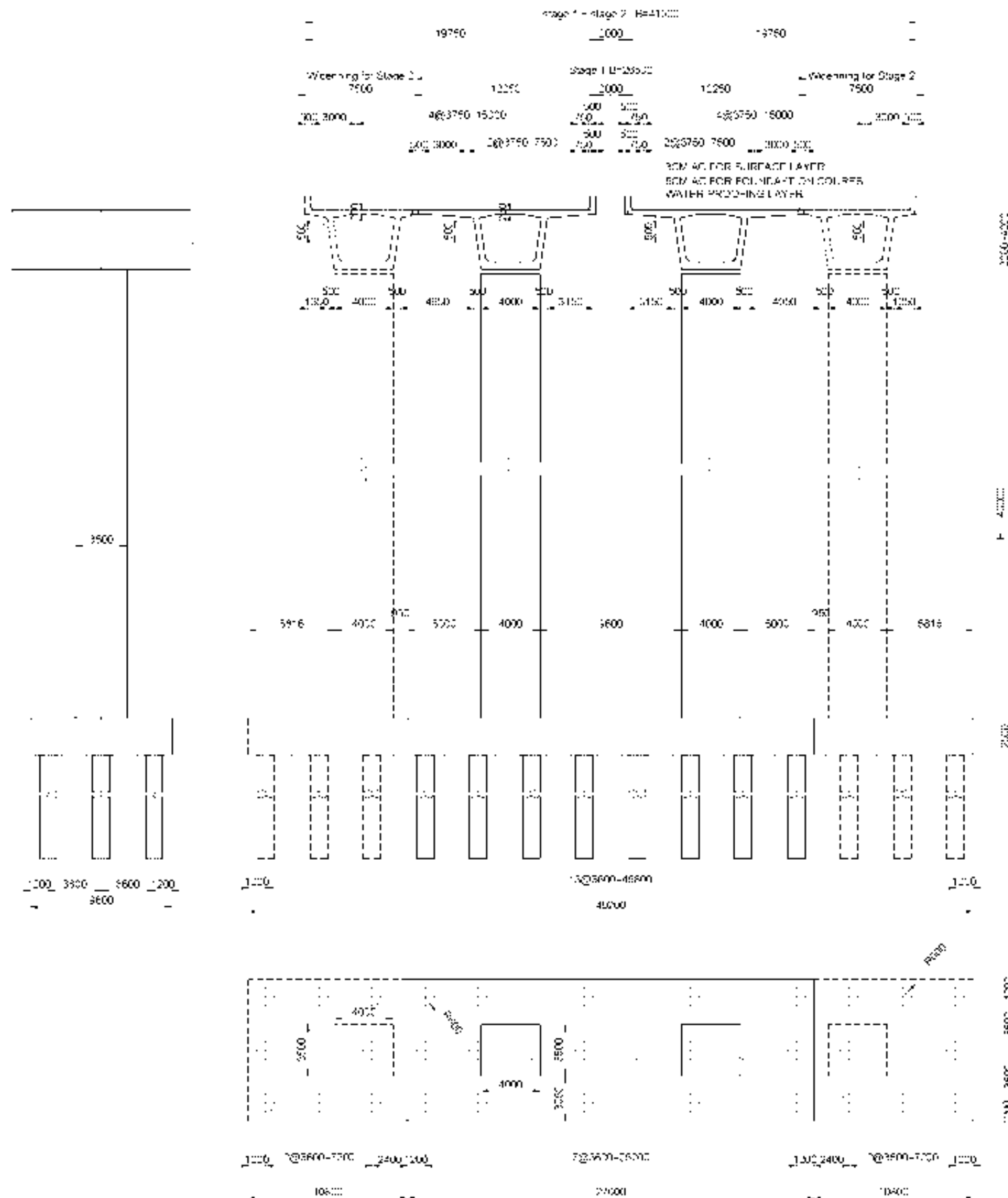
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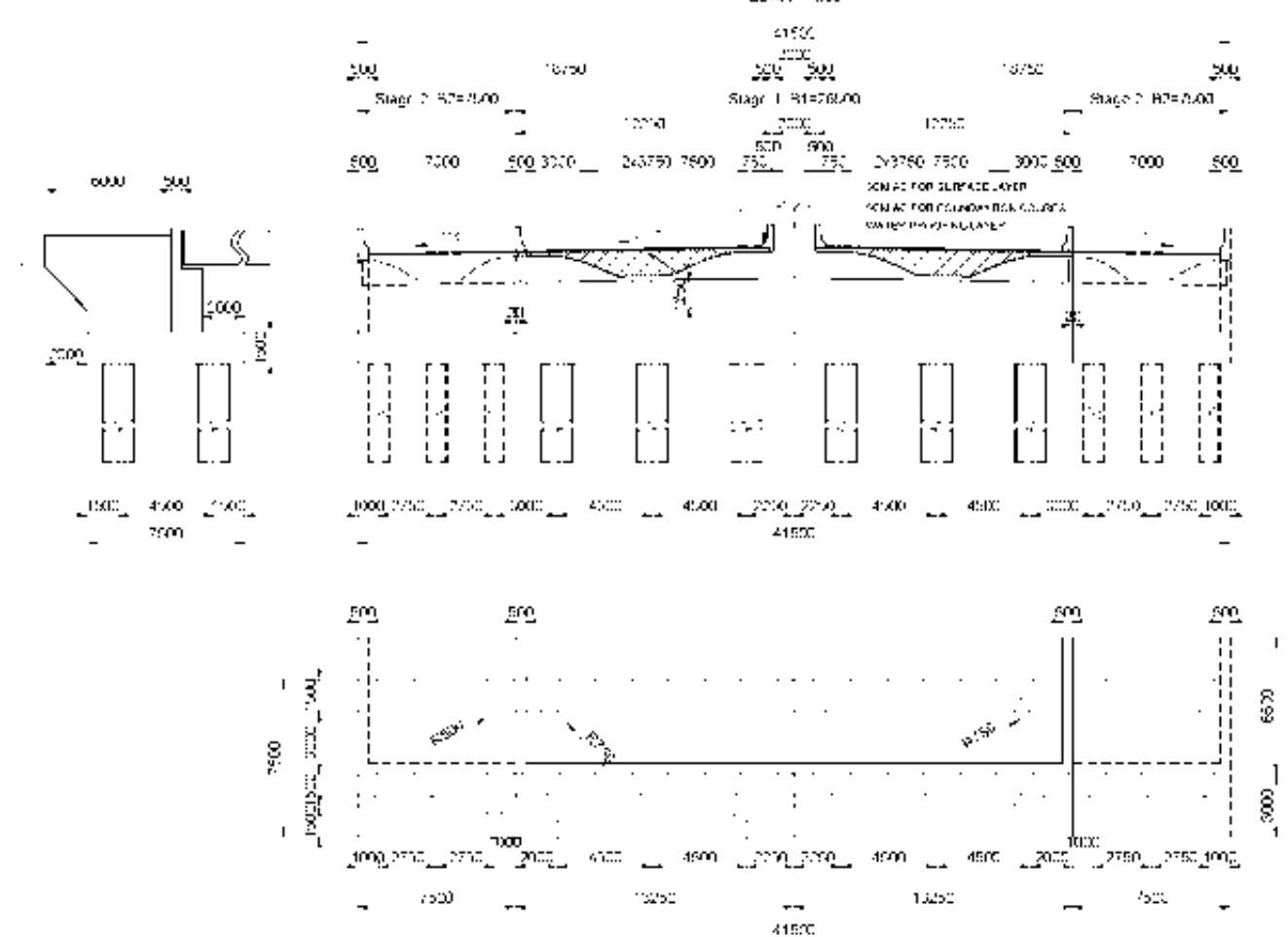
SECTION L-L - MẶT CẮT L-L

SCALE: 1/50



SECTION M-M - MẶT CẮT M-M

SCALE: 1/50



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
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TITLE NAME SIGNATURE
PREPARED BY **Dang Vu TUYEN**
CHECKED BY **La Ngoc HIEU**
APPROVED BY **Tien COLLETT**

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VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

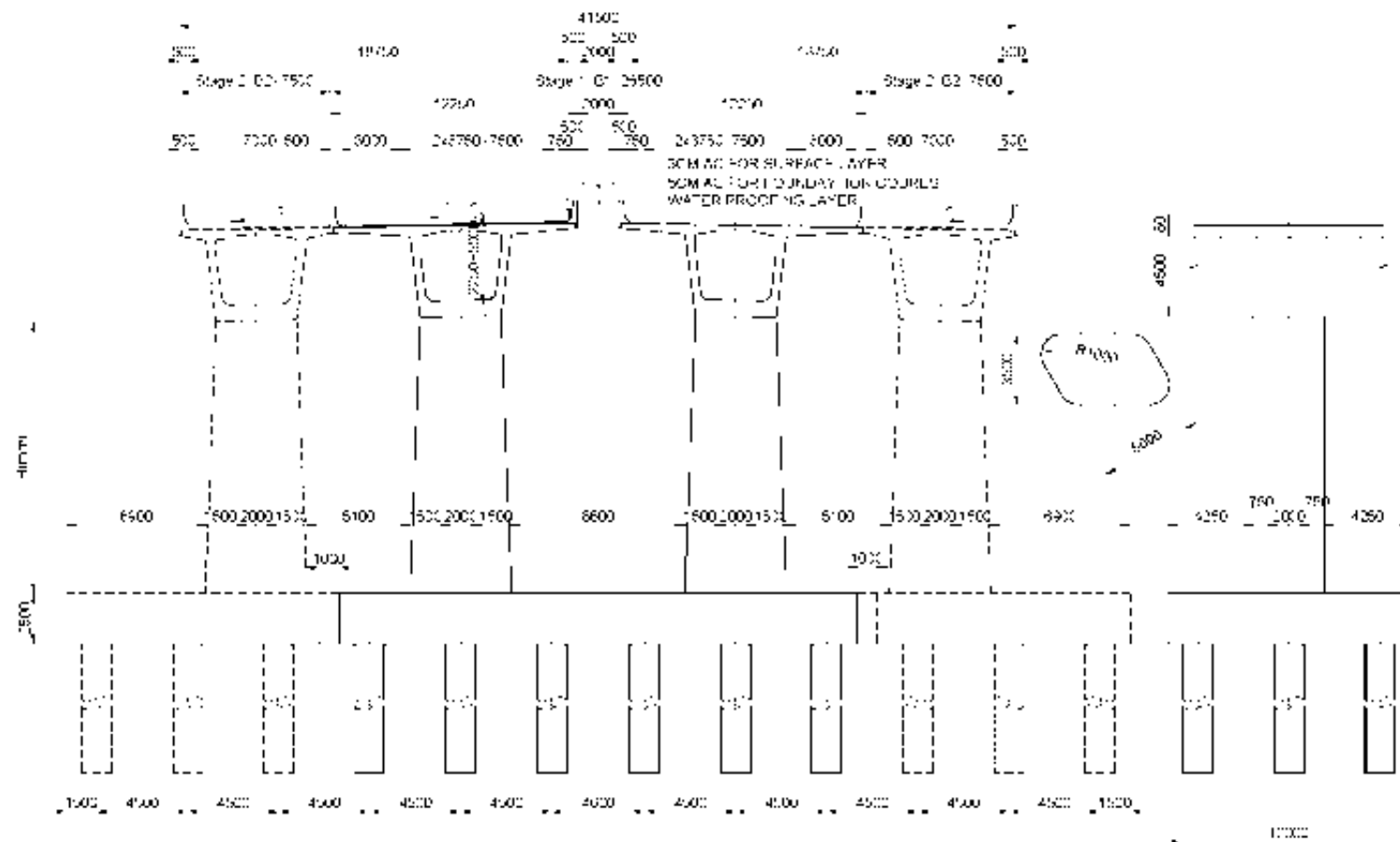
DRAWING TITLE
TYPICAL CROSSSECTION OF BK+PK+BL BRIDGES
MẶT CẮT NGANG ĐẾN HẸN CẦU BK+PK+BL

REV No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING DRAWING	SD BK+PK+BL
1	FEB-2010	FINAL DRAWING	A. TURNAT V

SCALE: AS SHOWN

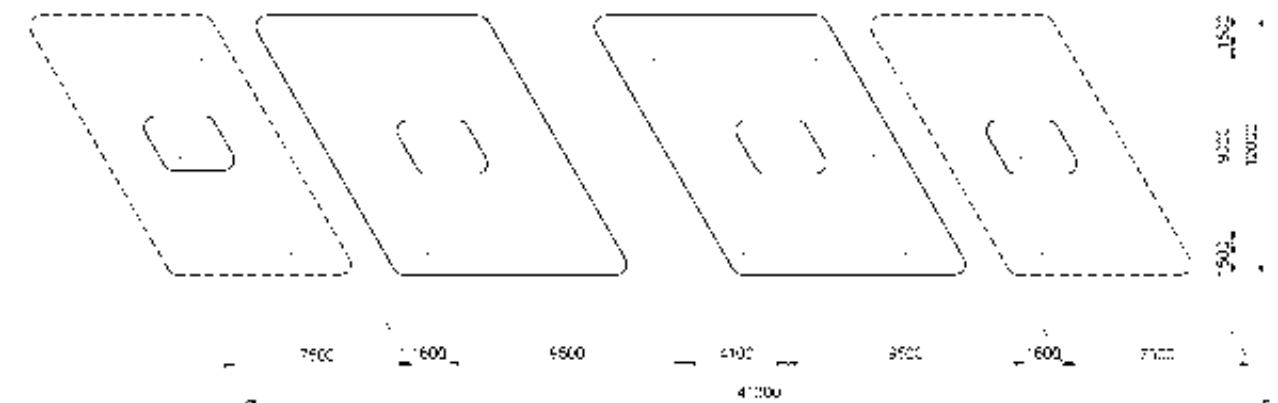
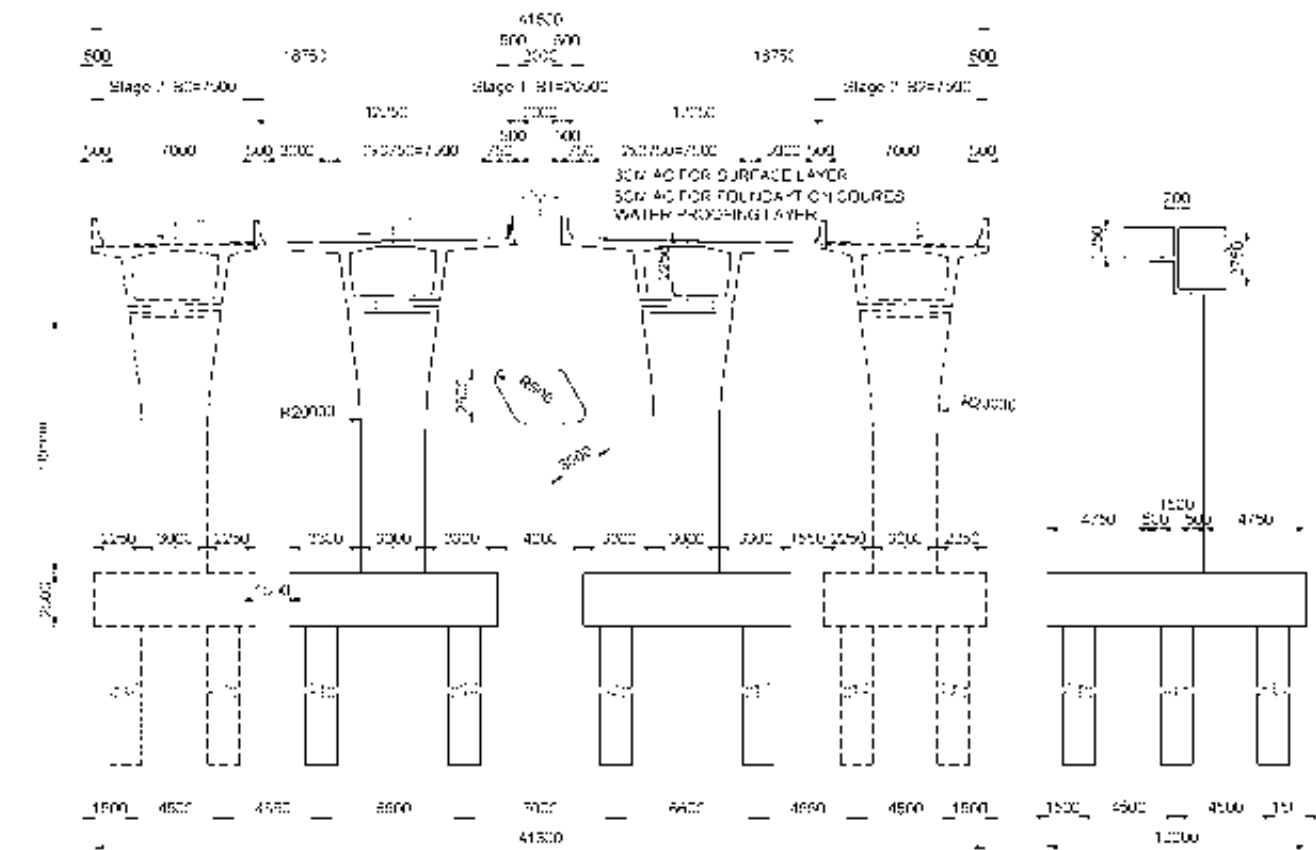
SECTION F-F - MẶT CẮT F-F

SCALE: 1:500



SECTION W-W - MẶT CẮT W-W

SCALE: 1:500



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TITLE
 NAME
 SIGNATURE
 PREPARED BY: **Đang Vũ TUYỀN**
 CHECKED BY: **Le Ngoc HIEU**
 APPROVED BY: **Tên COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
 TYPICAL CROSS SECTION OF SK + PK - BL BRIDGES
 MẶT CẮT NGANG ĐIỂM HẸN CẦU BÈ - PK - BL

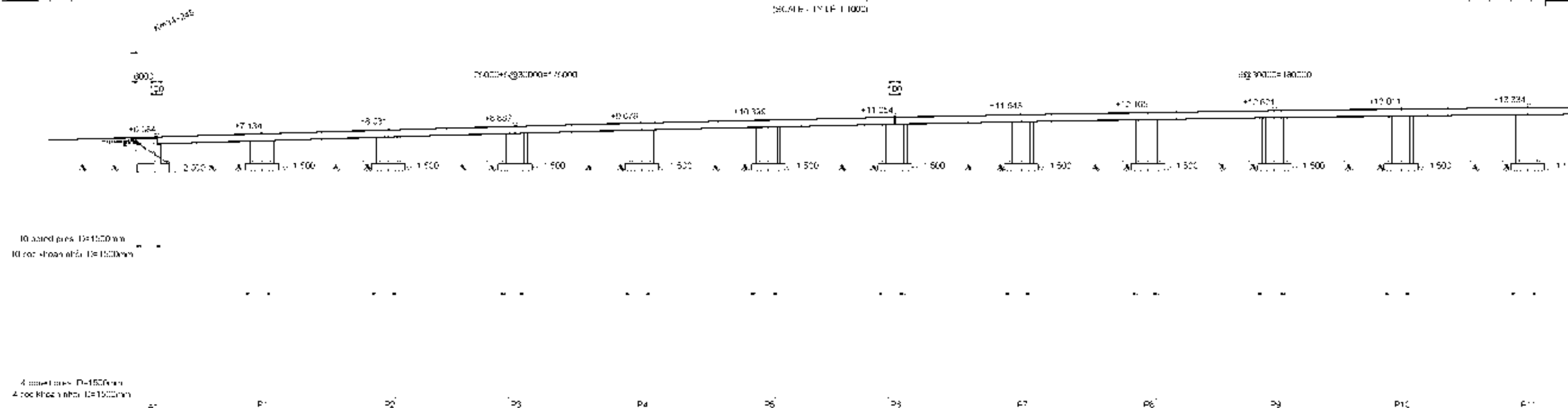
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7.ONG KEO BRIDGE
7.CẦU ÔNG KÈO
KM 34+245
(OPTION1)

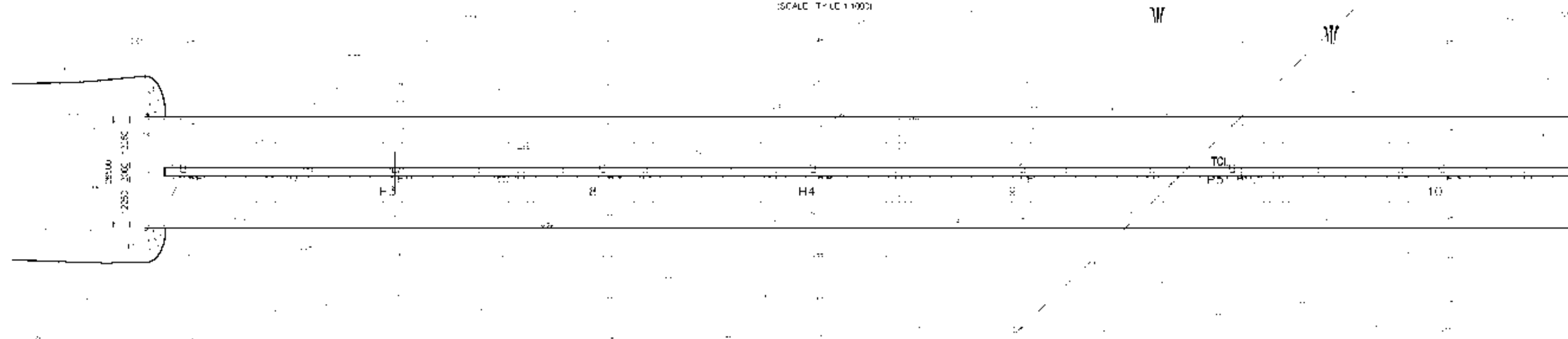
BEN LUC

PROFILE OF BRIDGE - MẶT CHÍNH CẦU
(SCALE: 1/1000)

LONG THANH



SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ		SỐ QUẾ THIẾT KẾ	
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KHOẢNG CÁCH QUẾ	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
KHOẢNG CÁCH TỔNG CỘNG	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00	3425.00
TÊN QUẾ	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
ĐƠN THẠNH ĐƠN CÔNG																	

PLAN VIEW - MẶT BẰNG CẦU
(SCALE: 1/1000)

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TITLE

NAME

SIGNATURE

PREPARED BY

Đang Vũ TUYẾN

CHECKED BY

Lê Ngọc HIEU

APPROVED BY

Tâm COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF ONG KEE BRIDGE
HỒ THỊ THUYẾT - A.01.01.01.01

REV. No.

DATE

DESCRIPTION

DRAWING No.

0 NOV-2009

DRAWING NO.

A.01.01.01.01

1 FEB-2010

FINAL DRAWING

A.01.01.01.01

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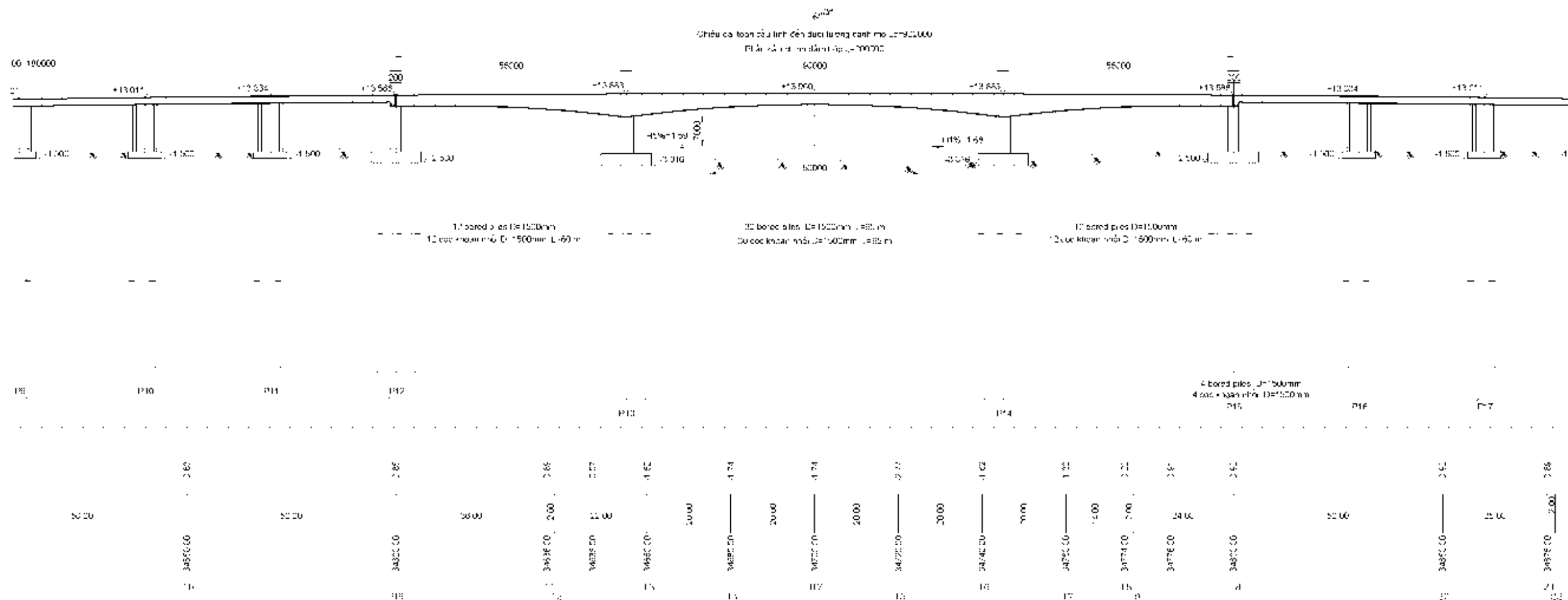
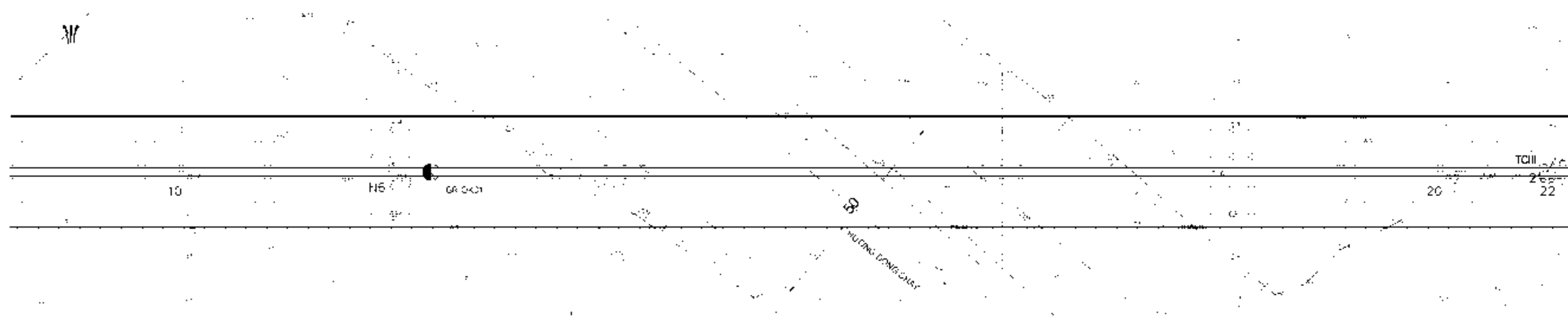
AS SHOWN

BEN LUC

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

(SCALE: 1/1000)

LONG THANH

PLAN VIEW - MẶT BÊN CẦU
(SCALE: 1/1000)

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Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE

NAME

SIGNATURE

PREPARED BY Đặng Vũ TUYỀN

CHECKED BY Lê Ngọc HIEU

APPROVED BY Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF ONG KEE BRIDGE
HỒ THỊ THUYẾT - A.01.01.01.01

REV. No.	DATE	DESCRIPTION	DRAWING No.
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1	FEB-2010	FINAL DRAWING	01/02

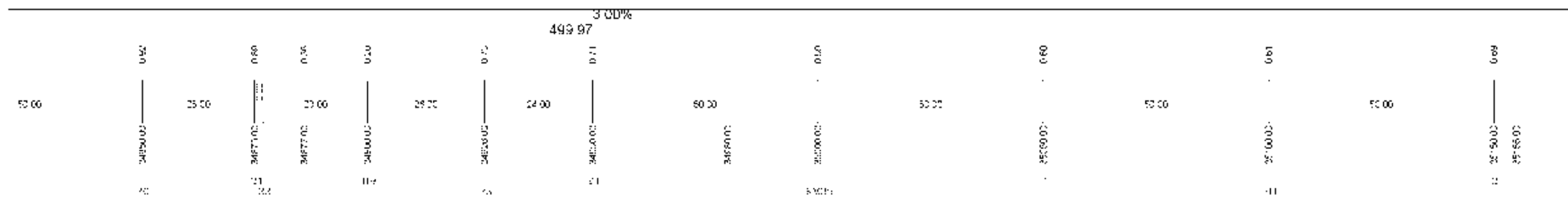
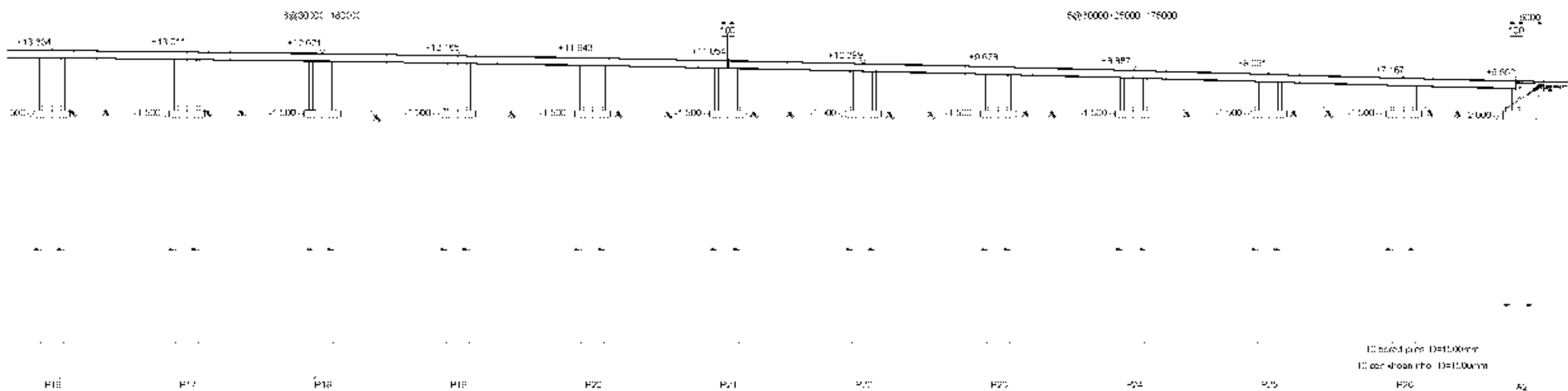
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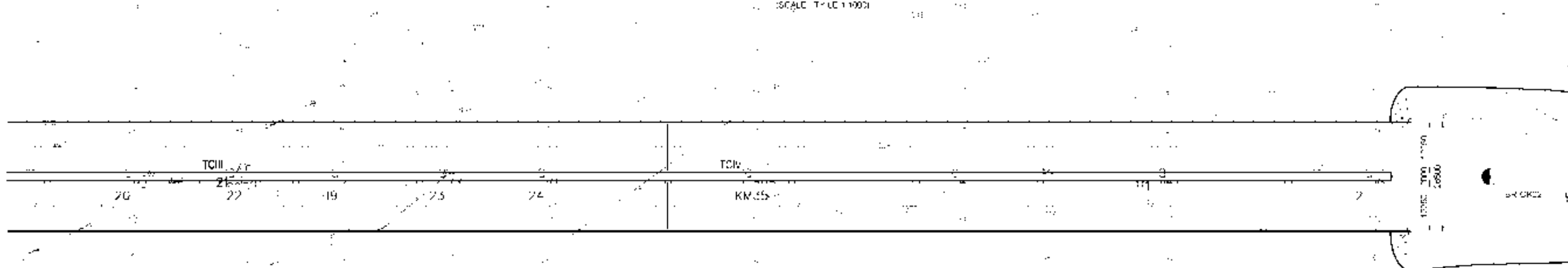
BEN LUC

PROFILE OF BRIDGE - MẶT CHÍNH CẦU (SCALE: 1/1000)

LONG THANH



PLAN VIEW - MẶT BẰNG CẦU (SCALE: 1/1000)



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TITLE NAME SIGNATURE
PREPARED BY **Đang Vũ TUYEN**
CHECKED BY **Le Ngoc HIEU**
APPROVED BY **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

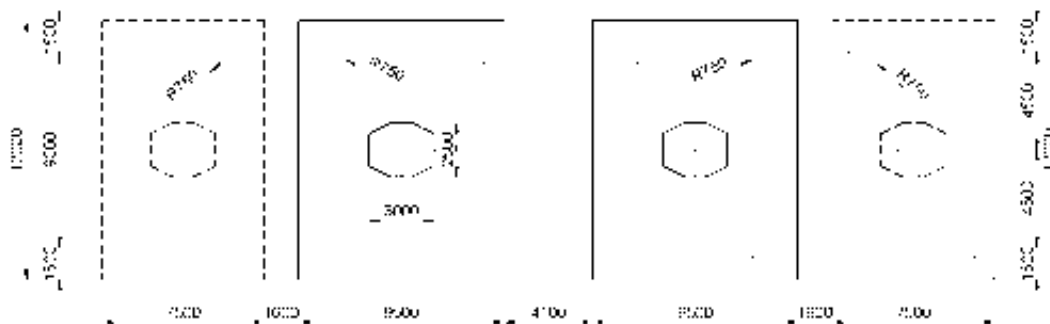
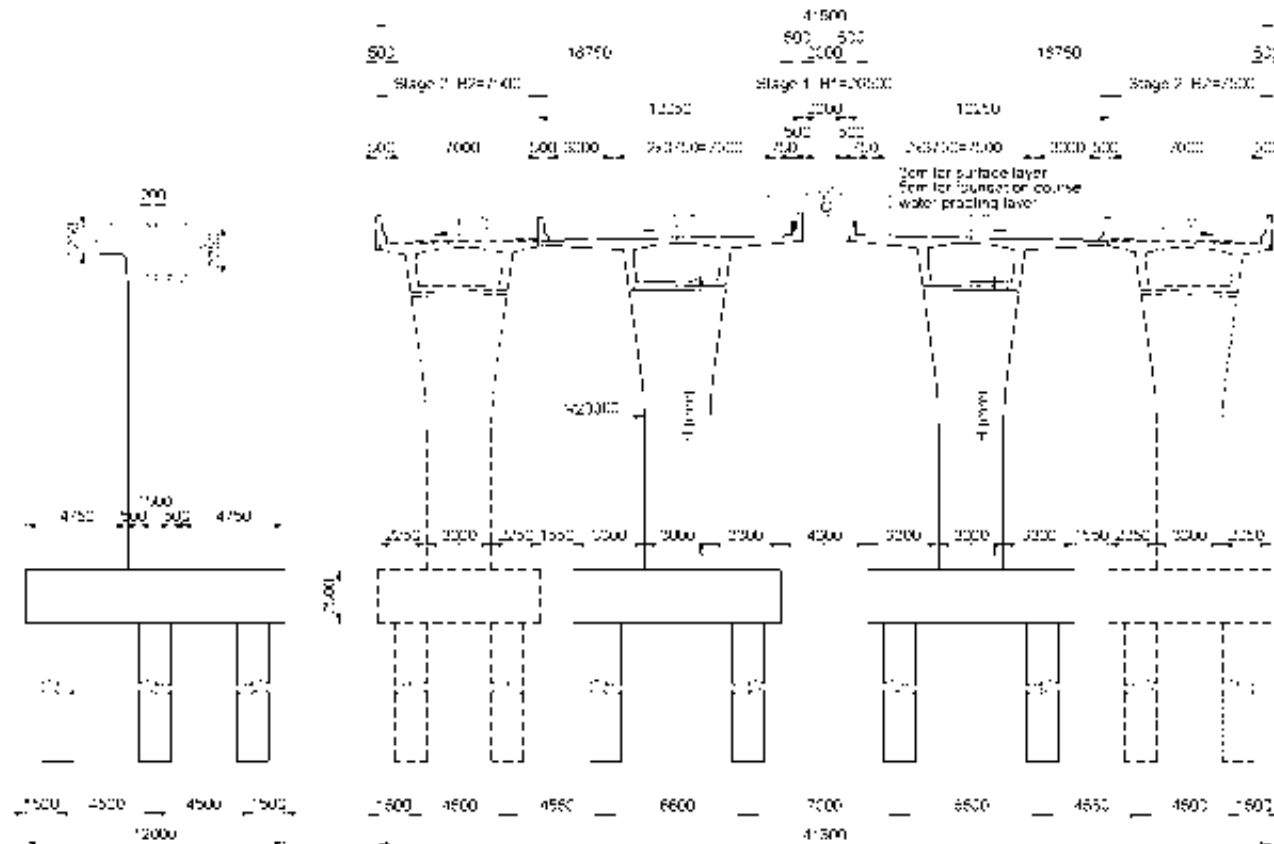
DRAWING TITLE
GENERAL VIEW OF ONG KEE BRIDGE
HỒ BỒ KHUẾ - Cầu Ông KEE

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1	FEB-2010	FINAL DRAWING	001/03

SCALE: 1/1000

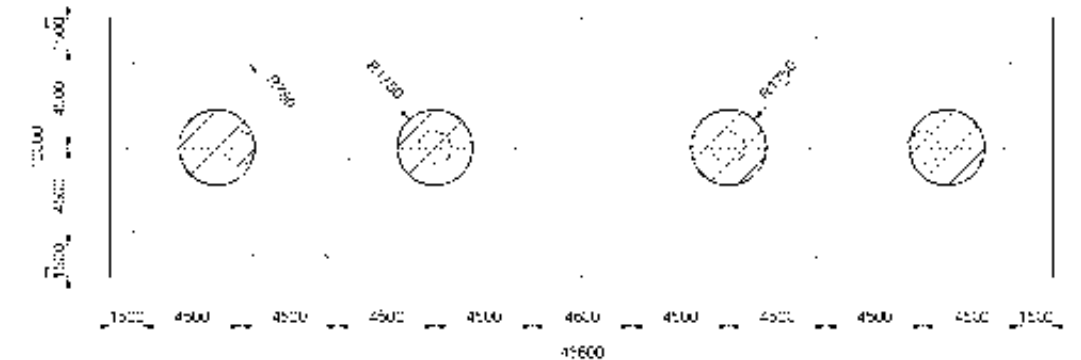
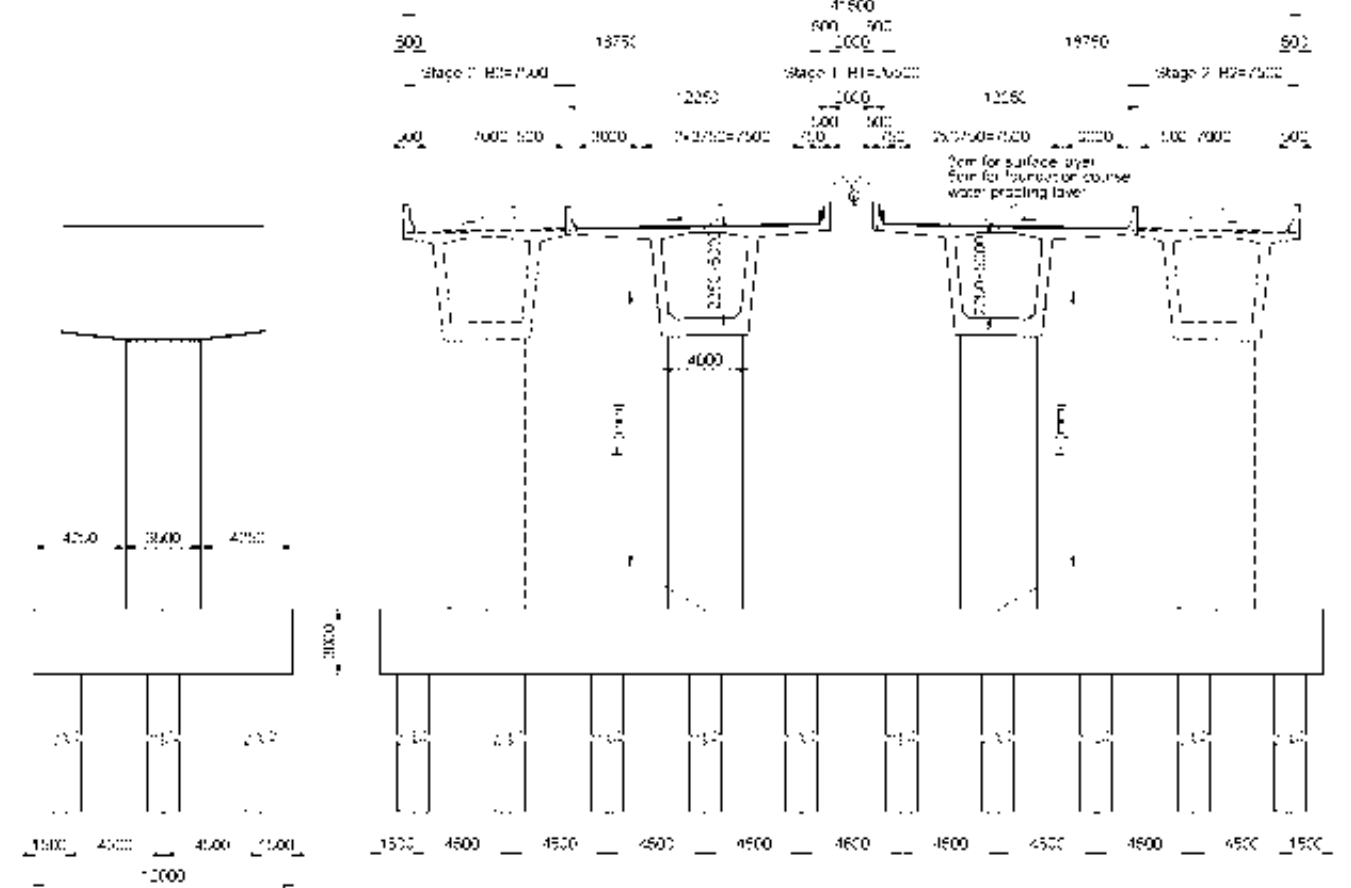
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(SCALE: 1/100)



CROSS SECTION AT MAIN PILR - MẶT CẮT TẠI TRỤ CHÍNH

(SCALE: 1/100)



VEI PROJECT PERFORMANCE CONSULTING LIMITED (2007) PERFORMANCE CONSULTING LIMITED (2007) CONSULTING LIMITED (2007) CONSULTING LIMITED (2007) CONSULTING LIMITED (2007)

CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
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TITLE NAME SIGNATURE
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CHECKED BY **La Ngoc HIEU**
APPROVED BY **Tin COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

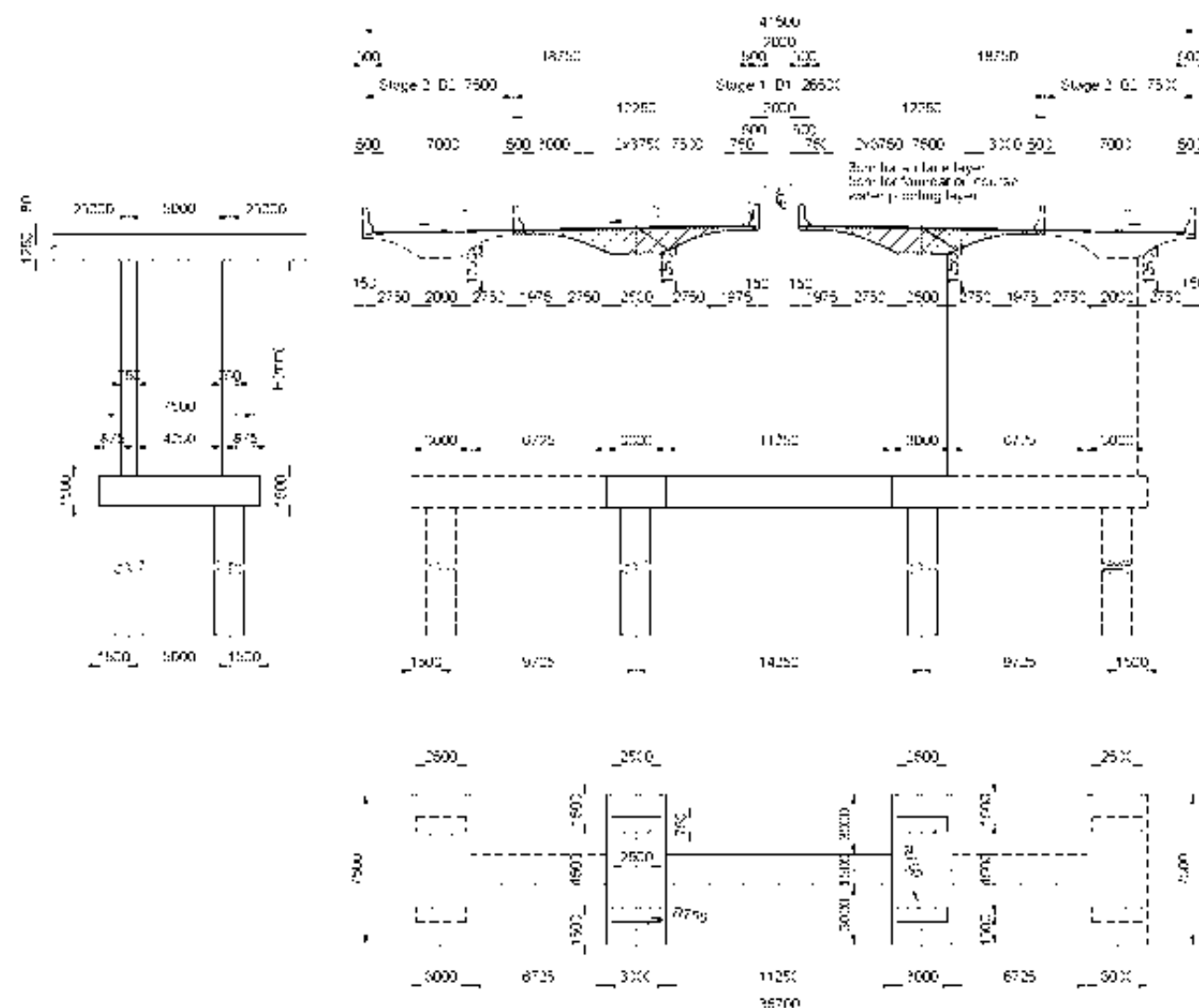
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF ONG KEE BRIDGE
BỘ TRƯỞNG: **ALONG KEE**

REV. NO.	DATE	DESCRIPTION	DRAWING NO.
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1	FEB-2010	DRAWING NO.	PR-1/04
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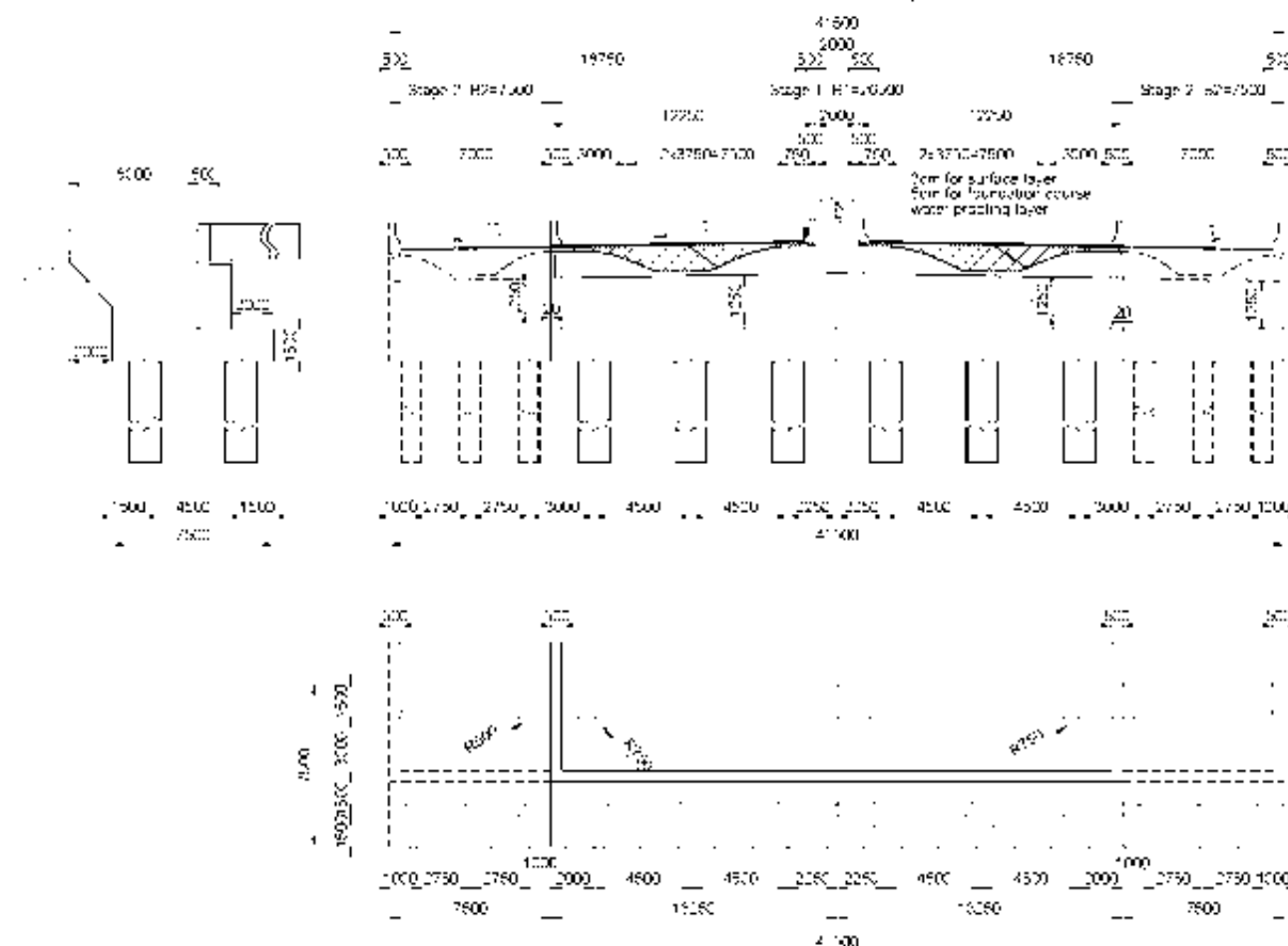
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(SCALE: 1/400)



CROSS SECTION AT ABUTMENT - MẶT CÁT TẠI MŌ

(SCALE: 1/400)



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TITLE NAME SIGNATURE
PREPARED BY **Dang Vu TUYEN**
CHECKED BY **La Ngoc HIEU**
APPROVED BY **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF ONG KEE BRIDGE
BỘ TRƯỞNG: **ALONG KEE**

REV. No	DATE	DESCRIPTION	DRAWING No
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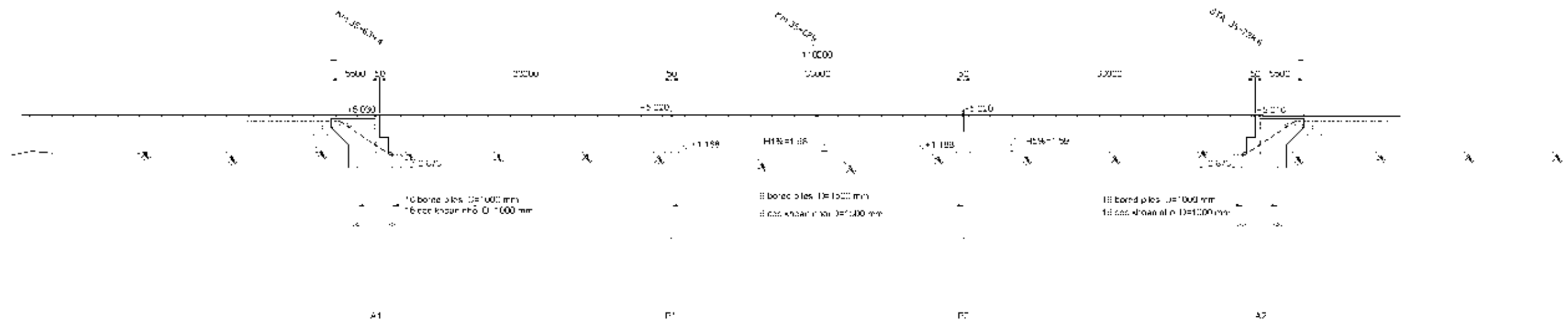
8.BAU SEN BRIDGE
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KM 35+689

PROFILE OF BRIDGE - MẶT CHỈNH CẦU

(SCALE: 1/100)

BEN LUC

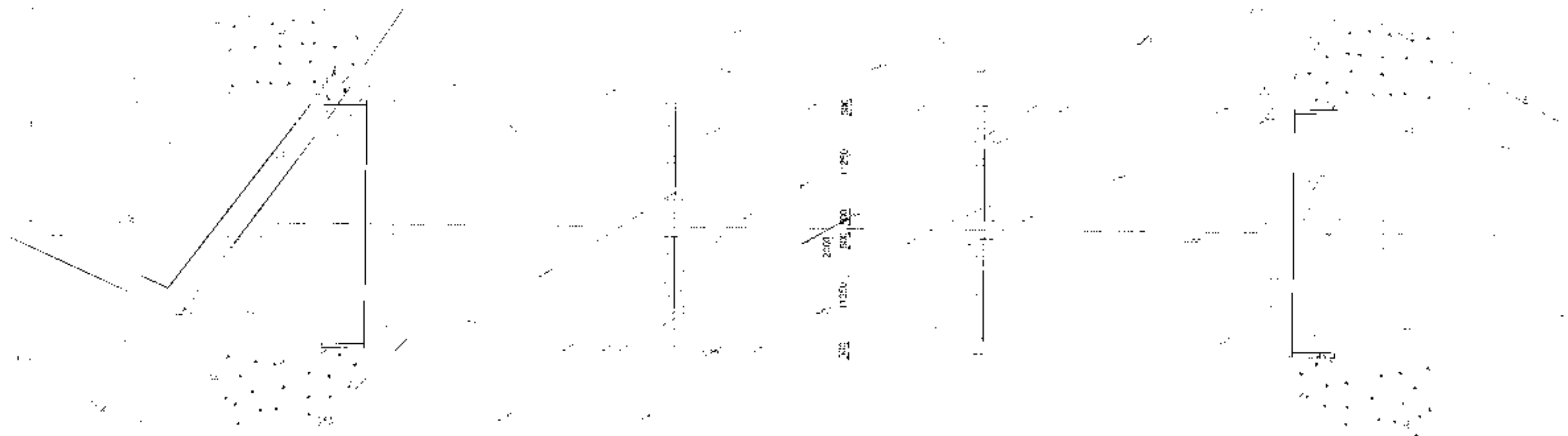
LONG THANH



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ĐƯỜNG TỰA LƯỚI	3.00	0.24	0.56	0.87	0.59	0.39	0.12	0.57	0.66
KHOẢNG CÁCH LƯỚI	3.00	0.24	0.56	0.87	0.59	0.39	0.12	0.57	0.66
KHOẢNG CÁCH LƯỚI	3.00	0.24	0.56	0.87	0.59	0.39	0.12	0.57	0.66
TÊN CỤC	3.00	0.24	0.56	0.87	0.59	0.39	0.12	0.57	0.66
ĐƠN VỊ	3.00	0.24	0.56	0.87	0.59	0.39	0.12	0.57	0.66

PLAN VIEW - MẶT BẰNG CẦU

(SCALE: 1/100)



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In Association With

APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Đang Vũ TUYÊN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tin COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF SAU SON BRIDGE
SƠ BỘ MẶT BẰNG CẦU SAU SON

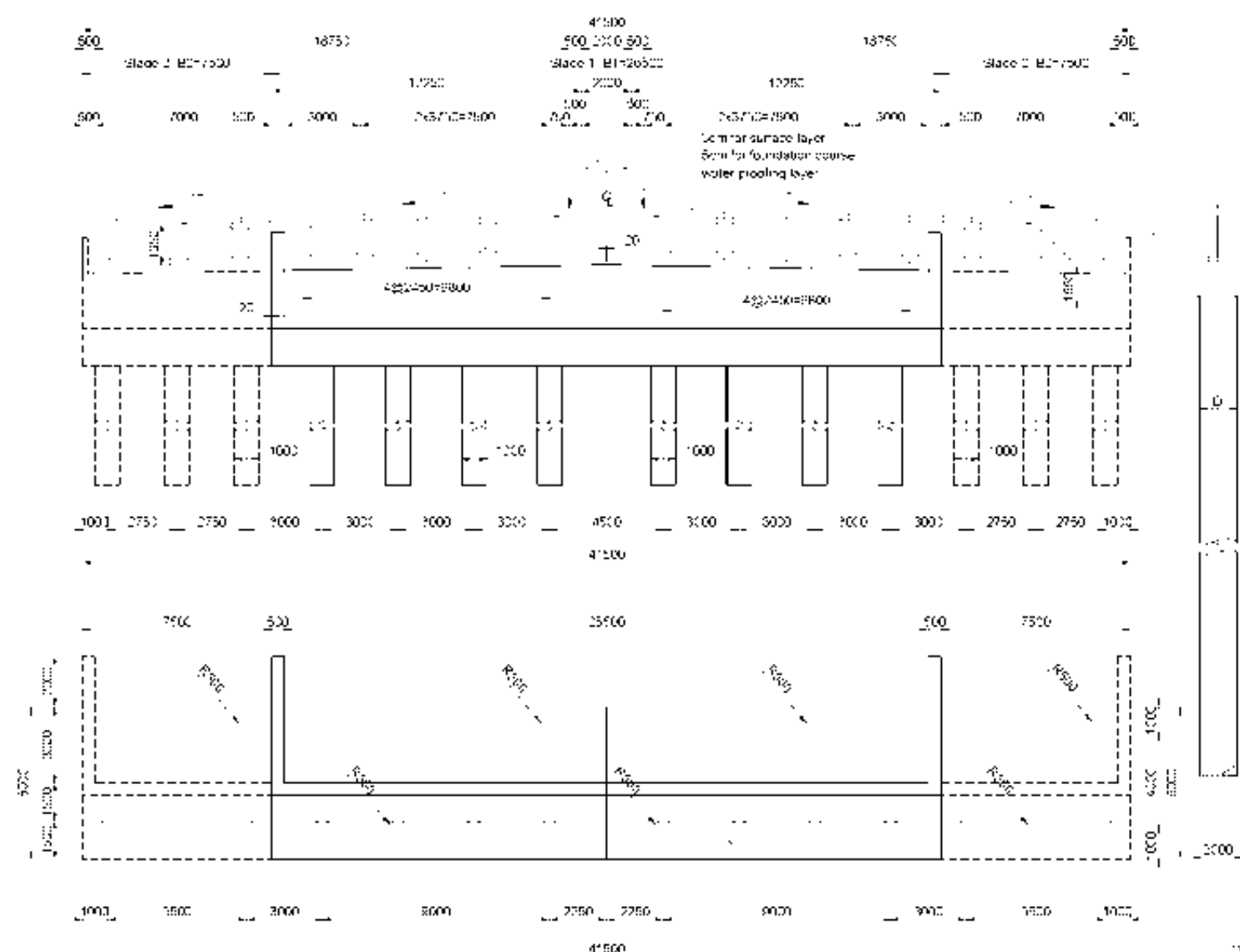
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1	FEB-2010	FINAL DRAWING	
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BEN LUC

LONG THANH

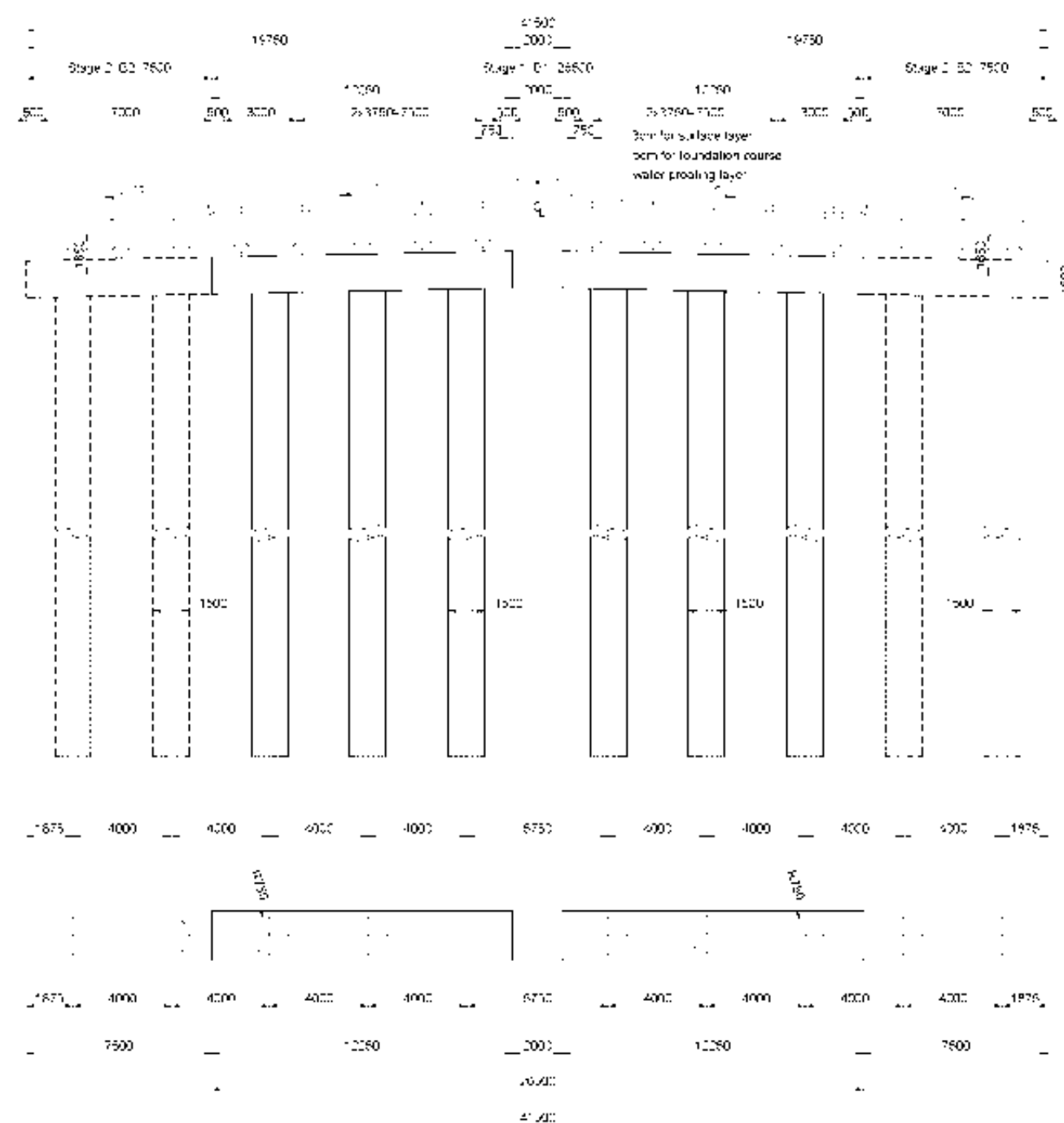
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1993-1994



CROSS SECTION AT PIER MAT CÁT TẠI TRỤ

SCALE: 100% = 200

[illegible]

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In Association With

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TITLE

NAME _____

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPROACHED BY Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TITLE

66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1041 1042 1043 1044 1045 1046 1047 1048 1049 1050 1051 1052 1053 1054 1055 1056 1057 1058 1059 1060 1061 1062 1063 1064 1065 1066 1067 1068 1069 1070 1071 1072 1073 1074 1075 1076 1077 10

UNIVERSITY OF CALIFORNIA, BERKELEY

FILE No.	DATE
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NOV-2006

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

F N&L DRAWING

PLANTING No. _____

538.012

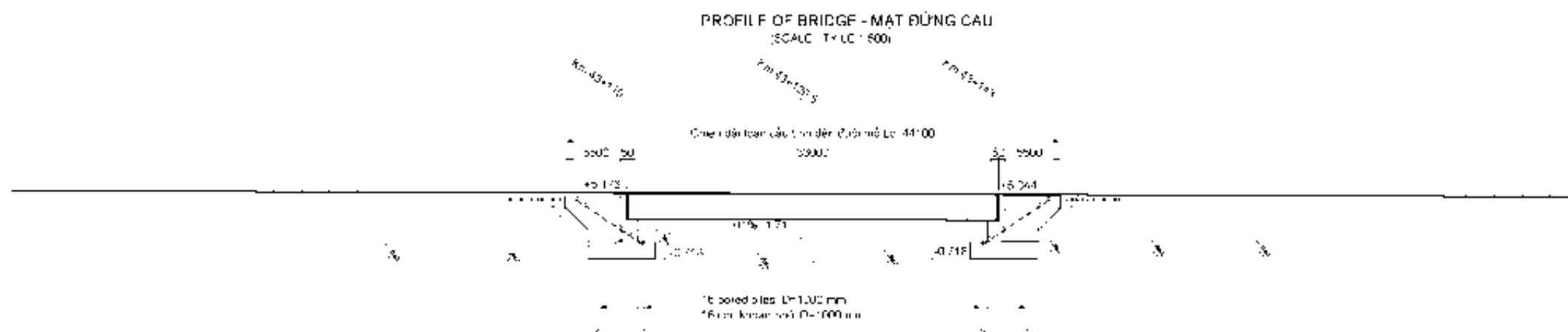
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ANALYST

9.VUNG GAM BRIDGE
9.CẦU VŨNG GẮM
KM 43+126.5

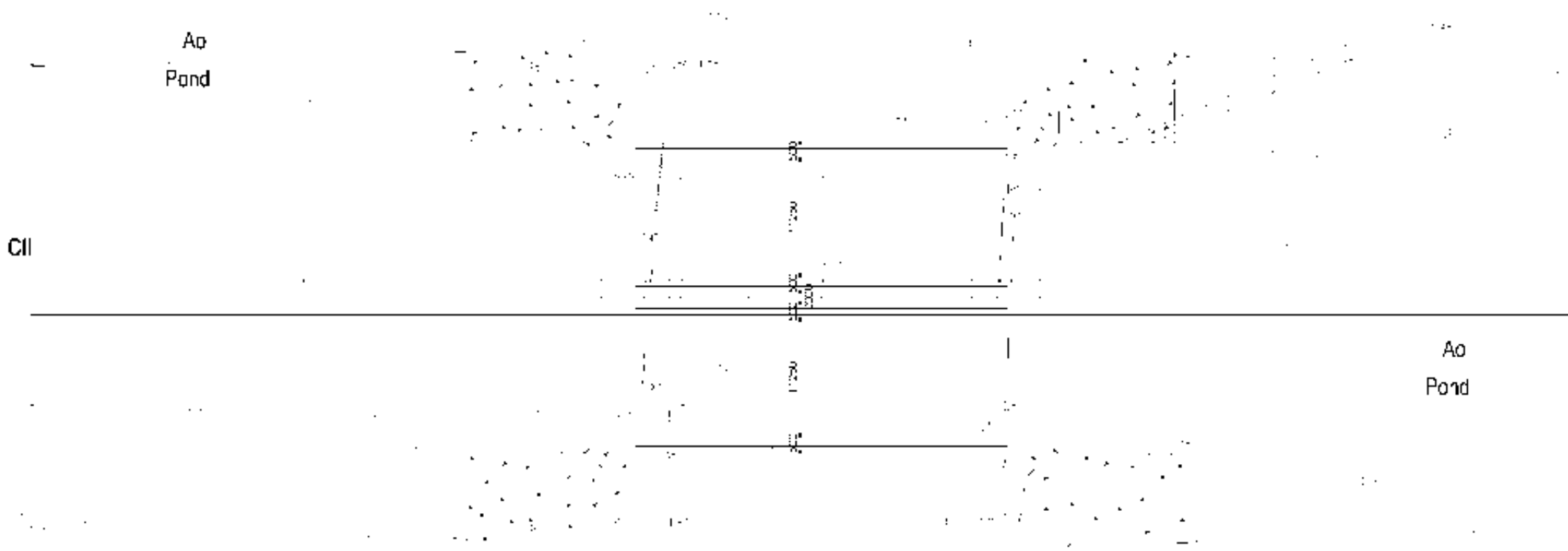
BEN LUC

LONG THANH



Tên địa điểm	0.40%									
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Khoảng cách	3.00	1.00	2.00	2.70	10.00	10.00	10.00	10.00	4.00	2.00
Khoảng cách công đoạn	4510.00	4510.00	4510.00	4510.00	4510.00	4510.00	4510.00	4510.00	4510.00	4510.00
Tên công	T	B	B	B	B	B	B	B	B	B
Loại công	đường	đường	đường	đường	đường	đường	đường	đường	đường	đường

PLAN VIEW - MẶT BANG CẦU
(SCALE: 1:1000)



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APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Đang Vũ TUYEN	
CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Tên COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

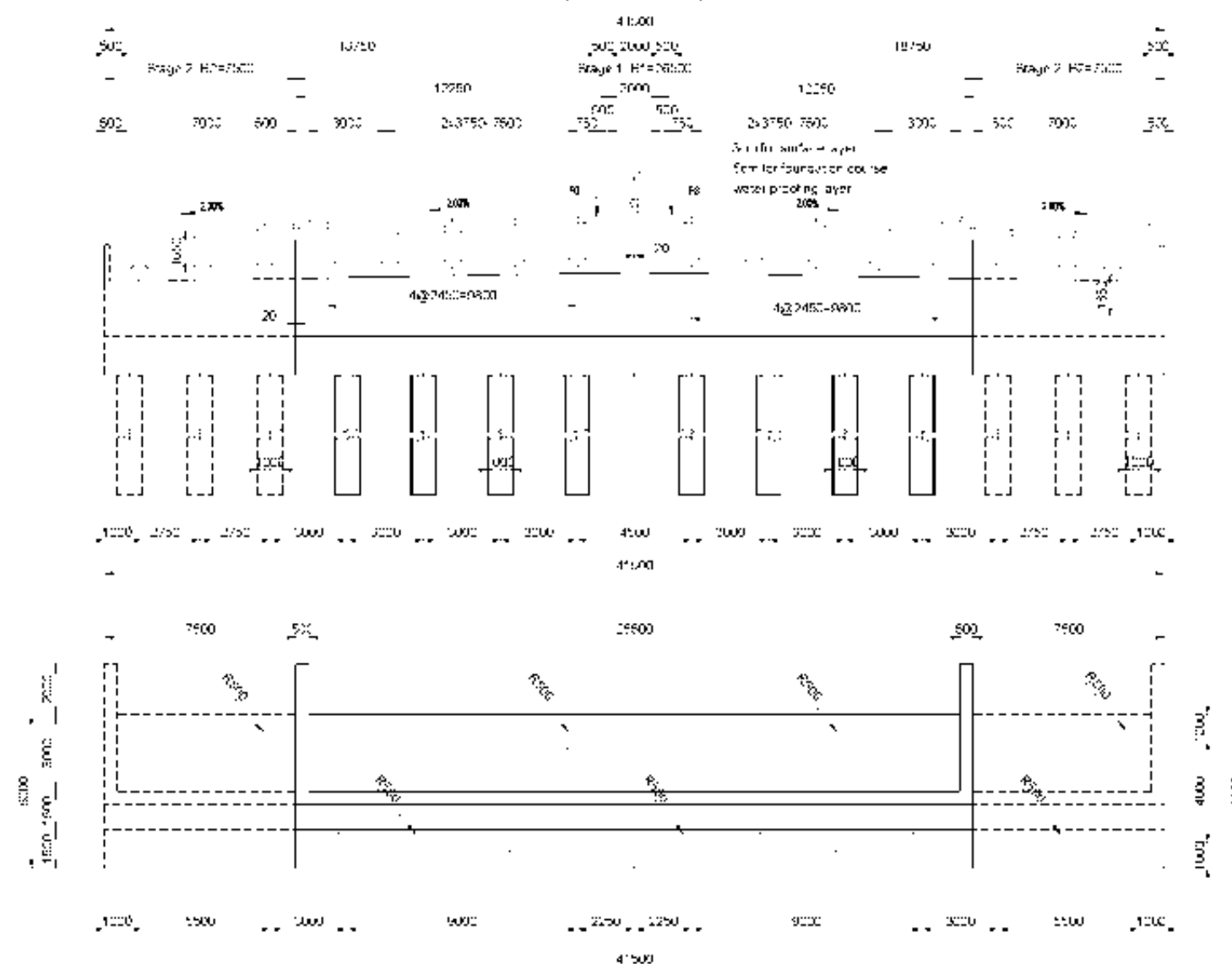
DRAWING TITLE
GENERAL VIEW OF VUNG GAI BRIDGE
HỒ SƠ CHUNG CẦU VUNG GAI

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAFT FINAL DRAWING	4501/01
1	FEB-2010	FINAL DRAWING	

SCALE: 1:5000

CROSS SECTION AT ABUTMENT MAT CAT TA MO

OSALL 15 JUL 1962



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NAME

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PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Mox HIEU

APPROCHES BY **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TITLE

ĐỀ THI VÀO LỚP 10 MÔN TOÁN

FILE No.	DATE
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NOV-2006

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

PLANTING No.

539.012

SCALE :

END OF STORY

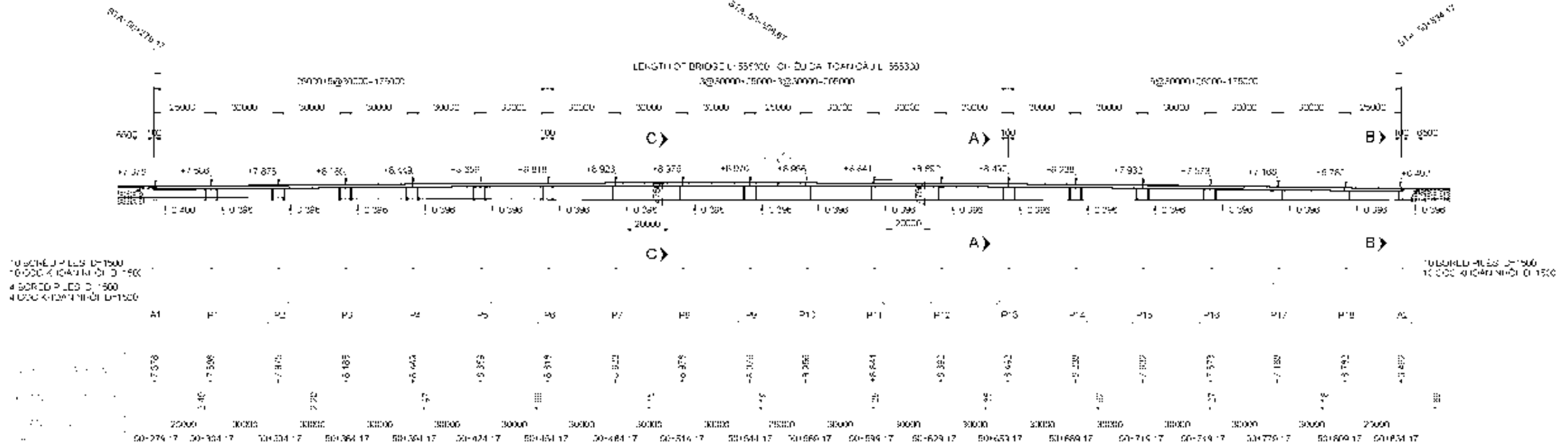
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KM 50+556.67

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/1000

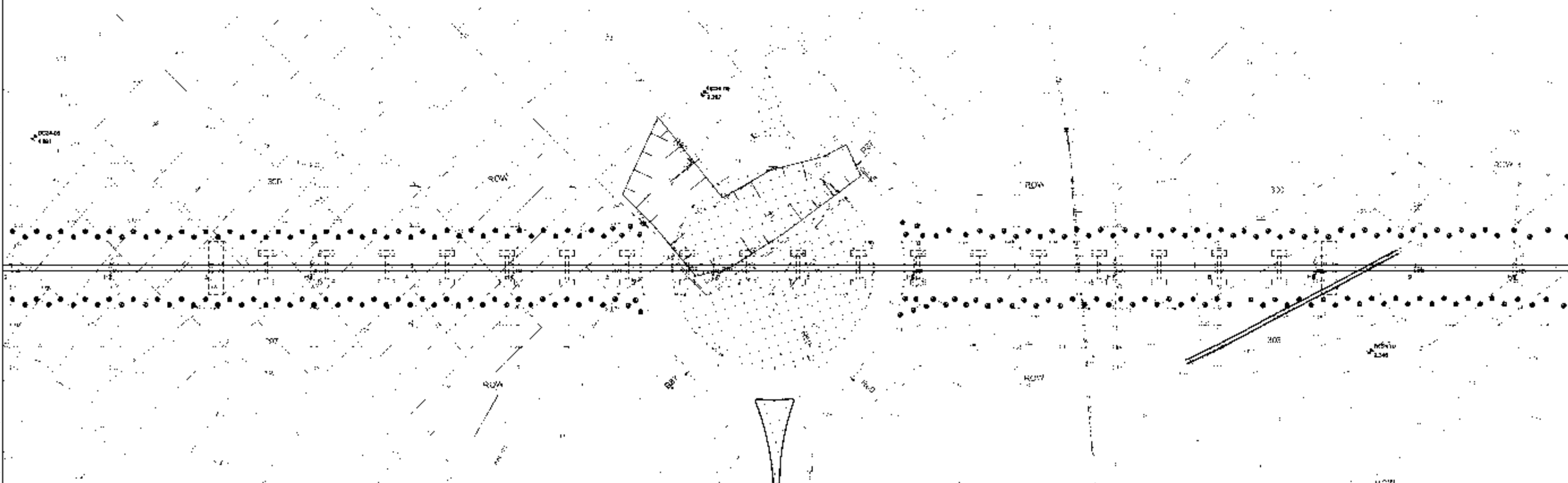
BEN LUC

LONG THANH



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



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KATAHIRA & ENGINEERS INTERNATIONAL
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TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tim COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE: GENERAL VIEW OF PROJECT INTER-CHANGE
 ĐI TRUNG NÚT GIAO ĐIỀU KIỆN

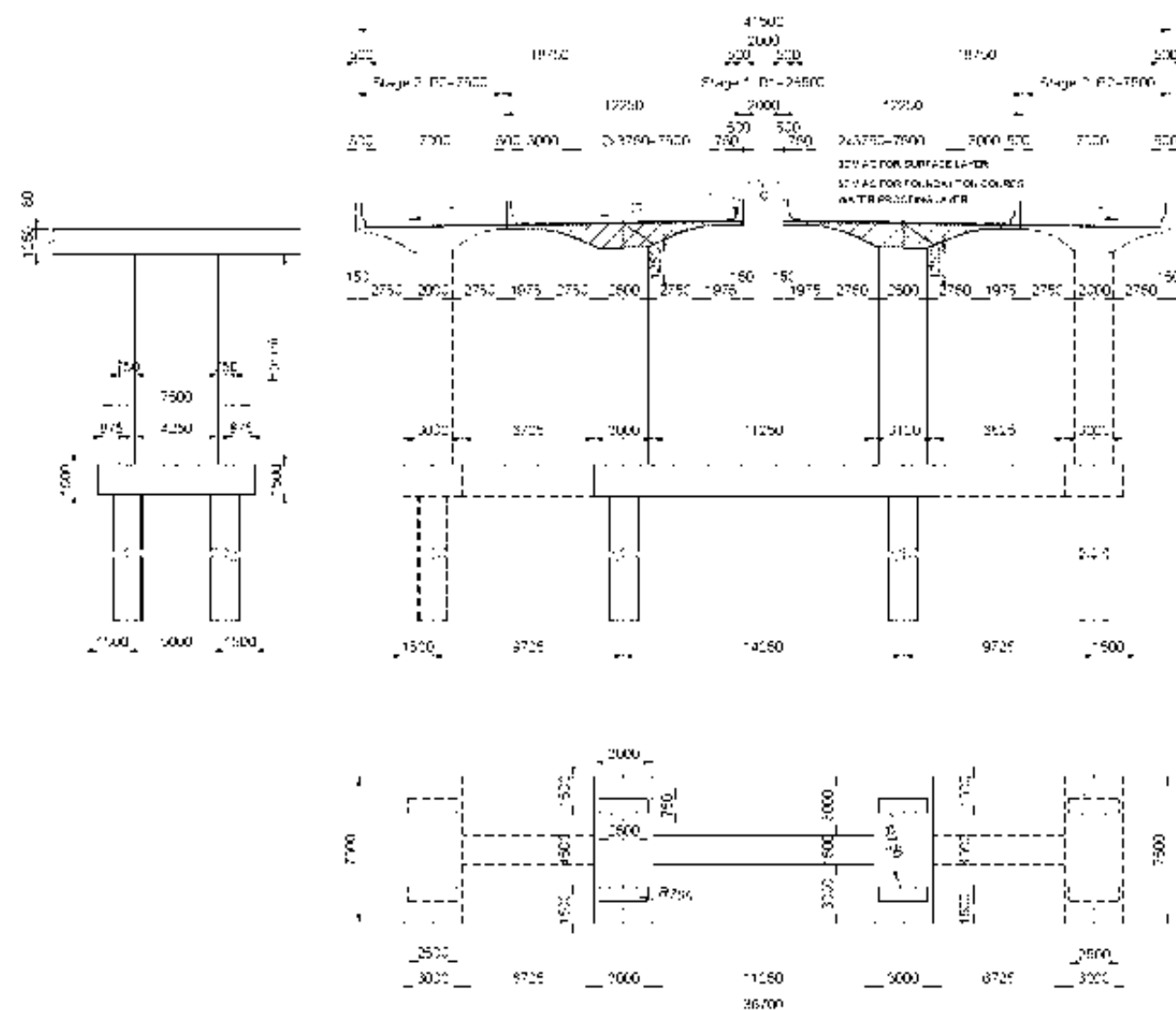
REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING NO	BR10-C1
1	FEB-2010	FINAL DRAWING	

SCALE: AS SHOWN

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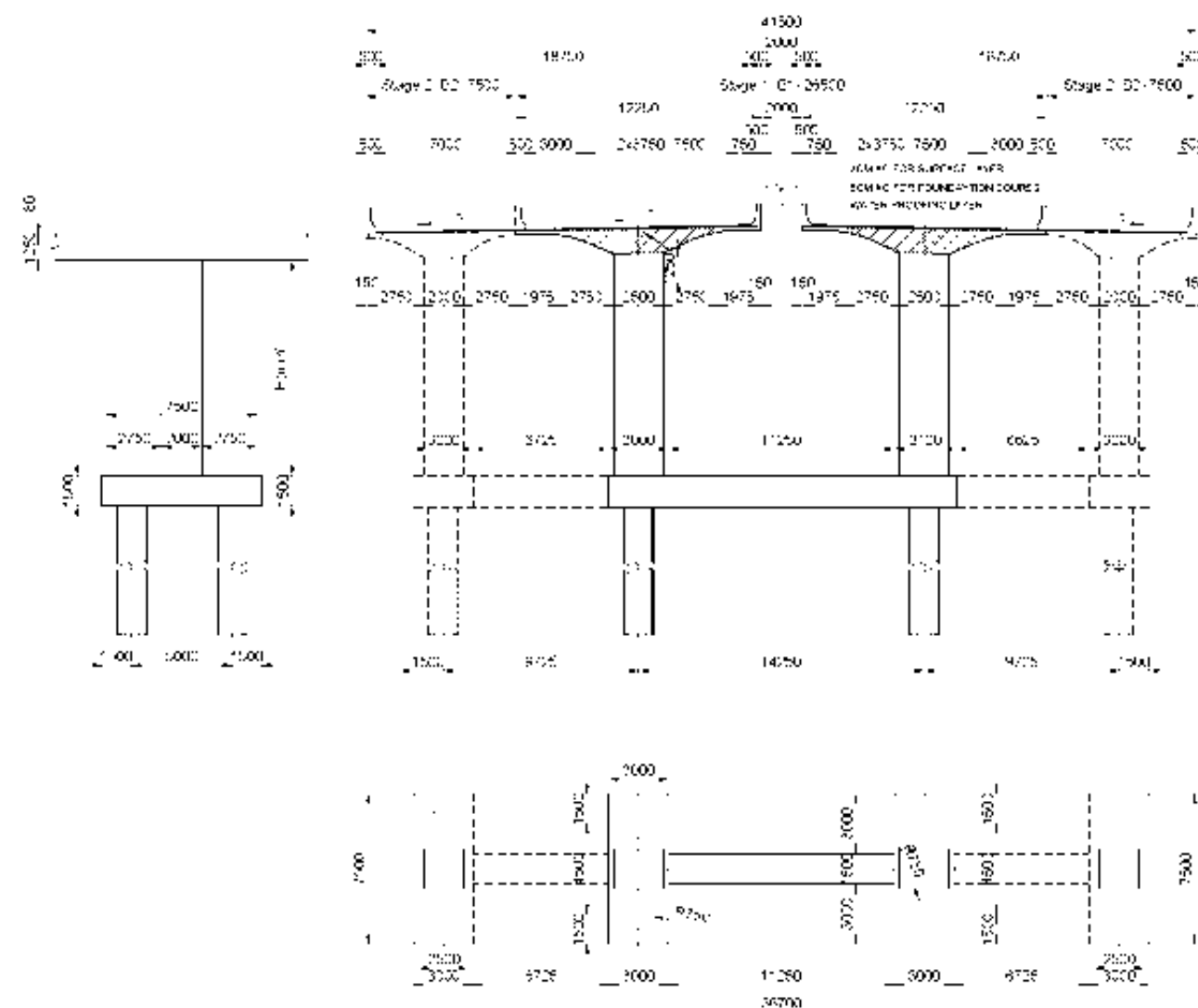
SECTION A-A - MẶT CÁT A-A

SCALE 1:250



SECTION C-C - MẶT CÁT C-C

SCALE 1:250



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TITLE

NAME

SIGNATURE

PREPARED BY **Đang Vũ TUYỀN**

CHECKED BY **Lê Ngọc HIEU**

APPROVED BY **Tên COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

**TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT**

DRAWING TITLE

**TYPICAL CROSS SECTION OF BRIDGE
MẶT CÁT NGANG ĐIỂN HÌNH CẦU**

REV No DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING DRAWING

DRAWING

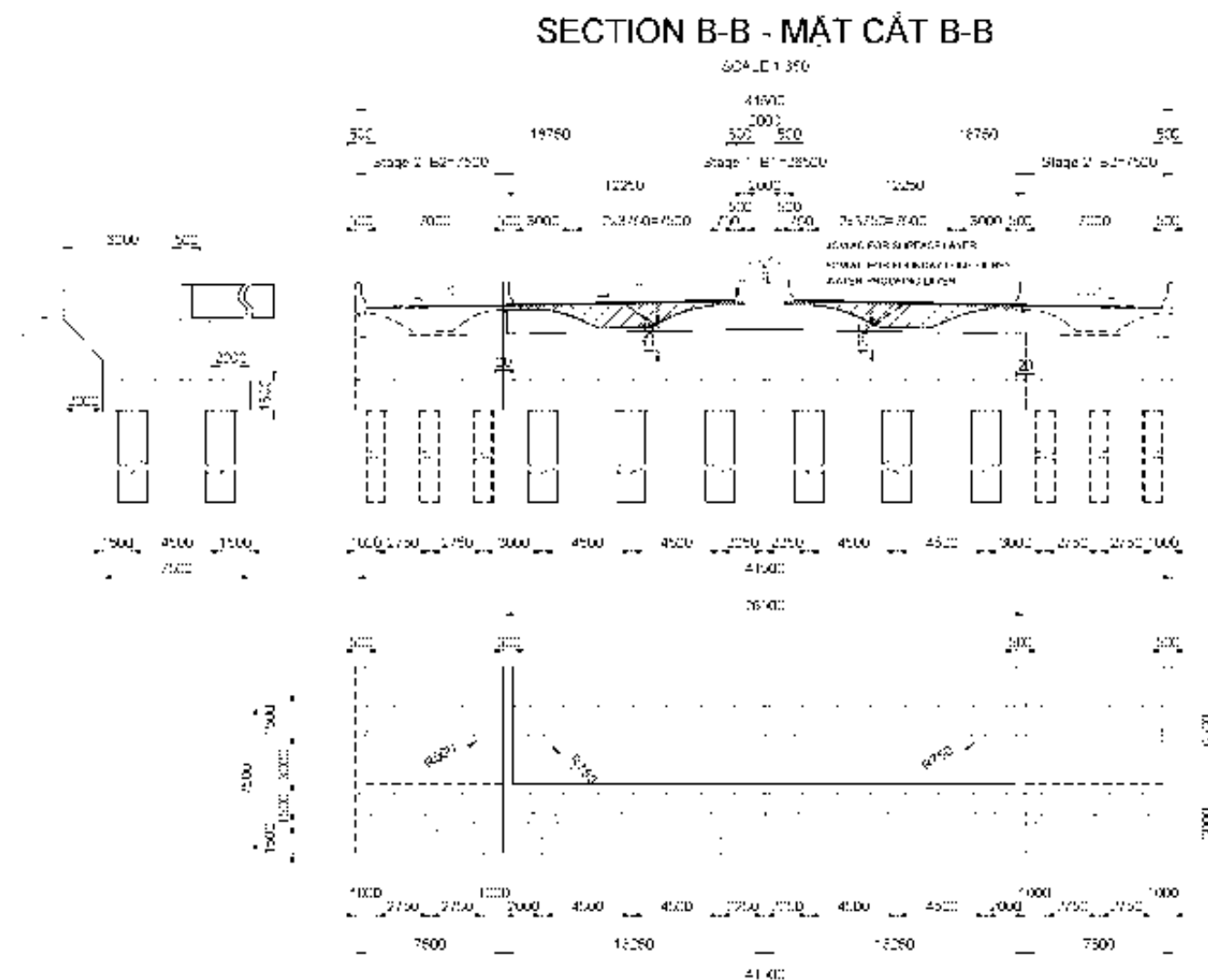
DRAWING No

BR10-C2

SCALE:

AS SHOWN

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KATAHIRA & ENGINEERS INTERNATIONAL Joint Venture With ORIENTAL CONSULTANTS CO., LTD In Association With APECO	TITLE	NAME	SIGNATURE
	PREPARED BY	Dang Vu TUYEN	
	CHECKED BY	Le Ngoc HIEU	
	APPROVED BY	Tim COLLETT	

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE: TYPICAL CROSS SECTION OF BRIDGE
MẶT CẮT NGANG ĐIỂN HÌNH CẦU

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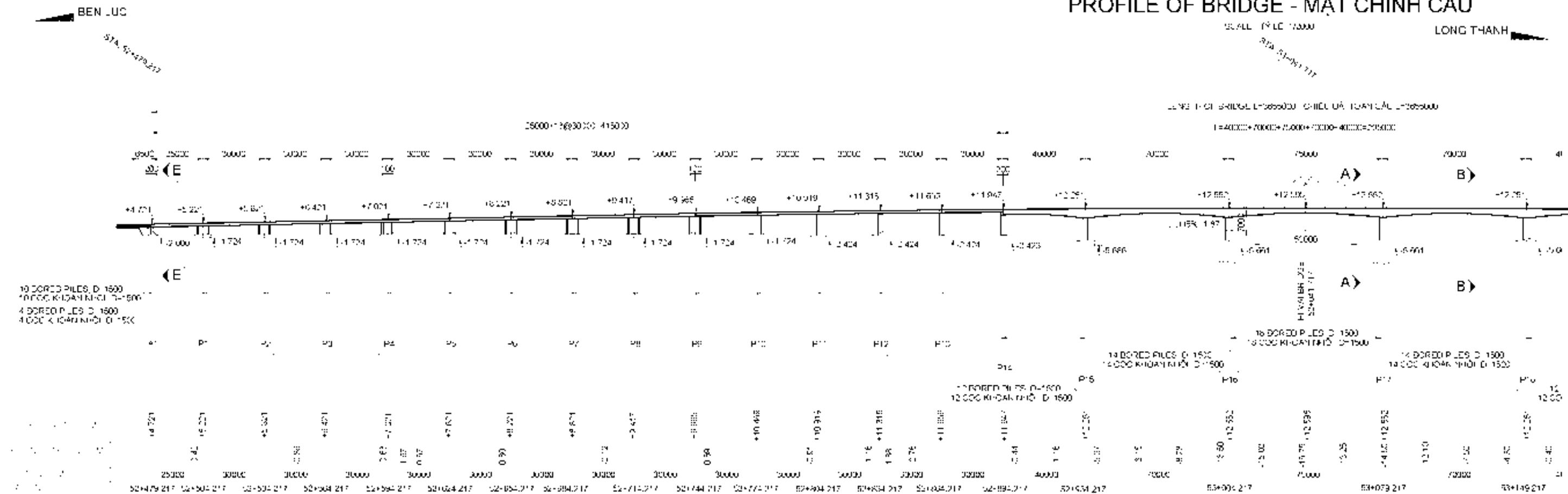
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11.THỊ VAI BRIDGE
11.CẦU THỊ VÀI
KM 53+041.717
(OPTION1)

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

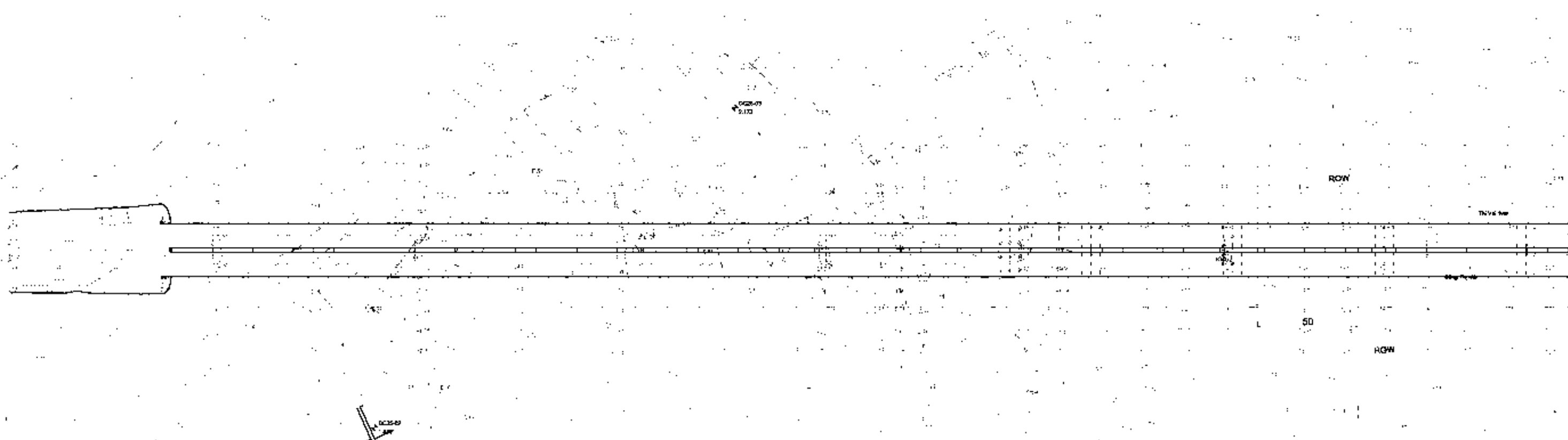
2000

LONG THANH



PLAN VIEW - MẶT BẰNG CẦU

55.61 F - TV 1 F 25000



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TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Migos HEBU

APPROVED BY **Tom COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-ME: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE GENERAL VIEW OF THAI BRIDGE
30 INCH LONG CAUTION

FILE No.	DATE
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DESCRIPTION

PLANNING No.

DRAFT NAL DRAWING

FINAL DRAWING

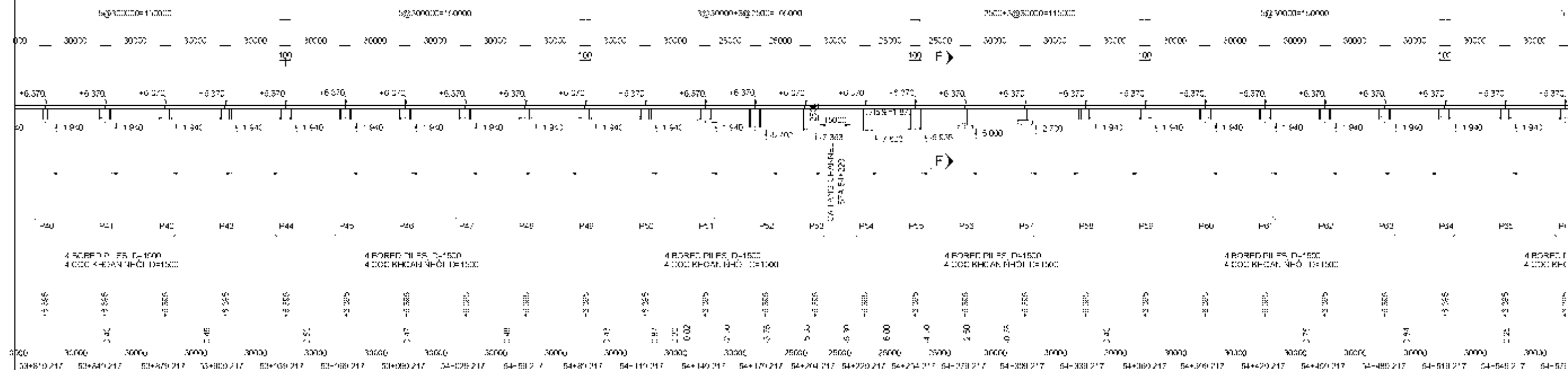
ALTERNATIVE

SCALE :

48 SHEN, CHEN

BEN LUC

LONG THANH



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TITLE

NAME

SIGNATURE

PREPARED BY: Dang Vu TUYEN

CHECKED BY: La Ngoc HIEU

APPROVED BY: Tim COLLETT

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VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VI: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECTDRAWING TITLE: GENERAL VIEW OF THUA LAI BRIDGE
BỘ THÔNG TIN CẦU THUA LAI

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

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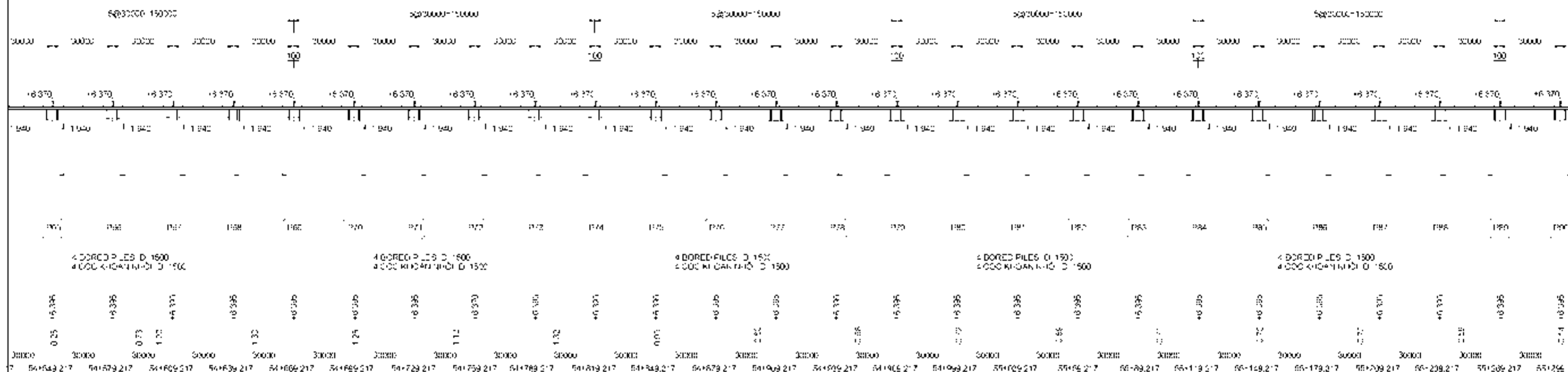
BHT 11X

ALTERNATIVE

SCALE:

AS SHOWN

H



4022 10

APECO

APPENDIX A

APPROVED BY Tim COLLETT

24

VIETNAM EXPRESSWAY CORPORATION (VEC)

DRAWING TITLE GENERAL VIEW OF T-104 BRIDGE
SỐ THIẾT KẾ CẦU - 04

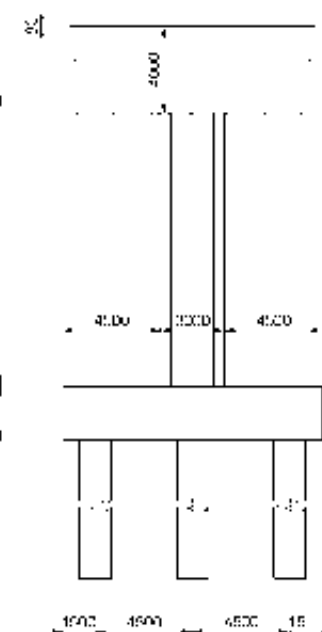
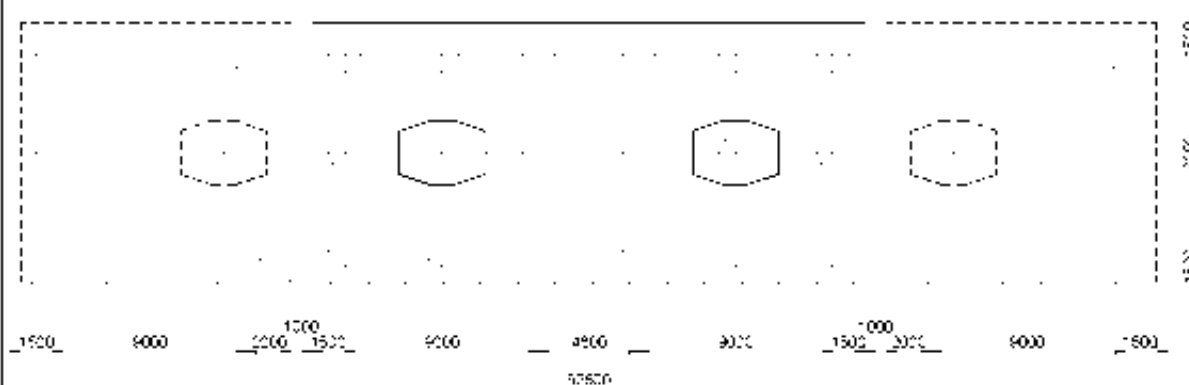
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FINAL DRAWING

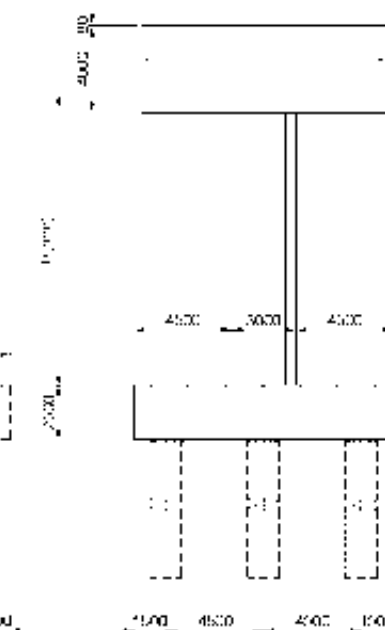
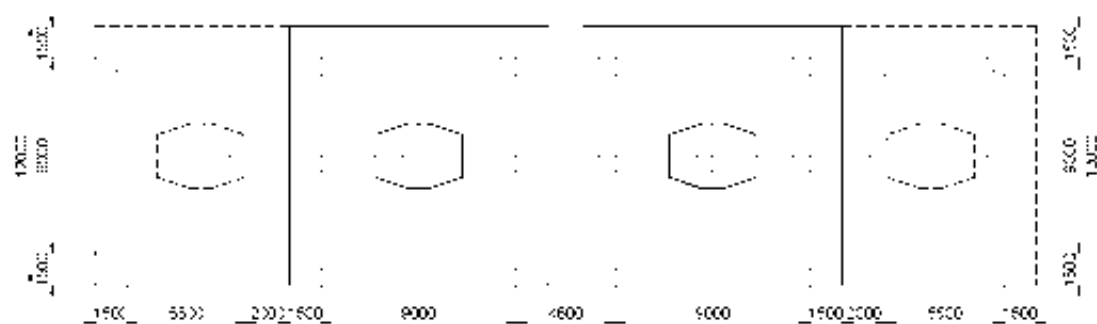
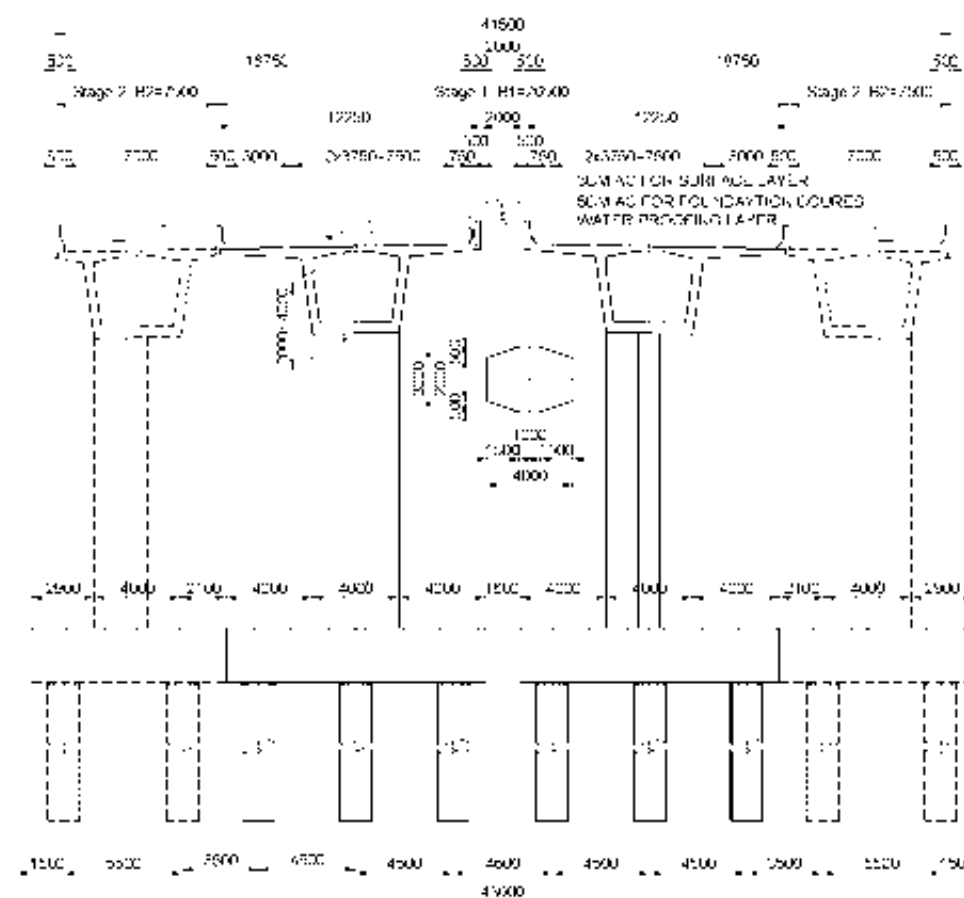
44 SHEN

PAUL J. SCHUBERT, Editor, *Journal of the Philosophy of Education Society of Great Britain*, 48, Abingdon Road, Bristol, B15 2TH, UK.

SCA_21355



④A=1.35%



44 SHEN

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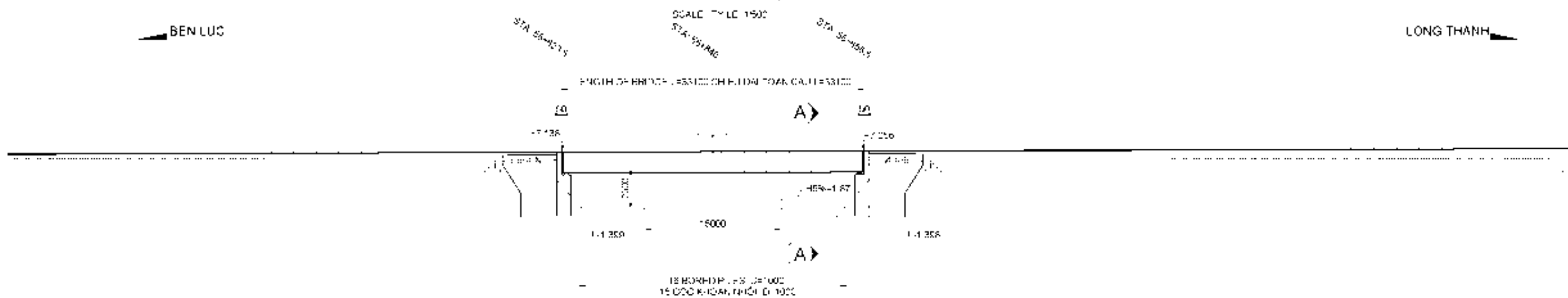
VIETNAM EXPRESSWAY CORPORATION (VEC)

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1	FEB-2010	FINAL DRAWING	ALTERNATIVE

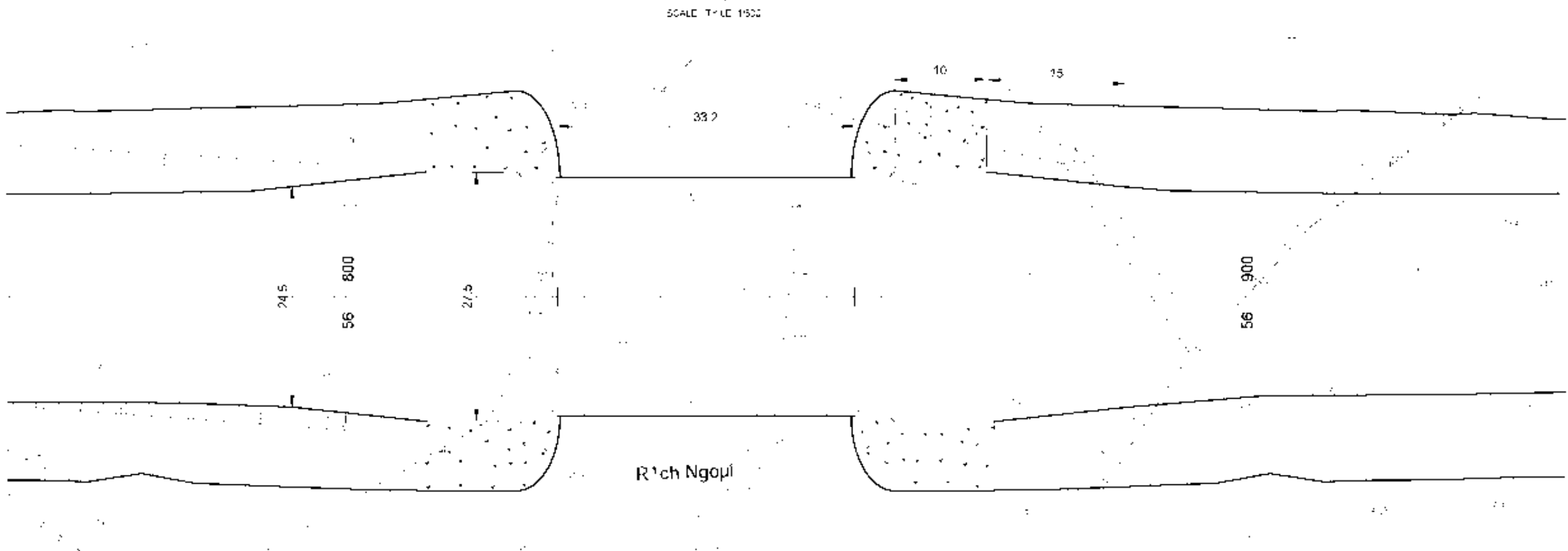
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AS SHOWN

12. NGOAI BRIDGE
12.CẦU NGOÀI
KM 56+840

PROFILE OF BRIDGE - MẶT CHÍNH CẦU



PLAN VIEW - MẶT BẰNG CẦU



VIỆN KỸ THUẬT KATAHIRA & ENGINEERS INTERNATIONAL (K&E) và CÔNG TY CỔ PHẦN KATAHIRA & ENGINEERS INTERNATIONAL (K&E) đã được cấp giấy chứng nhận đủ năng lực chuyên môn để thực hiện các công việc tư vấn kỹ thuật và thiết kế cho các dự án giao thông vận tải.

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APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tien COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE: GENERAL VIEW OF BRIDGE DECK
BỐ TRÍ CHUNG CẦU NGỒI

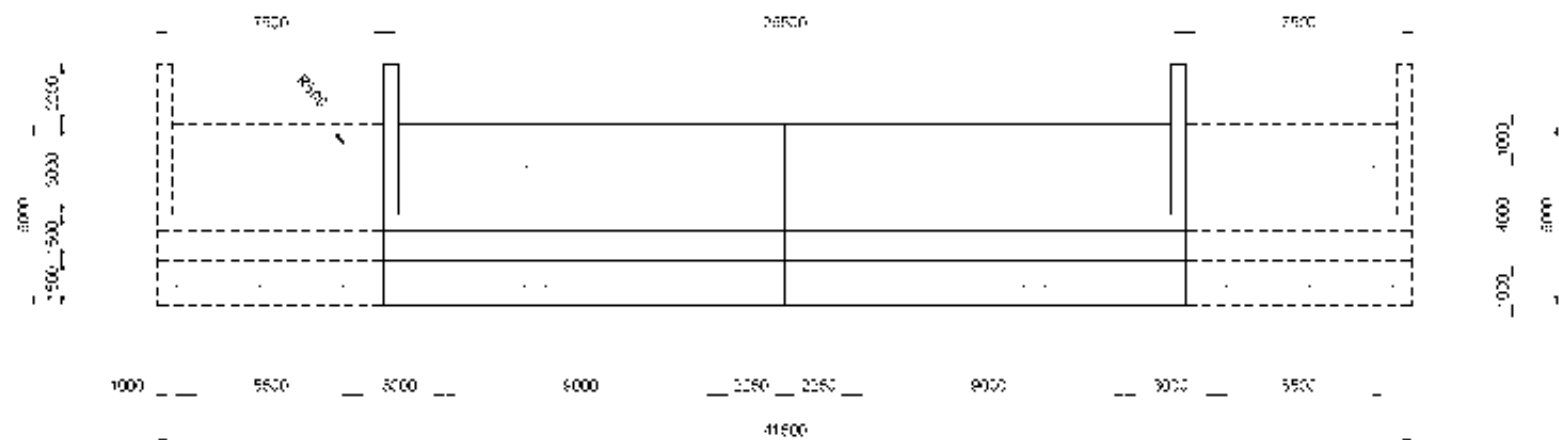
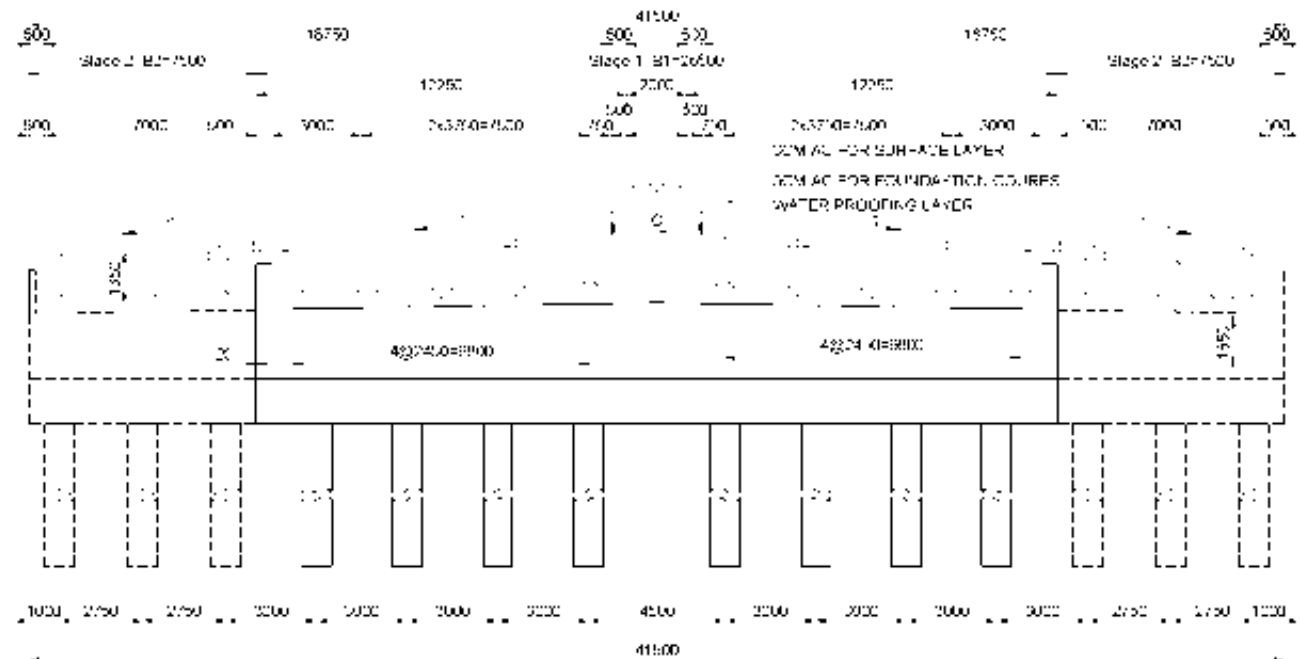
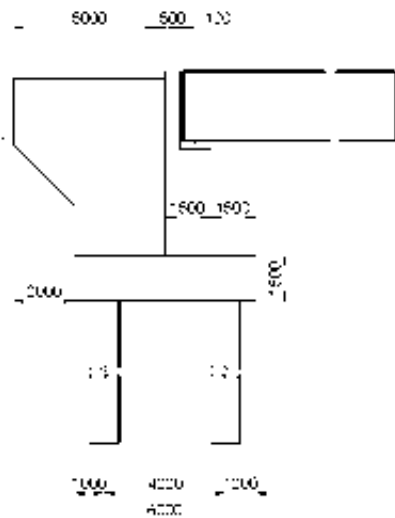
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SCALE: AS SHOWN

VIỆN KỸ THUẬT HẠ TẦNG GIAO THÔNG VÀ CÔNG TRÌNH KINH TẾ - KỸ THUẬT (VITTEC) - CÔNG TY CỔ PHẦN CÔNG NGHỆ VÀ THIẾT KẾ

SECTION B-B - MẶT CÁT B-B

SCALE 1:250



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TITLE

PREPARED BY Đặng Vũ TUYỀN

CHECKED BY Lê Ngọc HIEU

APPROVED BY Tim COLLETT

NAME

SIGNATURE

SOCIALIST REPUBLIC OF VIETNAM

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DRAWING TITLE

TIÊU CHUẨN THIẾT KẾ MẶT CÁT VÀO CÔNG TRÌNH

REV No DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING DRAWING

DRAWING

DRAWING No

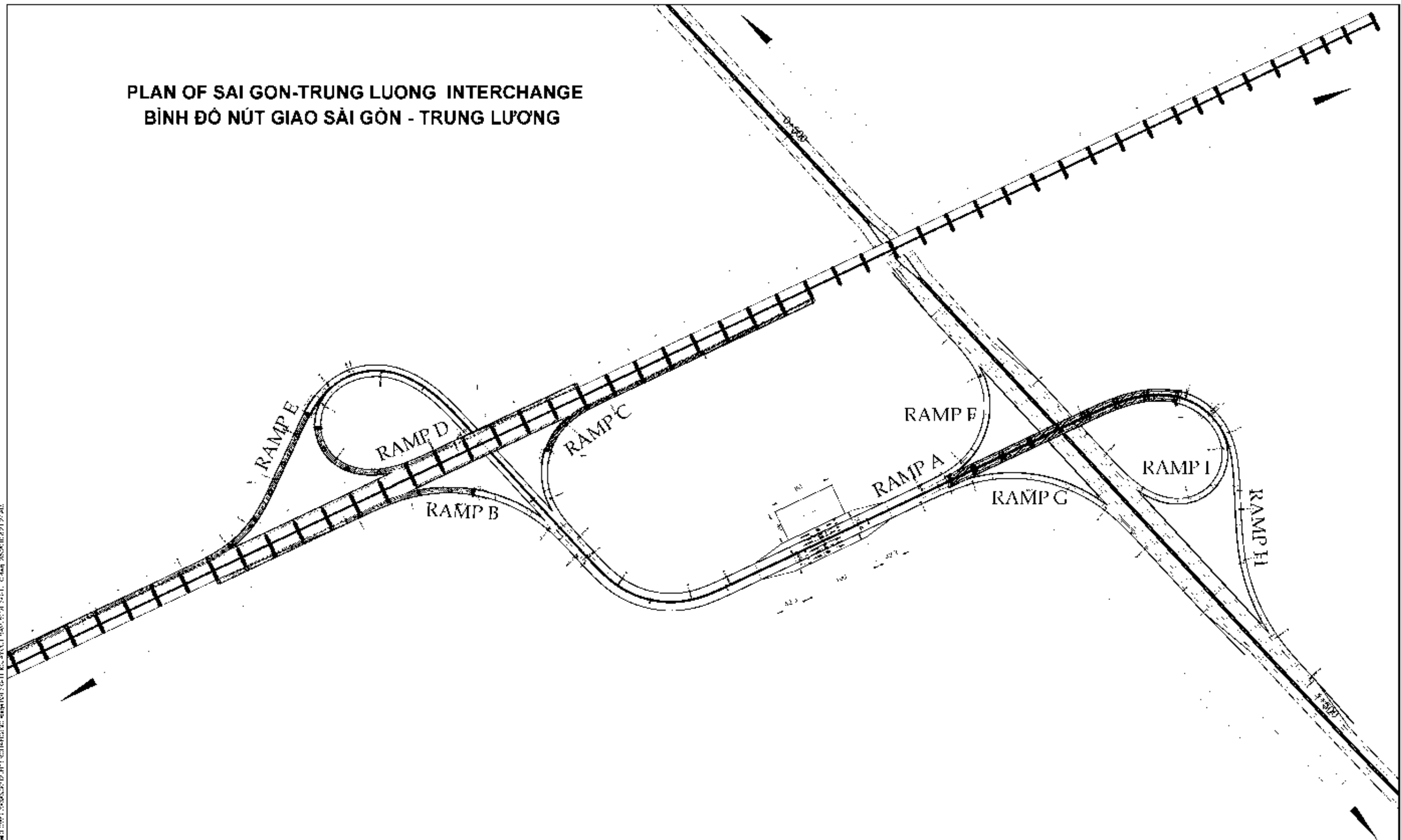
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SCALE:

AS SHOWN

13.BRIDGE OF IC1
SAI GON-TRUNG LUONG INTERCHANGE
13.CẦU TRÊN NÚT GIAO SÀI GÒN - TRUNG LƯƠNG
KM 1+000

PLAN OF SAI GON-TRUNG LUONG INTERCHANGE
BÌNH ĐỒ NÚT GIAO SÀI GÒN - TRUNG LƯƠNG



SỐ 01/2010/ĐKT-TH/UBND VÀ 01/2011/ĐKT-TH/UBND VỀ VIỆC SỬ DỤNG MẶT LƯỚI ĐƯỜNG VÀ CÁC CHỈ DẪN KỸ THUẬT TRONG THIẾT KẾ VÀ XÂY DỰNG CÁC CÔNG TRÌNH GIAO THÔNG

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KATAHIRA & ENGINEERS INTERNATIONAL
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In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Đang Vũ TUYẾN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tim COLLETT	

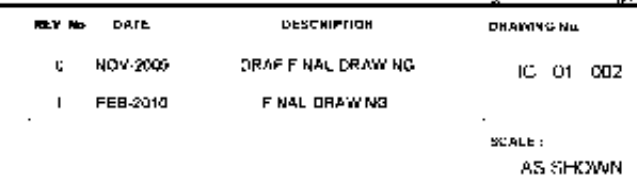
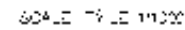
SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE
PLAN OF SAI GON-TRUNG LUONG INTERCHANGE
BÌNH ĐỒ NÚT GIAO SÀI GÒN - TRUNG LƯƠNG

REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAWING NO.	IC - 01 - 00
1	FEB-2010	FINAL DRAWING	

SCALE: 1/5000

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C. HILL D.A. 27000000, 1-400-4-6 1-2-10000

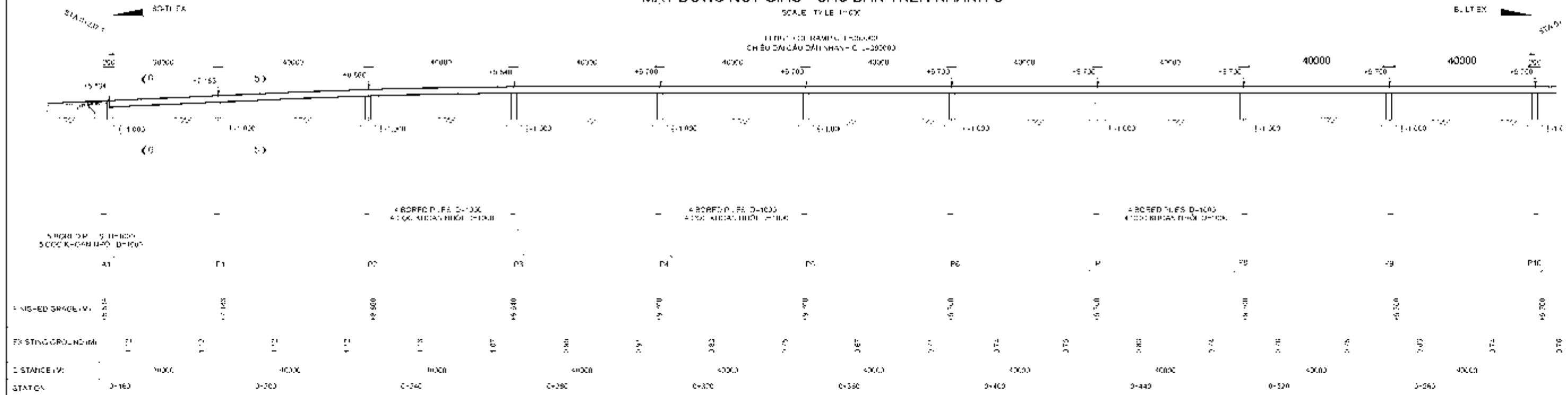


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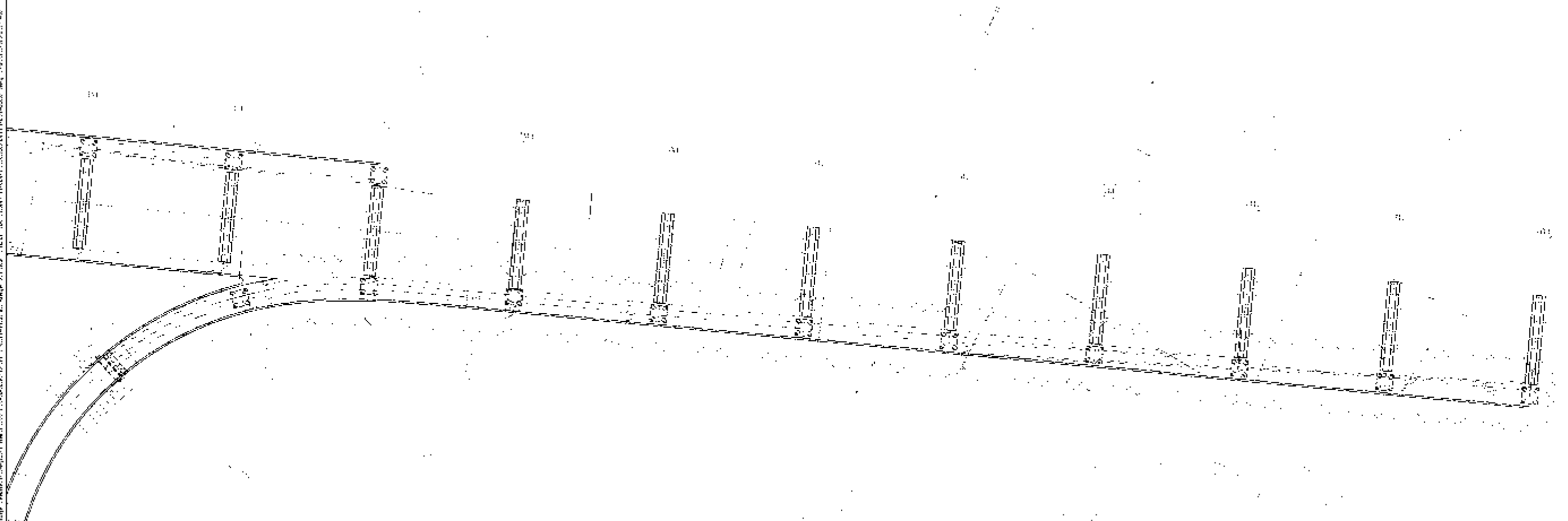
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CHẾ ĐỘ DẪN CẦU DẪN NHÁNH C-300000



PLAN VIEW - MẶT BẰNG

SCALE: 1/1000

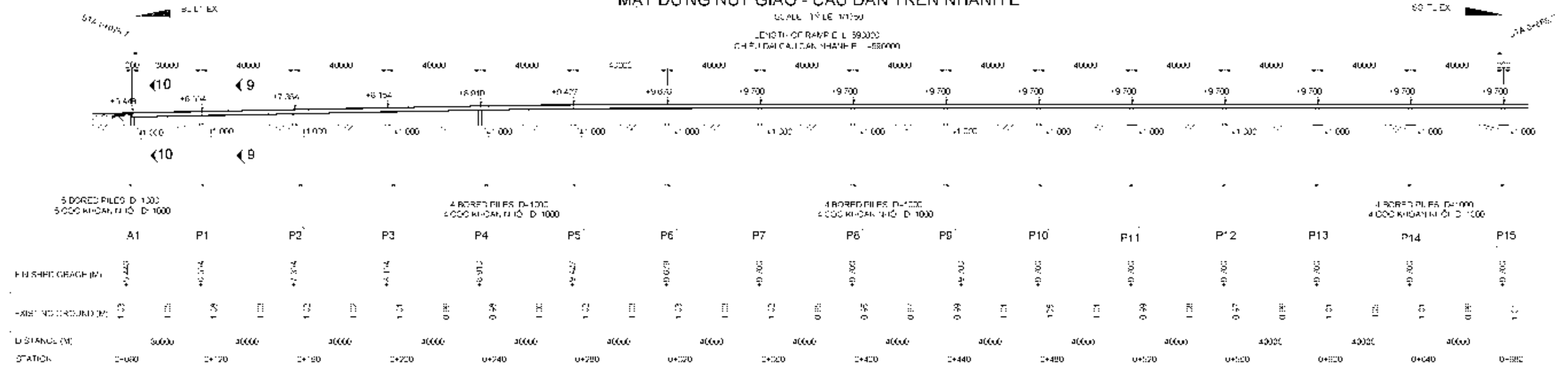


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KATAHIRA & ENGINEERS INTERNATIONAL			VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAWING NO.	IC-01-004
Joints Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING	
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TITLE	NAME	SIGNATURE	DRAWING TITLE		GENERAL VIEW OF SC-TLIC		SCALE: AS SHOWN			
PREPARED BY	Dang Vu TUYEN		BỐ TRÍ CHUNG MẶT ĐỪNG NÚT GIAO 5G-TI							
CHECKED BY	La Ngoc HIEU									
APPROVED BY	Tien COLLETT									

PROFILE OF INTERCHANGE - BRIDGE ON RAMP E MẶT ĐỪNG NÚT GIAO - CẦU DẪN TRÊN NHÁNH E

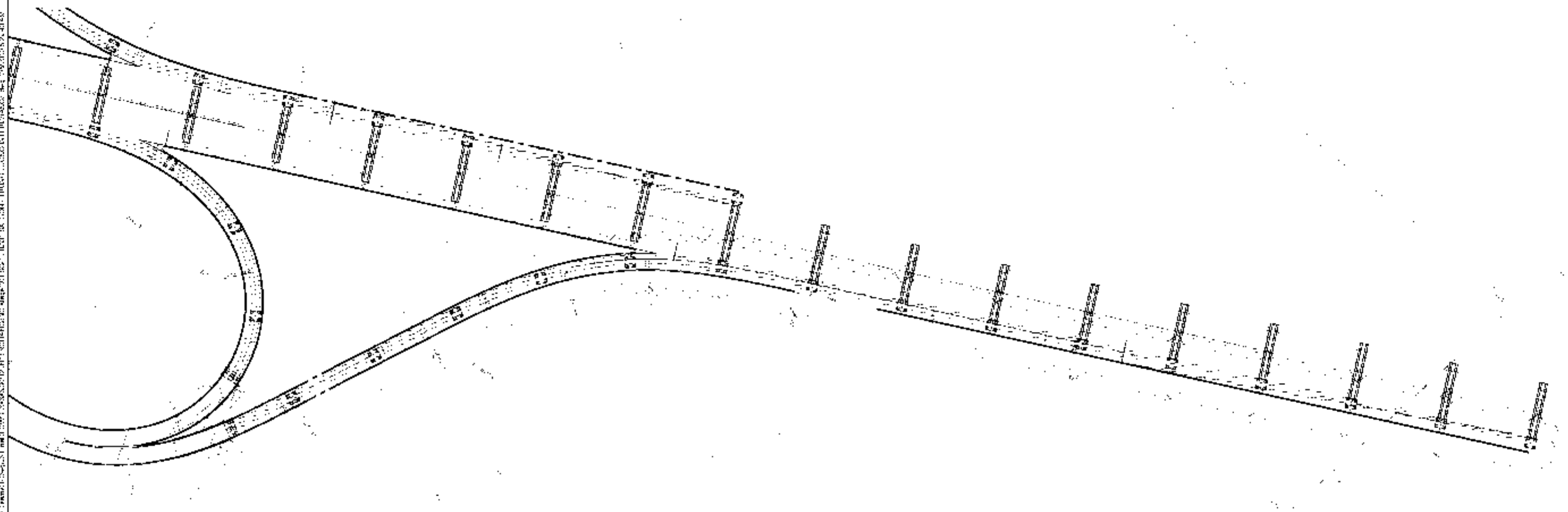
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PLAN VIEW - MẶT BANG

SCALE: 1/50



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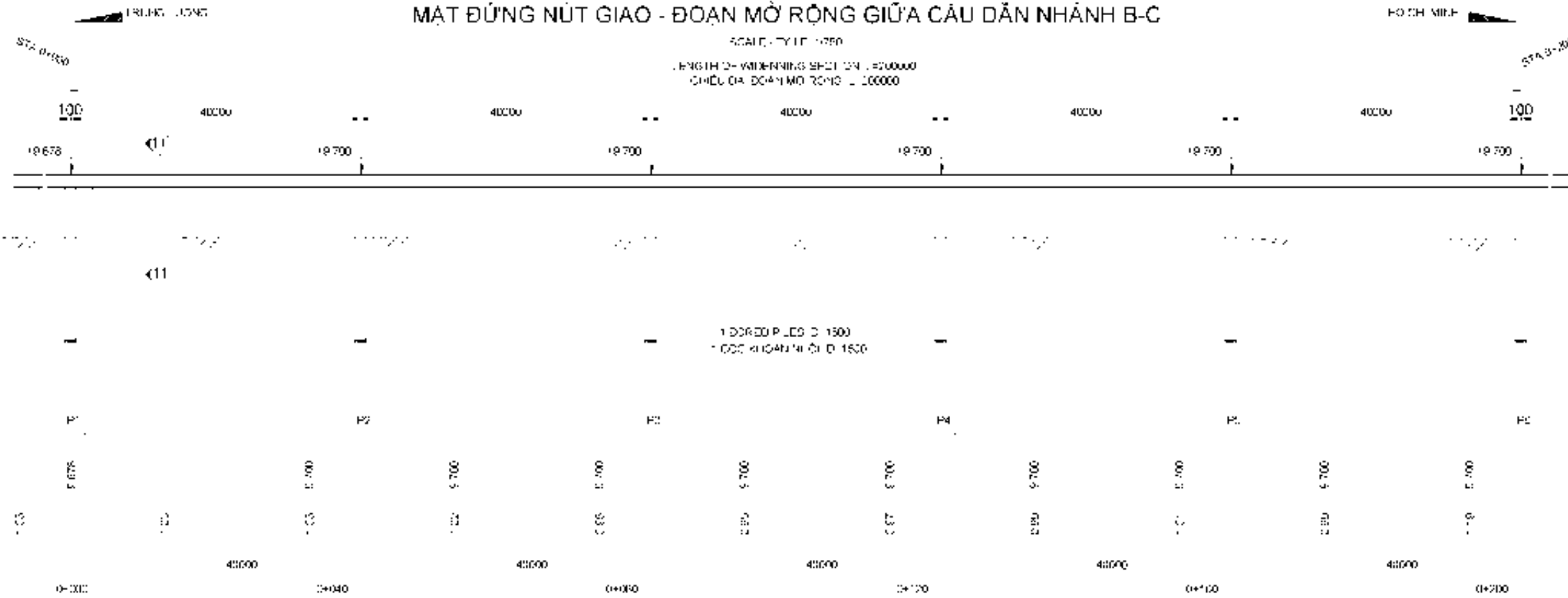
TITLE
NAME
SIGNATURE
PREPARED BY Đặng Vũ TUYẾN
CHECKED BY Lê Ngọc HIEU
APPROVED BY Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE GENERAL VIEW OF SC-TLIC
BỐ TRÍ CHUNG NÚT GIAO SC-TI

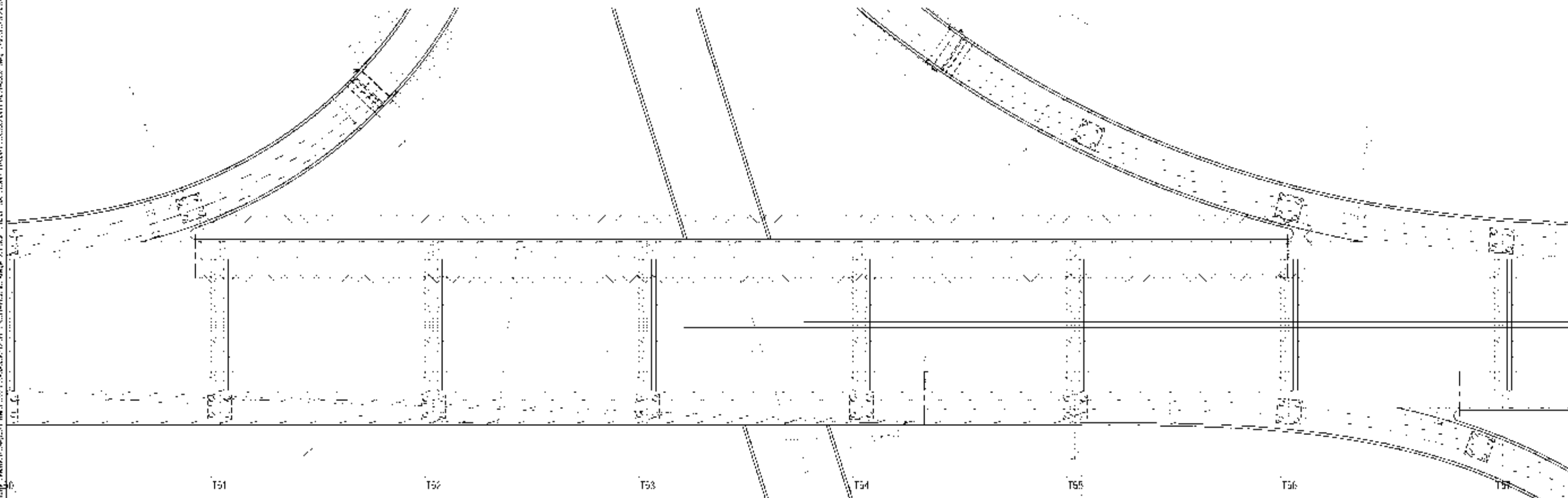
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1 NOV-2009 DRAFT FINAL DRAWING IC 01 006
2 FEB-2010 FINAL DRAWING
SCALE: AS SHOWN

PROFILE OF INTERCHANGE - WIDENNING SECTION BETWEEN RAMP B-C
MẶT ĐỪNG NÚT GIAO - ĐOẠN MỞ RỘNG GIỮA CẦU DẪN NHẢNH B-C



PLAN VIEW - MẶT BẰNG

SCALE: 1/250



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TITLE NAME SIGNATURE
PREPARED BY **Dang Vu TUYEN**
CHECKED BY **La Ngoc HIEU**
APPROVED BY **Tien COLLETT**

VIETNAM EXPRESSWAY CORPORATION (VEC)

SOCIALIST REPUBLIC OF VIETNAM

ASIAN DEVELOPMENT BANK

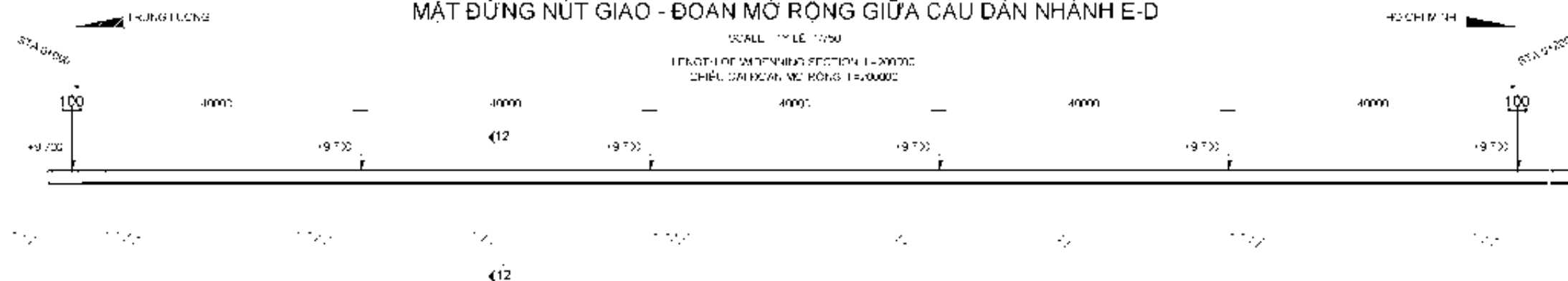
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF SC-TLIC
BỐ TRÍ CHUNG NÚT GIAO SC-TL

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAFT FINAL DRAWING	IC-01-00/
1	FEB-2010	FINAL DRAWING	

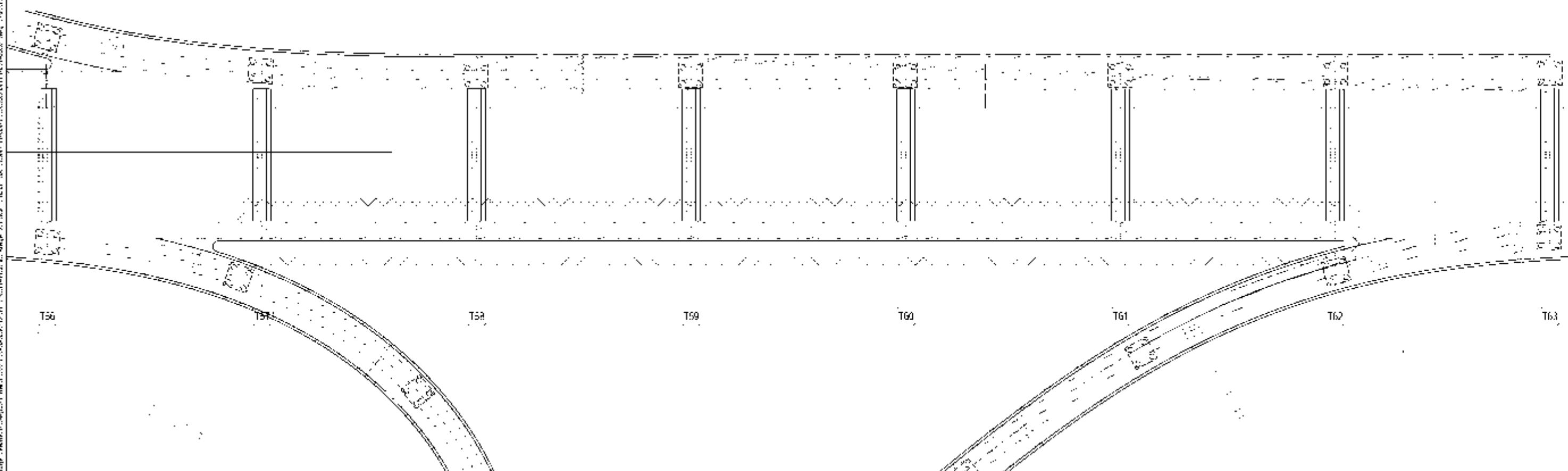
SCALE: AS SHOWN

PROFILE OF - WIDENING SECTION BETWEEN RAMP E-D
MẶT ĐỪNG NÚT GIAO - ĐOẠN MỞ RỘNG GIỮA CẦU DẪN NHÁNH E-D



PLAN VIEW - MẶT BẰNG

SCALE: 1:1000



CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No
KATAHIRA & ENGINEERS INTERNATIONAL							0	NOV-2009	DRAFT FINAL DRAWING	IC-01-008
Joint Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING	
In Association With APECO										SCALE: AS SHOWN
TITLE	NAME	SIGNATURE	VIETNAM EXPRESSWAY CORPORATION (VEC)		DRAWING TITLE		GENERAL VIEW OF SC-TLIC BỐ TRÍ CHUNG NÚT GIAO SG-TI			
PREPARED BY	Dang Vu TUYEN									
CHECKED BY	La Ngoc HIEU									
APPROVED BY	Tien COLLETT									

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 Jo nt Vancure With
ORIENTAL CONSULTANTS CO., LTD
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APECO

SIGNATURE



VIETNAM EXPRESSWAY CORPORATION (VEC)

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

REV No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	IC-01-010
1	FEB-2010	FINAL DRAWING	

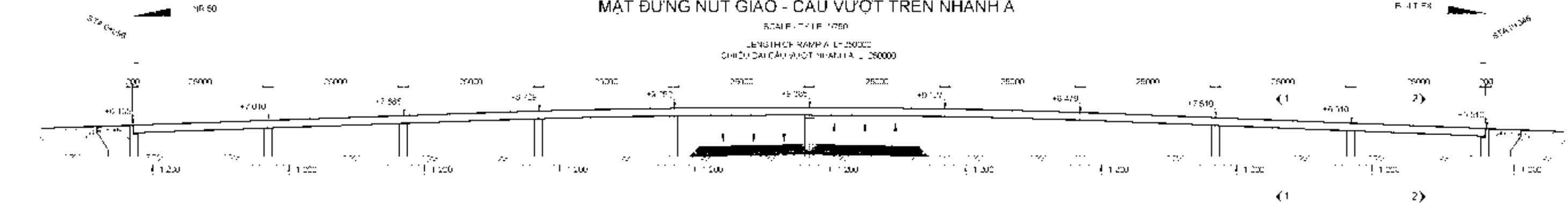
SCALE :
AS SHOWN

**14.BRIDGE OF IC3
NATIONAL HIGHWAY No.50 INTERCHANGE
14.CẦU TRÊN NÚT GIAO QUỐC LỘ 50
KM 13+700**

PROFILE OF INTERCHANGE - BRIDGE ON RAMP A MẶT ĐƯỜNG NÚT GIAO - CẦU VƯỢT TRÊN NHÁNH A

SCALE: 1/400

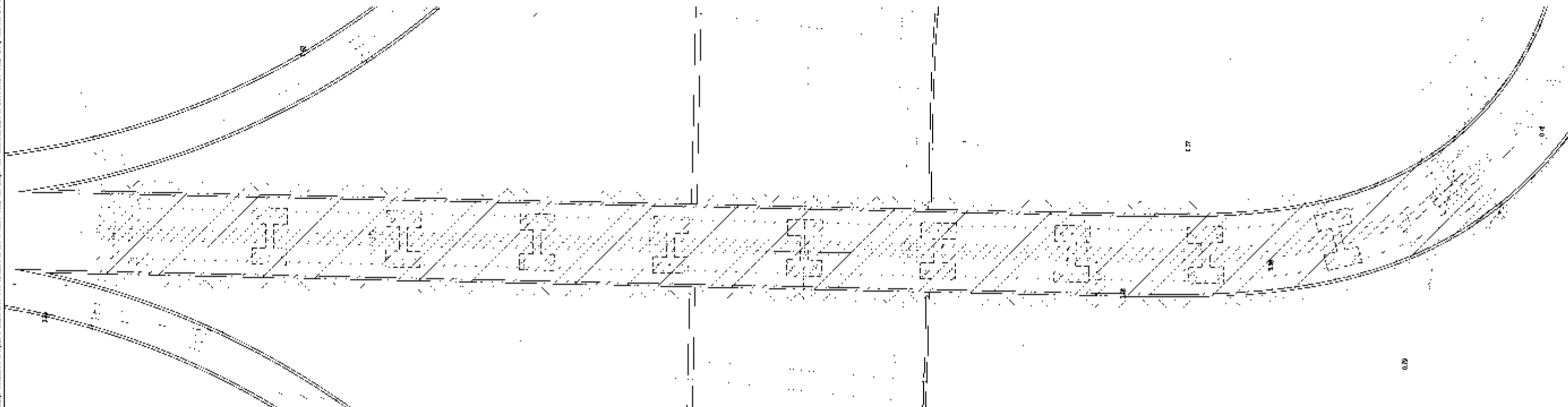
LENGTH OF RAMP A: 250000
CHIỀU DÀI CẦU VƯỢT NHÁNH A: 250000



PIERS	PIER 1	PIER 2	PIER 3	PIER 4	PIER 5	PIER 6	PIER 7	PIER 8	PIER 9	PIER 10	PIER 11
4 BORED PILES D=1500 4 CỌC KHOAN NHỎ D=1500											
FINISHED GRADE (M)	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15
EXISTING GROUND (M)	0.70	0.61	0.60	0.42	0.40	0.48	0.81	0.45	0.49	0.50	0.49
DISTANCE (M)	1000	2000	25000	25000	25000	25000	25000	25000	25000	25000	25000
STATION	0+000	0+1000	0+1600	0+2000	0+2500	0+3000	0+3500	0+4000	0+4500	0+5000	0+5500

PLAN VIEW - MẶT BẰNG

SCALE: 1/400






CONSULTANT		SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL		VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	C - 02 - 002
Joints Venture With ORIENTAL CONSULTANTS CO., LTD						1	FEB-2010	FINAL DRAWING	
In Association With APECO						DRAWING TITLE		GENERAL VIEW OF NH 50 INTERCHANGE BỒ TRÍ CHUNG NÚT GIAO QUỐC LỘ 50	
								SCALE: AS SHOWN	

[illegible]

554_E - 72_E 11.60

[illegible]

TITLE	NAME	SIGNATURE
PREPARED BY	Dang YU TUYEN	
CHECKED BY	La Ngoc HUU	
APPROVED BY	Tan COLLETTE	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE GENERAL VIEW OF NH 50 INTERCHANGE
BO TRI CHUNG NIUT GIAO QUOC LG 50

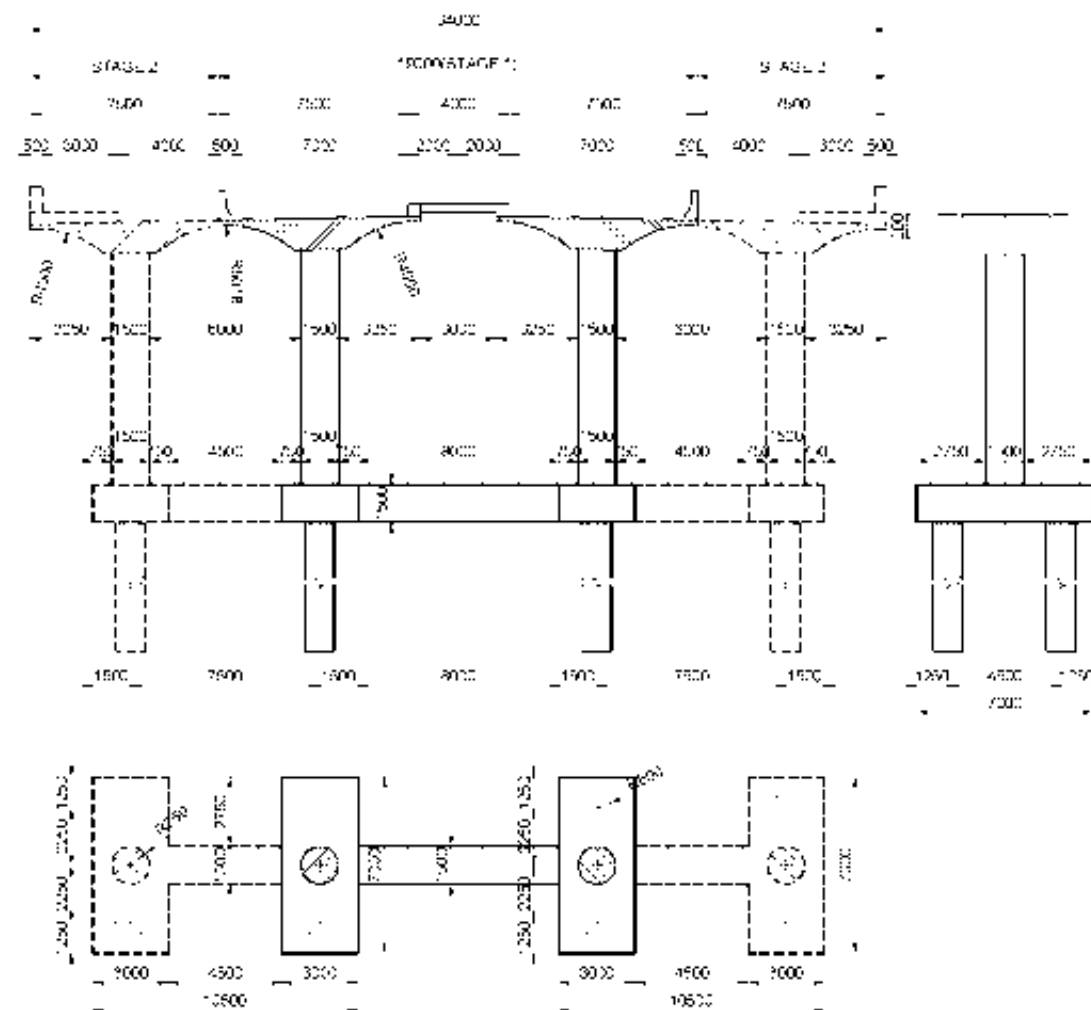
REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2006	DRAFT FINAL DRAWING	C - 02 - 003
1	FEB-2010	FINAL DRAWING	

SCALE :
AS SHOWN

TYPICAL CROSECTION OF FLYOVER BRIDGE ON NH50 IC MẶT CẮT NGANG ĐIỀN HÌNH CẦU VƯỢT NÚT GIAO QUỐC LỘ 50

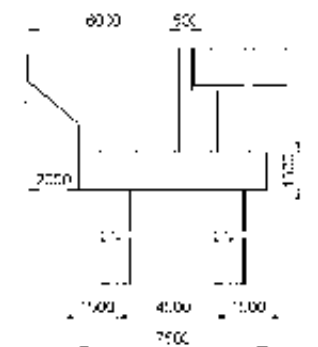
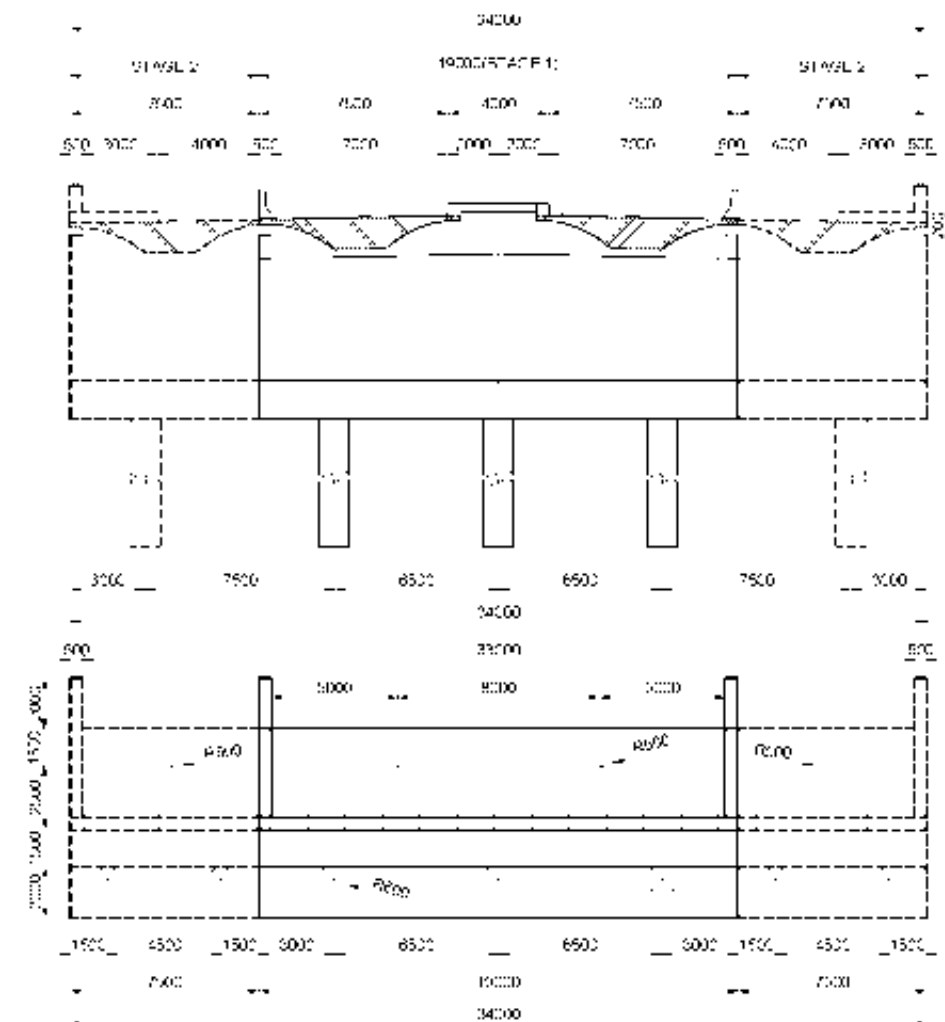
SECTION (MẶT CẮT) 1-1

SCALE 1:300



SECTION (MẶT CẮT) 2-2

SCALE 1:300



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Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE
NAME
PREPARED BY: **Dang Vu TUYEN**
CHECKED BY: **Le Ngoc HUU**
APPROVED BY: **Tan COU PTI**

SIGNATURE

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
TYPICAL CROSECTION OF NH50 INTERCHANGE
MẶT CẮT ĐIỀN HÌNH NÚT GIAO QUỐC LỘ 50

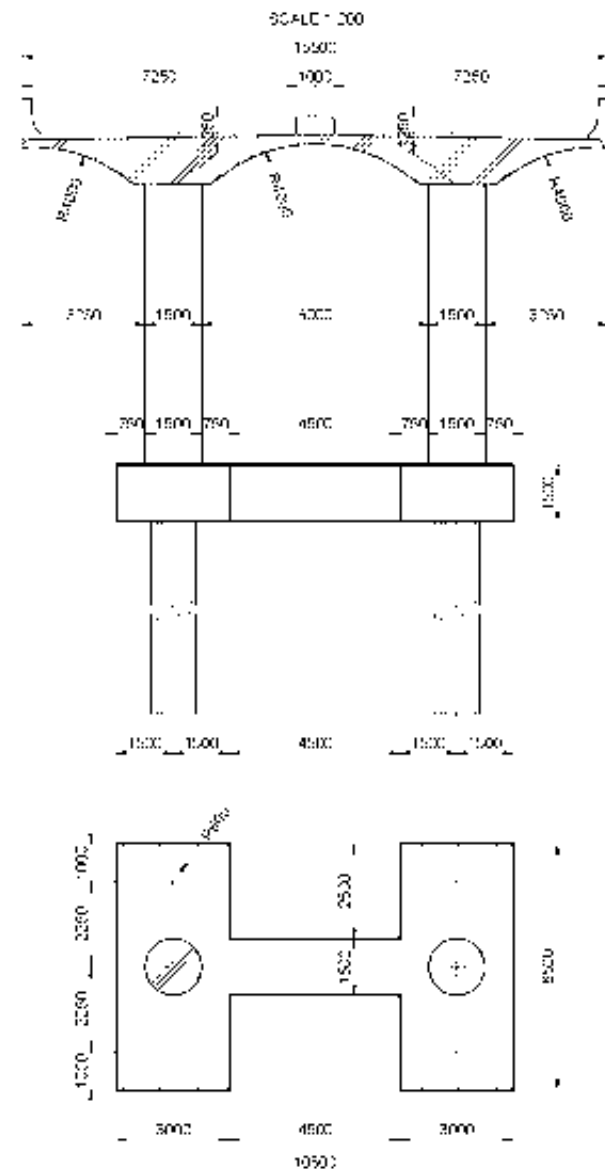
REV No. DATE
0 NOV-2009
1 FEB-2010

DESCRIPTION
DRAFTING DRAWING
FINAL DRAWING

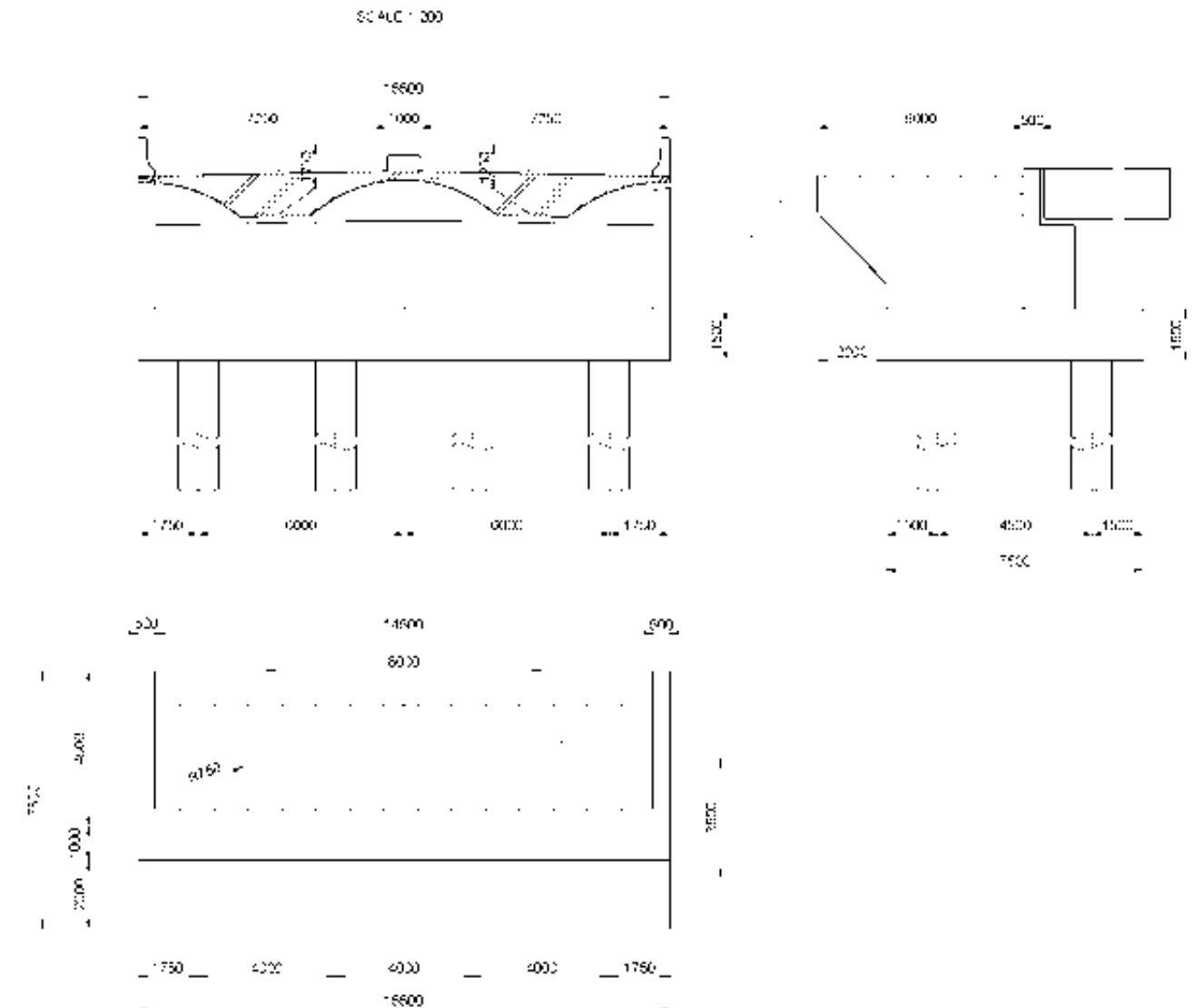
DRAWING No.
IC 02 004
SCALE:
AS SHOWN

TYPICAL CROSECTION OF RAMP A
MẶT CẮT NGANG ĐIỂN HÌNH CẦU DẪN NHÁNH A

SECTION (MẶT CẮT) 4-4



SECTION (MẶT CẮT) 3-3



VIỆN KỸ THUẬT KATAHIRA & ENGINEERS INTERNATIONAL CO., LTD. (K&E) VÀ CÔNG TY CỔ PHẦN TƯ VẤN KỸ THUẬT VÀ THIẾT KẾ APECO (APECO) ĐÃ HỢP TÁC TRONG VIỆC THIẾT KẾ VÀ CHUYỂN GIAO CÁC CÔNG TRÌNH GIAO THÔNG VÀ CÁC CÔNG TRÌNH KỸ THUẬT KHÁC.

CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
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ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	Le Ngoc HUU	
APPROVED BY	Tan COLUPTI	

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

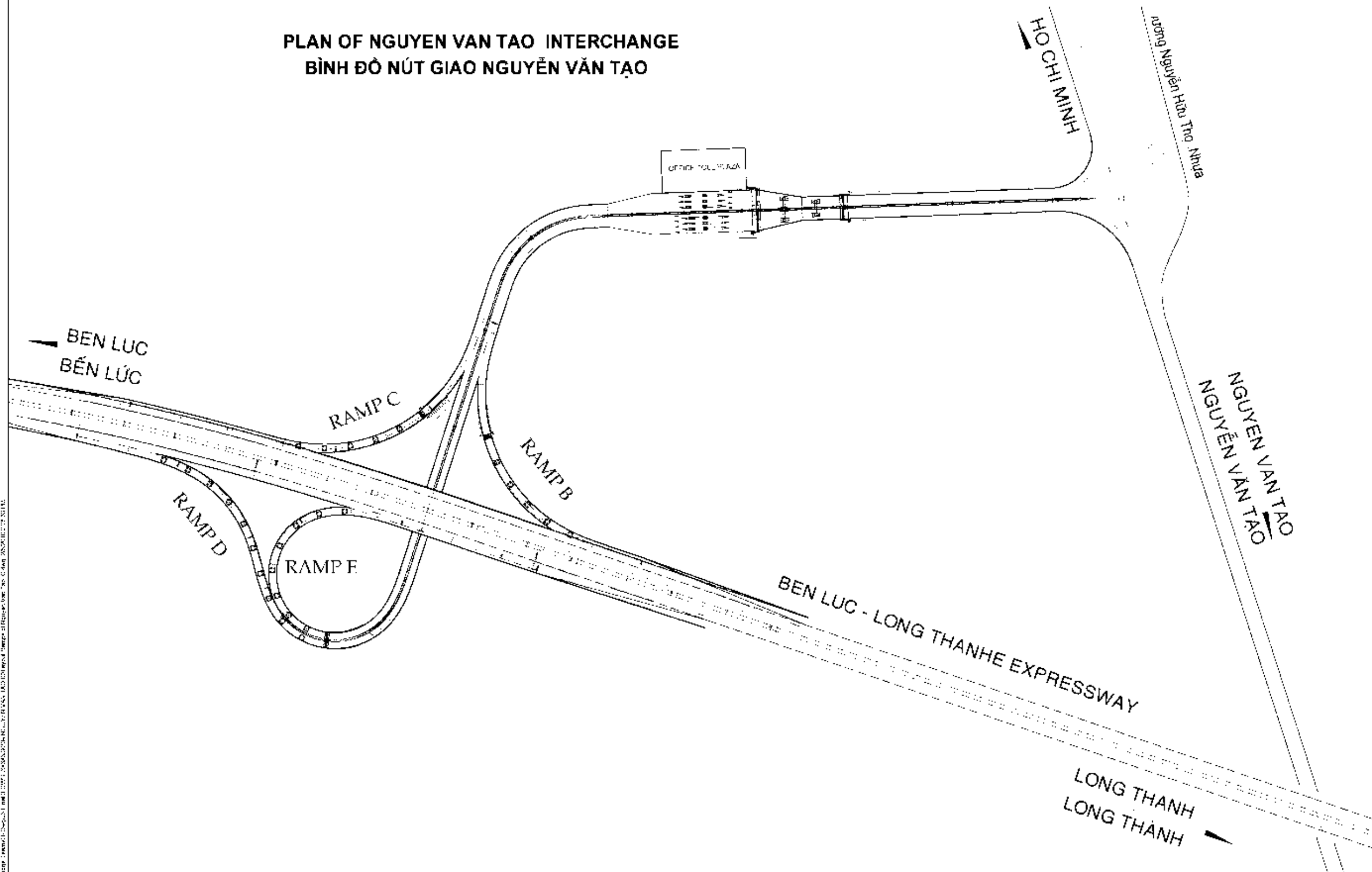
ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE: TYPICAL CROSECTION OF NH 50 INTERCHANGE
MẶT CẮT ĐIỂN HÌNH NÚT GIAO QUỐC LỘ 50

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING	C - 02 - 005
1	FEB-2010	FINAL DRAWING	

SCALE: AS SHOWN

**15.BRIDGE OF IC4
NGUYEN VAN TAO INTERCHANGE
15.CẦU TRÊN NÚT GIAO NGUYỄN VĂN TẠO
KM 20+950**

PLAN OF NGUYEN VAN TAO INTERCHANGE BÌNH ĐỒ NÚT GIAO NGUYỄN VĂN TẠO



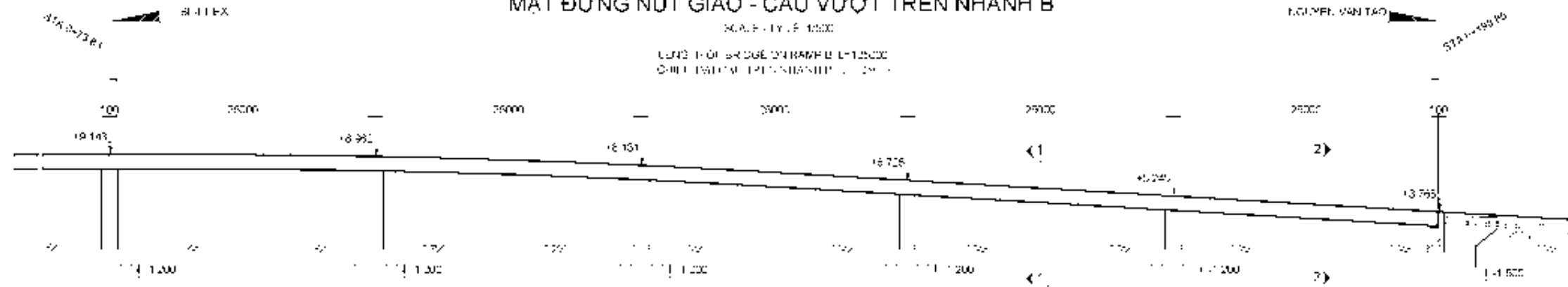
VIỆN KỸ THUẬT ĐƯỜNG LỘ VÀ CÔNG TRÌNH GIAO THÔNG - KINH TẾ VÀ MÔI TRƯỜNG - CÔNG TRÌNH GIAO THÔNG - KINH TẾ VÀ MÔI TRƯỜNG - CÔNG TRÌNH GIAO THÔNG - KINH TẾ VÀ MÔI TRƯỜNG

CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No	DATE	DESCRIPTION	DRAWING No	
KATAHIRA & ENGINEERS INTERNATIONAL			TITLE	NAME	SIGNATURE	TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	IC - 03 - 001
Joint Venture With ORIENTAL CONSULTANTS CO., LTD			PREPARED BY	Đặng Vũ TUYẾN		VIETNAM EXPRESSWAY CORPORATION (VEC)		1	FEB-2010	FINAL DRAWING	
In Association With APECO			CHECKED BY	Lê Ngọc HIEU		DRAWING TITLE	PLAN OF NGUYEN VAN TAO INTERCHANGE BÌNH ĐỒ NÚT GIAO NGUYỄN VĂN TẠO		SCALE : AS SHOWN		
			APPROVED BY	Tên COLLETT							

PROFILE OF INTERCHANGE - BRIDGE ON RAMP B MẶT ĐỪNG NÚT GIAO - CẦU VƯỢT TRÊN NHÁNH B

SCALE: 1/1000

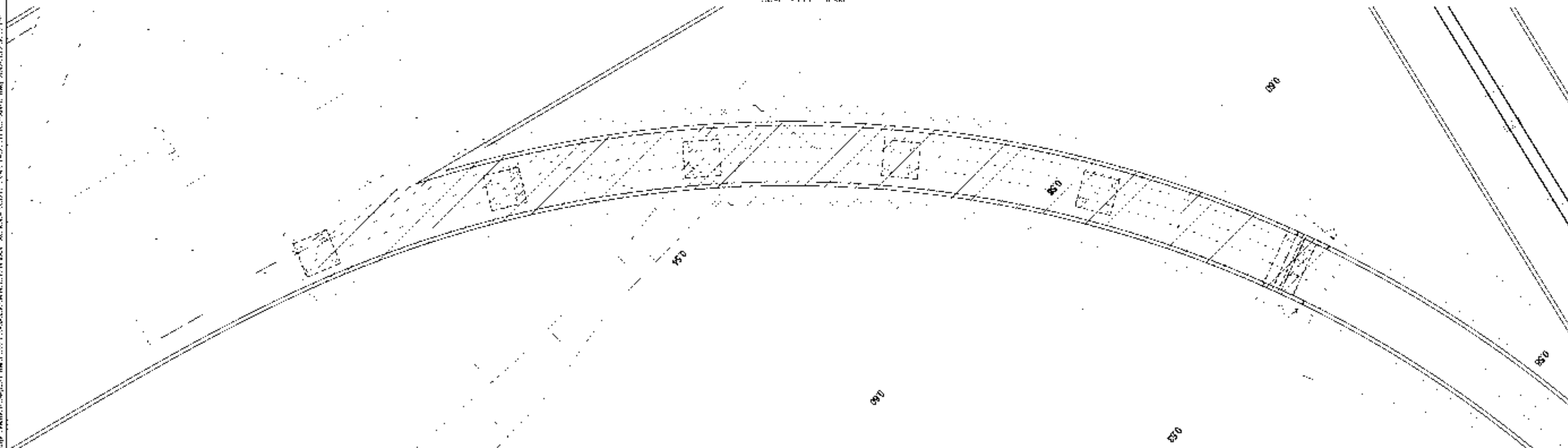
LENGTH OF BRIDGE ON RAMP B: 115.000
CHIEF ENGINEER: NGUYEN VAN TAO



	1	2	3	4	5	6
4 BUILT-UP PILES Ø1000 5 COG KI-DAK HỒ D 1000						
PI	P1	P2	P3	P4	P5	P6
FINISHED GRADE (M)	10.145	10.902	10.114	10.125	10.245	10.790
EXISTING GROUND (M)	0.86	0.72	0.85	0.80	0.95	0.87
DATA (M)	25.00	25.00	25.00	25.00	25.00	25.00
STATION	0+00	0+10	0+20	0+30	0+40	0+50

PLAN VIEW - MẶT BẰNG

SCALE: 1/1000



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
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In Association With
APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Ten COLLETT	

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF NGUYEN VAN TAO INTERCHANGE
BỐ TRÍ CHUNG NÚT GIAO NGUYỄN VĂN TAO

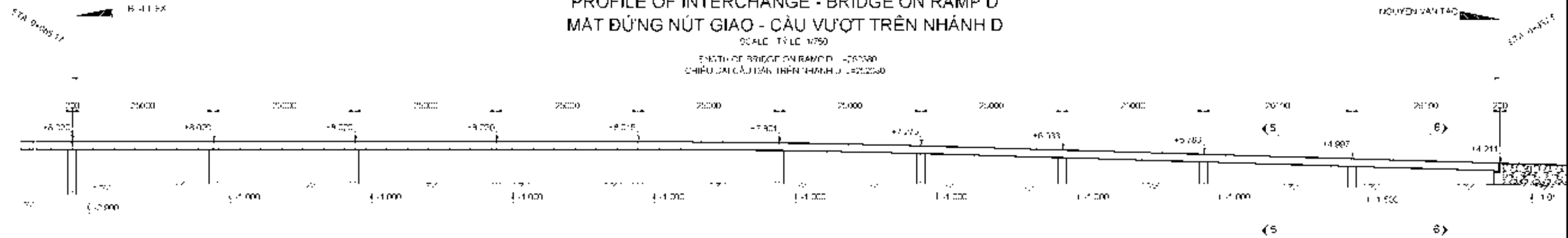
REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING DRAWING	IC-03-000
1	FEB-2010	FINAL DRAWING	

SCALE: AS SHOWN

PROFILE OF INTERCHANGE - BRIDGE ON RAMP D MẶT ĐỪNG NÚT GIAO - CẦU VƯỢT TRÊN NHÁNH D

SCALE: TỶ LỆ 1/750

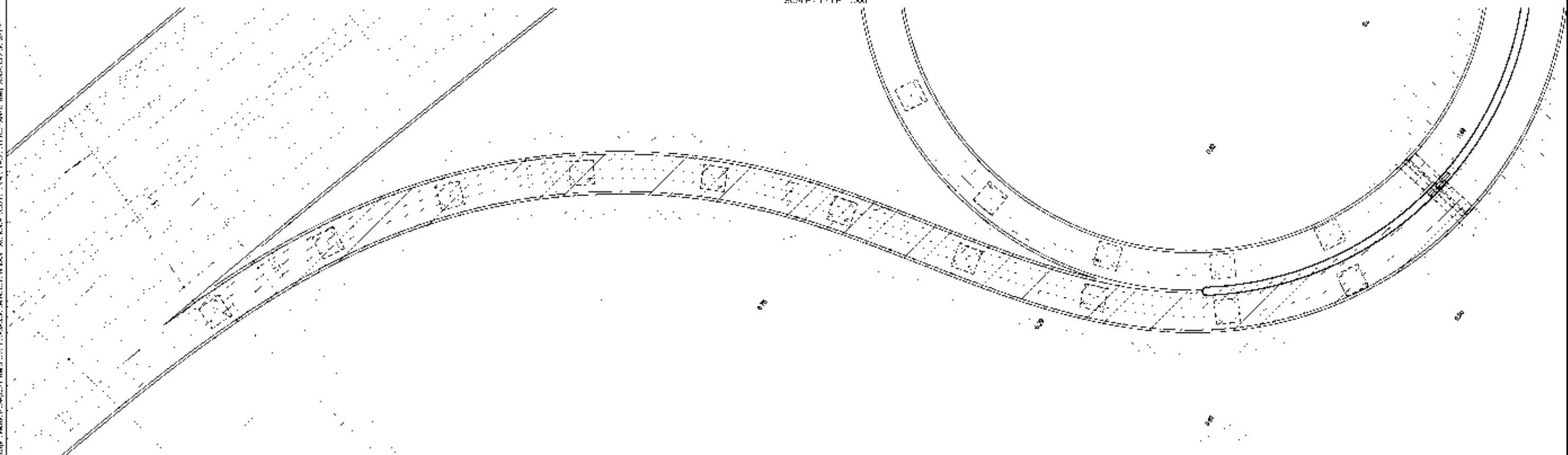
LENGTH OF BRIDGE ON RAMP D: 426.15M
CHIỀU DÀI CẦU VƯỢT TRÊN NHÁNH D: 426.15M



	4 CORRO PILES Ø 1000 4 CỌC KHUẨN NHỎ Ø 1000				4 BORED PILES Ø 1100 4 CỌC KHUẨN NHỎ Ø 1100				4 CORRO PILES Ø 1000 4 CỌC KHUẨN NHỎ Ø 1000				5 BORED PILES Ø 1000 5 CỌC KHUẨN NHỎ Ø 1000			
FINISHED GRASS (M)	+6.000				+6.000				+6.000				+6.000			
EXISTING GROUND (M)	-1.00				0.88				0.88				0.58			
DISTANCE (M)	25.000				25.000				25.000				25.000			
STATION	0+000				0+100				0+200				0+300			

PLAN VIEW - MẶT BẰNG

SCALE: TỶ LỆ 1/500



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL

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ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY **Le Ngoc HIEU**

APPROVED BY **Tim COLLETT**

[Signature]

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

**TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT**

DRAWING TITLE

GENERAL VIEW OF NGUYEN VAN TAO INTERCHANGE

BỒ TRÍ CHUNG NÚT GIAO NGUYỄN VĂN TAO

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING NO.

FINAL DRAWING

FINAL DRAWING

DRAWING No.

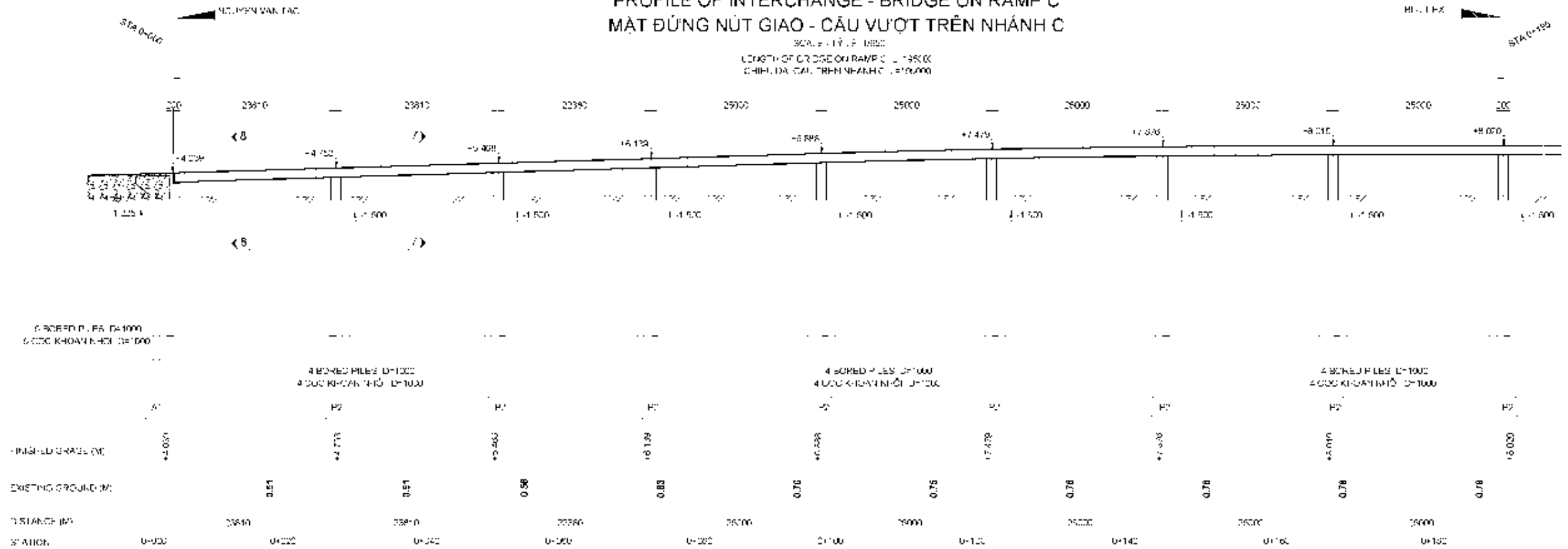
IC-03-005

SCALE:

AS SHOWN

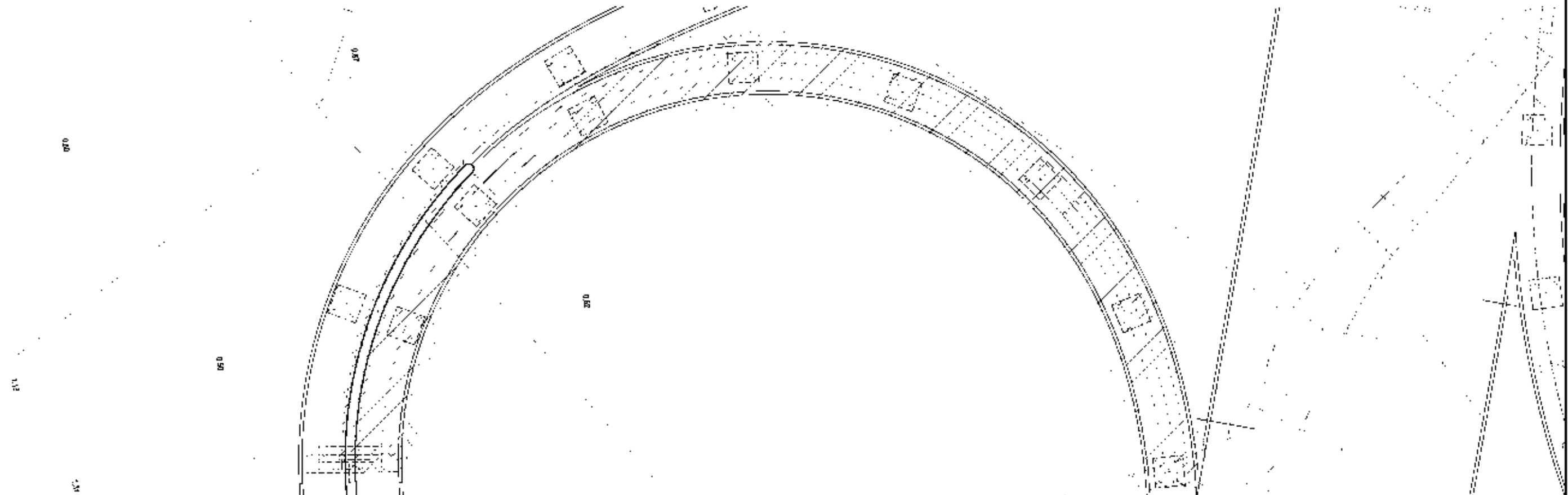
PROFILE OF INTERCHANGE - BRIDGE ON RAMP C MẶT ĐỪNG NÚT GIAO - CẦU VƯỢT TRÊN NHÁNH C

SCALE: 1/1000
LENGTH OF BRIDGE ON RAMP C: 13500
CHỈ DẪN CẦU TRÊN NHÁNH C: 1/10000



PLAN VIEW - MẶT BẰNG

SCALE: 1/1000



CONSULTANT
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TITLE
NAME
SIGNATURE
PREPARED BY: **Dang Vu TUYEN**
CHECKED BY: **La Ngoc HIEU**
APPROVED BY: **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

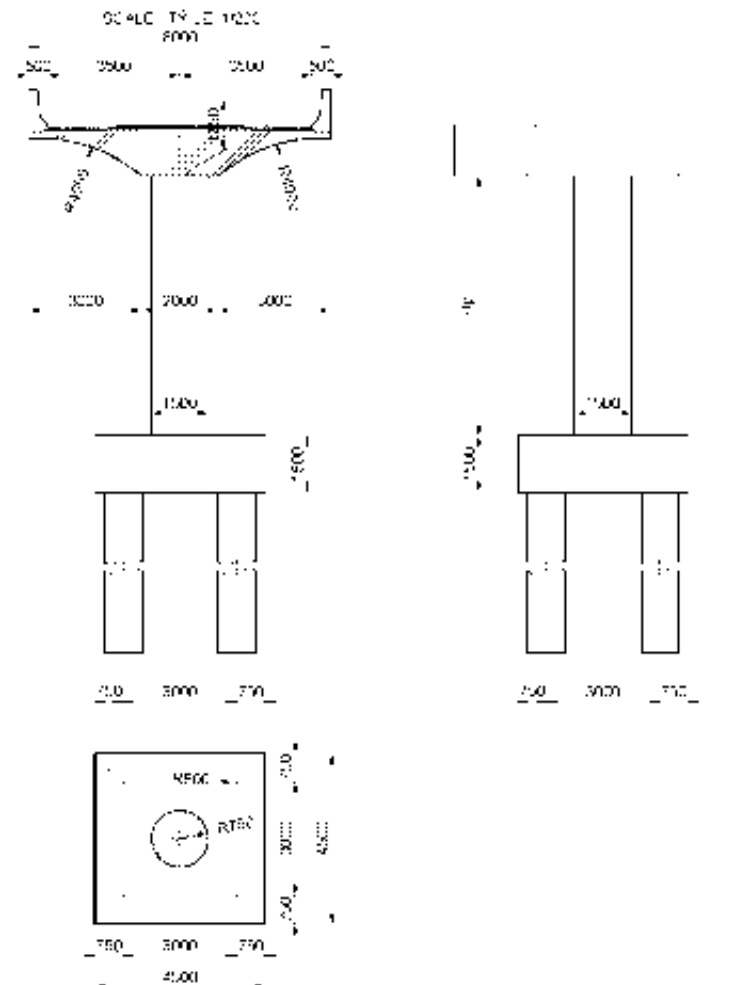
ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE:
GENERAL VIEW OF NGUYEN VAN TAO INTERCHANGE
BỐ TRÍ CHUNG NÚT GIAO NGUYỄN VĂN TAO

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING NO.	IC-03-008
1	FEB-2010	FINAL DRAWING	

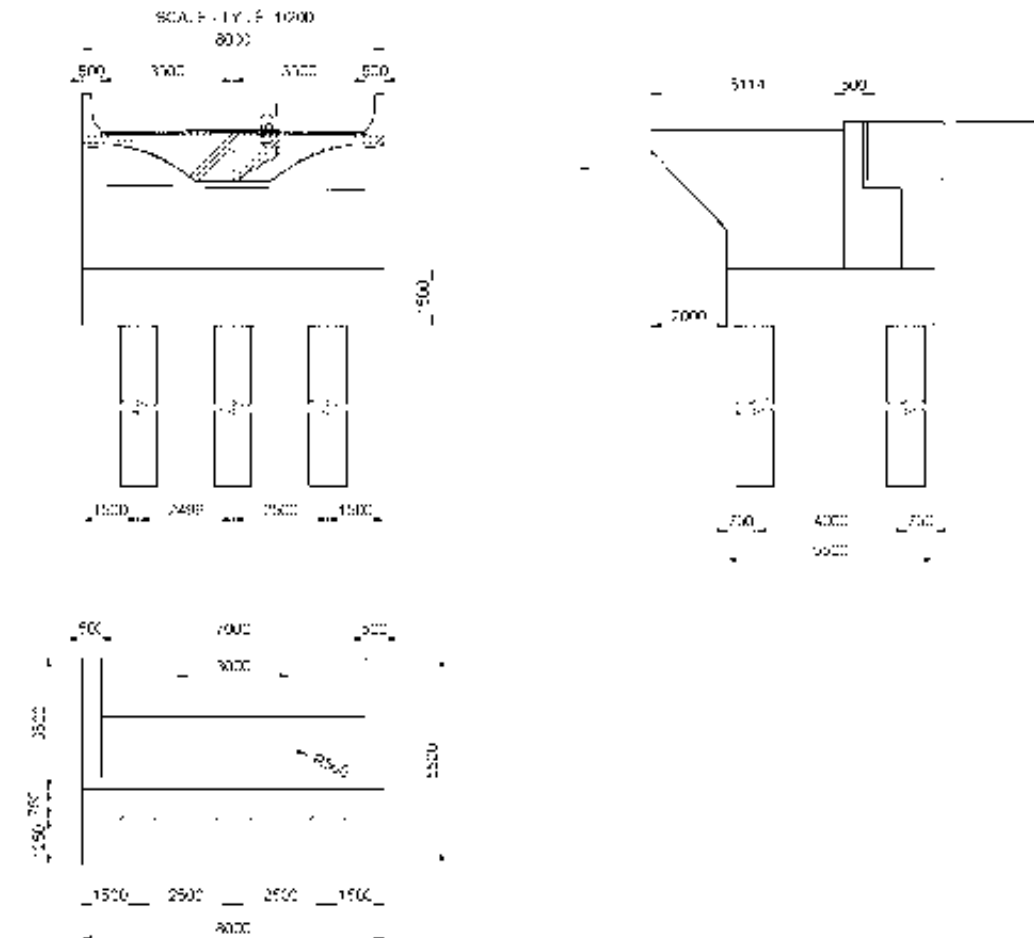
SCALE: AS SHOWN

TYPICAL CROSSECTION OF RAMP B,C,D,E MẶT CẮT NGANG ĐIỀN HÌNH CẦU VƯỢT NÚT GIAO B,C,D,E

CROSSECTION (MẶT CẮT): (1-1),(3-3),(5-5),(7-7)



CROSSECTION (MẶT CẮT): (2-2),(4-4),(6-6),(8-8)



VIỆN KỸ THUẬT KỸ SƯ THIẾT KẾ VÀ XÂY DỰNG CÁC CÔNG TRÌNH GIAO THÔNG VÀ CÁC CÔNG TRÌNH CÔNG NGHIỆP VÀ DÂN DỤNG

CONSULTANT
KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE
NAME
SIGNATURE
PREPARED BY: Đặng Vũ TUYỀN
CHECKED BY: Lê Ngọc HIEU
APPROVED BY: Trần COLLETT

SOCIALIST REPUBLIC OF VIETNAM
VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VI: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE
TYPICAL CROSSECTION OF NGUYEN VAN TAO INTERCHANGE
MẶT CẮT ĐIỀN HÌNH NÚT GIAO NGUYEN VAN TAO

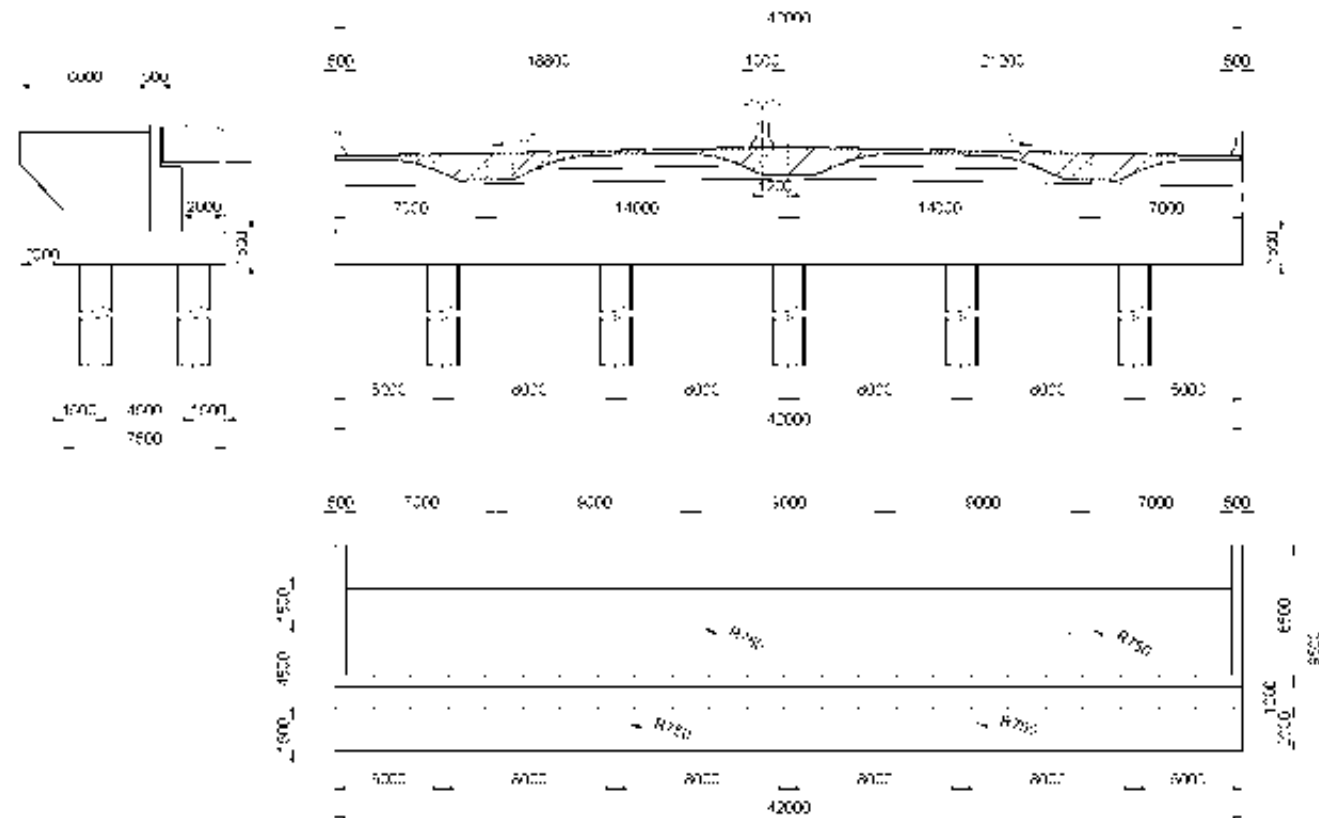
REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING DRAWING	C-03-008
1	FEB-2010	FINAL DRAWING	

SCALE:
AS SHOWN

TYPICAL CROSECTION OF RAMP B,C,D,E
MẶT CẮT NGANG ĐIỀN HÌNH CẦU VƯỢT NÚT GIAO B,C,D,E

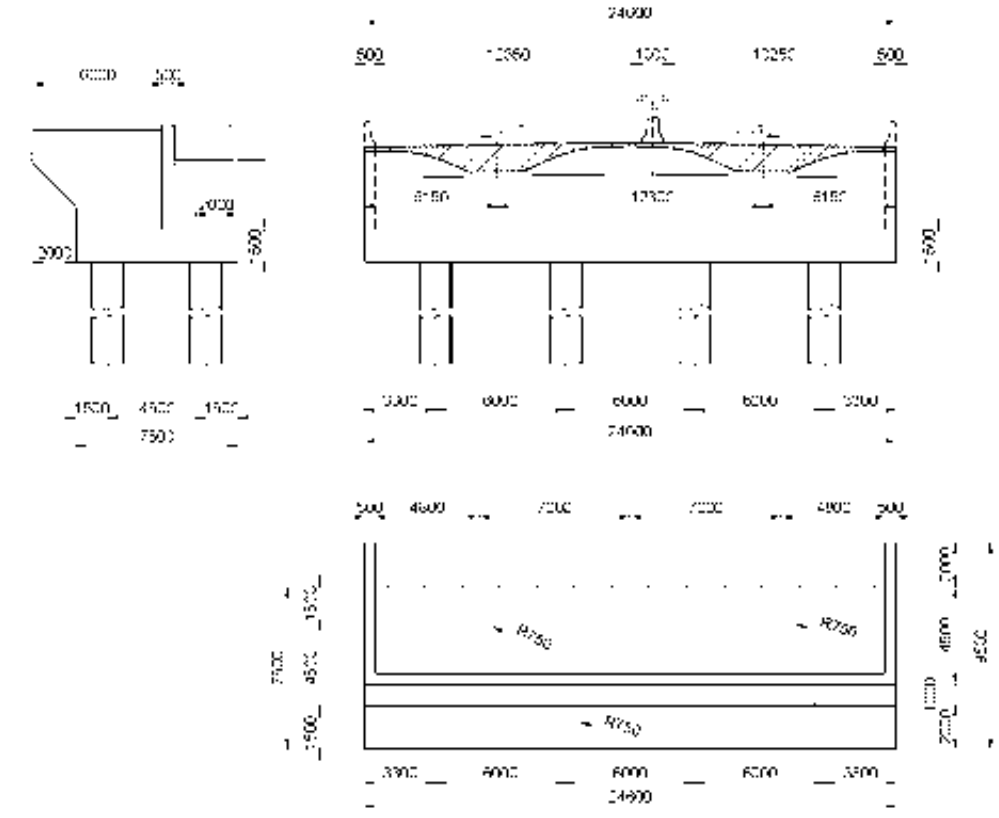
SECTION (MẶT CẮT) A-A

SCALE 1:50



SECTION (MẶT CẮT) D-D

SCALE 1:50



VEP 03/2010: HƯỚNG DẪN THIẾT KẾ VÀ XÂY DỰNG CẦU VƯỢT NÚT GIAO CẦU VÀ CẦU LƯỚI. (KHOA KỸ THUẬT XÂY DỰNG, ĐẠI HỌC KIẾN TRÚC VÀ KỸ THUẬT, HÀ NỘI, 2010). (KHOA KỸ THUẬT XÂY DỰNG, ĐẠI HỌC KIẾN TRÚC VÀ KỸ THUẬT, HÀ NỘI, 2010).

CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With

ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY **La Ngoc HIEU**

APPROVED BY **Tien COLLETT**

[Signature]

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
TYPICAL CROSECTION OF NGUYEN VAN TAO INTERCHANGE
MẶT CẮT ĐIỀN HÌNH NÚT GIAO NGUYEN VAN TAO

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING NO.

FINAL DRAWING

DRAWING No.

C - 03 - 007

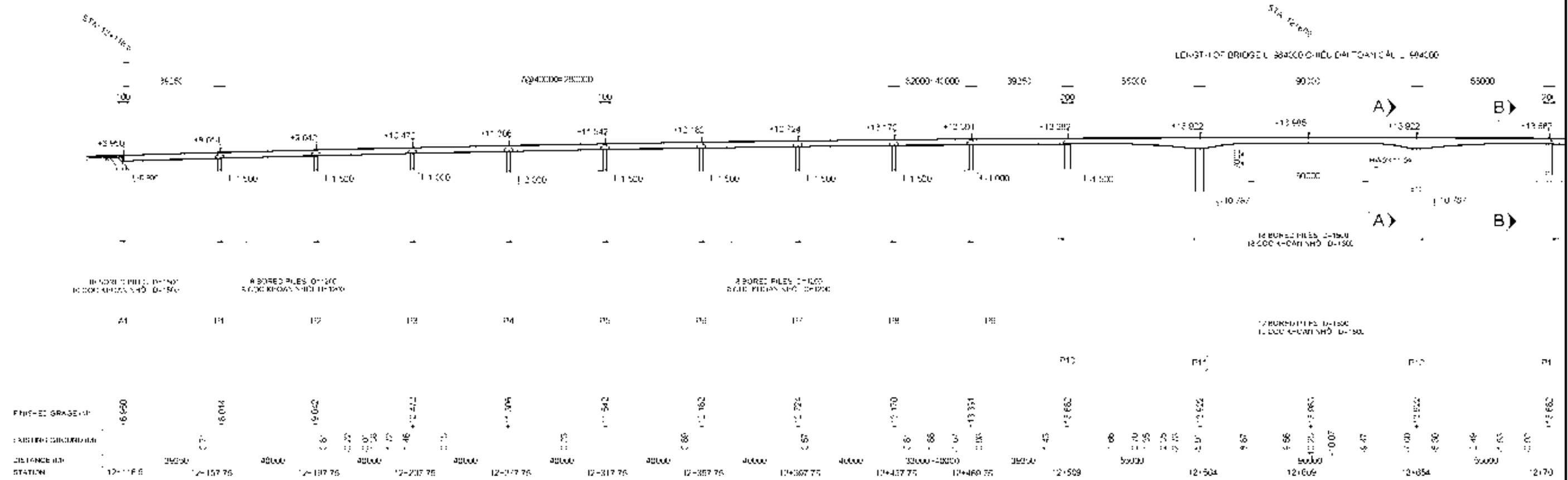
SCALE :
AS SHOWN

ALTERNATIVE 2 - PHƯƠNG ÁN 2
(COMPARISON - PHƯƠNG ÁN SO SÁNH)

16.ONG THIN BRIDGE
16.CẦU ÔNG THÌN
KM 12+609
(OPTION 2)

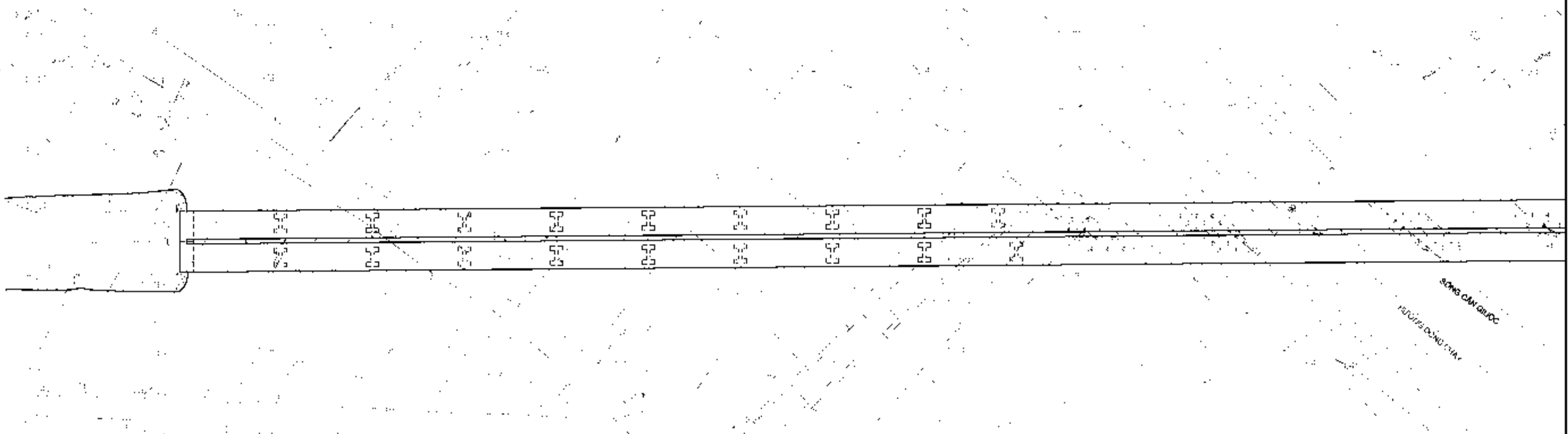
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/500



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



CONSULTANT

KATAHIRA & ENGINEERS INTERNATIONAL
Joint Venture With
ORIENTAL CONSULTANTS CO., LTD
In Association With
APECO

TITLE NAME SIGNATURE
PREPARED BY **Đang Vũ TUYẾN**
CHECKED BY **Le Ngoc HIEU**
APPROVED BY **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

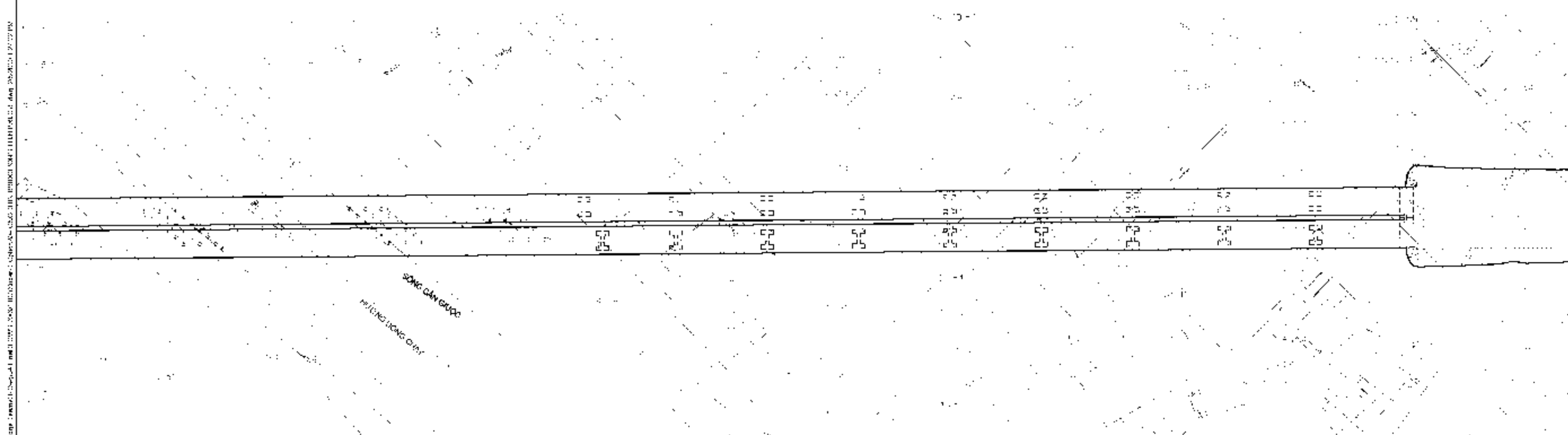
ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF LONG THIN BRIDGE
HỒ SƠ CHUNG ALONG THIN

REV. NO.	DATE	DESCRIPTION	DRAWING NO.
0	NOV-2009	DRAWING NO.	REV. 01
1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2
SCALE:			AS SHOWN

QCA_1 T_Y_1 10175%

 $\bar{X}_A = .17 = 17\%$ 

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

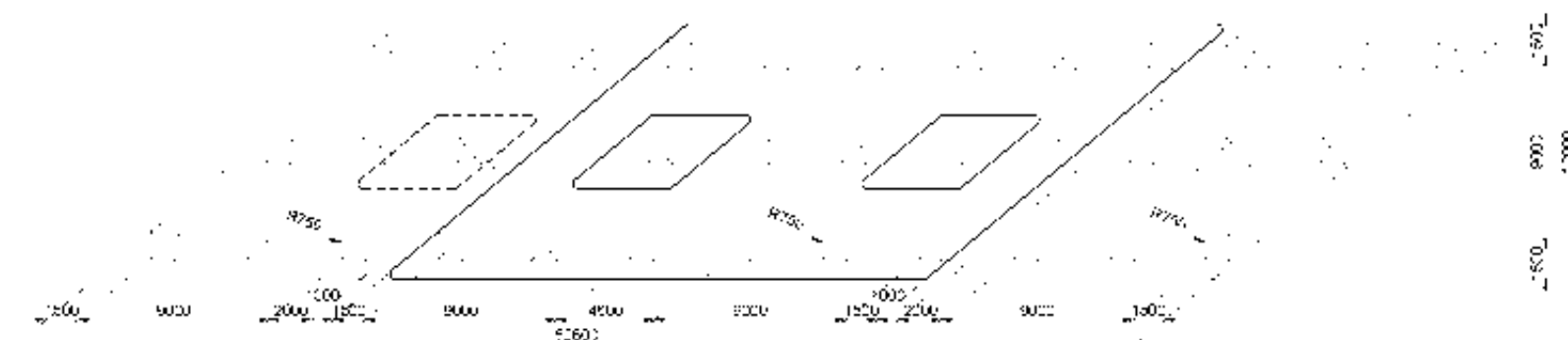
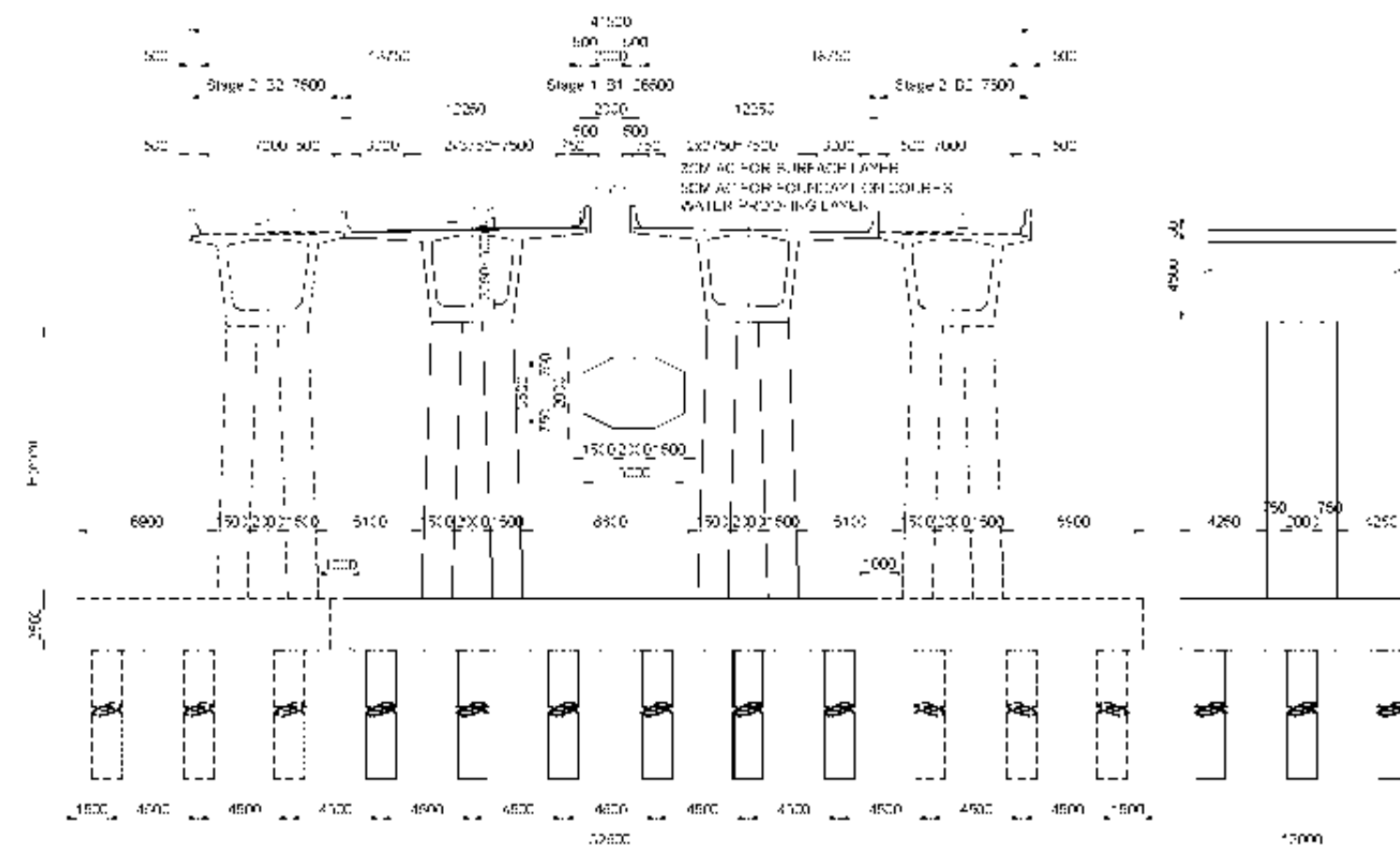
NOV-2006 DRAFT FINAL DRAWING 11/13/06

1 FEB-2010 FINAL DRAWING ALTERNATIVE 2

DRAWING TITLE GENERAL VIEW OF ONE-TEMPERATURE
BIPHOTONIC CATALYTIC SYSTEM




SCALE :
AS SHOWN

Received 1 October 2006; accepted 12 October 2006; first published online 12 November 2006

$\Delta G_{\text{f}}^{\circ} = -1.35$ 

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APECO

TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tim COLLETT	

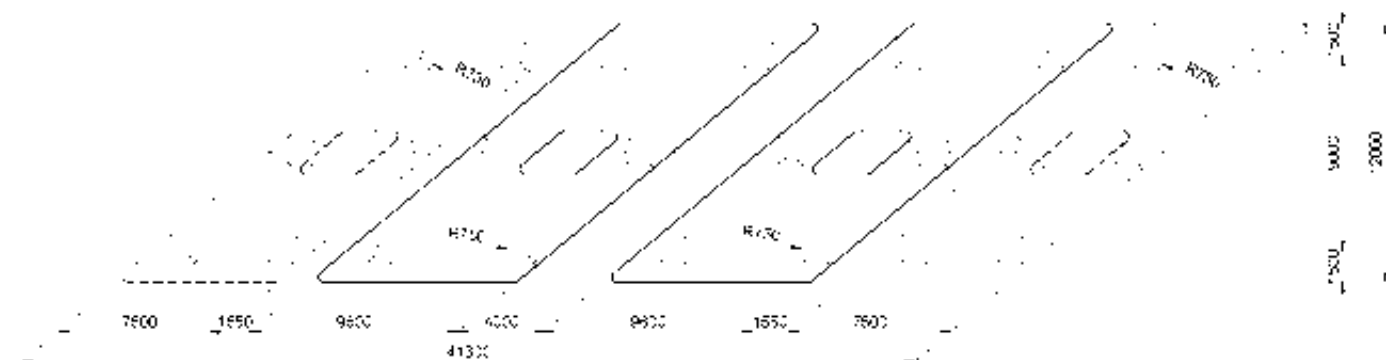
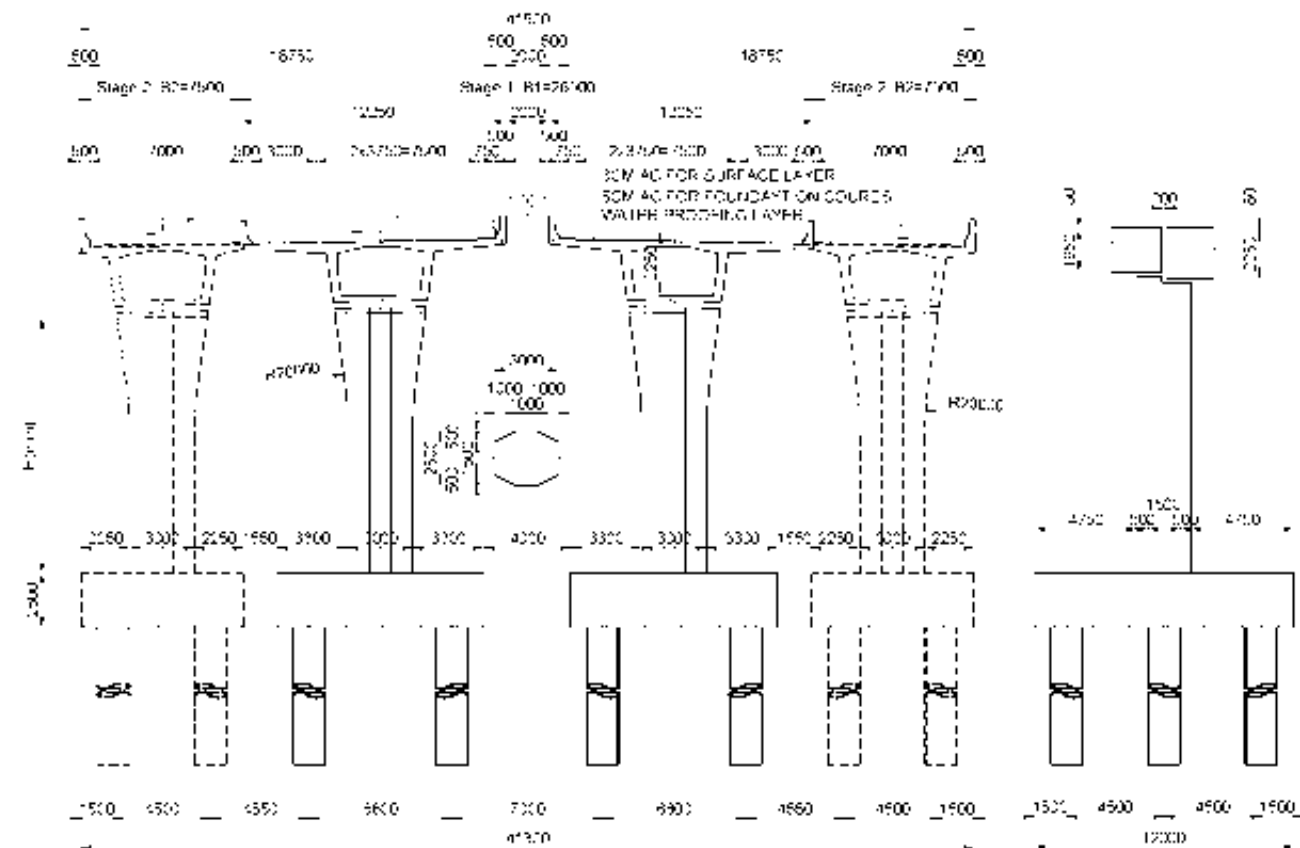
VIETNAM EXPRESSWAY CORPORATION (VEC)

DRAWING TITLE: TYPICAL CROSSSECTION OF LONG THIN BRIDGE
MÁI CẮT NGANG ĐƯỜNG NHỎ DẠNG LƯỚI

REV No	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	REL-113
1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2

SCALE:
AS SHOWN

SCALE 30



bioRxiv preprint doi: <https://doi.org/10.1101/000000>; this version posted January 1, 2016. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under aCC-BY-NC-ND 4.0 International license.

KATAHIRA & ENGINEERS INTERNATIONAL

Joint Venture With

ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPROXIMATELY Tim COLLETT

VIETNAM EXPRESSWAY CORPORATION (VEC)

**TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT**

DRAWING TITLE

MÀT CẮT MÃN CỎ ĐỂ NHỎ CHỖ NHỎ HƠN. HÃY

FILE No.	DATE
----------	------

NOV. 2006

1 FEB-2010

DESCRIPTION
1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal.
2. Once a problem is recognized, the next step is to define the problem more precisely. This involves identifying the specific aspects of the problem that need to be addressed.
3. The third step is to analyze the problem. This involves identifying the causes of the problem and the factors that contribute to its persistence.
4. The fourth step is to develop a solution. This involves identifying the resources needed to solve the problem and the steps that need to be taken to implement the solution.
5. The fifth step is to implement the solution. This involves putting the solution into action and monitoring its progress.
6. The sixth step is to evaluate the solution. This involves assessing the effectiveness of the solution and making adjustments as needed.
7. The seventh step is to communicate the results of the solution. This involves sharing the results with the relevant stakeholders and providing feedback on the process.

DRAFT NAL DRAWING

FINAL DRAWING

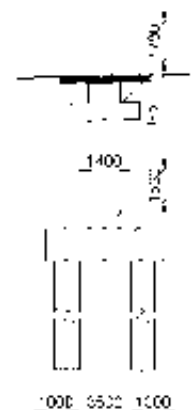
PHARMING & Nu

FR. 12

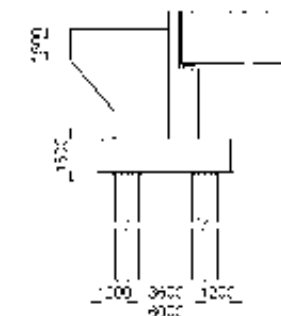
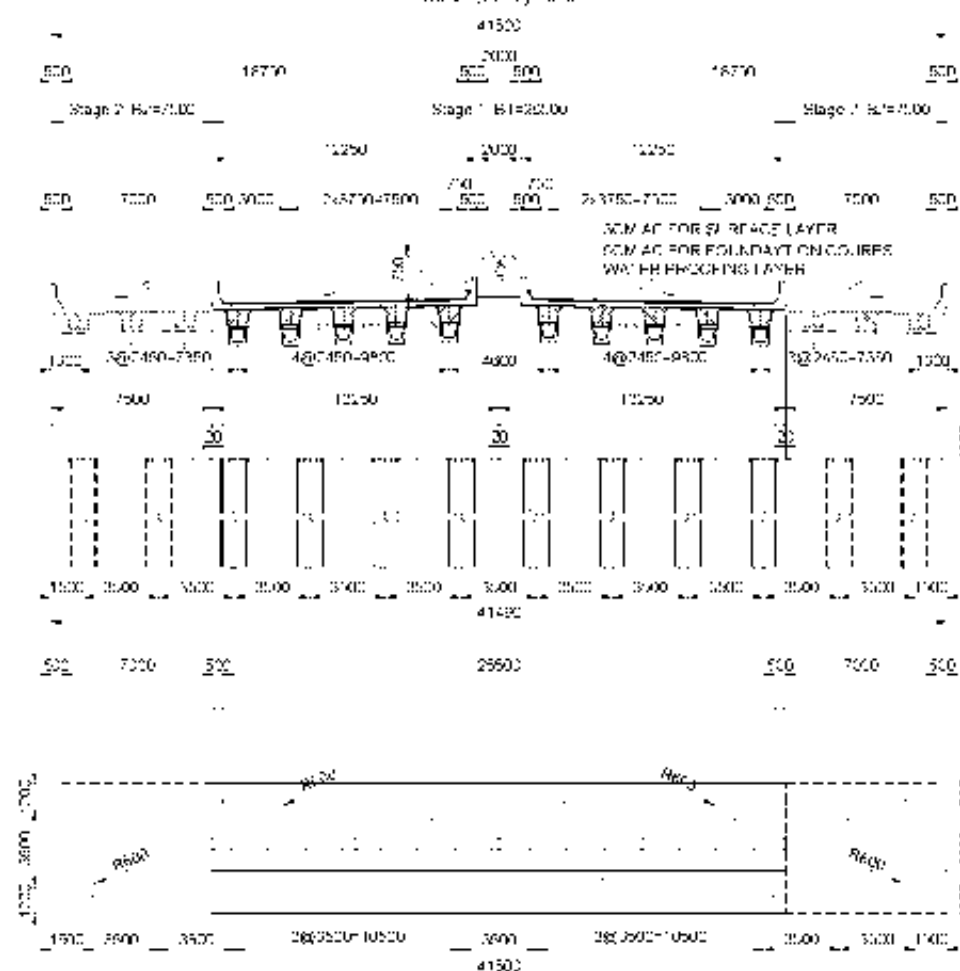
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SCALE :
AS SHOWN

AMERICAN JOURNAL OF MATHEMATICS



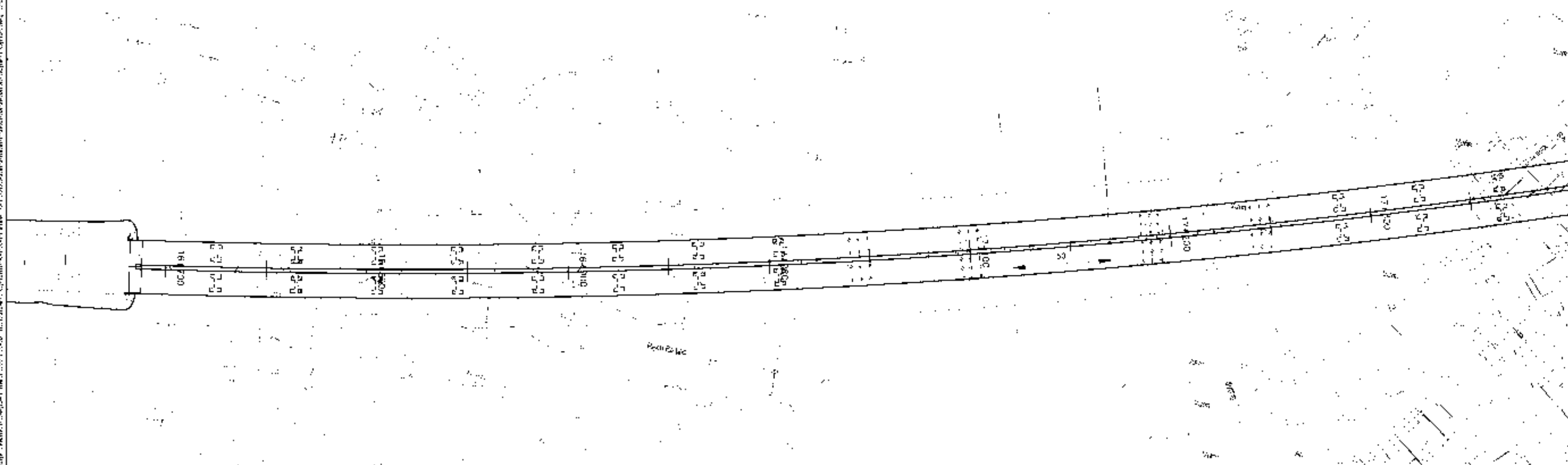
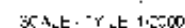
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SCALE :
AS SHOWN

17.BALAO, BINH KHANH, CHA RIVER AND PHUOC KHANH BRIDGE
17.CẦU BÀ LÀO, BÌNH KHÁNH, SÔNG CHÀ VÀ PHƯỚC KHÁNH
KM 16+690 - KM 32+322(OPTION2)

SCM = 1916-1937



PLANTING No. _____

ALTERNATIVE 2

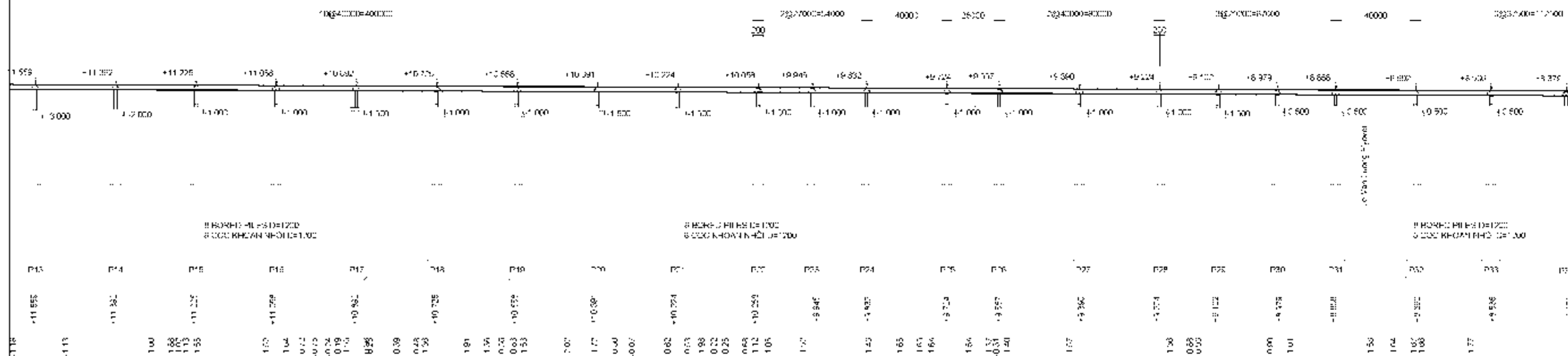
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BEN LUC

LONG THANH

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

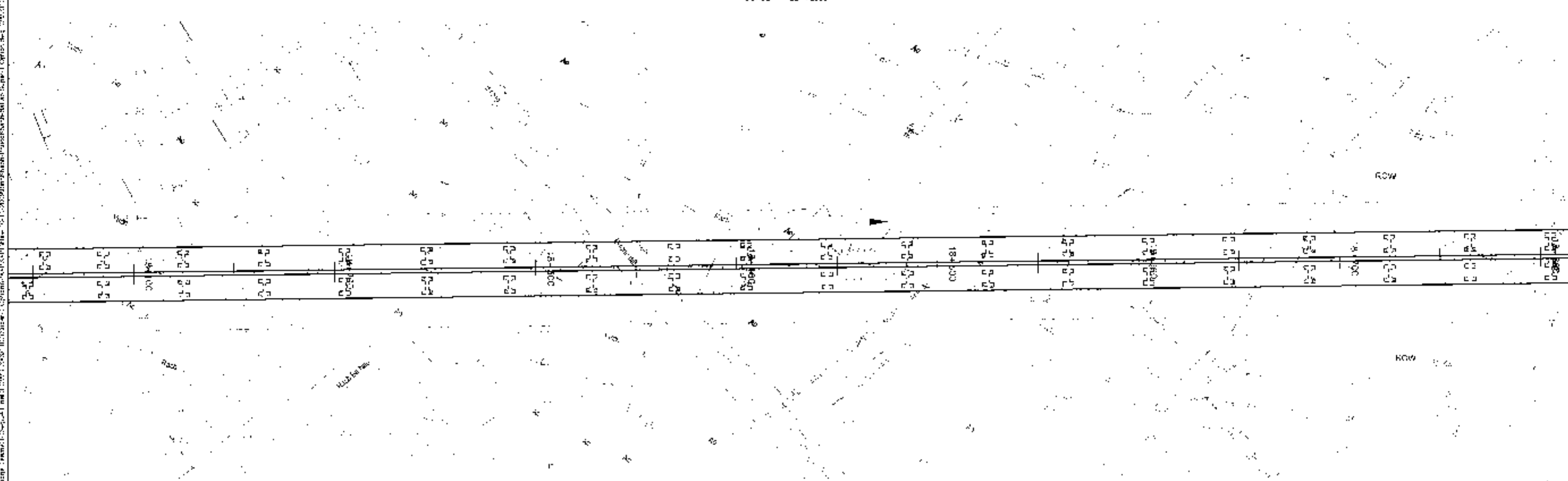
SCALE: 1/1000



SC-11 FILE 10000



JUNE 1995



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TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPROCHES BY **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TITLE

GENERAL YU OF BINH KHANH AND DO LOC KHANH BRIDGE
ĐỒ TRÍ CHUNG CẦU ĐẠY VĨNH GIANG KHANH VÀ PHẠM KHANH

FILE No.	DATE
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NOV. 2005

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

F N&L DRAWING

PLANTING No.

ALTERNATIVE 2

SCALE :

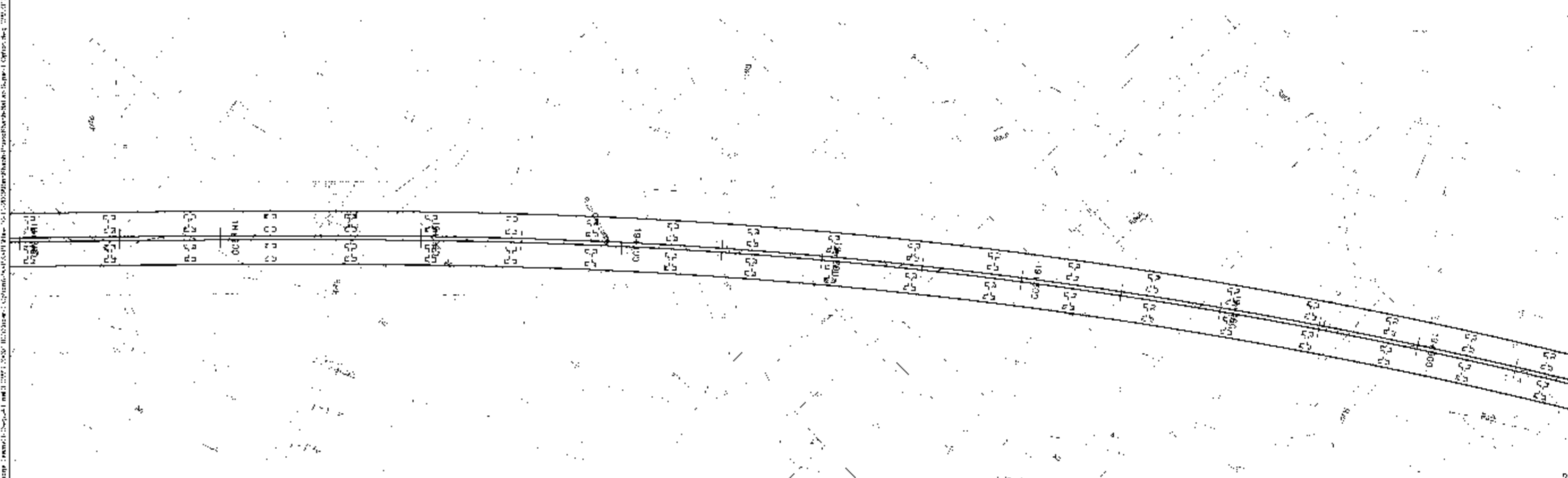
45 % 29th

LONG THANH

SCS-2 YLE 1999



JUNE 1990



ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

VIETNAM EXPRESSWAY CORPORATION (VEC)

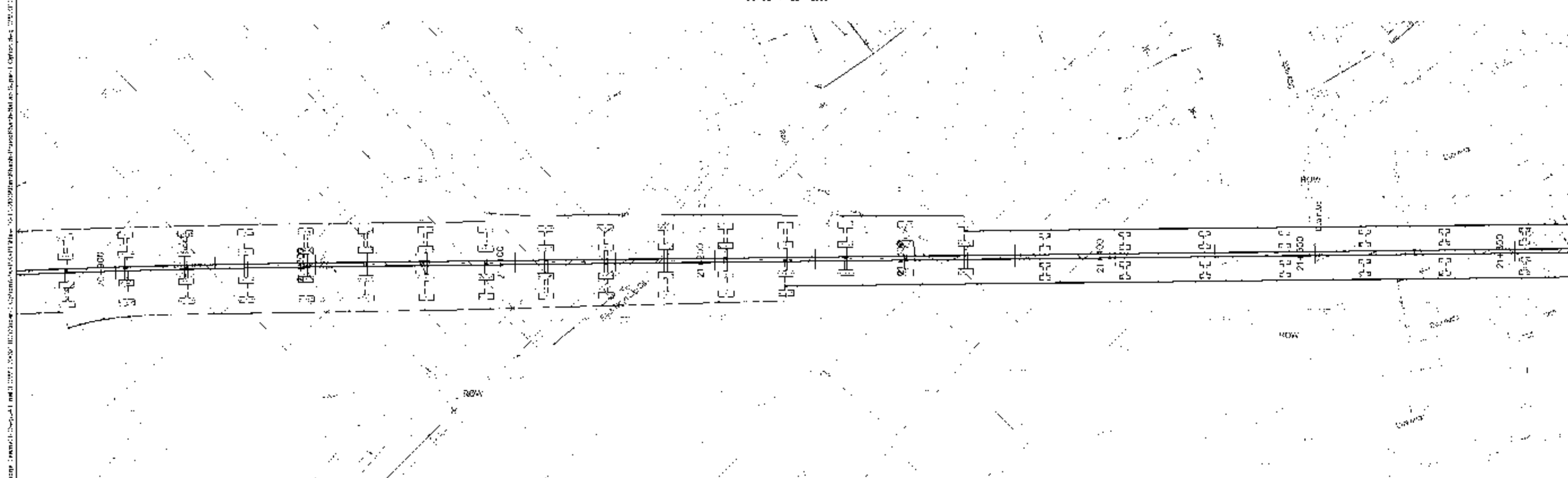
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GENERAL VIEW OF BINH KHANH AND PHU LOC KHANH BRIDGE
BỘ TRƯỞNG CẦU DÂY VANG B. N. KHANH VÀ PHU LOC KHANH

REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	40 BK-FK-1M
1	FEB-2010	FINAL DRAWING	40-ITERATIVE 2
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WILEY-INTERSCIENCE



SEP 27 1999



PLANTING No. _____

Mathematics 2022, 10, 1000

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AG 5-0706

AG 5-0706

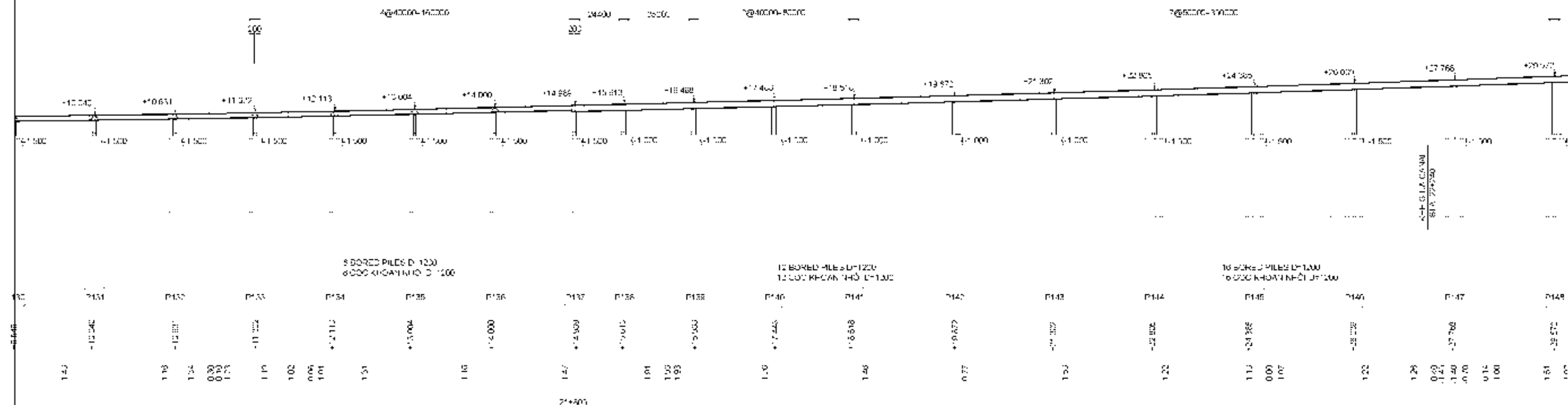
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BEN LUC

LONG THANH

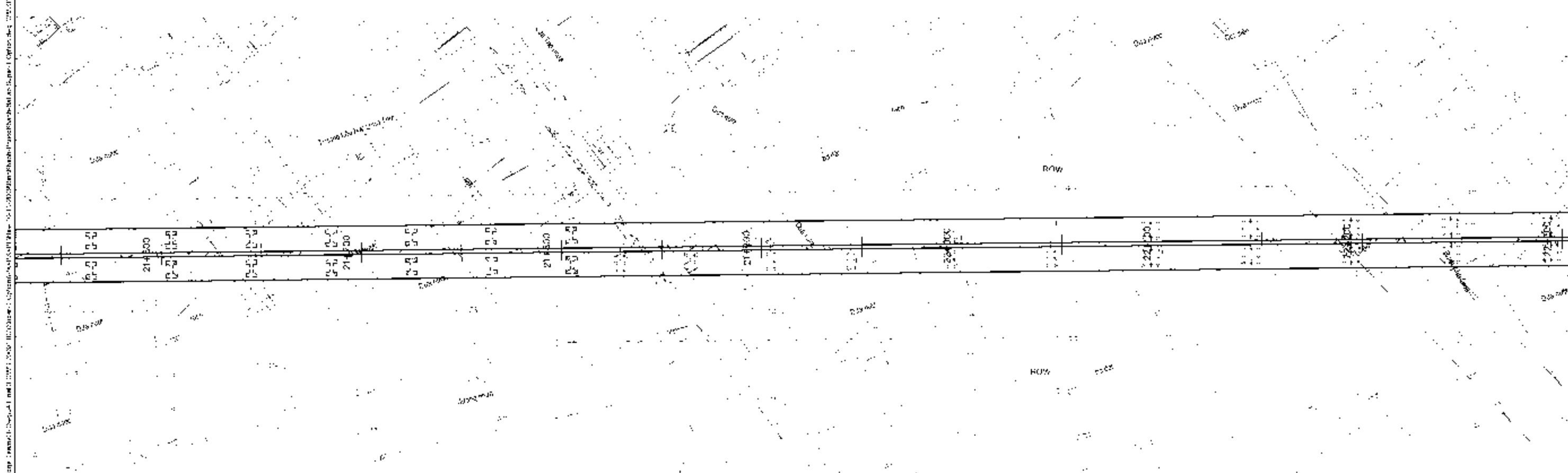
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/1000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



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 In Association With
APECO

TITLE: **VIETNAM EXPRESSWAY CORPORATION (VEC)**
 NAME: **VIETNAM EXPRESSWAY CORPORATION (VEC)**
 PREPARED BY: **Đang Vũ TUYEN**
 CHECKED BY: **Le Ngoc HIEU**
 APPROVED BY: **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

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ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE: **GENERAL VIEW OF BEN KHANH AND PHUOC KHANH BRIDGE**
 BỘ TRƯỞNG CẦU ĐƯỜNG VÀNG BÍNH KHANH VÀ PHUOC KHANH

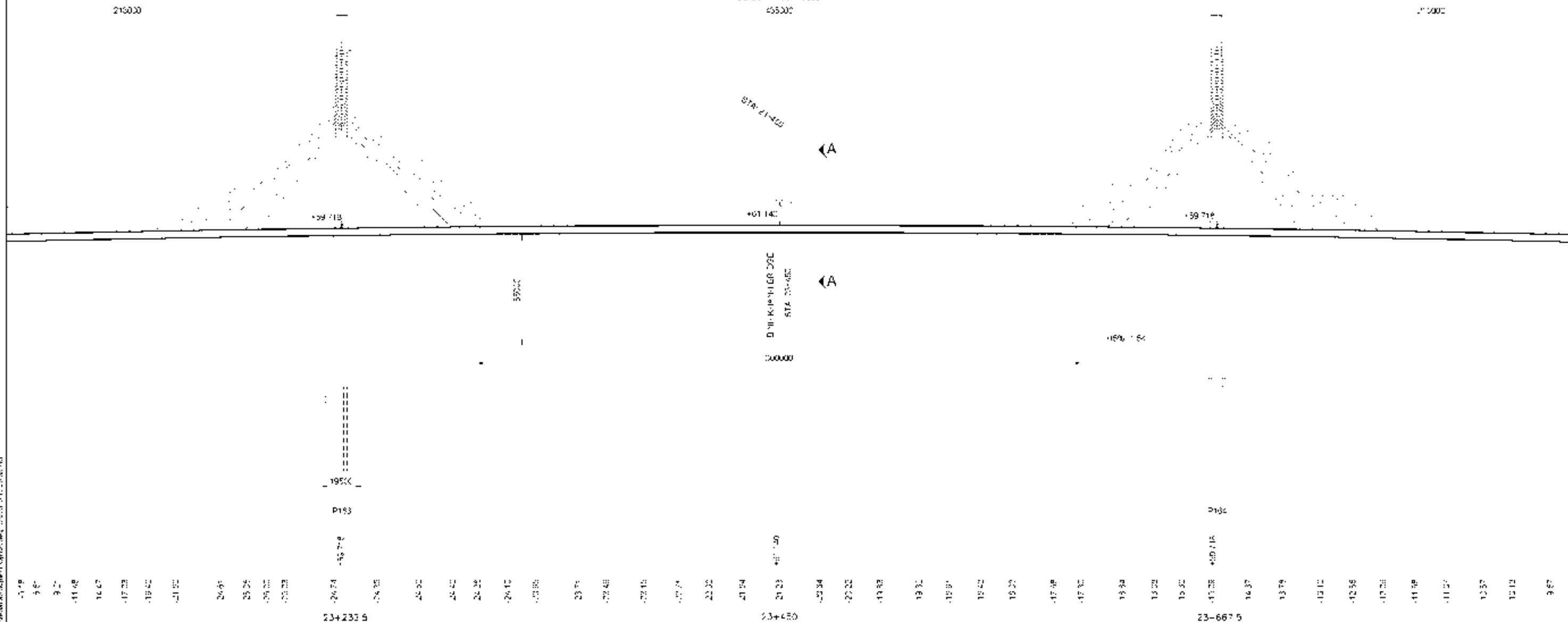
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1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2

SCALE: **AS SHOWN**

PROFILE OF BRIDGE - MẶT CHINH CAU

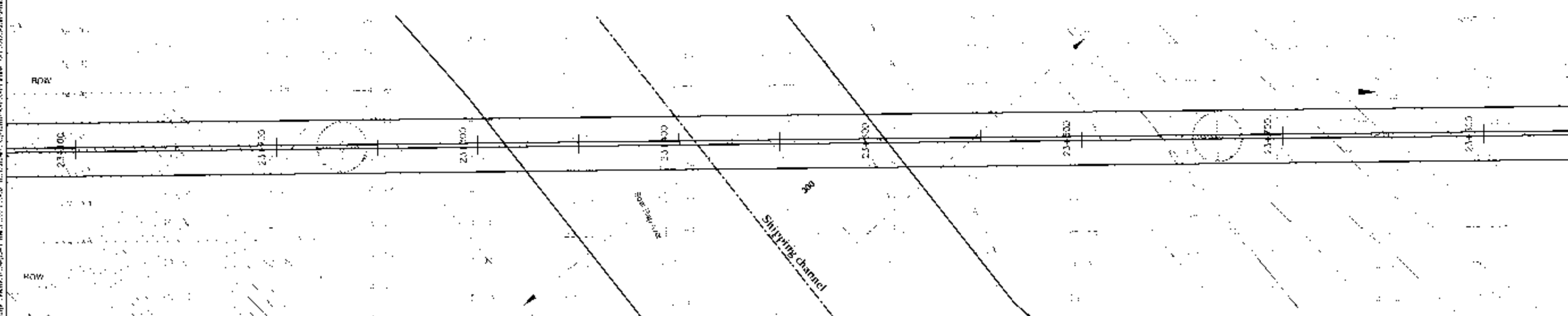
SCALE: 1/1000
 655.200

1/1000



PLAN VIEW OF BRIDGE

SCALE: 1/1000



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TITLE NAME SIGNATURE
 PREPARED BY **Dang Vu TUYEN**
 CHECKED BY **La Ngoc HIEU**
 APPROVED BY **Tim COLLETT**

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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
 GENERAL VIEW OF DINH KIEM AND PHUOC KIEM BRIDGE
 ĐỒ THỊ CHUNG CẦU CAY VẮNG BẾN KIỂM VÀ PHƯỚC KIỂM

REV No	DATE	DESCRIPTION	DRAWING No
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1	FEB-2010	FINAL DRAWING	TA 7155-VIE-2
SCALE:			As shown

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1:1000

LONG THANH

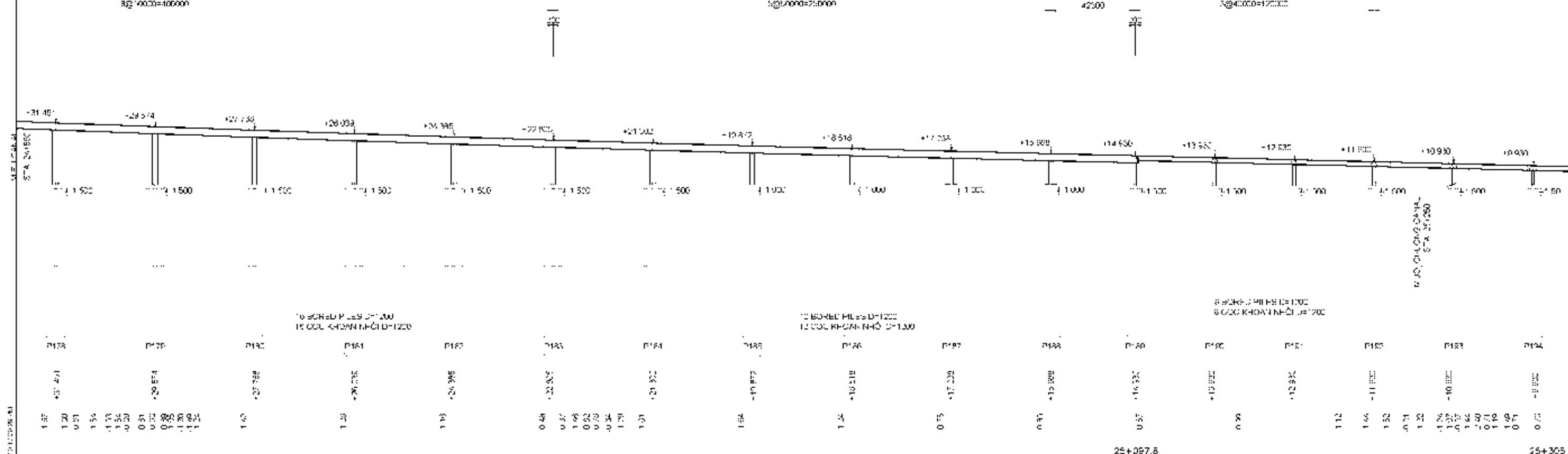
BEN LUC

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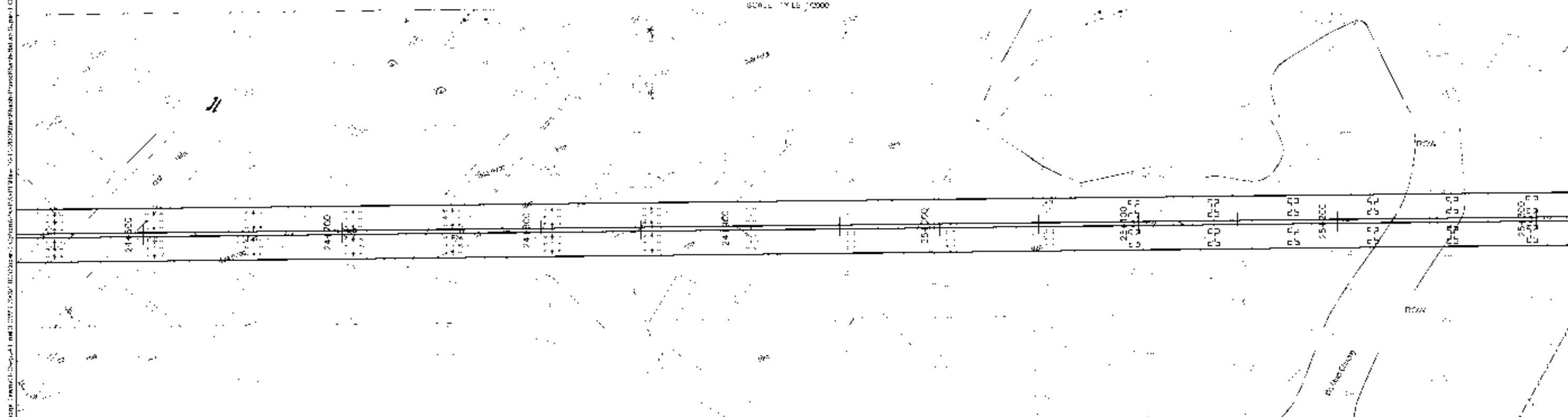
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PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1:2000



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TITLE NAME SIGNATURE
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CHECKED BY **La Ngoc HIEU**
APPROVED BY **Tien COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

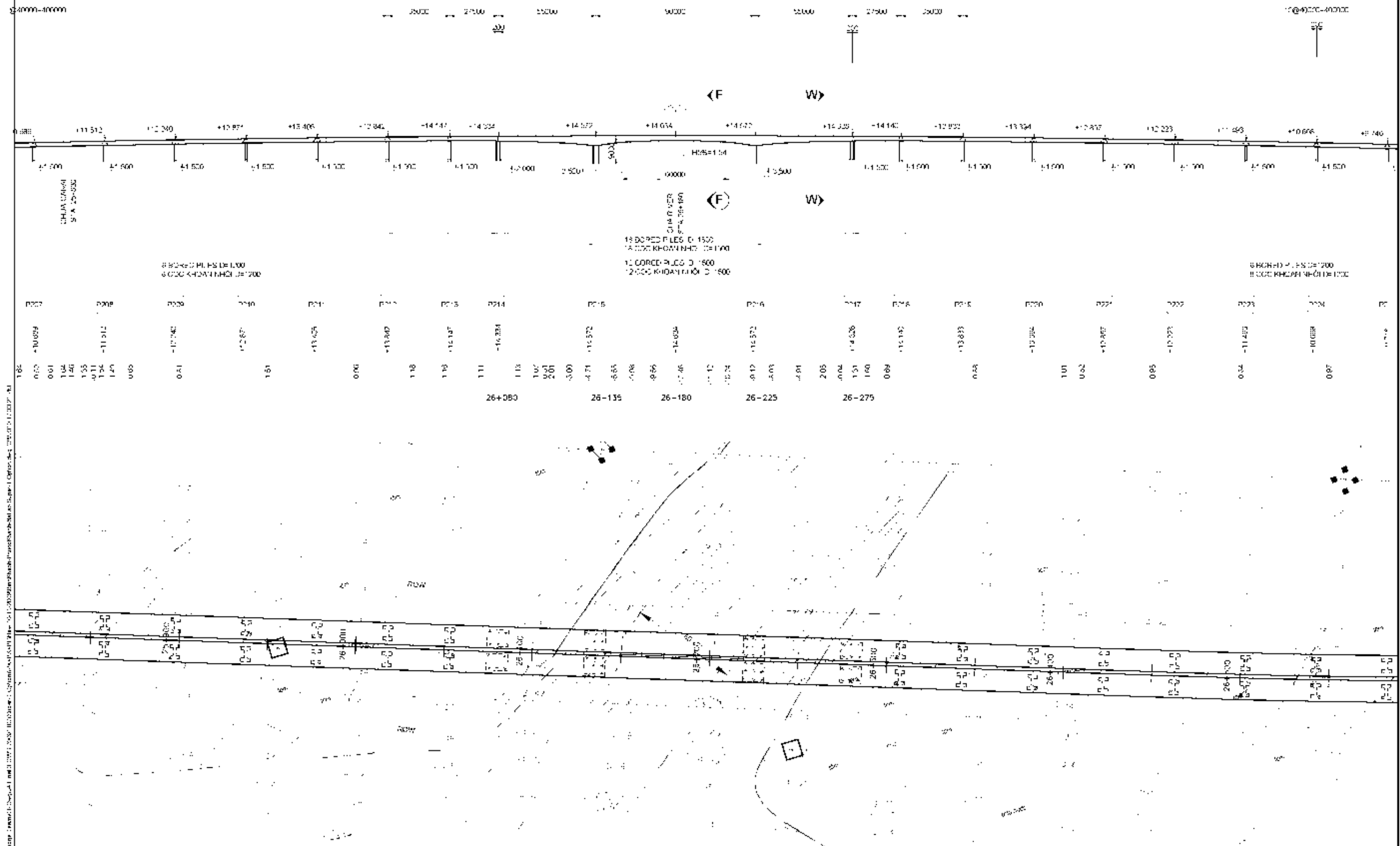
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU ĐÁY VẮNG B. NH. KH. ANH VÀ PH. KH. KH. ANH

REV. No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING DRAWING	NO. KH. KH. ANH
1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2
			SCALE: 1:2000

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE - TỶ LỆ 1/1000



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 CHECKED BY **La Ngoc HIEU**
 APPROVED BY **Tien COLLETT**

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VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
 GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
 ĐỒ THỊ CHUNG CẦU ĐAY VẮNG Ở BÌNH KHANH VÀ PHƯỚC KHANH

REV No	DATE	DESCRIPTION	DRAWING No
0	NOV-2009	DRAWING DRAWING	BRIDGE 12
1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2
			SCALE: 1/1000

BEN LUC

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

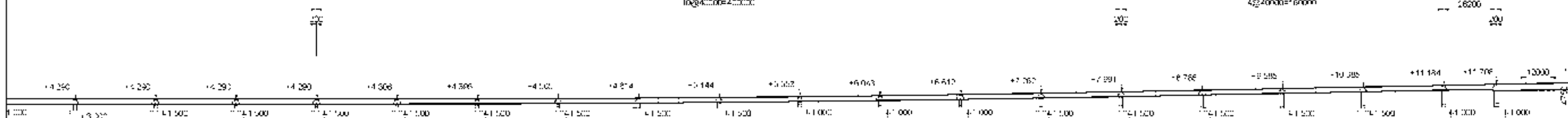
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LONG THANH

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16200

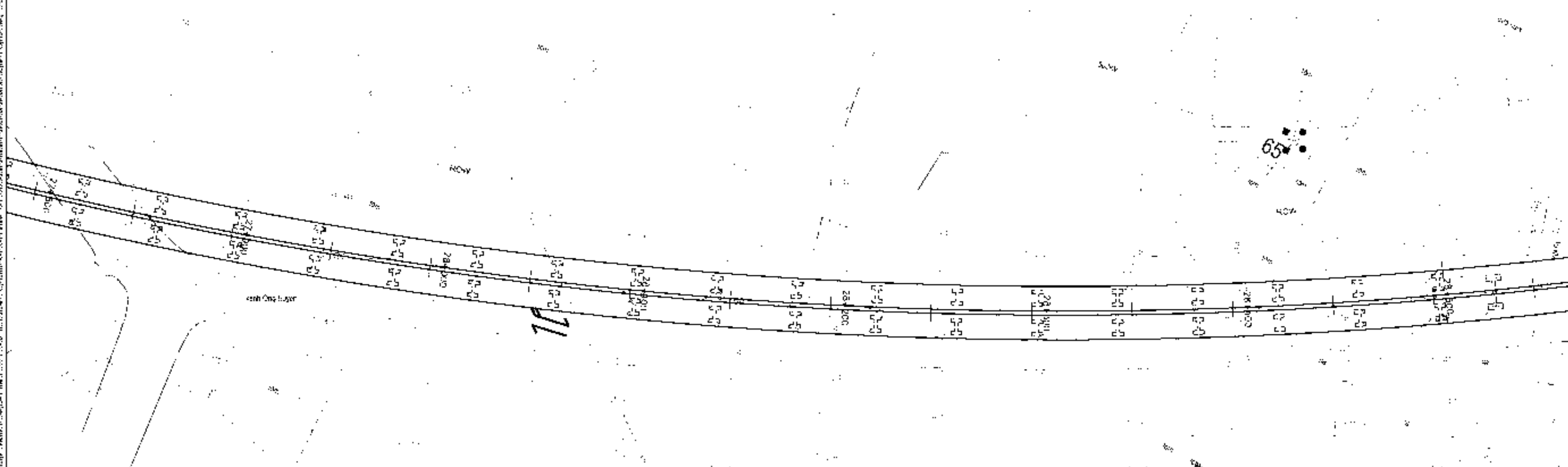
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+4.240	+4.250	+4.260	+4.270	+4.280	+4.290	+4.300	+4.310	+4.320	+4.330	+4.340	+4.350	+4.360	+4.370	+4.380	+4.390	+4.400	+4.410	+4.420
1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29

28+502.8

PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1" = 10'000



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REV. NO. DATE

DESCRIPTION

DRAWING NO.

KATAHIRA & ENGINEERS INTERNATIONAL

TITLE

NAME

SIGNATURE

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT0 NOV-2009
1 FEB-2010DRAFT FINAL DRAWING
FINAL DRAWINGBEN LUC - LONG THANH
ALTERNATIVE 2In Association With
ORIENTAL CONSULTANTS CO., LTD

PREPARED BY: Dang Vu TUYEN

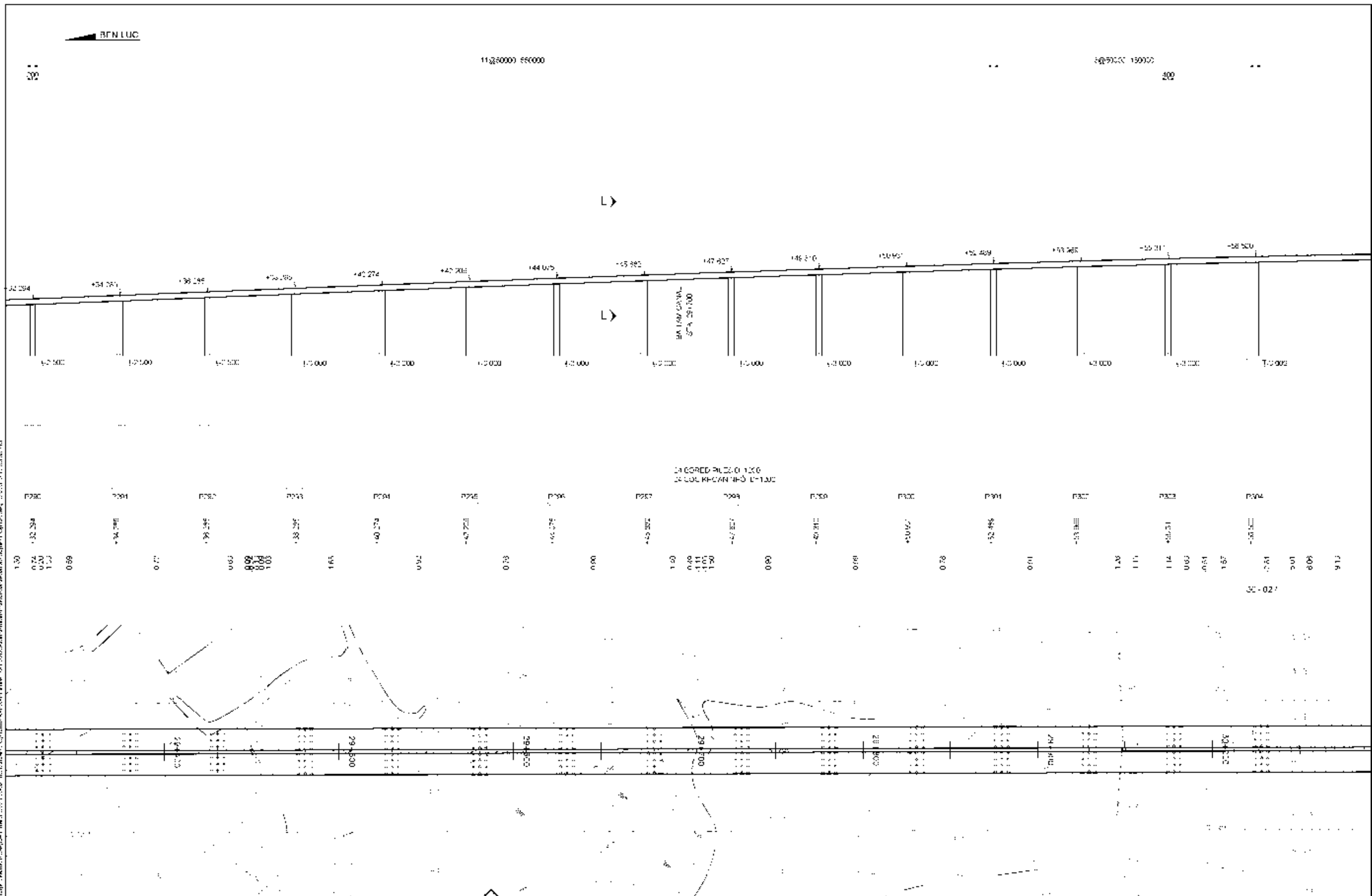
CHECKED BY: La Ngoc HIEU

APPROVED BY: Tim COLLETT

VIETNAM EXPRESSWAY CORPORATION (VEC)

DRAWING TITLE
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU ĐÁY VẮNG BÌNH KHANH VÀ PHƯỚC KHANHSCALE:
AS SHOWN

\\FS-01\DATA\PROJECTS\TA 7155-VIE\2010\BEN LUC\BEN LUC - LONG THANH\BEN LUC - LONG THANH - GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE

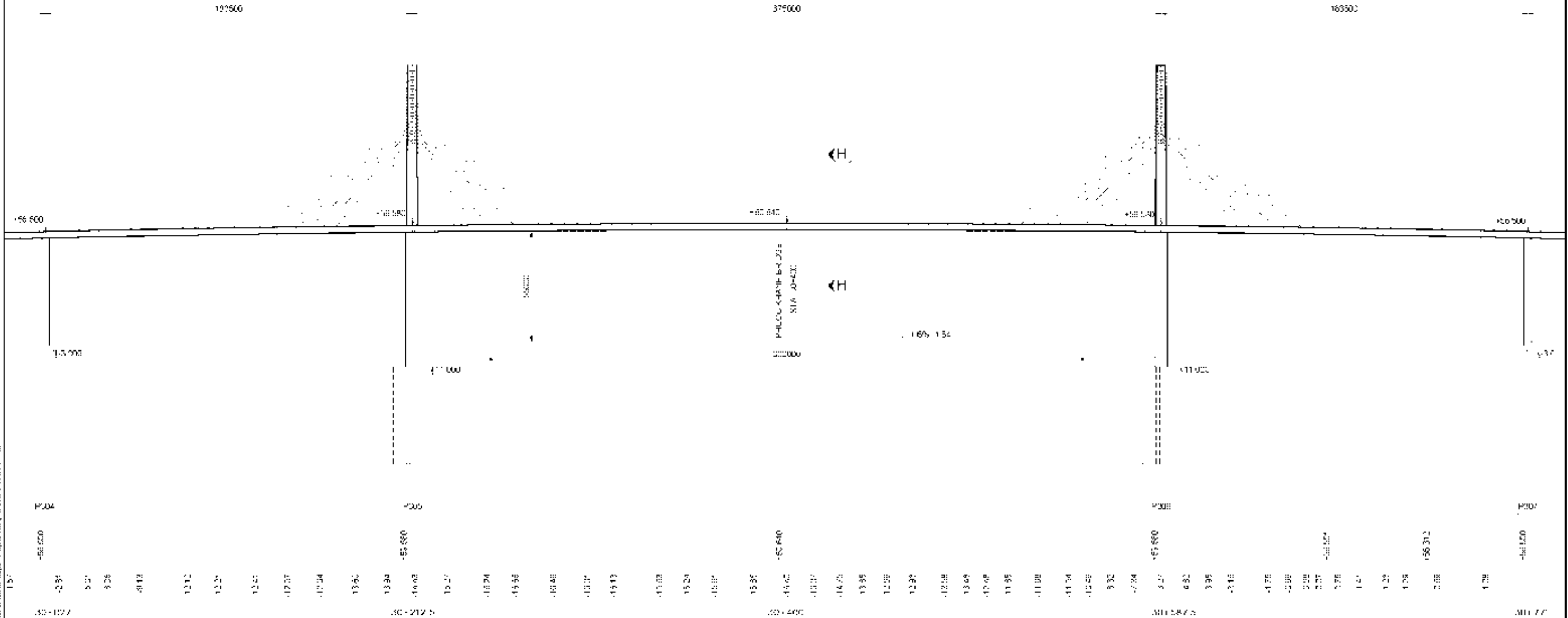


CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL			VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAWING NO.	H10-KPK-17-01
Joint Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2
In Association With APECO							DRAWING TITLE			
							GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE			
							ĐỒ TRÍ CHUNG CẦU DÂY VĂNG BÍNH KHANH VÀ PHƯỚC KHANH			
							SCALE:			
							AS SHOWN			

TITLE	NAME	SIGNATURE
PREPARED BY	Dang Vu TUYEN	
CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tim COLLETT	

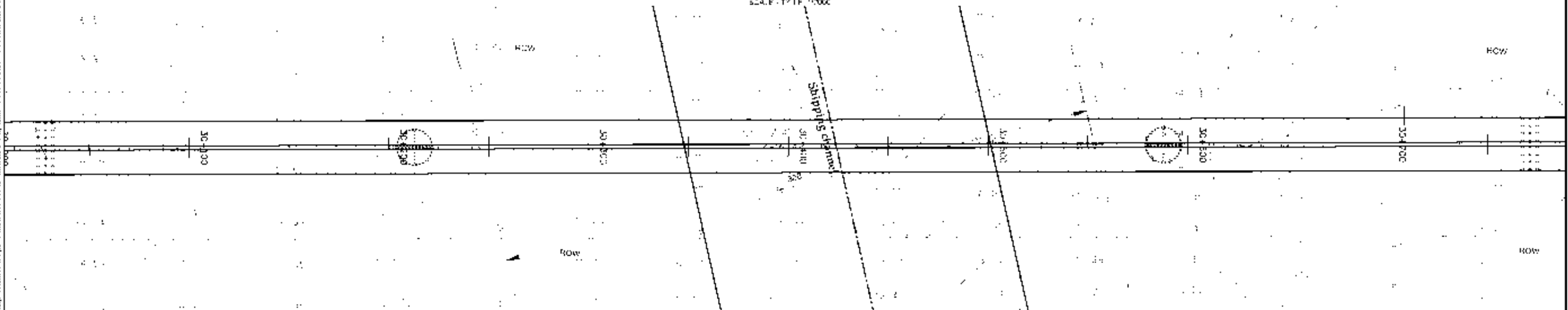
PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1:100
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PLAN VIEW OF BRIDGE

SCALE: 1:1000



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TITLE NAME SIGNATURE
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CHECKED BY **La Ngoc HIEU**
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SOCIALIST REPUBLIC OF VIETNAM

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ASIAN DEVELOPMENT BANK

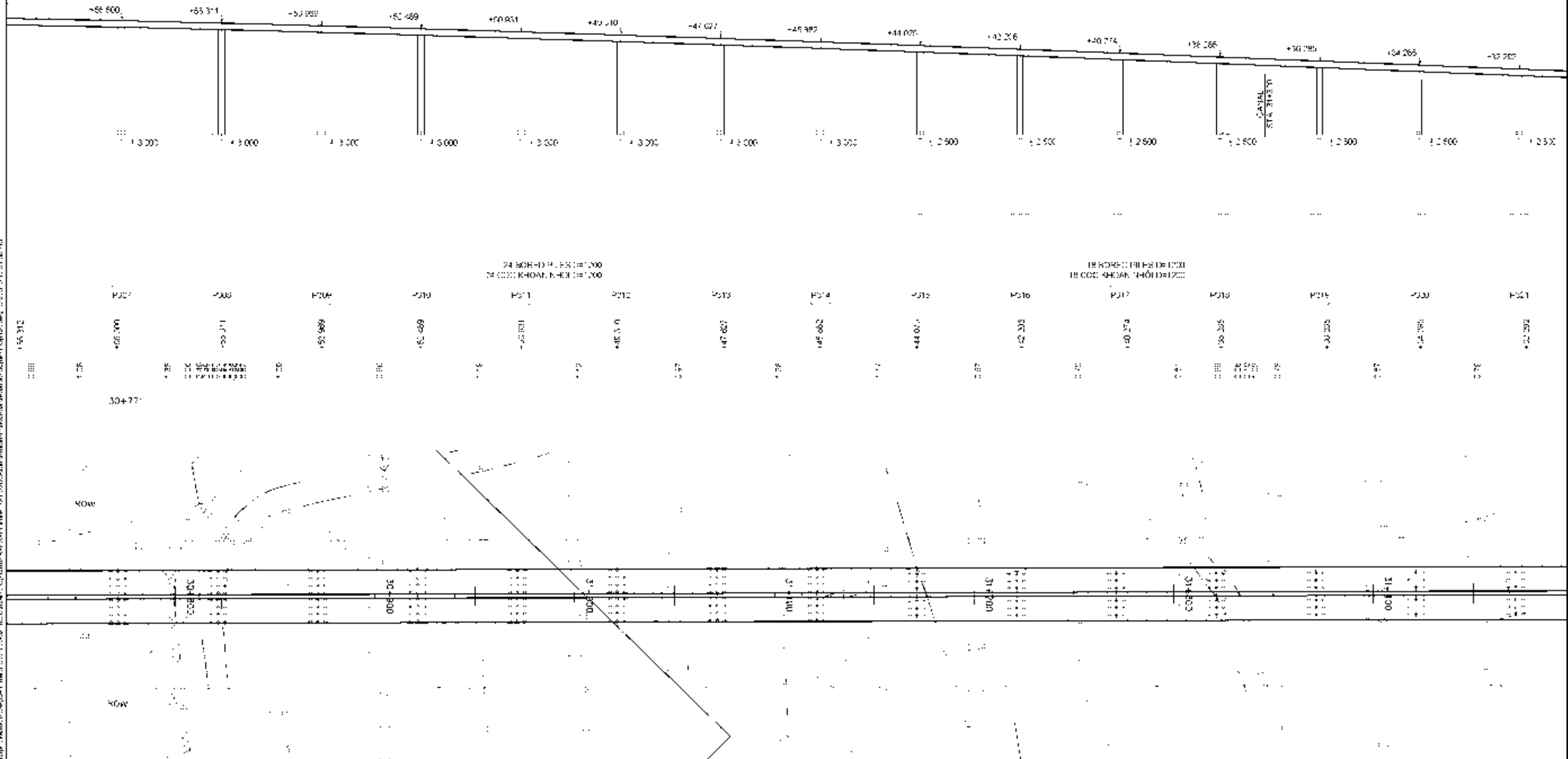
TA 7155-VI: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ THỊ CHUNG CẦU ĐÁY VẮNG B. NH. KH. ANH VÀ PH. KH. KH. ANH

REV. No.	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAWING DRAWING	40-KH-KH-1-002
1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2
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82510000=400000



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TITLE

NAME

SIGNATURE

PREPARED BY: Dang Vu TUYEN

CHECKED BY: La Ngoc HIEU

APPROVED BY: Tim COLLETT

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VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
ĐỒ TRÍ CHUNG CẦU ĐÁY VẮNG BÍNH KHANH VÀ PHƯỚC KHANH

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAFT FINAL DRAWING

FINAL DRAWING

DRAWING No.

RD BK-PK-17403

ALTERNATIVE 02

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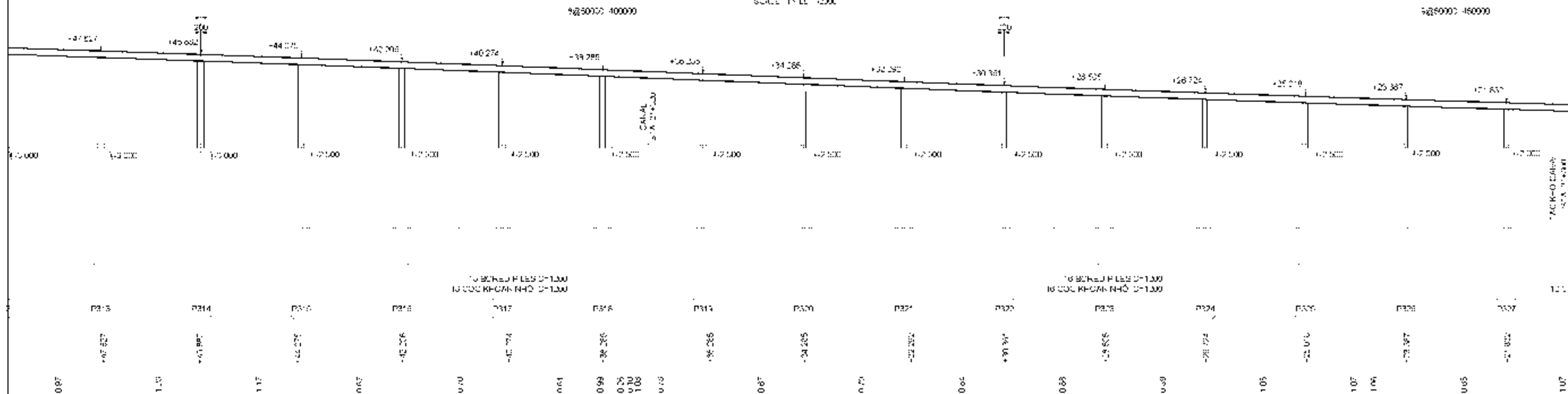
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PROFILE OF BRIDGE - MẶT CHÍNH CẦU

SCALE: 1/100

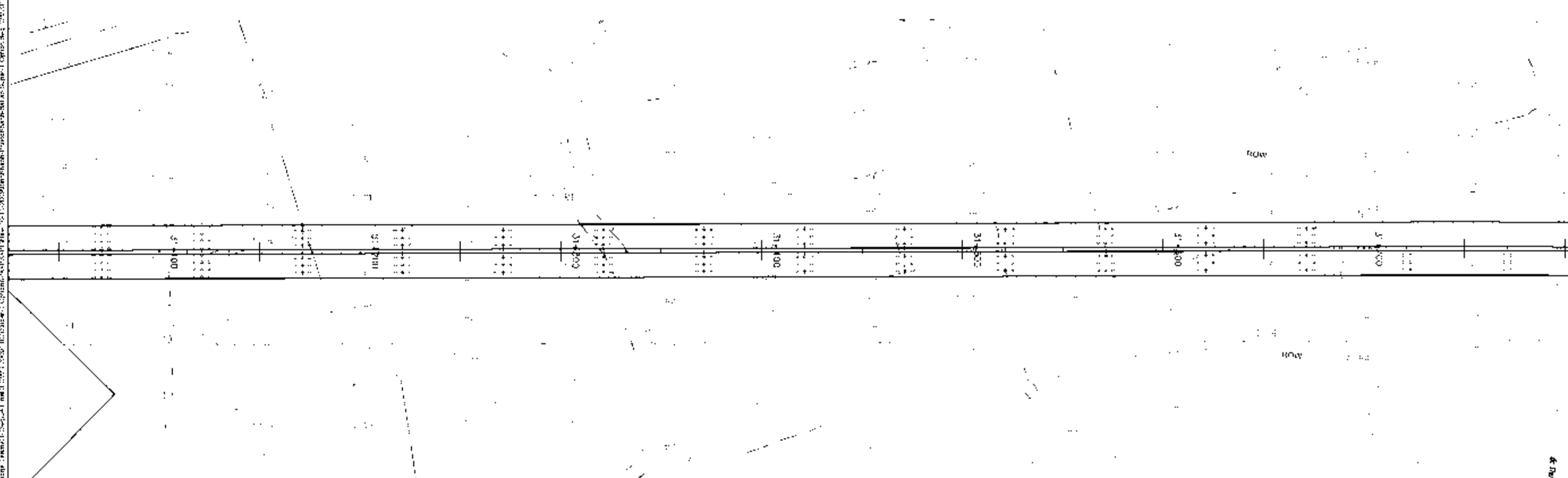
LONG THANH

5+250000 450000



PLAN VIEW - MẶT BẰNG CẦU

SCALE: 1/1000



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TITLE NAME SIGNATURE
 PREPARED BY **Dang Vu TUYEN**
 CHECKED BY **La Ngoc HIEU**
 APPROVED BY **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

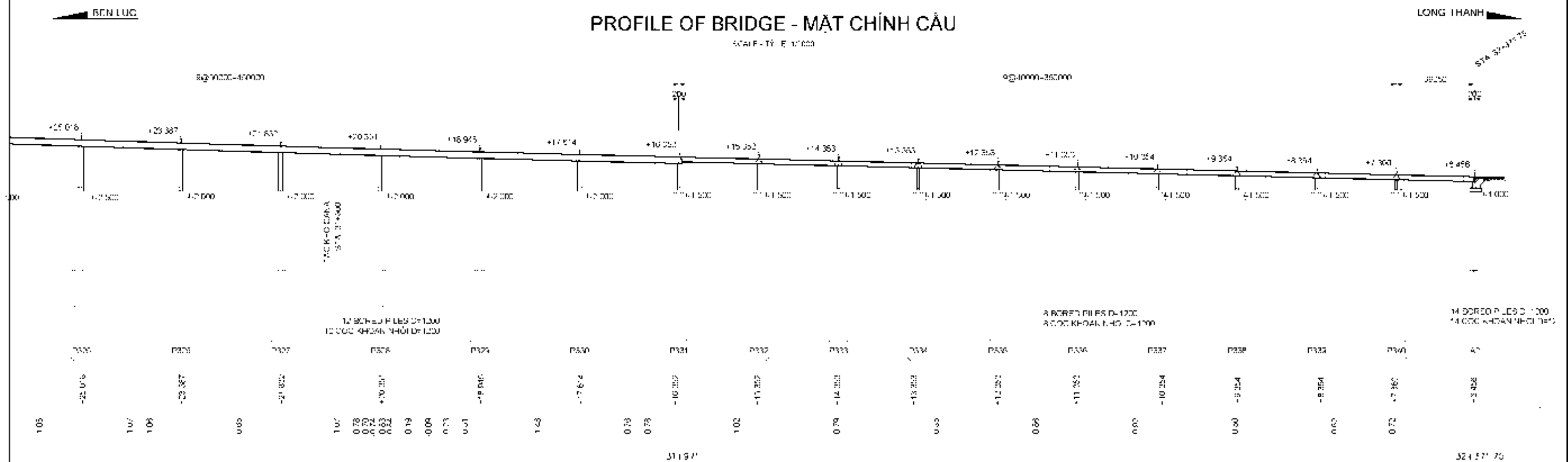
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
 GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE
 ĐỒ THỊ CHUNG CẦU DÂY VẮNG BÌNH KHANH VÀ PHƯỚC KHANH

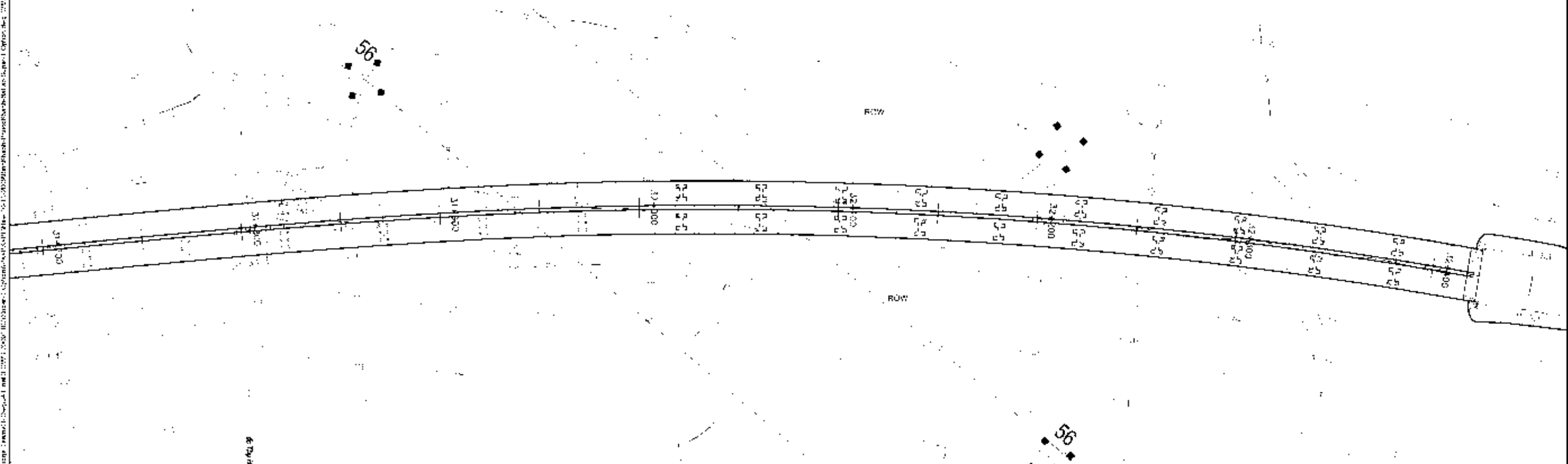
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1	FEB-2010	FINAL DRAWING	MT-7155-VIE-2

SCALE: 1/1000

\\F01H01\BEN\PROJECTS\TA 7155-VIE\TA 7155-VIE-VE\DRAWING\TA 7155-VIE-VE-01\TA 7155-VIE-VE-01.DWG



PLAN VIEW - MẶT BẰNG CẦU
SCALE: 1:500



CONSULTANT			SOCIALIST REPUBLIC OF VIETNAM		ASIAN DEVELOPMENT BANK		REV. No.	DATE	DESCRIPTION	DRAWING No.
KATAHIRA & ENGINEERS INTERNATIONAL			VIETNAM EXPRESSWAY CORPORATION (VEC)		TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT		0	NOV-2009	DRAFT FINAL DRAWING	01-KK-01
Joint Venture With ORIENTAL CONSULTANTS CO., LTD							1	FEB-2010	FINAL DRAWING	01-KK-02
In Association With APECO										SCALE: 1:500
TITLE	NAME	SIGNATURE			DRAWING TITLE					
PREPARED BY	Dang Vu TUYEN				GENERAL VIEW OF BINH KHANH AND PHUOC KHANH BRIDGE					
CHECKED BY	La Ngoc HIEU				ĐỒ THỊ CẦU ĐÁY VẮNG Ở BÌNH KHANH VÀ PHƯỚC KHANH					
APPROVED BY	Tim COLLETT									

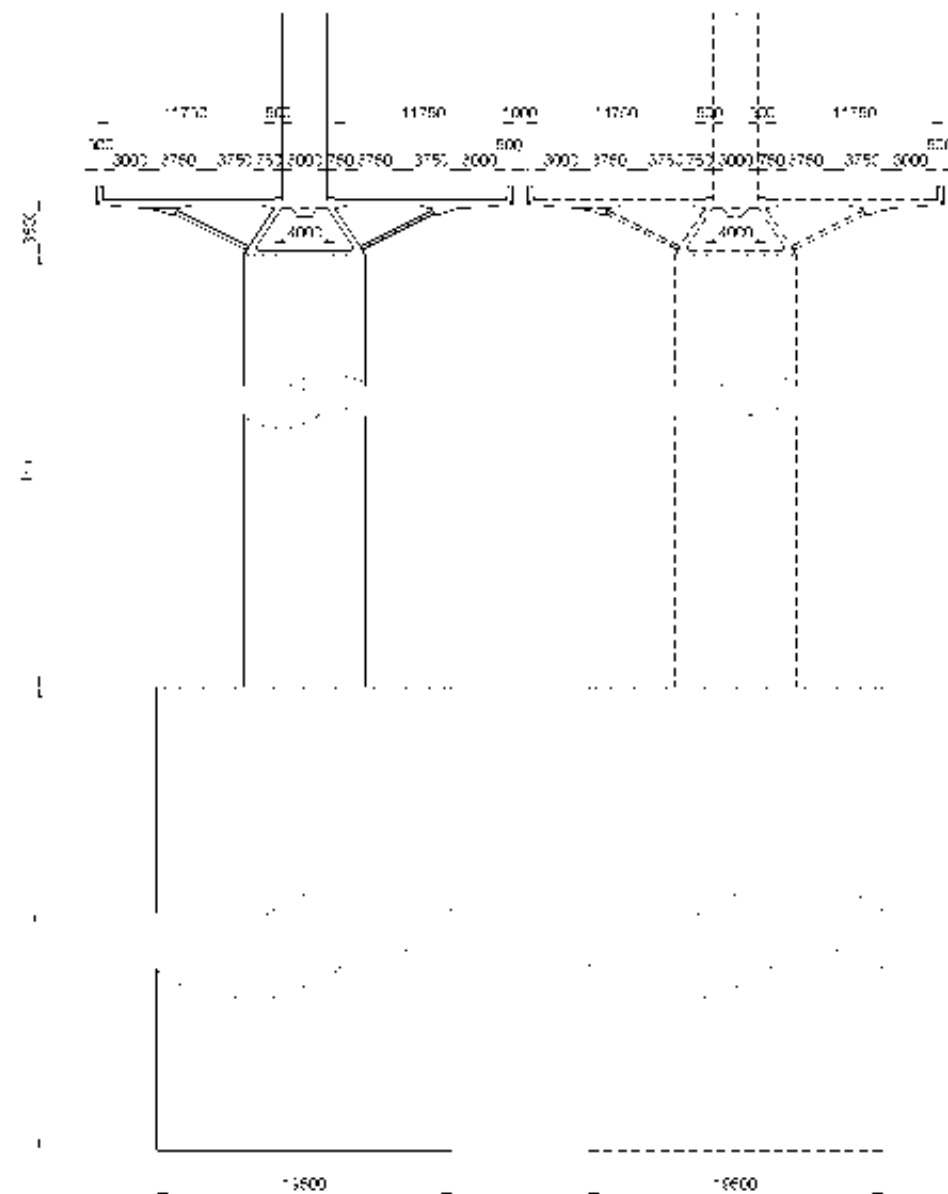
SCM 100

STAGE I

STAGE 2

Center Line
Of Expressway

CL
Final Stage



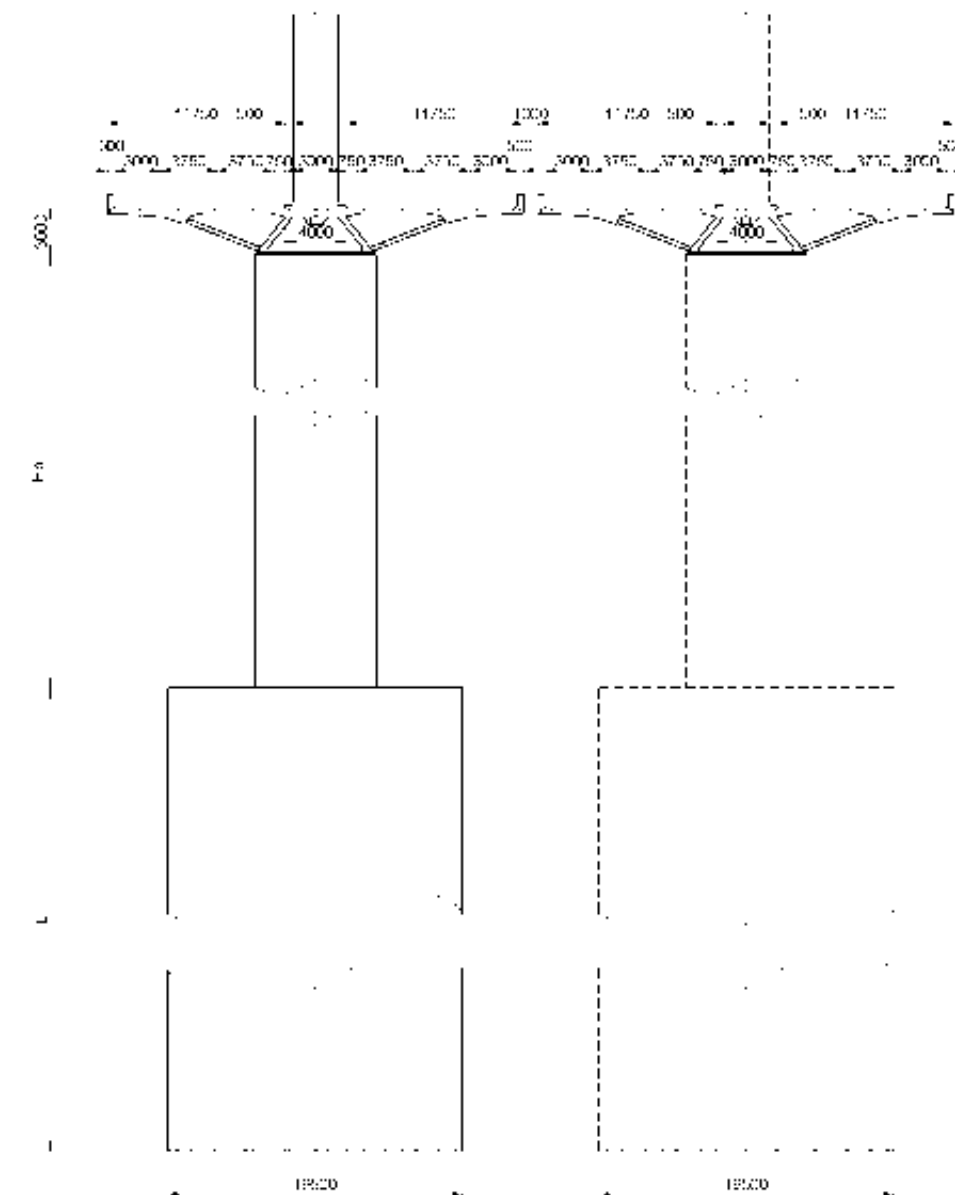
52641-4 100

STAGE I

STAGE 2

Center Line
Of Expressway

CL Final Stage



APECO

APPENDICES

APPROVED BY: Tim COLLETT

VIETNAM EXPRESSWAY CORPORATION (VEC)

DRAWING TITLE
TYPICAL CROSS SECTION OF CABLE STAYED BINH KHANH - PHUOC KHANH BRIDGE
MẶT CẮT NGANG CỦA CẦU BÌNH KHÁNH - PHƯỚC KHÁNH

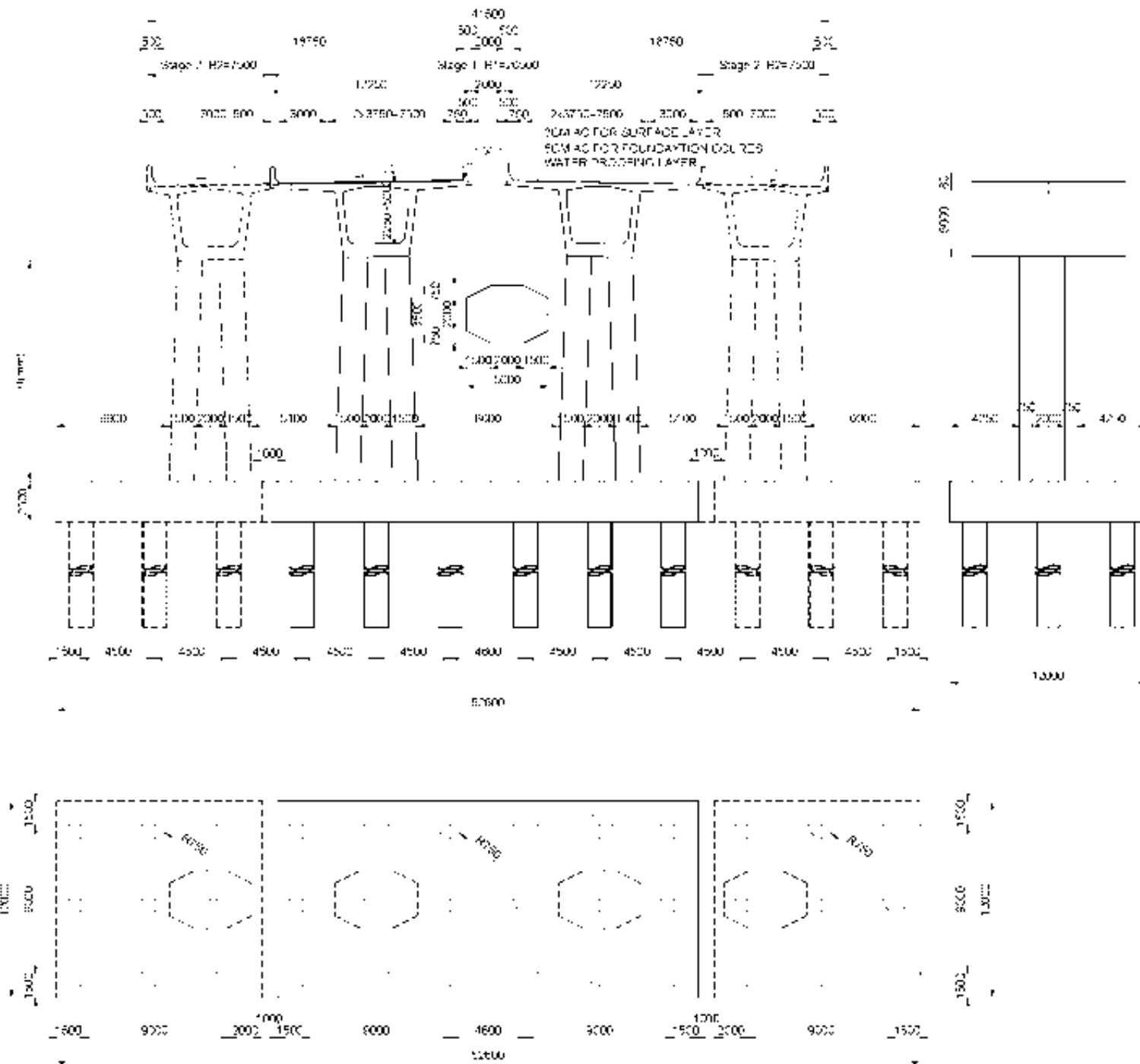
1 FEB-2010

FINAL DRAWING

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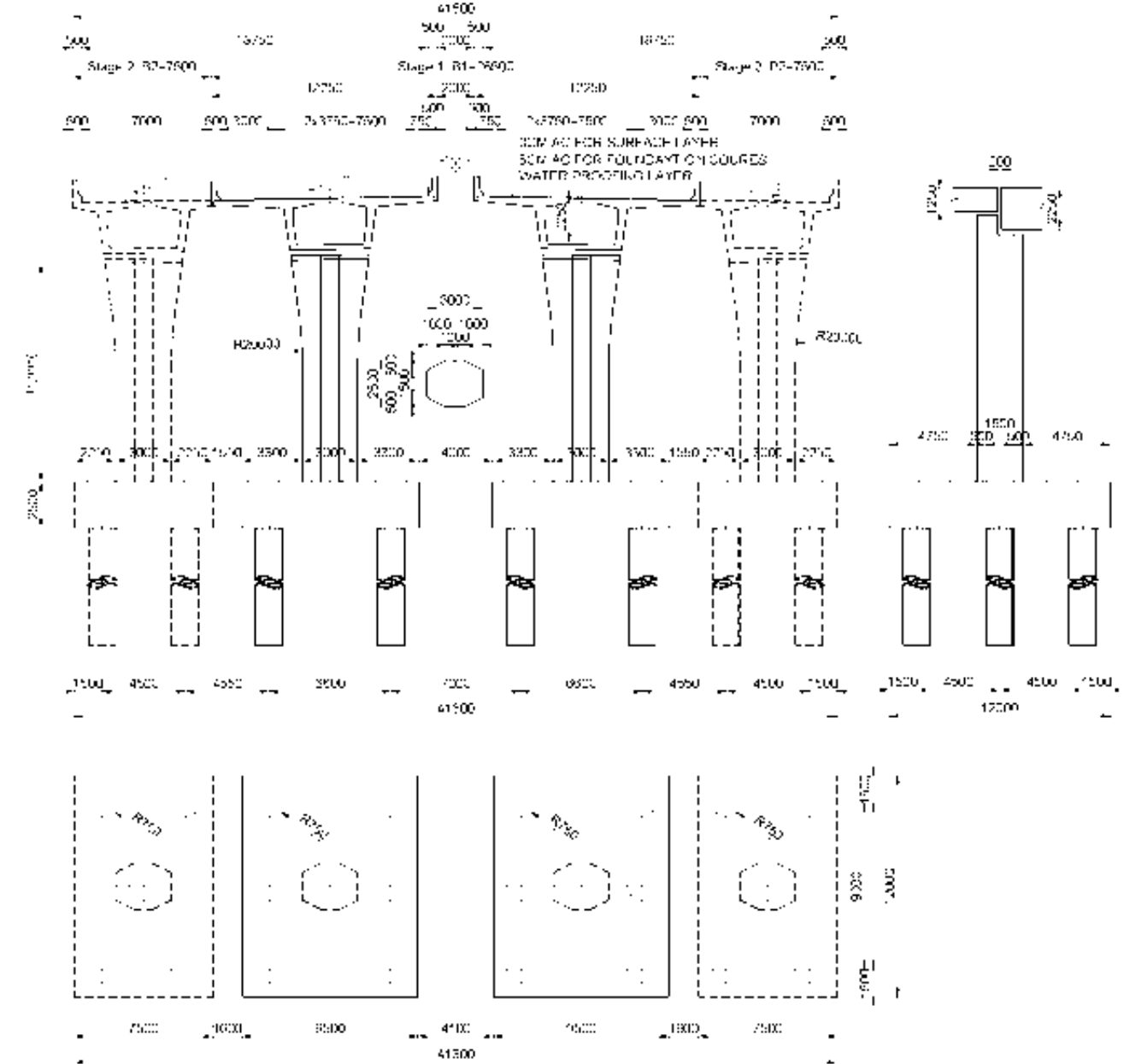
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56.9 1.50



SECTION (MAY CAT) K-K, W-W

Page 135



Journal of the American Statistical Association, 1998, Vol. 93, No. 443C, pp. 1218-1230
 DOI: 10.2307/1164790

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Leont Vanuren with

ORIENTAL CONSULTANTS CO., LTD.

In Association With

ΔΡΕΣΟ

TITLE

PLATE 1

SONA TIRE

PREPARED BY David S. JAMES

CHECKED BY: La Mox HIRU

REPORTS BY **Tom COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-ME: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE
TYPICAL CROSS SECTION OF CABLE STAYED BINH KHANH - PHUOC KHANH BRIDGE
MẶT CẮT VÀNG CẮT CỦA CẦU BÌNH KHÁNH - PHƯỚC KHÁNH

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FEB 24 1964

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FINAL DESIGN

PRINTING NO.

2010年6月

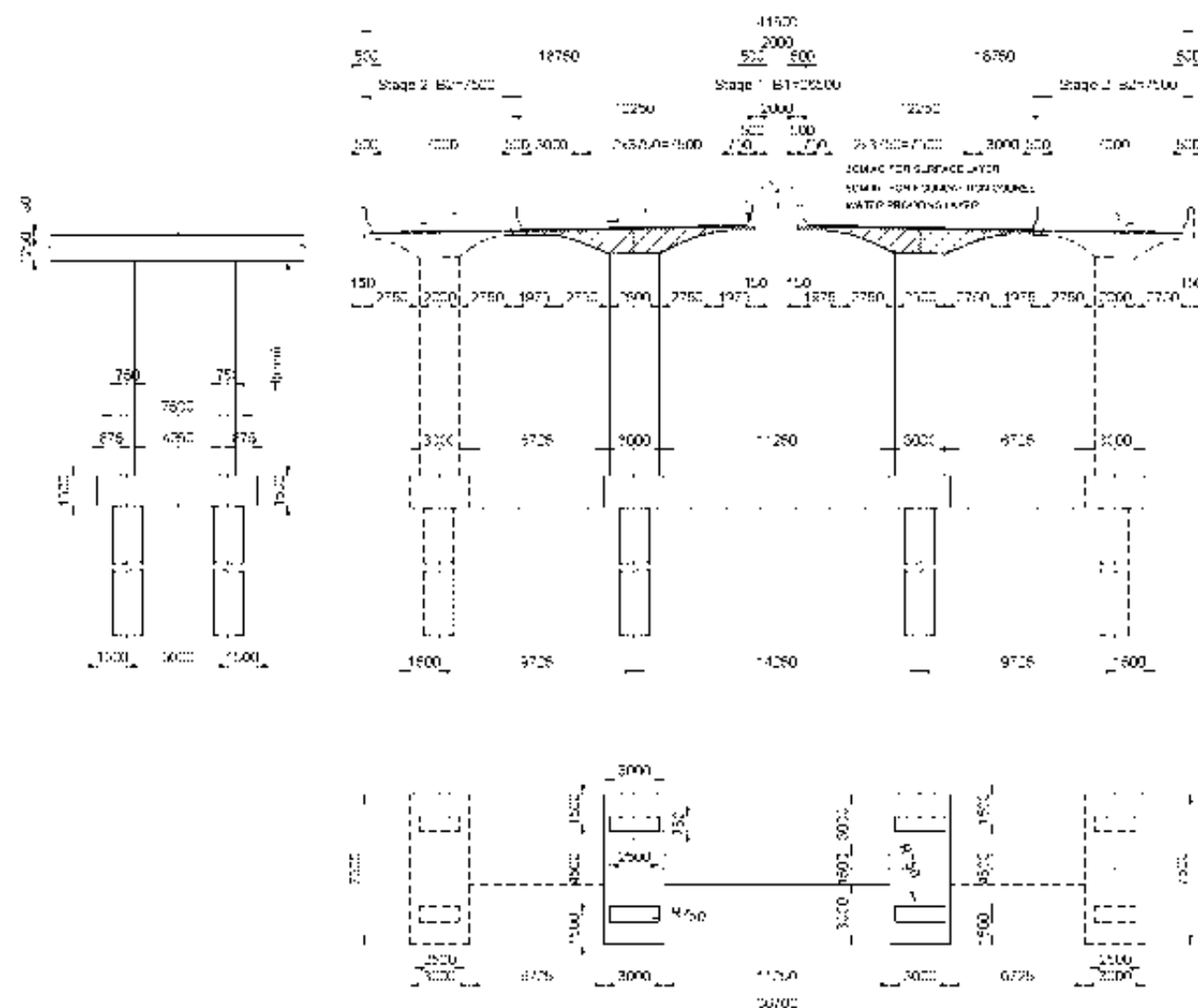
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AS SHOWN

KATAHIRA & ENGINEERS INTERNATIONAL CO., LTD. (K&E) is a member company of the K&E Group, which is a member company of the K&E Group. K&E is a member company of the K&E Group, which is a member company of the K&E Group.

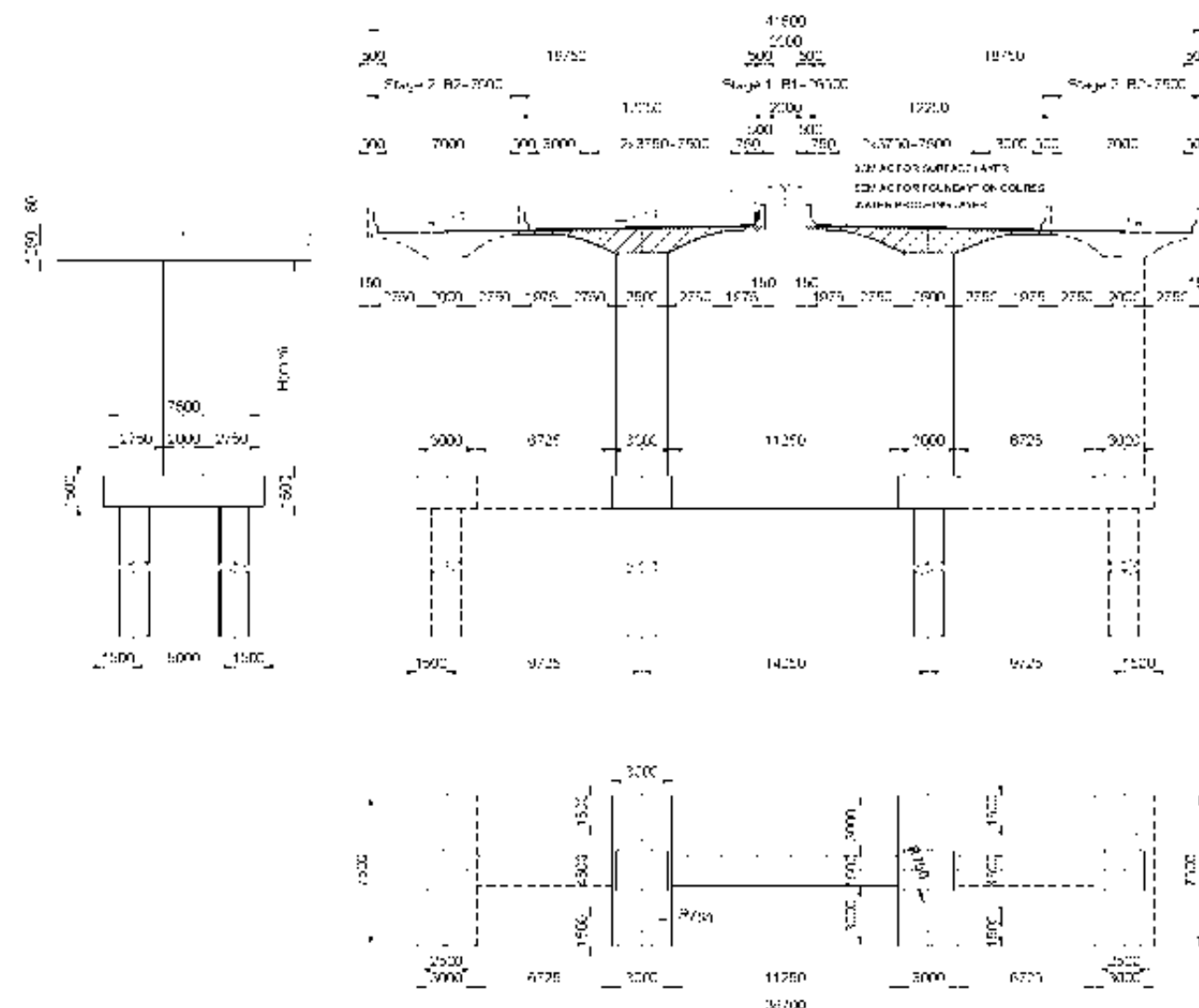
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SCALE 1:50



SECTION C-C - MẶT CẮT C-C

SCALE 1:350



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TITLE
 PREPARED BY: **Dang Vu TUYEN**
 CHECKED BY: **La Ngoc HIEU**
 APPROVED BY: **Tien COLLETT**

NAME
 SIGNATURE

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

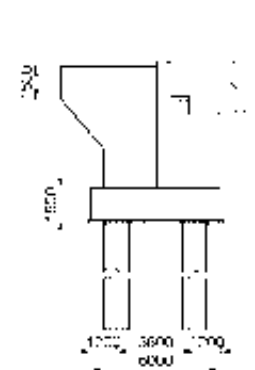
ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

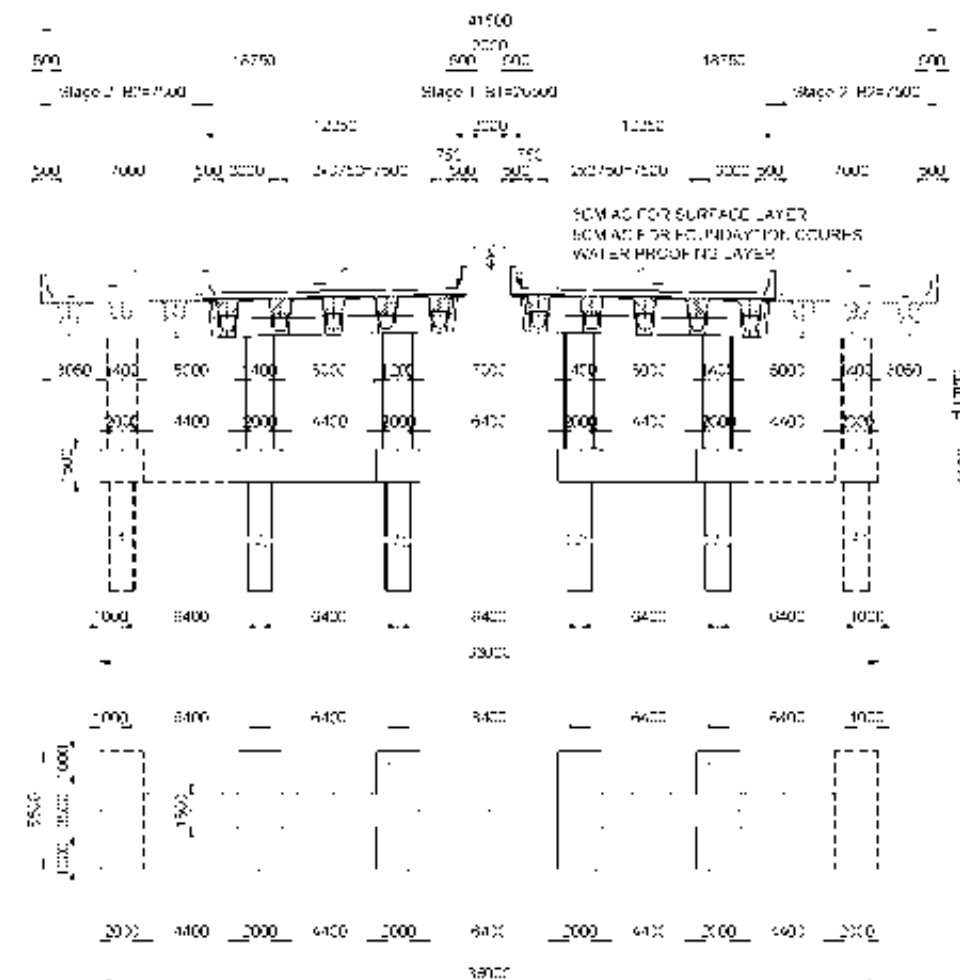
DRAWING TITLE
 TYPICAL CROSS SECTION OF CABLE STAYED BINH KHANH - PHUOC KHANH BRIDGE
 MẶT CẮT NGANG CỦA CẦU BÌNH KHANH - PHƯỚC KHANH

REV. NO.	DATE	DESCRIPTION	DRAWING NO.
0	NOV-2009	DRAWING NO.	DD GK F 4 - 22
1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2

SCALE:
 AS SHOWN

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2000 年 11 月 1 日



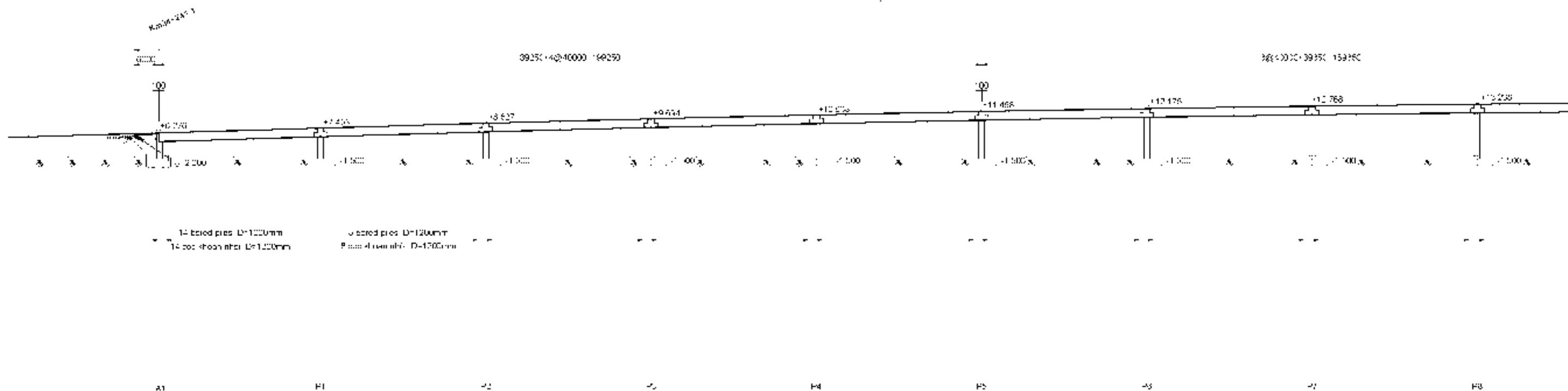
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AS SHOWN

18.ONG KEO BRIDGE
18.CẦU ÔNG KÈO
KM 34+245
(OPTION 2)

BEN LUC

LONG THANH

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

$$S(\Gamma) = \sum_{\Gamma \in \mathcal{F}} |\Gamma| \cdot \rho(\Gamma)$$


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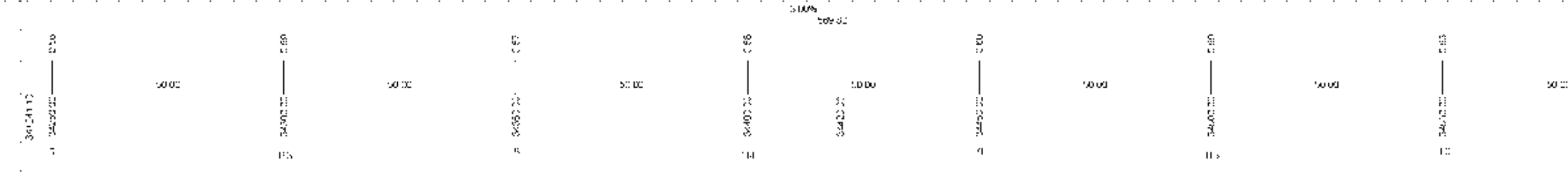
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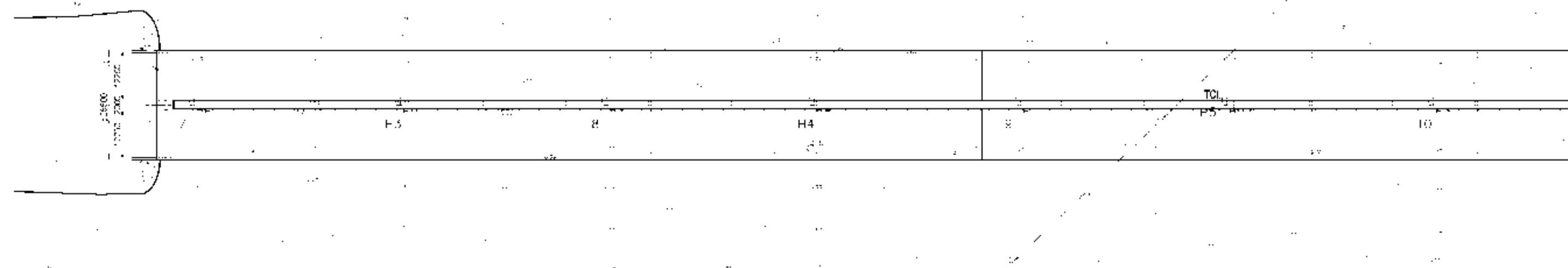
TEH OCC

CONTENTS: CONCLUDE



PLAN VIEW - MAT BANG CAJ

SCOTT, W. J. 1996.



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ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPROVED BY: Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TITLE

GENERAL VIEW OF THE χ^2 BRIDGING
FOR THE χ^2 BRIDGING

FILE# No:

DATE _____

DESCRIPTION
1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal.
2. Once a problem is recognized, the next step is to define the problem. This involves identifying the specific aspects of the problem that need to be addressed.
3. The third step is to analyze the problem. This involves identifying the causes of the problem and the factors that contribute to it.
4. The fourth step is to develop a solution. This involves identifying the best course of action to take to solve the problem.
5. The fifth step is to implement the solution. This involves putting the solution into practice and monitoring its progress.
6. The sixth step is to evaluate the solution. This involves assessing the effectiveness of the solution and making any necessary adjustments.

DRAFT FINAL DRAWING

FINAL DRAWING

PLANTING No. _____

535.011

A. 1 ÷ 11.51121...

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49 3-07-80

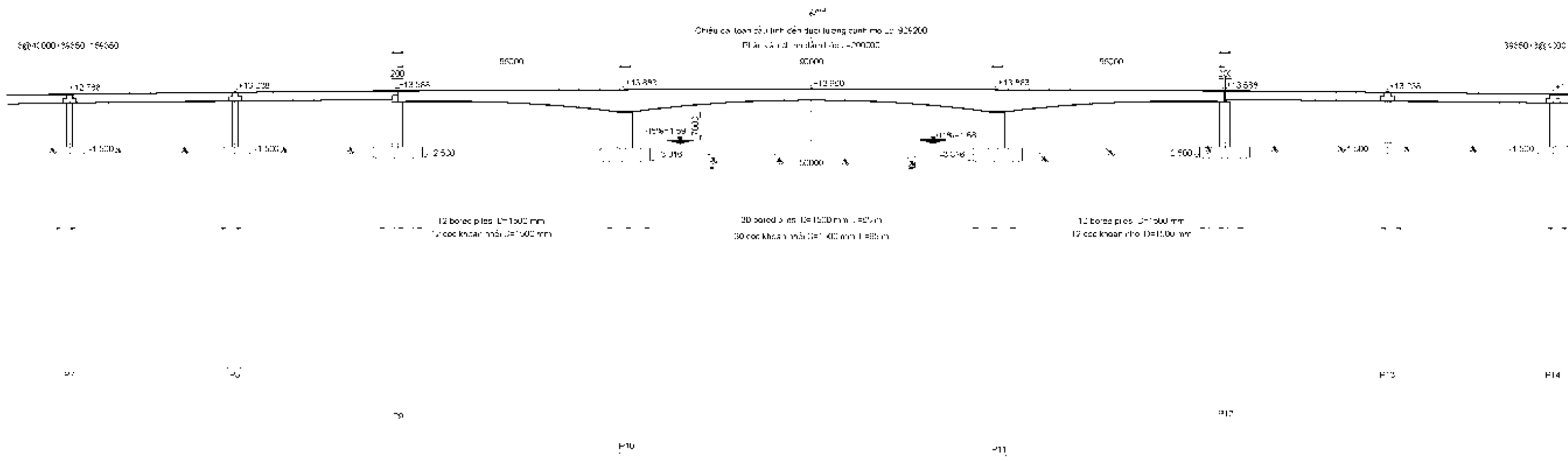
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BEN LUC

LONG THANH

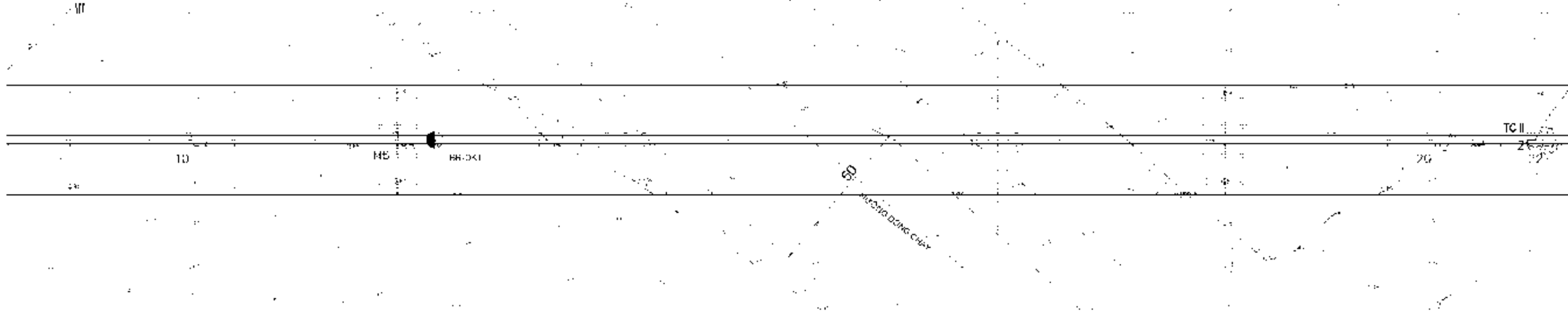
PROFILE OF BRIDGE - MẶT CHỈNH CẦU

(SCALE: 1/200)



PLAN VIEW - MẶT BẰNG CẦU

(SCALE: 1/200)



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PREPARED BY

Binh Vu TUYEN

CHECKED BY

La Ngoc HIEU

APPROVED BY

Tim COLLETT

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE

GENERAL VIEW OF ONG KEE BRIDGE
HỒ THỊ THÚY AN - ÔNG KEE

REV. No.

DATE

DESCRIPTION

DRAWING No.

0 NOV-2009

DRAFT FINAL DRAWING

457/07

1 FEB-2010

FINAL DRAWING

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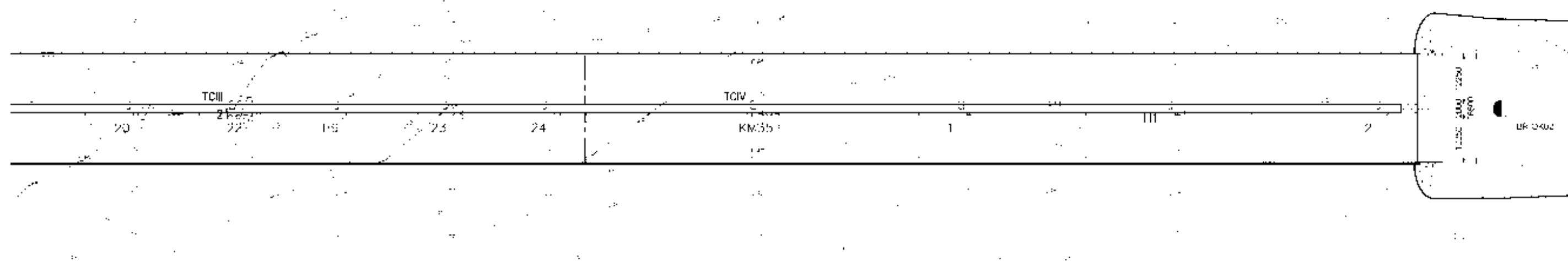
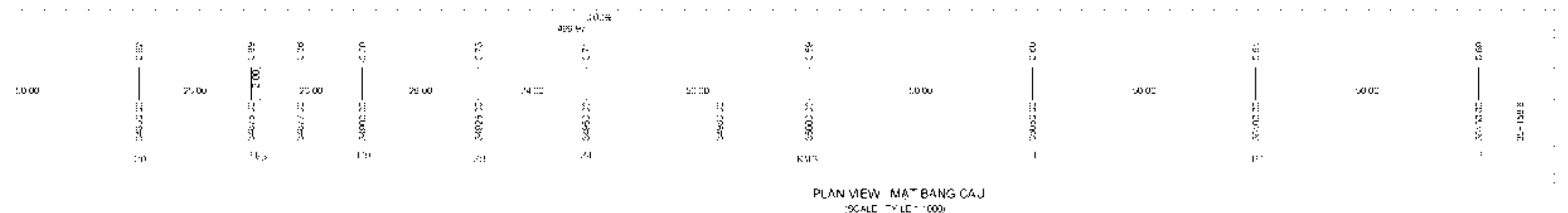
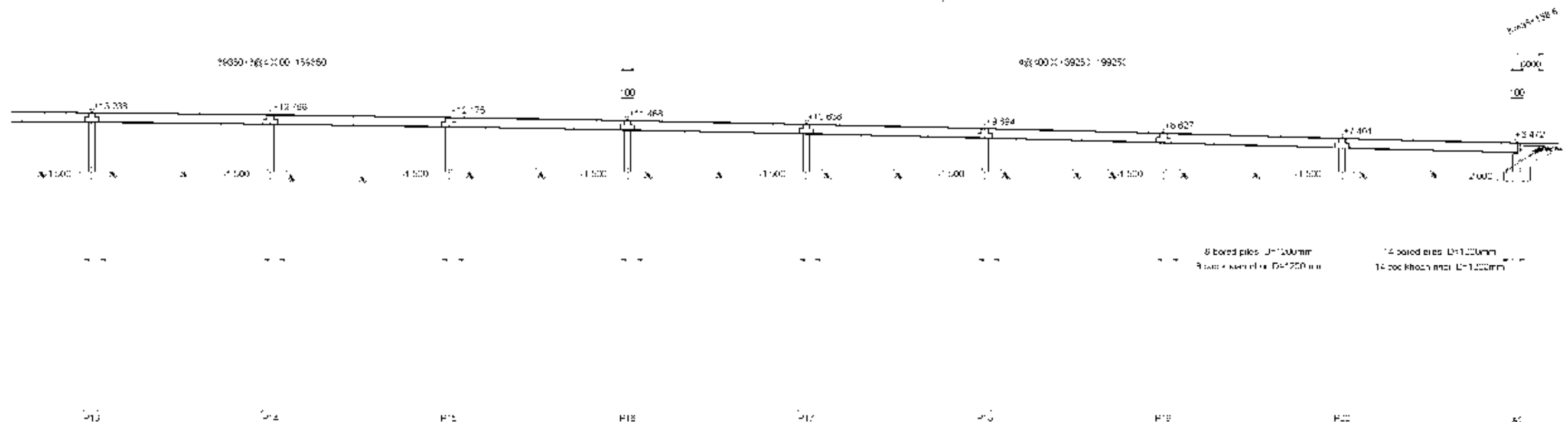
SCALE:

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BEN LUC

LONG THANH

PROFILE OF BRIDGE - MẶT CHỈNH CẦU (SCALE: 1/200)



BẢN VẼ NÀY CHỈ DÙNG ĐỂ MÔ TẢ CÁC THÔNG SỐ CƠ BẢN CỦA CÔNG TRÌNH VÀ KHÔNG ĐƯỢC SỬ DỤNG CHO CÁC MỤC ĐÍCH KHÁC.

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TITLE	NAME	SIGNATURE
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CHECKED BY	Le Ngoc HIEU	
APPROVED BY	Tim COLLETT	

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VIETNAM EXPRESSWAY CORPORATION (VEC)

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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

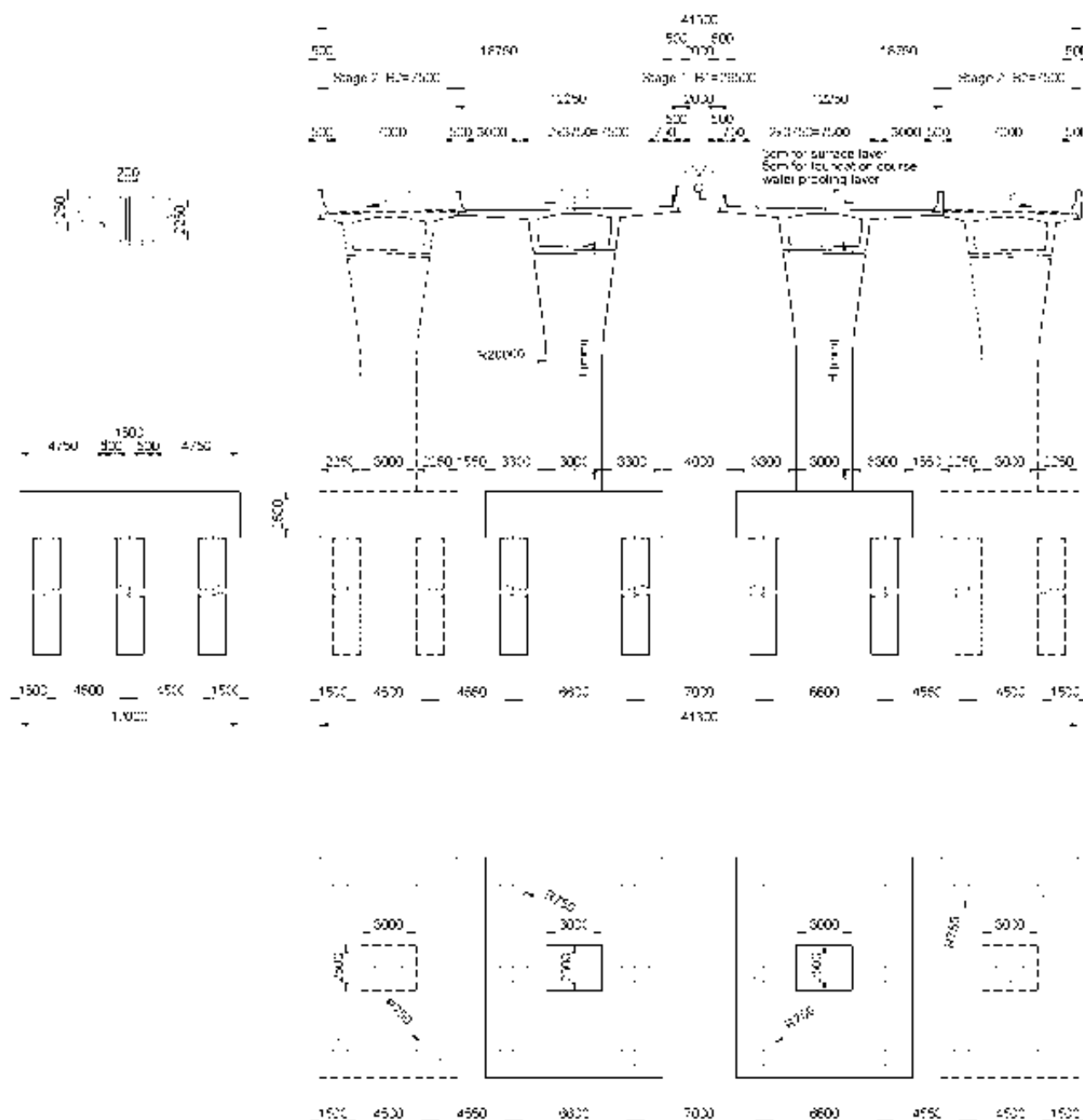
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 HỒ TÊN CHUNG: Cầu Ông KEE

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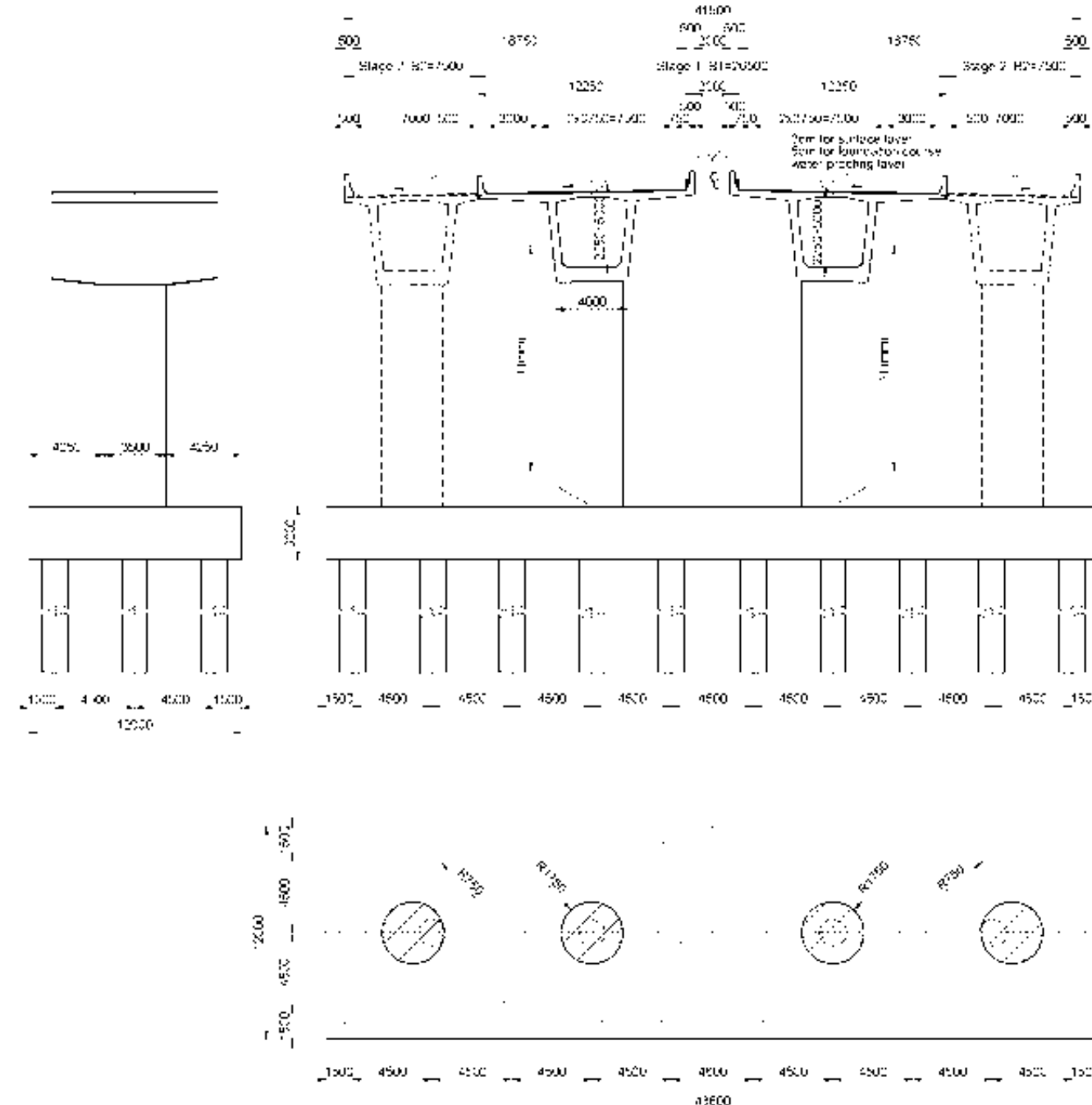
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(SCALE: 1:100)



CROSS SECTION AT MAIN PIER - MẶT CÁT TẠI TRỤ CHÍNH

(SCALE: 1:100)



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CHECKED BY **La Ngoc HIEU**
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SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

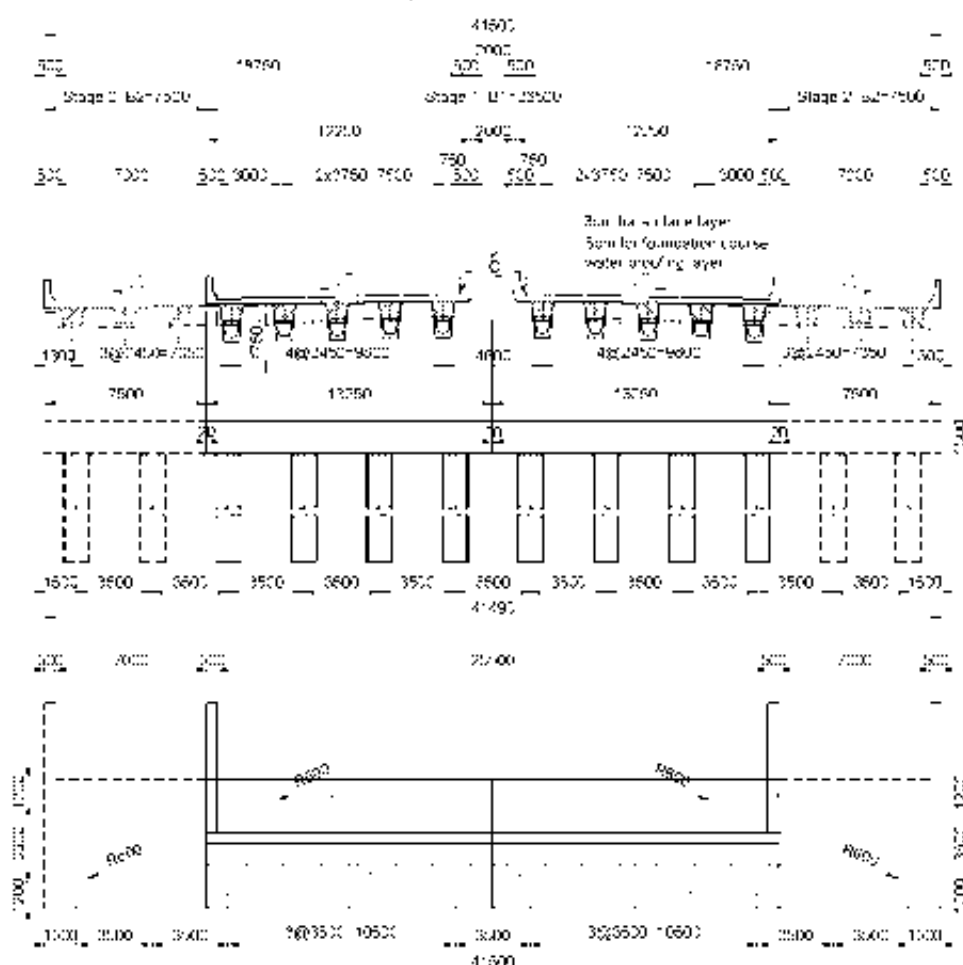
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HỒ TỒN CHUNG ÁO ÔNG KEE

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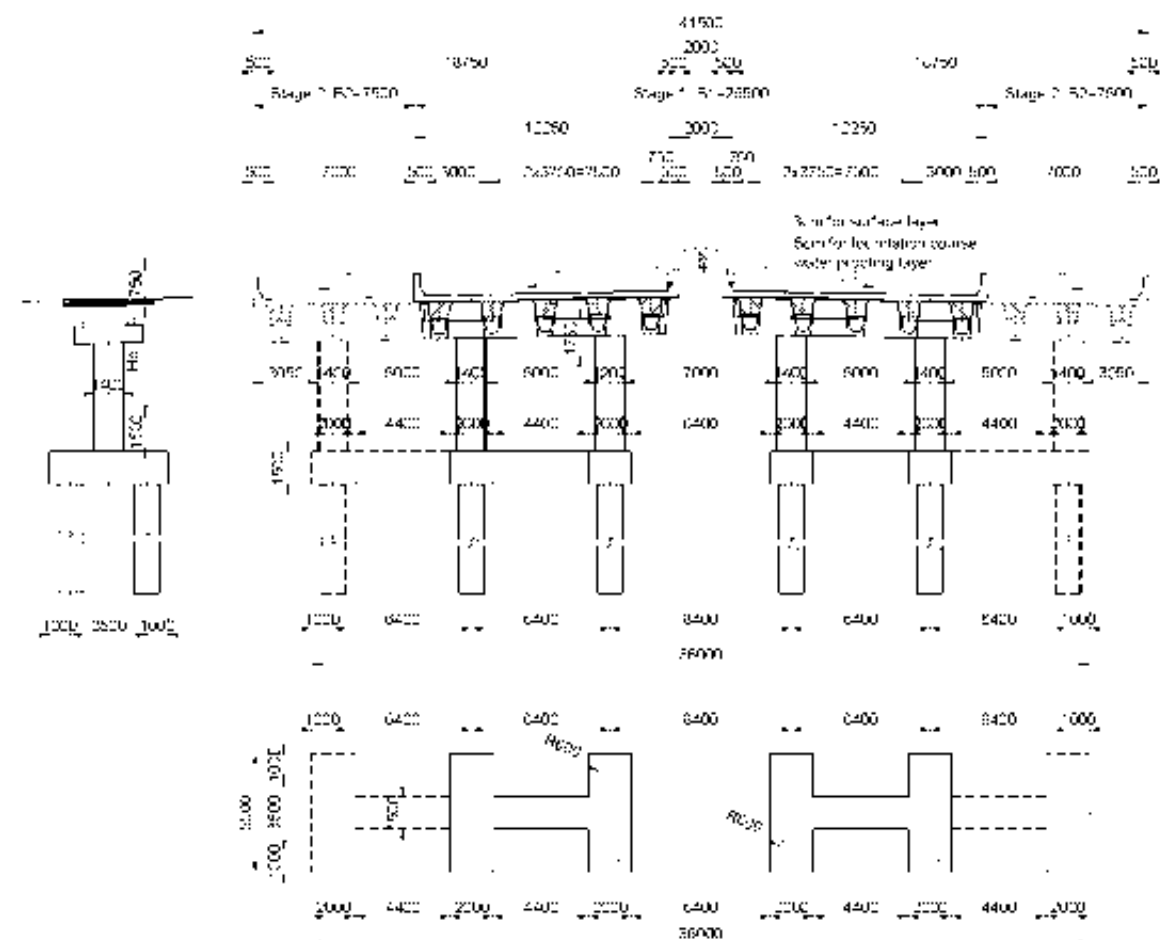
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In Association With

APECO

TITLE

NAME _____

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: Li Ning HEBU

APPROVED BY **Tim COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

CRAYING TITLE

GFMF 2004-2005 07 QHGE & CC BRIEFING

$$E(\hat{\beta}) = \beta, \quad \text{Var}(\hat{\beta}) = \frac{1}{n} \text{Cov}(\hat{\beta}) = \frac{1}{n} \text{Cov}(\beta)$$

FILE# No:

DATE _____

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F N&L DRAWING

PLANTING No. _____

736/01

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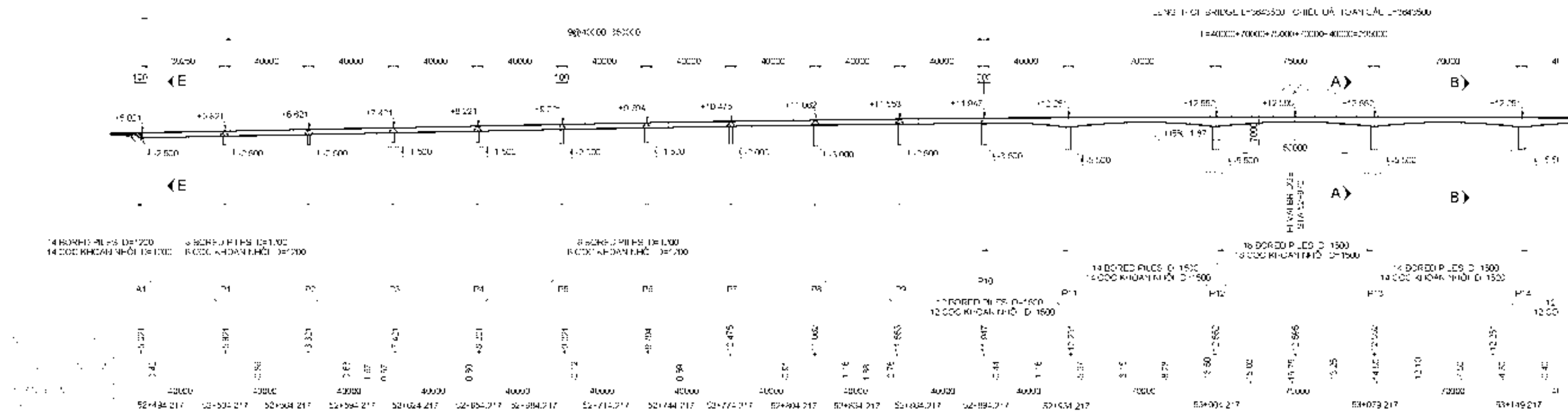
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19.THỊ VAI BRIDGE
19.CẦU THỊ VÀI
KM 53+041.717
(OPTION 2)

PROFILE OF BRIDGE - MẶT CHÍNH CẦU

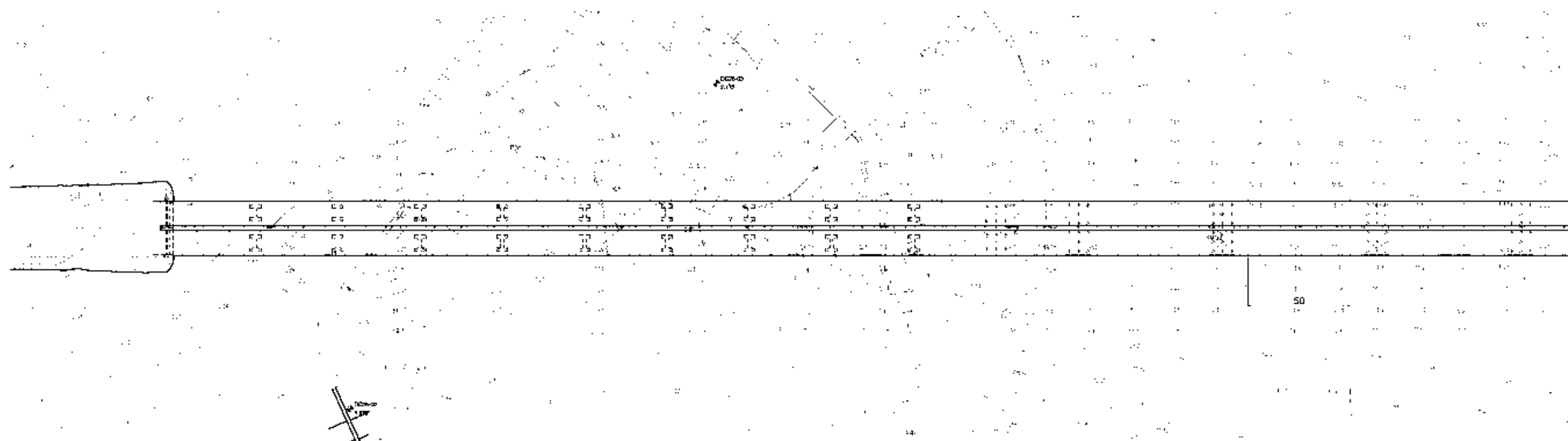
2. ALL FILE 7500

LONG THANH



PLAN VIEW - MẶT BẰNG CẦU

55.61 F - TV 1 F 25000



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ORIENTAL CONSULTANTS CO., LTD

In Association With

APECO

TITLE

NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPROVED BY **Tom COLLETT**

SOCIALIST REPUBLIC OF VIETNAM

VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

TA 7155-ME: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE GENERAL VIEW OF THAI VAI BRIDGE
BỐ TRÍ CHUNG CẦU THÁI VÀ

REF No	DATE
--------	------

NOV-2000

1 FEB-2010

DESCRIPTION
1. The first step in the process is to identify the problem or issue that needs to be addressed.
2. Once the problem is identified, the next step is to gather relevant information and data.
3. This information is then analyzed to determine the root cause of the problem.
4. Based on the analysis, a plan of action is developed to address the problem.
5. The plan is then implemented, and the results are monitored to ensure that the problem is resolved.
6. Finally, the process is evaluated to determine what lessons were learned and how the process can be improved for future use.

DRAFT NAL DRAWING

F NAL DRAWING

CHAMING Niu

341' DI

ALTERNATIVE 2

SCALE :

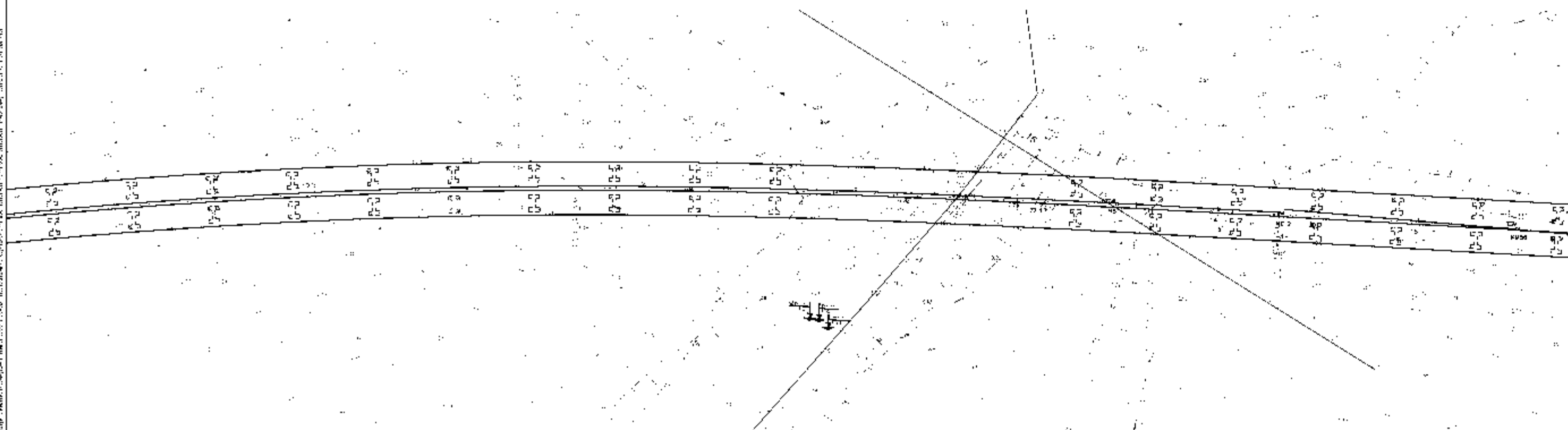
48 SHUN'ICHI

LONG THANH 1

360. $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$



SC# = TP = 1999



ASIAN DEVELOPMENT BANK

VIETNAM EXPRESSWAY CORPORATION (VEC)

DRAWING TITLE GENERAL VIEW OF T-HV41 BRIDGE
BY: N. CHUNG, L. T-HV41

REV No	DATE	DESCRIPTION	DRAWING No.
0	NOV-2009	DRAFT FINAL DRAWING	PH11-10
1	FEB-2010	FINAL DRAWING	ALTERNATIVE C

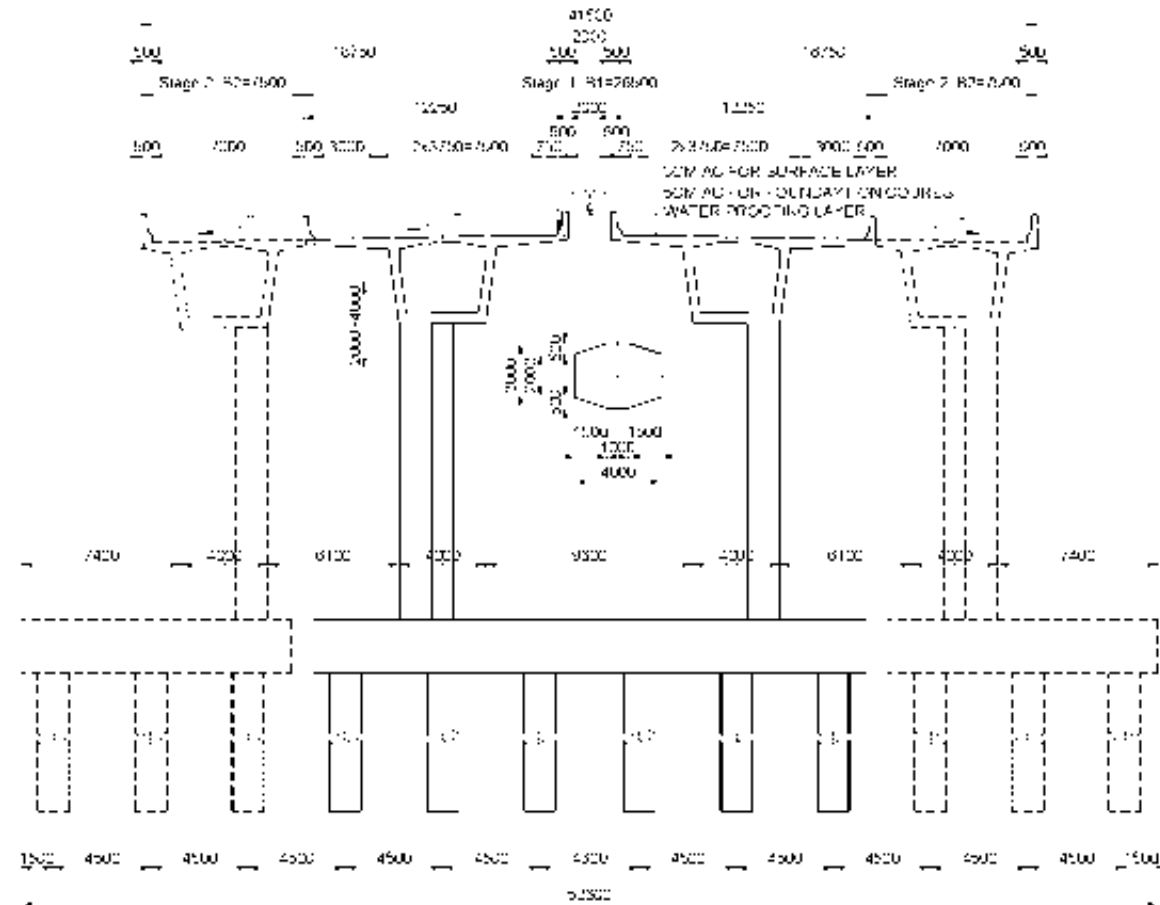
SCALE:
AS SHOWN

For more information, contact: info@hawaii.edu or [808.955.5888](tel:8089555888). <http://www.hawaii.edu>

TYPICAL CROSSECTION OF BRIDGE MẶT CẮT NGANG ĐIỂN HÌNH CẦU

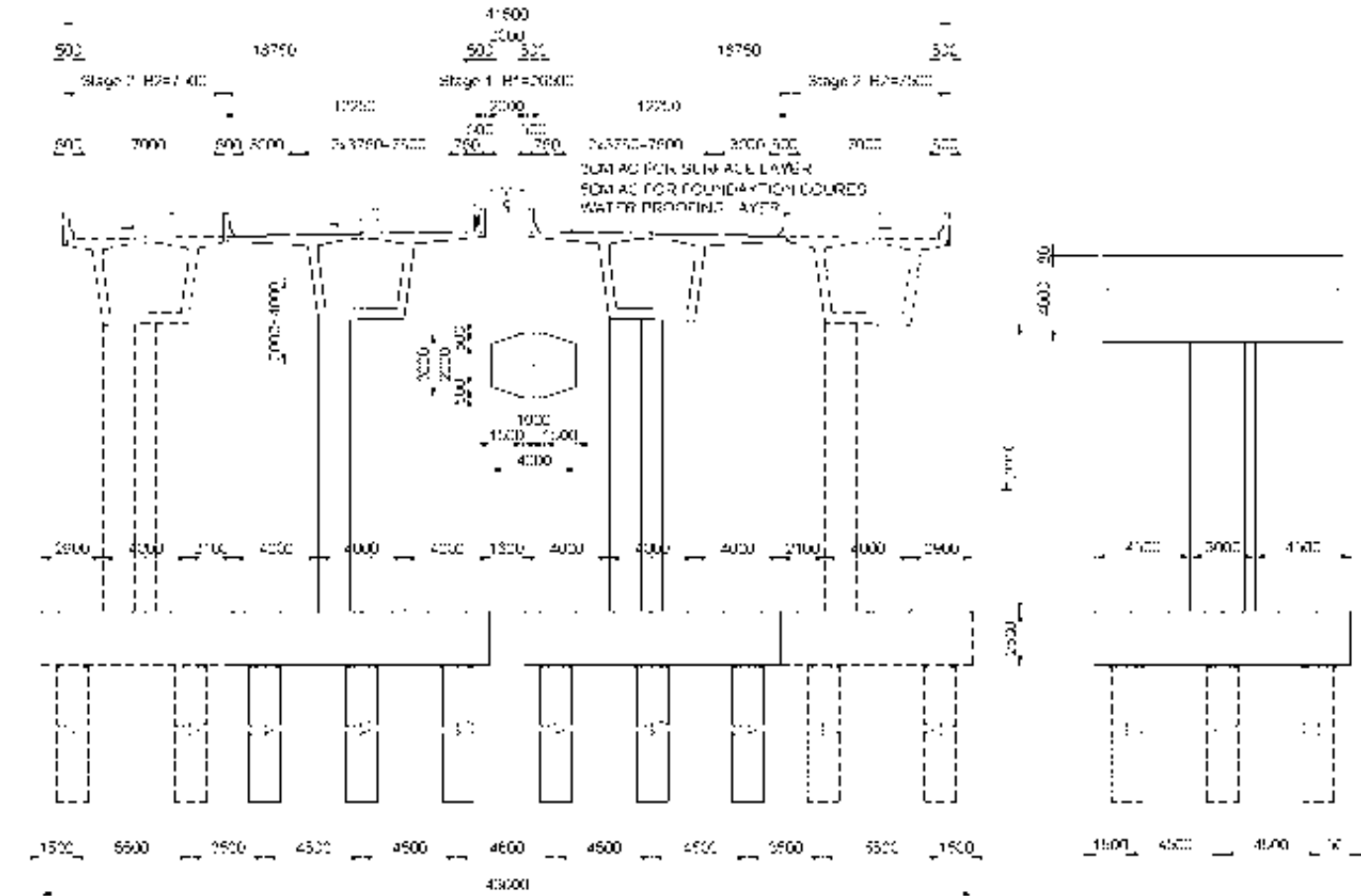
SECTION A-A - MẶT CẮT A-A

SCALE 1:300



SECTION B-B - MẶT CẮT B-B

SCALE 1:300



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 PREPARED BY: **Đang Vũ TUYẾN**
 CHECKED BY: **Lê Ngọc HIEU**
 APPROVED BY: **Tên COLLETT**

SIGNATURE

[Signature]

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**TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
 EXPRESSWAY PROJECT**

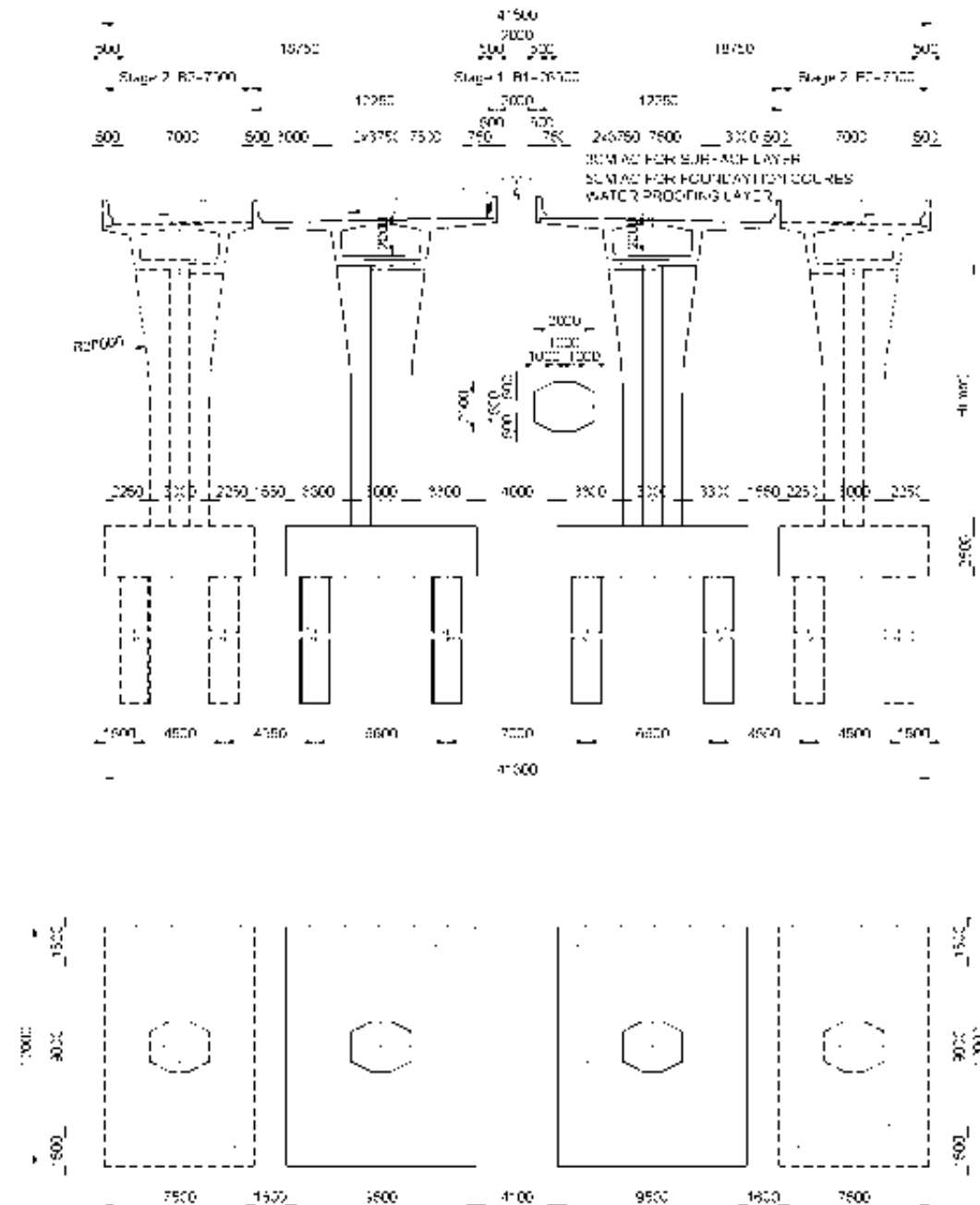
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 MẶT CẮT NGANG ĐIỂN HÌNH CẦU THIAI

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0	NOV-2009	DRAWING NO.	SHIT 01
1	FEB-2010	FINAL DRAWING	ALTERNATIVE 2
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TYPICAL CROSSECTION OF BRIDGE MẶT CẮT NGANG ĐIỂN HÌNH CẦU

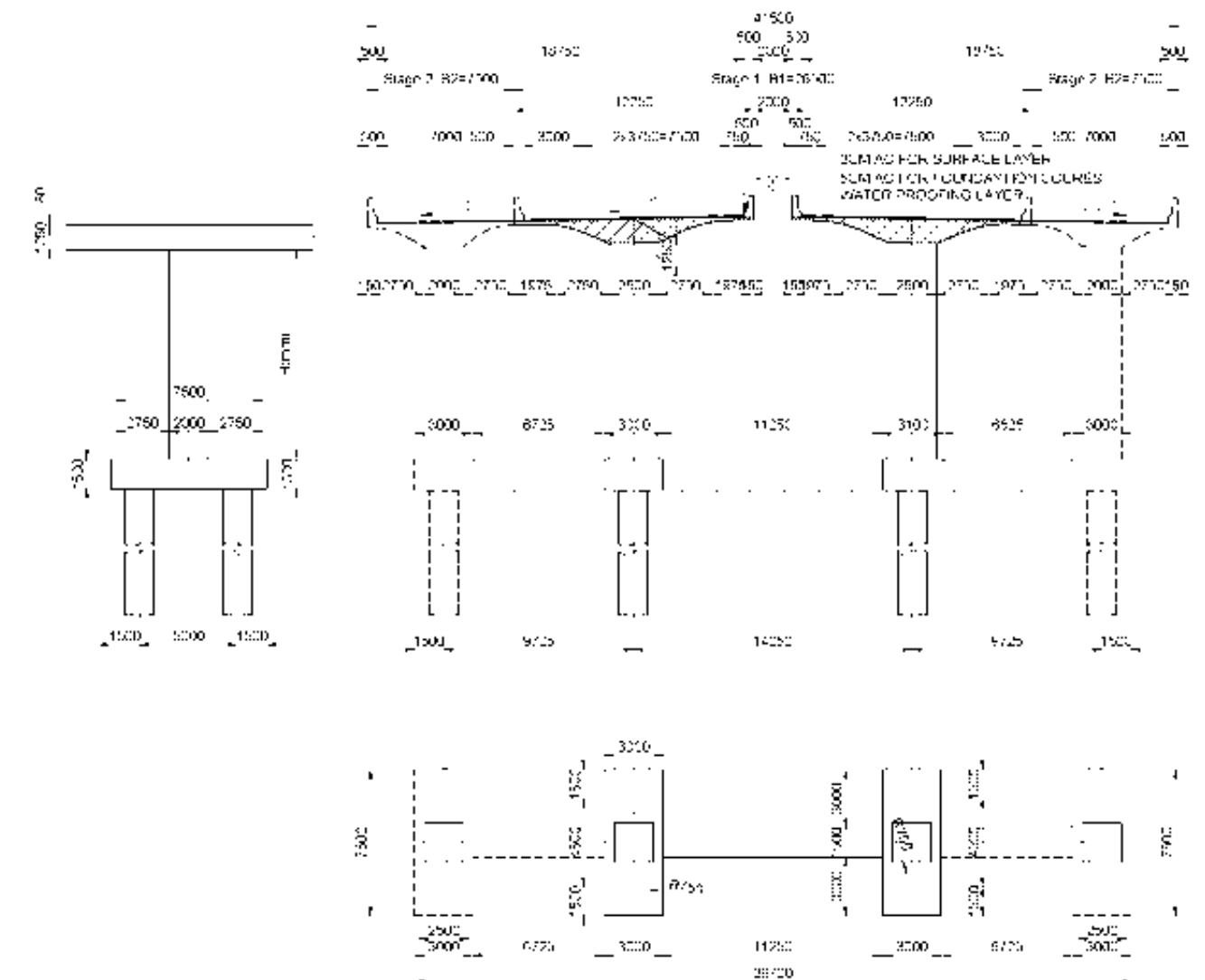
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SCALE: 1/300



SECTION F-F - MẶT CẮT F-F

SCALE: 1/300



VECTRA CONSULTING ENGINEERS INTERNATIONAL CO., LTD. (VCEI) and APECO ENGINEERING CONSULTANTS CO., LTD. (APEC) are the joint venture for the design and construction of the project.

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SIGNATURE
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CHECKED BY: **La Ngoc HIEU**
APPROVED BY: **Tien COLLETT**

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VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK

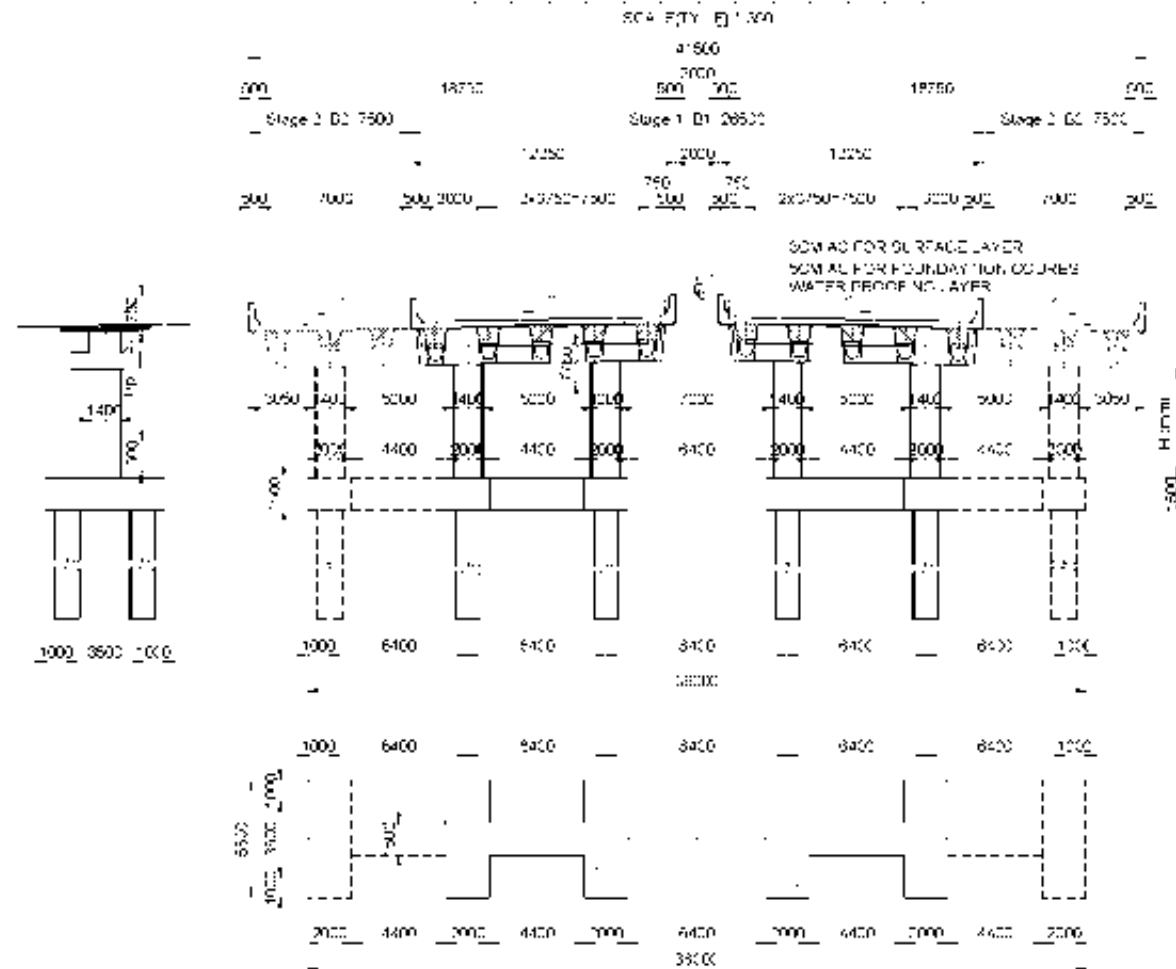
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
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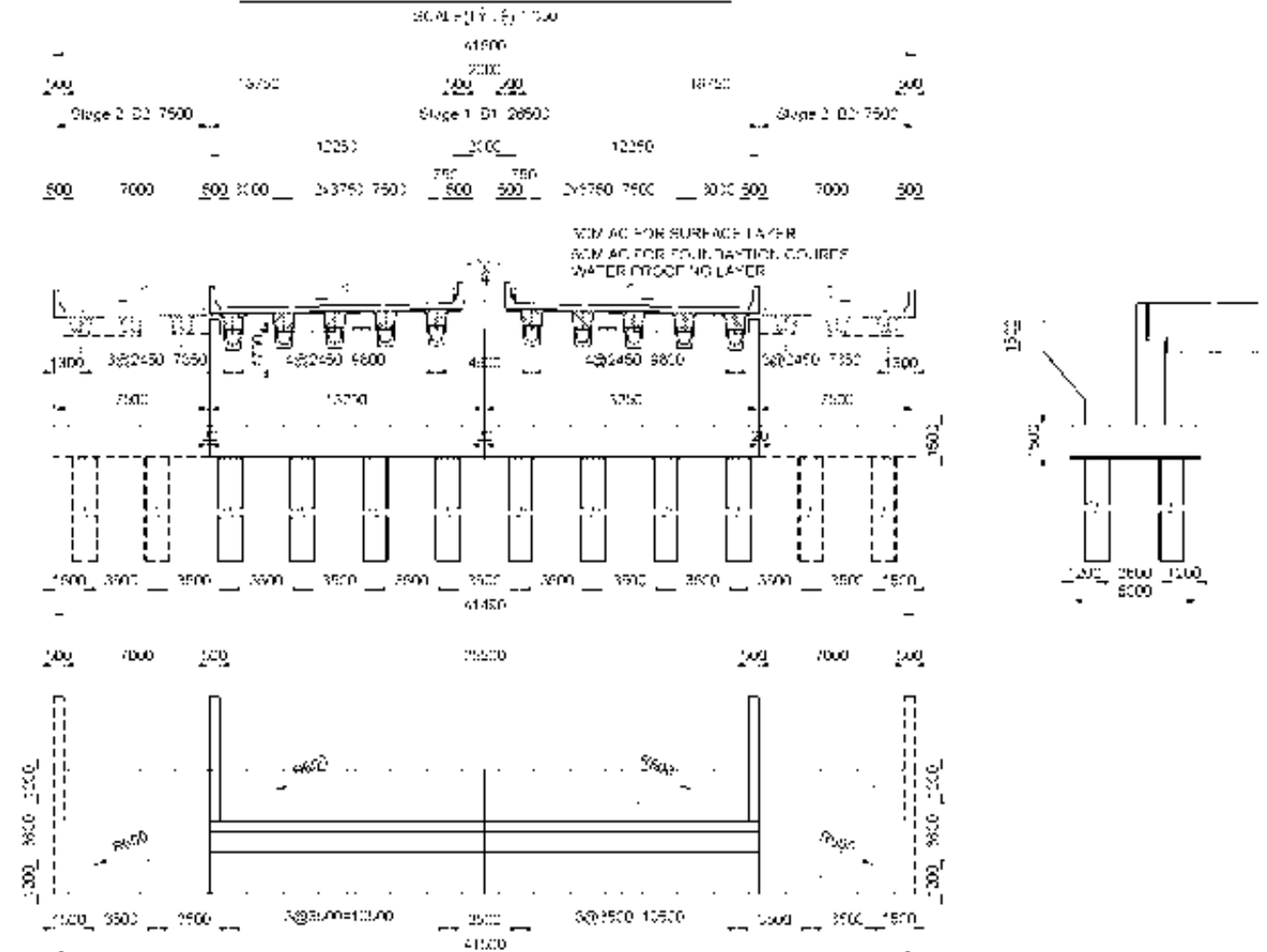
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SCALE:			AS SHOWN

TYPICAL CROSSECTION OF BRIDGE
MẶT CẮT NGANG ĐIỂN HÌNH CẦU

SECTION E-E - MẶT CẮT E-E



SECTION D-D - MẶT CẮT D-D



En 1946, la familia de los EXTEROS volvió a España, concretamente a Madrid, donde se trasladó a vivir. En 1947, la familia de los EXTEROS volvió a España, concretamente a Madrid, donde se trasladó a vivir.

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NAME

SIGNATURE

PREPARED BY **Dang Vu TUYEN**

CHECKED BY: La Ngoc HIEU

APPROXIMATELY Tim COLLETT

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DRAWING TITLE

THỰC DẠNG TIẾT DIỆN CỦA CẦU THỦY VÀ
MÔ HÌNH MÃNG DẠNG TIẾT DIỆN

FILE No.	DATE
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6 NOV-2006

1 FEB-2010

DESCRIPTION

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FINAL DRAWING

DRAWING No.

541

ALTERNATIVE 2

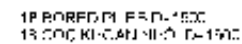
SCALE :
4:5 SHORTH

CABLE STAYED BRIDGE SOLUTION AND OPTIONS
GIẢI PHÁP VÀ CÁC PHƯƠNG ÁN CẦU DÂY VẼNG

20.BINH KHANH CABLE STAYED BRIDGE FROM OPTION1 TO OPTION5
20.CẦU DÂY VĂNG BÌNH KHÁNH TỪ PHƯƠNG ÁN 1 ĐẾN 5
KM 23+450

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LONG THANH



!! H2NF2 PH F2 D=15.22
!! COC. 4HF3F4 F-O H D=15.33

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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

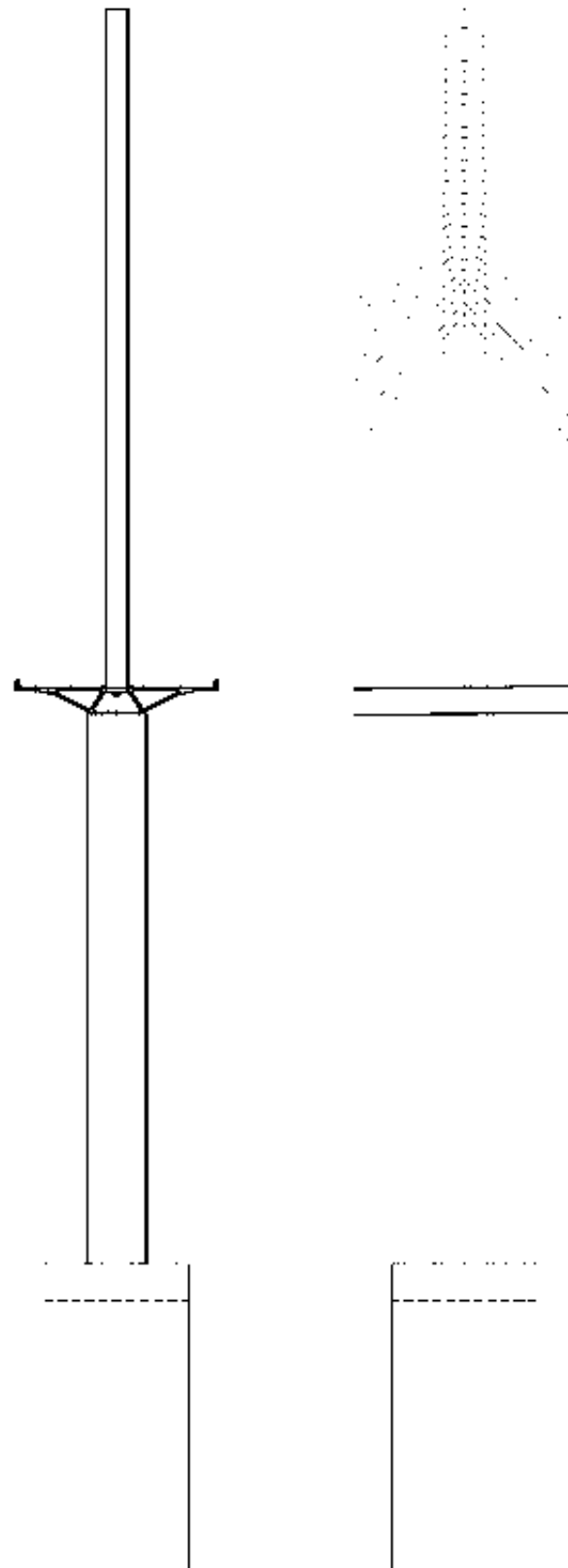
PREPARED BY Dang Vu TUYEN
CHECKED BY La Ngoc HIEU
APPROVED BY Tim COLLETT

DRAWING TITLE: **GENERAL VIEW OF THE KANTHESRIKAL CHURCH**
BỘ TRƯỞNG CẦU BÌNH KHANG - THƯỜNG AN

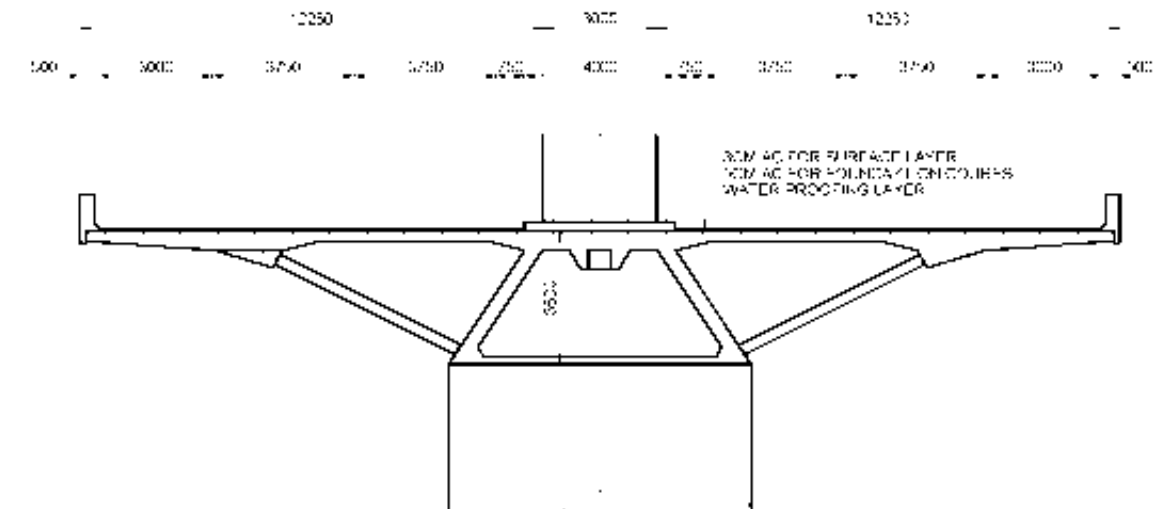
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1	FEB-2010	FINAL DRAWING	

SCALE :
AS B-CWt

PYLON DETAIL
CHI TIẾT TRỤ THÁP
SCALE: 1:1000 TỶ LỆ 1:1000



SC# F1700 - T41 F1700
BOX ORDER WITH STRUT



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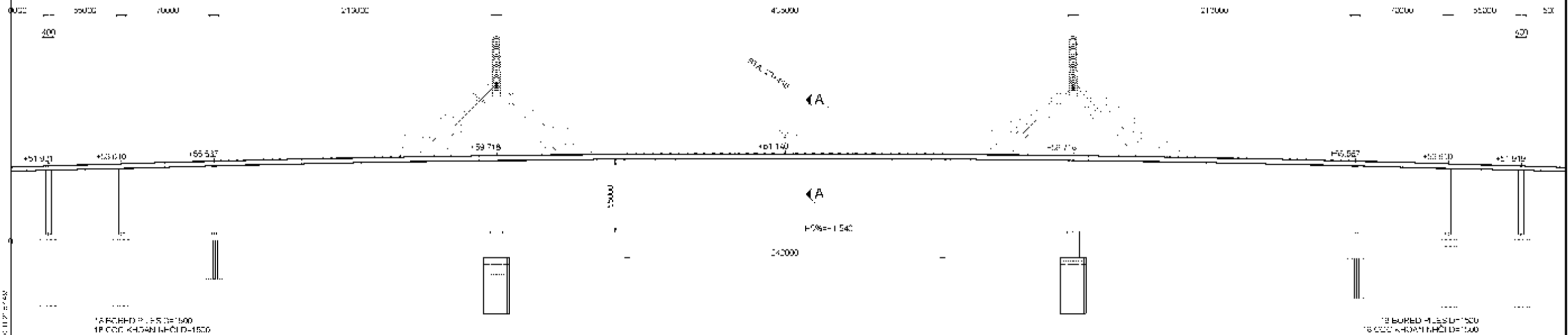
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PROFILE OF BRIDGE - MẶT ĐỨNG CẦU

SCALE 1:300 (TỶ LỆ 1:3000)

BEN LUC

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DRAWING TITLE
GENERAL VIEW OF BRIDGE - PROFILE
BỘ THỂ CHUNG CẦU BẾN LÚC - PHƯỜNG AN 2

REV No DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

DRAWING NO

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GENERAL DRAWING

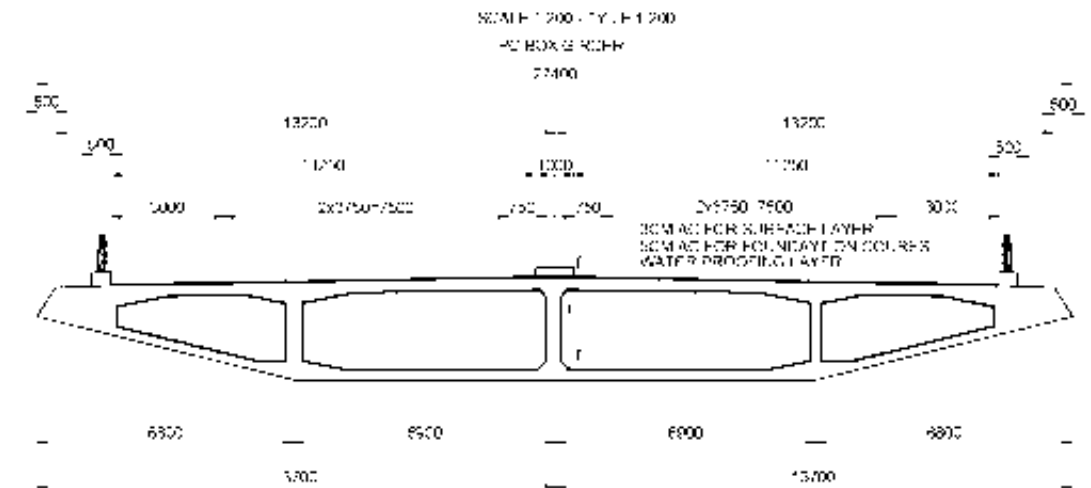
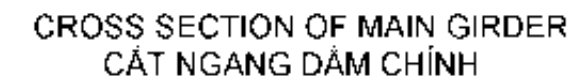
DRAWING No

DK A02.01

SCALE:

AS B-DWG

CHI TIẾT TRỤ THÁP
SCALE: 1/1000 - TỶ LỆ 1/1000



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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF HINH KHOAH BRIDGE TOP VIEW
BỘ TRƯỞNG CẦU KINH HẠNH - PHƯƠNG AN 2

REF No	DATE
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NOV. 2006

1 FEB-2010

DESCRIPTION
1. The first step in the process is to identify the problem or issue that needs to be addressed.
2. Once the problem is identified, the next step is to gather relevant information and data.
3. This information is then analyzed to determine the root cause of the problem.
4. Based on the analysis, a plan is developed to address the problem.
5. The plan is then implemented, and the results are monitored to ensure that the problem is resolved.
6. Finally, the process is evaluated to determine if it was effective and if any improvements can be made.

DRAFT NAL DRAWING

FINAL DRAWING

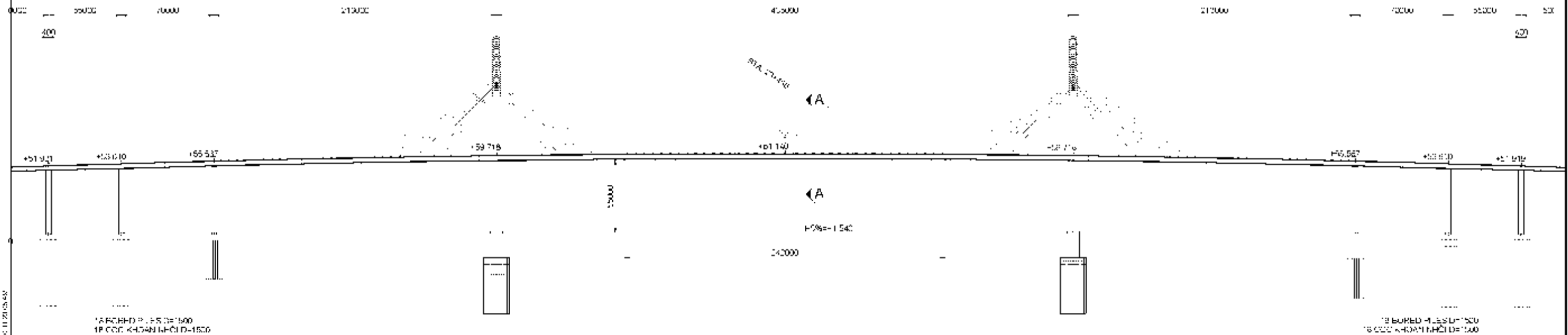
DRAWING No.

DK A02 22

SCALE :
A5 B-Craft

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LONG THANH



© 2012 John Wiley & Sons, Ltd. *J. Polym. Sci. Part A: Polym. Chem.* 50: 1155–1164, 2012
DOI: 10.1002/pola.23201

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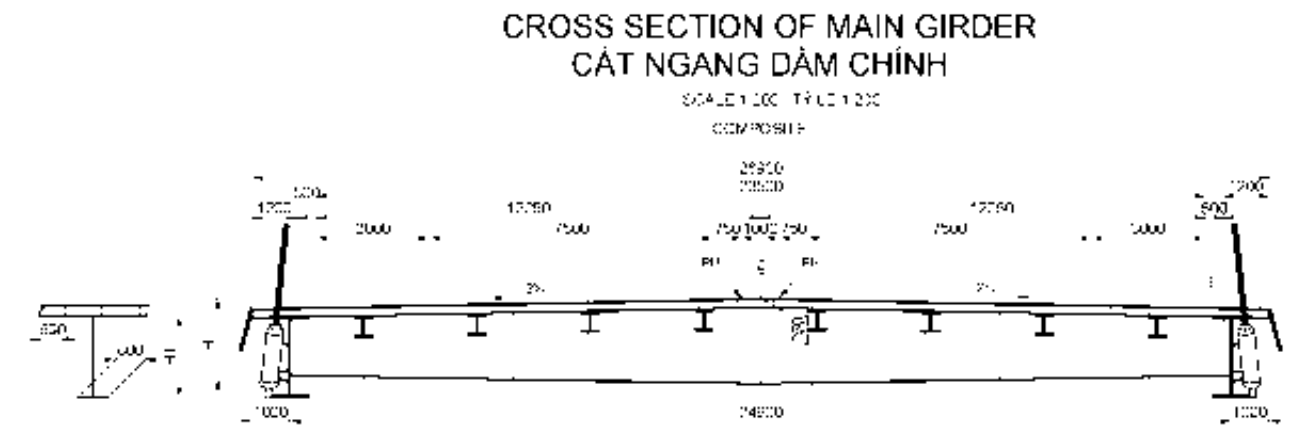
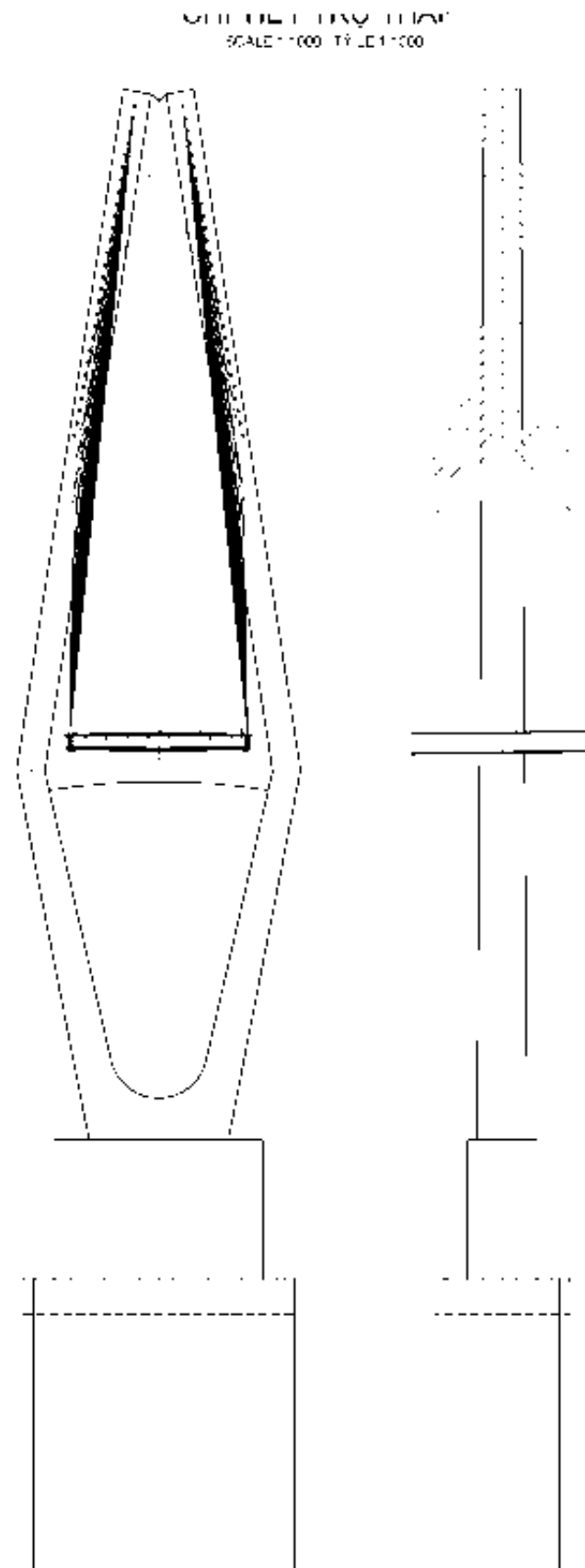
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF BINDERHEAD BRIDGE TOP VIEW
BỘ TRỌNG QUÁNG CÁI ĐẦU KÉP HẸM - PHƯƠNG ANH

DRAFT FINAL DRAWING

SCALE :
A5 B-7A16

PYLON AND TYPICAL CROSSECTION OF BRIDGE TRỤ THÁP VÀ CẮT NGANG CẦU



VIỆN KỸ THUẬT KATAHIRA & ENGINEERS INTERNATIONAL JOINT VENTURE WITH ORIENTAL CONSULTANTS CO., LTD. IN ASSOCIATION WITH APECO

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APPROVED BY	Tim COLLETT	

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VIETNAM EXPRESSWAY CORPORATION (VEC)

ASIAN DEVELOPMENT BANK
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
DRAWING TITLE
GENERAL VIEW OF BRIDGE Pylon and Typical Cross Section
BỘ THẠCH CẦU BẾN LÚC - PHƯỜNG AN

REV. No	DATE	DESCRIPTION	DRAWING No
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1	FEB-2010	FINAL DRAWING	

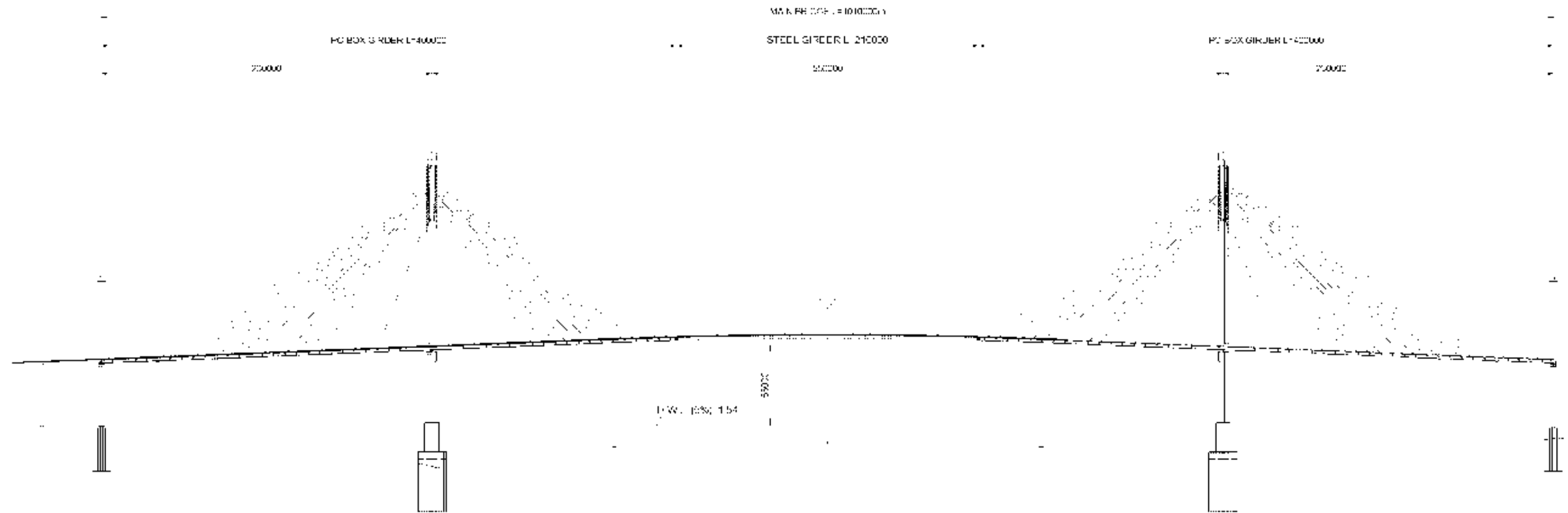
SCALE: AS SHOWN

PROFILE OF BRIDGE - MẶT ĐỨNG CẦU

SCALE: 1/1000 (1/2 LE 1/200)

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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF BENT/PIERS/BRIDGE TOP VIEW
BỘ THỂ CHUNG CẦU BÊN TRÁI - PHƯƠNG ANH

REV. No. DATE

0 NOV-2009

1 FEB-2010

DESCRIPTION

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FINAL DRAWING

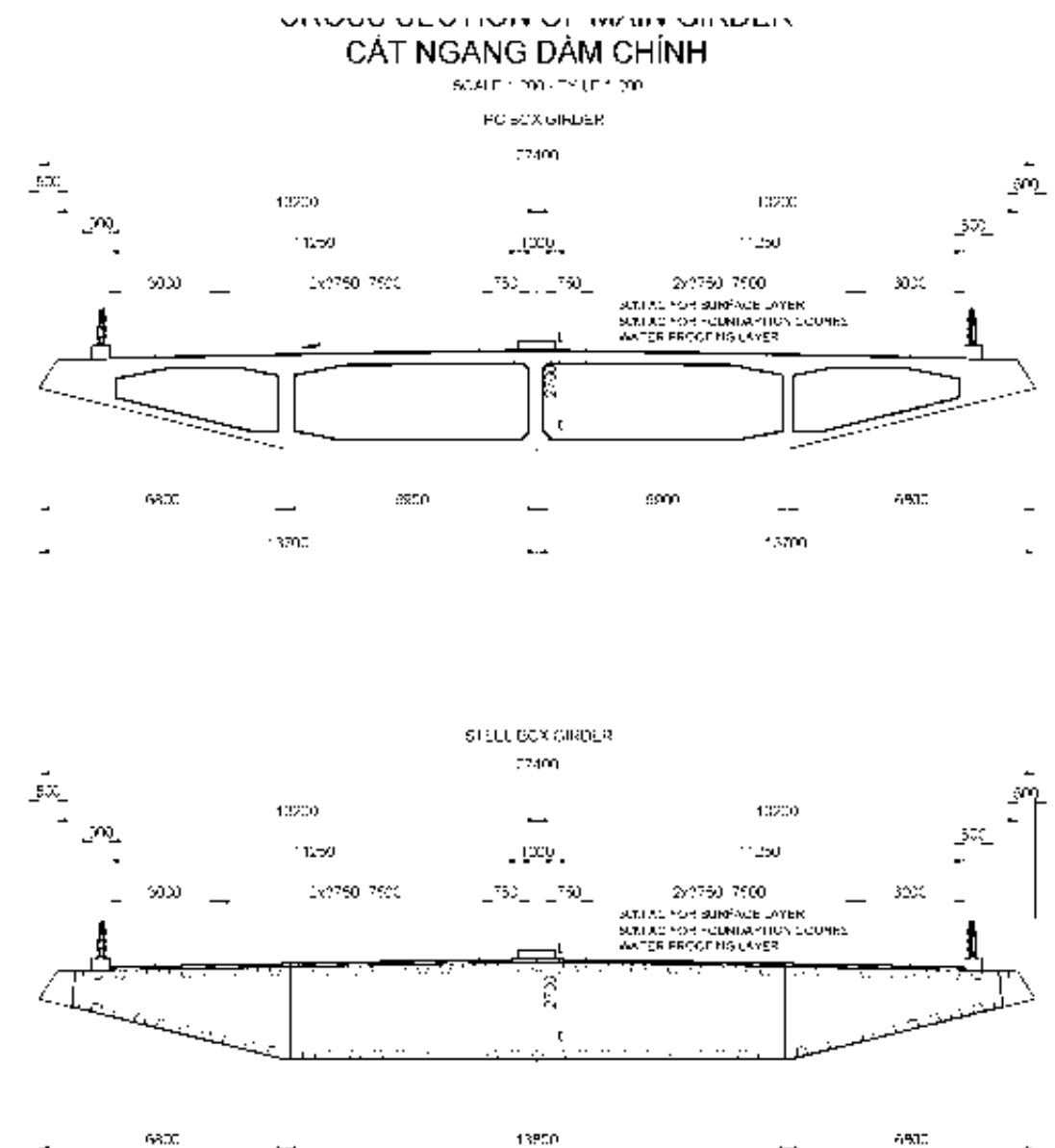
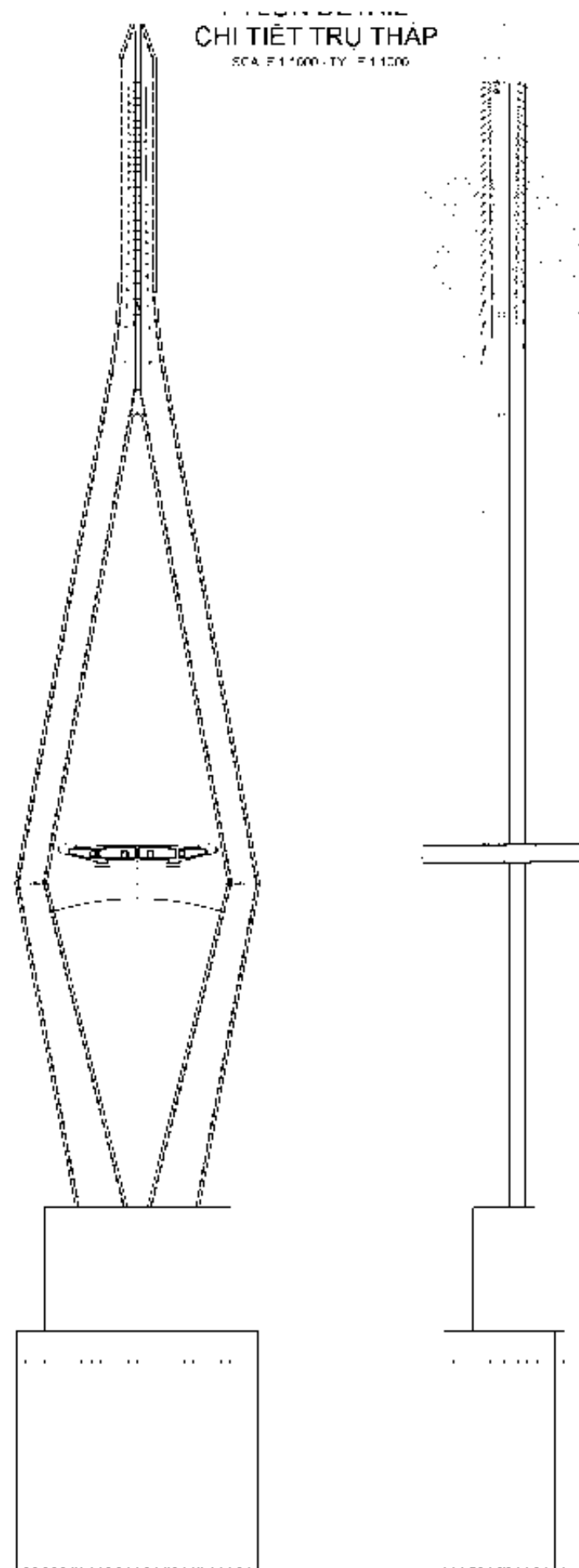
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PYLON AND TYPICAL CROSSECTION OF BRIDGE TRỤ THÁP VÀ CẮT NGANG CẦU



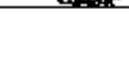


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APPROVED BY: **Tên COLLETT**

NAME
Đang Vũ TUYỀN
Lê Ngọc HIEU
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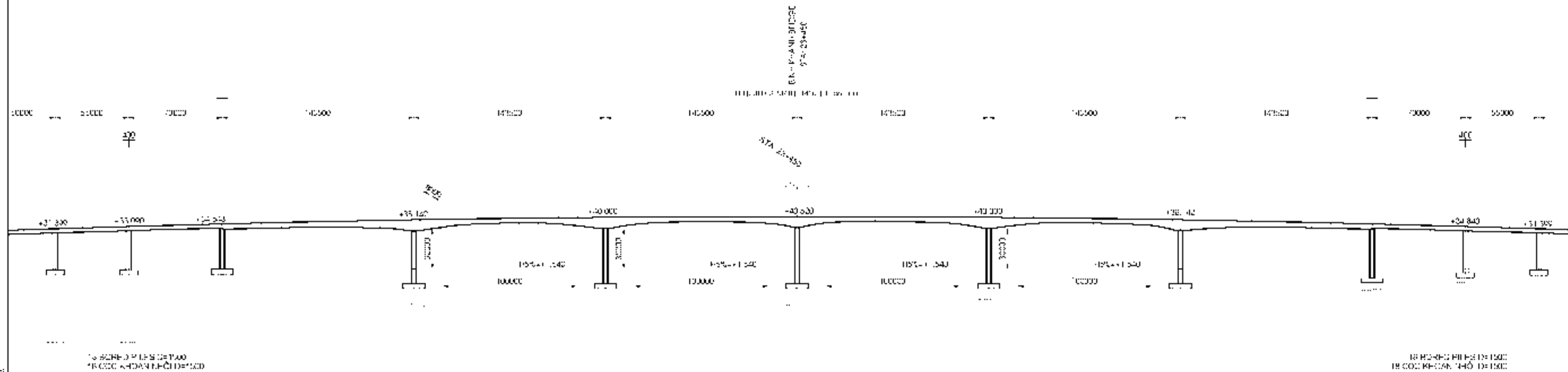
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GENERAL VIEW OF THE BRIDGE PROJECT
BỘ THẠCH CẦU BẾN LÚC - LƯU LONG AN

REV. No.	DATE	DESCRIPTION	DRAWING No.
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1	FEB-2010	FINAL DRAWING	

SCALE: 1:1000

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DOI: 10.1177/0886260513505443

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			CHECKED BY	La Ngoc HIEU		DRAWING TITLE		GENERAL VIEW OF BINH KHANH BRIDGE - OPTION 3			
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										SCALE:	AS SHOWN

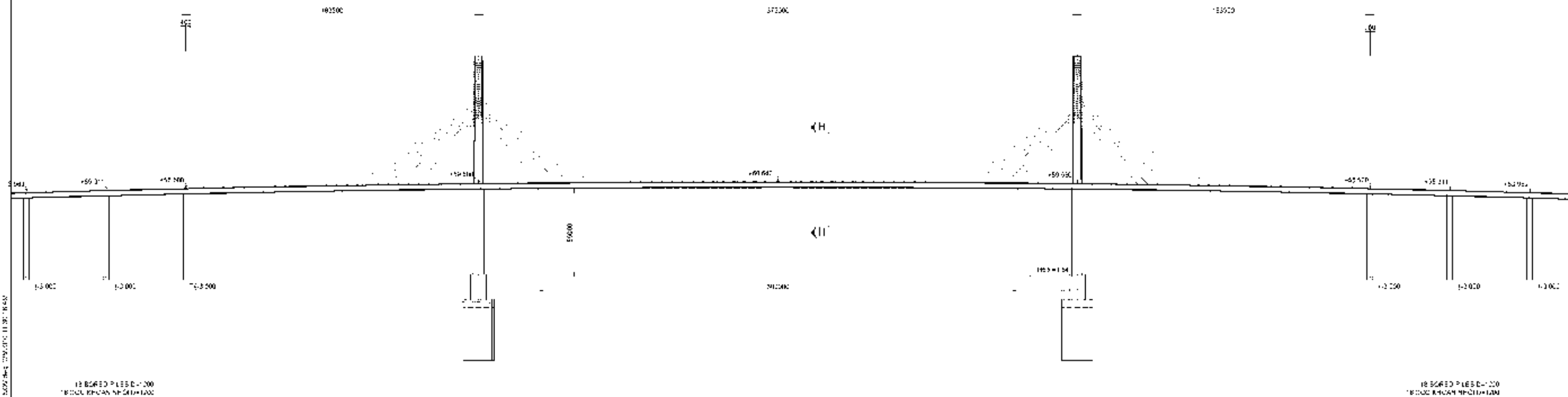
21.PHUOC KHANH CABLE STAYED BRIDGE FROM OPTION1 TO OPTION3
21.CẦU DÂY VĂNG PHƯỚC KHÁNH TỪ PHƯƠNG ÁN 1 ĐẾN 3
KM 30+400

PROFILE OF BRIDGE - MẶT ĐỨNG CẦU

SCALE 1:2500 (TỶ LỆ 1:2500)

BEN LUC

LONG THANH



VIỆN KỸ THUẬT KINH TẾ VÀ KỸ THUẬT ĐƯỜNG LƯU THÔNG VÀ KỸ THUẬT ĐƯỜNG LƯU THÔNG VÀ KỸ THUẬT ĐƯỜNG LƯU THÔNG

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APPROVED BY	Tim COLLETT	

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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

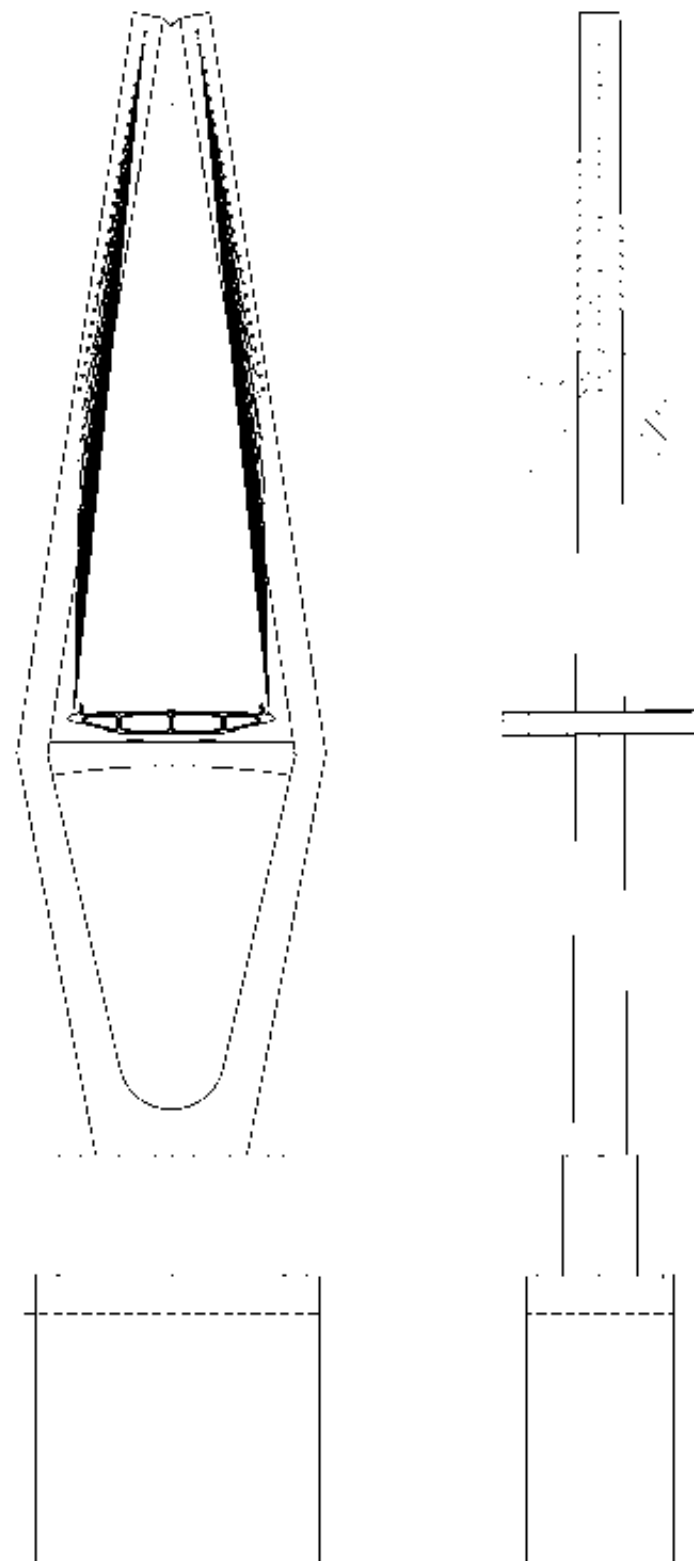
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GENERAL VIEW OF PHUOC KHANH BRIDGE - OPTION 2
BỘ TRƯỞNG CẦU PHUOC KHANH - PHUONG ANH

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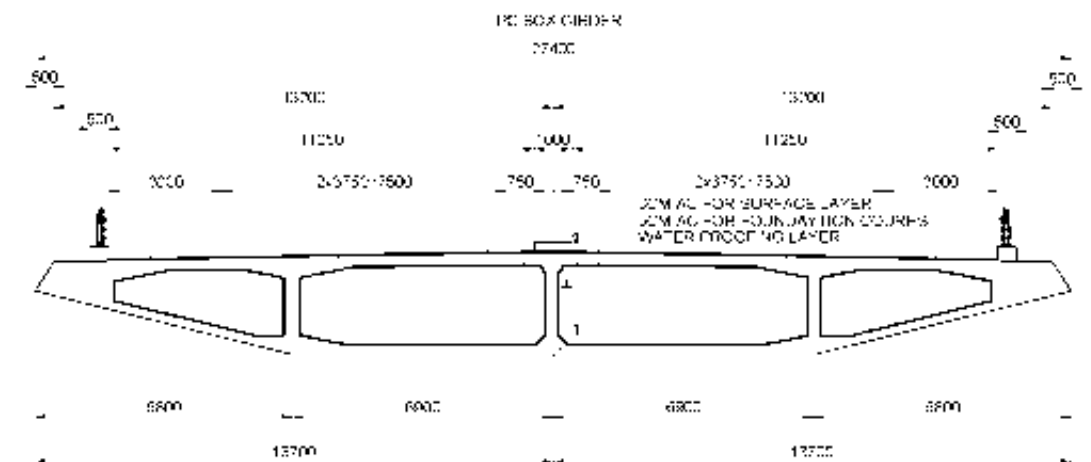
SCALE:
AS SHOWN

PYLON AND TYPICAL CROSSECTION OF BRIDGE TRỤ THÁP VÀ CẮT NGANG CẦU

PYLON DETAIL
CHI TIẾT TRỤ THÁP
SCALE 1:1000 TYPE 1:1000



CROSS SECTION OF MAIN GIRDER
CẮT NGANG DÀM CHÍNH
SCALE 1:200 TYPE 1:200



Ước tính khối lượng công trình: 1.000.000.000 VNĐ (Một tỷ đồng) - 1.000.000.000 VNĐ (Một tỷ đồng) - 1.000.000.000 VNĐ (Một tỷ đồng)

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**TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT**

DRAWING TITLE
GENERAL VIEW OF BRIDGE, KHA THI BRIDGE, OPTION 2
BỘ THẠCH CẦU THỦY KHA THI - PHƯƠNG AN 2

REV. No	DATE	DESCRIPTION	DRAWING No
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1	FEB-2010	FINAL DRAWING	

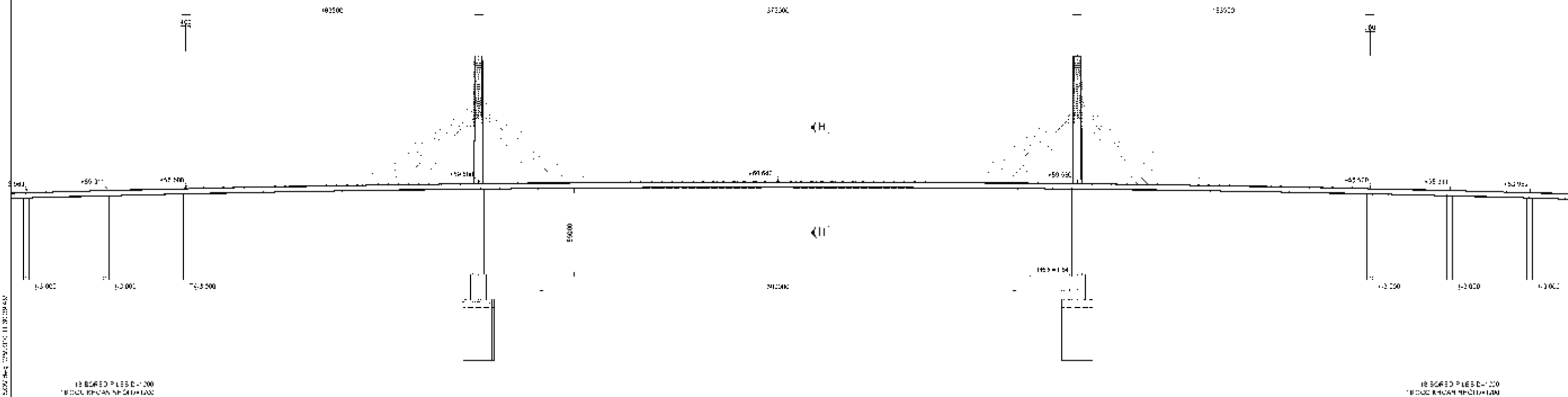
SCALE: 1: AS SHOWN

PROFILE OF BRIDGE - MẶT ĐỨNG CẦU

SCALE 1:2500 (TỶ LỆ 1:2500)

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CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tim COLLETT	

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VIETNAM EXPRESSWAY CORPORATION (VEC)

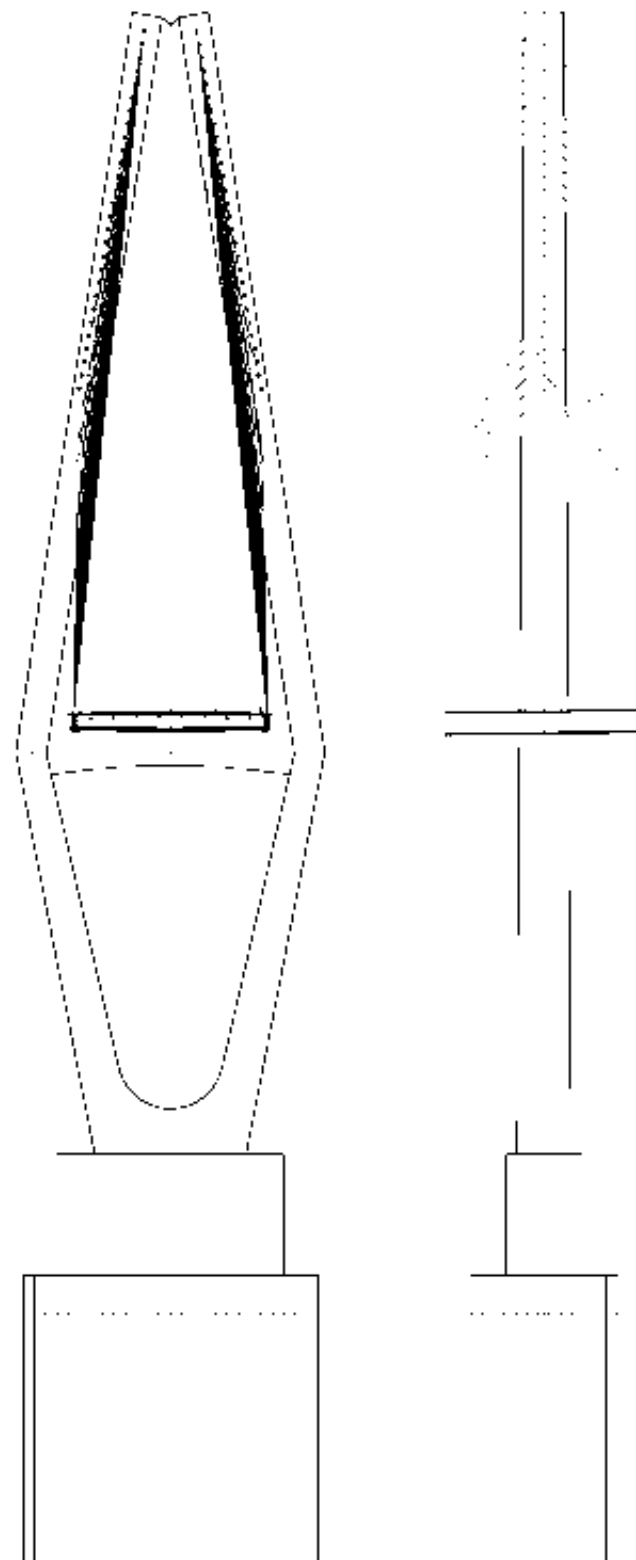
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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
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 GENERAL VIEW OF PHUOC KHANH BRIDGE - OPTION 3
 BỘ TRƯỞNG CẦU PHUOC KHANH - PHUONG ANH

REV. No.	DATE	DESCRIPTION	DRAWING No.
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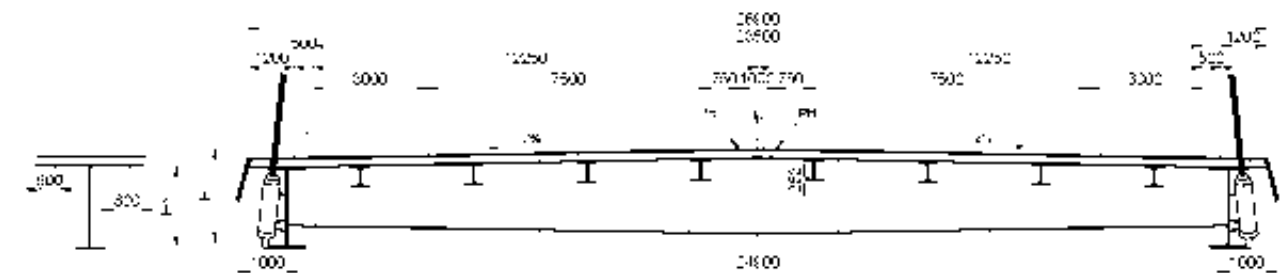
PYLON AND TYPICAL CROSSECTION OF BRIDGE TRỤ THÁP VÀ CẮT NGANG CẦU

PYLON DETAIL
CHI TIẾT TRỤ THÁP
SCALE 1:1000 PYLET 1:1000



CROSS SECTION OF MAIN GIRDER
CẮT NGANG DÀM CHÍNH

SCALE 1:500 PYLET 1:500
COMPOSITE



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CHECKED BY	La Ngoc HIEU	
APPROVED BY	Tim COLLETT	

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TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF PILEX, K&E BRIDGE OPTION 2
BỘ THẠCH CẦU MỘT CỘT KHUẤT - PHƯƠNG ANS

REV. No	DATE	DESCRIPTION	DRAWING No
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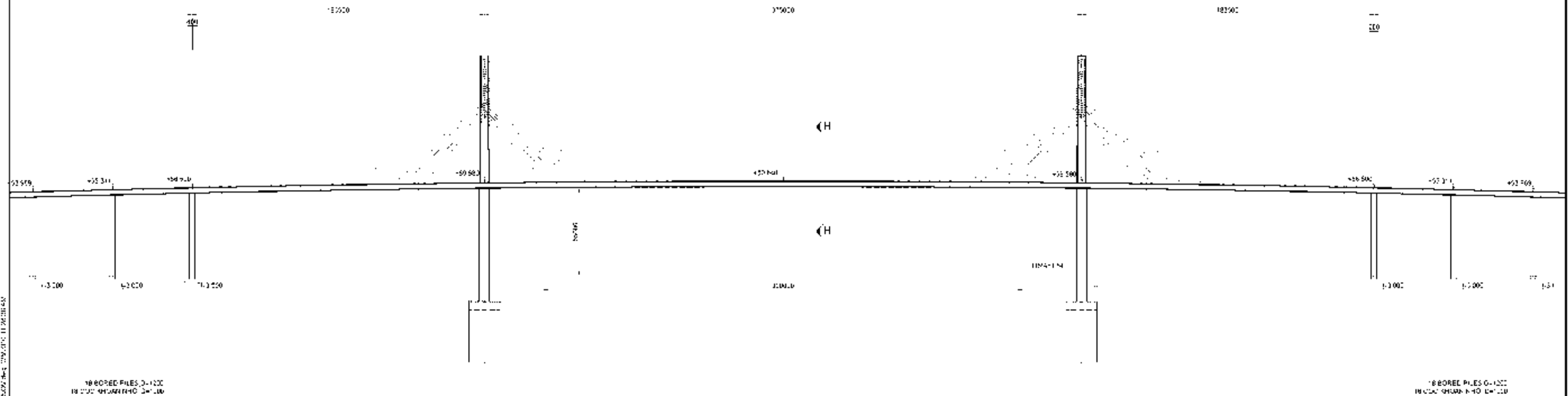
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BEN LUC

LONG THANH



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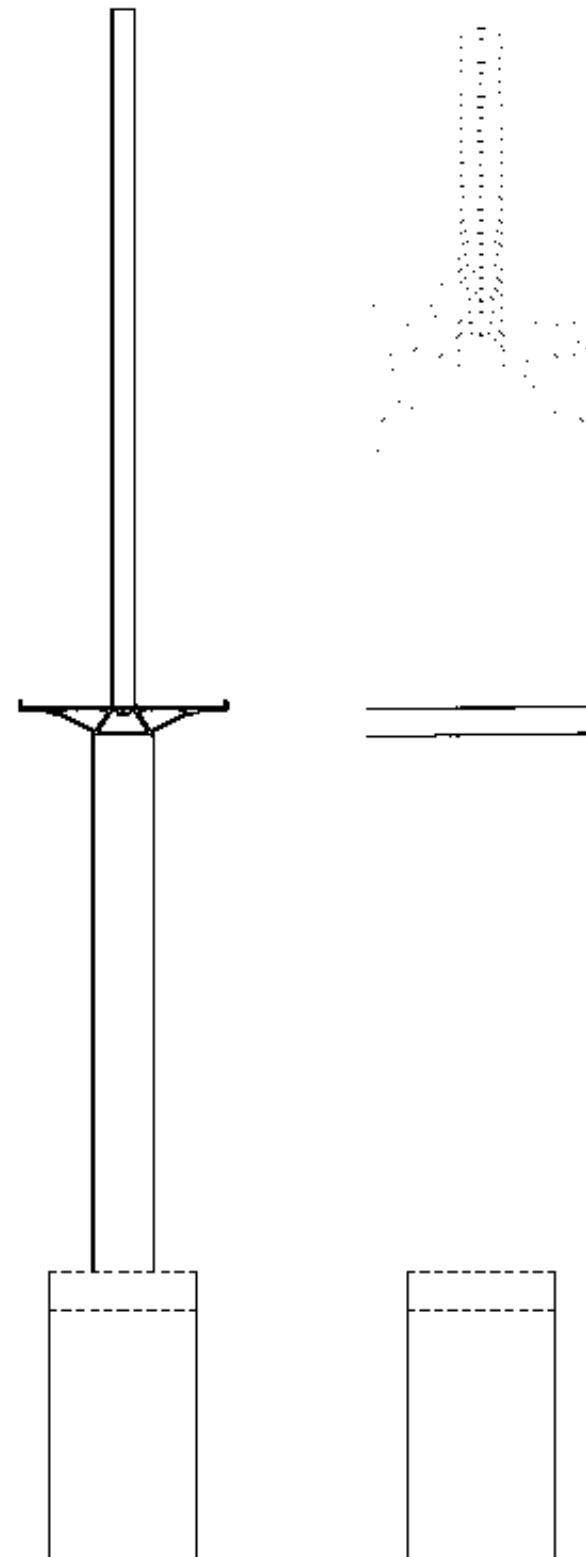
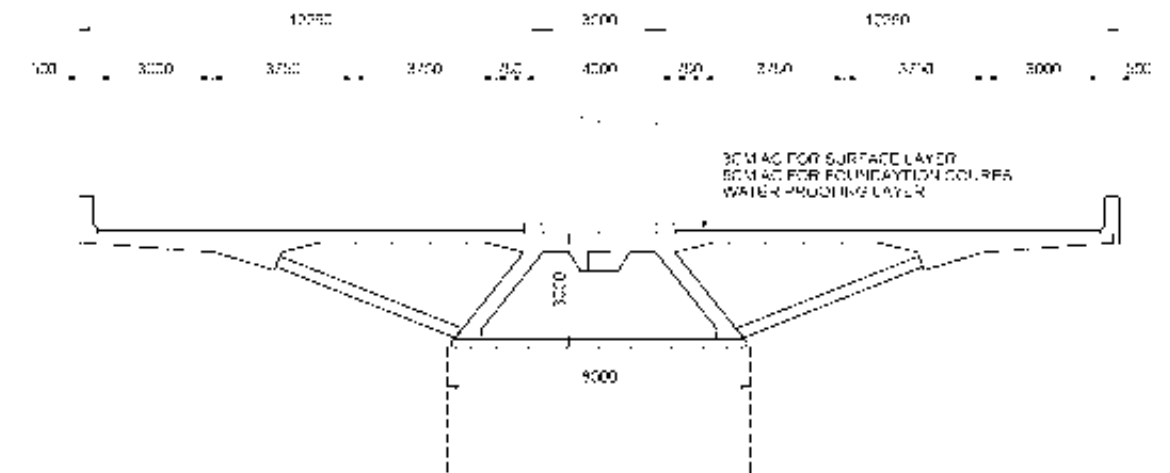
TA 7155-VIE: PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT

DRAWING TITLE
GENERAL VIEW OF PHUOC KHANH BRIDGE - OPTION 1
BỘ TRƯỞNG CẦU PHUOC KHANH - PHUONG ANH

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APPENDIX B

Tom COLLETT

VIETNAM EXPRESSWAY CORPORATION (VEC)

ĐỖ THỊ CHUỖNG CẢNH PHULC KHÁNH - THƯỜNG AN

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22. CABLE STAYED SOLUTION OF STAGE 1, STAGE 2
22.GIẢI PHÁP CẦU DÂY VĂNG TRONG HAI GIAI ĐOẠN

APPENDIX C3: HYDROLOGY REPORT

FINAL HYDROLOGICAL REPORT

**TA 7155 – VIE: PREPARING THE BEN LUC - LONG THANH
EXPRESSWAY PROJECT**

FEBRUARY 2010

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BEN LUC - LONG THANH EXPRESSWAY FEASIBILITY STUDY

HYDROLOGICAL REPORT

I. GEOGRAPHICAL CONDITION

1. Project location

Ben Luc - Long Thanh Expressway starts from intersection of Ho Chi Minh city – Trung Luong Expressway with Ring Road No.3 of Ho Chi Minh city on My Yen commune, Ben Luc district, Long An province. It ends at the intersection with Bien Hoa – Vung Tau Expressway on Phuoc Thai commune, Long Thanh district, Dong Nai province. Alignment crosses national highway 1A, national highway 50, national highway 51 and several large rivers such as Can Giuoc, Ba Lao, Xoai Rap, Long Tau, Ong Keo, Thi Vai, in which Xoai Rap and Long Tau are main passages for ocean ship on South Viet Nam. The length of whole route is about 58.5 km long and is located on Long An, Dong Nai and Ho Chi Minh city.

2. Topographical features.

Ben Luc - Long Thanh Expressway traverses through on low and flat of land with natural ground is about from 0.2m to 1.5m (except about 3km, where is higher 1.5m). Therefore, many parts of the alignment trace are inundated during spring tide on wet season. The terrain is mostly divided by natural canals and ditches connecting to each other. The flow in this river system is almost tidal flow with two in and two out on day.

The alignment passes across the muddy soil with paddy fields, marsh/mangrove wetland areas. The wetlands with mangroves are present and Can Gio Biosphere Reserve is located to the South of the alignment.

3. River features.

Ben Luc - Long Thanh Expressway crosses the three main river branches of Dong Nai river system; Soai Rap river, Long Tau river and Thi Vai river. Dong Nai river system is a very important resource in Viet Nam with a length of 635Km main Dong Nai river and a total basin area of 44.100 km². This system develops mainly south of the Highlands, in the North East Southern area and a small part of Cambodia upstream of Vam Co basins and a part of Sai Gon river

The main flow of Dong Nai River originates from Nhon Giao at the elevation of about 1700m in the Lang Biangs, flow in the direction of North East – South West, after meeting Be River and Sai Gon River, it changes to the direction of North West – South East to follow into the sea in Ganh Rai bay through the Xoai Rap, Dong Tranh and Long Tau Estuaries. The network of rivers and streams develops fairly well with the density 0.64Km/km². The total system has as many as 265 estuaries, which develop to grade 4 and nearly 50% of the estuaries develop to grade 2. Some important grade 1 estuaries are La Nga with the length of 272 Km and the basin area

of 4.170 km², Be river with the length of 344 Km and the basin area of 7.170 km², Sai Gon with the length of 256 Km and the basin area of 5.560 km², Vam Co with the length of 218 Km and the basin area of 12.800 km².

The soil layer in Dong Nai River is thick weathered strata, abundant, and fairly-developed vegetation cover. The proportion of forest is about 40% in Da Dung and La Nga basins, and about 20% in Sai Gon and Vam Co basins.

In addition, the alignment intersects several other rivers and ditches, among them Can Giuoc, Ba Lao, Ong Keo are medium size and important waterways in the area.

The main features of the rivers in this area are : the water is frequent; slope of riverbed and water surface is small. As it is a marsh area, riverbanks consist of easily erodible muddy soil. There are locations where sign boards displayed at the riverbank indicating the erosion areas.

4. Hydro-meteorological features.

The study area is in Southern climatic area. Temperature is almost high throughout the year. The wet and rainy climate changes are according to the season and the wind. As this area is near the equator, annual variations of rainfall and temperature have equatorial features. In the annual variation line, there may appear two maximums responding to twice of zenith position of the sun and two minimums responding to the max latitudes of the sun at the South or the North poles.

The climate varies slightly in this area and not too hot or cold weather. The rains or storms are weak and short time and heavy rain or storm, if any, is occasional. Natural disasters due to climate are a few.

In the lowlands of Dong Nai River, flood season starts from July to November and dry season starts from December to April the following year. In rainy season, the flow volume takes up about 85% of the whole year's flow volume. The biggest, average, and smallest values of hydrological factors depend much on the flow value from upstream and tidal water levels. According to hydrological investigation data, in the flood rain in 1952 (at that time, Dong Nai River system didn't have any works to control the flow from upstream) the heavy rainfall in a vast area made the water level reach the frequency of 1% to 1.5%. At that time, the water level in Phu An and Nha Be stations reach to 1.53m.

The oceanographic factors of this coastal area directly affect the hydrological system of the lowlands in Dong Nai River – water level variation. The water level variation in this area is mixed tide, mainly in semi-diurnal tide. The variation amplitude of water level reaches 3.5m to 4.0m, belong to the highest in the coastal area of Vietnam. Because Xoai Rap and Long Tau river have fairly large width and depth, tidal variation in Dong Nai River may reach to Tri An and the tidal variation of other rivers like Sai Gon, Vam Co may reach near upstream.

II. WEATHER AND CLIMATE FEATURES

1. Meteorological stations

In the whole Southern area, there are not many meteorological stations due to less changes in climate because the terrain and climate factors are relatively identical. The most relevant stations for this study area are Tan Son Nhat in Ho Chi Minh city, Bien Hoa in Dong Nai province and Vung Tau in Ba Ria – Vung Tau province stations. These stations have meteorological observation data for many years. In addition to main meteorological stations, along of the route, there are Long Thanh rain gauging station of Dong Nai province, Ba Ria rain recording station of Ba Ria – Vung Tau province. List of stations is in Table 1.

Table 1. List of main meteorological and rain gauging stations.

Station Name	Coordinates		Province/city	Establishing year	Note
	Latitude N	Longitude E			
Tan Son Nhat	10° 48'	106° 41'	HCM City	1906	Meteo. station
Bien Hoa	10° 57'	106° 50'	Dong Nai	1907	Meteo. station
Long Thanh	10° 45'	106° 56'	Dong Nai	1949	Rain station
Vung Tau	10° 20'	107° 05'	BR – VT	1911	Meteo. station
Ba Ria	10° 29'	107° 10'	BR – VT	1949	Rain station

2. Meteorological characteristics.

• **Sunny hours** : In dry months from December to April, the number of sunny hours is over 200 hours/month. The less sunny months are June and September corresponding with two maximums of rainfall and cloud. The average number of sunny hours in the area is listed in Table 2.

Table 2. Average number of sunny hours in the area

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
T.S.N	244	246	272	239	195	171	180	172	162	182	200	223	2489
B. Hoa	267	255	283	259	234	161	194	183	170	211	197	236	2650
V. Tau	259	266	301	275	245	180	231	197	188	194	245	235	2816

• **Rain** : The study area locates in the rainy zone XVIII. Rainfall concentrates from May to November when South-West monsoon governs. Total rainfall of this period is about 80-90% of the whole year. On the contrary, in the period from December to April, when North – East monsoon governs, rainfall is not much and about 10 -15% of the whole year.

Rainfall variations are due to the monsoon in tropical area. Rainfall is mainly in monsoonal summer. The difference in rainfall between rainy and dry season is very high. The maximum is usually in September or October with monthly rainfall over

250mm. The minimum is in January or in February with the least monthly rainfall less than 10mm.

The average numbers of rainy days are over 100 days/year. Rainy days mainly concentrate on rainy months, on average about 15 to 20 days a month. When there is a little rain, on average there are not over 5 rainy days a month, and only less than 2 rainy days in January, February, and March.

Distribution of rain highly varies from year to year, especially rainfall. The highest annual rainfall of a year with the most rain may be twice the least rainfall in a year.

Table 3. Rainfall (mm) and average number of rainy days

Chara c.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Tan Son Nhat station													
Rain.	14	4	10	50	218	312	294	270	327	267	116	48	1931
Days	2	1	2	5	18	22	23	22	23	21	12	7	159
Bien Hoa station													
Rain.	8	4	13	46	159	235	268	282	298	212	89	28	1642
Days	1	1	1	4	12	14	16	16	16	13	7	3	104
Vung Tau station													
Rain.	2	1	5	33	188	206	213	178	214	215	69	23	1347
Days	1	0	1	3	15	18	20	19	19	16	7	4	121

Daily maximum rainfall in the area is not high. Base on annual daily maximum rainfall at stations, probable maximum daily rainfalls with design frequencies by Pierson III method at the meteorological stations along the route are calculated. Results are presented in Table 4.

Table 4. Maximum daily rainfalls (mm) according to design frequencies

Station	Period (years)	Cv	Cs	Average (mm)	1%	2%	4%	10%	25%
Tan Son Nhat	41	0.325	1.560	94.734	199	180	162	135	109
Bien Hoa	62	0.365	0.640	92.097	186	172	158	137	112
Long Thanh	29	0.365	1.169	106.207	228	208	188	158	127

• **Air temperature** : The remarkable feature of temperature in the area is that it is high and nearly does not change in the year. Annual average temperature is about 27°C. The annual temperature variation is equatorial form with two maximums corresponding two zenith positions of the sun and two minimums at the times the latitude of the sun reaches the maximum values at the North or the South poles.

The temperature slightly changes during the months. The difference between the hottest and the coldest month is about 3 - 4°C.

Table 5. Monthly variation of temperature (°C)

Chara.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Tan Son Nhat station													
Aver.	25.8	26.7	27.9	28.9	28.3	27.5	27.1	27.1	26.8	26.7	26.4	25.7	27.1
Max	36.4	38.7	39.4	40.0	39.0	37.5	35.2	35.0	35.3	34.9	35.0	36.3	40.0
Min	13.8	16.0	17.4	20.0	20.0	19.0	16.2	20.0	16.3	16.5	15.9	13.9	13.8
Bien Hoa station													
Aver.	25.2	26.9	28.4	29.0	28.6	27.2	26.9	26.8	26.8	26.7	26.4	25.2	27.0
Max	35.0	36.8	37.4	38.3	37.5	36.4	34.7	33.9	33.8	33.7	34.0	33.5	38.3
Min	13.6	14.5	16.5	20.9	21.5	21.5	20.0	21.7	21.9	21.2	18.0	13.2	13.2
Vung Tau station													
Aver.	25.6	26.3	27.8	28.9	28.9	28.0	27.4	27.4	27.2	27.1	26.9	25.5	27.2
Max	32.9	32.8	34.2	35.8	35.7	34.5	33.5	33.5	33.1	32.6	33.3	32.3	35.8
Min	16.8	18.4	16.8	21.0	18.7	17.9	20.0	18.2	18.6	19.0	17.1	15.0	15.0

• **Humidity and evaporation** : The variation of the annual humidity is responding to rainfall variation. Humidity is high in rainy season and low in dry season. The air humidity are listed in Table 6.

Total annual average evaporation is as much as 1700 mm. The variation of annual evaporation is against the variation of annual air moisture. In every year, March is the month with maximum evaporation about 215mm and October is the month with minimum evaporation about 100mm.

Table 6. Monthly variation of air relative humidity (%)

Chara.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Tan Son Nhat station													
Aver.	71	69	69	71	78	82	82	83	84	84	80	75	77
Min	23	22	20	21	26	30	40	44	43	40	33	29	20
Bien Hoa station													
Aver.	71	68	68	70	78	82	84	84	84	84	82	75	78
Min	29	21	23	22	32	34	47	49	47	49	42	38	21
Vung Tau station													
Aver.	75	76	74	75	77	80	82	81	83	82	79	76	78
Min	40	21	33	45	38	51	49	56	50	49	41	39	21

• **Wind, storms** : The governing wind direction in the area distinctly varies according to season. The governing wind direction is from the South West to the West from June to September and East to the South East from January to April. Average wind velocity in the area is 1.8m/s - 3.1m/s and it gradually decreases from the coast to the land.

In winter, the governing direction is North - East with frequency 30 – 50%. Besides, the frequency of East direction is also fairly big, from 20% to 30%. In summer, the governing direction is South - West or West, two absolutely governing directions in summer monsoon.

Table 7. Monthly variation of wind velocity (m/s)

Charac.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Tan Son Nhat station													
Aver.	2.3	3.1	3.6	3.3	2.5	2.7	2.9	3.8	2.7	2.2	2.2	2.0	2.8
Max	12	12	14	16	25	36	22	28	26	26	19	21	36
Bien Hoa station													
Aver.	1.8	2.2	2.4	2.4	1.8	1.6	1.8	1.7	1.7	1.4	1.5	1.6	1.8
Max	16	15	16	16	18	20	20	25	20	20	16	8	25
Vung Tau station													
Aver.	3.2	4.6	4.7	3.8	2.7	3.2	2.8	2.9	2.3	2.0	2.4	2.1	3.1
Max	15	15	15	15	20	26	20	19	18	14	16	14	26

The study area is slightly affected by storm and tropical low pressure. The storms and low tropical pressure in this area is usually due to heavy rains and increase of wind velocity for a certain period of time. List of storms affecting days during 1962 to 2007 from Binh Thuan to Ca Mau province is presented in Table 8.

Table 8. Storms affecting during 1962 to 2007 from Binh Thuan to Ca Mau.

STT	Name	Storms	Day	Vmax * (m/s)	Pc * (mb)	Areas landing (province)
1	LUCY	STS	30/XI/1962	36	-	Tra Vinh
2	HESTER	TS	19/X/1968	18	-	Binh Thuan
3	MAMIE	STS	23/XI/1968	26	-	Tien Giang
4	THELMA	TS	16/XI/1973	15	-	Soc Trang
5	TESS	STS	06/XI/1988	23	985	Bac Lieu
6	TERESA	TS	26/X/1994	23	1002	Binh Thuan
7	ERNIE	TS	16/XI/1996	15	1008	Ben Tre
8	LINDA	STS	02/XI/1997	28	990	Soc Trang
9	CHIP	STS	14/XI/1998	26	1002	Ba Ria – Vung Tau
10	RUMBIA	TS	8/XII/2000	18	1006	Ca Mau
11	MUFIA	TS	24/XI/2004	21	-	Binh Thuan
12	DURIAN	STS	05/XII/2006	33	-	HCM city

Note : TS – Tropical storm; STS – Strong storm

(*) – Velocity Vmax and Pressure Pc are at the time landing of storms.

High wind velocity rarely and occurs in thunderstorms. The highest wind velocity recorded at Tan Son Nhat station is 36m/s in a thunderstorm in VI/1972. According to the data of maximum wind velocity recorded annually (from 1952 to 2005) at Tan Son Nhat station, probable maximum wind velocities with design frequencies have been calculated are presented in Table 9.

Table 9. Maximum wind velocity in Tan Son Nhat station (m/s)

Frequency	1%	2%	4%	10%	25%	50%
V (m/s)	38	35	32	26	21	17

• **Some special weather phenomena :** In the whole area, fog rarely occurs and only less than 10 times in a year. However, in this area, the frequency of thunders is the highest in Vietnam with an average of more than 60 thunders in a year.

Table 10. Number of thunderous and foggy days in the area

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Tan Son Nhat station													
Fog	3.0	0	1.0	0	0	0	0	0.3	0.3	0.3	1.0	1.0	6.9
Thunder	0	0.3	0.2	2.0	11.0	8.0	13.0	9.0	9.0	8.0	6.0	1.0	67.5
Bien Hoa station													
Fog	0.5	0	0	0.3	0.2	0.3	0	0	0	0.3	0.5	0	2.1
Thunder	0	0.8	0.8	4.3	4.8	8.7	15.0	11.6	7.7	9.7	4.0	2.0	69.5
Vung Tau station													
Fog	0	0	0	0	0	0	0	0	0	0	0	0	0
Thunder	0	0	0.7	1.7	7.2	6.5	6.8	4.5	5.8	4.2	1.0	0	38.4

III. HYDROLOGICAL FEATURES

1. Elevation system.

All water levels given in this report are referred to National elevations (Hon Dau datum).

2. Hydrological stations and data

a. Network of hydrological stations

• **Water levels stations** : In the related project area, there are many hydrological stations belonging to the hydrological network system of the Hydro-meteorological General Bureau. In the flood area regime, the main factors recorded area flows, water levels, temperature and some chemical compositions of the river water. In tidal area regime, the water levels variation is recorded continuously by self recorder. Main recording stations are listed in Table 11.

In addition to the main stations, several water levels recording stations along Sai Gon river and Dong Nai river are available for a short term to serve the transport, irrigation, environmental project, etc. executed by various companies.

Table 11. List of main hydrological stations

Station	Coordinates		River	S basin Km ²	Establishin g Year	Measure ment
	Latitude N	Longitude E				
Ben Luc	10° 38'	106° 28'	V.C.Dong	-	1977	Tide
Nha Be	10° 41'	106° 47'	Nha Be	-	1980	Tide
Vung Tau	10° 20'	107° 04'	East Sea	-	1907	Tide

• **Current observation stations** : At the observation stations in the tidal area regime, Hydro-meteorological General Bureau does not record the current. Thus, by now, in a very large area of the low lands in Dong Nai river system, i.e. in the river branches : Nha Be, Sai Gon, Xoai Rap, and Thi Vai, there are no long continuous current recordings. The systematic recordings were conducted by :

i) The water environmental project on lowland of Dong Nai river system. The client is the Environmental Committee under Ho Chi Minh City's Department of Science and Technology, and executed by the Southern Hydro-meteorological Center. The Project was executed in 1996 and 1997 with 2-day recording every month and the recording covered 11 cross sections in 11 main river branches downstream of Dong Nai river system.

ii) The Xoai Rap chanel improve project. The client is Transport Ministry, and executed by The Southern Institute for Irrigation Science under Ministry of Agriculture and Rural development. The Project was executed in 1993 with 3 day recording and the recording covered 5 cross sections in 5 main river branches downstream of Dong Nai river system.

iii) The flow data on Nha Be cross section on Nha Be river in November 2000 with 7-day recording, from 06 h to 18 h. It was executed by the Southern Hydro-meteorological Center. Flow was measured by ADCP new instrument (Acoustic Doppler Current Profilers). The flow data (water level, average and maximum velocity, discharge) is presented on Appendix.

iv) The Cai Mep – Thi Vai channel project. The client is Ministry of Transport, and executed by TEDI SOUTH. The Project was executed from 1987 to 1990 and 2001, for flow measurements on cross sections in Thi Vai, Cai Mep rivers and in Ganh Rai bay.

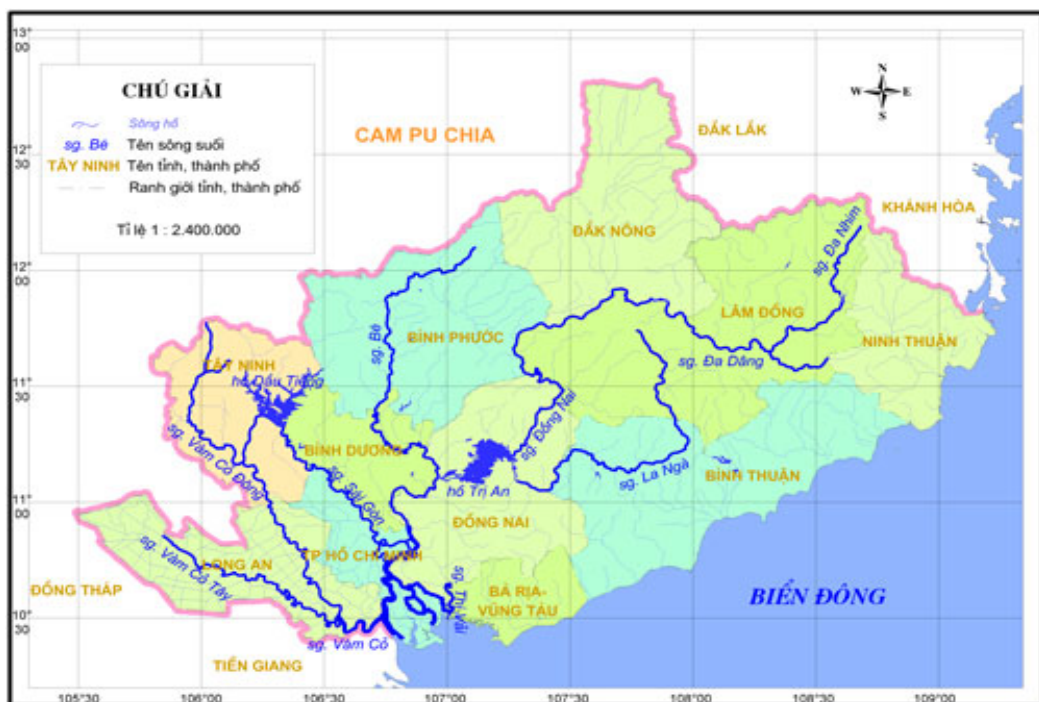
b. Hydrological data.

The hydrological data are used in this report :

- From the Southern Hydro-meteorological Center:
 - Hourly water level (several years) at stations Ben Luc, Nha Be, Vung Tau, etc.
 - Characteristic monthly water level (many years, to 2007) at stations Ben Luc, Nha Be, Vung Tau, etc.
 - Flow data on lowland area of Dong Nai river system in 1996 to 1997.
 - Flow data on Nha Be river in November 2000.
- From the different projects: The Xoai Rap chanel improve project; The Cai Mep – Thi Vai chanel project; The Ho Chi Minh city – Long Thanh – Dau Giay expressway project; The Ring Road 3 of Ho Chi Minh city etc.

3. Effects of artificial works on hydrological features.

At present, upstream of main rivers that cross the Ben Luc – Long Thanh Expressway, consists of water flow controlling structures : Dau Tieng irrigation lake in Sai Gon River – about 125 km from Ho Chi Minh city; the lake of Tri An Hydro-electric plant in Dong Nai River – about 90 km from Ho Chi Minh city; the lake of Srok Phumieng Hydro-electric in Be River.



One of characteristic of these works is its low frequency. They are mainly for the maintenance of water supply, water for daily activities and contribution in the restraint of salinity in dry season, and to control the flood volume in rainy and flood season. According to the result of hydraulic model in the lowlands of Dong Nai River system, in the flood discharge release condition (0.1%) of Tri An and Dau Tieng lakes combining with Be River with the frequency 0.1%, the water level in the center of Ho

Chi Minh City – Nha Be only increases from 20cm to 25cm, comparing with normal conditions [1].

According to operation standard, when there is continuous heavy rain and depending on design water level, lakes must discharge a large quantity of water. Often in a year, lakes must discharge 1 to 3 times with 3 to 7 days at a time. The flooded area due to discharge is vast in 1986, 1997 and 2000. Statistics of the biggest total volume (W) and discharge (Q) inlet to and outlet from Tri An lake from the operational year of 1999 are presented in table 12.

Table 12. Total flood volume and discharge to lake and through spillway of Tri An lake

Year	W x 10 ⁶ m ³		Q m ³ /s		Year	W x 10 ⁶ m ³		Q m ³ /s	
	To lake	Overflowing	To lake	Overflowing		To lake	Overflowing	To lake	Overflowing
1988	11330	4879	1725	1475	1994	19113	3656	2343	2250
1989	15385	4754	2071	1500	1995	13733	1927	2050	1600
1990	18173	4620	2964	2800	1996	17417	2920	2049	1930
1991	15732	2446	2123	2050	1997	17745	4070	2363	2075
1992	14682	1213	2549	1460	1998	13907	1341	1930	1725
1993	15352	143	1753	1300	1999	23296	4156	3360	2956

Following is main information of reservoirs at upstream of rivers directly relating to Ben Luc – Long Thanh Expressway.

a. The Tri An Lake.

At Tri An Hydro - Power plant, the water flow for machines operation and excess discharge all releases directly to Dong Nai River. The average water flow for machines operation is about 700 to 800 m³/s. The excess discharge depends on water level in lakes and flow discharge to lakes. In the most unfavorable case, when water level in lakes reaches to the design level, lakes will discharge flow equivalent to the input water flow.

In 1999, whole water flow to Tri An Lake was the highest since the construction completion, and therefore, total discharge was also the highest. The input and output water flow in the lake in the rainy season (from July to November) in 1999 is presented in Table 13; the process of the highest flood discharge is presented in table 14.

Table 13. Flow discharge and volume in the Tri An lake in flood season 1999

Character (Month)	VII	VIII	IX	X	XI	The total amount in flood season
Q to lake m ³ /s	1372	1866	1007	774	671	
Q outlet m ³ /s	275	1092	147		34	
Q operation m ³ /s	808	862	787	672	634	
W water to lake x10 ⁶ m ³	3673	4997	2610	2072	1739	15092
W outlet x10 ⁶ m ³	738	2924	381		87	4130
W operation x10 ⁶ m ³	2163	2310	2039	1801	1643	9957
W in lake x10 ⁶ m ³	735	-274	149	229	-32	807

Table 14. Variations of the highest water level (H) and flood discharge (Q) at the Tri An lake

Date	H upstream (m)	H downstream (m)	Q outlet m ³ /s	Q through turbine m ³ /s	Total of discharge m ³ /s	Q to lake m ³ /s
28/7/1999	61.231	6.40	641	795	1436	2063
29/7/1999	61.580	8.70	983	813	1796	3078
30/7/1999	61.745	9.90	1878	864	2742	3360
31/7/1999	61.843	10.10	2168	750	2918	3291
01/8/1999	61.887	9.90	2064	892	2956	3130

b. The Srok Phumieng Lake.

- General specifications :
 - Project grade : project grade 2.
 - Design discharge $Q_{0.5\%} = 6500\text{m}^3/\text{s}$; $Q_{0.1\%} = 7180\text{m}^3/\text{s}$
 - Operation discharge $Q_{\text{max}} = 301\text{m}^3/\text{s}$; $Q_{\text{guarantee}} = 70\text{m}^3/\text{s}$.
 - Discharge capacity when decreasing flood with frequency $Q_{0.5\%} = 6017\text{m}^3/\text{s}$; $Q_{0.1\%} = 6598\text{m}^3/\text{s}$.
 - Basin area $F = 3822\text{km}^2$.
- Main relevant projects
 - Reservoir : Normal water level $H_{\text{bt}} = +72\text{m}$; design water level $H_{\text{tk}} = +73.6\text{m}$; lake area corresponding with normal water level = 16.42km^2 , lake area corresponding with dead water level = 12.26km^2 ; the total volume $W = 0.99 \cdot 10^9\text{m}^3$; the volume corresponding with dead water level $W_{\text{c}} = 0.71 \cdot 10^9\text{m}^3$;
 - Spillway : Concrete spillway with 6 outlets, each 12.3m wide, 10m high; Energy irradiation by the bottom.
 - Flood discharges directly to Be River.

c. The Dau Tieng Lake.

- General specifications :
 - Grade of the project : project grade I.
 - Resistance guarantee frequency $P = 0.1\%$.
 - Design flood discharge $Q_{0.1\%} = 2800\text{m}^3/\text{s}$.
 - Basin area $F = 2700\text{km}^2$.
 - Regulating regime : Many years.
- Relevant main projects.
 - Reservoir : Normal water level $H_{\text{bt}} = +24.4\text{m}$; Design water level $H_{\text{tk}} = +25.1\text{m}$, dead water level $H_{\text{c}} = +17.0\text{m}$; lake surface area corresponding with normal water

level = 270km^2 , lake surface area corresponding to $H_c = 110\text{km}^2$; The total volume $W = 1.58 \times 10^9 \text{m}^3$, the volume corresponding with dead water level $W = 0.47 \times 10^9 \text{m}^3$;

- Spillway : the deep spillway model has 6 outlets, each 10m wide, 6m high with front wall; overflowing point has spillway with large peaks, height of overflowing +14.0m; energy irradiation by ejecting gutter, arch shaped door made of steel, operating by hydraulic piston; After the spillway is the canal 1000m long directing flood to Saigon River.
- Overflowing standard (extract from Article 20 about temporary operation and regulation process of Dau Tieng reservoir) :

+ Annually, when the height of the lake's water level reaches +23.3m, the main season flood appears (November, October): If the flood to lake has the frequency $P = 1\% - 0.5\%$, the highest discharge Q outlet is from 750 to $1000\text{m}^3/\text{s}$; if $P = 0.1\%$, the highest discharge Q is $1600\text{m}^3/\text{s}$; if the flood is especially high with frequency 0.01% , the highest discharge Q is $2800\text{m}^3/\text{s}$.

+ When the lake's water level reaches the normal water level of +24.4m or late flood appears after October 20th: if the flood has the frequency $P = 1\%$, the highest discharge Q outlet is $1800\text{m}^3/\text{s}$; if it has frequency $P = 0.5\%$, the highest discharge Q reaches $2100 \text{m}^3/\text{s}$; if it has $P = 0.1\%$, the highest discharge Q outlet is $2800\text{m}^3/\text{s}$.

4. Main hydrological features.

Hydrological system of the area comprises the mixture system between East sea tide with the flood of Dong Nai river system and flood due to rain in the basin itself. In this relationship, East sea tide system plays a role to control the whole hydrological regime.

When analyzing the hydrological conditions, it is clear that the hydrological regime in the area where the route passes by is affected by both continental hydrological regime and East Sea tide regime. The main features of this system may be summarized as follows.

a. Feature of the flow.

• **Features of the flood flow** : Natural geographical features of the basin affect to the flow in rivers. According to author Tran Thanh Xuan's calculation (1988) the total water flow in whole Dong Nai River's basin is about $32.8 \times 10^9 \text{m}^3/\text{year}$ equivalent to the current layer of 814 mm/year and the current coefficient of 0.4. In this total amount, main water flow at Tri An is $16.777 \times 10^9 \text{m}^3/\text{year}$ with average flow in many years $532 \text{m}^3/\text{s}$ equivalent to the current modulus of $35.91/\text{s} \cdot \text{km}^2$, water flow in Be River is $6.5 \times 10^9 \text{m}^3/\text{year}$ (about 20% of the total flow).

The water regime of Dong Nai River system is relatively simple. The flood season in the area lasts about 5 months, usually from early July to the end of November. The total flow volume in flood season takes up about 85% of annual flow volume. The dry season lasts about 4 months, from January to April every year. In rainy season, the rainfall is high and river flow rapidly increases. Then national reservoirs discharge overflowing flood according to operation standard in rain and flood seasons. In addition, flood-tide is often highest in rainy months. So, in this area, average water level on flood season usually is higher from 0.4m to 0.5m, than on dry season. Thus,

proportion between month with the highest water flow and month with the least water flow is up to 26.2 times (Table 15).

In main current of Dong Nai River in Tri An, the average discharge for many years is $532 \text{ m}^3/\text{s}$, equivalent to the total flow 16.8 billion m^3/year and the current module 35.9 l/s.km^2 . After receiving water from Be, Sai Gon and Vam Co Rivers, total water volume in the whole area is about 32.8 billion m^3/year . In the total system, current modulus is 26.1 l/s.km^2 , however, they distribute irregularly: 37.91 l/s.km^2 in La Nga at TaPao, 37.2 l/s.km^2 in Song Be at Phuoc Hoa, 24.2 l/s.km^2 in Sinh Doi Ditch (Sai Gon River) at Loc Ninh, and 17.3 l/s.km^2 in Vam Co River at Can Dang.

The heavy floods occurred in 1952, 1978 through a vast area. In the flood in 1978, water level in Dau Tieng in Sai Gon River was higher than annual flood level by nearly 3m, in Tri An in Dong Nai River by 4m and in Phuoc Hoa in Be River over 6m. Especially the flood in 1952 occurred due to concurrent heavy rains in the provinces of Dong Nai - Sai Gon Rivers' lowlands, and it inundated whole area of agricultural land within 3 to 4 days. This was a historical flood and evaluated with a frequency of from 1.5% to 1%.

Table 15. Monthly variation of discharge (m^3/s) at Tri An and Phuoc Hoa stations

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Dong Nai river: Tri An station; $S = 14800 \text{ km}^2$												
Aver.	103	66	48	60	12 7	417	751	134 5	131 7	127 9	594	239
Max	162	120	153	320	40 3	148 0	237 0	290 0	319 0	240 0	136 0	525
Min	54	27	24	22	35	56	250	339	571	534	284	135
Be river; Phuoc Hoa station; $S = 5240 \text{ km}^2$												
Aver.	49	26	14	14	34	110	237	490	560	460	232	102
Max	90	55	31	71	13 2	508	750	144 0	155 0	972	491	946
Min	25	11	6	4	4	7	40	107	223	199	96	43

• **Features of the tidal flow** : The tidal regime in the area is irregular semi-diurnal tide, similar to the South Eastern coastal area. Most of the days in the month, there are two rising tides and two falling tides (for the current : twice the current is from the sea to the land and twice the current from the land to the sea). The difference between the heights of two continuous tide peaks is about 0.3 – 0.4m, the difference between the heights of two continuous tide troughs is very high – up to 2.0m. The maximum tidal amplitude is 3 – 4m, to rank of the highest in Vietnam.

The periodic vibration by the tide in Ho Chi Minh City area is about 85% - 90% on average of the total water level variation. The tidal current is caused mainly by East Sea tide phenomenon and affected by the river current. The current has the characteristics of clear forward and backward and repeats nearly completely water level oscillation – when the water rises, the current is the rising tide, when the water falls, the current is the falling tide. When the rising tide changes into the falling tide and vice versa, the “stopping water” appears, it means that the current velocity is 0.

The “stopping water” time is not long. The time of “stopping water” is about 1.5 to 2 hours later than the time of the tidal peak or bottom.

The current velocity in rainy season is often higher than in dry season, the falling tidal flow is larger than the rising tidal flow. The main direction of the current coincides with the direction of the bank.

In general, the out-current discharge through the cross sections is bigger than the in-current discharge; however at certain times in some cross sections, there appears the situation that the in-current discharge is bigger than the out-current discharge, which shows the connection in the river system of the area.

Table 16. Highest current discharge and measured velocity

Month	Current Direction	Nha Be cross section in Nha Be river				Phuoc Khanh cross section in Long Tau river			
		Vmax cm/s	Hour/ day	Qmax m3/s	Hour/ Day	Vmax cm/s	Hour/ Day	Qmax m3/s	Hour/ Day
V (1996)	Out	100	22 h/06	8346	21 h/06	112	22 h/05	7506	21h/05
	In	-81	23 h/06	-7533	03 h/06	-93	03 h/07	-6411	03h/07
VI (1996)	Out	90	21 h/04	7796	21 h/04	133	20 h/04	9251	20h/04
	In	-98	04 h/05	-9110	04 h/05	-94	03 h/04	-6928	03h/04
VII (1996)	Out	84	21 h/03	7380	20 h/03	103	23 h/03	6475	19h/02
	In	-98	04 h/04	-9312	04 h/04	-73	04 h/03	-5664	04h/03
VIII (1996)	Out	90	10 h/29	7733	10 h/29	109	22 h/30	7740	19h/29
	In	-100	03 h/31	-9696	03 h/31	-71	01 h/30	-5096	02h/30
IX (1996)	Out	82	23 h/29	7195	24 h/29	120	10 h/29	8326	09h/29
	In	-60	15 h/28	-5945	15 h/28	-70	02 h/29	-5400	02h/29
XI (1996)	Out	87	08 h/26	7351	08 h/26	121	08 h/26	8367	08h/26
	In	-76	14 h/26	-7351	14 h/26	-62	12 h/25	-4639	14h/26
XII (1996)	Out	97	09 h/12	8265	09 h/12	139	09 h/13	9778	08h/13
	In	-89	15 h/13	-8334	15 h/13	-77	14 h/13	-5523	14h/13
I (1997)	Out	99	11 h/10	7939	09 h/12	138	09 h/11	9884	08h/11
	In	-97	15 h/11	-9358	15 h/11	-84	15 h/11	-6421	15h/11

II	Out	90	09 h/23	7637	09 h/23	123	08 h/23	8663	08h/23
(1997)	In	-80	15 h/23	-7720	15 h/23	-76	14 h/23	-5730	14h/23
IV	Out	95	09 h/09	8409	09 h/09	115	21 h/10	7914	21h/10
(1997)	In	-81	15 h/10	-7792	15 h/19	-73	03 h/11	-5432	04h/10

b. Features of water levels.

• **Features of tidal variations** : The tidal regime in the area is irregular semi-diurnal tide. Most of the days in the month, there are two rising tides and two falling tides. The maximum tidal amplitude at high tide may reach about from 3m to 4m in the area of the expressway.

The main cause of the tide is gravitation force of the Moon and the Sun with the earth. According to the physical viewpoint, it can be considered that tide water level (tide wave) is piled up of component tide waves with different amplitudes and phases (4, 5, 10).

$$H_t = \sum_{i=1}^N f_i \times H_i \times \cos (q_i \times t + (V_0 + U)_i - g_i) + H_0 \quad (1)$$

Where : H_t - water level at time point t

i – component wave symbol, N – number of component waves

f_i – decreasing factor depending on the position of the Moon and the

Sun

q_i – angular rate of wave

$(V_0 + U)$ – beginning phase

H_i, g_i – harmonic constant of component tide waves – is the quantum feature of tidal variations at a specific area and unchangeable according to the time.

H_0 – average water level.

Harmonic constant determines structure and basic features of tidal variations. For calculating harmonic constant, harmonizing data has been analyzed. The main method applied here is the minimum square method for observation data of water level continually every hour in many years [4] to separate 60 basic tidal waves. Results of analysis are presented in Table 17.

Table 17. Harmonic constants at several stations

No	Wave	Angular rate Q (deg./hour)	Vung Tau		Nha Be		Ben Luc		Phu My	
			H (cm)	G (deg.)	H (cm)	G (deg.)	H (cm)	G (deg.)	H (cm)	G (deg.)
1	SA	0.0411	20.9	272.6	20.8	270.9	25.1	261.9	19.3	281.6
2	SSA	0.0821	5.6	93.8	7.2	59.1	9.2	97.5	5.3	92.2
3	MM	0.5443	0.6	48.9	4.9	23.4	4.1	22.6	1.5	25.5
4	MSF	1.0159	1.1	204.	7.9	63.4	7.6	60.1	0.6	214.

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				9						2
5	MF	1.0980	0.7	78.8	2.1	74.1		120.6	1.4	46.9
6	2Q1	12.8542	1.1	226.8	1.3	318.4	2.6 0.8	129.9	1.1	220
7	SIG1	12.9271	1.1	272.0	4.4	12.7	3.9	23.5	1.6	296.2
8	Q1	13.3987	8.4	243.1	6.0	271.8	3.4	281.3	8.6	247.3
9	RHO1	13.4715	1.7	244.0	1.6	273.5	1.9	252.4	1.3	259.3
10	O1	13.9430	44.5	263.6	38.0	290.5	24.5	297.1	44.7	268.3
11	MP1	14.0252	1.4	357.0	5.7	96.8	5.1	106.1	2.8	24.9
12	M1	14.4920	1.7	318.3	0.8	303.4	2.1	20.5	2.4	335.5
13	CHI1	14.5695	0.7	306.2	0.6	335.7	0.4	340.5	0.8	305.9
14	PI1	14.9179	1.5	309.7	1.2	333.2	0.8	302.9	0.8	340.9
15	P1	14.9589	18.8	311.0	13.0	345.3	9.8	355.7	18.4	315.5
16	S1	15.0000	0.9	215.6	0.4	152.9	1.3	84.1	0.7	178.8
17	K1	15.0411	59.0	313.6	53.7	343.0	36.2	353.9	60.2	318.6
18	PSI1	15.0821	2.1	161.3	2.6	184.1	1.4	160.7	1.4	119.4
19	PHI1	15.1232	0.8	320.8	0.7	203.8	0.8	310.7	0.6	343
20	THI1	15.5126	0.8	342.6	1.0	307.5	1.2	39.8	0.7	18.3
21	J1	15.5854	2.3	350.1	1.5	71.5	1.1	133.2	2.7	18.4
22	SO1	16.0570	1.1	153.1	4.8	198.6	5.2	204.3	1.4	135.1
23	OO1	16.1391	1.8	20.2	0.7	89.7	1.5	165.1	1.5	37.8
24	OQ2	27.3417	0.6	159.8	0.6	222.7	0.5	191.0	0.5	213.9
25	MNS2	27.4238	0.1	233.6	1.4	191.0	1.7	193.2	1.2	105.1
26	2N2	27.8954	2.1	349.3	2.4	15.0	1.7	97.1	0.2	65.8
27	MU2	27.9682	2.1	335.5	4.6	206.4	4.8	234.7	3.6	13.9
28	N2	28.4397	15.5	14.0	11.3	83.0	9.3	97.1	18.3	24.9
29	NU2	28.5126	2.4	27.8	2.3	63.2	2.5	111.	4.0	33.4

								9		
30	OP2	28.9020	2.0	246. 0	3.1	334. 8	2.5	186. 3	3.0	264. 8
31	M2	28.9841	75. 8	37.7	71. 1	99.6	60.2	118. 9	91.4	48.8
32	MKS2	29.0662	0.8	96.9	1.2	216. 2	1.0	185. 7	1.6	139. 4
33	LAM2	29.4556	0.8	38.4	3.6	99.4	2.6	125. 8	2.1	31
34	L2	29.5285	2.2	61.3	5.9	124. 8	5.0	126. 3	2.0	71.1
35	T2	29.9589	1.7	75.1	0.1	227. 1	1.2	153. 1	1.6	85.5
36	S2	30.0000	29. 4	80.9	24. 4	146. 5	18.5	168. 3	37.0	95.1
37	R2	30.0411	0.4	79.6	1.1	283. 5	0.5	39.0	0.5	239. 9
38	K2	30.0821	9.3	92.6	7.8	150. 2	8.0	170. 1	11.8	106. 5

Table 17. Harmonic constants at several stations (continous).

No	Wave	Angular rate Q (deg./hou r)	Vung Tau		Nha Be		Ben Luc		Phu My	
			H (cm)	G (deg.)	H (cm)	G (deg.)	H (cm)	G (deg.)	H (cm)	G (deg.)
39	MSN2	30.5444	0.3	257. 9	1.7	313. 0	1.3	349. 6	0.8	217. 9
40	KJ2	30.6265	0.5	299. 4	0.1	339. 8	0.4	98.3	0.9	310. 8
41	2SM2	31.0159	0.7	300. 8	2.7	348. 0	2.1	18.2	1.7	284. 3
42	MO3	42.9271	1.8	134. 1	2.4	255. 3	2.6	176. 7	2.0	149. 7
43	M3	43.4762	0.3	138. 5	0.8	1.2	0.5	35.5	1.8	137. 6
44	SO3	43.9430	1.6	193. 9	1.6	299. 0	2.5	29.2	0.5	203. 6
45	MK3	44.0252	2.9	195. 7	4.9	286. 7	3.9	338. 1	2.4	185. 1
46	SK3	45.0411	0.9	270. 0	1.4	51.9	2.2	128. 1	0.6	305. 7
47	MN4	57.4238	0.5	247. 8	1.6	38.9	2.6	76.4	1.6	222. 1
48	M4	57.9682	1.2	266. 6	4.9	54.1	7.7	92.7	4.9	239. 4
49	SN4	58.4397	0.2	305. 3	0.5	119. 5	0.3	200. 7	0.6	283. 5
50	MS4	58.9841	1.1	313. 2	4.4	96.1	4.3	155. 6	4.8	280. 4

51	MK4	59.0662	0.3	315. 6	1.3	68.9	2.5	82.9	1.9	267. 5
52	S4	60.0000	0.4	11.9	0.5	166. 2	0.2	287. 2	1.0	359. 9
53	SK4	60.0821	0.2	350. 4	0.7	120. 5	0.5	199. 7	0.8	317. 9
54	2MN6	86.4079	0.2	132. 9	0.5	0.9	2.8	71.8	0.3	255
55	M6	86.9523	0.5	165. 6	1.0	27.0	5.6	91.9	0.6	281. 4
56	MSN6	87.4238	0.1	192. 9	0.4	70.7	0.8	139. 2	0.1	315. 4
57	2MS6	87.9682	0.4	221. 4	1.8	71.6	4.5	154. 2	0.4	317. 9
58	2MK6	88.0503	0.1	211. 6	0.5	91.5	2.6	141. 6	0.3	47.5
59	2SM6	88.9841	0.2	267. 3	0.5	126. 2	0.8	235. 3	0.2	285. 1
60	MSK6	89.0662	0.1	275. 9	0.6	127. 2	1.6	202. 4	0.2	123. 9

Note : Base on harmonic constants, tidal prediction can be calculated at stations.

$$\text{Tidal properties are determined by the formula: } K = \frac{H_{o1} + H_{k1}}{H_{M2}} \quad (2)$$

From Table 17 we can see that along Vam Co Dong and Xoai Rap rivers, when entering the river, because of friction, the amplitude of main tidal waves decreases gradually while diurnal tidal waves decreases faster than semi-diurnal tidal waves, resulting in the gradual decrease of diurnal tide and gradual increase of semi-diurnal tide. Besides, according to the analyzed results : when entering the river, the amplitude of short period wave such as 1/4 day, 1/6 day increases very fast, for example the amplitude of M6 in Vung Tau is only 0.5cm while in Bien Hoa is 1.0cm and in Ben Luc is 5.6cm. However the total value of increasing the short term wave amplitude is smaller than the total value of decreasing long term waves' amplitude, so in the process of entering Dong Nai river, the magnitude of the tide decreases. However, along Thi Vai river, amplitude of tide increases from Vung Tau to Phu My station. Main reason of this phenomenon is resonant of topograph with fluctuation of tidal waves. At Phu My station, maximum of water level is higher than Vung Tau about 25cm to 30cm and minimum of water level is lower than Vung Tau about 20 cm.

The tide phase at the Nha Be station is later than the tide phase in Vung Tau about 2.0 hours, and the tide phase at the Ben Luc station is later than the tide phase in Vung Tau about 2.5 hours, the tide phase at the Phu My station is later than the tide phase in Vung Tau about 0.5 hours, (angular rate of semi-diurnal wave is about 30° in an hour that of diurnal tide is about 15° in an hour).

- **Frequency of hourly water levels** : Frequency of hourly water levels is calculated by the formula:

$$F(\%) = 100 \times N_i / \sum N_i \quad (3)$$

Where, N_i is the number of times, the water level is higher or equal to the given water level, $\sum N_i$ is water level data for calculating. To ensure that the result contains the yearly oscillations, $\sum N_i$ is chosen to be continual measurement data sufficient for a year or for a multiple of years. Table 18 is the result of guarantee frequency of water level hourly in 1987, 1988, and 1999 at Nha Be stations in Nha Be river.

Table 18. Frequency of hourly water levels in Nha Be

H (cm)	≥-245	≥-240	≥-235	≥-230	≥-225	≥-220	≥-215	≥-210	≥-205
F (%)	100.0	100.0	100.0	99.9	99.9	99.8	99.7	99.6	99.4
H (cm)	≥-200	≥-195	≥-190	≥-185	≥-180	≥-175	≥-170	≥-165	≥-160
F (%)	99.2	99.0	98.8	98.4	98.1	97.5	97.1	96.5	96.0
H (cm)	≥-155	≥-150	≥-145	≥-140	≥-135	≥-130	≥-125	≥-120	≥-115
F (%)	95.3	94.7	93.7	93.1	92.3	91.4	90.4	89.5	88.6
H (cm)	≥-110	≥-105	≥-100	≥-95	≥-90	≥-85	≥-80	≥-75	≥-70
F (%)	87.7	86.8	85.8	84.8	84.0	83.0	81.8	80.8	79.6
H (cm)	≥-65	≥-60	≥-55	≥-50	≥-45	≥-40	≥-35	≥-30	≥-25
F (%)	78.1	77.4	76.1	74.9	73.5	72.2	71.0	69.5	68.2
H (cm)	≥-20	≥-15	≥-10	≥-5	≥0	≥5	≥10	≥15	≥20
F (%)	66.75	64.85	63.49	61.62	59.9	58.22	56.44	54.37	52.02
H (cm)	≥25	≥30	≥35	≥40	≥45	≥50	≥55	≥60	≥65
F (%)	49.8	47.3	44.6	42.1	39.4	36.8	33.5	30.3	27.0
H (cm)	≥70	≥75	≥80	≥85	≥90	≥95	≥100	≥105	≥110
F (%)	22.8	19.4	15.4	11.4	8.9	6.0	4.0	2.5	1.4
H (cm)	≥115	≥120	≥125	≥130					
F (%)	0.7	0.2	0.1	0.0					

- **Features of monthly water level oscillation** : Average tide water level increases in September, October, and November every year, due to the effects of North East monsoon pushing water from Pacific Ocean and East Sea into Vietnam sea. In February, March, April and May, average water level decreases due to the effect of South West monsoon pushing water from Vietnam sea.

Table 19. Monthly variation of water level (cm)

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Vam Co Dong River; Ben Luc station												
Aver.	24	17	10	2	-7	-15	-14	-10	9	40	41	32
Max	123	119	123	104	110	92	92	101	137	145	140	127
Min	-143	-152	-155	-151	-166	-184	-187	-184	-165	-140	-113	-124
Nha Be River; Nha Be Station												
Aver.	17	10	5	-3	-12	-23	-22	-18	-4	18	25	22
Max	136	143	140	127	125	110	113	131	146	158	149	148
Min	-213	-222	-205	-223	-247	-270	-274	-256	-238	-221	-220	-222
East Sea; Vung Tau Station												
Aver.	-13	-19	-24	-29	-37	-46	-47	-44	-33	-12	-4	-5
Max	143	145	141	121	112	94	101	110	126	142	145	147
Min	-297	-273	-256	-282	-314	-332	-324	-311	-274	-255	-291	-289

• The highest and lowest water level according to design frequencies at the hydrological stations.

From the data of maximum annual water level, the highest and lowest water levels according to design frequencies are estimated by Pierson III method. Results are as shown in Table 20.

Table 20. Highest and lowest water levels (cm) according to design frequencies

Station		Ben Luc		Nha Be		Vung Tau	
		Max	Min	Max	Min	Max	Min
Number of years N =		32	32	27	27	47	42
Cv =		0.145	0.06	0.067	0.068	0.078	0.046
Cs =		0.233	-0.732	0.727	0.692	0.146	0.068
Htb =		119.22	-170.97	137.22	-244.18	133.55	-307.86
No	Frequency P%						
1	0.010	192	-195	187	-332	176	-363
2	0.100	178	-193	176	-312	168	-353
3	0.200	174	-192	172	-306	165	-350
4	0.333	170	-191	169	-302	163	-347
5	0.500	168	-190	167	-298	162	-345
6	1.000	162	-189	163	-291	160	-341
7	2.000	157	-188	160	-284	156	-338
8	3.000	153	-187	157	-280	154	-335
9	5.000	149	-186	154	-274	152	-331
10	10.000	142	-183	150	-266	147	-326
11	20.000	134	-180	144	-257	142	-320
12	25.000	130	-178	143	-254	140	-317
13	30.000	128	-177	141	-251	139	-315
14	40.000	123	-175	138	-246	136	-311

15	50.000	119	-172	136	-242	133	-308
16	60.000	114	-170	134	-238	131	-304
17	70.000	110	-167	132	-234	128	-300
18	75.000	107	-165	131	-232	126	-298
19	80.000	104	-163	129	-230	125	-296
20	85.000	101	-160	128	-228	123	-293
21	90.000	98	-157	126	-224	120	-290
22	95.000	92	-152	124	-220	117	-285
23	97.000	88	-149	123	-218	115	-282
24	99.000	82	-142	121	-214	110	-276
25	99.900	71	-128	118	-208	104	-266
26	99.990	63	116	116	-204	98	-257

c. Relationship between water level and flow discharge.

As of all the available current data in Dong Nai river system, we can see that September was the month with the biggest discharge. In general, the biggest discharge occurs when water level reaches from -50cm to +60 cm at the falling time of tide, i.e. when the flood current and tide current are in the same direction and are the strongest. This relationship is illustrated in the Appendix.

d. Features of water salinity.

Water salinity is given according to the data [11]. It depends much on the rainfall and decreases gradually from the sea into the land. In March, April, and May at the end of the dry season, the water salinity reaches the highest value, in August, November, and December at end of the rainy season, the salinity reaches the smallest value. Recently, due to the operation of reservoirs upstream, in dry season, the saline boundary is pushed far away, the area of fresh water increases. The high values of salinity at several locations measured are presented in Table 21.

Table 21. Maximum salinity (%) at several stations

River	Station	Month	Year	Salinity S‰
Dong Nai river	Nha Be	VI	1977	32.9
	Cat Lai	IV	1978	22.3
	Long Dai	V	1977	7.22
Vam Co Dong river	Cau Noi	III, IV	1978	34.5
	Ben Luc	V	1980	24.9

5. Hydrological features along the route.

Most of the area along the route is low elevation, below 1.5m and the terrain is very flat. The hydrological regime and features of water levels and flow in this section mainly depend on the tidal oscillation and is partly affected by flood and rain from upstream. The flood and rain from upstream have relations to the discharge volume from Tri An and Dau Tieng Lakes and flood from Be River.

The tide from the sea to the route area is through Xoai Rap, Nha Be, Long Tau and Thi Vai rivers. The tidal regime in the area is irregular semi-diurnal tide. In one lunar

month, there are two spring tides corresponding to full moon and new moon and two neap tides corresponding to the first quarter and the third quarter of the moon and two median tides.

The annual variation of water levels in the area is relatively compatible with the annual variation of water levels in the East Sea (typically Vung Tau Station). Because of the rising and falling water levels due to monsoon and flood upstream, water levels are the highest in September, October and November every year and the lowest in April, May, June, July.

In some zone, natural ground elevation is higher than 1.5m (near km49+500 and end of route); the hydrological features are not directly affected by tidal oscillation and backwater from Dong Nai river system. They completely depend on the rainfall on the basins.

According to hydrological investigation data, which carried out on August, September, October 2009, higher water level along route occurred on 2008, 2003, 2007 and 2002. These data are appropriated to data at hydrological stations and may be used to calculate design water level along route.

IV. HYDROLOGICAL AND HYDRAULIC CALCULATION FOR BRIDGES.

1. Velocity and discharge analysis.

Hydrological features at the bridges along the expressway depends mainly on the East Sea tidal system than on the upstream flood condition, much attention shall be paid to the flow characteristics, tidal flooded area, amplitudes and properties of tide variations. In this area the relationship between water level, current discharge and velocity doesn't obey the geomorphology rules as in the tide-unaffected area.

Along expressway Ben Luc – Long Thanh, most rivers are of tidal flow, having 95% of total flow. Only in some rivers, measured flow data is available.

a. Velocity and discharge on large and medium rivers.

• **Velocity and discharge on rivers where measured flow data** : Nha Be, Long Tau and Thi Vai rivers, measured flow data for certain periods are available. Maximum velocity (average on whole cross-section), water level corresponding with maximum velocity H_v , time at maximum velocity; and maximum discharge (total on whole cross-section), water level corresponding with maximum discharge H_d , time at maximum discharge are presented in table 22.

Table 22. Maximum velocity and discharge (measured) on rivers

River	Maximum velocity			Maximum discharge		
	V (cm/s)	H_v (m)	Time	Q (m ³ /s)	H_d (m)	Date
Nha Be	-100	0.66	03h/31/8/1996	-9696	0.66	03h/31/8/1996
Long Tau	139	-0.72	09h/13/12/1996	9884	-0.10	08h/11/01/1997
Thi Vai	105	-0.98	06h/17/11/2001	6537	-0.98	06h/17/11/2001

According to the measured current data at river, the highest value of the current velocity and discharge is calculated according to the tidal intensity [10]. Calculation is presented as below:

Maximum velocity and discharge at Nha Be are 100 cm/s and 9696 m³/s on August 31/ 1996. According to [10] on August 31/ 1996 the tide intensity for semi-diurnal area is 1.02 while the maximum tide intensity is 1.18. Then, the possible highest current velocity and discharge at Nha Be river are $(100 \times 1.18 / 1.02) = 116$ cm/s and $(9696 \times 1.18 / 1.02) = 11220$ m³/s.

Similar, at Long Tau river, maximum velocity and discharge are about 160 cm/s and 11400 m³/s. At Thi Vai river, maximum velocity and discharge are about 120 cm/s and 6800 m³/s.

According to flow measurements, when water level reach to maximum or minimum, flow velocity and discharge are equal 0 (flow changes its direction). In generally, on tidal area maximum velocity and discharge occurs when water level reaches nearly to its average. Therefore, water level corresponding with maximum velocity and discharge can be considered as the average water level (months of higher water level) on this area, it is 0.20m.

- Binh Khanh bridge crosses Nha Be river at a location closed to the flow measured cross section. Therefore, design velocity and discharge at Binh Khanh bridge can be considered as 1.25 m/s and 11500 m³/s (when water level H = 0.2m).
- Phuoc Khanh bridge crosses Long Tau river at a location closed to the flow measured cross section. The design velocity and discharge at Phuoc Khanh bridge can be considered as 1.65 m/s and 11500 m³/s (when water level H = 0.2m).
- Thi Vai bridge crosses Thi Vai river and is far from flow measured cross section, about 15 km to upstream. The design velocity can be taken as 1.25 m/s when water level H = 0.2m. Corresponding to H = 0.2m, wetted area of the Thi Vai bridge is about 2875 m², then maximum design discharge at Thi Vai bridge is about 3600 m³/s.

• **Velocity and discharge on rivers where measured flow data is not** : According to site investigations, current velocities through the canals are relatively small, less than 1.00 m/s and maximum of current velocity occurs when water level reaches to its average value in falling tide. Base on the tidal intensity during the site visits and the maximum tide intensity; approximate value of maximum current velocity on whole cross section Can Giuoc, Ba Lao, Ong Keo, Tac Ca Tang) can be taken as 1.25m/s and in other rivers, it would be about 1.00m/s.

Maximum discharge on river is calculated by: $Q_{max} \text{ (m}^3\text{/s)} = A \text{ (m}^2\text{)} \times V_{max} \text{ (m/s)}$
(4)

Where A is wetted area (perpendicular with flow) correspondent average value of water level (average WL about 0.2m).

The results of velocity and discharge on large and medium rivers are presented on table 23.

Table 23. Velocity and discharge on large and medium rivers along route.

No	Name	Charnage	Wetted area (m ²)	Skew (degree)	V max (m/s)	Q max (m ³ /s)
1	Ong Thoan	2+220	75	80	1.00	74
2	Ong Thin	12+609	734	40	1.25	590
3	Ba Lao	17+145	1037	90	1.25	1296
4	Binh Khanh	23+450	-	-	1.25	11500
5	Cha river	26+183	882	75	1.25	852
6	Phuoc Khanh	30+300	-	-	1.65	11500
7	Ong Keo	34+700	226	45	1.25	200
8	Thi Vai	53+042	2998	90	1.25	3748
9	Tac Ca Tang canal	54+220	250	70	1.25	294
10	Bun Ngu	55+700	125	90	1.00	125

b. Calculation discharge on small catchments.

This area is frequently affected by the tide, backwater from Dong Nai river and rain. Flow discharge for drainage structures are calculated based on the following formula:

$$Q_{\text{total}} = Q_t + Q_r \quad (5)$$

Where Q_t is the discharge by tide and Q_r is the discharge by rain.

• Calculation of discharge due to tide :

The discharge by tide is calculated based on the formula : $Q_t = W / (3600 \times T_r)$ (6)

Where : W is the volume of tidal water accumulated in front of the structures (m³)

$$W = Z \times S_t$$

Z is the depth of tidal water level in full moon and new moon (m) and S_t is the area of tidal water accumulated, depending on each specific basin.

T_r is the average time of falling tide in full moon and new moon (hours). In practise of calculation, T_r is taken on the same time of falling water level from peak to natural ground with fall velocity is 0.2m/hour.

The results of tidal discharge are presented in tab 24.

• **Calculation of discharge due to rainfall :** For the catchments are less than 100 km², the flood discharge is calculated according to the formula of critical strength (22TCN220-95). The formula for discharge calculation is as follows:

$$Q_r = A_P \times \alpha \times X_1 \times S_r \times \delta \quad (\text{m}^3/\text{s}) \quad (7)$$

Where : X_1 - Maximum daily rainfall with frequency 1% (mm).

S_r - Basin area (km²).

α - Flow coefficient depending on the soil class, design daily rainfall and basin area.

δ - Factor reducing the discharge due to ponds and lakes, swamps, forests.

A_P - Modulus of peak flood corresponding with the design frequency, depending on the properties of hydrological geomorphology of the river Φ_L , the flow time in the backfall T_S and rainy zone.

The properties of hydrological geomorphology of the river are calculated according to the formula:

$$\Phi_L = \frac{1000 \times L}{m_L \times J_L^{1/3} \times F^{1/4} \times (\alpha \times H_P)^{1/4}}$$

Where; m_L - parameter of water accumulation in the river.

J_L - grade of the main current (‰).

L - length of the main current (km).

The flow time in the backfall T_S depends on the factor of hydrological geomorphology of the backfall Φ_S and the rainy zone. The factor of hydrological geomorphology of the backfall Φ_S is calculated according to the following formula:

$$\Phi_S = \frac{b_S^{0.6}}{m_S \times J_S^{0.3} \times (\alpha \times H_P)^{0.4}}$$

Where; b_S - the average length of backfall in the basin, calculated according to the formula:

$$b_S = \frac{1000 \times F}{1.8 \times (L + \sum I)}$$

Where; $\sum I$ - total length of river branches (km).

m_S - parameter of water accumulation at the backfall.

J_S - grade of the backfall (‰).

According to the topographical maps with scale 1/50.000, 1/10.000, horizontal plan 1/5.000 (only a very narrow strip on either side of the alignment), alignment profile and cross sections, in combination with the site hydrological survey, the basin properties of the drainage structures have been defined.

The road section is in the rainy zone XVIII. Soil in the basin is clay sand with thick vegetation; flow coefficient agrees with soil class IV. The flood frequency is taken according to the frequency of the maximum daily rainfall. Based on the rainy regime, rainfall in the whole area and the location of the road section, the maximum daily rainfall is calculated following the maximum daily rainfall at Long Thanh station $X1\% = 228\text{mm}$.

Properties of basin and results of discharge by rainfall are shown in Table 24.

Table 24. Discharge of some catchments along route

STT	river	Chainage	By tide		By rain				
			St Km2	Qt m3/s	Sr Km2	L Km	ΣI Km	Ic ‰	Q1% m3/s
1	Bau Sen	35+689	0.7	38.9	8.0	4.0	0	2.5	41.5
2	Vung Gam	43+126	0.5	27.8	9.4	4.0	0	3.5	58.8
3	Rach Ngoai	56+838	0.0	0.0	5.0	2.5	0	6.0	39.2

2. Analysis design water level at bridges.

a. Highest water level at bridges.

- Binh Khanh bridge is far from Nha Be hydrological station about 4km. Due to the difference of maximum water level in the area is very small (about 3mm/1km), it can be conservatively considered that the highest water level at Binh Khanh bridge equals the highest water level at Nha Be station.
- Phuoc Khanh bridge is 3.5km downstream of Nha Be hydrological station. As similar to Binh Khanh bridge, the highest water level at Phuoc Khanh bridge equals the highest water level at Nha Be station.
- Thi Vai bridge is far from Vung Tau hydrological station about 35km and is far from Thi Vai hydrological station about 15km on upstream. Along Thi Vai river from Vung Tau station, tidal amplitude increases following the linear correlate equation :

$H_{max tv} = H_{max vt} + 20\text{cm}$ (slope of maximum water level is 1cm/1km).

Where : $H_{max tv}$ and $H_{max vt}$ are maximum water level at Thi Vai and Vung Tau stations.

At Vung Tau station : $H_{max 1\%} = 1.60\text{m}$, $H_{max 5\%} = 1.52\text{m}$

Then : The highest water level at Thi Vai bridge $H_{max 1\%} = 1.95\text{m}$ and $H_{max 5\%} = 1.87\text{m}$.

- Water level at other large bridges : All bridges on Ben Luc – Long Thanh expressway are affected by tide East Sea through Xoai Rap, Nha Be and Long Tau and Thi Vai rivers. Base on hydrological condition and hydrological investigation data, the highest water level at Ong Thin, Ba Lao are taken in the same Nha Be station, the highest water level from Phuoc Khanh to Thi Vai are taken with increase from Phuoc Khanh to Thi Vai.
- Water level at small bridges : The highest water level at small bridges depend to design discharge, to length of bridges and to river condition. In this case, we have calculated water level by Sedi – Maning formular. If result is lower than bacwater level from mail river, then take bacwater level for design water level. Sedi – Maning formular is as follow :

$$Qp\% = \left[\frac{Rbt^{2/3} \times \omega_{bt}}{Nbt} + \frac{Rlc^{2/3} \times \omega_{lc}}{Nlc} + \frac{Rbp^{2/3} \times \omega_{bp}}{Nbp} \right] \times J^{1/2} = Qbt + Qlc + Qbp \quad (8)$$

Where : Qp%, Qbt, Qlc, Qbp : Total discharge and in the river banks and the main river bed.

Nbt, Nlc, Nbp : roughness of the river banks and main current.

Rbt, Rlc, Rbp : hydraulic radius of the river banks and main current (m).

ω_{bt} , ω_{lc} , ω_{bp} : Area of wet cross section of the river bank and main current (m²) depending on the depth h (m).

J : The slope of the water surface is taken the same for the main current and the river banks.

According to the above formula, after getting the total discharge in front of the structure Qp%, the drainage area ω is defined and from ω the current velocity Vp% and the water level Hp% can be calculated. The calculation is repeated with increasing depths from $h = 0$ with $\Delta h = 0.01$ until the calculated value of Q reaches the approximate value of the given value of Qp% .

Based on the natural cross section (the cross section which is not narrowed due to the location of culverts or bridges), the current velocity and water level P% corresponding with the natural conditions of rivers and streams shall be calculated.

b. Lowest water levels at bridges.

- The lowest water level at Binh Khanh and Phuoc Khanh bridges are taken equal to the lowest water level at Nha Be station.

- Thi Vai bridge is far from Vung Tau hydrological station about 35km and is far from Thi Vai hydrological station about 15km to upstream. Along Thi Vai river from Vung Tau station, tidal amplitude increases following the linear correlate equation :

$$H_{mintv} = H_{minvt} - 16\text{cm (slope of minimum water level is 0.8cm/1km)}.$$

Where: Hmintv and Hminvt are minimum water level at Thi Vai and Vung Tau stations.

$$\text{At Vung Tau station: } H_{min 1\%} = -3.41\text{m, } H_{min 5\%} = -3.31\text{m}$$

Then : The lowest water level at Thi Vai bridge $H_{min 1\%} = -3.69\text{m}$ and $H_{min 5\%} = -3.59\text{m}$.

- Other bridges:

- The lowest water level at the bridges in the section from the beginning point to km30 of the route are taken the same lowest water level at Nha Be station (if the elevation of riverbed is higher than the lowest water level at Nha Be station; then elevation of riverbed is taken as the lowest water level)

- The lowest water level at the bridges in the section from km30 to Thi Vai bridge are taken gradually decrease from the lowest water level at Nha Be station to the lowest water level at Thi Vai bridge (if the elevation of riverbed is higher than the lowest water level; then elevation of riverbed is taken as the lowest water level)

3. Design length for bridges.

a. Minimum length required for bridge opening.

• **Calculation of bridge length in tide – affected area :** For the river in tide-affected area, minimum bridge opening required is defined according to the formula [7]:

$$L = B + \Delta B \times \sum \frac{Q_b}{V_b \times H_b} \quad (m) \quad (9)$$

Where: B is the width of the main stream at the cross section of bridge centerline (m)

ΔB is the factor reducing the width in the river bank at the calculated water level.

Q_t is the calculated total discharge (m³/s)

Q_b is the discharge through the river bank (m³/s)

V_b is the average current velocity in the river bank (m/s)

H_b is the average depth of the river bank (m)

The value of ΔB is defined according to the table hereunder :

$\sum Q_b/Q_t$ (%)	100	90	80	70	60	50	40	30	20	10
ΔB	-	0.92	0.90	0.89	0.86	0.84	0.80	0.74	0.60	0.30

• **Calculation of bridge length in flood areas:** In flooded areas, minimum bridge opening required is calculated according to the formulae [3]:

$$L = L_{lc} \times \frac{Q_{tt}}{Q_{lc}} \times \frac{1}{P^{(1+x)}} \quad (10)$$

Where: L_{lc} is the length of the main current before scour, Q_{tt} is the calculated total discharge, Q_{lc} is the discharge of the main current (under existing condition without bridge), P is the permissible general scour factor depending on the discharge/liner meter on the bridge cross section, calculated by formula (10); $P = 1.00$, $(1+x)$ is the parameter depending on the diameter of the bed sediments.

The calculation procedures are as follows:

- At the river section, calculate the total discharge Q_{tt} between river banks and the discharge of main current – defining the values of Q_{lc} and L .
- Calculating the unit discharge $q = Q_{tt}/L$, the factor P is selected based on Table XIII.2 [3] .
- Based on the diameter of bed sediments from Table XIII.3, selecting the parameters $(1+x)$
- Calculate the minimum drainage length (L_1) according to the formula (10)
- Arranging spans, piers and abutments according to L_1 , calculate the hydraulic parameters and the wetted area under the bridge (St_x) before scour.

- Calculate the general scour and the wetted area under the bridge (S_{sx}) after scour.
- Establishing the ratio of actual scour $K = S_{sx}/S_{tx}$. If $K \leq P$, accepting L_1 , otherwise, increasing the value of L for recalculation according to the above procedures.

According to Formula (10), when calculating with the scour factor $P = 1.00$ (without scour), the bridge minimum length shall be greater than the minimum lengths calculated with other factors of scour. Accordingly, in this Feasibility Study, for the safety of bridges, minimum bridges required, are calculated with the scour factor $P = 1.00$.

Tab 25. Clearance of bridges

No.	Bridge name	Chainage	River grade	Clearance (m)		Management Agency
				Ngang	Dọc	
1	Ong Thoan	2+220	VI	15	2.5	VN inland waterway
2	Ong Thin	12+609	II	>50	10	VN inland waterway
3	Ba Lao	17+145	III	50	7	VN inland waterway
4	Binh Khanh	23+450	I	242	55	VN maritime
5	Cha river	26+183	II	60	9	VN inland waterway
6	Phuoc Khanh	30+300	I	242	55	VN maritime
7	Ong Keo	34+700	III	50	7	VN inland waterway
8	Bau Sen	35+689	-	-	-	-
9	Vung Gam	43+126	-	-	-	-
10	Thi Vai	53+042	III	50	7	VN inland waterway
11	Tac Ca Tang	54+220	VI	15	2.5	VN inland waterway
12	Bun Ngu	55+700	VI	15	2.5	VN inland waterway
13	Rach Ngoai	56+838	-	-	-	-

b. Minimum clearance.

Allmost of the river along route are waterway or navigation, therefor they are required clearance. Base on documents of Management Agencies, table 25 showed clearance size of bridges along route.

c. Select on design length for bridges.

According to formulas 9 and 10, minimum bridge opening required is calculated. In tide-effect area, discharge through banks at average water level 0.2m is very small. Therefore, minimum length required for bridge opening is the same width of the main stream. Depending on the other factors such as soil condition etc. and navigational clearance, actual bridge design length selected is longer than the calculated minimum required opening length.

4. Calculation hydraulic parameters at bridges.

After the bridges are located, because the current cross section is narrowed, the values of current velocity and water levels shall be changed and shall be calculated according to the formulas :

- **Current velocity is calculated according to the formula :** $V_2 = Q_{tt} / (\mu \times S)$ (11)

Where $Q_{p\%}$ is the calculated volume of the basin, μ is the narrowing factor of the current depending on the span length and the current velocity on the natural cross section, S is the wetted area under the bridge.

- **Highest water level :** Design water level is the total of the natural water level with the back water level due to the arrangement of the bridge :

The back water level in front of the bridge is calculated according to formula [3] :

$$H_d = K \times \frac{V_2^2 - V_{dc}^2}{2 \times g} \quad (12)$$

$$\text{Where : } K = 1 + \frac{V_0^2 \times a}{V_{dc}^2 \times (Fr/Jc)^{1/2}} \quad \text{and} \quad Fr = \frac{V_0^2}{g \times L_r}$$

V_2 – current velocity under the bridge, V_{dc} – velocity of the current through the cross section under the bridge (when the bridge is not located yet), V_0 – average current velocity in the whole cross section, Fr – Frut coefficient, Jc – slope of water surface, L_r – length of cross section and a is the factor defined according to (Table, page 195, document [3]).

The almost of bridges along route Ben Luc – Long Thanh, in practise of calculation, water level corresponding to maximum discharge are taken 0.2m. However, this water level added to backwater (about 0.1m) is also less than highest natural from main river. Therefore, highest natural from main river are taken highest design water level bridges [except Bau Sen bridge km35+689, where highest natural is 1.42m, backwater is 0.46m, then design water level H1% is 1.88m, Rach Ngoai bridge km56+838, where highest natural is 1.85m, backwater is 0.29m, then design water level H1% is 2.14m].

- **The distance between the bridge to the point with highest back water level is defined according to the formula :**

$$X_0 = a \times L_r \times (Fr/Jc)^{1/2} \quad (m)$$

The list of bridges and hydrological parameters of the relevant rivers along the alignment of Ben Luc – Long Thanh are shown in Table 26.

Table 26. Hydrological and hydraulic parameters at bridges.

No	Name	Chainage	Qmax (m ³ /s)	Vmax (m/s)	Minimum length required (m)	Maximum water level (m)		Minimum water level (m)
						1%	5%	
1	Ong Thoan	2+220	74	1.00	35	1.70	1.57	-2.91

2	Ong Thin	12+609	590	1.25	250	1.63	1.54	-2.91
3	Ba Lao	17+145	1296	1.25	250	1.63	1.54	-2.91
4	Binh Khanh	23+450	11500	1.25	1200	1.63	1.54	-2.91
5	Cha River	26+183	852	1.25	185	1.63	1.54	-2.91
6	Phuoc Khanh	30+300	11500	1.65	700	1.63	1.54	-2.91
7	Ong Keo	34+700	200	1.25	230	1.68	1.59	-3.06
8	Bau Sen	35+689	80.4	2.02	24	1.88	-	-0.58
9	Vung Gam	43+126	86.6	1.86	24	1.82	-	-0.99
10	Thi Vai	53+042	3748	1.25	300	1.95	1.87	-3.69
11	Tac Ca Tang	54+220	294	1.25	125	1.95	1.87	-3.69
12	Bun Ngu	55+700	125	1.00	75	1.95	1.87	-3.69
13	Rach Ngoai	56+838	39.2	1.33	12	2.14	2.00	0.78

5. Estimation of scour depths at main bridges.

Scour at bridge causes due to the erosive action of flowing water, excavating and carrying away materials from the riverbed and its banks. Scour process is cyclic in nature which makes complicated to determine the magnitude of scour. Scour can be deepest near the peak of a flood; however it is hardly visible since scour holes refill with sediment during receding stage of flood. In general, several floods may be needed to attain maximum scour under typical flow conditions at bridge crossings.

This section presents the evaluation of scour potential at bridge based on Hydraulic Engineering Circular No 18 (HEC 18) published by Federal Highway Administration, USA. The equations recommended in this document are considered to be the most applicable for estimating scour depths and are widely applied in Vietnam and many other countries.

In designing the bridge sub structure, it is very important to evaluate the scour potential at piers and abutments, carefully studying site-specific subsurface information. Total scour at a bridge crossing is comprised of contraction scour and local scour for a stable river regime.

a. Methodology of contraction scour computation.

Contraction scour at a bridge crossing, involves the removal of material from the streambed and banks across the channel width, as a result from a contraction of the flow area and an increase in discharge at the bridge.

In case of highway construction, common causes for contraction of flows are constriction (encroachment) of highway embankment onto the floodplain and/or into the main channel or piers blocking a portion of flow. As a result, flow area decreases that causes an increase in velocity and bed shear stress. Hence, more bed material is removed from the contracted reach than transported into the reach. As bed elevation is lowered, the flow area increases, velocity reduces and a situation of relative equilibrium is reached.

Contraction scour can be either clear-water or live-bed, depending on the ability of the upstream approach reach to transport bed material. Live-bed scour occurs when

material is being transported into the contracted bridge section from the upstream approach section. Clear-water contraction scour occurs when there is no bed material transport in the approach reach or the bed material being transported in the upstream reach is so fine that it washes through the contracted section.

• **Live-bed contraction scour** : HEC 18 recommends a modified version of Laursen's equation for live-bed scour at a long contraction to predict the depth of scour in a contracted section and is given below.

$$\frac{y_2}{y_1} = \left[\frac{Q_2}{Q_1} \right]^{6/7} \left[\frac{W_1}{W_2} \right]^{k_1}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

where:

y_1 = Average depth in the upstream main channel, m

y_2 = Average depth in the contracted section, m

y_0 = Existing depth in the contracted section before scour, m

Q_1 = Flow in the upstream channel transporting sediment, m³/s

Q_2 = Flow in the contracted channel, m³/s

W_1 = Bottom width of the upstream main channel that is transporting bed material, m

W_2 = Bottom width of the main channel in the contracted section less pier width(s), m

k_1 = Exponent determined below

Table Coefficient of 'k₁'

V^*/w	k_1	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge
>2.0	0.69	Mostly suspended bed material discharge

$V^* = (\tau_0/\rho)^{1/2} = (gy_1 S_1)^{1/2}$, shear velocity in the upstream section, m/s

w = Fall velocity of bed material based on the D_{50} , m/s

g = Acceleration of gravity (9.81 m/s²)

S_1 = Slope of energy grade line of main channel, m/m

τ_0 = Shear stress on the bed, Pa (N/m²)

ρ = Density of water (1000 kg/m³)

• **Clear-water contraction scour** : The recommended clear-water contraction scour equation given in HEC 18 is as follows :

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3} W^2} \right]^{3/7}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

where:

y_2 = Average equilibrium depth in the contracted section after contraction scour, m

Q = Discharge through the bridge or on the set-back overbank area at the bridge associated with the width W , m³/s

D_m = Diameter of the smallest nontransportable particle in the bed material (1.25 D_{50}) in the contracted section, m
 D_{50} = Median diameter of bed material, m
 W = Bottom width of the contracted section less pier widths, m
 Y_0 = Average existing depth in the contracted section, m
 K_u = 0.025 SI units

b. Methodology of local scour computation.

Local scour at piers or abutments is due to the removal of bed material as a result of formation of vortices known as the horseshoe vortex and wake vortex at their base. The horseshoe vortex results from the pileup of water on the upstream surface of the obstruction and subsequent acceleration of the flow around the nose of the pier or abutment. The action of the vortex removes bed material around the base of the obstruction. In addition to the horseshoe vortex around the base of a pier, there are vertical vortices downstream of the pier called the wake vortex. Both the horseshoe and wake vortices remove material from the pier base region. The intensity of wake vortices diminishes rapidly as the distance downstream of the pier increases. As a result, immediately downstream of a long pier there is often deposition of material.

Factors which affect the magnitude of local scour depth at piers and abutments are;

- Velocity of the approach flow,
- Depth of flow,
- Width of the pier,
- Discharge intercepted by the abutment and returned to the main channel at the abutment,
- Length of the pier if skewed to flow,
- Size and gradation of bed material,
- Angle of attack of the approach flow to a pier or abutment,
- Shape of a pier or abutment,
- Bed configuration, and
- Ice formation or jams and debris.

An equation based on the Colorado States University (CSU) equation is recommended to determine pier scour, both live-bed and clear-water pier scour as given in HEC 18. The equation predicts maximum pier scour depths. The equation is:

$$\frac{y_s}{y_1} = 2.0 K_1 K_2 K_3 K_4 \left[\frac{a}{y_1} \right]^{0.65} Fr_1^{0.43}$$

For round nose piers aligned with flow
 $y_s \leq 2.4$ times the pier width (a) for $Fr \leq 0.8$
 $y_s \leq 3.0$ times the pier width (a) for $Fr > 0.8$

In terms of y_s/a , above Equation becomes:

$$\frac{y_s}{a} = 2.0 K_1 K_2 K_3 K_4 \left[\frac{y_1}{a} \right]^{0.35} Fr_1^{0.43}$$

where:

y_s = Scour depth, m

y_1 = Flow depth directly upstream of the pier, m

K_1 = Correction factor for pier nose shape from Table (K1)

K_2 = Correction factor for angle of attack of flow from Table (K2)

K_3 = Correction factor for bed condition from Table (K3)

K_4 = Correction factor for armoring by bed material size (for $D_{50} < 2\text{mm}$ or $D_{95} < 20\text{mm}$, then $K_4 = 1$)

a = Pier width, m

L = Length of pier, m

Fr_1 = Froude Number directly upstream of the pier = $V_1/(gy_1)^{1/2}$

V_1 = Mean velocity of flow directly upstream of the pier, m/s

g = Acceleration of gravity (9.81 m/s^2)

Table (K1). Correction Factor, for Pier Nose Shape

Shape of Pier Nose	K_1
(a) Square nose	1.1
(b) Round nose	1.0
(c) Circular cylinder	1.0
(d) Group of cylinders	1.0
(e) Sharp nose	0.9

Table (K2). Correction factor, for Angle of Attack of the Flow

Angle	$L/a=4$	$L/a=8$	$L/a=12$
0	1.0	1.0	1.0
15	1.5	2.0	2.5
30	2.0	2.75	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5.0

Note: Angle = skew angle of flow L = length of pier, m

Table (K3). Increase in Equilibrium Pier Scour Depths, for Bed Condition

Bed Condition	Dune Height, m	K_3
Clear-Water Scour	N/A	1.1
Plane bed and Antidune flow	N/A	1.1
Small Dunes	$3 > H \geq 0.6$	1.1
Medium Dunes	$9 > H \geq 3$	1.2 to 1.1
Large Dunes	$H \geq 9$	1.3

c. Some of results scour estimation

• **General result** : The contraction and local scour caused by piers at main bridges was analyzed by model simulations of HEC-RAS 3.1.3 which is built up with 'Bridge Scour' under 'Hydraulic Design Functions' based on Hydraulic Engineering Circular No. 18 (HEC 18) of Federal Highway Administration (FHWA), USA.

Scour estimations were carried out for the main bridges where piers are located within the rivers, namely Ba Lao Bridge, Binh Khanh Bridge, Phuoc Khanh Bridge and Thi Vai Bridge. The discharge adopted for computation is 1% frequency or available/estimated historical maximum. As there are no data of particle size analysis available, during this feasibility study, particle size D_{50} and D_{95} were assumed as 0.015mm and 0.5mm referring the data used for Long Thanh bridge design (Hydrological Study Report of Ho Chi Minh City-Long Thanh-Dau Giay Expressway), considering the similarity in nature. However, during the detail design, scour estimations should be updated with relevant particle sizes of D_{50} and D_{95} at each bridge site.

General results of estimated scour at bridges are given in tab 27.

Table 27. Estimated Bridge Scour

Station	Bridge	Scour Depth (m)			Remarks
		Contraction Scour	Local Scour	Total Scour	
12+609	Can Giuoc	-	-	-	Note 1
17+145	Ba Lao	0.16	4.38	4.54	
23+450	Binh Khanh - Alt. B1	0.29	6.86	7.15	
	Binh Khanh - Alt. B2	0.23	7.73	7.96	
	Binh Khanh - Alt. B3	0.11	7.73	7.84	
26+183	Cha river	-	-	-	Note 1
30+300	Ong Keo	-	-	-	Note 1
34+700	Phuoc Khanh - Alt. P1	0.26	9.51	9.76	
	Phuoc Khanh - Alt. P2	0.2	9.51	9.71	
53+042	Thi Vai	0.34	5.07	5.41	

Note 1: Piers are not located in the main river.

• **Calculation detail scour at main bridges.**

(1) Ba Lao Bridge - Station 17+145

Hydraulic Design Data
Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (m):		4.22	
Approach Velocity (m/s):		1.34	
Br Average Depth (m):		4.24	
BR Opening Flow (m ³ /s):		1296.00	

BR Top WD (m):	216.24		
Grain Size D50 (mm):	0.15	0.15	0.15
Approach Flow (m3/s):	1296.00		
Approach Top WD (m):	229.51		
K1 Coefficient:	0.690		

Results

Scour Depth Ys (m):		0.16
Critical Velocity (m/s):	0.42	
Equation:	Live	

Pier Scour

All piers have the same scour depth

Input Data

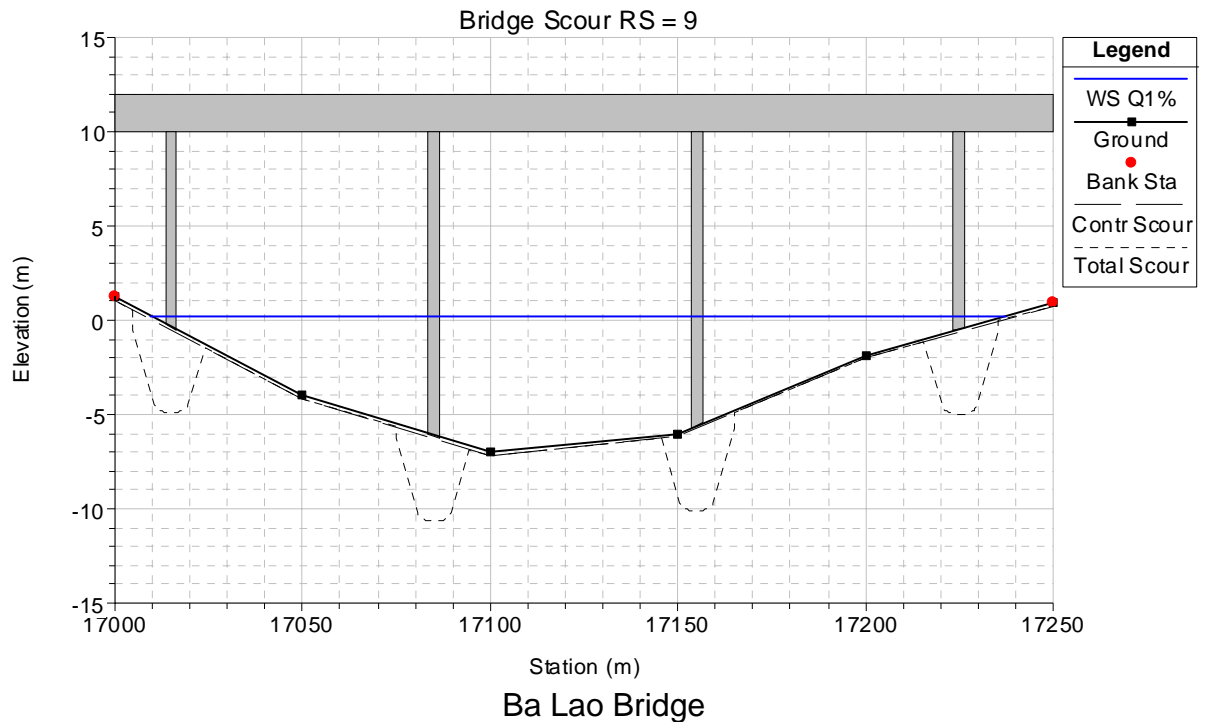
Pier Shape:	Round nose
Pier Width (m):	3.00
Grain Size D50 (mm):	0.15000
Depth Upstream (m):	6.76
Velocity Upstream (m/s):	1.62
K1 Nose Shape:	1.00
Pier Angle:	0.00
Pier Length (m):	20.00
K2 Angle Coef:	1.00
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	0.50000
K4 Armouring Coef:	1.00

Results

Scour Depth Ys (m):	4.38
Froude #:	0.20
Equation:	CSU equation

Combined Scour Depths

Pier Scour + Contraction Scour (m):	
Channel:	4.54



(2.1) Binh Khanh Bridge - Station 23+450; Alt. B1

Hydraulic Design Data
Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (m):		18.95	
Approach Velocity (m/s):		0.59	
Br Average Depth (m):		18.94	
BR Opening Flow (m ³ /s):		11500.00	
BR Top WD (m):		1013.18	
Grain Size D50 (mm):	0.15	0.15	0.15
Approach Flow (m ³ /s):		11500.00	
Approach Top WD (m):		1035.30	
K1 Coefficient:		0.690	
Results			
Scour Depth Ys (m):		0.29	
Critical Velocity (m/s):		0.54	
Equation:		Live	

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Round nose
Pier Width (m):	8.00
Grain Size D50 (mm):	0.15000
Depth Upstream (m):	26.89
Velocity Upstream (m/s):	0.68
K1 Nose Shape:	1.00
Pier Angle:	0.00

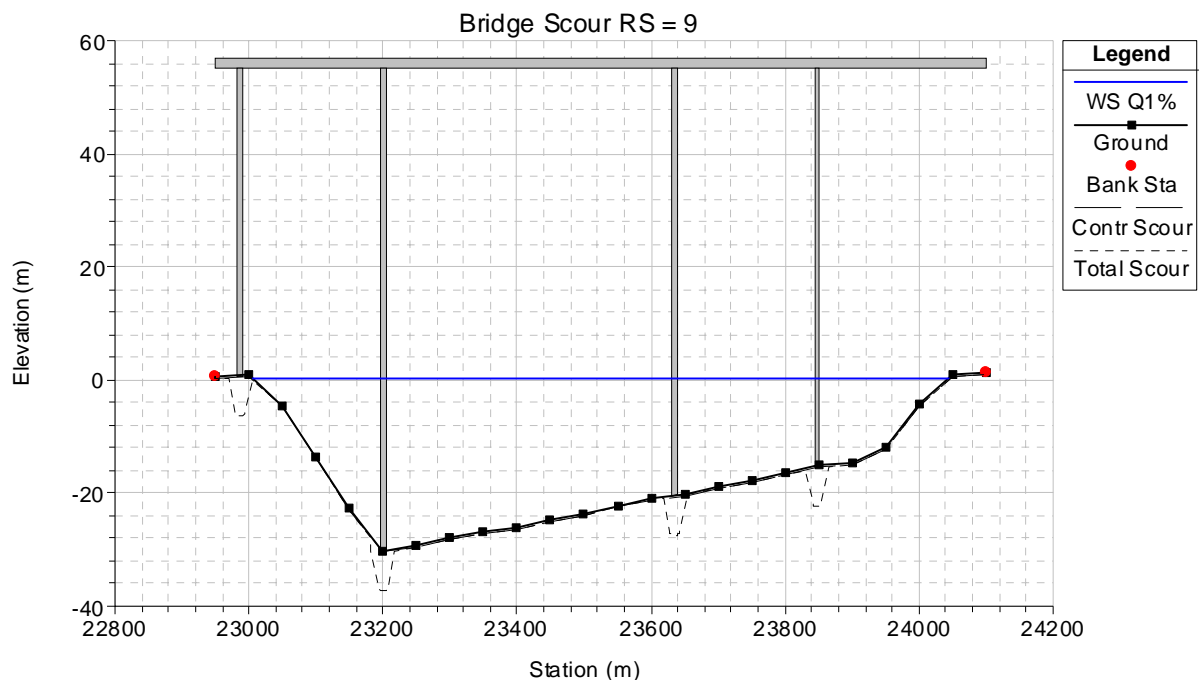
Pier Length (m): 20.00
 K2 Angle Coef: 1.00
 K3 Bed Cond Coef: 1.10
 Grain Size D90 (mm): 0.50000
 K4 Armouring Coef: 1.00

Results

Scour Depth Ys (m): 6.86
 Froude #: 0.04
 Equation: CSU equation

Combined Scour Depths

Pier Scour + Contraction Scour (m):
 Channel: 7.15



Binh Khanh Bridge Alt. B1

(2.2) Binh Khanh Bridge - Station 23+450; Alt. B2

Hydraulic Design Data
 Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (m):		18.95	
Approach Velocity (m/s):		0.59	
Br Average Depth (m):		19.01	
BR Opening Flow (m3/s):		11500.00	
BR Top WD (m):		1013.19	
Grain Size D50 (mm):	0.15	0.15	0.15
Approach Flow (m3/s):		11500.00	
Approach Top WD (m):		1035.30	

K1 Coefficient:	0.690
Results	
Scour Depth Ys (m):	0.22
Critical Velocity (m/s):	0.54
Equation:	Live

Pier Scour

All piers have the same scour depth

Input Data

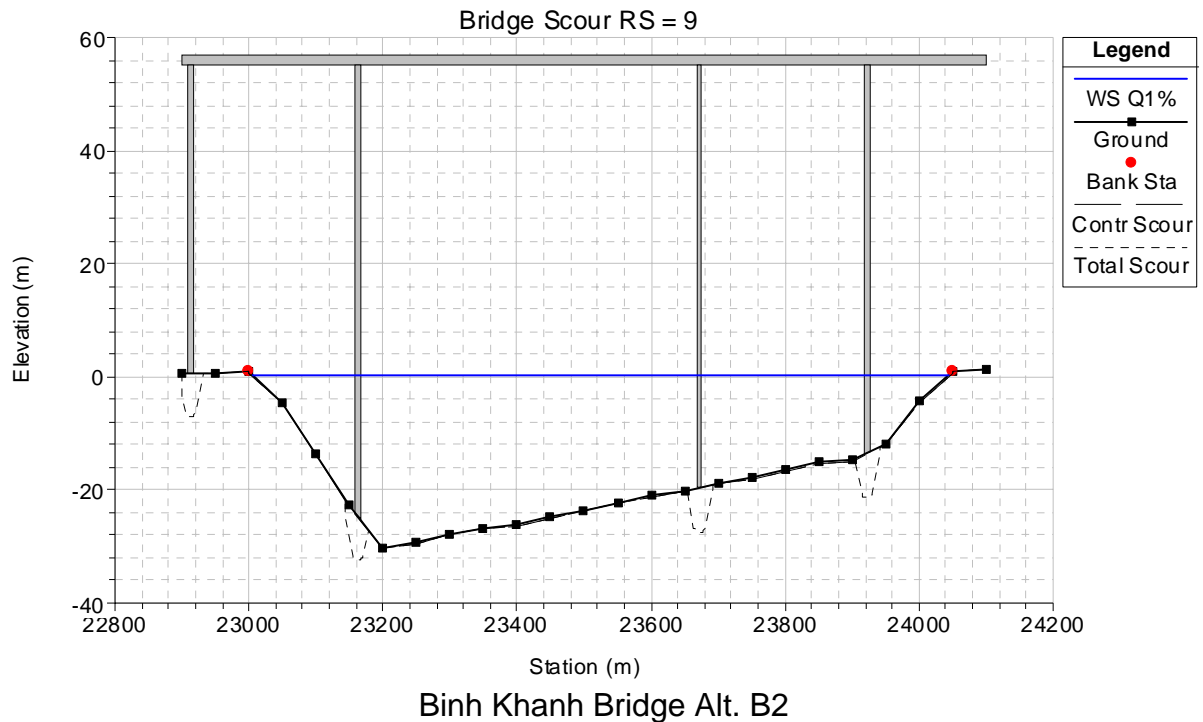
Pier Shape:	Square nose
Pier Width (m):	8.00
Grain Size D50 (mm):	0.15000
Depth Upstream (m):	28.40
Velocity Upstream (m/s):	0.70
K1 Nose Shape:	1.10
Pier Angle:	0.00
Pier Length (m):	20.00
K2 Angle Coef:	1.00
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	0.50000
K4 Armouring Coef:	1.00

Results

Scour Depth Ys (m):	7.73
Froude #:	0.04
Equation:	CSU equation

Combined Scour Depths

Pier Scour + Contraction Scour (m):	
Left Bank:	7.73
Channel:	7.96



(2.3) Binh Khanh Bridge - Station 23+450; Alt. B3

Hydraulic Design Data
Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (m):		18.95	
Approach Velocity (m/s):		0.59	
Br Average Depth (m):		19.13	
BR Opening Flow (m3/s):		11500.00	
BR Top WD (m):		1013.19	
Grain Size D50 (mm):		0.15	0.15
Approach Flow (m3/s):		11500.00	
Approach Top WD (m):		1035.29	
K1 Coefficient:		0.690	
Results			
Scour Depth Ys (m):			0.10
Critical Velocity (m/s):		0.54	
Equation:		Live	

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Square nose
Pier Width (m):	8.00
Grain Size D50 (mm):	0.15000
Depth Upstream (m):	28.40
Velocity Upstream (m/s):	0.70
K1 Nose Shape:	1.10
Pier Angle:	0.00

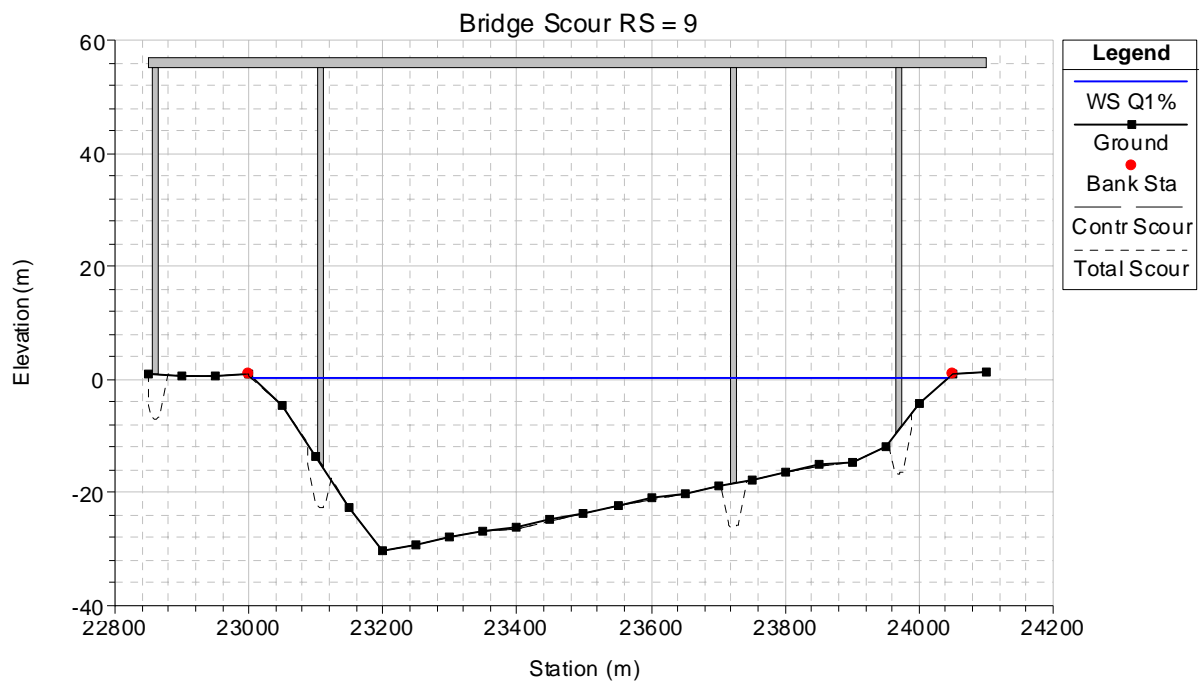
Pier Length (m): 20.00
 K2 Angle Coef: 1.00
 K3 Bed Cond Coef: 1.10
 Grain Size D90 (mm): 0.50000
 K4 Armouring Coef: 1.00

Results

Scour Depth Ys (m): 7.73
 Froude #: 0.04
 Equation: CSU equation

Combined Scour Depths

Pier Scour + Contraction Scour (m):
 Left Bank: 7.73
 Channel: 7.84



Binh Khanh Bridge Alt. B3

(3.1) Phuoc Khanh Bridge - Station 34+700; Alt. P1

Hydraulic Design Data
 Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (m):		12.64	
Approach Velocity (m/s):		1.43	
Br Average Depth (m):		12.61	
BR Opening Flow (m3/s):		11500.00	
BR Top WD (m):		621.65	
Grain Size D50 (mm):	0.15	0.15	0.15

Approach Flow (m³/s): 11500.00
 Approach Top WD (m): 637.95
 K1 Coefficient: 0.690

Results

Scour Depth Ys (m): 0.26
 Critical Velocity (m/s): 0.50
 Equation: Live

Pier Scour

All piers have the same scour depth

Input Data

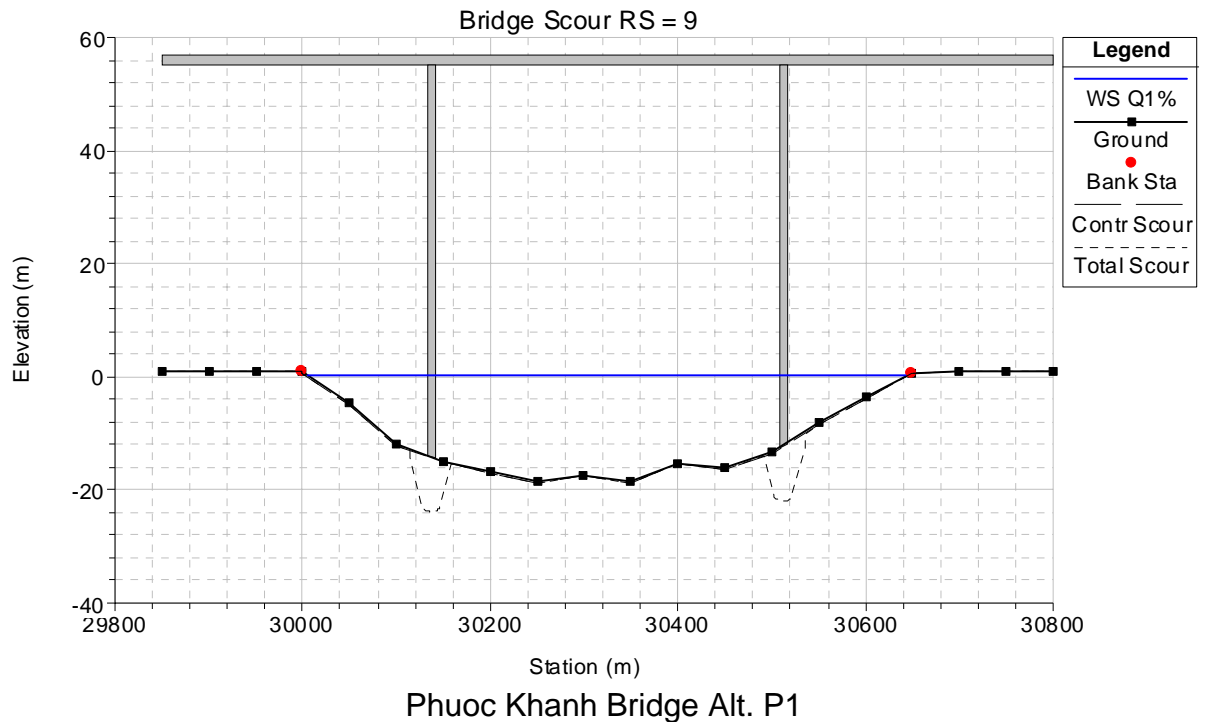
Pier Shape: Round nose
 Pier Width (m): 8.00
 Grain Size D50 (mm): 0.15000
 Depth Upstream (m): 18.04
 Velocity Upstream (m/s): 1.64
 K1 Nose Shape: 1.00
 Pier Angle: 0.00
 Pier Length (m): 20.00
 K2 Angle Coef: 1.00
 K3 Bed Cond Coef: 1.10
 Grain Size D90 (mm): 0.50000
 K4 Armouring Coef: 1.00

Results

Scour Depth Ys (m): 9.51
 Froude #: 0.12
 Equation: CSU equation

Combined Scour Depths

Pier Scour + Contraction Scour (m):
 Channel: 9.77



(3.2) Phuoc Khanh Bridge - Station 34+700; Alt. P2

Hydraulic Design Data Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (m):		12.64	
Approach Velocity (m/s):		1.43	
Br Average Depth (m):		12.67	
BR Opening Flow (m ³ /s):		11500.00	
BR Top WD (m):		621.66	
Grain Size D50 (mm):	0.15	0.15	0.15
Approach Flow (m ³ /s):		11500.00	
Approach Top WD (m):		637.94	
K1 Coefficient:		0.690	
Results			
Scour Depth Ys (m):		0.20	
Critical Velocity (m/s):		0.50	
Equation:		Live	

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Round nose
Pier Width (m):	8.00
Grain Size D50 (mm):	0.15000
Depth Upstream (m):	18.04
Velocity Upstream (m/s):	1.64
K1 Nose Shape:	1.00
Pier Angle:	0.00

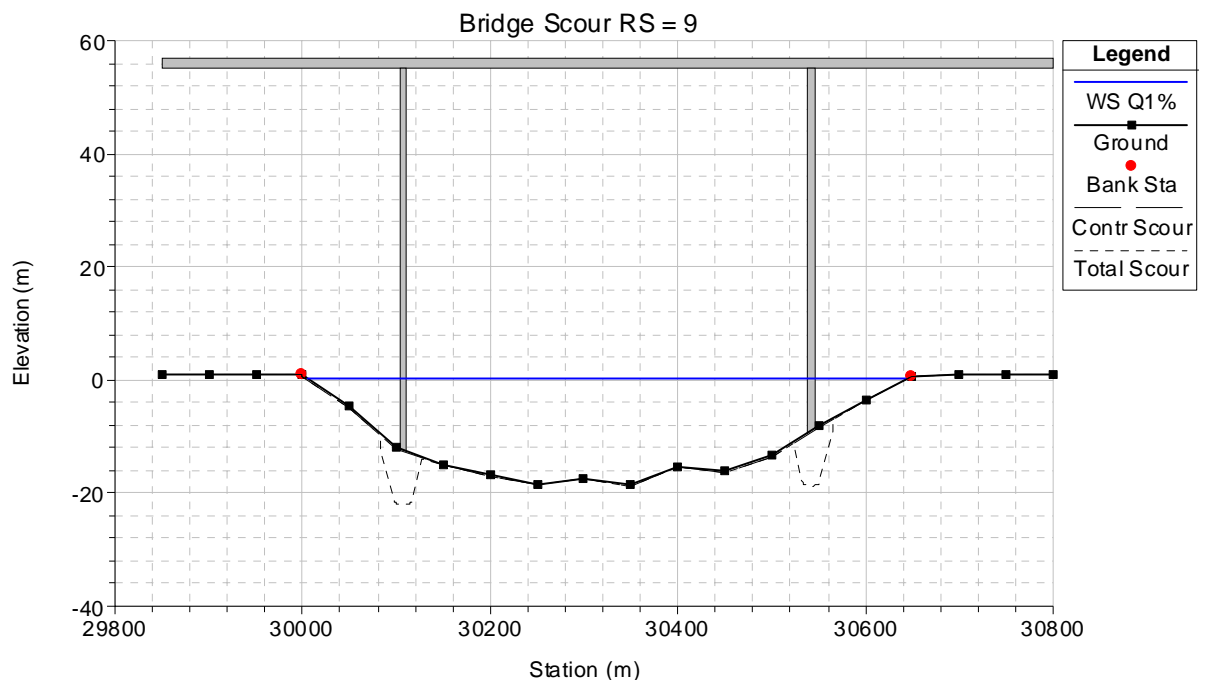
Pier Length (m): 20.00
 K2 Angle Coef: 1.00
 K3 Bed Cond Coef: 1.10
 Grain Size D90 (mm): 0.50000
 K4 Armouring Coef: 1.00

Results

Scour Depth Ys (m): 9.51
 Froude #: 0.12
 Equation: CSU equation

Combined Scour Depths

Pier Scour + Contraction Scour (m):
 Channel: 9.71



Phuoc Khanh Bridge Alt. P2

(4) Thi Vai Bridge - Station 53+042

Hydraulic Design Data
 Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (m):		2.70	
Approach Velocity (m/s):		2.14	
Br Average Depth (m):		2.43	
BR Opening Flow (m3/s):		3748.00	
BR Top WD (m):		625.96	
Grain Size D50 (mm):	0.15	0.15	0.15

Approach Flow (m³/s): 3748.00
 Approach Top WD (m): 649.99
 K1 Coefficient: 0.690

Results

Scour Depth Ys (m): 0.34
 Critical Velocity (m/s): 0.39
 Equation: Live

Pier Scour

All piers have the same scour depth

Input Data

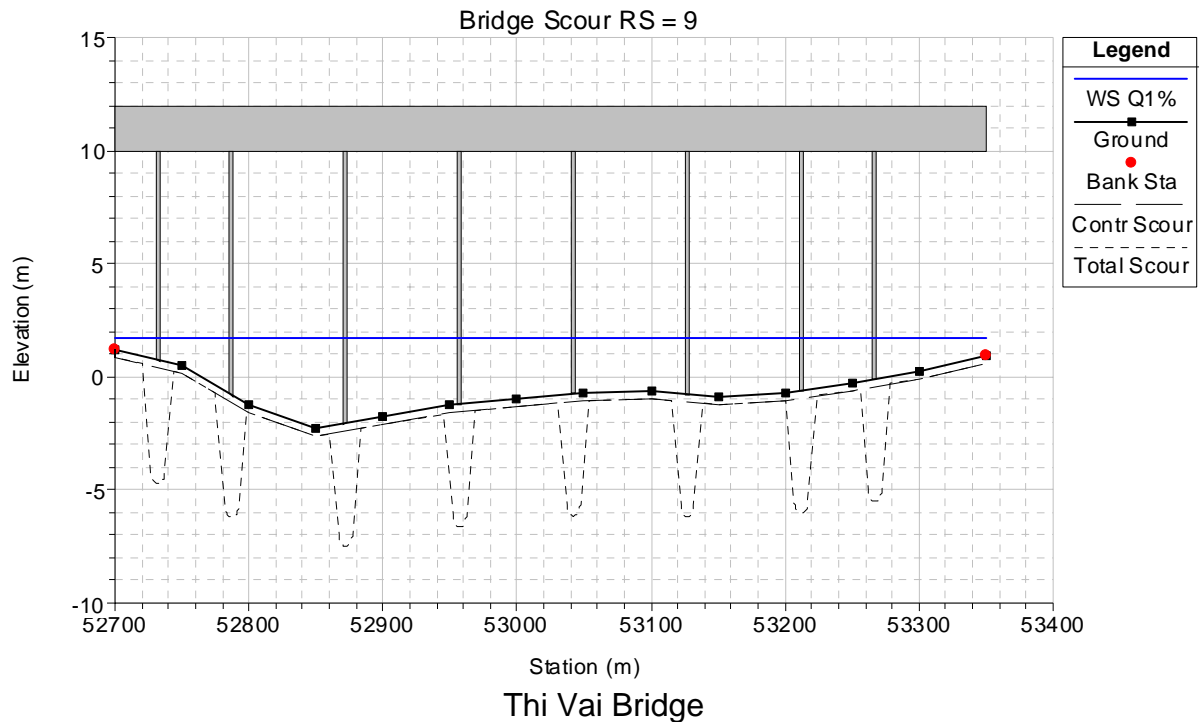
Pier Shape: Round nose
 Pier Width (m): 3.00
 Grain Size D50 (mm): 0.15000
 Depth Upstream (m): 3.63
 Velocity Upstream (m/s): 2.77
 K1 Nose Shape: 1.00
 Pier Angle: 0.00
 Pier Length (m): 20.00
 K2 Angle Coef: 1.00
 K3 Bed Cond Coef: 1.10
 Grain Size D90 (mm): 0.50000
 K4 Armouring Coef: 1.00

Results

Scour Depth Ys (m): 5.07
 Froude #: 0.46
 Equation: CSU equation

Combined Scour Depths

Pier Scour + Contraction Scour (m):
 Channel: 5.41



V. HYDROLOGICAL AND HYDRAULIC CALCULATION FOR CULVERTS.

1. Calculation of catchment discharge.

The area along Ben Luc – Long Thanh is frequently affected by the tide, backwater from Dong Nai river and rain in catchment. Depend on properties of catchment as area, volume of tidal water, regime and rainfall, discharge of small catchments along route are calculated by formulas in part IV.1.b “Calculate discharge on small catchments”. The parameters are taken as below :

- The area and volume of tidal water of catchments : are defined from topographical map with scale 1/10.000.
- Falling velocity of water level from peak to natural ground is taken 0.2m/hour.
- If catchment, it's area is more than 1.0 km² then discharge is calculated by 22TCN220-95, otherwise discharge is taken in the same area multiply by discharge modul (10 m³/s/km²).

Design discharge of culvert is total of discharge by tide and by rain. Properties of catchment basins and discharge at the culverts are shown in Table 28.

2. Design of drainage dimensions.

There is about 24.9km out of total 58.5km long of route is over river or viaduct, where needn't to lay culvert. On the remaining 33.6km necessary provide 72 culverts. Description positions is below :

- The route alignment crosses 25 irrigation canals. Most of them are smal ditch excavated by local residents. In these locating, due to small catchment area, the discharge is not and unclear calculated in the report. However, after consideration of

current conditions of this area, it is found that those canals are function like irrigation system and drainage when heavy rain, thus a culvert of minimum size of $\Phi 1.50\text{m}$ will be placed at those locating (in case, if natural ground of canal is low or skew of canal is smaller than 75 degree, then will be replaced by size of $\Phi 2.0\text{m}$).

- The discharge of 23 positions along alignment can not calculate because these positions are not clear and small basin. However, they are far from the main drainages, thus still propose the arrangement culvert (structure culverts) of minimum size of $\Phi 1.50\text{m}$ at these positions (like irrigation canal, in case, if natural ground of position is low, then will be replaced by size of $\Phi 2.0\text{m}$).
- There are 3 locations on route from km 33+100 to km33+800, where placed the culverts for super elevation. Size of them is $\Phi 1.00\text{m}$.
- On the 21 remaining positions, based on discharge volume, drainage structures are to be selected. Because design discharge is big, the box with 1, 2 or 3 entrances. The calculation of culvert hydraulic is as following :

- Calculation of Pipe Culverts :

The following formula is applied to calculate the discharge through pipe culverts:

$$Q = \varphi \times \varepsilon \times \omega \times [2 g \times (H - \varepsilon \times H_c)]^{1/2} \quad (13)$$

Where $\varphi = 0.85$; $\varepsilon = 0.65$; $g = 9.81$; ω is the area of the culvert cross section.
H is the water level in front of the culverts and H_c is the culvert height.

- **Calculation of Box Culverts:** With box culverts with rectangular sections, the determination of flow regime depends on the relations between the downstream actual water depth and the critical depth.

The critical depth H_k is calculated from the relation:

$$\frac{\alpha \times Q^2}{g} = \frac{Wk^3}{Bk} \quad (14)$$

Where; α is the Koriolic coefficient; taken to be = 1.0
g is the acceleration of gravity taken to be 9.81 m / s^2
 Wk , Bk are the wetted area and the width of the water surface corresponding with the depth H_k .

According to the above relation, critical depth H_k only depends on the calculated discharge and the shape of the cross sections, not depending on the roughness and the slope of the rivers and streams.

+ Free flow regime : If downstream flow doesn't affect to flow on box (average of downstream depth flow is $< 1.3 \times H_k$) then flow regime on box is free flow. Then the required drainage width of the culverts is :

$$L = (g \times Q) / (\mu \times V_{cp}^3) \quad (15)$$

Where : V_{cp} is the permissible speed through the culverts depending on the types of materials and the forms of consolidation under the culverts, μ is the narrowing factor of the current - with normal box culverts, μ is taken to be $\mu = 0.80$.

Arrangements of culverts: Based on the reinforce material, select the size of box width larger (L_t) than the required drainage width of the box (L). Then :

$$(1) \text{ Actual flow velocity in box } V = [(g \times Q) / (\mu \times L_t)]^{1/3} \quad (16)$$

$$(2) \text{ Depth of water in front of box } Y = 1.6 \times [(V^2 / g) - (V_0^2 / 2g)] \quad (15)$$

+ No free flow regime : Corresponding with downstream flow depth $H_{tb} > 1.3 \times H_k$, flow on box is no free flow regime. Then the required drainage length of the culverts is :

$$L = Q / (\mu \times H_{tb} \times V_{cp}) \quad (17)$$

Arrangements of culverts : Based on the reinforce material, select the size of box larger (L_t) than the required drainage length of the box (L). Then :

$$(1) \text{ Actual flow velocity in box } V = Q / (\mu \times H_{tb} \times L_t) \quad (18)$$

$$(2) \text{ Depth of water in front of box } Y = H_{tb} + [(V^2 - V_0^2) / (2g \times \varphi^2)] \quad (19)$$

φ ; flow coefficient, is taken = 0.85

Summary of hydraulic parameters and calculation results is presented in Table 28 [Column (12) in table 28 showed the depth of water in front of culvert].

Table 28. Hydrological and hydraulic parameters of drainage works.

No	Chainage	Note	Skew (degree)	Tide		Rain		Total Q m3/s	Design drainage works			
				St km2	Qt (m3/s)	Sr km2	Qr (m3/s)		Form of culvert	Dimension (m)	WL1% (m)	V1% (m/s)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	1+187	Irrigation canal	35	-	-	-	-	-	Pipe	Φ2.0	-	-
2	2+525	Irrigation canal	35	-	-	-	-	-	Pipe	Φ2.0	-	-
3	4+250	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
4	4+700	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
5	5+132	Irrigation canal	80	-	-	-	-	-	Pipe	Φ1.5	-	-
6	5+772	Irrigation canal	80	-	-	-	-	-	Pipe	Φ1.5	-	-
7	7+171	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
8	7+591	Irrigation canal	65	0.4	22.2	0.4	4.0	26.2	Box	2 x 3 x 3	+2.12	3.50
9	9+619	Irrigation canal	90	-	-	-	-	-	Pipe	Φ2.0	-	-
10	10+200	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
11	10+600	Irrigation canal	90	-	-	-	-	-	Pipe	Φ2.0	-	-
12	11+000	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
13	11+450	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
14	11+750	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
15	13+200	Irrigation canal	65	-	-	-	-	-	Pipe	Φ2.0	-	-
16	14+075	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
17	14+339	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
18	14+600	Irrigation canal	90	0.4	22.2	0.4	4.0	26.2	Box	2 x 3 x 3	+2.12	3.50
19	14+950	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
20	15+426	Structure	90	-	-	-	-	-	Pipe	Φ2.0	-	-
21	15+595	Natural canal	90	0.35	19.4	0.35	3.5	22.9	Box	2 x 3 x 3	+1.98	3.35
22	15+832	Natural canal	90	0.2	11.1	0.2	2.0	13.1	Box	3 x 3	+2.12	3.50
23	16+322	Natural canal	90	0.35	19.4	0.35	3.5	22.9	Box	2 x 3 x 3	+1.98	3.35
24	16+533	Natural canal	90	0.2	11.1	0.2	2.0	13.1	Box	3 x 3	+2.12	3.50

Table 28. Hydrological and hydraulic parameters of drainage works (continuos).

No	Chainage	Note	Skew (degree)	Tide		Rain		Total Q m3/s	Design drainage works			
				St km2	Qt (m3/s)	Sr km2	Qr (m3/s)		Form of culvert	Dimension (m)	WL1% (m)	V1% (m/s)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
25	32+754	Irrigation canal	80	-	-	-	-	-	Pipe	Φ2.0	-	-
26	33+100	Super elevation	-	-	-	-	-	-	Pipe	Φ1.0	-	-
27	33+282	Structure	75	-	-	-	-	-	Pipe	Φ2.0	-	-
28	33+400	Super elevation	-	-	-	-	-	-	Pipe	Φ1.0	-	-
29	33+527	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
30	33+800	Super elevation	-	-	-	-	-	-	Pipe	Φ1.0	-	-
31	33+960	Irrigation canal	75	0.4	22.2	0.4	4.0	26.2	Box	2 x 3 x 3	+2.12	3.50
32	35+407	Irrigation canal	90	0.2	11.1	0.2	2.0	13.1	Box	3 x 3	+2.12	3.50
33	35+931	Irrigation canal	75	-	-	-	-	-	Pipe	Φ2.0	-	-
34	36+367	Irrigation canal	75	-	-	-	-	-	Pipe	Φ2.0	-	-
35	36+825	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
36	37+137	Irrigation canal	75	-	-	-	-	-	Pipe	Φ2.0	-	-
37	37+500	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
38	38+000	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
39	38+416	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
40	38+911	Natural canal	90	0.1	5.6	18.0	73.8	79.4	Box	4 x 3 x 3	+2.79	4.02
41	39+130	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
42	39+473	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
43	39+800	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
44	40+100	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
45	40+637	Natural canal	90	0.15	8.3	10.2	56.0	64.3	Box	4 x 3 x 3	+2.42	3.75
46	41+000	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
47	41+359	Natural canal	90	0.1	5.6	1.3	10.5	16.1	Box	2 x 2 x 2	+2.03	3.40
48	41+650	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
49	41+916	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-

Table 28. Hydrological and hydraulic parameters of drainage works (continuos).

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No	Chainage	Note	Skew (degree)	Tide		Rain		Total Q m3/s	Design drainage works			
				St km2	Qt (m3/s)	Sr km2	Qr (m3/s)		Form of culvert	Dimension (m)	WL1% (m)	V1% (m/s)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
50	42+318	Irrigation canal	75	-	-	-	-	-	Pipe	Φ2.0	-	-
51	42+770	Structure	90	-	-	-	-	-	Pipe	Φ2.0	-	-
52	43+600	Structure	75	-	-	-	-	-	Pipe	Φ2.0	-	-
53	43+775	Irrigation canal	75	-	-	-	-	-	Pipe	Φ2.0	-	-
54	44+144	Irrigation canal	75	-	-	-	-	-	Pipe	Φ2.0	-	-
55	44+400	Irrigation canal	80	-	-	-	-	-	Pipe	Φ1.5	-	-
56	44+986	Irrigation canal	65	-	-	-	-	-	Pipe	Φ2.0	-	-
57	45+143	Natural canal	90	0.1	5.6	8.7	57.7	63.3	Box	4 x 3 x 3	+2.40	3.72
58	45+545	Natural canal	65	0.1	5.6	0.75	7.5	13.1	Box	2 x 2 x 2	+1.76	3.20
59	45+768	Natural canal	80	0.1	5.6	0.75	7.5	13.1	Box	2 x 2 x 2	+1.76	3.20
60	46+050	Natural canal	90	0.15	8.3	0.75	7.5	15.8	Box	2 x 2 x 2	+2.02	3.39
61	46+506	Natural canal	65	0.1	5.6	0.74	7.4	13.0	Box	2 x 2 x 2	+1.72	3.19
62	46+750	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
63	47+100	Natural canal	75	0.1	5.6	0.82	8.2	13.8	Box	2 x 2 x 2	+1.80	3.23
64	47+421	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
65	47+606	Natural canal	90	0.1	5.6	0.6	6.0	11.6	Box	2 x 2 x 2	+1.61	3.05
66	47+900	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
67	48+167	Natural canal	90	0.1	5.6	0.63	6.3	11.9	Box	2 x 2 x 2	+1.64	3.08
68	48+550	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
69	48+833	Irrigation canal	90	-	-	-	-	-	Pipe	Φ1.5	-	-
70	49+050	Natural canal	90	0.1	5.6	0.32	3.2	8.8	Box	2 x 2	+2.12	3.50
71	49+600	Structure	90	-	-	-	-	-	Pipe	Φ1.5	-	-
72	51+800	Natural canal	90	0.2	11.1	0.2	2.0	13.1	Box	3 x 3	+2.12	3.50

VI. DESIGN WATER LEVEL ALONG THE ROUTE

In the section from the beginning km0 to km56 of route, design water level along the route is determined based on high water level at the rivers and streams crossing the route and the design water levels of drainage structures. In the section from km57 to the end of route, the design water level is given taking topographical elevations into consideration. The design water levels at nearby river stations were calculated by frequency analysis (Pierson III method) applying the data for long term period. The design high water levels along the route are listed in Table 29.

Table 29. Design maximum water level along the expressway (frequency P = 1%)

No	Chainage	WL (m)	No	Chainage	WL (m)	No	Chainage	WL (m)
1	Km0+000	1.70	22	Km21+000	1.63	42	Km41+000	1.78
2	Km1+000	1.70	23	Km22+000	1.63	43	Km42+000	1.80
3	Km2+000	1.70	24	Km23+000	1.63	44	Km43+000	1.82
4	Km3+000	1.70	25	Km24+000	1.63	45	Km44+000	1.83
5	Km4+000	1.69	26	Km25+000	1.63	46	Km45+000	1.85
6	Km5+000	1.68	27	Km26+000	1.63	47	Km46+000	1.86
7	Km6+000	1.67	28	Km27+000	1.63	48	Km47+000	1.88
8	Km7+000	1.66	29	Km28+000	1.63	49	Km48+000	1.90
9	Km8+000	1.65	30	Km29+000	1.63	50	Km49+000	1.91
10	Km9+000	1.64	31	Km30+000	1.63	51	Km50+000	1.93
11	Km10+000	1.63	32	Km31+000	1.64	52	Km51+000	1.95
12	Km11+000	1.63	33	Km32+000	1.66	53	Km52+000	1.95
13	Km12+000	1.63	34	Km33+000	1.67	54	Km53+000	1.95
14	Km13+000	1.63	35	Km34+000	1.68	55	Km54+000	1.95
15	Km14+000	1.63	36	Km35+000	1.70	56	Km55+000	1.95
16	Km15+000	1.63	36*	Km35+689	1.88	57	Km56+000	1.95
17	Km16+000	1.63	37	Km36+000	1.71	58*	Km56+838	2.14
18	Km17+000	1.63	38	Km37+000	1.72	59	Km57+000	5.20
19	Km18+000	1.63	39	Km38+000	1.73	60	Km58+000	7.50
20	Km19+000	1.63	40	Km39+000	1.75			
21	Km20+000	1.63	41	Km40+000	1.76			

Note : (*) Design maximum water level at Bau Sen and Rach Ngoai bridges.

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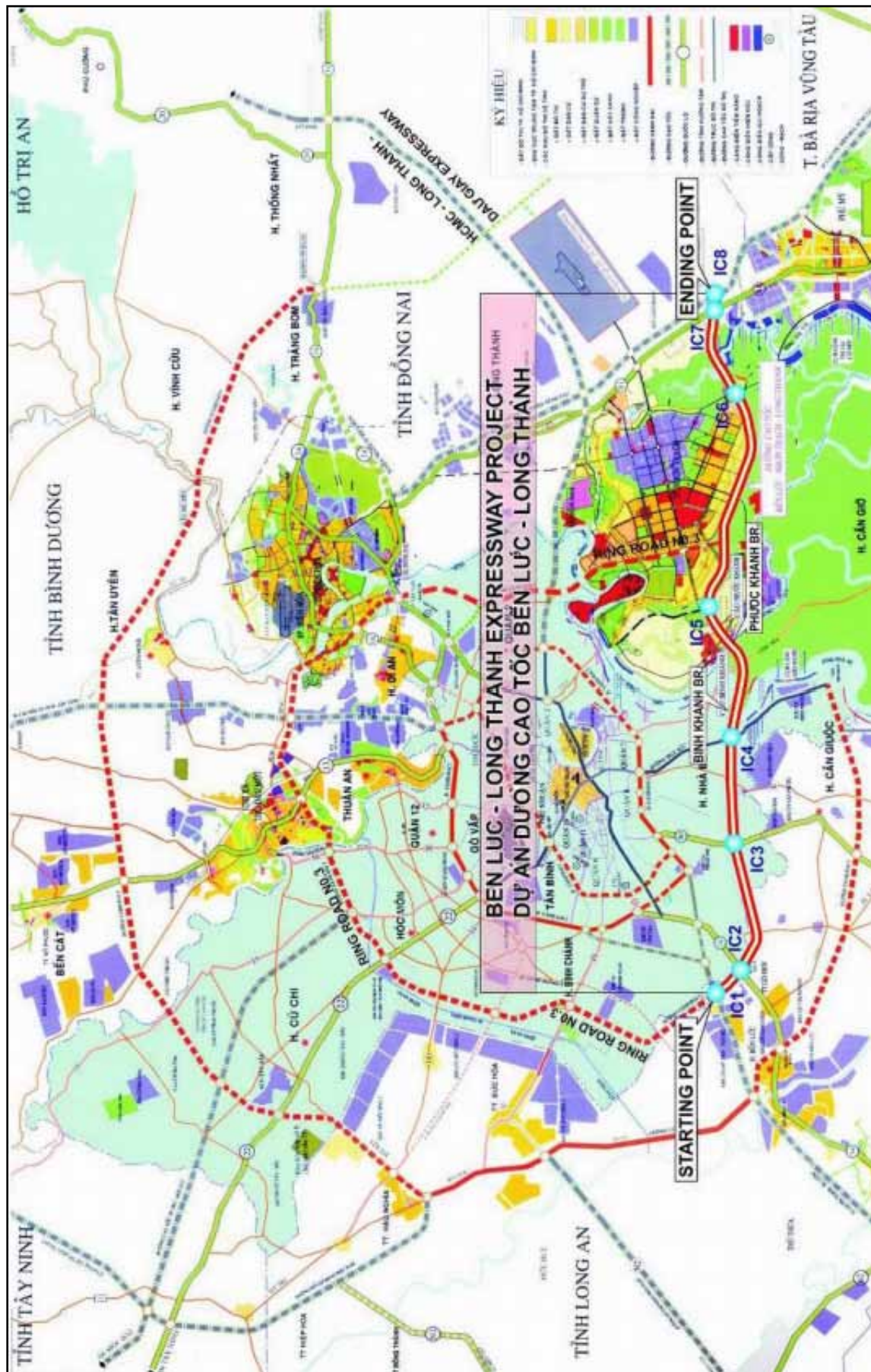
APPENDIX

- Alignment of Ben Luc – Long Thanh Expressway.
- Figure 1. Rose of average wind velocity at Tan Son Nhat station.
- Figure 2. Frequency curve of maximum wind velocity at Tan Son Nhat station.
- Figure 3. Monthly characteristic of rainfall at stations.
- Figure 4. Frequency curve of maximum day rainfall at Tan Son Nhat station.
- Figure 5. Frequency curve of maximum day rainfall at Long Thanh station.
- Figure 6. Distribution of hourly water level at Nha Be station.
- Figure 7. Monthly characteristic of water level at Ben Luc station.
- Figure 8. Monthly characteristic of water level at Nha Be station.
- Figure 9. Monthly characteristic of water level at Vung Tau station.
- Figure 10. Frequency curve of maximum water level at Ben Luc station.
- Figure 11. Frequency curve of minimum water level at Ben Luc station.
- Figure 12. Frequency curve of maximum water level at Nha Be station.
- Figure 13. Frequency curve of minimum water level at Nha Be station.
- Figure 14. Frequency curve of maximum water level at Vung Tau station.
- Figure 15. Frequency curve of minimum water level at Vung Tau station.
- Figure 16. Typical correlative WL – Q – V at Nha Be river
- Figure 17. Typical correlative WL – Q – V at Long Tau river

Hydrological data :

- Average velocity at verticals on Nha Be river on November 2000
- Maximum velocity at verticals on Nha Be river on November 2000
- Discharge data at cross section on Nha Be river on November 2000
- Flow data at cross section on Nha Be river on December 1993
- Flow data at cross section on Long Tau river on December 1993

Alignment of Ben Luc Long Thanh Expressway



Rose of average wind velocity at Pan-Sun Station

Scale (m.p.h.)

15
30
45

60
75
90

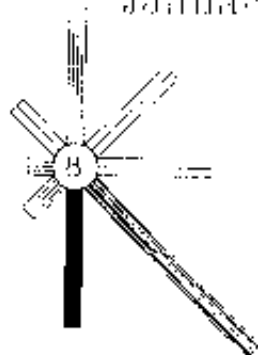
105
120
135

150
165
180

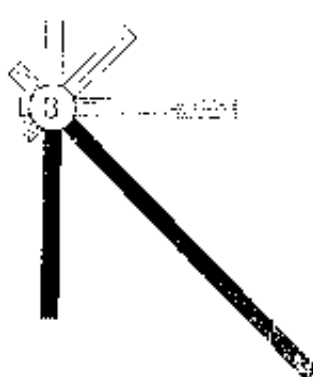
195
210
225

Scale
0 25 50 Miles

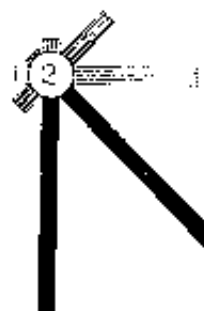
January



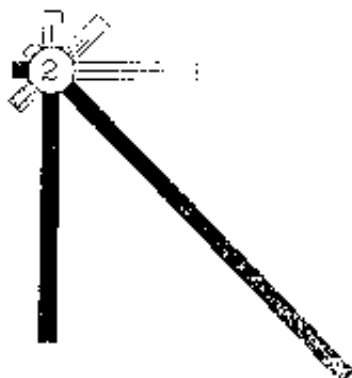
February



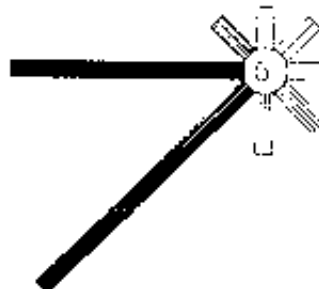
March



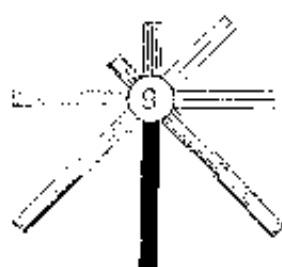
April



June



May



Pass of meteoroid and velocity of Tauri Star Abell 4500

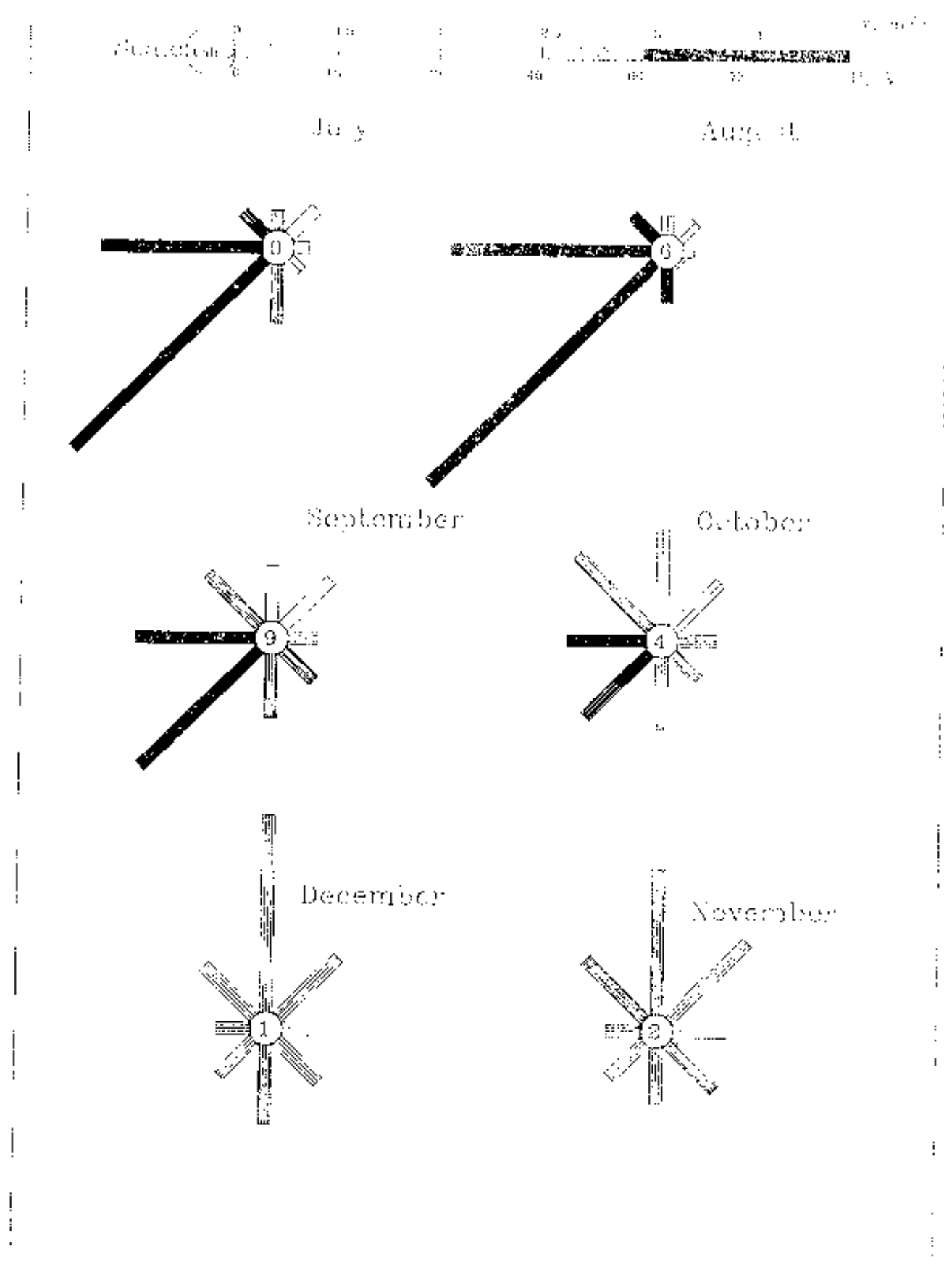


Figure 2. Frequency curve of maximum wind velocity at Tan Son Nhat station

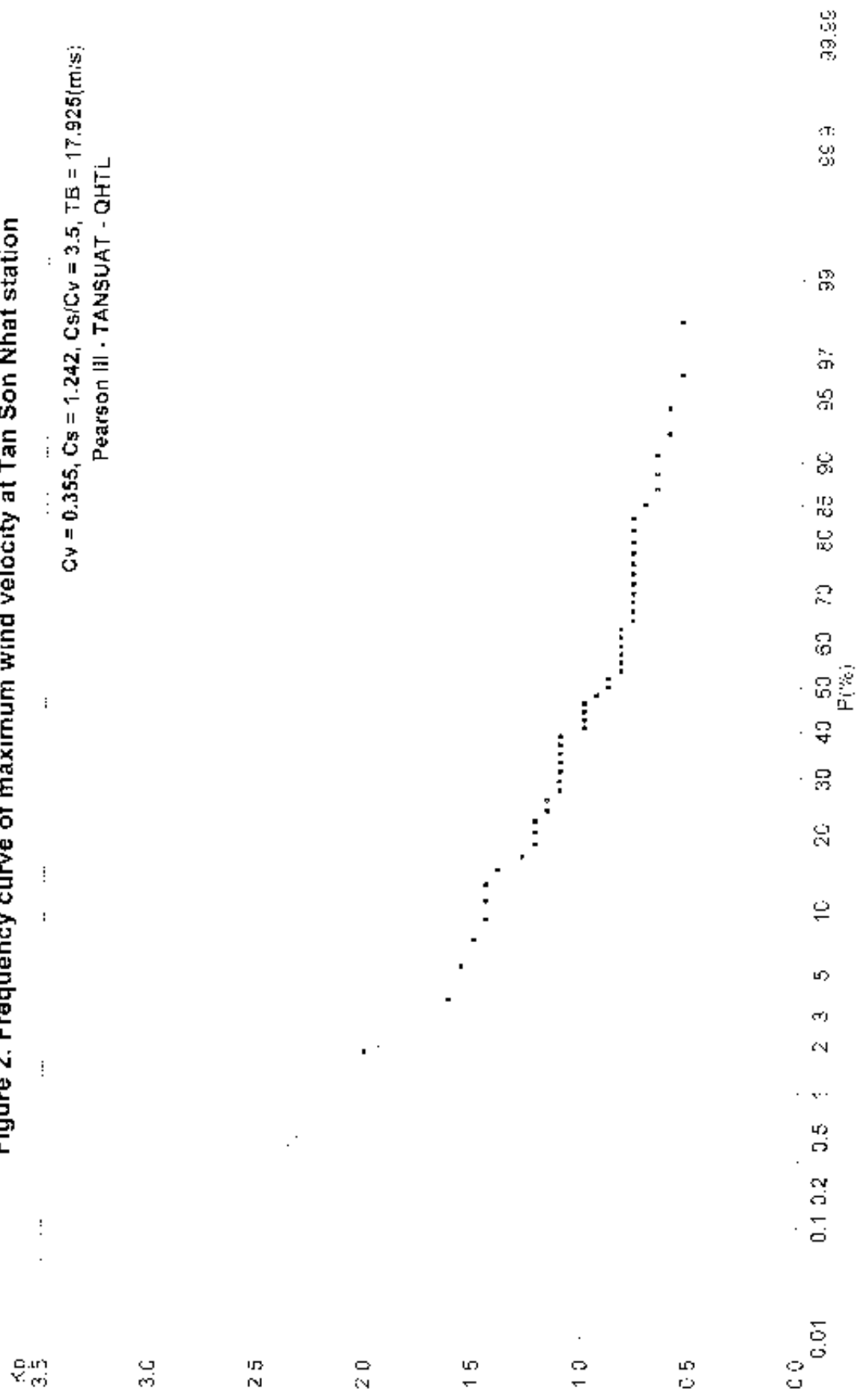


Figure 3. Monthly characteristic of rainfall at stations



Figure 4. Frequency curve of maximum daily rainfall at Tan Son Nhut station

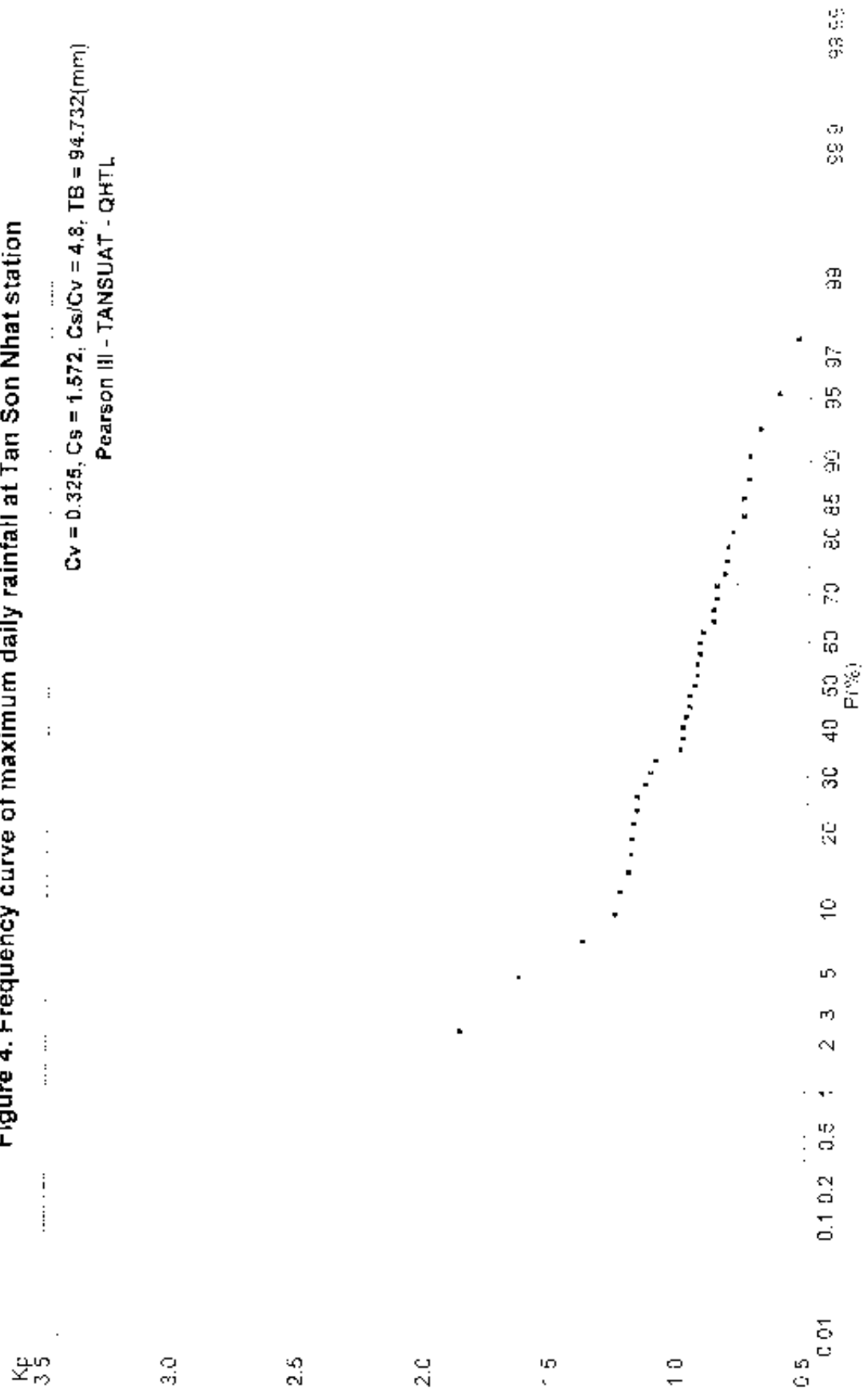


Figure 5. Frequency curve of maximum daily rainfall at Long Thanh station

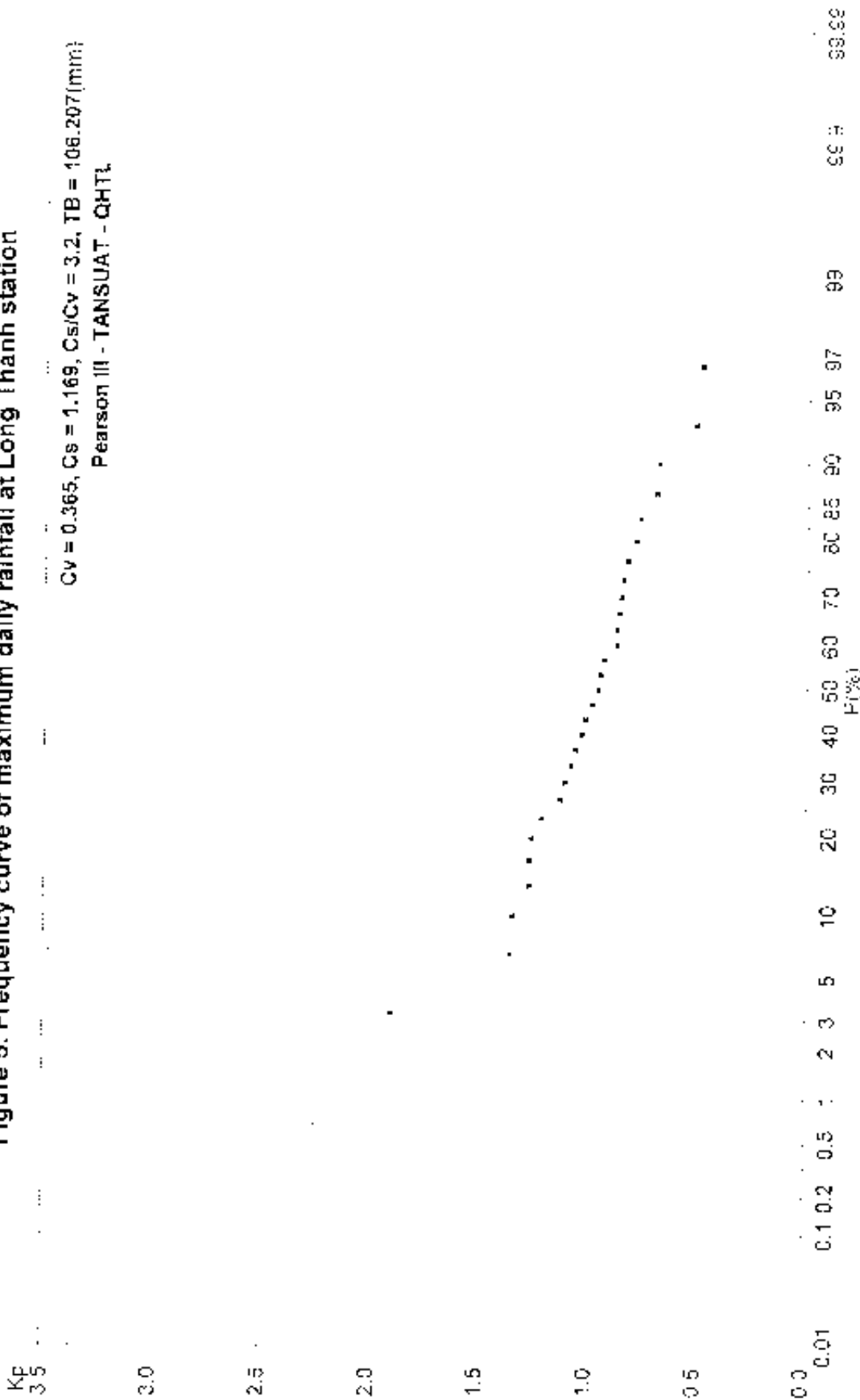


Figure 6. Distribution of hourly water level at Nha Be station

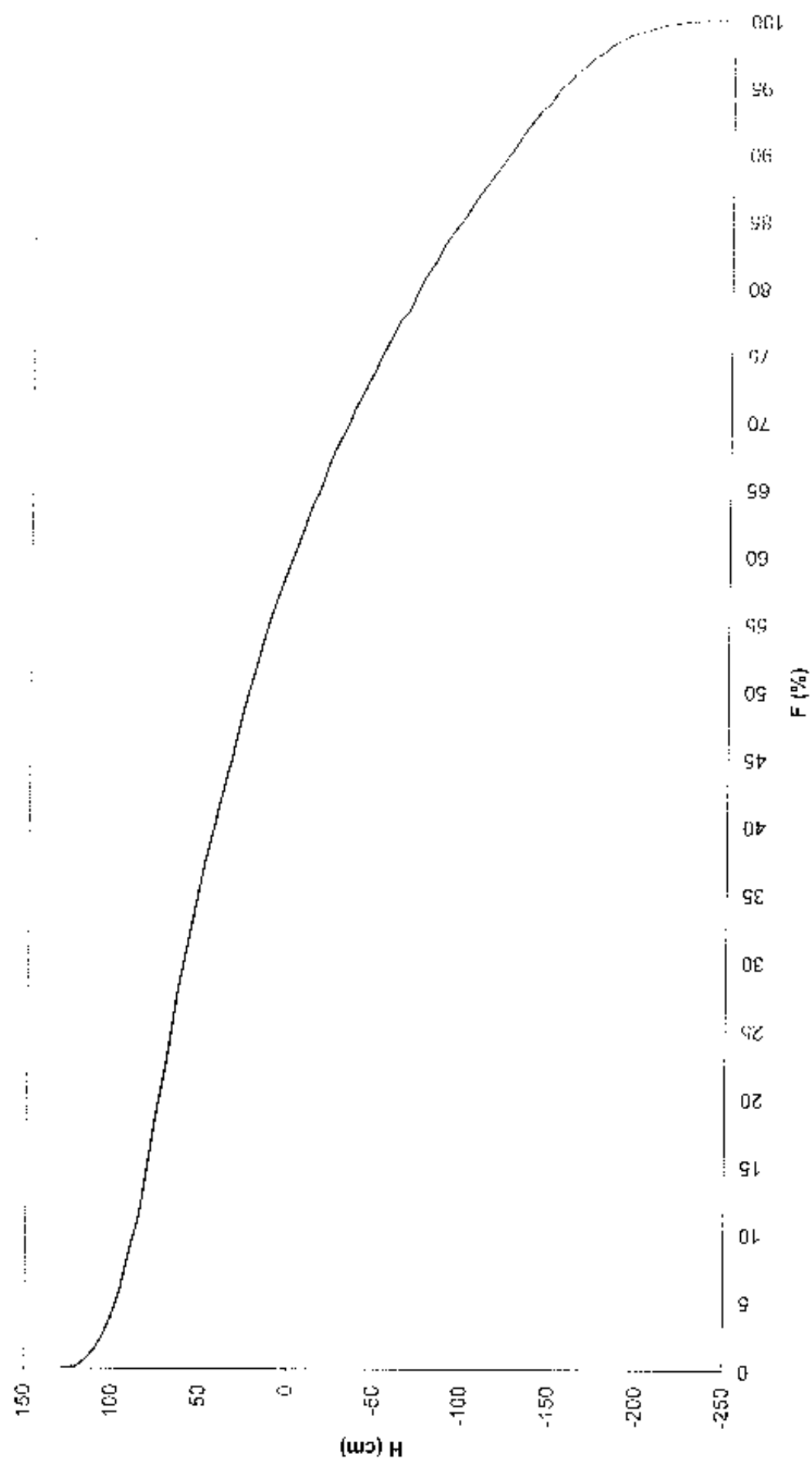


Figure 7. Monthly characteristic of water level at Ben Luc station

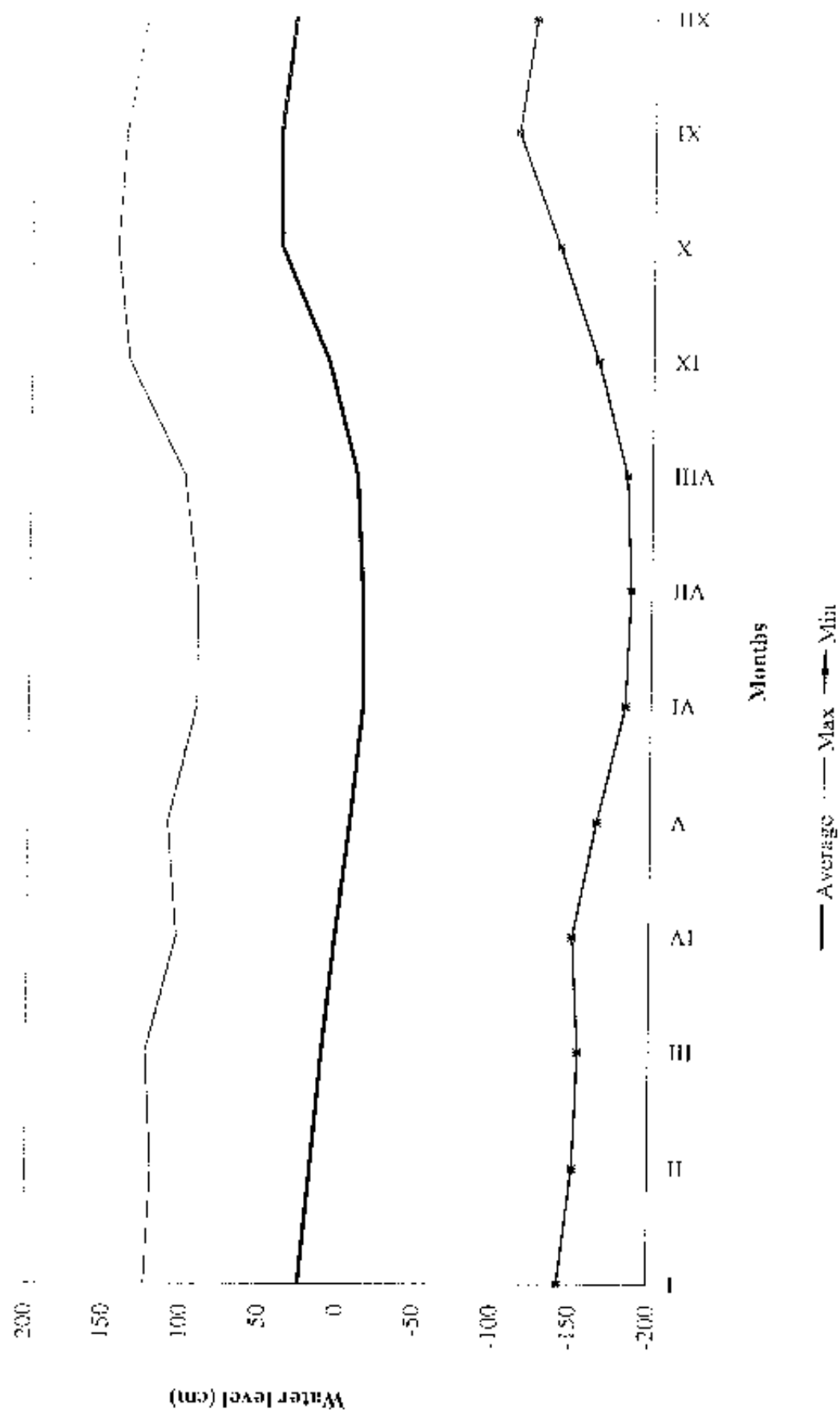


Figure 8. Monthly characteristic of water level at Nha Be station

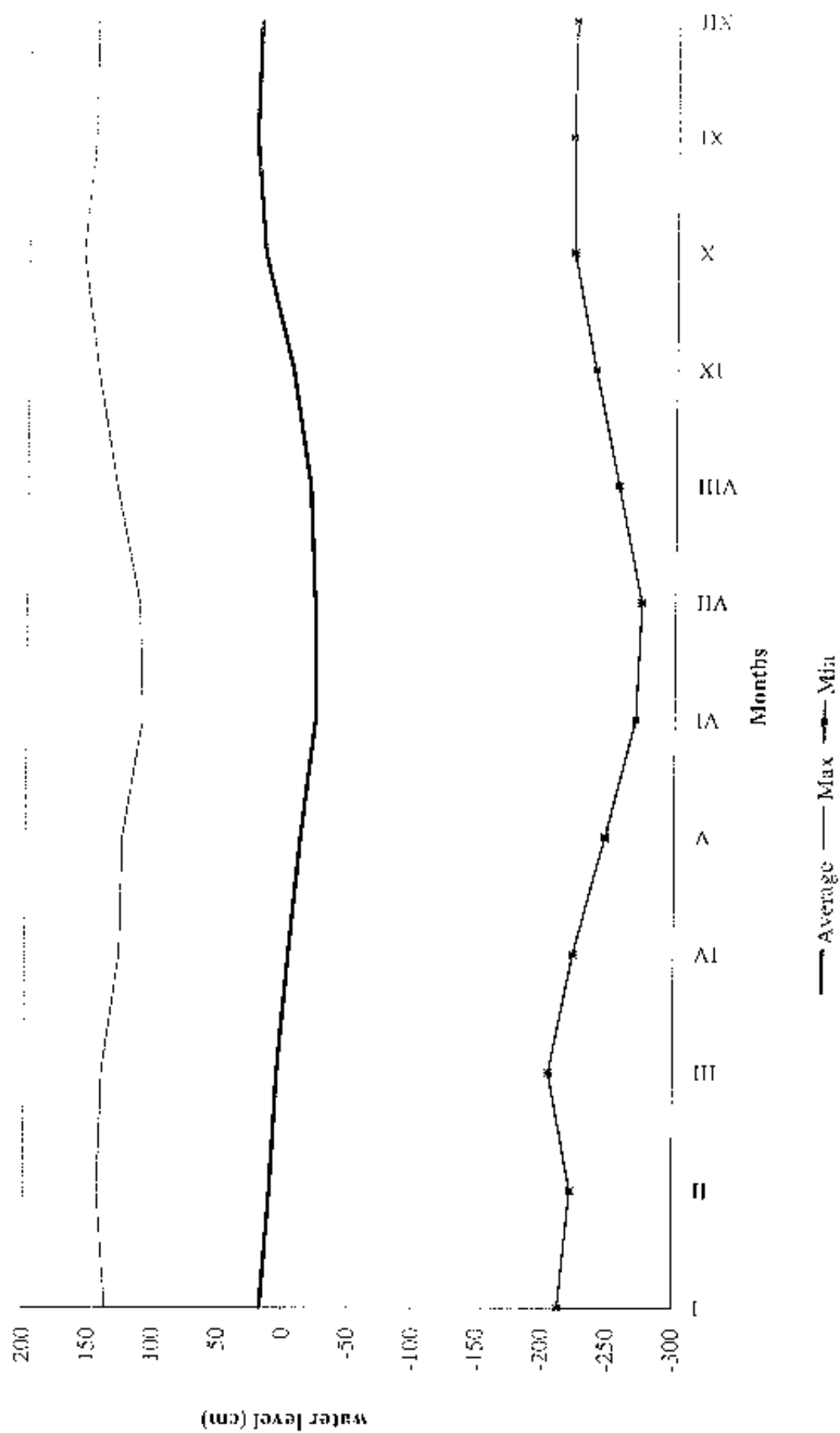


Figure 9. Monthly characteristic of water level at Vung Tau station

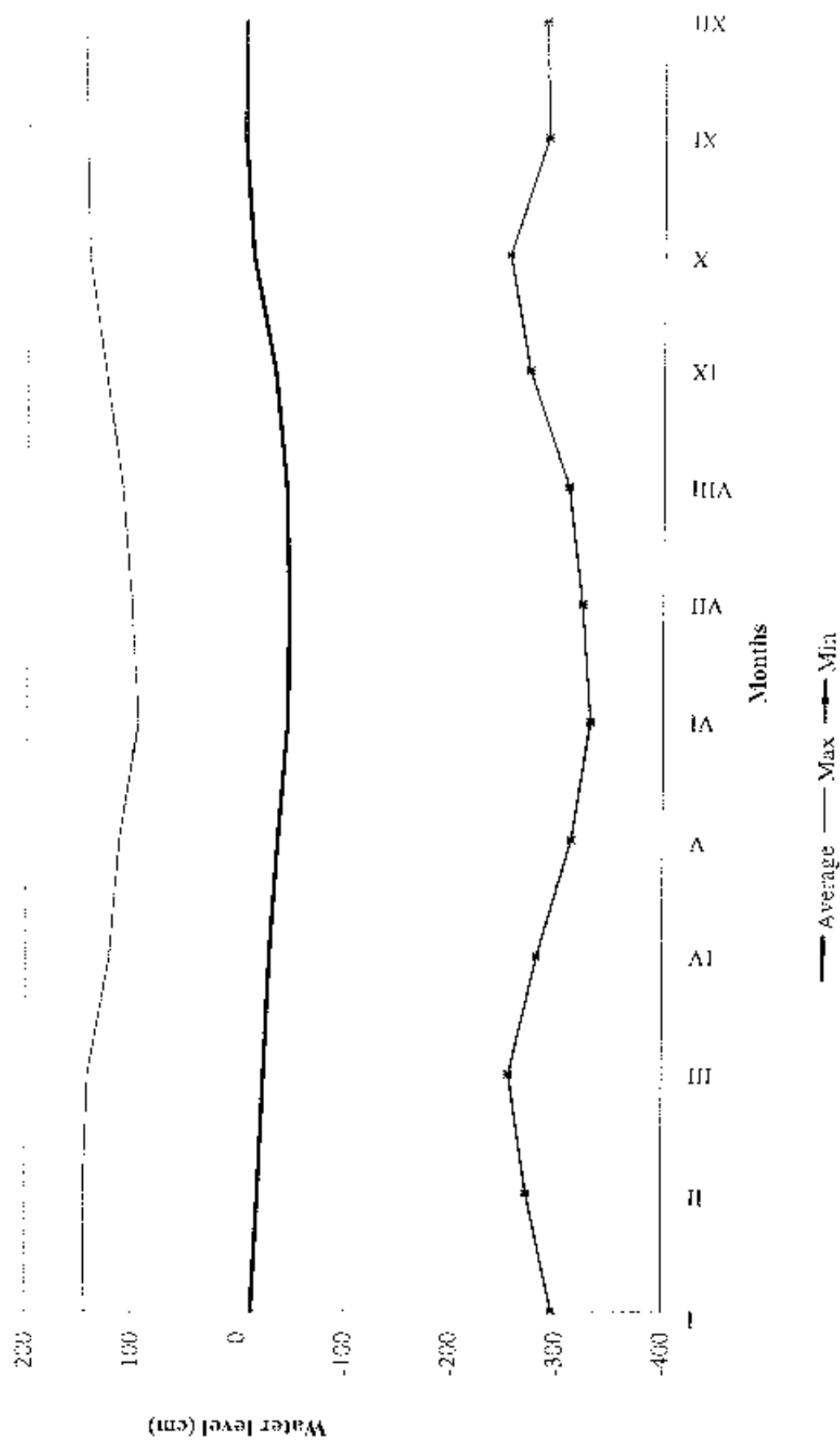


Figure 10. Frequency curve of maximum water level at Ben Luc station

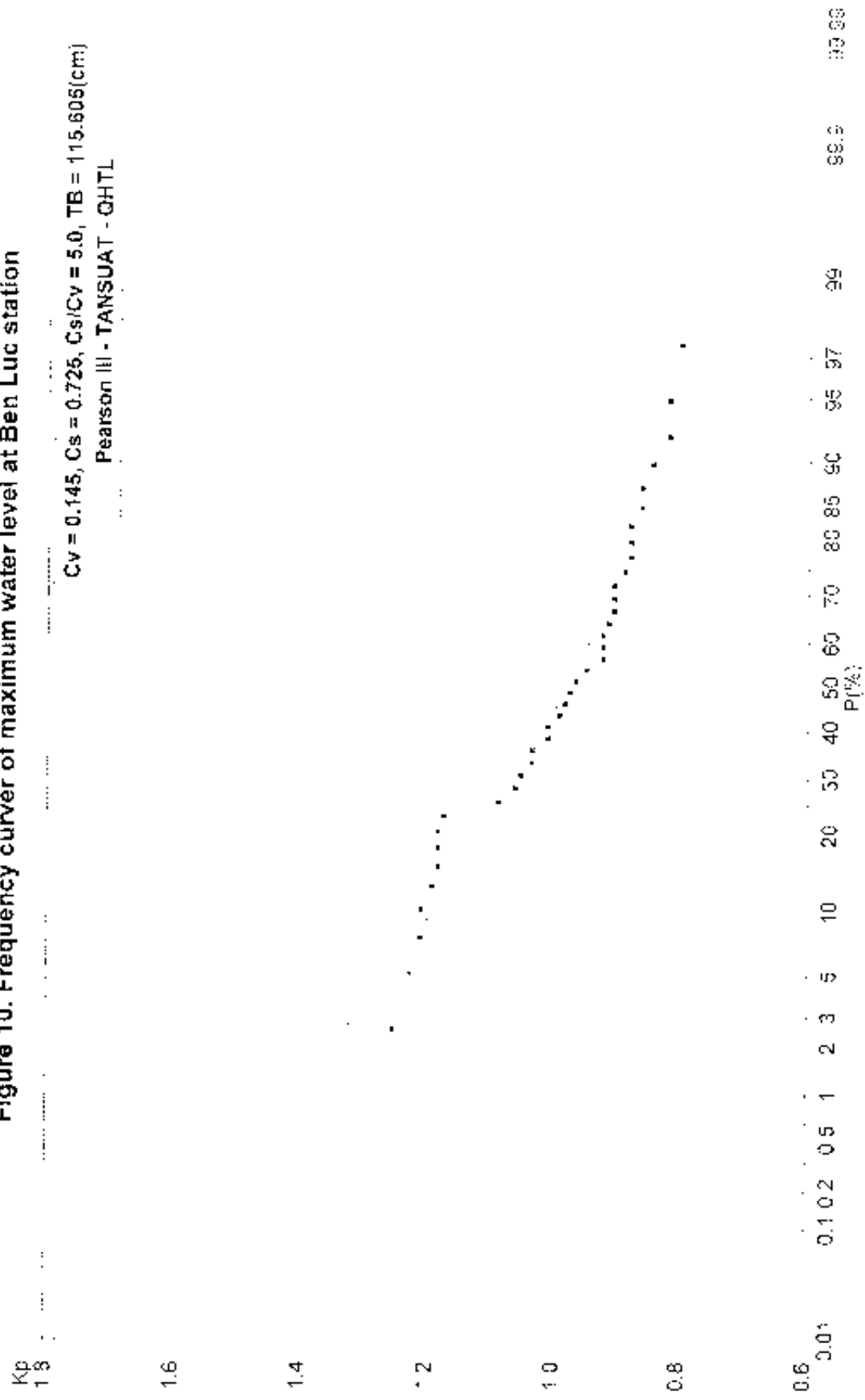


Figure 11. Frequency curve of minimum water level (-H) at Ben Luc station

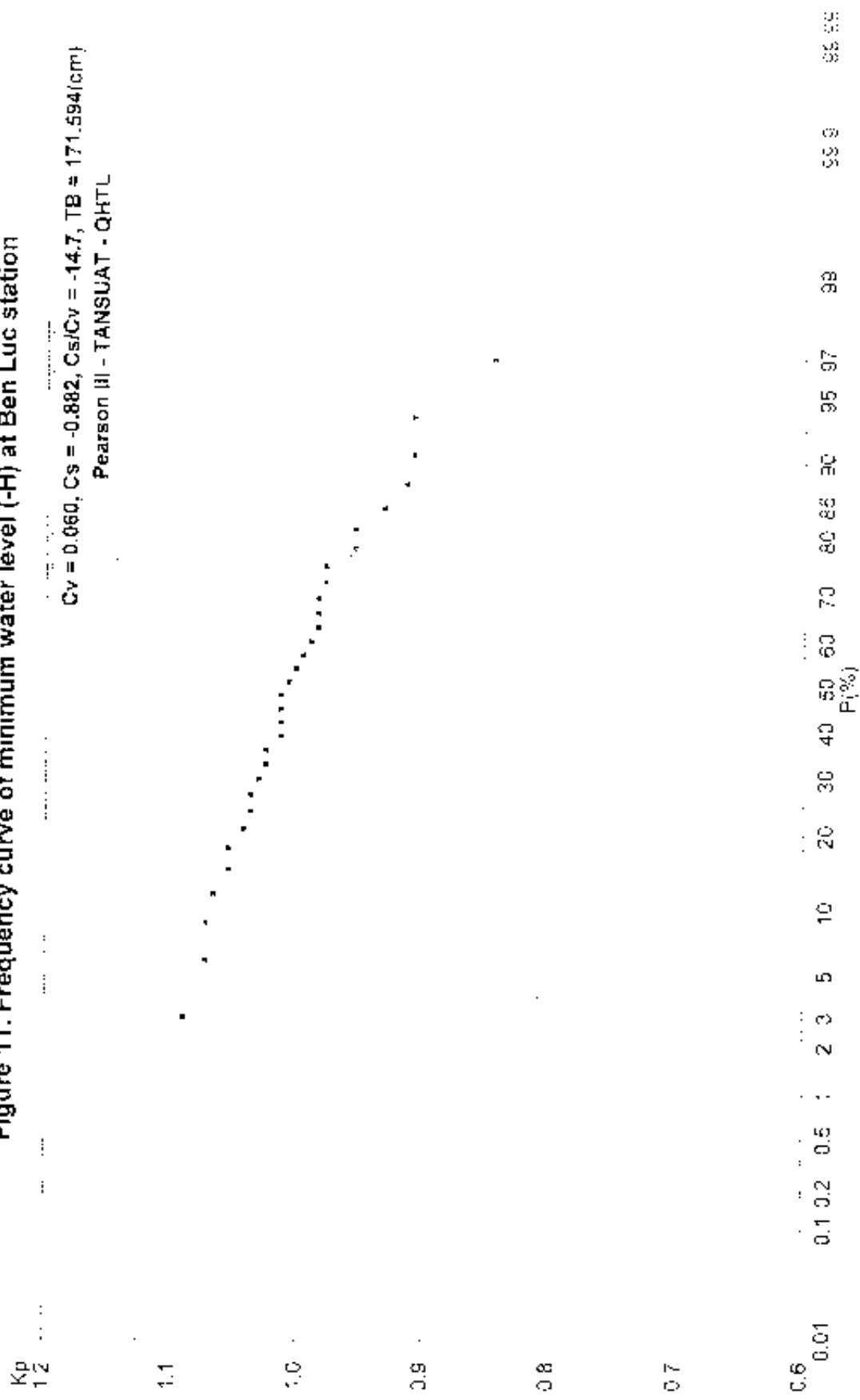


Figure 12. Frequency curve of mainmum water level at Nha Be station

$C_v = 0.067, C_s = 0.727, C_s/C_v = 10.9, TB = 137.222(\text{cm})$
Pearson III - TANSUAT - QHTL

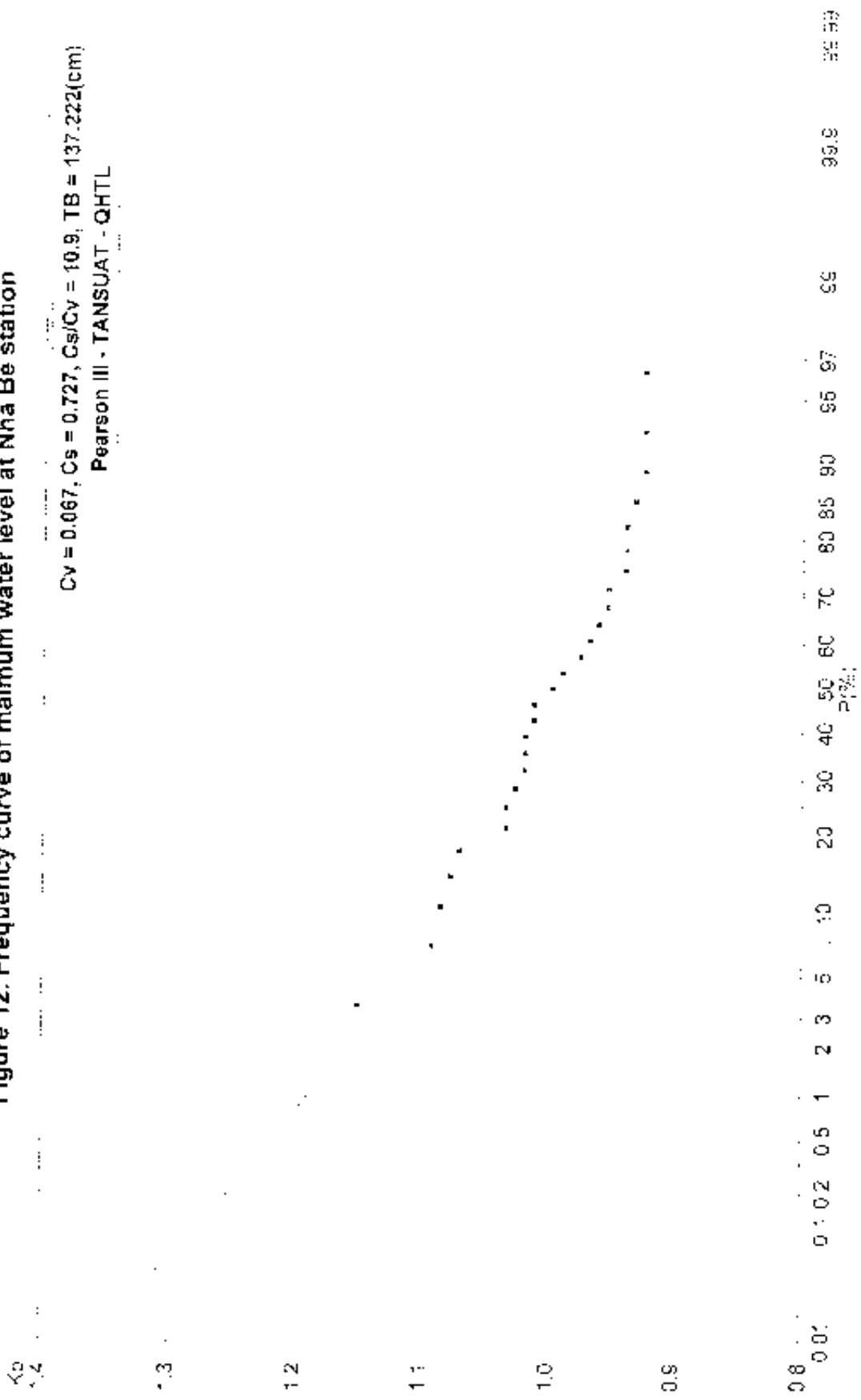


Figure 13. Frequency curve of minimum water level (-H) at Nha be station

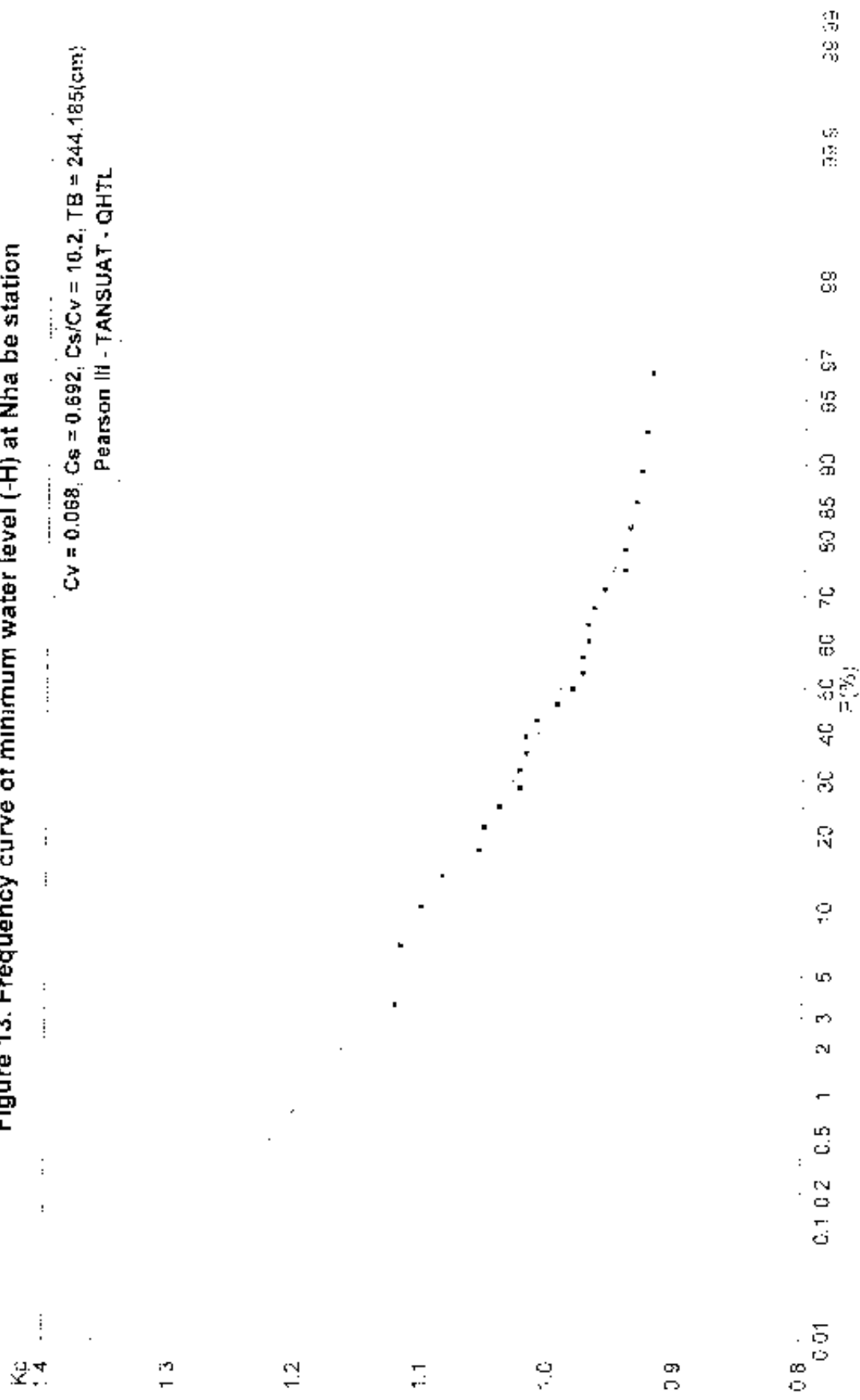


Figure 14. Frequency curve of maximum water level at Vung Tau station

$C_v = 0.078$, $C_s = 0.146$, $C_s/C_v = 1.9$, $TB = 133.553(\text{cm})$

Pearson III - TANSUAT - QHT

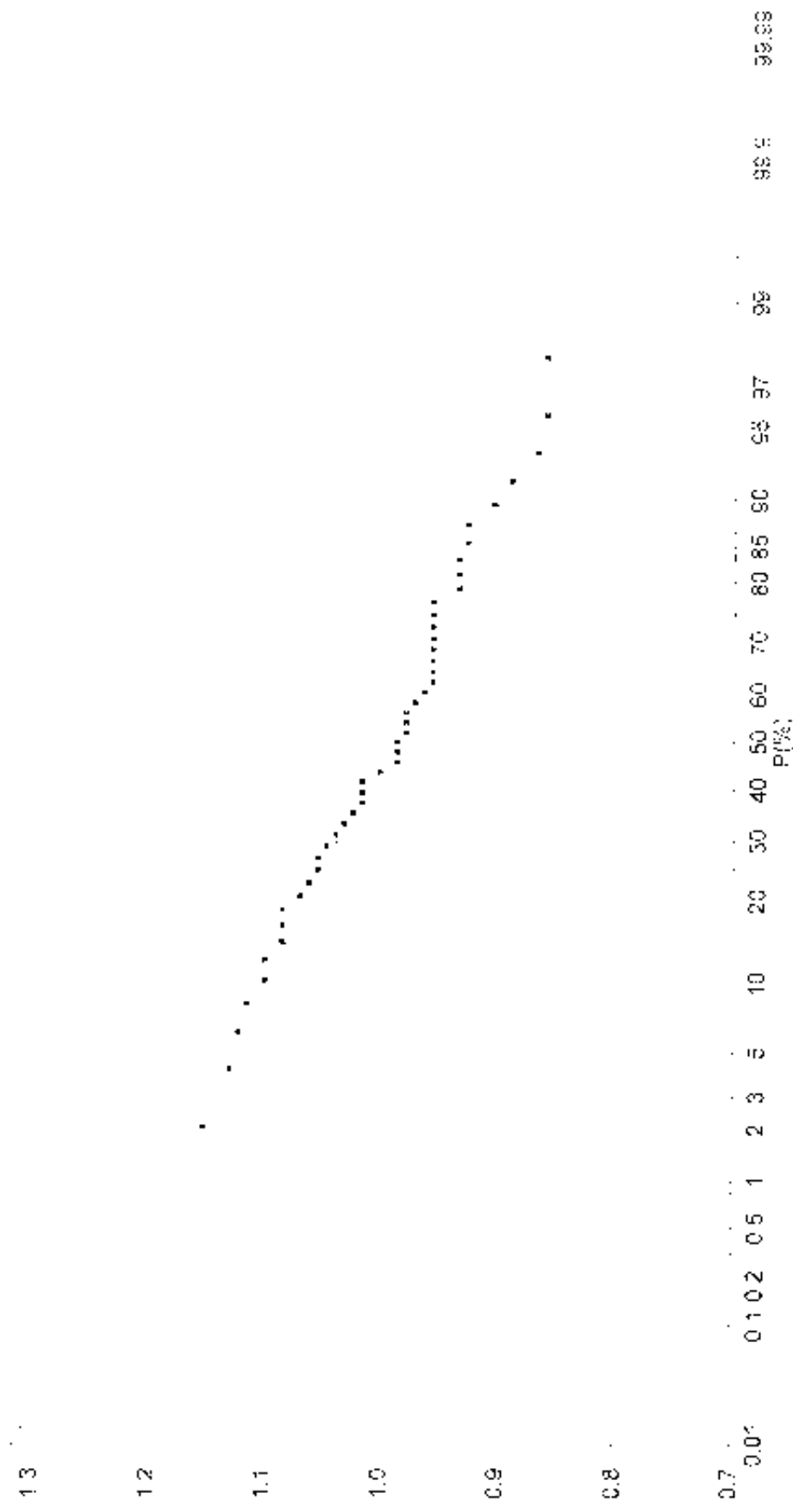


Figure 15. Frequency curve of minimum water level (-H) at Vung Tau station

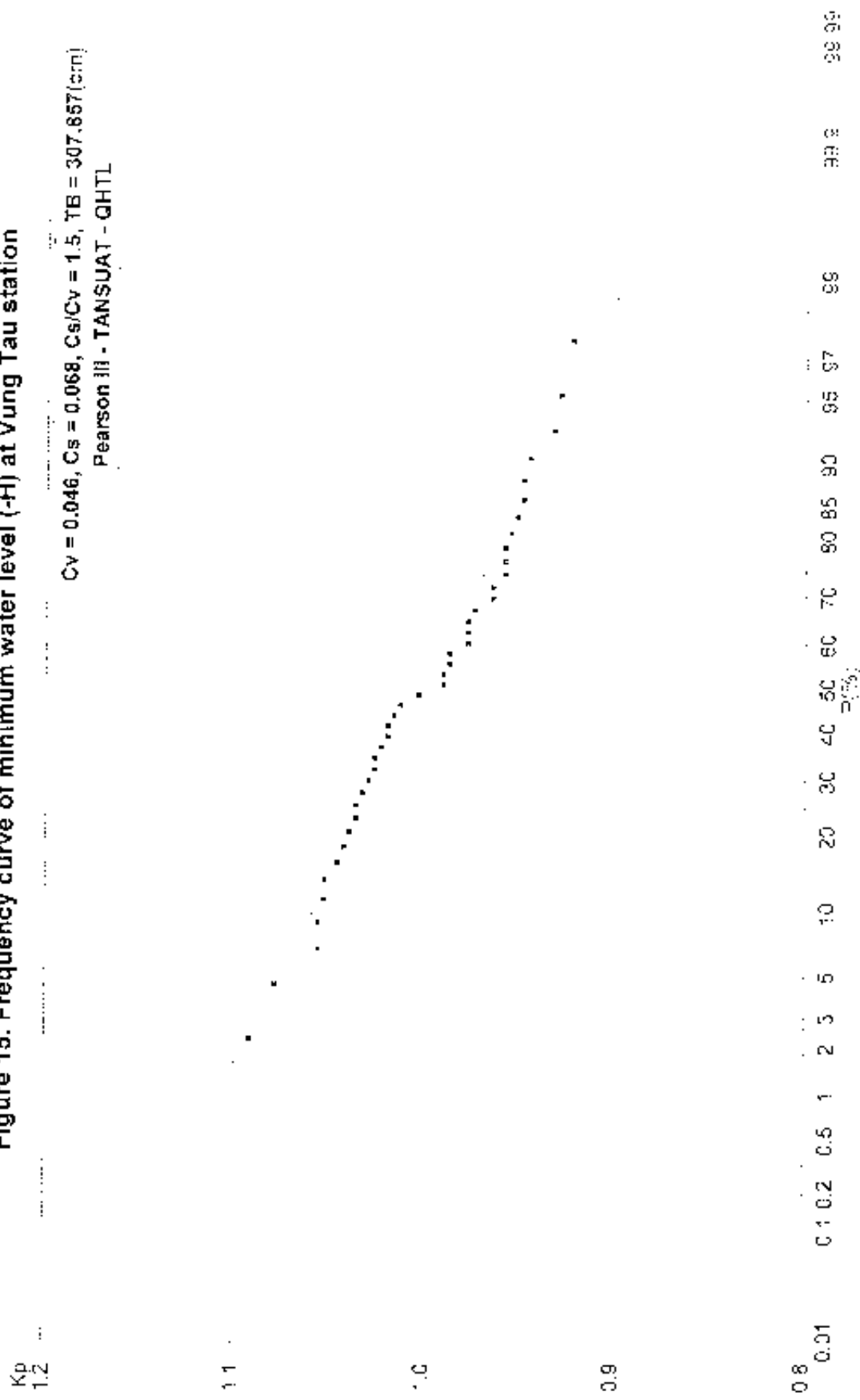


Figure 16. Typical correlative WL - Q - V at Nha Be river, from 28 to 30/09/1996

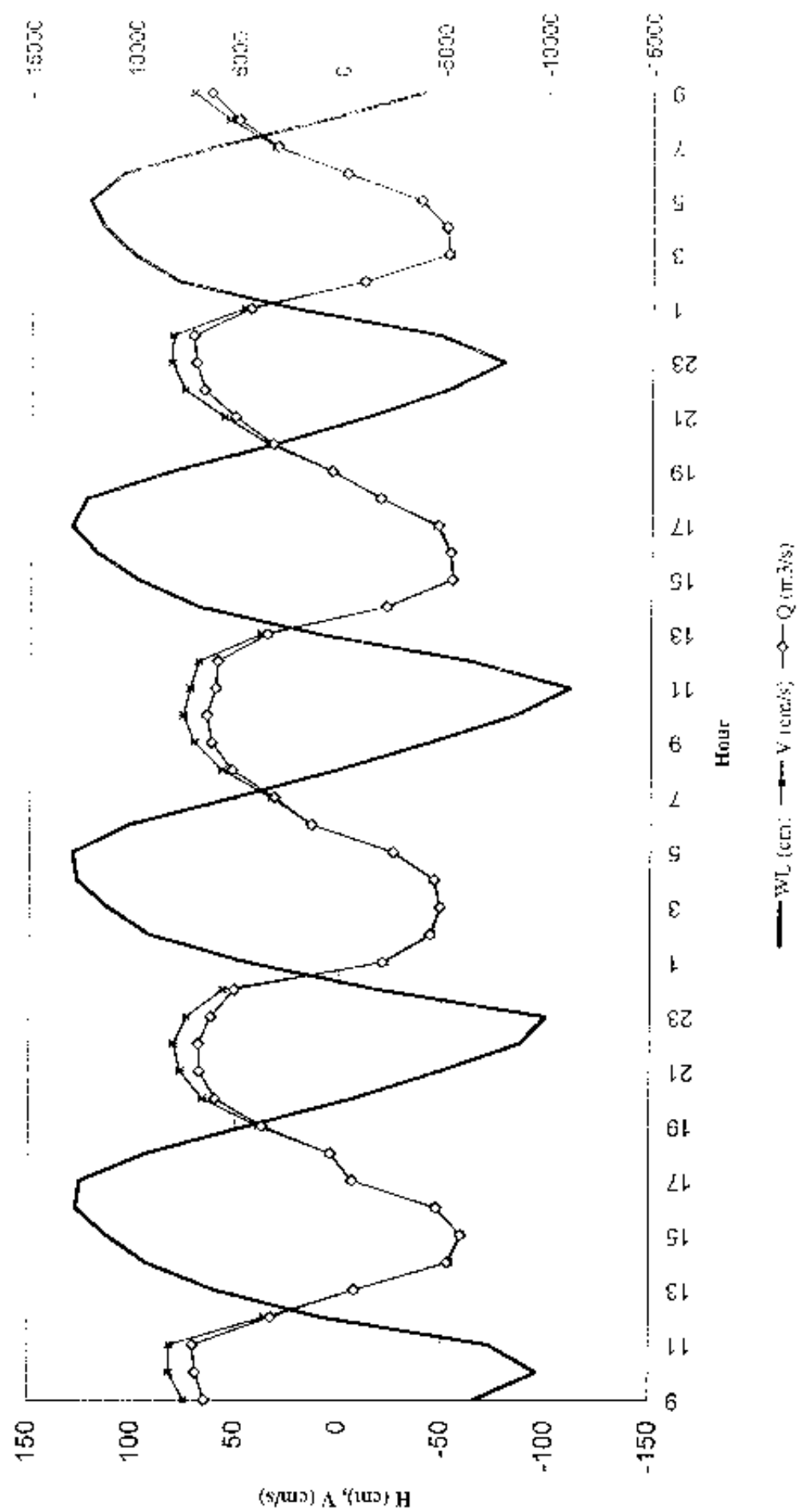
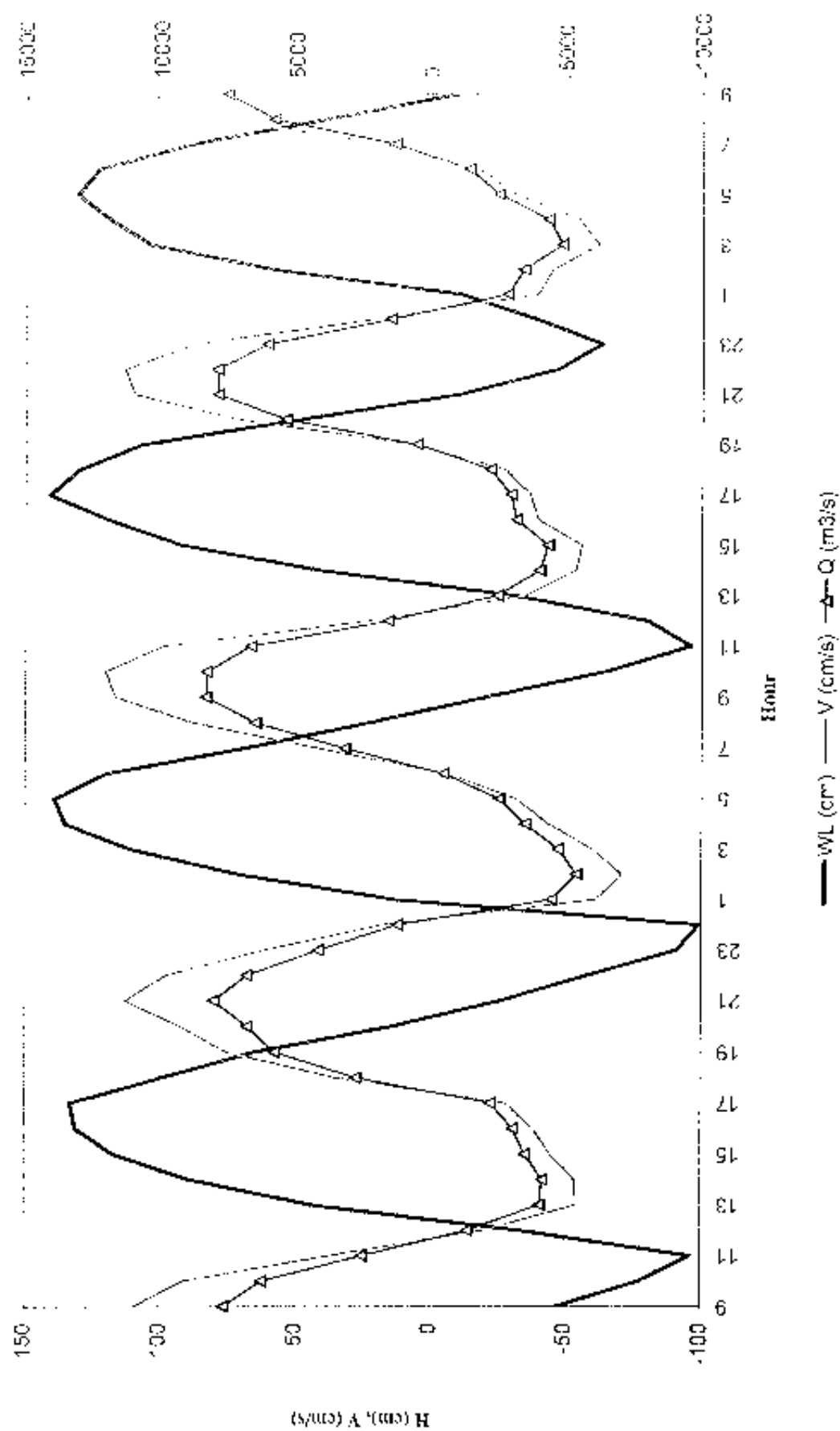


Figure 17. Typical correlative WL - Q - V at Long Tau river, from 28 to 30/09/1996



range velocity at verticals on cross section Nha Be (cm/s) in November 2000
Nha Be river, measured by ADCP instrument

Date	Hour	WL (cm)	Verticals				
			I	II	III	IV	V
07/11	6h30	15	83	65	70	90	87
	7h00	4	72	63	73	87	82
	8h00	-3	72	49	55	65	74
	9h00	4	51	39	41	42	50
	10h00	20	29	29	25	22	24
	11h00	34	19	23	17	11	10
	12h00	40	17	19	14	7	4
	13h00	31	17	15	14	13	15
	14h00	10	34	30	32	38	43
	15h00	-20	58	51	57	57	67
	16h00	-53	70	67	72	73	67
	17h00	-81	62	70	67	54	50
	18h00	-97	60	53	62	51	36
08/11	7h00	-15	74	81	100	97	93
	8h00	-30	80	83	81	78	66
	9h00	-20	61	48	50	55	49
	10h00	10	28	24	20	26	22
	11h00	40	25	30	20	12	6
	12h00	59	44	42	33	26	18
	13h00	66	35	37	36	22	10
	14h00	58	21	31	25	11	12
	15h00	38	28	17	24	30	51
	16h00	6	60	53	57	52	66
	17h00	-34	67	83	84	92	72
	17h30	-53	75	79	85	87	68
	18h00	-72	94	84	84	84	72
09/11	7h00	-27	79	103	101	98	85
	7h30	-38	76	101	92	92	78
	8h00	-48	90	99	87	92	69
	9h00	-46	74	75	65	60	45
	10h00	0	46	34	30	23	8
	11h00	41	27	24	24	27	30
	12h00	71	63	53	53	51	49
	13h00	87	61	57	56	48	57
	14h00	94	41	47	46	47	49
	15h00	79	23	25	24	16	12
	16h00	48	9	10	23	39	54
	17h00	8	45	61	82	89	71
	18h00	-32	92	97	95	87	80
10/11	7h00	-31	70	106	113	97	96
	7h30	-48	82	104	102	99	77
	8h00	-66	97	99	93	104	81
	9h00	-86	91	88	80	81	65

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	10h00	-51	66	62	59	47	25
	11h00	14	7	4	18	23	33
	12h00	59	52	63	68	72	74
	13h00	87	83	76	77	68	62
	14h00	101	67	72	75	65	59
	15h00	106	53	54	53	49	29
	16h00	89	17	23	22	15	8
	17h00	51	11	16	41	67	75
	18h00	11	41	77	93	91	81
11/11	7h00	-21	57	128	120	105	95
	7h30	-44	101	115	107	98	86
	8h00	-67	82	104	112	97	80
	9h00	-102	94	99	93	90	72
	10h00	-115	88	91	86	75	61
	11h00	-49	44	37	21	18	7
	12h00	24	35	43	57	69	71
	13h00	72	122	94	86	76	67
	14h00	97	79	92	91	79	86
	15h00	112	76	74	73	69	61
	16h00	114	53	53	57	50	39
	17h00	102	19	19	17	13	11
	18h00	58	5	14	55	84	74
12/11	7h00	2	39	109	120	105	90
	7h30	-20	85	108	116	116	102
	8h00	-42	93	117	111	107	103
	9h00	-90	113	99	98	93	80
	10h00	-127	97	102	95	79	66
	11h00	-117	86	77	62	55	30
	12h00	-32	5	9	19	32	46
	13h00	41	70	73	99	90	90
	14h00	84	106	95	101	92	90
	15h00	110	87	90	88	85	76
	16h00	125	73	79	73	62	62
	17h00	127	47	56	52	44	26
	18h00	107	16	20	15	14	21
13/11	7h00	22	57	102	112	112	97
	7h30	-6	68	122	115	102	92
	8h00	-34	91	129	114	107	98
	9h00	-81	118	114	119	84	79
	10h00	-125	94	104	107	87	68
	11h00	-145	100	95	95	79	56
	12h00	-87	58	41	32	21	4
	13h00	4	29	43	56	70	78
	14h00	63	116	111	96	90	74
	15h00	99	99	104	101	94	80
	16h00	119	87	95	82	81	70

Maximum velocity at verticals on cross section Nha Be (cm/s) in November 2000
Nha Be river, measured by ADCP instrument

Date	Hour	WL (cm)	Verticals									
			I		II		III		IV		V	
			V (cm/s)	Dir. (deg.)	V (cm/s)	Dir. (deg.)	V (cm/s)	Dir. (deg.)	V (cm/s)	Dir. (deg.)	V (cm/s)	Dir. (deg.)
07/11	6h30	15	100	168	110	172	110	164	111	171	114	152
	7h00	4	97	167	105	167	108	159	108	155	111	147
	8h00	-3	88	172	86	163	89	160	92	155	93	151
	9h00	4	61	165	68	165	73	154	67	149	66	150
	10h00	20	41	169	48	354	41	163	42	169	39	161
	11h00	34	38	352	52	351	35	348	29	163	21	302
	12h00	40	28	351	40	354	27	110	19	172	8	356
	13h00	31	33	172	32	173	36	168	34	167	30	166
	14h00	10	69	178	75	167	69	166	63	174	65	161
	15h00	-20	78	172	83	167	89	164	82	154	85	159
	16h00	-53	76	175	85	170	90	163	87	151	84	151
	17h00	-81	73	176	83	163	80	160	73	154	64	161
	18h00	-97	75	172	65	146	78	164	59	160	47	160
08/11	7h00	-15	91	168	118	161	129	158	120	151	115	149
	8h00	-30	86	175	104	152	104	153	103	154	84	156
	9h00	-20	71	170	63	158	67	155	66	151	60	142
	10h00	10	38	74	47	355	36	161	35	149	31	141
	11h00	40	55	348	70	347	52	350	29	337	13	338
	12h00	59	63	348	67	353	64	352	39	334	25	338
	13h00	66	49	348	65	359	75	350	47	344	22	86
	14h00	58	53	348	58	350	50	342	18	162	21	108
	15h00	38	38	177	36	176	58	174	58	164	66	160
	16h00	6	70	175	90	175	86	169	87	162	81	155
	17h00	-34	87	201	100	163	104	155	104	152	92	154
	17h30	-53	83	167	94	175	108	156	106	148	88	158
	18h00	-72	110	189	98	168	94	165	95	159	83	160
09/11	7h00	-27	92	178	124	176	121	164	118	158	100	149
	7h30	-38	101	175	122	164	112	165	109	162	100	158
	8h00	-48	100	161	126	165	104	164	111	163	94	160
	9h00	-46	86	166	85	170	81	159	69	174	61	162
	10h00	0	51	176	43	191	36	171	35	157	15	157
	11h00	41	40	340	38	323	48	319	40	332	58	71
	12h00	71	69	342	65	343	67	347	61	353	63	342
	13h00	87	73	354	77	355	76	0	67	353	63	351
	14h00	94	49	346	62	346	62	343	60	334	55	338
	15h00	79	30	342	35	327	35	351	31	1	22	59
	16h00	48	18	193	23	79	41	167	55	174	66	162
	17h00	8	57	180	81	183	101	152	131	146	86	157
	18h00	-32	102	179	114	167	111	164	114	156	91	161
10/11	7h00	-31	87	195	133	176	133	168	107	155	113	157
	7h30	-48	94	164	120	174	122	171	111	165	95	157

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	8h00	-66	112	168	127	177	110	173	119	162	94	158
	9h00	-86	103	160	107	164	98	157	94	168	76	164
	10h00	-51	76	163	84	159	66	166	59	163	32	166
	11h00	14	12	145	10	68	32	334	38	329	48	334
	12h00	59	66	348	83	328	92	332	100	333	91	338
	13h00	87	91	350	91	340	92	348	84	354	88	337
	14h00	101	82	348	91	354	85	352	76	332	83	336
	15h00	106	58	355	65	342	69	343	57	354	44	323
	16h00	89	21	297	29	330	29	343	26	338	18	183
	17h00	51	22	223	34	178	58	161	82	164	92	160
	18h00	11	56	175	99	175	110	175	102	158	98	158
11/11	7h00	-21	72	162	146	168	132	162	122	167	110	164
	7h30	-44	112	169	132	182	125	159	117	169	107	157
	8h00	-67	89	168	119	170	133	160	114	165	95	154
	9h00	-102	106	183	119	180	107	157	107	166	89	159
	10h00	-115	101	176	106	174	100	164	85	160	73	160
	11h00	-49	53	168	47	171	28	163	23	162	10	326
	12h00	24	45	346	62	344	71	341	85	340	95	339
	13h00	72	133	352	108	350	100	343	94	330	97	335
	14h00	97	87	344	107	349	110	334	93	333	113	339
	15h00	112	86	349	98	343	94	339	91	330	82	338
	16h00	114	60	345	63	0	67	340	61	325	53	330
	17h00	102	24	360	24	341	26	331	26	2	20	139
	18h00	58	12	236	23	166	73	155	103	152	85	148
12/11	7h00	2	62	185	138	165	132	171	123	163	105	163
	7h30	-20	100	147	149	177	128	169	127	162	124	158
	8h00	-42	100	191	137	181	128	175	123	167	117	157
	9h00	-90	118	176	119	171	112	172	107	170	102	159
	10h00	-127	109	153	119	160	105	166	93	157	79	160
	11h00	-117	105	164	90	173	75	169	69	159	43	156
	12h00	-32	10	99	15	354	66	2	41	342	56	345
	13h00	41	73	348	87	345	114	350	118	336	108	340
	14h00	84	111	355	113	339	124	341	114	339	113	343
	15h00	110	104	349	107	353	116	334	119	332	97	337
	16h00	125	88	348	95	338	96	339	83	337	86	332
	17h00	127	59	350	69	346	62	343	55	329	37	339
	18h00	107	23	335	27	339	31	346	22	360	28	168
13/11	7h00	22	70	196	144	181	131	178	131	162	116	160
	7h30	-6	131	223	144	162	127	169	122	165	112	158
	8h00	-34	101	182	177	171	132	167	120	162	115	155
	9h00	-81	134	175	153	172	140	152	97	162	102	161
	10h00	-125	115	182	115	178	125	161	102	152	85	161
	11h00	-145	112	169	110	169	110	157	92	162	69	157
	12h00	-87	70	154	51	168	39	154	31	149	10	193
	13h00	4	37	353	54	341	65	342	79	346	103	340
	14h00	63	124	352	124	353	117	344	105	335	114	338
	15h00	99	115	347	117	345	126	337	127	340	110	339
	16h00	119	99	347	111	351	102	335	110	329	95	336

Discharge data on Nha Be cross section in November 2000
Nha Be river, measured by ADCP

Date	Hour	WL (cm)	Discharge (m ³ /s)						
			R. B to V.I	I to II	II to III	III to IV	IV to V	V to L. B	Total
07/11	6h30	15	818	1566	1538	1324	744	136	6126
	7h00	4	845	1514	1511	1540	1364	986	7760
	8h00	-3	716	1195	1380	1276	1197	502	6266
	9h00	4	542	808	851	869	743	309	4122
	10h00	20	359	69	172	320	344	201	1465
	11h00	34	81	-339	-109	134	117	-114	-230
	12h00	40	14	-277	-183	67	53	-30	-356
	13h00	31	115	89	174	198	258	151	985
	14h00	10	332	779	758	792	682	409	3752
	15h00	-20	649	1372	1353	1262	998	396	6030
	16h00	-53	668	1728	1766	1624	1106	345	7237
	17h00	-81	660	1891	1816	1431	897	242	6937
	18h00	-97	675	1687	1468	1205	698	164	5897
08/11	7h00	-15	726	1957	2326	2151	1597	620	9377
	8h00	-30	722	2078	2086	1780	1233	420	8319
	9h00	-20	566	1423	1370	1203	869	284	5715
	10h00	10	329	139	269	458	388	85	1668
	11h00	40	-79	-796	-648	-325	-120	-56	-2024
	12h00	59	-388	-1198	-945	-678	-318	-117	-3644
	13h00	66	-258	-1010	-964	-711	-163	13	-3093
	14h00	58	16	-612	-591	-180	222	115	-1030
	15h00	38	205	303	269	499	786	491	2553
	16h00	6	524	1477	1521	1152	962	496	6132
	17h00	-34	626	2004	2354	1873	1211	340	8408
	17h30	-53	669	2239	2280	1927	1210	359	8684
	18h00	-72	853	2176	2125	1735	1232	435	8556
09/11	7h00	-27	734	2526	2611	2090	1548	592	10101
	7h30	-38	707	2563	2534	2093	1462	516	9875
	8h00	-48	707	2452	2365	1988	1292	463	9267
	9h00	-46	673	2031	1949	1450	908	272	7283
	10h00	0	376	998	860	582	257	-13	3060
	11h00	41	-186	-668	-584	-568	-415	-240	-2661
	12h00	71	-556	-1535	-1500	-1223	-854	-387	-6055
	13h00	87	-604	-1670	-1595	-1320	-897	-416	-6502
	14h00	94	-410	-1422	-1281	-1104	-725	-283	-5225
	15h00	79	-151	-693	-592	-458	-201	-38	-2133
	16h00	48	134	204	438	729	863	365	2733
	17h00	8	302	1556	1894	1960	1351	511	7574
	18h00	-32	417	2289	2414	2019	1461	661	9261
10/11	7h00	-31	714	2522	2771	2144	1534	756	10441
	7h30	-48	774	2743	2720	2137	1389	546	10309

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	8h00	-66	919	2686	2510	2062	1331	468	9976
	9h00	-86	840	2361	2348	1856	1120	292	8817
	10h00	-51	628	1686	1518	1093	566	95	5586
	11h00	14	71	111	-259	-502	-465	-283	-1327
	12h00	59	-526	-1650	-1771	-1608	-1146	-501	-7202
	13h00	87	-882	-2269	-2180	-1870	-1096	-452	-8749
	14h00	101	-682	-2050	-2034	-1654	-1009	-400	-7829
	15h00	106	-505	-1446	-1563	-1223	-680	-196	-5613
	16h00	89	-133	-537	-556	-398	-56	85	-1595
	17h00	51	105	-322	707	1159	1330	372	3351
	18h00	11	364	1790	2362	1964	1273	592	8345
11/11	7h00	-21	102	2422	3020	2389	1747	852	10532
	7h30	-44	947	2965	2888	2172	1412	576	10960
	8h00	-67	723	2768	2653	2550	1128	345	10167
	9h00	-102	780	2554	2517	1974	1304	389	9518
	10h00	-115	1023	2311	2090	1635	967	259	8285
	11h00	-49	551	1051	665	345	43	-65	2590
	12h00	24	-333	-1065	-1411	-1462	-1280	-548	-6099
	13h00	72	-1029	-2856	-2579	-2054	-1259	-542	-10319
	14h00	97	-412	-2273	-2797	-2325	-1424	-529	-9760
	15h00	112	-730	-2075	-2218	-1751	-1190	-421	-8385
	16h00	114	-481	-1496	-1597	-1298	-773	-173	-5818
	17h00	102	-174	-555	-476	-314	-61	181	-1399
	18h00	58	9	4	874	1586	1279	705	4457
12/11	7h00	2	144	2435	2901	2365	1601	691	10137
	7h30	-20	418	2380	2856	2489	1726	844	10713
	8h00	-42	538	2871	2878	2299	1592	711	10889
	9h00	-90	1021	2784	2538	2104	1274	471	10192
	10h00	-127	904	2598	2456	1852	1167	271	9248
	11h00	-117	919	2033	1804	1334	606	119	6815
	12h00	-32	39	-97	-366	-594	-639	-408	-2065
	13h00	41	-655	-1884	-2332	-2358	-1490	-619	-9338
	14h00	84	-978	-2712	-2785	-2485	-1681	-682	-11323
	15h00	110	-872	-2476	-2699	-2232	-1526	-581	-10386
	16h00	125	-787	-2195	-2147	-1743	-1191	-402	-8465
	17h00	127	-471	-1435	-1518	-1206	-597	-23	-5250
	18h00	107	-133	-468	-417	-280	174	209	-915
13/11	7h00	22	395	2204	3159	1530	1603	693	9584
	7h30	-6	600	2427	2905	2322	1594	677	10525
	8h00	-34	497	2786	2896	2428	1669	734	11010
	9h00	-81	984	2821	2752	2154	1383	483	10577
	10h00	-125	1117	2706	2470	1989	1140	286	9708
	11h00	-145	1215	2414	2204	1766	923	198	8720
	12h00	-87	733	1371	967	531	137	-35	3704
	13h00	4	-278	-993	-1333	-1461	-1272	-516	-5853
	14h00	63	-1040	-3021	-2864	-2279	-1377	-648	-11229
	15h00	99	-1016	-2801	-2837	-2340	-1605	-619	-11218
	16h00	119	-965	-2609	-2467	-2002	-1380	-480	-9903

Flow data on Nha Be river

Investigation cross section is far from crossing Nha Be - Long Tau 500m downstream of Nha Be river. Time is from 28/12 to 31/12/1993

Date	Hour	WL cm	A m2	Vaver. mm/s	Q m3/s	Direction
28/12	13	6	7960	-860	-6846	In
	14	54	8557	-925	-7915	In
	15	86	8956	-861	-7711	In
	16	105	9196	-710	-6529	In
	17	108	9234	-466	-4303	In
	18	100	9133	-115	-1050	In
	19	84	8931	151	1349	Out
	20	67	8719	298	2598	Out
	21	52	8532	432	3686	Out
	22	54	8557	463	3962	Out
	23	65	8694	174	1513	Out
	24	82	8906	-158	-1407	In
29/12	1	104	9183	-284	-2608	In
	2	114	9310	-406	-3780	In
	3	118	9361	-312	-2921	In
	4	106	9209	199	1833	Out
	5	74	8806	277	2439	Out
	6	31	8271	775	6410	Out
	7	-15	7703	985	7587	Out
	8	-61	7141	871	6220	Out
	9	-109	6529	678	4427	Out
	10	-150	6042	720	4350	Out
	11	-150	6042	709	4284	Out
	12	-100	6636	375	2489	Out
	13	-37	7433	-666	-4950	In
	14	22	8160	-1067	-8707	In
	15	66	8706	-993	-8645	In
	16	93	9044	-796	-7199	In
	17	107	9221	-670	-6178	In
	18	110	9260	-470	-4352	In
	19	97	9095	-217	-1974	In
	20	78	8856	212	1877	Out
	21	55	8569	510	4370	Out
	22	42	8407	594	4994	Out
	23	46	8457	487	4119	Out
	24	65	8694	198	1721	Out
30/12	1	88	8982	-185	-1662	In
	2	107	9221	-277	-2554	In
	3	117	9348	-407	-3805	In
	4	117	9348	-395	-3692	In
	5	95	9069	-217	-1968	In
	6	68	8731	509	4444	Out
	7	22	8160	799	6520	Out
	8	-30	7518	846	6360	Out

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	9	-74	6983	766	5349	Out
	10	-122	6374	730	4653	Out
	11	-152	6018	705	4243	Out
	12	-122	6374	482	3072	Out
	13	-67	7068	-470	-3322	In
	14	-6	7813	-864	-6750	In
	15	53	8544	-1002	-8561	In
	16	92	9032	-823	-7433	In
	17	108	9234	-703	-6492	In
	18	112	9285	-514	-4772	In
	19	104	9183	-288	-2645	In
	20	82	8906	199	1772	Out
	21	59	8619	431	3715	Out
	22	39	8370	537	4495	Out
	23	27	8222	424	3486	Out
	24	42	8407	232	1950	Out
31/12	1	72	8781	-1	-9	In
	2	94	9057	-310	-2808	In
	3	110	9260	-451	-4176	In
	4	114	9374	-464	-4350	In
	5	119	9310	-287	-2672	In
	6	92	9032	-223	-2014	In
	7	47	8469	552	4675	Out
	8	0	7886	699	5512	Out
	9	-47	7311	769	5622	Out
	10	-94	6708	777	5212	Out
	11	-136	6208	706	4383	Out
	12	-154	5994	671	4022	Out

Flow data on Long Tau river

Investigation cross section is far from crossing Nha Be - Long Tau 400m downstream of Long Tau river. Time is from 28/12 to 31/12/1993

Date	Hour	WL cm	A m2	Vaver. mm/s	Q m3/s	Direction
28/12	13	60	5767	-847	-4885	In
	14	80	5885	-710	-4178	In
	15	105	6036	-644	-3887	In
	16	111	6072	-501	-3042	In
	17	115	6094	-401	-2444	In
	18	106	6041	150	906	Out
	19	83	5904	559	3300	Out
	20	66	5802	664	3853	Out
	21	58	5755	600	3453	Out
	22	62	5780	399	2306	Out
	23	74	5850	223	1305	Out
	24	93	5963	-408	-2433	In
29/12	1	108	6052	-473	-2863	In
	2	119	6119	-545	-3335	In
	3	122	6136	-506	-3105	In
	4	107	6047	-63	-381	In
	5	68	5815	620	3605	Out
	6	26	5571	940	5237	Out
	7	-16	5325	1062	5655	Out
	8	-68	5042	1173	5914	Out
	9	-108	4823	1155	5571	Out
	10	-144	4628	989	4577	Out
	11	-136	4683	371	1737	Out
	12	-74	5008	-634	-3175	In
	13	2	5435	-810	-4402	In
	14	58	5755	-891	-5128	In
	15	92	5975	-740	-4422	In
	16	112	6076	-635	-3858	In
	17	116	6101	-589	-3593	In
	18	114	6089	-261	-1589	In
	19	94	5969	208	1242	Out
	20	73	5844	567	3314	Out
	21	58	5755	701	4034	Out
	22	48	5696	466	2654	Out
	23	58	5755	271	1560	Out
	24	78	5874	-196	-1151	In
30/12	1	100	6005	-471	-2828	In
	2	117	6107	-593	-3621	In
	3	123	6143	-557	-3422	In
	4	90	5945	-168	-999	In
	5	53	5725	222	1271	Out
	6	6	5456	814	4441	Out
	7	-37	5211	1120	5836	Out
	8	-81	4971	1092	5428	Out

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	9	-124	4744	1002	4753	Out
	10	-150	4601	888	4086	Out
	11	-117	4778	385	1840	Out
	12	-45	5167	-470	-2428	In
	13	24	5560	-803	-4465	In
	14	77	5868	-831	-4876	In
	15	101	6011	-743	-4466	In
	16	113	6082	-658	-4002	In
	17	117	6107	-588	-3591	In
	18	105	6036	-402	-2426	In
	19	77	5868	210	1232	Out
	20	53	5725	593	3395	Out
	21	38	5641	733	4135	Out
	22	36	5629	694	3907	Out
	23	53	5725	413	2364	Out
	24	68	5815	95	552	Out
31/12	1	82	5897	-443	-2612	In
	2	97	5988	-544	-3257	In
	3	114	6089	-534	-3252	In
	4	121	6129	-518	-3175	In
	5	116	6101	-147	-897	In
	6	79	5879	475	2793	Out
	7	33	5611	1072	6015	Out
	8	-9	5363	1235	6623	Out
	9	-57	5102	1277	6515	Out
	10	-101	4862	1136	5523	Out
	11	-147	4613	987	4553	Out
	12	-153	4585	616	2824	Out

APPENDIX C4: OVERHEAD TRANSMISSION LINES REPORT

**OVERHEAD TRANSMISSION LINES
FINAL REPORT**

**TA 7155-VIE PREPARING THE BEN LUC-LONG THANH
EXPRESSWAY PROJECT
IN
VIETNAM**

FEBRUARY 2010

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1. DATA FOR COMPARISON**1.1 Alternatives at large river crossing**

Alternative routes of the Expressway will be estimated as following Table 1, including the original route “A0” from the Pre Feasibility Study.

Table 1: Alternative at the Large River Crossings

Alignment	Bridge		IMT Method		TBM Method	
	Bridge 1	Bridge 2	Tunnel 1	Tunnel 2	Tunnel 1	Tunnel 2
A0 Pre FS	1,500 m	920 m	2,180 m	1,585 m	3,100 m	2,265 m
A1	1,010 m	861 m	1,666 m	1,134 m	3,000 m	2,265 m
A2	1,660 m	n/a	1,660 m	n/a	n/a	n/a
A3	1,310 m	n/a	1,660 m	n/a	n/a	n/a

- Note:
1. Bridge 1 and Tunnel 1 over the Song Soai Rap for A0 and A1.
 2. Bridge 2 and Tunnel 2 over the Song Long Tau for A0 and A1.
 3. Bridge 1 and Tunnel 1 over the Song Nha Be for A2 and A3.
 4. IMT Method: Immersed Tube Tunneling Method
 5. TBM Method: Tunnel Boring Machine Tunneling Method

1.2 Estimated Crossing over the Expressway or Closer to in Alternatives

Estimated crossing over the Expressway at Alternatives above or closer to the structure of road is shown in Figure 1 and Figure 2.

1.3 Given data related High-voltage transmission lines

Given data related above are:

1. ID No. 5953/TTD4-KTAT dated 17 December 2007: Subject: Parameters of safety corridor of 500Kv, 220Kv for Ben Loc Long Thanh Expressway Project by Electrical Corporation of Vietnam Electrical Company No.4
2. Decree No.54/1999/ND-CP dated 08 July 1999: Safety Protection of High-voltage Power Grid.

1.4 Photos of Overhead Transmission Lines (OTL) at the site

Photos of typical existing OTL at the project site are attached them below in Figure 3 to Figure 8.

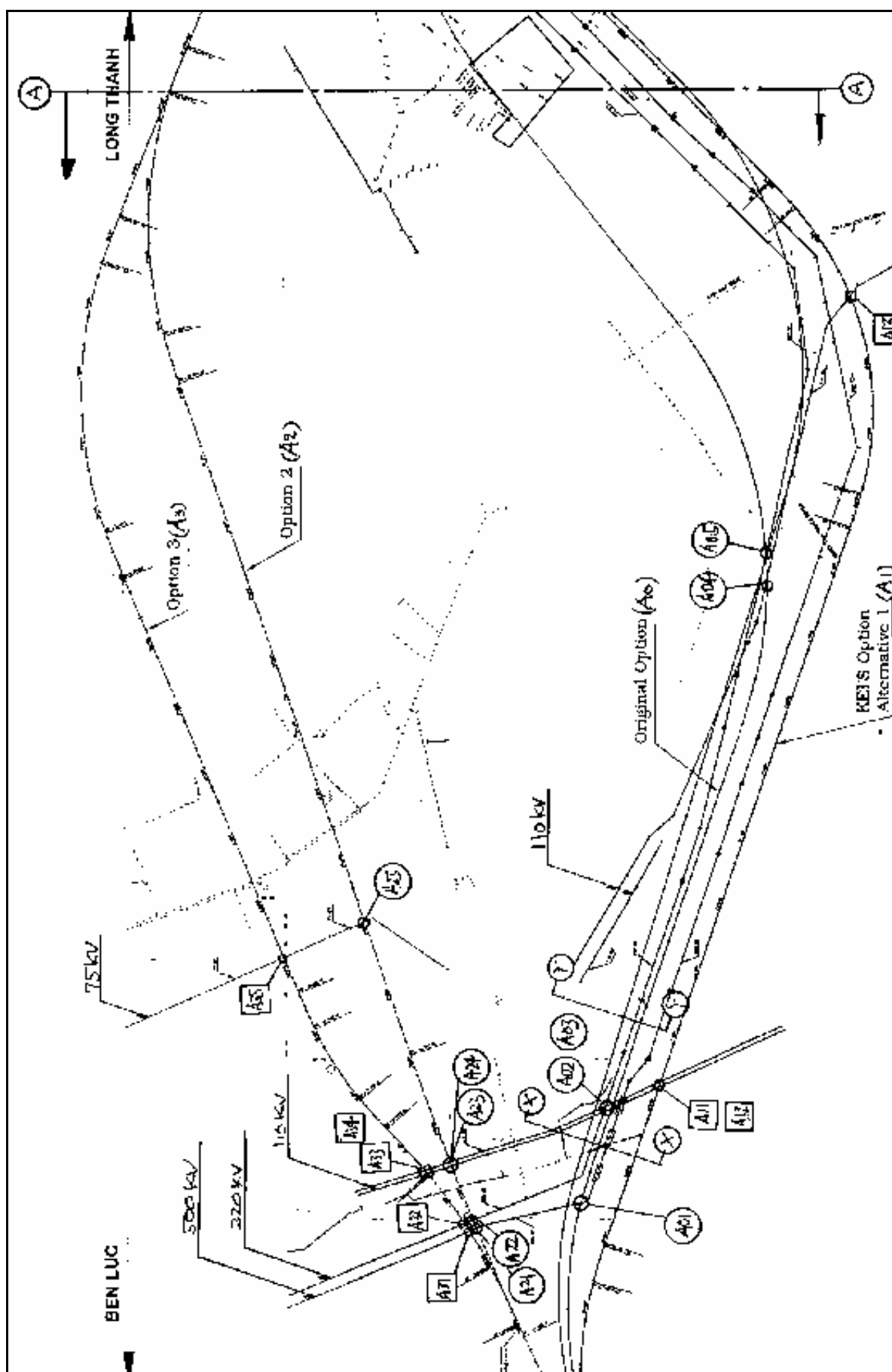


Figure 1: Relationship between the Overhead Transmission Lines and the Alignments S1

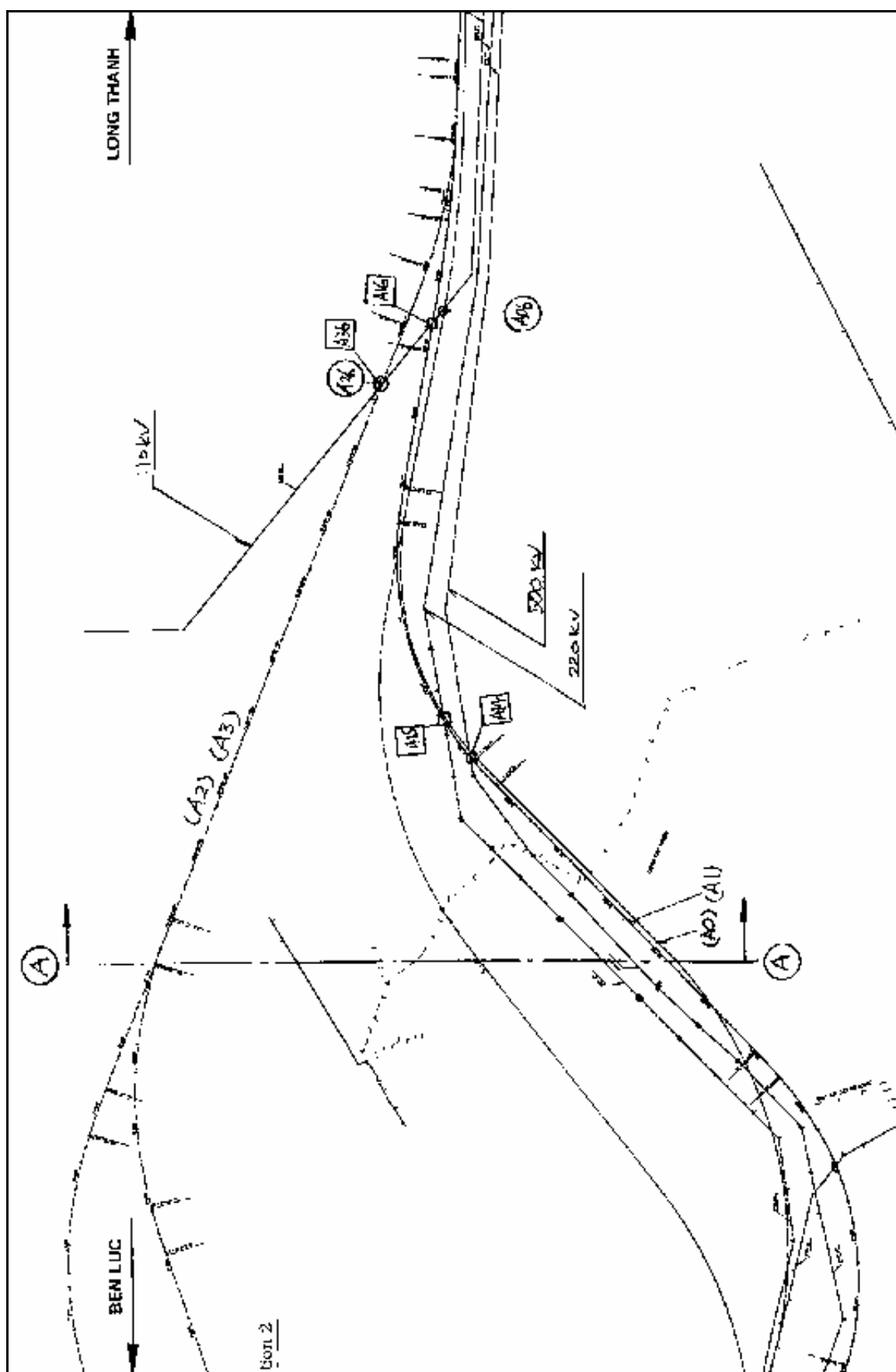


Figure 2: Relationship between the Overhead Transmission Lines and the Alignments S2



Figure 3: OTL 550Kv & 220Kv around river



Figure 4: Parallel OTL of 500Kv & 220Kv



Figure 5: OTL 220Kv across river



Figure 6: View of OTL 500Kv & 220Kv



Figure 7: View of OTL 500Kv crossing road



Figure 8: OTL 500Kv Pylon

2. VERTICAL SAFETY DISTANCE FROM PYLONS AT CROSSING OF THE EXPRESSWAY

2.1 Vertical distance regulation in Vietnam

(CTN18-19-20-2006 Electrical installation regulations in Vietnam)

The vertical distance from transmission lines in static position to any part of houses and road surface must be equal to or bigger than vertical safety distance specified in Table 2. The figures of vertical distance originate from Decree No. 54/1999/ND-CP of July 8, 1999 on "Safety Protection of High-Voltage Power Grids".

Table 2: Vertical Safety Distance (VSD) from Houses and Road Surface

Voltage Class	Up to 22Kv	35Kv	66Kv	110Kv	220Kv	500Kv
VSD from houses	2.0 m	3.0 m	4.0 m	4.0 m	6.0 m	7.0 m
VSD from road surface	5.5 m	5.5 m	6.0 m	6.0 m	7.0 m	10.0 m

Note: 1. Reference Standard: 11 TCN 18-19-20-2006 Code for electrical installation in Vietnam.

2. Safety corridor of electric is stipulated at Article No.4 of Decree Mo ND106/2005/ND-CP dated 17 Aug.2005 of Prime Minister, stipulating and instructing implementation some of Electrical Law's Articles in protection of Safety corridor for high voltage line.

3. Electrical specification Section II of Electrical System 11 TCN-19-2006, Chapter II.5 Item DDK crossing or near the highway, Item II.5.148 stipulated minimum distance from any part of the electrical column to edge of roadbed when crossing and parallel with highway.

Source: 1. Subject: Parameters of safety corridor of 500Kv, 220Kv for Ben Luc – Long Thanh Expressway Project: Ref. No. 5953/TTD4-KTAT dated 17 Dec. 2007 by Electrical Corporation of Vietnam Electrical Company No.4.

2. Lighting and Power Supply Report Ho Chi Minh City - Long Thanh- Dau Giay Expressway Project, Page-14

2.2 Required vertical distance from Technical Static Height of the Expressway

2.2.1 Regulated VSD between OTL and Intersect traffic road

In the Decree No. 54/1999/ND-CP of July 8, 1999 on Safety Protection of High-voltage Power Grids dated 08 July 1999, Regulated vertical safety distance between Overhead Transmission Lines (OTL) and Intersect traffic road is regulated itself as in Figure 3.

Table 3: Regulated VSD between OTL and Intersecting Traffic Road

Voltage Class	Up to 22Kv	35Kv	66Kv	110Kv	220Kv	500Kv
VSD from road surface	5.5 m	5.5 m	6.0 m	6.0 m	7.0 m	10.0 m
Minimum VSD	3.0 m	3.0 m	4.0 m	4.0 m	5.0 m	6.0 m
Vertical safe electrical discharge distance	1.5 m	1.5 m	2.0 m	2.0 m	3.0 m	4.0 m

Note: 1. Refer to note 3 of Table 2, $1 = 2 + 3$

2. Refer to Decree No. 54/1999/ND-CP Article 8. Figure (6.0) estimates in Article 7.

3. Refer to Decree No. 54/1999/ND-CP Article 9.

2.2.2. VSEDD: Vertical safe electric discharge distance

For example, a lowest point of wires of 500Kv OTL at a waterway is required the VSD as minimum 59m, where 55m of technical static height of waterway plus 4m of safe electric discharge distance. On the other hand, required vertical distance to lowest point of wires at a crossing point of the Expressway is estimated itself as shown in Table 4 and Figure 2.2.1.1.

Table 4: Regulated VSD between OTL and Intersecting Traffic Road

Location	Voltage Class	Up to 22Kv	35Kv	66Kv	110Kv	220Kv	500Kv
Viaduct	Height of facilities on the Expressway ¹	20 m	20 m	20 m	20 m	20 m	20 m
	VSDD ²	1.5 m	1.5 m	2.0 m	2.0 m	3.0 m	4.0 m
	TSHE ³	21.5 m	21.5 m	22 m	22 m	23 m	24 m
Embankment	Height of facilities on the Expressway ⁴	15 m	15 m	15 m	15 m	15 m	15 m
	VSDD ⁵	1.5 m	1.5 m	2.0 m	2.0 m	3.0 m	4.0 m
	TSHE ⁶	16.5 m	16.5 m	17 m	17 m	18 m	19 m

2.2.3 Requirement from Design team to ETL at the Construction

For the alternative routes by the design team, the existing transmission lines are required the Power Company to become higher than the existing, to clear the vertical safety distance said Table 4 as shown TSHE. Estimated list for each alternative and required to augment is shown in Table 5.

The Power Company will be required to take the minimum distance, or clearance between the facilities of the Expressway (TSHE) and the lowest point of wires of OTL. Estimated construction cost of elevating towers of each alternative is shown in Table 6.

2.2.3 Estimated period of the works of elevated pylons of OTL

The period of the works of elevating pylons estimates 6- 8 months. However, the period will be informed us by the Power Company of HCMC.

(Summary) In the alternatives, A2 and A3, or A0 and A1 are same cost level, however, A0 and A1 mark 6% high cost comparing with A2 and A3.

The period of the works of elevating pylons estimates 6- 8 months. However, the period will be informed us by the Power Company of HCMC.

¹ Height of Facilities on the Expressway includes the height of the Viaduct (adopted an average height) plus VSDD.

² Refer to Note 3 of Table 3.

³ TSHE denotes Technical Static Height of Expressway. TSHE = height of facilities plus VSDD (3= 2+1).

⁴ Height of Facilities on the Expressway includes the height of the Viaduct (adopted an average height) plus VSDD.

⁵ Refer to Note 3 of Table 3.

⁶ TSHE denotes Technical Static Height of Expressway. TSHE = height of facilities plus VSDD (3= 2+1).

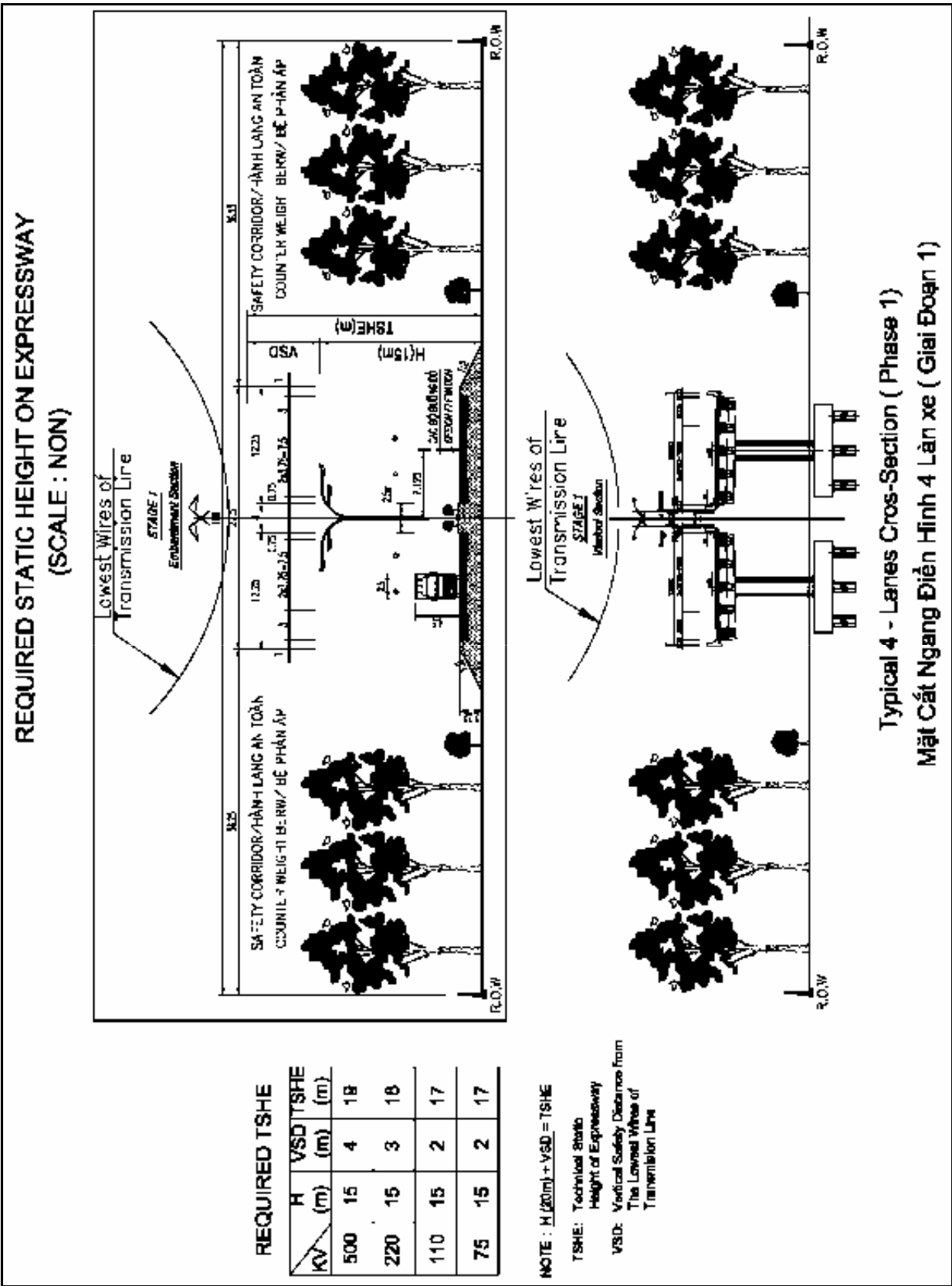


Figure 9: Required Static Height on Expressway

Table 5: Requirement from Design Team to Existing Transmission Lines (ETL) at Construction

		Type of ETL	Prospective clearance between the lowest wires and static position (m) /1		Max. Height of Road Facilities (m) /2		Proposed Max. Height of Road Facilities (m) /3		Notes
HG	Degree No.54/1999/ND-CP	500 Kv	220Kv		110Kv		75Kv		
	Min. Vertical safety distance /4	6 m	5m		4m		4m		(Article 7)
	Vertical safe electric discharge distance /5	4 m	3m		2m		2m		
	Vertical Safety Distance from Road Surface /6	10 m	7 m		6.0m		6.0m		
HW	Min. Height at Waterway /7	59 m	58m		57m		57m		55m+ /5
A0	Alternative A0	Type of Existing ETL	Static position	Minimum Clearance (m)	Name	Height (m)	Type of Road Structure	Required Max. Height (m)	Comment /8
	A01	500 Kv	Ground	6	Pole	12	Viaduct	23	To be higher
	A02	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A03	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A04	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A05	220 Kv	Ground	5	Pole	12	Viaduct	22	To be higher
	A06	110 Kv	Ground	4	Pole	12	Embankment	17	To be higher
A1	Alternative A1	Type of Existing ETL	Static position	Minimum Clearance (m)	Name	Height (m)	Type of Road Structure	Required Max. Height (m)	Comment
	A11	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A12	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A13	110 Kv	Ground	4	Pole	12	Embankment	17	To be higher
	A14	500 Kv	Ground	6	Pole	12	Embankment	19	To be higher
	A15	220 Kv	Ground	5	Pole	12	Embankment	18	To be higher
	A16	110 Kv	Ground	4	Pole	12	Embankment	17	To be higher
A2	Alternative A2	Type of Existing ETL	Static position	Minimum Clearance (m)	Name	Height (m)	Type of Road Structure	Required Max. Height (m)	Comment
	A21	500 Kv	Ground	6	Pole	12	Viaduct	23	To be higher
	A22	220 Kv	Ground	5	Pole	12	Viaduct	22	To be higher
	A23	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A24	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A25	75 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A26	110 Kv	Ground	4	Pole	12	Embankment	17	To be higher
A3	Alternative A3	Type of Existing ETL	Static position	Minimum Clearance (m)	Name	Height (m)	Type of Road Structure	Required Max. Height (m)	Comment
	A31	500 Kv	Ground	6	Pole	12	Viaduct	23	To be higher
	A32	220 Kv	Ground	5	Pole	12	Viaduct	22	To be higher
	A33	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A34	110 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A35	75 Kv	Ground	4	Pole	12	Viaduct	21	To be higher
	A36	110 Kv	Ground	4	Pole	12	Embankment	17	To be higher

Note: 0. Refer crossing points as shown in Figure 1 and Figure 2.

1. The figure shows minimum height from ground level. Refer to Note 4.

2. Planed the height of the highest lighting pole.

3. Proposed maximum height of road facilities. The height of the lowest wires of each transmission line should keep safety vertical clearance from road facilities.
4. Degree No.54/1999/ND-CP Article 7 & 8
5. Degree No.54/1999/ND-CP Article 9
6. TCN-18-19-20 2006 Electrical installation regulations.
7. The 55m height of vessel clearance from the maximum water level is included.
8. The lowest wires of transmission line are required to heighten than the existing to the Power Company.

Table 6: Estimated Construction Cost of Elevating Pylon

Alternative	Voltage	No. of Pylon (ea) /1	Estimated Cost per Pylon (US\$) /2	Estimated Cost (US\$)	Estimated Construction Cost (US\$)
A0	500Kv	3	\$3,958,333	\$11,875,000	\$36,250,000
	220Kv	3	\$3,125,000	\$9,375,000	
	110Kv	12	\$1,250,000	\$15,000,000	
A1	500Kv	3	\$3,958,333	\$11,875,000	\$36,250,000
	220Kv	3	\$3,125,000	\$9,375,000	
	110Kv	12	\$1,250,000	\$15,000,000	
A2	500Kv	3	\$3,958,333	\$11,875,000	\$34,062,500
	220Kv	3	\$3,125,000	\$9,375,000	
	110Kv	9	\$1,250,000	\$11,250,000	
	75Kv	3	\$520,833	\$1,562,500	
A3	500Kv	3	\$3,958,333	\$11,875,000	\$34,062,500
	220Kv	3	\$3,125,000	\$9,375,000	
	110Kv	9	\$1,250,000	\$11,250,000	
	75Kv	3	\$520,833	\$1,562,500	

Note: 1. 2 pylons for new construction and 2 for re-created.

2. The figures are experience of OTL works in Japan by Nuclear and Industrial Safety Agency.

3. SAFETY DISTANCE BETWEEN THE CLOSEST WIRES OF 220KV & 500KV

3.1 Estimated locations to generate the closest wires of 220Kv & 500Kv OTL

The locations will be coming up to Section X-X (100m separation between pylons) and Section Y-Y (200m separation) as shown in Figure 1 and Figure 2, and Safety Corridor between Pylons Figure 10 and Figure 3.1.2

3.2 Safety Corridor between Pylons

3.2.1 Section X-X (100m separation) in Figure 10

The protected corridor of the overhead transmission line (OTL) is estimated the following.

(1) The width is estimated 17.2 m from the outmost wire(s) when the wire(s) in static position, plus 7m at 500Kv stipulated in Article 6. Total 24.2m will occupy the corridor by the Regulation. If a width is 50m, only a 12.5m working space will be estimated.

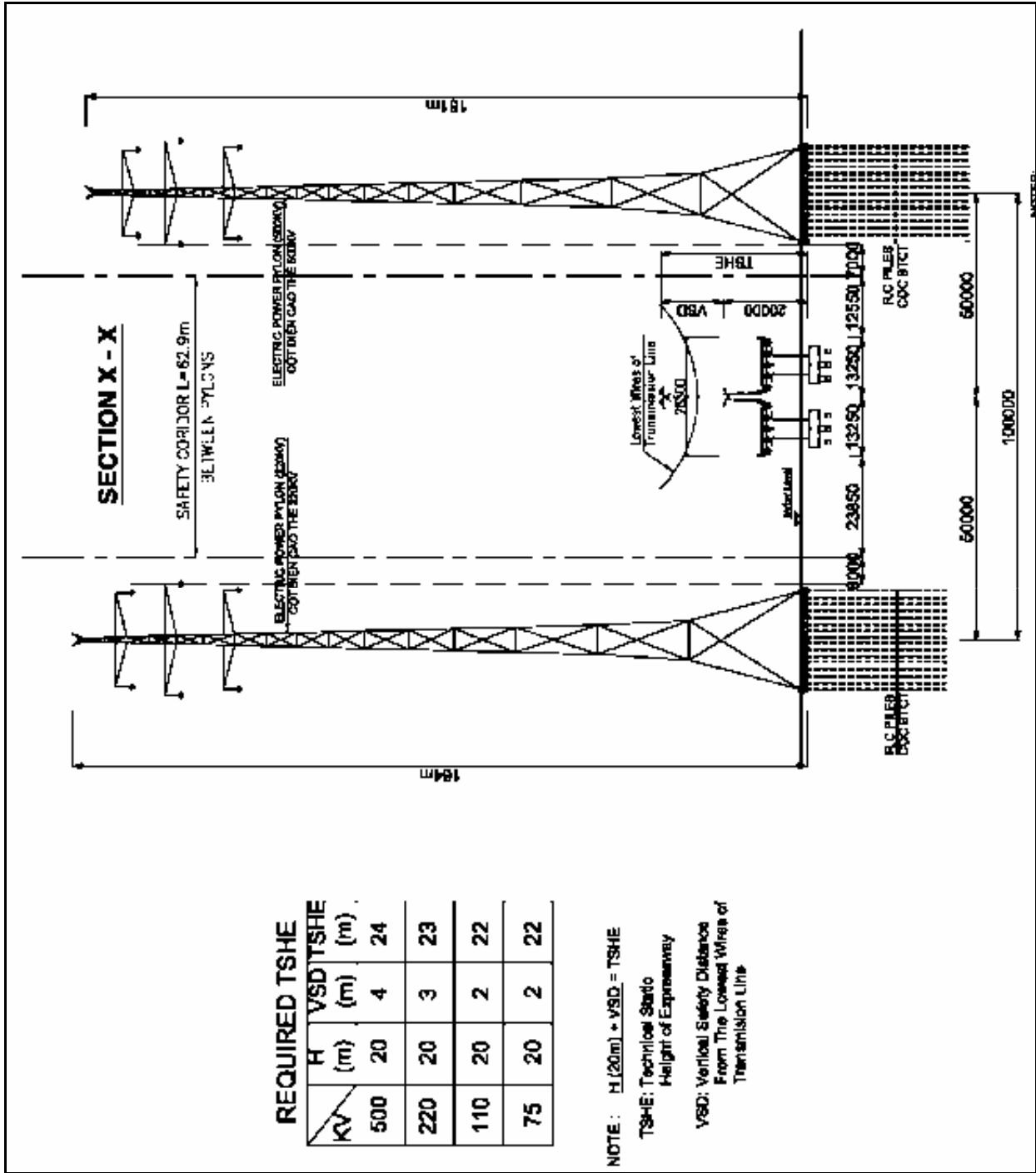


Figure 10: Safety Corridor between Pylons

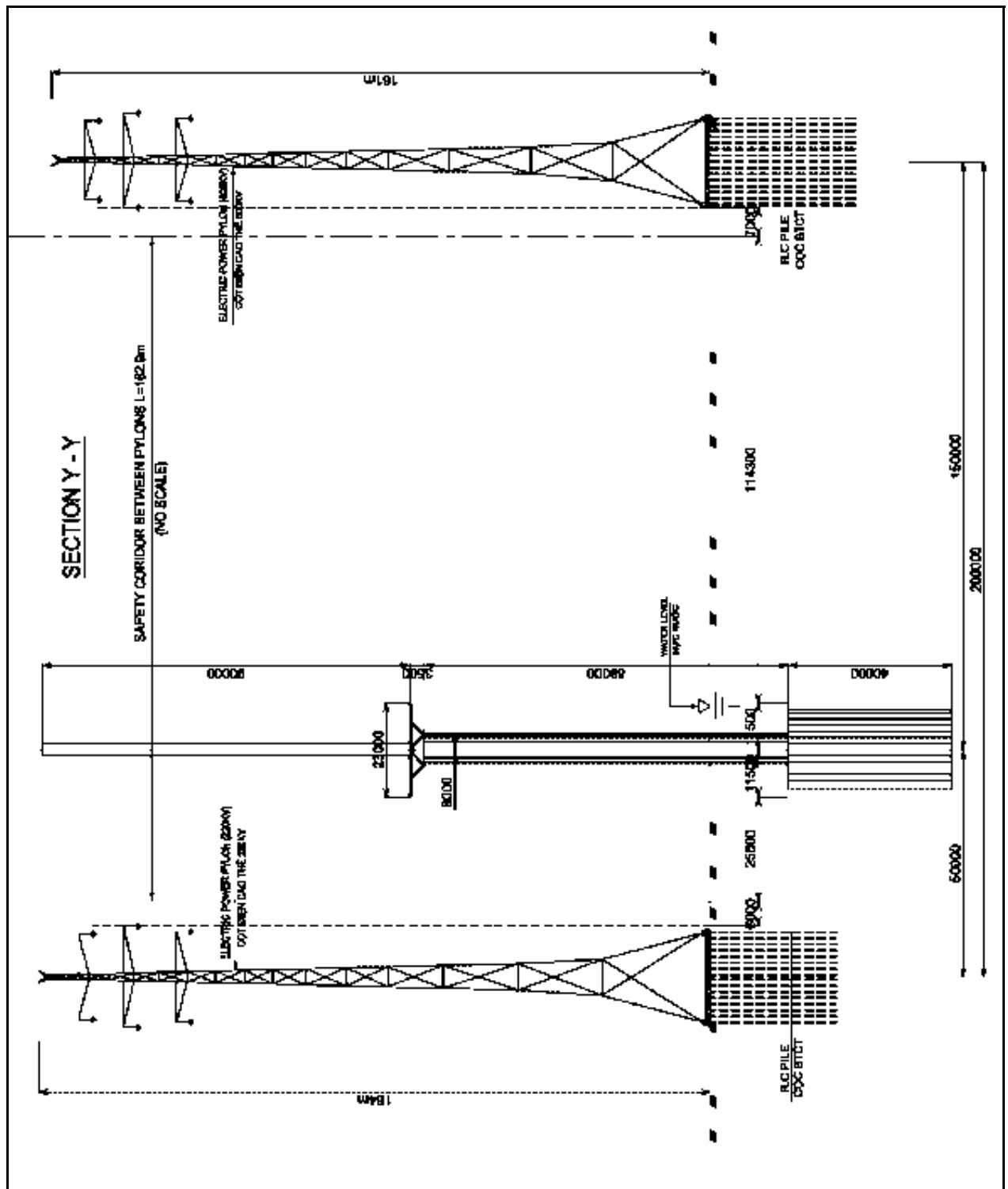


Figure 11: Safety Corridor between Pylons over the River

(2) 220Kv OTL is estimated as the same rule said above.

(3) At the Section X-X in static condition, the safety corridor between pylons will estimate 62.9m. This will cause difficulty in the construction of Phase 2 to 8-lanes.

3.2.2 Section Y-Y (200m separation) in Figure 11

The protected corridor of the overhead transmission line (OTL) is estimated the following.

(1) The width is estimated 6.9 m from the outmost wire(s) when the wire(s) in static position, plus 6m at 220Kv stipulated in Article 6. Total 12.9m will occupy the corridor by the Regulation. If a width is 50m, a 37.1m working space will be estimated.

(2) 550Kv OTL is no effect to the construction due to wide space.

(3) At the Section Y-Y in static condition, the safety corridor between pylons will estimate 162.9m.

3.2.3. Summary of Safety Corridor

In the Alternatives, plan A0 is closing 500Kv OTL around A01 section, and it runs itself between 220Kv and 500Kv OTL for paralleling. This route A0 will effect to construct of the bridge on safety and cost of protection of the existing OTL.

Others, A1, A2 and A3 are same safety level.

3.2.4 Estimated sag by Overhead Transmission Lines (OTL)

(1) Estimated sag

At the crossing OTL, the sag of each line is estimated as follows:

Table 7: Estimated Sag of OTL at crossing river

Voltage Class (Kv)	Weight of wire (w) (Kg/m)	Rated Strength of wire (T) (Kg)	Span of wire (S) (m) /3	Sag (d) (m) /4	Max. Swing Distance (m)
500	1.3 /1	10,759.8 /1	991 m	14.8 m	5.9 m
220	1.2 /2	7,260 /2	830 m	14.2 m	5.6 m

- Note:
1. Maker's catalog ACSR 666.6MCM 8 (Given data)
 2. Maker's catalog ACSR 402.8 mm² instead of 380mm² (Given data).
 3. Given data.
 4. Sag Calculation Formula: $d = (w \times S^2) / 8 \times T$ (m) Standard Handbook for Electrical Engineers, U.S.A.

(2) Supposition of maximum swing distance of OTL above the section

In the Table 7, the sag of OTL at crossing river is calculated as 14.8m for 500Kv OTL and 14.2m for 220Kv. By a pressure generated from continuous strong wind (for example 40m/s), the wire will swing the distance of sag in theoretical sense. However, 4-wire per circuit, which combining by a wire separator for 500Kv OTL and 3-wire for 220Kv are used at the Site. Plus anti-swing protections are installed at each tower and each wire due to avoid failure of shortage between wires. Drawing a conclusion from experience on the OTL in Japan, maximum distance of wire's swing is estimated 5.9m at 500Kv OTL and 5.6m for 220Kv. These figures show within 7m for safety zone for 500Kv and 6m for 220Kv said Article 6 in the Regulation (Refer to Figure 11)

4. SAFETY DISTANCE TOWER CRANE TO WIRES AT CONSTRUCTION STAGE

4.1 Tower crane at Section X-X (100m separation) in Figure 10

For the construction at Section X-X area, a 20m-height crane will be used at the construction. A corruption of the crane by human-error is no effect to the 220Kv OTL, if it has founded to the wide space side of 220Kv. However, if 500Kv-side founded, the crane will be possible given damage to the pylon.

Moreover, damage to a crossing OTL will be estimated by though the operation of crane.

4.2 Tower crane at Section Y-Y (200m separation) in Figure 11

For the construction at Section Y-Y area, finally a 90m tower crane will be founded on the deck of the bridge for setting up the main tower for bridge. If a human-error occurred like corruption of the tower crane, at the side of 220Kv OTL, the OTL will be damaged by falling of the crane due to only 50 m separation from the wires of OTL.

4.3 Summary of Safety Corridor

In the Alternatives, plan A0 is closing 500Kv OTL around A01 section, and it runs itself between 220Kv and 500Kv OTL for paralleling. This route A0 will effect to construct of the bridge on safety and cost of protection of the existing OTL.

Others, A1, A2 and A3 are same safety level.

5. ESTIMATED IMPACTS TO ROAD FACILITIES BY ESI & EMI

5.1 ESI & EMI for Human health

The field limiting values of continued exposure in Electrostatic induction (ESI) and Electromagnetic induction (EMI) for Human health are regulated in as following Table 8.

Table 8: Exposure Limits based on Acute Effects on Electric and Magnetic Fields

Effect to		Exposure Limit by ICNIRP /1 /2		ICNIRP Guideline	IEEE Standard - 2002 60Hz /3	Technical Regulation for Electrical Equipment Japan	Notes
Item	For	50Hz	60Hz	General Figures			
EF Kv/m	Workers	100V/cm	83V/cm	4.16Kv/m (41.6V/cm)	20Kv/m	3Kv/m (30V/cm) /4	OTL 0.1-3Kv/m above ground 1m
		10Kv/m	8.3Kv/m				
	General Public	50V/cm 5Kv/m	42V/cm 4.2Kv/m		5Kv/m		
MF μ T	Workers	5,000mG 500 μ T	4,157mG 416.7 μ T	883mG 83.3 μ T	2,710 μ T	x	OTL 200mG 20 μ T
	General Public	1,000mG 100 μ T	833mG 83.3 μ T		904 μ T		

Note: 1. (ICNIRP) International Commission on Non-Ionizing Radiation Protection.
 2. Environmental Health Criteria 238 Extremely Low Frequency Fields Risk Characterization.
 3. IEEE: Institute of Electrical and Electronics Engineers.
 4. 30V/cm (3Kv/m) or under value of ESI on 1m above from the road surface

5.2 Case study of generating EF and MF by OTL

5.2.1 Data for case study

The list of case study is shown in Table 9.

Table 9: List of Case study

Voltage Class	Condition of road and OTL	Length of Wire (m) /1	Distance from Closest wires (m)	Case No.
220Kv	Parallel	1,000 m	50	C11
500Kv	Parallel	1,000 m	150	C12
220Kv	Crossing	1,000 m	23	C21
500Kv	Crossing	1,000 m	23	C22
110Kv	Crossing	1,000 m	22	C23
75Kv	Crossing	1,000 m	22	C24

Note: 1. Adopting unit length for calculation.

5.2.2 Estimated Values of EF and MF to Communication Cables

Estimated values of EF and MF for conditions of road and OTL are shown in Table 10.

Table 10: Estimated Values of EF and MF to Communication Cables

Case No.	Voltage Class (Kv)	Value of MF /1		Value of EF /3		Notes
		Value (μA)	Comment	Value (V)	Comment	
C11	220	66,040 /2 (52.5mT)	No	66 (6.6V/cm)	Yes	
C12	500	39,520 /2 (31.4mT)	No	136 (13.6V/cm)	Yes	
C21	220	41.9 /2 (33.3μT)	Yes	87 (11.9V/cm)	Yes	
C22	500	75.2 /2 (59.8μT)	Yes	178 (24.5V/cm)	Yes	
C23	110	20.9 /2 (16.6μT)	Yes	77 (6.0V/cm)	Yes	
C24	75	14.3 /2 (11.3μT)	Yes	27 (4.0V/cm)	Yes	

Note: 1. $I = V_s \times D \times 10^{-3} (0.33n + 26 \sum (L/b))$ (μA). (Source: Handbook of Technical Calculation of Electric Installation, Japan). Where: V_s : Line Voltage (Kv); D : Length of wire (m); n : No. of crossing (ea); L : Length of wire on parallel section (m); b : Distance between wires and Communication cable (m).

2. To compare with 100μT in Regulation (50Hz; for Common People), 1μT = 125.6μA / m.

3. $V = ((\sum (L_p \times Z_{mp}) + \sum (L_c \times Z_{mc})) \times I \times \lambda)$ (V), I f $L_p = 1m$; $L_c = 1m$, unit shows as (V/m).

(Source: Standards of Japan Highway; Simplified Equation by Mr. Takeuchi),

Where: L_p : Parallel length of OTL and Communication Cable (Km),

Z_{mp} : Mutual average impedance (Ω/Km) at parallel section,

L_c : Crossing length of OTL and Communication Cable (Km),

Z_{mc} : Mutual average impedance (Ω/Km) at crossing section,

I : Generated induction current (A),

λ_g : Shielded coefficient 0.95 (120mm² ACSR Overhead ground wire),

λ_t : Shielded coefficient 0.2 (Communication cable PEF-P),

σ : Earth conductivity ($\sigma=5.48 \times 10^{-3}$ MHO/m)

5.2.3. Case study of generating EF and MF Summary

1. On the parallel section with the bridge and 220Kv OTL, the value of 52.5 mT (52,567 μ T) in magnetic field (MF) estimates very higher than 100 μ T for value of exposure limit of General Public, and 31.4mT on the 500Kv OTL, said 31,457 μ T > 100 μ T. The values are extraordinarily high, so they are out of seizing general public from magnetic fields by facilities. For ideas of solution, one for moving OTL out to area of under the regulation of exposure limit, or re-selection of route of the expressway is proposed to on the situations. However, each value of electric field (EF) at both parallel sections is under the 50V/cm.
2. On the crossing sections with the viaduct, each value of MF or MF is estimated under the figure of 100 μ T, or 50V/cm.

6. A COMPARISON OF THE ALTERNATIVES

A comparison of the Alternatives is shown in Table 11.

Table 11: List of comparison of Alternatives

Item	A0		A1		A2		A3	
	Judge	Score	Judge	Score	Judge	Score	Judge	Score
Compliance with MF Guideline	No	0	Yes	3	Yes	3	Yes	3
Compliance with EF Guideline	Yes	3	Yes	3	Yes	3	Yes	3
Difficulty on Construction by OTL	Yes	1	No	3	No	3	No	3
Effect by breakage Tower crane	Yes	0	No	3	Yes	3	Yes	3
Aesthetic value	Bad	0	Good	3	Good	3	Good	3
Cost for Elevated Pylons	1.06	1	1.06	1	1	2	1	2
Total Score		5		16		17		17

Note: Score: 0 - Poor; 1 - Average; 2 - Above Average; 3 - Good

1. On the parallel section with the bridge and 220Kv OTL, the value of 52.5 mT (52,567 μ T) in magnetic field (MF) estimates very higher than 100 μ T for value of exposure limit of General Public, and 31.4mT on the 500Kv OTL, said 31,457 μ T > 100 μ T. These values are extraordinarily high, so they are out of seizing general public from magnetic fields by facilities. For ideas of solution, one for moving OTL out to area of under the regulation of exposure limit, or re-selection of route of the expressway is proposed to on the situations. However, each value of electric field (EF) at both parallel sections is under the 50V/cm. The route in alternative A0 is very difficult to comply with the limit.
2. On the crossing sections with the viaduct, each value of MF or MF is estimated under the figure of 100 μ T, or 50V/cm.
3. In the Alternatives, plan A0 is closing 500Kv OTL around A01 section, and it runs itself between 220Kv and 500Kv OTL for paralleling. This route A0 will effect to construct of the bridge on safety and cost of protection of the existing OTL. Others, A1, A2 and A3 are same safety level.

4. In the alternatives, A2 and A3, or A0 and A1 are same cost level, however, A0 and A1 mark 6% high cost comparing with A2 and A3.
5. The period of the works of elevating pylons estimates 6- 8 months. However, the period will be informed us by the Power Company of HCMC.
6. On the score in the Table above, Alternative A2 and A3 are marked high score comparing with A1 and A0. However, A1 is scored down comparing with A2 and A3, only 6% high cost. The 6% is almost same level in the construction cost.

Through the alternatives, A1, A2 and A3 is the same level comparing with A0 in the estimation from Impact statement on overhead transmission lines around Binh Khanh bridge.

7. POSSIBLE CONFLICTS WITH OTL ON APPROVED ALIGNMENT

After the Inception Mission in June 2009 Alignment A1 was approved for further study.

Table 12: Conflicts with OTL on Approved Alignment (A1)

Station	Voltage Class (Kv)	Elevation of Road	VSD from Road Surface	Safe OTL Elevation	Actual Lowest OTL	Note
Km 02+400	110 Kv	5.08	6.00	11.08	11.80	OK
Km 10+800	110 Kv	5.48	6.00	11.48		must check in field
Km 18+550	500 Kv	9.17	10.00	19.17		Proposed OTL
Km 22+200	110 Kv	23.74	6.00	29.74		possibly go under road
Km 28+050	110 Kv	4.84	6.00	10.84		must check in field
Km 31+950	500 Kv	8.34	10.00	18.34		must check in field
Km 32+060	220 Kv	5.72	7.00	12.72		must check in field
Km 35+220	110 Kv	5.77	6.00	11.77		must check in field

From Table 12 there are a number of places that need to be checked to ensure that a safe VSD distance is maintained. The proposed 500 Kv OTL at Km 18+950 should be constructed to the safe elevation.

APPENDIX C5: TUNNEL REPORT

FINAL TUNNEL REPORT

TA 7155-VIE PREPARING THE BEN LUC-LONG THANH EXPRESSWAY PROJECT IN VIETNAM

FEBRUARY 2010

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1. TUNNEL TYPES

There two types of tunnels that will be considered for the Project. The immersed tube tunneling method (IMT) and the tunnel boring machine (TBM) method.

1.1. Immersed Tube Tunneling Method

The immersed-tube, or sunken-tube, method, used principally for underwater crossings, involves prefabricating long tube sections, floating them to the site, sinking each in a previously dredged trench, and then covering with backfill.

1.1.1. Cross Section Planning

The first phase of the expressway is proposed as a 4-lane so the cross section dimensions including lane width, clearance are developed considering traffic facilities to layout compartment for each function. This is shown in Figure 1.

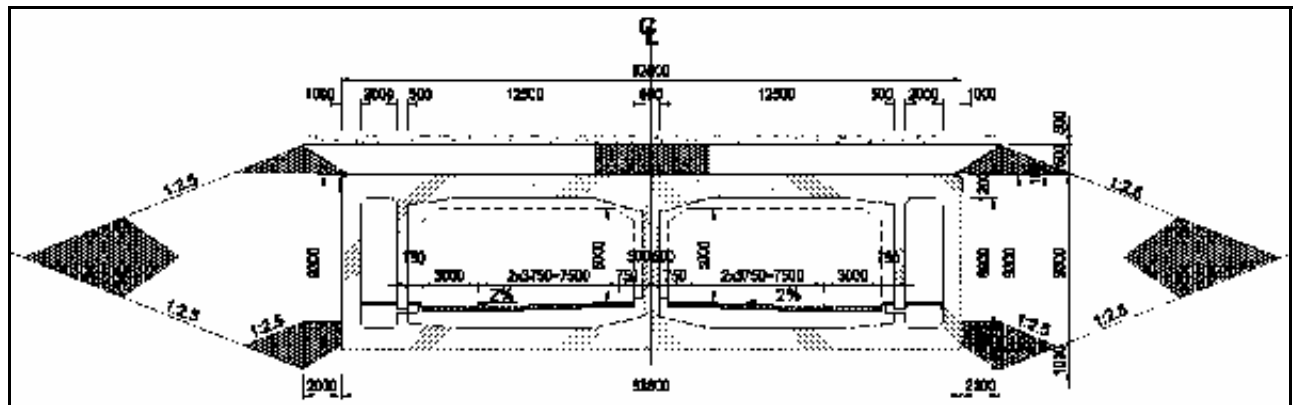


Figure 1: Cross-Section of 4-Lane Immersed Tube Tunnel

Fundamental dimensions are listed below.

Lane width:	3.75 metres
Shoulder width:	0.75 metres
Emergency lane width:	3.00 metres
Traffic Sign Clearance:	0.60 metres
Vertical Clearance:	5.00 metres
Pavement thickness:	0.30 metres

The Cross sections for the possible developing the first phase of 4 lanes into the second phase of 8-lanes are displayed in Figure 2.

1.1.2. Longitudinal Profiling

According to the horizontal route alignment, tunnel option is to be profiled beginning with large river crossings. Mekong River delta is formed by large rivers consisting of soft soil ground so as to span the approaching section on both side bridges by viaduct in principle crossing small rivers and roads with clearance lower than 6m. Immersed tunnel section meets cut and cover tunnel at coastal line with minimal soil cover containing underground common ducts followed by U shaped retaining wall or retaining wall separated into both lane side before transition to viaduct section. However it is most economical that the deepest sag point of immersed tunnel would be determined by fairway depth and soil cover influenced from shipping capacity, countermeasure to mitigate score should be examined to raise the profile by considering stable river bottom. Geometrical restrictions are shown as below.

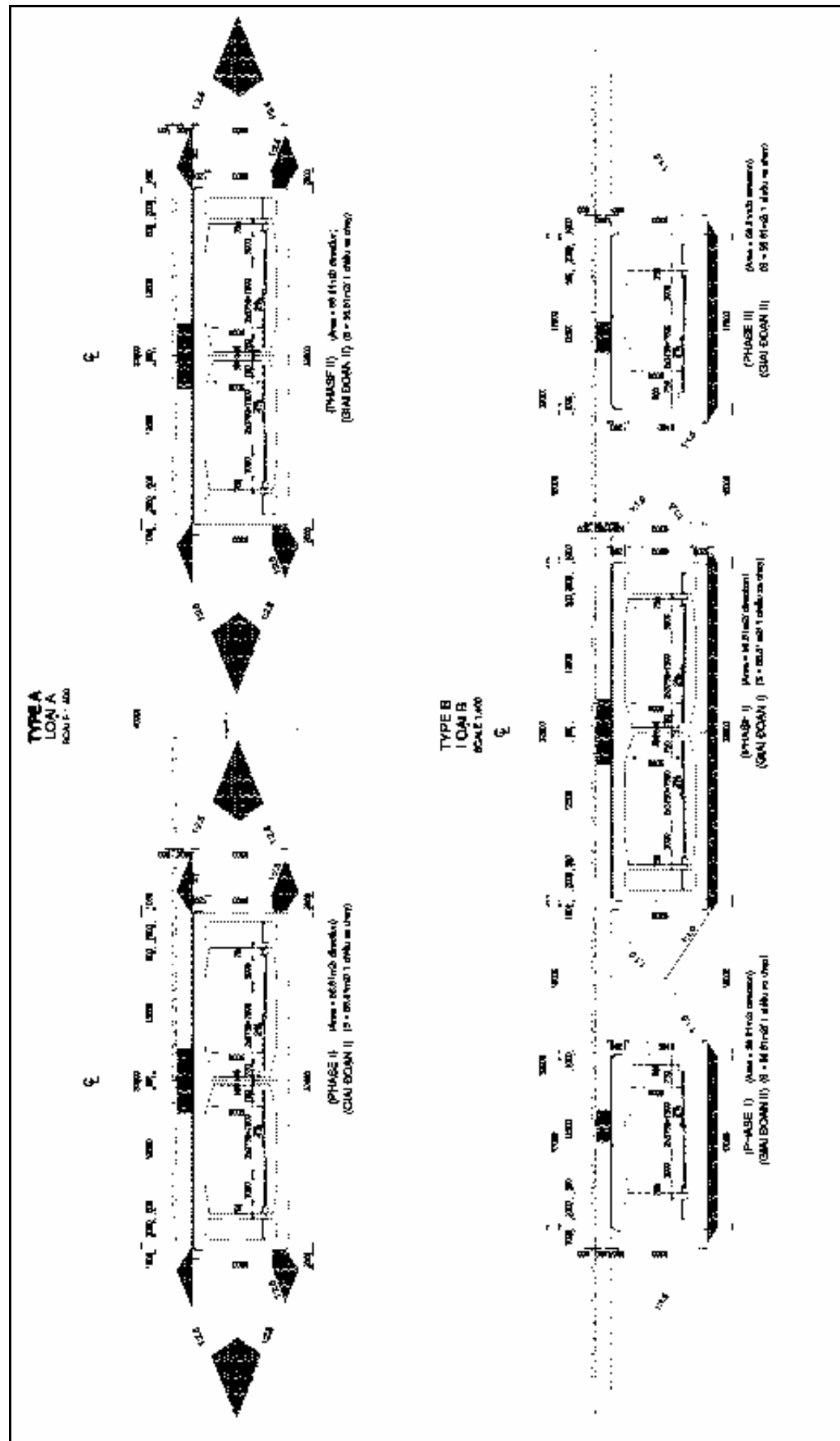


Figure 2: Development from Phase 1 (4-Lanes) to Phase 2 (8-Lanes)

Underground common utility space depth; 2m below ground surface

Longitudinal gradient limit; 3% under design speed of 120km/h

Traffic signs space clearance; 0.6m-1.3m

Ground level free from flood; +2.2m

Viaduct elevation assumption; 6m clearance + 1m girder depth = 7m not Rach Song Cha

Soil Cover for Protection against Dragging Anchor; 2.0m

Fairway width; 300m

Fairway Depth; -12m

1.1.3. Structural Planning

Material and member dimensions including element length are to be set based on the examination of structural safety, water tightness and economical case study seeking the optimal style, formation and construction manner. Considering the Japanese recent cases and the performance of Saigon East West Highway Project, steel-concrete composite or steel shell reinforced concrete type is recommended even with equal thickness of members.

Interfacing structure between cut and cover tunnel and immersed tunnel should be primarily designed as a part of Levee of the river with the final joint structure and not always a shaft type except for ventilation or evacuation needs. While the interfacing cofferdam might need the deepest excavation, it would be raised by shifting inside land and elongate the immersed tunnel section.

Upper and Lower slab thickness; supposed 1.2m

Element length not less than 100m not longer than 150m
--

1.1.4. Construction Planning

Immersed tunnel option in company with cut and cover tunneling section is to furnish with suitable fabrication method considering case study in the similar ground and topographical condition. Immersed tunneling method emphasizes element fabrication method, fabrication yard selection and towing/immersing manner. Construction Work Items are broken down as below.

- i. Clearing and Grubbing, Survey for setting out for the project area on the ground and river
- ii. Temporary Bridge for Traffic Detour and Pile Driving and Decked Surfacing
- iii. Sheet Pile Driving for Retaining Wall Section and U-shaped road section works at the shallower depth than the cut and cover tunnel
- iv. Tubular Steel Pile Driving for the Levee cofferdam facing Immersed Tunnel end section
- v. Diaphragm wall driving for Cut and Cover Tunnel section works
- vi. Excavation and Wailing with protecting underground commons
- vii. Building of Retaining wall, U-shaped section and Cut/cover tunnel employing foundation, re-bar, formwork and concrete-casting
- viii. Backfilling, removing wailings, decked surfacing and steel piles
- ix. Fabrication yard preparation for Immersed Tunnel elements

- x. Fabrication of Immersed Tunnel element with steel shell, re-bar and concrete
- xi. Dredging of the trench for Immersed Tunnel and foundation screed
- xii. Outfitting and Towing out Immersed Tunnel elements from the Yard
- xiii. Towing, Immersing, jointing, bottom filling and backfilling of Immersed Tunnel
- xiv. Final jointing to the Cut and Cover Tunnel section
- xv. Jointing between Immersed Tunnel elements and Interior works including drainage, lighting, electricity, communication cable, traffic signs, ventilation fan, fire fighting equipment and fire protection for interior surfaces.

1.1.5. High Voltage Power Line

The tower foundation of high voltage power line faces close excavation effect from tunneling works and claims a due way of mitigation plan and estimation of cost up. As shown in Figure 3 an influence from close excavation works seems slight and necessitates no significant countermeasure to mitigate.

1.1.6. Electrical and Mechanical Works

Based on the environmental requirement, traffic needs and case study, tunnel option is to summarize its facility layout of ventilation, drainage, lighting, disaster prevention or fire fighting and traffic safety with initial cost, operation cost and operation program. The result is to reflect to structural planning of tunnel option.

Ventilation facility is to be furnished with three sets of ventilation fan in 1.5m clearance at both exits of 150m long where clearance of roadway is enlarged for assistance to traffic air piston and exhausting smoke in case of fire.

Emergency lane of 3m wide is to be secured in the midst element by enlarging outside clearance for 60m long on each direction at 500m interval.

Sump pit for draining and pumping is to be secured in the deepest point of sag element.

Electricity power cable and communication cable may be laid in above part of evacuation path or below evacuation floor on the equal elevation to the maintenance corridor mounted up from and beside shoulder.

Environmental pollutions as noise, vibration, dust, exhaust of fuel consume and carbon dioxide emission associating with construction activity and employed machine for IMT option

- i. Clearing and Grubbing works apply bulldozer and dumping truck to haul the deposit area where concrete blocks encountered need rock breaker powered by air compressor and welding apparatus to cut rebar entangled. Pavement cutter is applied to distinguish the clearing area. Survey activity has almost no effect on the environs.
- ii. Temporary Bridge works for Traffic Detour includes Pile Driving and Decked Surfacing associating with pile hammer and cranes to lift piles and steel beams to support concrete segment for roadway surfacing. Welding instrument and gas bombe is necessary as usual iron works. Pile driving machine is to be selected from below according to availability and environmental restriction to evaluate shocking noise level, vibration level and diesel exhaust concentration.

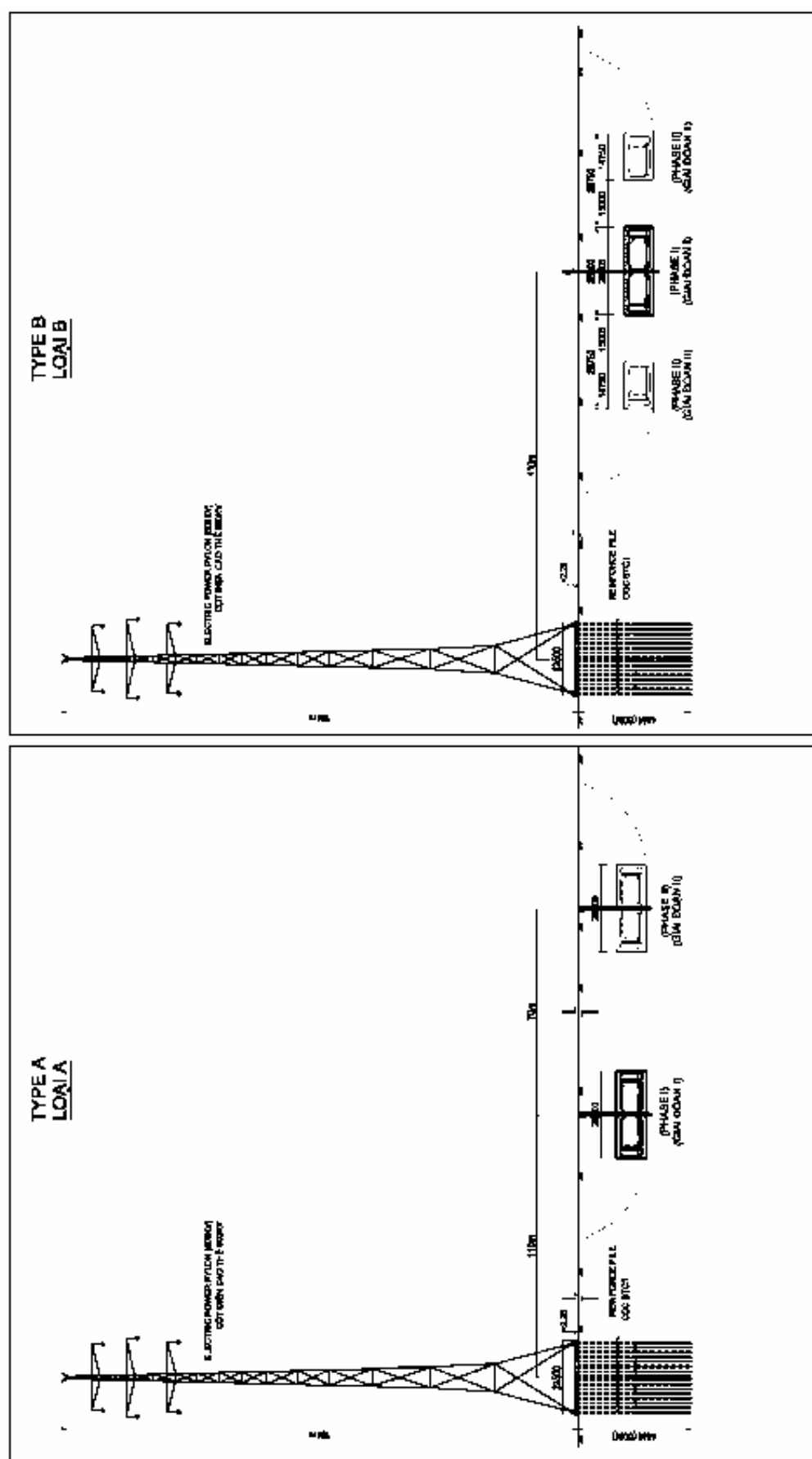


Figure 3: Alignment 1 in relation to power-lines

Diesel hammer	Earth auger borer
Pneumatic hammer	Earth drilling borer
Vibration-hammer	Rotary bit borer
Pneumatic penetrating machine	Mixed method

- iii. Sheet Pile Driving for Retaining Wall Section and U-shaped road section necessitate selecting pile driving machine, crane and hauling trailer. Welding equipment is needed as iron works.
- iv. Tubular Steel Pile Driving for Levee cofferdam facing Immersed Tunnel end section meets the selection of driving machine heavier than the above listed works and cranes on barge.
- v. Diaphragm wall building for Cut and Cover Tunnel section works requires special excavator in rectangular section with clamshell bucket type or rotary cutter bit type, rebar cages works lifted by crane and concrete chute. Mud waste mixed with bentonite slurry to stabilize excavated pit takes place much to be removed in proper manner and place. Excavator causes several noises and vibration through ground surface. Concrete mixing truck and pumping truck will take place some noise and vibration through ground surface depending on their actions in site.
- vi. Excavation and Wailing with protecting underground commons apply backhoe and bulldozer with dump-trucks hauling soil waste. Wailing and strut beams are lifted by crane and jointed by welding or bolt wrench. Excavated waste may send off toxic gas or disgusting odes.
- vii. Building of Retaining wall, U-shaped section and Cut/cover tunnel employing foundation, re-bar, formwork and concrete-casting are applying dumping truck with crusher, bulldozer to spread, grader for leveling, rebar placing, carpentry of formwork, pump casting and vibrating compaction of fresh concrete carried by mixing trucks. Heavy bundle of rebar and machines are to be lifted and passed into site by cranes hauled by trailer.
- viii. Backfilling, removing wailings, decked surfacing and steel piles need welding to cut connection, cranes to lift and dumping truck to haul backfill material and compaction roller or tamper for small space.
- ix. Preparation of fabrication yard for Immersed Tunnel elements depends on the availability of land lot as shown in Figure 4. If a steel workshop or factory is available, assembling works of steel shell could be done there. If a jetty on nearby port is available, final assembling could be done there and concreting in the floating condition on berth. If there is a wide stretch of ground near the project area, a casting basin can be built enclosed with cofferdam to prepare the basin below water level with leveling by bulldozer or roller and improving soft subsoil by sand spread or cement mixing or compaction piling or concrete basement in order to provide flat and firm foundation and install cranes and bollard foundation for winches. The depth of the yard depends on the way of concrete casting.
- x. Fabrication of Immersed Tunnel element with steel shell, re-bar and concrete works needs lifting material and apparatus by cranes, cutting, welding and placing steel members and casting concrete. Trailers hauling material and mixing trucks for concrete supply visit the yard.

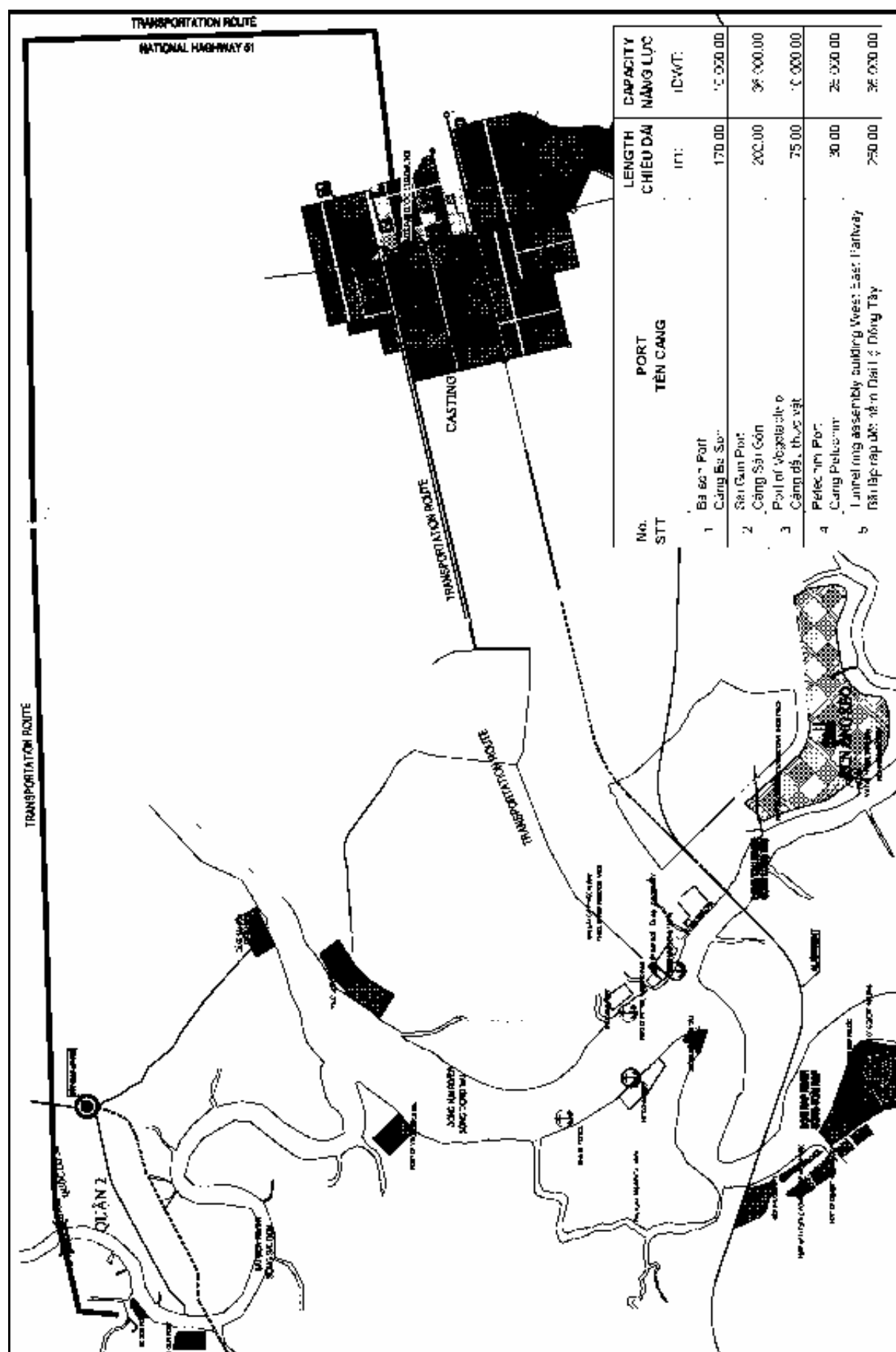


Figure 4: Fabrication yard location

- xi. Dredging of the trench for Immersed Tunnel are to be carried out by dredger or drag line or pipe evacuator with turbid prevention curtain. Mud waste is to be kept under contamination examination and hauled by barge to the designated area. Dredging is to be terminated by sounding required depth and placed with crusher as a foundation leveled by screed machine.
- xii. Outfitting of Immersed tunnel element needs lifting material or facilities by crane and connecting by welding or bolt wrenching. Outfitting works can be divided depending on the yard space. Towing out Immersed Tunnel elements from the Yard needs two or three tug boat of around 4000ps to take roles as direction control other than towing and a guard boat against traffic vessels on the fairway. Towing out works should follow the bulkhead shuttering on both sides of the element opening ends.
- xiii. Towing Immersed tunnel element to the crossing area is to be executed by tug boats. Immersing tunnel element is to be assisted by tugboat and pontoon to provide wires i.e. slinging wire and handling wire anchored to river bed installed by anchor boat. Immersing works is finalized by hydraulic jointing to the installed element after position sensing and fixed by bottom filling works with mortar or sand pushing. Consequent backfilling on the Immersed Tunnel is executed by split barge or suspended pipe chute.
- xiv. Final jointing to the Cut and Cover Tunnel section needs cofferdam building and reinforced concrete works under narrow space or underwater level by diver.
- xv. Jointing between Immersed Tunnel elements and Interior works enforce inside activities for transporting material by loader, concrete by pipe and ventilation by duct. Small sized vehicles are employed. Labor's safety and sanitation are paid of special attention due to closed space.
- xvi. Environmental problems have been observed a noise as of a crane falling accident or concreting during illegal working hour or unsuitable machine selection and an excessive exhaust from machine handling under over capacity or over durability. An appropriate equipment control program in accordance to the instructions should mitigate the effect below regulations.

1.2 Tunnel Boring Machine (TBM) Method

Tunnel boring machines (TBM) are used as an alternative to drilling and blasting (D&B) methods in rock and conventional 'hand mining' in soil. A TBM has the advantages of limiting the disturbance to the surrounding ground and producing a smooth tunnel wall. This significantly reduces the cost of lining the tunnel, and makes them suitable to use in heavily urbanized areas. The major disadvantage is the upfront cost. TBMs are expensive to construct, difficult to transport and require significant infrastructure. A TBM is a machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata. They can bore through hard rock, sand, and almost anything in between.

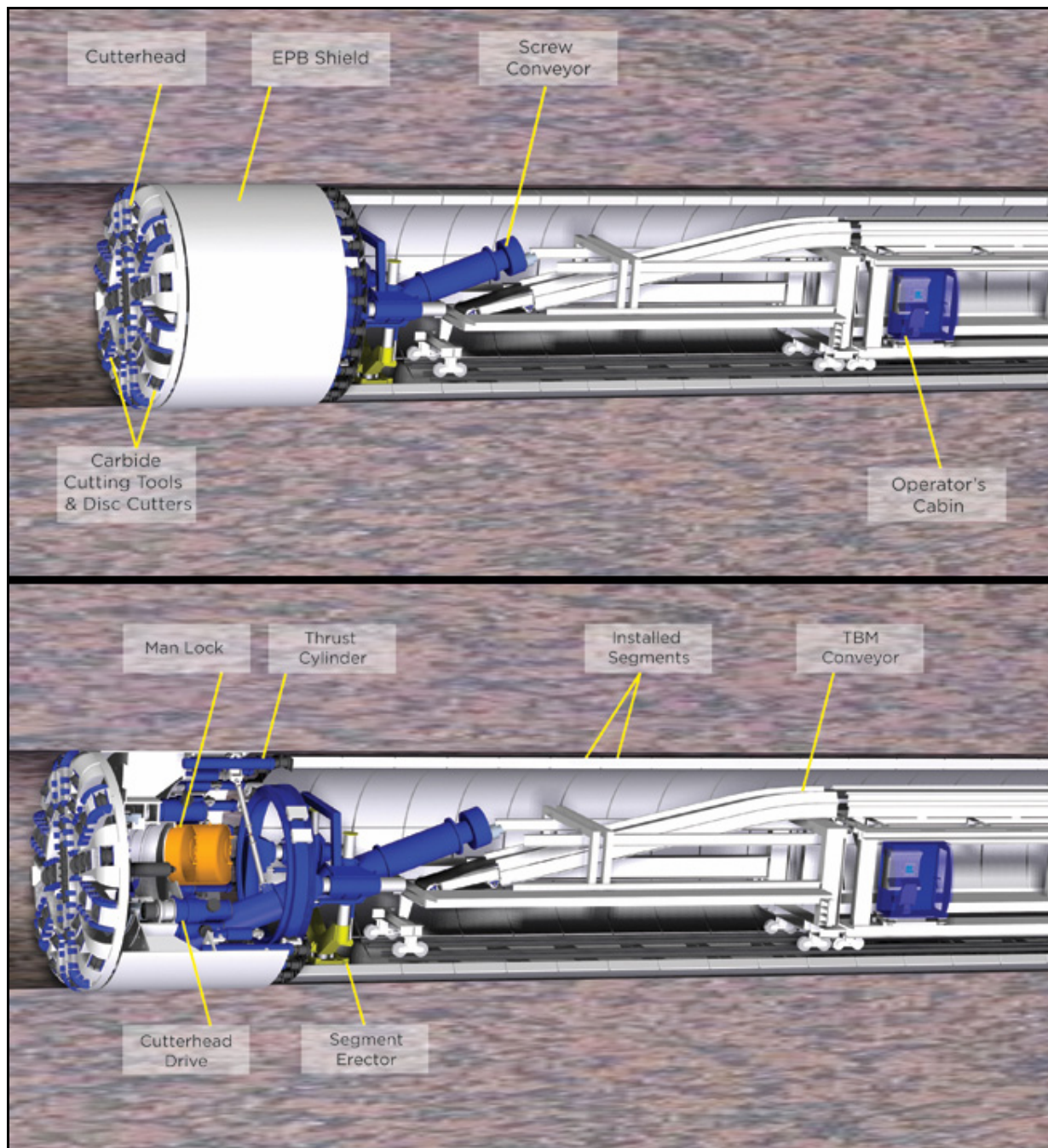


Figure 5: Typical Tunnel Boring Machine (source Robbins)

1.2.1. Cross Section Planning

The TBM method would be the first experience in Vietnam. Considering unfamiliarity to the application on soft soil as well as the method, recommended is with full circumference shielded in circular section. Tunnel arrangement to enclose lanes in one bore or two bores is to be examined its applicability. Tunnel machine diameter has recorded up to 19m at Saint-Gotthard Tunnel under the mountainous border of Swiss and Italy that would imply the cross section planning. In our case the diameter of tunnel structure is to be assumed 15m for 2 lanes plus emergency lane per tube or 20m for dual 2 lanes including emergency lanes for 1 tube as shown in Figure 6. The diameter greater than 19m seems difficult to complete for time being. Therefore phase 1 construction stage shall take 2 tubes of 15m diameters for dual 2 lanes and the second phase stage shall follow the same 2 tubes as shown in Figure 16.

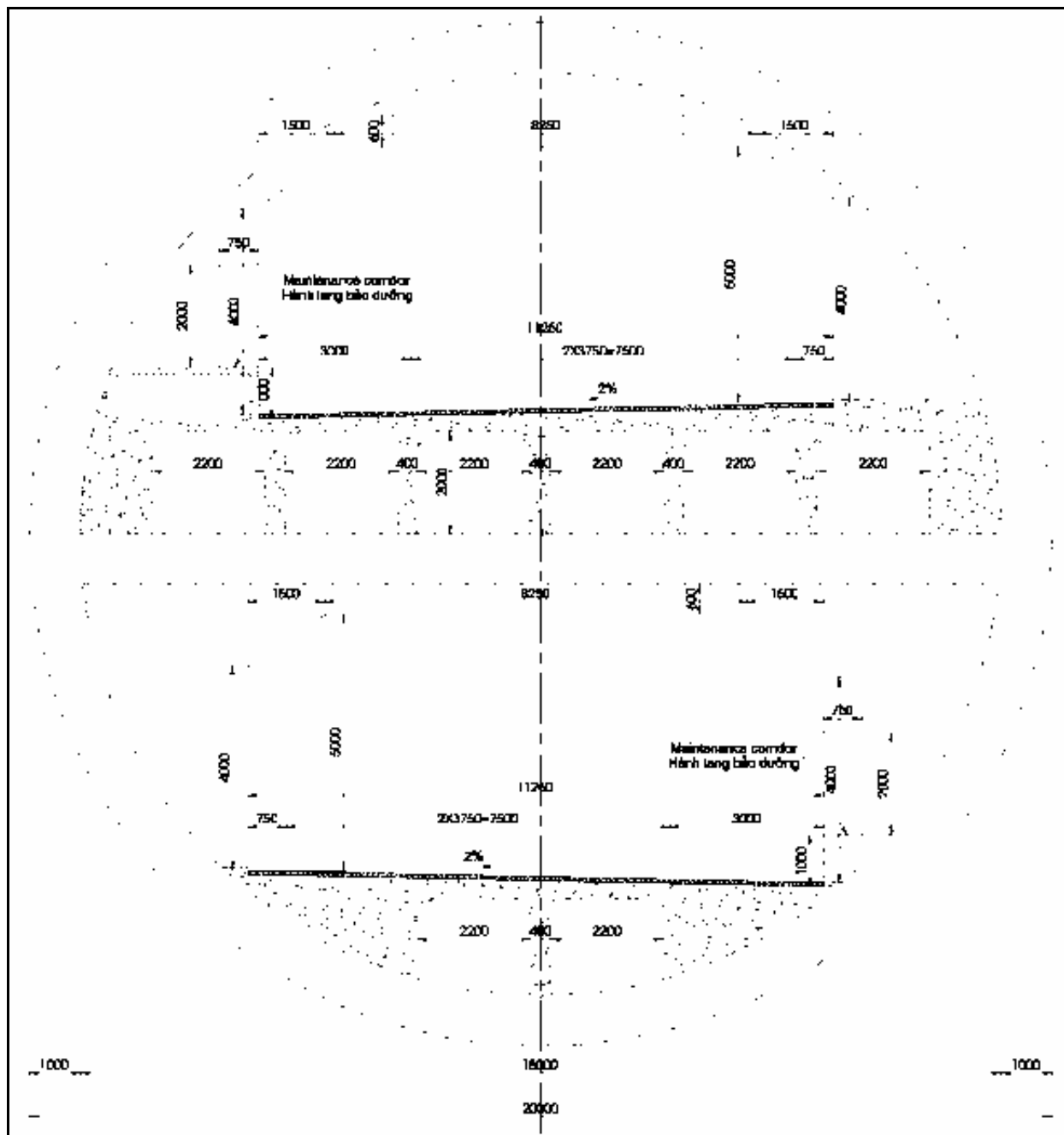


Figure 6: Single Tube TBM Cross-Section

1.2.2. Longitudinal Profiling

TBM method requires soil cover in the same thickness as the tunnel diameter. Machine launches from the shaft enclosed by cofferdam to advance and run under the large river. Behind the shaft soil cover has less thickness to apply cut and cover method or U-shaped hollow structure. Interchange location prefers shallower tunnel or underground structures. While the whole section stretching large river crossing in 10km could be driven by one TBM without coming up to ground, IC ramp ways suffers from difficulty of underground connection to the main tunnel. These are to be considered to develop the TBM option.

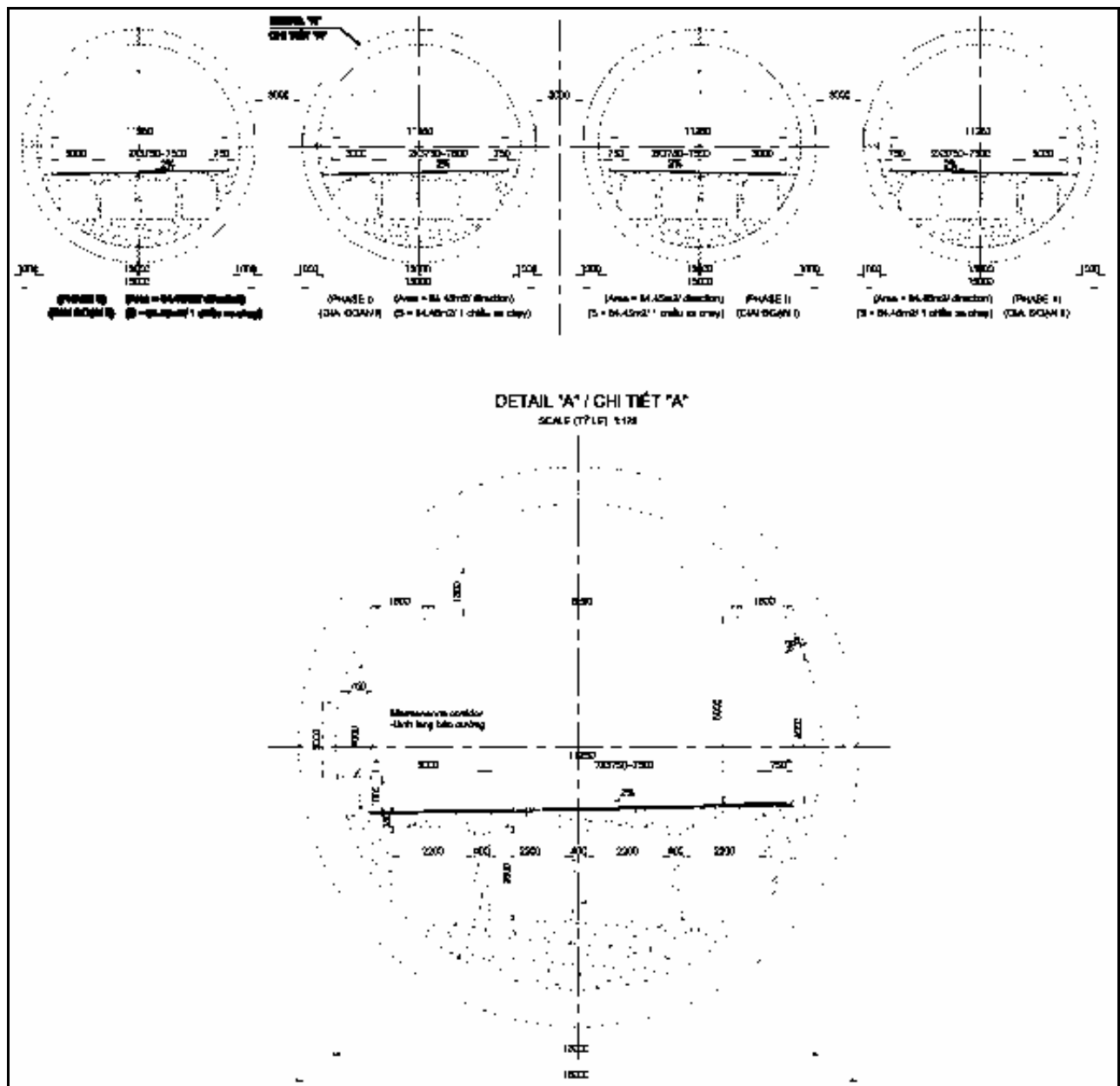


Figure 7: Double tube TBM Cross-Section Both Phase 1 & Phase 2

1.2.3. Structural Planning

TBM method applies segmented lining of pre-cast concrete with sufficient strength and joints predominating economy. Thicker soil cover than ordinary cut cover tunneling needs special attention to the planning of cofferdam.

1.2.4. Construction Method

Based on the profile the machine driving is to be planned its process from launching to arrival considering machine number. Soil condition would select the machine type of discharging muck and stabilizing the cutting face if a slurry type or earth pressure balance type. Machine transportation plan requires the selection of unloading port and access road to the shaft. Construction Work Items are broken down as below.

- i. Clearing and Grubbing, Survey for setting out
- ii. Temporary Bridge for Traffic Detour and Pile Driving and Decked Surfacing

- iii. Sheet Pile Driving for Retaining Wall Section and U-shaped road section works
- iv. Diaphragm wall building, excavation and permanent lining for launching and arrival shaft for TBM
- v. Diaphragm wall building for Cut and Cover Tunnel section works
- vi. Excavation and Wailing with protecting underground commons
- vii. Building of Retaining wall, U-shaped section and Cut/cover tunnel employing foundation, re-bar, formwork and concrete-casting
- viii. Backfilling, removing wallings, decked surfacing and steel piles
- ix. Fabrication yard preparation for Tunnel Lining Segments
- x. Fabrication of Tunnel Lining Segment and transportation to the launching shaft
- xi. Launching preparation for shaft exit and entrance of TBM
- xii. Transportation of TBM into shaft and assembling and logistic system
- xiii. Driving TBM and mucking waste
- xiv. Building secondary lining and flooring
- xv. Interior works including drainage, lighting, electricity, water main, communication cable, traffic signs, ventilation fan, fire fighting equipment and fire protection for interior surfaces.

1.2.5. High Voltage Power Line

The tower foundation of high voltage power line faces close excavation effect from tunneling and shaft works and claims a due way of mitigation plan and estimation of cost up.

1.2.6. Electrical and Mechanical Works

Based on the environmental requirement, traffic needs and case study, tunnel option is to summarize its facility layout of ventilation, drainage, lighting, disaster prevention or fire fighting and traffic safety with initial cost, operation cost and operation program. The result is to reflect to structural planning of tunnel option.

1.2.7. Environmental pollutions associating with construction activity and employed machine for TBM option

- i. Fabrication yard preparation for Tunnel Lining Segments needs installation of plant, gantry crane, production system and basement leveling in association with earth works, iron works, welding works and concreting works.
- ii. Fabrication of Tunnel Lining Segment needs activities in concrete production plant and segment production plant and stocking yard where hauling trailers and material trucks visit frequently and along the way of transportation to the launching shaft with noise.
- iii. Launching preparation for departure exit from and arrival entrance to the shaft needs soil improvement however effect to the ground surface is not problematic.
- iv. Transportation of TBM into shaft needs unloading at port jetty and hauling on the paved roadway finally to be lowered into shaft for assembling. Logistic system i.e. cargo and track for supplying segment and material or feeding pipes and discharging pipes is to be laid from shaft to TBM.

- v. Driving TBM and mucking waste have a little influence because of underground activity except for muck treatment by sieving or filtration associating with vibration and noise usually covered by shutting room. However waste hauling trucks come and go thereby through logistic yard behind shaft.
- vi. Building secondary lining and flooring are to be executed inside tunnel and take place little effect to the ground surface.
- vii. Quantity and Construction Scheduling
- viii. Based on quantity estimation, construction sequence and work speed setting leads to scheduling. Quantity calculation result is as listed below table.
- ix. Construction Cost and Annual Allocation: Based on market cost survey, construction cost is to be estimated in a local portion and import. Fiscal investment is to be allocated on the basis of construction program. Prices in Vietnam and labor's fee in 3 counties of HCMC is observed 70% of Japan in general items as construction material, food, social services and public investment. Unit cost of IMT in Japan is conceived from 1,000 to 1,200USD per unit cubic meter of mass volume.
- x. Maintenance Program, Operating Plan and Operation Cost: Maintenance and operation works are to be defined in terms of organization and annual cost estimation.

Table 1: List of main equipment for tunnel construction

No	Description	Size-Capacity or KW
1	Bulldozer	140 HP
2	Excavator	1.0 m3
3	Dump truck	12T
4	Generator	200 KVA
5	Air compressor	10 m3/min
6	Crawler crane	60 T
7	Truck crane	25 T
8	Concrete mixing car	6 m3
9	Concrete pump	100 m3/h
10	Vibrator	Dia. 27-60
11	Rebar cutting machine	5 KW
12	Rebar bending machine	2.5 KW
13	Water pump	45 CV
14	Barge	15000 T
15	Tug-boat	1200 CV
16	Diesel hammer	115 Ps
17	Auger borer	1850 W

2. ALIGNMENT SELECTION

As stated in the main body of the Interim Report there were a total of three alternative alignments considered. Along with these three alignments there were also the two alignments considered in the JETRO Study and the Pre-Feasibility Study. These



Figure 8: Alternative Alignments

These Alignments are as follows:

Alternative FS: which crosses the Soai Rap River between the 220 kV and the 500 kV power-lines approximately 110-metres south of the all the power-lines and runs between them until south of Binh Khanh Village and it emerges south of the these power-lines then crossing the Long Tau River and entering Dong Nai Province. This alignment has two tunnels.

Alternative Jetro: which crosses the Soai Rap River again between the 220 kV and the 500 kV power-lines approximately 110-metres south of the all the power-lines and runs between them and overlaps these power-lines near Binh Khanh Village and then crossing the Long Tau River north of the Pre FS Alignment and entering Dong Nai Province. This alignment has two tunnels.

Alternative 1: which crosses the Soai Rap River approximately 110-metres south of the all the power-lines and runs parallel with the power lines within Can Gio District of Ho Chi Minh City south of Binh Khanh Village then crossing the Long Tau River and entering Dong Nai Province very near the Pre-FS Alignment. This alignment has two tunnels.

Alternative 2: enters Phu Xuan commune of Nha Be District of Ho Chi Minh City and crosses the Nha Be River and therefore has only one tunnel.

Alternative 3: enters Phu Xuan commune of Nha Be District of Ho Chi Minh City but runs north of Alignment 2 to avoid a temple then and crosses the Nha Be River and therefore has only one tunnel.

Each of the two types of tunnels was considered and basically priced for each of the above alignments. There was a problem with the first two alignments (Pre F.S. and JETRO) because there between the foundations of the closeness of the power-line pylon foundation. Please see Figure 9 on the following pages that shows that the an IMT tunnel could under-mine these foundations. This danger is enough to eliminate this alignment from consideration. The other alignment near the power-lines is Alignment #1 which far enough not to be in this danger.

2.1. The cost of Immersed Tube Tunnel

The IMT tunnel can be broken down into six basic parts for cost estimation. These are as follows:

- Retaining Wall Section
- U-Shaped Section
- Cut and Cover Tunnel Section
- Portal
- Immersed Tube Section
- Electrical & Mechanical Costs

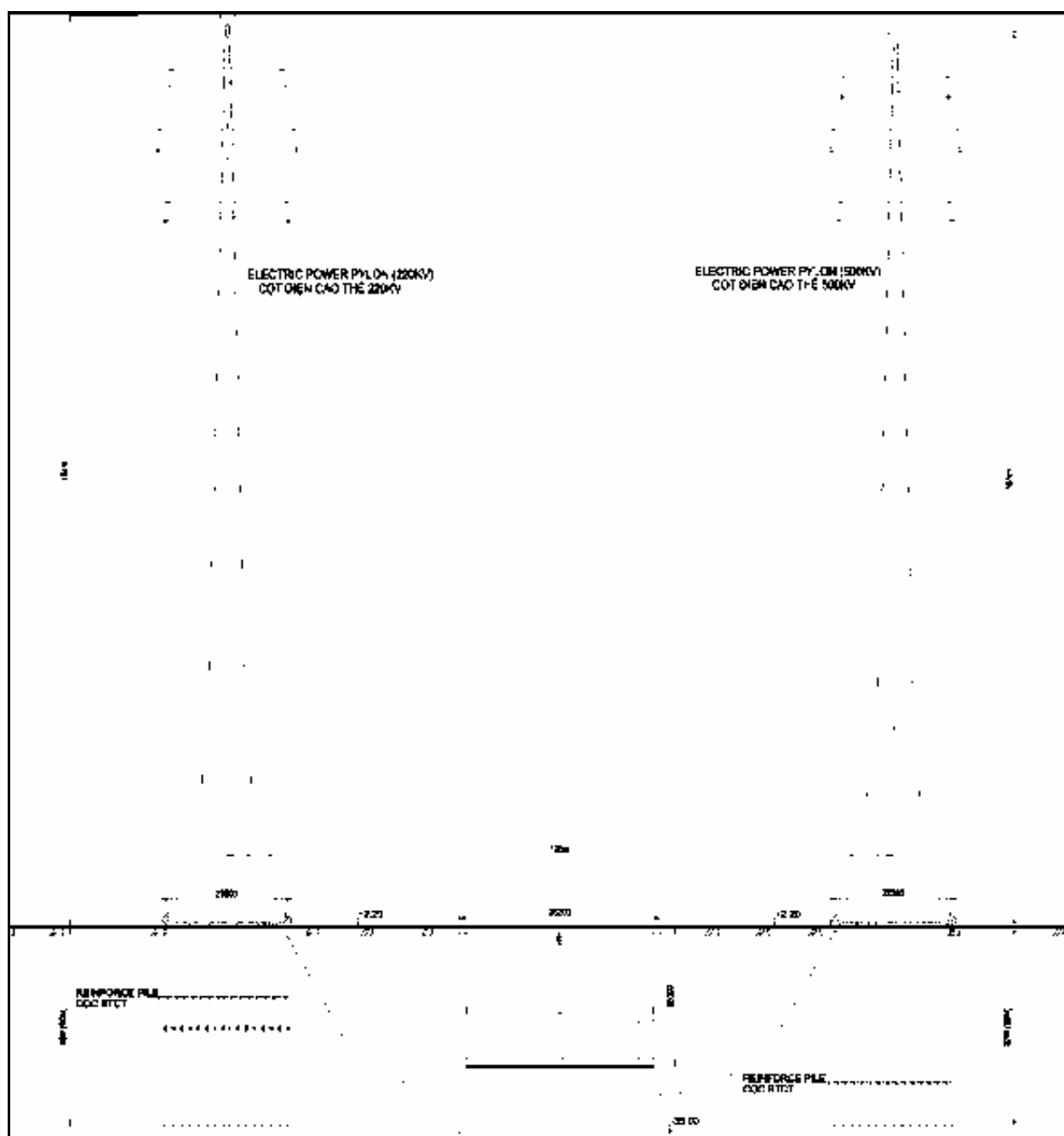


Figure 9: Location of Tunnel on Alignment of Pre F.S. and JETRO Study between Power-lines

Please see the following figures and using them the following tables have been used to calculate the costs of each type of section per unit length.

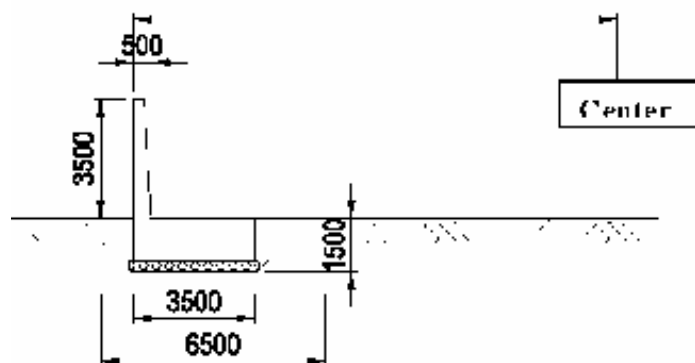


Figure 10: Retaining Wall Section

Table 2: Cost Break Down of Retaining Wall Section

Embanked & Retaining Walls	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Sheet Plies	m3	0.0	34,000	0	\$0
Excavation	m3	15.0	1,450	21,750	\$227
Crushed stone	m3	1.4	1,360	1,904	\$20
Blind concrete	m3	0.7	5,070	3,549	\$37
Concrete	m3	5.95	36,000	214,200	\$2,231
Reinforcement	tonne	1.8	140,000	252,000	\$2,625
Backfill	m3	113.0	840	94,920	\$989
Pavement	m2	31.0	4,000	124,000	\$1,292
Other Engineering Costs		20%	712,323	142,465	\$1,484
Total per metre				854,788	\$8,904

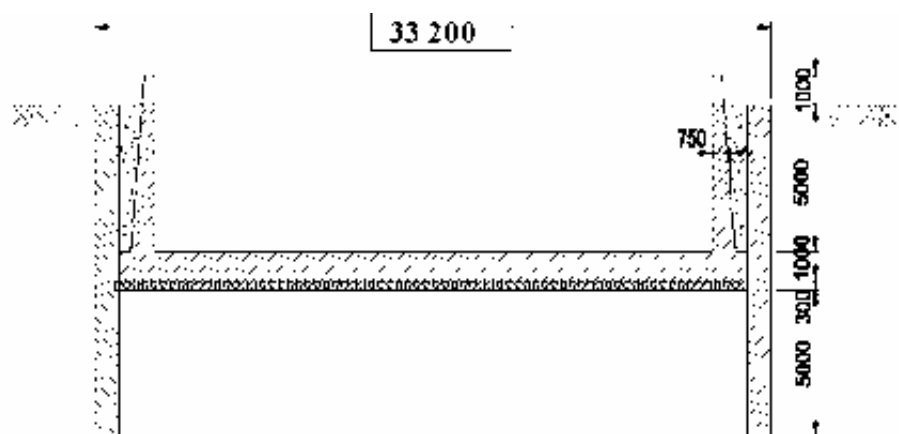


Figure 11: U-Shaped Section

Table 3: Cost Break Down of U-Shaped Section average 5-metres high

U-shape R/Wall	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Diaphragm wall	m3	24.0	34,000	816,000	\$8,500
Excavation	m3	209.2	1,450	303,340	\$3,160
Crushed stone	m3	6.6	1,360	8,976	\$94
Blind concrete	m3	3.3	5,070	16,731	\$174
Concrete	m3	42.2	36,000	1,519,200	\$15,825
Reinforcement	tonne	4.2	140,000	588,000	\$6,125
Backfill	m3	7.5	840	6,300	\$66

U-shape R/Wall	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Pavement	m2	30.2	4,000	120,800	\$1,258
Other Engineering Costs		20%	3,379,347	675,869	\$7,040
Total per metre				4,055,216	\$42,242

Table 4: Cost Break Down of U-Shaped Section average 10-metres high

U-shape R/Wall	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Sheet Piles	m3	32.6	34,000	1,108,400	\$11,546
Excavation	m3	375.2	1,450	544,040	\$5,667
Crushed stone	m3	6.6	1,360	8,976	\$94
Blind concrete	m3	3.2	5,070	16,224	\$169
Concrete	m3	70.8	36,000	2,548,800	\$26,550
Reinforcement	tonne	7.1	140,000	994,000	\$10,354
Backfill	m3	15.0	840	12,600	\$131
Pavement	m2	30.2	4,000	120,800	\$1,258
Other Engineering Costs		20%	5,353,840	1,070,768	\$11,154
Total per metre				6,424,608	\$66,923

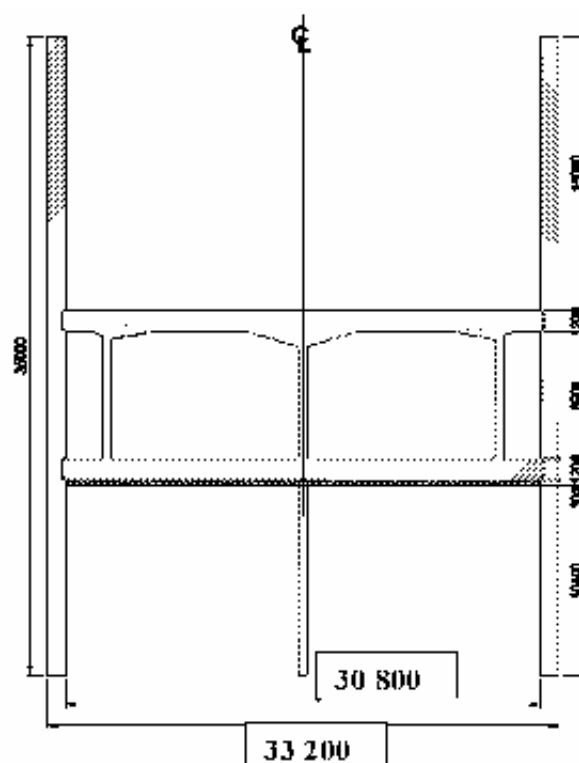


Figure 12: Cut & Cover Tunnel Section

Table 5: Cost of a Cut & Cover Tunnel (mean depth 23m)

Cut & Cover Tunnel A	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Diaphragm wall	m3	88.2	32,000	2,822,400	\$29,400
Excavation	m3	754.6	1,450	1,094,170	\$11,398
Crushed stone	m3	6.2	1,360	8,432	\$88

Cut & Cover Tunnel A	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Blind concrete	m3	3.1	5,070	15,717	\$164
Concrete	m3	84.3	36,000	3,034,800	\$31,613
Reinforcement	tonne	16.9	140,000	2,366,000	\$24,646
Backfill	m3	462.0	840	388,080	\$4,043
Pavement	m2	22.5	4,000	90,000	\$938
Other Engineering Costs		20%	9,819,599	1,963,920	\$20,457
Total per metre				11,783,519	\$122,745

Table 6: Cost of a Cut & Cover Tunnel (mean depth 13.5m)

Cut & Cover Tunnel B	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Diaphragm wall	m3	65.4	32,000	2,092,800	\$21,800
Excavation	m3	462.0	1,450	669,900	\$6,978
Crushed stone	m3	6.2	1,360	8,432	\$88
Blind concrete	m3	3.1	5,070	15,717	\$164
Concrete	m3	84.3	36,000	3,034,800	\$31,613
Reinforcement	tonne	16.9	140,000	2,366,000	\$24,646
Backfill	m3	169.4	840	142,296	\$1,482
Pavement	m2	22.5	4,000	90,000	\$938
Other Engineering Costs		20%	8,419,945	1,683,989	\$17,542
Total per metre				10,103,934	\$105,249

Table 7: Cost of a Cut & Cover Tunnel (mean depth 17m)

Cut & Cover Tunnel C	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Diaphragm wall	m3	73.8	32,000	2,361,600	\$24,600
Excavation	m3	569.8	1,450	826,210	\$8,606
Crushed stone	m3	6.2	1,360	8,432	\$88
Blind concrete	m3	3.1	5,070	15,717	\$164
Concrete	m3	84.3	36,000	3,034,800	\$31,613
Reinforcement	tonne	16.9	140,000	2,366,000	\$24,646
Backfill	m3	277.2	840	232,848	\$2,426
Pavement	m2	22.5	4,000	90,000	\$938
Other Engineering Costs		20%	8,935,607	1,787,121	\$18,616
Total per metre				10,722,728	\$111,695

Table 8: Cost of the Immersed Tube Tunnel (125-metre section length)

IMT-tube 125m Section	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Concrete	m3	12,858.8	43,000	552,928,400	\$5,759,671
Steel	tonne	2,495.0	350,000	873,250,000	\$9,096,354
Dredging	m3	103,862.5	1,500	155,793,750	\$1,622,852
Backfill	m3	65,732.0	1,500	98,598,000	\$1,027,063
Rubber Gaskets	m	72.0	700,000	50,400,000	\$525,000
Outfitting	tonne	1,000.0	100,000	100,000,000	\$1,041,667
Pontoon	tonne	1,000.0	100,000	100,000,000	\$1,041,667
Tug Boat Operations	each	1.0	46,153,846	46,153,846	\$480,769

IMT-tube 125m Section	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Other Engineering Costs		20%	1,977,123,996	395,424,799	\$4,119,008
E&M Works for Tunnel		25%	2,372,548,795	593,137,199	\$6,178,512
Total for Section				2,965,685,994	\$30,892,562
Section Length	m	125.0		125 m	125 m
Total per metre				23,725,488	\$247,140

Table 9: Tunnel Boring Machine Estimated Costs per metre

TBM	Unit	Quantity	Unit-cost	Amount in Yen	Amount in US\$
Full Shielded TBM	each	1	10,000,000,000	10,000,000,000	\$104,166,667
TBM Right Tunnel	m3	505,403.7	80,000	40,432,297,452	\$421,169,765
TBM Left Tunnel	m3	505,403.7	80,000	40,432,297,452	\$421,169,765
E&M Works for Tunnel		15%	90,864,594,903	13,629,689,236	\$141,975,930
Total for Tunnel 2,860m				104,494,284,139	\$1,088,482,126
Section Length	m	2,860.0		2,860 m	2,860 m
Total per metre				36,536,463	\$380,588

Once the cost per metre are calculated for each type of tunnel then these are assessed to the three alignments

Table 10: Calculating Cost of Alignment 1 Tunnels

#	From	To	Length	Type	Unit Cost	Amount
A1	KM 20+778	KM 21+011	233 m	Retaining Wall	\$8,904	\$2,074,641
A1	KM 21+011	KM 21+314	303 m	U-Shaped Section H5	\$42,242	\$12,799,277
A1	KM 21+314	KM 21+704	390 m	Cut & Cover Tunnel B	\$105,249	\$41,047,232
A1	KM 21+704	KM 22+107	403 m	U-Shaped Section H10	\$66,923	\$26,969,969
A1	KM 22+107	KM 23+020	913 m	Cut & Cover Tunnel A	\$122,745	\$112,066,174
A1	KM 23+020	KM 23+021	1 m	West Cofferdam	\$11,773,177	\$11,773,177
A1	KM 23+021	KM 24+021	1,000 m	IMT	\$247,140	\$247,140,500
A1	KM 24+021	KM 24+022	1 m	East Cofferdam	\$11,773,177	\$11,773,177
A1	KM 24+022	KM 24+331	309 m	Cut & Cover Tunnel B	\$105,249	\$32,522,038
A1	KM 24+331	KM 24+631	300 m	U-Shaped Section H5	\$42,242	\$12,672,551
A1	KM 24+631	KM 24+864	233 m	Retaining Wall	\$8,904	\$2,074,641
			4,086 m	Song Soai Rap IMT		\$512,913,375
A1	KM 28+986	KM 29+219	233 m	Retaining Wall	\$8,904	\$2,074,641
A1	KM 29+219	KM 29+522	303 m	U-Shaped Section H5	\$42,242	\$12,799,277
A1	KM 29+522	KM 30+006	484 m	Cut & Cover Tunnel C	\$111,695	\$54,060,422
A1	KM 30+006	KM 30+007	1 m	West Cofferdam	\$6,569,792	\$6,569,792
A1	KM 30+007	KM 30+639	632 m	IMT Civil Costs	\$247,140	\$156,192,796
A1	KM 30+639	KM 30+640	1 m	East Cofferdam	\$6,086,167	\$6,086,167
A1	KM 30+640	KM 31+090	450 m	Cut & Cover Tunnel C	\$111,695	\$50,262,789
A1	KM 31+090	KM 31+393	303 m	U-Shaped Section H5	\$42,242	\$12,799,277
A1	KM 31+393	KM 31+626	233 m	Retaining Wall	\$8,904	\$2,074,641
			2,640 m	Song Long Tau IMT		\$302,919,801
			6,726 m	Alignment 1 Tunnels		\$815,833,176



Figure 13: Profile of IMT Tunnel on Alignment 1

Table 11: Tunnel Boring Machine Costs on Alignment 1 Song Soai Rap

#	From	To	Length	Type	Unit Cost	Amount
A1	KM 20+565	KM 20+798	233 m	Retaining Wall	\$8,904	\$2,074,641
A1	KM 20+798	KM 21+101	303 m	U-Shaped Section H5	\$42,242	\$12,799,277
A1	KM 21+101	KM 21+328	227 m	Cut & Cover Tunnel C	\$111,695	\$25,354,785
A1	KM 21+328	KM 21+378	50 m	West Shaft	\$4,055,625	\$202,781,250
A1	KM 21+378	KM 24+139	2,761 m	TBM	\$380,588	\$1,050,803,899
A1	KM 24+139	KM 24+189	50 m	East Shaft	\$4,055,625	\$202,781,250
A1	KM 24+189	KM 24+416	227 m	Cut & Cover Tunnel C	\$111,695	\$25,354,785
A1	KM 24+416	KM 24+719	303 m	U-Shaped Section H5	\$42,242	\$12,799,277
A1	KM 24+719	KM 24+952	233 m	Retaining Wall	\$8,904	\$2,074,641
			4,387 m	Song Soai Rap TBM		\$1,536,823,804

Table 12: Tunnel Boring Machine Costs on Alignment 1 Song Long Tau

#	From	To	Length	Type	Unit Cost	Amount
A1	KM 27+870	KM 28+103	233 m	Retaining Wall	\$8,904	\$2,074,641
A1	KM 28+103	KM 28+406	303 m	U-Shaped Section H5	\$42,242	\$12,799,277
A1	KM 28+406	KM 28+633	227 m	Cut & Cover Tunnel C	\$111,695	\$25,354,785
A1	KM 28+633	KM 28+683	50 m	West Shaft	\$4,055,625	\$202,781,250
A1	KM 28+683	KM 30+783	2,100 m	TBM	\$380,588	\$799,235,128
A1	KM 30+783	KM 30+833	50 m	East Shaft	\$4,055,625	\$202,781,250
A1	KM 30+833	KM 31+060	227 m	Cut & Cover Tunnel C	\$111,695	\$25,354,785
A1	KM 31+060	KM 31+363	303 m	U-Shaped Section H5	\$42,242	\$12,799,277
A1	KM 31+363	KM 31+596	233 m	Retaining Wall	\$8,904	\$2,074,641
			3,726 m	Song Long Tau TBM		\$1,285,255,033

Table 13: Summary of Alignment 1 Tunnels by Type

Tunnel	Length	Type	Amount	Cost per m
Song Soai Rap IMT	4,086 m	IMT Alignment 1	\$512,913,375	\$125,529
Song Long Tau IMT	2,640 m	IMT Alignment 1	\$302,919,801	\$114,742
Alignment 1 IMT	6,726 m	IMT Alignment 1	\$815,833,176	\$121,295
Song Soai Rap TBM	4,387 m	TBM Alignment 1	\$1,536,823,804	\$350,313
Song Long Tau TBM	3,726 m	TBM Alignment 1	\$1,285,255,033	\$344,942
Alignment 1 TBM	8,113 m	TBM Alignment 1	\$2,822,078,836	\$347,847

From Table 13 above it can be seen that the Immersed Tube Tunnels cost much less than the Tunnel Boring Machine type. This eliminates the TBM type from further consideration. The cost of IMT tunnels will be calculated for Alignments 2 and 3 to compare with the cost of bridges for these alignments.

In Table 14 the cost of the IMT tunnel is calculated.

Table 14: Immersed Tube Tunnel Cost Alignment 2

#	From	To	Length	Type	Unit Cost	Amount
A2	KM 23+989	KM 24+222	233 m	Retaining Wall	\$8,904	\$2,074,641
A2	KM 24+222	KM 24+576	354 m	U-Shaped Section H5	\$42,242	\$14,953,610
A2	KM 24+576	KM 24+721	145 m	Cut & Cover Tunnel C	\$111,695	\$16,195,788
A2	KM 24+721	KM 24+722	1 m	West Cofferdam	\$6,600,000	\$6,600,000
A2	KM 24+722	KM 26+323	1,601 m	IMT Civil Costs	\$247,140	\$395,671,940
A2	KM 26+323	KM 26+324	1 m	East Cofferdam	\$6,600,000	\$6,600,000

#	From	To	Length	Type	Unit Cost	Amount
A2	KM 26+324	KM 26+469	145 m	Cut & Cover Tunnel C	\$111,695	\$16,195,788
A2	KM 26+469	KM 26+823	354 m	U-Shaped Section H5	\$42,242	\$14,953,610
A2	KM 26+823	KM 27+056	233 m	Retaining Wall	\$8,904	\$2,074,641
			3,067 m	Nha Be 1 IMT Tunnel		\$475,320,017

In Table 15 the costs are calculated for Alignment 3.

Table 15: Immersed Tube Tunnel Cost Alignment 3

#	From	To	Length	Type	Unit Cost	Amount
A3	KM 23+817	KM 24+050	233 m	Retaining Wall	\$8,904	\$2,074,641
A3	KM 24+050	KM 24+404	354 m	U-Shaped Section H5	\$42,242	\$14,953,610
A3	KM 24+404	KM 24+549	145 m	Cut & Cover Tunnel C	\$111,695	\$16,195,788
A3	KM 24+549	KM 24+550	1 m	West Cofferdam	\$6,600,000	\$6,600,000
A3	KM 24+550	KM 26+050	1,500 m	IMT Civil Costs	\$247,140	\$370,710,749
A3	KM 26+050	KM 26+051	1 m	East Cofferdam	\$6,600,000	\$6,600,000
A3	KM 26+051	KM 26+196	145 m	Cut & Cover Tunnel C	\$111,695	\$16,195,788
A3	KM 26+196	KM 26+550	354 m	U-Shaped Section H5	\$42,242	\$14,953,610
A3	KM 26+550	KM 26+783	233 m	Retaining Wall	\$8,904	\$2,074,641
			2,966 m	Nha Be 2 IMT Tunnel		\$450,358,827

Table 16: Summary of all IMT Type Tunnels all Alignments

Tunnel	Length	Type	Amount	Cost per m
Song Soai Rap IMT	4,086 m	IMT Type Alignment 1	\$512,913,375	\$125,529
Song Long Tau IMT	2,640 m	IMT Type Alignment 1	\$302,919,801	\$114,742
Alignment 1 IMT	6,726 m	IMT Type Alignment 1	\$815,833,176	\$121,295
Nha Be 1 Tunnel IMT	3,067 m	IMT Type Alignment 2	\$475,320,017	\$154,979
Nha Be 2 Tunnel IMT	2,966 m	IMT Type Alignment 3	\$450,358,827	\$151,840

Tunnel option of Immersed Tunneling (IMT) Method and Tunnel Boring Machine (TBM) Method for each alignment is based on the topographical profile. The profile of the Song Soai Rap river diverging south of Song Nha Be has some very deep sections up to a depth of 34 metres is observed according to the topographic map. Even so as reported by Hiep Phuoc Port the Song Soai Rap requires dredging in places for shipping with capacity not less than 70,000 DWT necessitating 12m draft (plans call for dredging to 9.5m from 2009 to 2010, to 11m from 2012 to 2013 and finally to 12m later than 2015). This means the river bottom remains shallower than 9.5m in places at present.

The profile of the Song Long Tau river diverging eastward from Song Nha Be has conveyed the main shipping fairway with span of 600m approximately between coasts in the depth from 10m of the contour line to 13m at a bottom.

The other routes of A2 and A3 cross at the upstream of 3,700m and 4,500m from A1 respectively where the main stream of the river Song Nha Be. A2 spans 1,500m and go down to the 10m depth of the contour on the west half side of the stream at a bottom point of 15m. A3 spans 1,350m and go down to the depth of the 20m depth of the contour line on the west half side of the stream at a bottom point of 21m.

Heavy shipping fairways (air draft) need provides a clearance of about 4 times the depth of river, where tunnel options connect both sides in shorter spans than bridge options at the nearer coast area. Immersed tunnel with thinner soil cover makes the crossing structures shorten and expands the access area to receive benefits. Bored tunnel options as of a Tunnel Boring Machine Method and a Steel-Shot-Concrete

Lining Method are supposed the latter inapplicable due to the soft soil ground and omitted in the study. Especially Immersed Tunnel method has the following advantages compared with the bridge option.

- The elevation can be raised until scouring affects the soil cover as far as the fairway draft secured.
- Nothing except ventilation tower obstructs the aircraft landing or taking off the airport.
- Unit weight is so close to that of water that almost little settlement will take place.
- Weather effects as rain and wind are lessen by covering.
- Tunnel section can convey a winding alignment.
- Ship collision is restricted to the stranding on the soil cover and not a direct hit.

The cost data and will be brought forward to compare tunnel crossings with bridge crossings on each of the three alignments.

APPENDIX C6:

BORING LOGS

**BORING LOGS HAVE UNDERTAKEN
BY THE CONSULTANT**

Borehole : BH1
 Chainage : KM2+767
 Elevation : 1.30 m
 Drilling machine : XJ-100

Scale : 1/200
 Coordinates: E= 1178964.11; N= 588589.70
 Elevation of G.W.L: -0.2m

Drilling date: 25/06/2009-29/06/2009
 Driller: NGUYỄN VĂN DUYNH
 Supervisor: PHẠM ĐẮC KIỂM
 Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)							Symbol and depth of SPT
								No of blow for each 15cm			N	SPT diagram			
								15 cm	15 cm	15 cm					
								15 cm	15 cm	15 cm		10 20 30 40 >40			
2.0	K1	0.60		0.7		UD1	Fill: soil with some gravel and rock 4x5								
4.0	1c	-3.20	1.5 m	3.8		1.50 - 2.00 UD2	CLAY, with some gravel and organic, blue grey, soft	1	1	1	2			SPT1 2.00 - 2.45	
						3.00 - 3.50 UD3	CLAY with Sand (CL)s, blue grey and dark grey, soft	0	1	1	2			SPT2 3.50 - 3.95	
6.0			4.5			4.50 - 5.00 UD4	CLAY (CL), light grey, yellow grey, stiff	4	5	7	12			SPT3 5.00 - 5.45	
8.0						6.00 - 6.50 UD5	CLAY (CL), light grey, yellow grey, stiff	4	6	8	14			SPT4 6.50 - 6.95	
						7.50 - 8.00 UD6	Fat CLAY (CH), red brown, yellow grey, stiff	3	5	9	14			SPT5 8.00 - 8.45	
10.0						9.00 - 9.50 UD7	Fat CLAY (CH), red brown, yellow grey, stiff	5	4	7	11			SPT6 9.50 - 9.95	
12.0	2b			14.1		10.50 - 11.00 UD8	Fat CLAY (CH), red brown, blue grey, stiff	4	6	9	15			SPT7 11.00 - 11.45	
						12.00 - 12.50 UD9	Fat CLAY (CH), red brown, blue grey, stiff	5	6	9	15			SPT8 12.50 - 12.95	
14.0						13.50 - 14.00 UD10	Fat CLAY (CH), red brown, blue grey, stiff	5	8	10	18			SPT9 14.00 - 14.45	
16.0						15.00 - 15.50 UD11	Fat CLAY (CH), blue grey, stiff	5	8	11	19			SPT10 15.50 - 15.95	
18.0		-17.30	18.6			16.50 - 17.00 UD12	Fat CLAY (CH), blue grey, stiff	4	7	10	17			SPT11 17.00 - 17.45	
20.0						18.00 - 18.50	Sandy CLAY, yellow brown, stiff	3	4	7	11			SPT12 18.50 - 18.95	
22.0							Clayey SAND (SC), fine-medium grained, with some gravel, medium dense	5	8	15	23			SPT13 19.50 - 19.95	
24.0							Clayey SAND (SC), fine grained, yellow brown, medium dense	4	8	11	20			SPT14 21.00 - 21.45	
26.0							Silty Clayey SAND (SC-SM), fine grained, yellow brown, medium dense	7	10	18	26			SPT15 22.50 - 22.95	
28.0							Silty Clayey SAND (SC-SM), fine grained, yellow brown, medium dense	6	10	15	25			SPT16 24.00 - 24.45	
30.0							Silty Clayey SAND (SC-SM), fine grained, yellow, dense	10	15	17	32			SPT17 25.50 - 25.95	
32.0	3b			28.3			Silty Clayey SAND (SC-SM), fine grained, yellow, dense	10	18	21	39			SPT18 27.00 - 27.45	
							Silty Clayey SAND (SC-SM), line grained, yellow, dense	9	13	17	30			SPT19 28.50 - 28.95	
34.0							Silty Clayey SAND (SC-SM), line grained, yellow brown, with some gravel, dense	11	15	25	40			SPT20 30.00 - 30.45	
36.0							Silty SAND (SM), medium grained, brown, dense	11	19	25	44			SPT21 31.50 - 31.95	
38.0							Silty SAND (SM), medium grained, brown, dense	10	18	27	45			SPT22 33.00 - 33.45	
40.0							Silty SAND (SM), medium grained, brown, dense	9	12	19	31			SPT23 34.50 - 34.95	
42.0							Silty SAND (SM), medium grained, light grey, yellow grey, medium dense	6	10	13	23			SPT24 36.00 - 36.45	
44.0							Silty SAND (SM), medium grained, with some gravel, light grey, dense	11	14	17	31			SPT25 37.50 - 37.95	
							Silty SAND (SM), medium grained, with some gravel, light grey, dense	12	14	18	32			SPT26 39.00 - 39.45	
							Silty SAND (SM), medium grained, light grey, dense	11	14	21	35			SPT27 40.50 - 40.95	
							Silty SAND (SM), medium grained, yellow grey, with some gravel, dense	9	14	19	33			SPT28 42.00 - 42.45	
							Silty SAND (SM), medium grained, yellow grey, dense	8	15	18	33			SPT29 43.50 - 43.95	

Borehole : BH2

Scale : 1/200

Drilling date: 02/07/2009-06/07/2009

Chainage : KM B + 600

Coordinates: E= 1178517.00; N= 594221.00

Driller: NGUYỄN TRỌNG TÀI

Elevation: 1.65 m

Elevation of G.W.L: 0.5m

Supervisor: PHẠM ĐẮC KIỂM

Drilling machine: XJ-100













































Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)							Symbol and depth of SPT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Borehole : CG
Coordinates: KM 12+222
Elevation: 1.00 m
Drilling machine: XJ-100

Scale : 1/200
Coordinates: E= 1178697.16; N= 597837.74
Elevation of G.W.L: 0.0m

Drilling date: 26/10/2007-30/10/2007
Driller: Lê Mai Bích
Supervisor: Nguyễn Đoàn Tĩnh
Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)							Symbol and depth of SPT		
								No of blow for each 15cm			N	SPT diagram					
								15 cm	15 cm	15 cm							
													10	20	30	40	>40
2.0	K1	-1.20	2.2	2.2		UD1 1.50 - 2.00	FILL: from D.D-1.5m; clay and aggregate; 1.5-2.2m: clay, light grey, soft.	1	1	1	2						SPT1 2.00 - 2.45
4.0	1a			3.7		UD2 3.00 - 3.50	Fat CLAY (CH), gray with some shell, very soft	0	0	0	0						SPT2 3.50 - 3.95
6.0		-4.90	5.9			UD3 5.00 - 5.50	Fat CLAY (CH), gray with some shell, very soft	0	0	1	1						SPT3 5.50 - 5.95
8.0						UD4 7.00 - 7.50	Fat CLAY (CH), yellow, green gray, stiff	3	5	7	12						SPT4 7.50 - 7.95
10.0	2b			6.4		UD5 9.00 - 9.50	Fat CLAY (CH), yellow, green gray, stiff	4	5	7	12						SPT5 9.50 - 9.95
12.0		-11.30	12.3			UD6 11.00 - 11.50	Sandy lean CLAY s(CL), yellow mottled gray, stiff	3	6	8	14						SPT6 11.50 - 11.95
14.0							Silty SAND (SM), fine to medium, with silt, yellow, light grey, moistured, medium dense	5	7	8	15						SPT7 13.50 - 13.95
16.0							Silty SAND (SM), fine grained, with silt, light grey, loose	2	3	4	7						SPT8 15.50 - 15.95
18.0						UD7 19.00 - 19.50	Clayey SAND (SC), light grey, light yellow, loose	3	4	5	9						SPT9 17.50 - 17.95
20.0	3b			14.7		UD8 21.00 - 21.50	Silty Clayey SAND (SC-SM), light grey, yellow, medium dense.	5	9	10	19						SPT10 19.50 - 19.95
22.0						UD9 23.00 - 23.50	Silty Clayey SAND (SC-SM), yellow, grey, medium dense	5	9	11	20						SPT11 21.50 - 21.95
24.0						UD10 25.00 - 25.50	Silty Clayey SAND (SC-SM), yellow, grey, medium dense	3	8	12	20						SPT12 23.50 - 23.95
26.0						UD11 27.00 - 27.50	Clayey SAND, yellow, grey SPT: fine sand with silt	4	8	11	19						SPT13 25.50 - 25.95
28.0	TK2	-26.00 -27.00	27.0 28.0	1.0			From 27.0-28.0m: Light CLAY (CL), red brown mottled grey, stiff	5	7	9	16						SPT14 27.50 - 27.95
30.0							Silty SAND, fine grained with silt, yellow grey, medium dense	5	8	11	19						SPT15 29.50 - 29.95
32.0							Silty Clayey SAND (SC-SM), fine grained, light grey, light yellow, medium dense	5	8	10	19						SPT16 31.50 - 31.95
34.0	3b			11.5			Silty SAND, fine grained, light yellow, medium dense	6	8	10	19						SPT17 33.50 - 33.95
36.0							Silty Clayey SAND (SC-SM), red brown, yellow, medium dense	8	13	16	29						SPT18 35.50 - 35.95
38.0							Silty SAND (SM), fine grained with silt, medium dense.	6	10	11	21						SPT19 37.50 - 37.95
40.0		-38.50	39.5			UD12 41.00 - 41.50	At 39.5m Cemented, yellow brown	10	4	6	10						SPT20 39.50 - 39.95
42.0	TK2			4.0		UD13 43.00 - 43.50	Fat CLAY (CH), dark grey, stiff	6	8	10	18						SPT21 41.50 - 41.95
44.0	3b	-42.50	43.5	17.0			Silty SAND, Coarse grained, yellow, dense	18	19	20	39						SPT22 43.50 - 43.95

Borehole : PK1
Coordinates: KM 29+275
Elevation: 1.20 m
Drilling machine: XJ-100

Scale : 1/200
Coordinates: E= 1179877.00; N= 613153.00
Elevation of G.W.L: 0.3m

Drilling date: 26/10/2007 - 31/10/2007
Driller: NGUYỄN ĐỨC VIỆT
Supervisor: NGUYỄN MẠNH TUÂN
Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)						Symbol and depth of SPT							
								No of blow for each 15cm			N	SPT diagram									
								15 cm	15 cm	15 cm											
								15	15	15		10	20	30	40	>40					
2.0	K1	-0.1	0.90 m	1.3		UD1	Fill: Clay, brown grey, green grey, firm											SPT1 2.00 - 2.45			
4.0	1a			13.7		UD2	Fat CLAY (CH), green grey, very soft	0	0	0	0							SPT2 3.50 - 3.95			
						UD3	Fat CLAY (CH), green grey, very soft	0	0	0	0									SPT3 5.50 - 5.95	
6.0						UD4	Fat CLAY (CH), green grey, very soft													SPT4 7.50 - 7.95	
8.0						UD5	Fat CLAY (CH), green grey, very soft, some sand alternated													SPT5 9.50 - 9.95	
10.0						UD6	Fat CLAY (CH), green grey, very soft, some sand alternated													SPT6 11.50 - 11.95	
12.0						UD7	Fat CLAY (CH), green grey, very soft, some sand alternated														SPT7 13.50 - 13.95
14.0						UD8	Fat CLAY (CH), green grey, very soft														SPT8 15.50 - 15.95
16.0	1b	-13.80	15.0	11.1		UD9	Fat CLAY (CH), green grey, very soft	0	0	0	0							SPT9 17.50 - 17.95			
18.0			UD10		Fat CLAY (CH), green grey, very soft, some sand alternated	0	0	0	0									SPT10 19.50 - 19.95			
20.0			UD11		Fat CLAY (CH), green grey, very soft	0	0	0	0									SPT11 21.50 - 21.95			
22.0			UD12		Fat CLAY (CH), green grey, very soft, some thin clay layer alternated, very soft - soft	0	0	0	0									SPT12 23.50 - 23.95			
24.0			UD13		Fat CLAY (CH), green grey, very soft - soft	0	1	1	2									SPT13 25.50 - 25.95			
26.0			UD14		Fat CLAY (CH), green grey, very soft-soft	0	1	1	2									SPT14 27.50 - 27.95			
28.0	2b			8.1		UD15	Lean CLAY (CL), green grey, brown grey, stiff	5	8	11	19							SPT15 29.50 - 29.95			
30.0						UD16	Lean CLAY with sand (CL)s, green grey, light grey, stiff	6	8	10	18								SPT16 31.50 - 31.95		
32.0						UD17	Sandy Lean CLAY s(CL), yellow brown, yellow grey, very stiff	5	8	15	23								SPT17 33.50 - 33.95		
34.0								9	13	18	29								SPT18 35.50 - 35.95		
36.0																				SPT19 37.50 - 37.95	
38.0	3b			16.1			Silty SAND (SM), medium grained, light yellow, medium dense	10	13	15	28							SPT20 39.50 - 39.95			
40.0							Silty SAND (SM), medium dense, light grey, light yellow, medium dense	7	11	16	27								SPT21 41.50 - 41.95		
42.0							Silty SAND (SM), medium grained, light yellow, medium dense	7	10	16	26								SPT22 43.50 - 43.95		
44.0								10	18	19	35									SPT23 45.50 - 45.95	

Borehole : PK1
Coordinates: KM 29+275
Elevation: 1.20 m
Drilling machine: XJ-100

Scale : 1/200
Coordinates: E= 1179877.00; N= 613153.00
Elevation of G.W.L: 0.3m

Drilling date: 26/10/2007 - 31/10/2007
Driller: NGUYỄN ĐỨC VIỆT
Supervisor: NGUYỄN MẠNH TUÂN
Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	No of blow for each 15cm			N	SPT diagram	Symbol and depth of SPT
								15 cm	15 cm	15 cm			
								15 cm	15 cm	15 cm			
												10 20 30 40 >40	
46.0	3b	-49.10	50.3	16.1		UD18	Silty SAND (SM), fine to medium grained, light grey, light yellow, dense	10	17	20	37		SPT23 45.50 - 45.95
48.0							Silty SAND (SM), fine to medium grained, light grey, light yellow, dense	11	16	20	36		SPT24 47.50 - 47.95
50.0							Silty SAND (SM), fine to medium grained, light grey, light yellow, dense	12	16	22	38		SPT25 49.50 - 49.95
52.0	TK2	-57.20	58.4	8.1		UD19	Fat CLAY (CH), dark grey, green grey, stiff	6	8	10	19		SPT26 51.50 - 51.95
54.0							Fat CLAY (CH), dark grey, green grey, stiff	7	10	12	22		SPT27 53.50 - 53.95
56.0							Fat CLAY (CH), dark grey, green grey, stiff	7	11	12	23		SPT28 55.50 - 55.95
58.0							Fat CLAY (CH), dark grey, green grey, stiff	7	10	11	21		SPT29 57.50 - 57.95
60.0	3b	-67.3	68.5	10.1			Silty SAND (SM), fine to medium grained, dark yellow, dense	12	22	20	42		SPT30 59.50 - 59.95
62.0							Silty Clayey SAND (SC-SM), fine to medium dense, dark yellow, dense	13	18	20	38		SPT31 61.50 - 61.95
64.0							Silty SAND (SM), fine to medium dense, dark yellow, dense	14	19	20	39		SPT32 63.50 - 63.95
66.0							Silty SAND (SM), fine grained, dark yellow, dense	14	18	19	37		SPT33 65.50 - 65.95
68.0							Silty SAND (SM), fine to medium grained, light yellow, dense	15	18	20	38		SPT34 67.50 - 67.95
70.0							Silty SAND (SM), fine to medium grained, light yellow, light grey, very dense	16	21	24	45		SPT35 69.50 - 69.95
72.0							Silty SAND (SM), light yellow, light grey, very dense	17	25	30	56		SPT36 71.50 - 71.95
74.0							Silty SAND (SM), fine grained, light grey, very dense	20	25	34	59		SPT37 73.50 - 73.95
76.0	3c		21.5				Silty SAND (SM), fine grained, light yellow, light grey, dense to very dense	14	22	29	61		SPT38 75.50 - 75.95
78.0							Silty SAND (SM), fine grained, light yellow, light grey, dense to very dense	15	23	27	60		SPT39 77.50 - 77.95
80.0							Silty SAND (SM), fine to medium grained, very dense	18	25	25	50		SPT40 79.50 - 79.95
82.0							From 82.3-83.0m: Sandy CLAY (SC), light grey, stiff to very stiff.	17	25	27	52		SPT41 81.50 - 81.95
84.0							Silty SAND (SM), fine to medium grained, light yellow, light grey, dense	9	16	26	42		SPT42 83.50 - 83.95
86.0							Silty SAND (SM), fine to medium grained, light yellow, light grey, dense	15	21	30	51		SPT43 85.50 - 85.95
88.0							Silty SAND (SM), light grey, very dense	18	22	30	52		SPT44 87.50 - 87.95

Appendix: 3
Sheet: 11

Dri ling date: 26/10/2007 - 31/10/2007
Dri ler: NGUYỄN ĐỨC VIỆT
Supervisor: NGUYỄN MẠNH TUẤN
Dri ling method: Rotary with bentonite

[illegible]

Borehole : PK2
Coordinates: KM 29+983
Elevation: 1.50 m
Drilling machine: XJ-100

Scale : 1/200
Coordinates: E= 1180295.00; N= 613734.00
Elevation of G.W.L: 0.2m

Drilling date: 19/10/2007 - 22/10/2007
Driller: NGUYỄN ĐỨC VIỆT
Supervisor: NGUYỄN MẠNH TUẤN
Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)						Symbol and depth of SPT			
								No of blow for each 15cm			N	SPT diagram					
								15 cm	15 cm	15 cm							
								10	20	30	40	>40					
2.0	K1	0.30		1.2		UD1 2.00 - 2.50	<u>Fill</u> : Clay brown grey, green grey, stiff	0	0	0	0				SPT1 2.50 - 2.95		
4.0	1a	-12.50	14.0	12.8		UD2 4.00 - 4.90	Fat CLAY (CH), green grey, very soft	0	0	0	0				SPT2 4.50 - 4.95		
6.0						UD3 6.00 - 6.50	Fat CLAY (CH), green grey, very soft	0	0	0	0				SPT3 6.50 - 6.95		
8.0						UD4 8.00 - 8.50	Fat CLAY (CH), green grey, very soft	0	0	0	0				SPT4 8.50 - 8.95		
10.0						UD5 10.00 - 10.50	Fat CLAY (CH), green grey, very soft, some thin sand layer, laminated	0	0	0	0				SPT5 10.50 - 10.95		
12.0						UD6 12.00 - 12.50	Fat CLAY (CH), green grey, very soft, some thin sand layer	0	0	0	0				SPT6 12.50 - 12.95		
14.0						UD7 14.00 - 14.50	Fat CLAY (CH), green grey, very soft	0	0	0	0				SPT7 14.50 - 14.95		
16.0	1b	-20.50	22.0	8.0		UD8 16.00 - 16.50	Fat CLAY (CH), green grey, very soft	0	0	0	0				SPT8 16.50 - 16.95		
18.0						UD9 18.00 - 18.50	Fat CLAY with sand (CH)s, green grey, very soft - soft	0	0	0	0				SPT9 18.50 - 18.95		
20.0						UD10 20.00 - 20.50	Fat CLAY (CH), green grey, very soft - soft	0	1	1	2				SPT10 20.50 - 20.95		
22.0						UD11 22.00 - 22.50	Lean CLAY green grey, brown grey, firm	2	3	3	6				SPT11 22.50 - 22.95		
24.0	2a	-23.10	24.6	2.6		UD12 23.50 - 24.00	Sandy Lean CLAY s(CL) green grey, brown grey, yellow grey, firm	3	4	4	8				SPT12 24.00 - 24.45		
26.0	3b	-23.10	45.4			From 24.6-25.4m: Silty SAND (SM), medium dense, with some silty clay, yellow grey. Silty SAND (SM), medium grained, medium dense	5	10	12	22				SPT13 26.00 - 26.45			
28.0						Silty SAND (SM), medium dense, yellow, medium dense	10	12	13	25				SPT14 28.00 - 28.45			
30.0						Silty SAND (SM), medium grained, yellow, medium dense	9	10	11	21				SPT15 30.00 - 30.45			
32.0						UD13 33.00 - 33.50	Clayey SAND, yellow grey	6	8	11	19				SPT16 32.00 - 32.45		
34.0						Clayey SAND with gravel (SC)g, yellow grey, light grey	6	15	18	31				SPT17 33.50 - 33.95			
36.0						Silty SAND (SM), fine to medium grained, yellow, dense	10	15	16	31				SPT18 35.50 - 35.95			
38.0						Silty SAND (SM), fine to medium grained, yellow, medium dense	6	14	15	29				SPT19 37.50 - 37.95			
40.0						Silty SAND (SM), fine to medium dense, yellow, dense	10	16	18	35				SPT20 39.50 - 39.95			
42.0						Silty SAND (SM), fine to medium dense, yellow, light yellow, dense	10	15	17	32				SPT21 41.50 - 41.95			
44.0						Silty SAND (SM), fine to medium grained, with some gravel, light yellow, light grey, dense	12	17	23	40				SPT22 43.50 - 43.95			

Borehole : BH3

Scale : 1/200

Drilling date: 22/06/2009 - 26/06/2009

Chainage : KM34 + 000

Coordinates: E= 1180921.22; N= 617917.29

Driller: HDANG NGHIA TAN

Elevation: 0.98 m

Elevation of G.W.L: 0.6m

Supervisor: TRINH MINH KHIEM

Drilling machine: XJ-100

Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)							Symbol and depth of SPT
								No of blow for each 15cm			N	SPT diagram			
								15 cm	15 cm	15 cm					
	TK1													10 20 30 40 >40	
2.0	1a	0.48	0.3 m	0.5		UD1 1.00 - 1.50	Topsoil: CLAY with roots, brown grey, green grey, firm	0	0	0	0		SPT1 1.50 - 1.95		
4.0		UD2 2.50 - 3.00		Fat CLAY with organic (CH), black grey, green grey, very soft		1	0	0	0	SPT2 3.00 - 3.45					
6.0	2a	-3.22	4.2	1.6	UD3 4.20 - 4.70	CLAY with laterite gravel s(CL), green grey, red brown, yellow brown, stiff	3	4	5	9	SPT3 4.70 - 5.15				
8.0		UD4 6.00 - 6.50	Sandy CLAY with some quartz gravel s(CL), green grey, yellow grey, stiff	3	5	6	11	SPT4 6.50 - 6.95							
10.0	2b	-4.82	5.8	5.7	UD5 7.50 - 8.00	Sandy CLAY with some quartz gravel s(CL), green grey, yellow grey, stiff	4	5	5	10	SPT5 8.00 - 8.45				
12.0		UD6 9.00 - 9.50	Sandy CLAY s(CL), yellow grey, green grey, stiff		4	5	7	12	SPT6 9.50 - 9.95						
14.0	3b	-10.52	11.5	32.1	UD7 10.50 - 11.00	Sandy CLAY s(CL), yellow grey, green grey, stiff	3	6	8	14	SPT7 11.00 - 11.45				
16.0		Silty CLAY (SM), green grey, white grey, medium dense	4		7	10	17	SPT8 12.50 - 12.95							
18.0		Silty SAND (SM), medium grained, with some quartz gravel, yellow grey, white grey, medium dense	5		8	10	18	SPT9 14.00 - 14.45							
20.0		Silty SAND (SM), coarse grained, with some quartz gravel, red brown, yellow brown, medium dense	5		7	13	20	SPT10 15.50 - 15.95							
22.0		Silty Clayey SAND(SC-SM), fine grained, yellow brown, medium dense	3		4	7	11	SPT11 17.00 - 17.45							
24.0		Silty Clayey SAND (SC-SM), medium grained, yellow brown, loose-medium dense	2		4	5	9	SPT12 18.50 - 18.95							
26.0		Silty Clayey SAND (SC-SM), medium grained, quartz gravel, yellow brown, medium dense	4		6	8	14	SPT13 20.00 - 20.45							
28.0		Clayey SAND (SC), yellow brown, red brown, medium dense	4		7	8	15	SPT14 21.50 - 21.95							
30.0		Clayey SAND (SC), fine grained, yellow brown, yellow grey, medium dense	4		6	7	13	SPT15 23.00 - 23.45							
32.0		Silty Clayey SAND (SC-SM), fine grained, some quartz gravel, yellow brown, yellow grey, medium dense	4		6	7	13	SPT16 24.50 - 24.95							
34.0		Silty Clayey SAND (SC-SM), medium grained, some quartz gravel, yellow brown, yellow grey, medium dense	4		7	11	18	SPT17 26.00 - 26.45							
36.0		Silty SAND (SM), fine grained, yellow brown, medium dense	3		5	6	11	SPT18 27.50 - 27.95							
38.0		Silty SAND (SM), coarse grained, some quartz gravel, yellow brown, yellow grey, medium dense	4		7	8	15	SPT19 29.00 - 29.45							
40.0		Silty SAND (SP-SM), coarse grained, some quartz gravel, yellow brown, yellow grey, medium dense	5		7	10	17	SPT20 30.50 - 30.95							
42.0		Silty SAND (SP-SM), medium grained, some quartz gravel, yellow brown, yellow grey, medium dense	7		10	11	21	SPT21 32.00 - 32.45							
44.0		Silty SAND (SW-SM) with quartz gravel, coarse grained, yellow brown, yellow grey, medium dense	6		9	11	20	SPT22 33.50 - 33.95							
46.0		Silty SAND (SW-SM) with quartz gravel, coarse grained, yellow brown, yellow grey, medium dense	7		8	9	17	SPT23 35.00 - 35.45							
48.0		Silty SAND (SP-SM) with quartz gravel, coarse grained, yellow brown, yellow grey, medium dense	7		9	10	19	SPT24 36.50 - 36.95							
50.0		Silty SAND (SP-SM) with quartz gravel, coarse grained, yellow brown, yellow grey, medium dense	5		7	11	18	SPT25 38.00 - 38.45							
52.0		Silty SAND (SP-SM) with quartz gravel, coarse grained, yellow brown, yellow grey, medium dense	5		6	7	13	SPT26 39.50 - 39.95							
54.0		Sandy CLAY with gravel s(CL), yellow brown, yellow grey, medium dense	5		7	9	16	SPT27 41.00 - 41.45							
56.0			7		8	11	19	SPT28 42.00 - 42.45							
58.0		TK2	-42.62		43.6	1.8	D1 43.70 - 44.00								

Borehole : NG
Coordinates : KM 49+995
Elevation : 2.00 m
Drilling machine : XJ-100

Scale : 1/200
Coordinates: E= 1179245.00; N= 633396.00
Elevation of G.W.L: 0.4m

Drilling date: 03/11/2007 - 06/11/2007
Driller: NGUYỄN ĐỨC VIỆT
Supervisor: NGUYỄN MẠNH TUẤN
Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)						
								No of blow for each 15cm			N	SPT diagram	Symbol and depth of SPT	
								15 cm	15 cm	15 cm				
								15 cm	15 cm	15 cm		10 20 30 40 >40		
2.0	K2	-2.80	1.60 m	4.8			Silty SAND (SM), fine grained, light grey, loose.	2	3	4	7		SPT1 1.50 - 1.95	
4.0							Silty SAND (SM), fine grained, light grey, loose.	3	4	5	9		SPT2 3.50 - 3.95	
6.0	2a	-2.80	4.8	18.8		UD1 5.50 - 6.00	Fat CLAY (CH), yellow grey, brown grey, green grey, firm.	1	3	4	7		SPT3 6.00 - 6.45	
8.0						UD2 7.50 - 8.00	Fat CLAY (CH), green grey, firm	2	3	3	6		SPT4 8.00 - 8.45	
10.0						UD3 9.50 - 10.00	Fat CLAY (CH), green grey, firm	2	3	4	7		SPT5 10.00 - 10.45	
12.0						UD4 11.50 - 12.00	Fat CLAY (CH), green grey, firm.	3	4	4	8		SPT6 12.00 - 12.45	
14.0						UD5 13.50 - 14.00	Fat CLAY (CH), green grey, firm to stiff	3	4	6	10		SPT7 14.00 - 14.45	
16.0						UD6 15.50 - 16.00	Fat CLAY (CH), yellow grey, green grey, firm to stiff	2	4	5	9		SPT8 16.00 - 16.45	
18.0						UD7 17.50 - 18.00	Lean CLAY with sand (CL)s, yellow grey, yellow, silty.	4	7	9	16		SPT9 18.00 - 18.45	
20.0						UD8 19.50 - 20.00	Lean CLAY (CL), green gray to dark gray, firm.	1	2	3	5		SPT10 20.00 - 20.45	
22.0	3b	-19.40	21.4	28.3			Silty SAND (SM), coarse grained, yellow grey, light grey, medium dense.	4	6	7	13		SPT11 22.00 - 22.45	
24.0							Silty SAND (SM), coarse grained, brown yellow grey, light red brown, medium dense.	3	7	8	15		SPT12 24.00 - 24.45	
26.0							Silty SAND (SM), fine grained, light yellow, light grey, medium dense.	6	8	10	18		SPT13 26.00 - 26.45	
28.0							Silty SAND (SM), medium grained, light yellow, light grey, medium dense.	5	7	9	16		SPT14 28.00 - 28.45	
30.0							Silty SAND (SM), medium grained, light grey, medium dense.	6	7	10	17		SPT15 30.00 - 30.45	
32.0							Silty SAND (SM), medium grained, light grey, medium dense	4	6	8	14		SPT16 32.00 - 32.45	
34.0							Silty SAND (SM), medium grained, light grey, light yellow, medium dense	5	6	8	14		SPT17 34.00 - 34.45	
36.0							Silty SAND (SM), medium grained, light grey, light yellow, medium dense.	5	8	9	17		SPT18 36.00 - 36.45	
38.0							Silty SAND (SM), medium grained, light grey, light yellow, medium dense.	5	8	10	18		SPT19 38.00 - 38.45	
40.0							Silty SAND (SM), medium grained, light grey, light yellow, medium dense.	6	8	9	17		SPT20 40.00 - 40.45	
42.0							Silty SAND (SM), medium grained, light grey, light yellow, medium dense.	10	11	14	25		SPT21 42.00 - 42.45	
44.0														

Appendix: 3
Sheet: 19

Scale : 1/200
Coordinates: E= 1179245.00; N= 633396.00
Elevation of G.W.L: 0.4m

Dri ling date: 03/11/2007 - 06/11/2007
Dri ler: NGUYỄN ĐỨC VIỆT
Supervisor: NGUYỄN MẠNH TUẤN
Dri ling method: Rotary with bentonite

[illegible]

Borehole : BH6
 Drainage : KM52+293
 Elevation : 1.86 m
 Drilling machine : XJ-100

Scale : 1/200
 Coordinates : E= 1180373.26; N= 635397.94
 Elevation of G.W.L: 0.96m

Drilling date: 02/07/2009-05/07/2009
 Driller: HDANG NGHIA TAN
 Supervisor: TRINH MINH KHIEM
 Drilling method: Rotary with bentonite

Depth (m)	Layer name	Elevation (m)	Layer depth(m)	Layer thickness(m)	PROFILE	Symbol and depth of sample	DESCRIPTIONS	STANDARD PENETRATION TEST (SPT)						Symbol and depth of SPT
								No of blow for each 15cm			N	SPT diagram		
								15 cm	15 cm	15 cm				
								10	20	30	40	>40		
2.0	K	0.86	0.9 m	1.0		UD1	FILL: Clay with some organic, blackish grey, soft to limon	1	0	0	0			SPT1 1.50 - 1.95
4.0	1a			14.0		UD2	Fat CLAY (CH), with some organic, blackish grey, very soft	0	0	0	0			SPT2 3.00 - 3.45
						UD3	Fat CLAY (CH), with some organic, blackish grey, very soft	0	0	0	0			SPT3 4.50 - 4.95
						UD4	Fat CLAY (CH), with some organic, blackish grey, very soft	0	0	0	0			SPT4 6.00 - 6.45
						UD5	Fat CLAY (CH), with some organic, blackish grey, very soft	0	0	0	0			SPT5 7.50 - 7.95
						UD6	Fat CLAY (CH), with some organic, blackish grey, very soft	0	0	0	0			SPT6 9.00 - 9.45
						UD7	Fat CLAY (CH), with some organic, blackish grey, very soft	0	0	1	1			SPT7 10.50 - 10.95
						UD8	Fat CLAY (CH), with some organic, greenish grey, very soft	0	0	1	1			SPT8 12.00 - 12.45
						UD9	Fat CLAY (CH), with some organic, greenish grey, very soft	0	0	1	1			SPT9 14.00 - 14.45
						UD10	Fat CLAY (CH), with some organic, greenish grey, very soft	0	0	1	1			SPT10 15.50 - 15.95
						UD11	Fat CLAY (CH), with some organic, greenish grey, very soft	0	0	1	1			SPT11 17.00 - 17.45
16.0	TK1	-13.24 -13.74	15.0 15.6	0.6		UD12	Sandy CLAY (CL), yellowish grey, whitish grey, stiff	3	4	5	9			SPT12 19.00 - 19.45
18.0	3a			3.0		UD13	Silty SAND (SM), fine grained, whitish grey, loose, saturated	2	3	5	8			SPT13 20.50 - 20.95
20.0	TK2	-16.74 -17.24	18.6 19.1	0.5		UD14	Lean CLAY (CL), whitish grey, stiff	2	3	5	8			SPT14 22.00 - 22.45
22.0	3b			6.0			Silty SAND (SM), fine grained, whitish grey, loose	5	7	10	17			SPT15 23.50 - 23.95
							Silty SAND (SM), coarse grained, whitish grey, medium dense	6	7	9	16			SPT16 25.00 - 25.45
							Silty SAND (SM), coarse grained, whitish grey, medium dense	6	7	9	16			SPT17 26.50 - 26.95
							Silty SAND (SM), coarse grained, whitish grey, medium dense	6	8	12	20			SPT18 28.00 - 28.45
26.0	TK2	-23.24 -25.64	25.1 27.5	2.4		UD15	CLAY with Sand (CL)s, greenish grey, very stiff	7	10	12	22			SPT19 29.50 - 29.95
28.0	3b			4.3			Silty Clayey SAND (SC-SM), medium grained with some gravel quartz, whitish grey, yellowish grey, medium dense	7	8	11	20			SPT20 31.00 - 31.45
							Silty Clayey SAND (SC-SM), fine medium with some gravel quartz, whitish grey, medium dense	6	10	12	22			SPT21 32.50 - 32.95
							Silty Clayey (SC-SM), fine medium with some gravel quartz, whitish grey, medium dense	7	10	11	21			SPT22 34.00 - 34.45
							Fat CLAY with sand (CH)s, greenish grey, very stiff	10	13	18	31			SPT23 35.50 - 35.95
34.0	3b			5.2			Silty SAND (SM) fine to medium grained with some gravel quartz, whitish grey, dense	9	14	18	32			SPT24 37.00 - 37.45
							Silty SAND (SM), fine to medium grained with some gravel quartz, whitish grey, dense	9	13	18	31			SPT25 38.50 - 38.95
							Silty SAND (SM), fine to medium grained with some gravel quartz, whitish grey, dense	12	16	20	36			SPT26 39.50 - 39.95
38.0	5			3.2		UD16	Elastic SILTY (MH), yellowish brow, greenish grey, hard	15	24	26	>50			SPT27 40.50 - 41.25
						UD17	Lean CLAY (CL), yellowish brow, greenish grey, hard	12	24	30	>50			SPT28 41.50 - 42.05
						UD18	Lean CLAY (CL), yellowish brow, greenish grey, hard	20	30	35	>50			SPT29 42.50 - 43.45
						UD19	Lean CLAY (CL), yellowish brow, greenish grey, hard	20	30	35	>50			SPT30 43.50 - 44.45
42.0	6a			3.3		RI	Phyllite rock highly weathered, highly fractured, with clay, yellowish brow.	From 41.1m - 42.8m (RQD: 5%, ICR: 20%)						SPT31 44.50 - 45.45
44.0							Phyllite rock highly weathered, highly fractured, some clay, yellowish brow, greenish grey, hard	From 42.8m - 44.3m (RQD: 0%, ICR: 25%)						

**ADDITIONAL BORING LOGS HAVE
PROVIDED BY VEC
(29TH OCTOBER 2009)**

Phụ lục :
Tờ :

Ngày khoan: 25/9/2009
 Tổ trưởng: **NGUYỄN NGỌC DŨNG**
 Kỹ sư giám sát: **VÕ VĂN BÌNH**
 Phương pháp khoan: Xoay sử dụng bentonit

[illegible]

Phụ lục :
Tờ :

Ngày khoan: 21/9/2009
 Tổ trưởng: NGUYỄN NGỌC THẠCH
 Kỹ sư giám sát: PHẠM ĐẮC KIỀM
 Phương pháp khoan: Xoay sử dụng bentonit

[illegible]

Phụ lục :
Tờ :

Ngày khoan: 21/9/2009
 Tổ trưởng: **NGUYỄN NGỌC THẠCH**
 Kỹ sư giám sát: **PHẠM ĐẮC KIÊM**
 Phương pháp khoan: Xoay sử dụng bentonit

[illegible]

Công trình : ĐƯỜNG Ô TÔ CAO TỐC BẾN LÚC - NHƠN TRẠCH - LONG THÀNH

Phụ lục :
Tổ :

Lỗ khoan : **FL-ĐĐT** Tỷ lệ : 1/200
Lý trình : **KM6+300** Tọa độ: N= 1178194,677; E= 591890,607
Cao độ : **0.59 m**
Máy khoan : **XJ-100**

Ngày khoan: 22/9/2009-25/9/2009
Tổ trưởng: **NGUYỄN ĐỨC CÔNG**
Kỹ sư giám sát: **NGUYỄN MẠNH TUẤN**
Phương pháp khoan: Xoay sử dụng bentonit

Độ sâu (m)	Tên lớp	Cao độ (m)	Độ sâu lớp (m)	Bề dày lớp (m)	TRU CẮT	Số hiệu và độ sâu mẫu	MÔ TẢ	THÍ NGHIỆM XUYỀN TIÊU CHUẨN (SPT)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
								Số búa ứng với mỗi 15cm			N	Biểu đồ SPT	Số hiệu và độ sâu SPT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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Phụ lục :
Tờ :

Ngày khoan: 22/9/2009-25/9/2009
 Tổ trưởng: NGUYỄN ĐỨC CÔNG
 Kỹ sư giám sát: NGUYỄN MẠNH TUẤN
 Phương pháp khoan: Xoay sử dụng bentonit

[illegible]

Phụ lục :
[0 -

Ngày khoan: 23/9/2009-26/9/2009
 Tổ trưởng: HỒNG TUẤN MINH
 Kỹ sư giám sát: PHAN LONG
 Phương pháp khoan: Xọc sử dụng bentonit

Độ sâu (m)	Tên lớp	Cao độ (m)	Độ sâu lớp (m)	Bề dày lớp (m)	TRỤ CẮT	Số hiệu và độ sâu mẫu	MÔ TẢ	THÍ NGHIỆM XUYÊN TIÊU CHUẨN (SPT)								
								Số búa rơi với mỗi 15cm			N	Biểu đồ SPT	Số hiệu và độ sâu SPT			
								15 cm	15 cm	15 cm						
	K1	1.77	0.5	0.5			ĐẤT ĐÁP nền đường lẫn sỏi sạn									
2.0	1a		0.5	22.5		UD1	Bùn sét màu xám xanh, xám nhạt	0	0	0	0				SPT1	2.50 - 2.95
4.0						UD2	Bùn sét màu xám xanh, xám nhạt	0	0	0	0				SPT2	4.50 - 4.95
6.0						UD3	Bùn sét màu xám xanh, xám nhạt	0	0	1	1				SPT3	6.50 - 6.95
8.0						UD4	Bùn sét màu xám xanh, xám nhạt	0	0	1	1				SPT4	8.50 - 8.95
10.0						UD5	Bùn sét màu xám xanh, xám nhạt	0	0	1	1				SPT5	10.50 - 10.95
12.0						UD6	Bùn sét màu xám xanh, xám nhạt	0	0	1	1				SPT6	12.50 - 12.95
14.0						UD7	Bùn sét màu xám xanh, xám nhạt	0	0	1	1				SPT7	14.50 - 14.95
16.0						UD8	Bùn sét màu xám xanh, xám nhạt	0	0	1	1				SPT8	16.50 - 16.95
18.0						UD9	Bùn sét màu xám xanh, xám nhạt, lẫn ít hữu cơ	0	0	1	1				SPT9	18.50 - 18.95
20.0						UD10	Bùn sét màu xám xanh, xám nhạt, lẫn ít hữu cơ	0	0	1	1				SPT10	20.50 - 20.95
22.0						UD11	Bùn sét màu xám xanh, xám nhạt, lẫn ít hữu cơ	0	0	1	1				SPT11	22.50 - 22.95
24.0	2b	-21.28	23.0	4.4		UD12	SÉT CÁT màu xám xanh, nâu vàng, dẻo cứng	6	7	8	15				SPT12	24.50 - 24.95
26.0			UD13	SÉT CÁT màu xám xanh, nâu vàng, nửa cứng	8	8	9	17				SPT13	26.40 - 26.85			
28.0	3b	-25.68	27.4	1.6		UD14	SÉT CÁT màu nâu đỏ, nâu vàng, xám xanh, chặt	14	15	16	31				SPT14	28.40 - 28.85
30.0		-27.28	29.0	21.8		D1	CÁT màu nâu vàng lẫn sỏi sạn thạch anh, kết cấu chặt	13	16	19	35				SPT15	30.30 - 30.75
32.0			D2	CÁT hạt nhỏ, hạt mịn màu xám trắng, kết cấu chặt vừa	4	5	7	12				SPT16	32.30 - 32.75			
34.0			D3	CÁT hạt nhỏ màu xám trắng, kết cấu chặt vừa	4	6	7	13				SPT17	34.30 - 34.75			
36.0			D4	CÁT hạt nhỏ màu xám trắng, kết cấu chặt vừa	4	6	6	12				SPT18	36.30 - 36.75			
38.0			D5	CÁT hạt nhỏ màu xám trắng, kết cấu chặt vừa	6	7	7	14				SPT19	38.30 - 38.75			
40.0			D6	CÁT hạt nhỏ màu xám trắng, kết cấu chặt vừa	6	7	8	15				SPT20	40.30 - 40.75			
42.0		D7	CÁT hạt trung - thô lẫn sỏi sạn, màu nâu vàng, kết cấu chặt	9	16	18	34				SPT21	42.30 - 42.75				
44.0																

Công trình : ĐƯỜNG Ô TÔ CAO TỐC BẾN LÚC - NHƠN TRẠCH - LONG THÀNH

Phụ lục :
[0 -

Lỗ khoan : BR-BK1 Tỷ lệ : 1/200
 Lý trình : KM22+545 Tọa độ : N=
 Cao độ : 0.81 m
 Máy khoan : XU-100

Ngày khoan: 3/10/2009-5/10/2009
 Tổ trưởng:
 Kỹ sư giám sát:
 Phương pháp khoan: Xoay sử dụng bentonit

Độ sâu (m)	Tên lớp	Cao độ (m)	Độ sâu lớp(m)	Bề dày lớp(m)	TRỤ CẮT	Số hiệu và độ sâu mẫu	MÔ TẢ	THÍ NGHIỆM XUYÊN TIÊU CHUẨN (SPT)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
								Số đũa đập với mỗi 15cm			N	Biểu đồ SPT	Số hiệu và độ sâu SPT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Phụ lục :
[0 -

Ngày khoan: 3/10/2009-5/10/2009
Tổ trưởng:
Kỹ sư giám sát:
Phương pháp khoan: Xoay sử dụng bentonit

[illegible]

Lỗ khoan : BR-BK3
Lý trình : KM24+284
Cao độ : 0.43 m
Máy khoan : XU-100

Tỷ lệ : 1/200
Tọa độ : N= 1178662,77; E= 608885,494

Ngày khoan: 7/10/2009
Tổ trưởng:
Kỹ sư giám sát:
Phương pháp khoan: Xoay sử dụng bentonit

Độ sâu (m)	Tên lớp	Cao độ (m)	Độ sâu lớp (m)	Bề dày lớp (m)	TRU CÁT	Số hiệu và độ sâu mẫu	MÔ TẢ	THÍ NGHIỆM XUYÊN TIÊU CHUẨN (SPT)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
								Số lần đập với mũi 15cm			N	Biểu đồ SPT	Số hiệu và độ sâu SPT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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Phụ lục :
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Ngày khoan: 7/10/2009
Tổ trưởng:
Kỹ sư giám sát:
Phương pháp khoan: Xoay sử dụng bentonit

[illegible]

Phụ lục :
[0 -

Ngày khoan: 4/10/2009-10/10/2009
 Tổ trưởng:
 Kỹ sư giám sát: TRẦN KHẮC CƯỜNG
 Phương pháp khoan: Xoay sử dụng bentonit

Độ sâu (m)	Tên lớp	Cao độ (m)	Độ sâu lớp(m)	Bề dày lớp(m)	TRỤ CẮT	Số hiệu và độ sâu mẫu	MÔ TẢ	THÍ NGHIỆM XUYÊN TIÊU CHUẨN (SPT)									
								Số lần đập với mỗi 15cm			N	Biểu đồ SPT	Số hiệu và độ sâu SPT				
								15 cm	15 cm	15 cm							
												10	20	30	40	≥50	
2.0	1a	-31.20	27.0	27.0		UD1 2.00 - 2.80	Bùn sét màu xám đen, xám xanh	0	0	0	0		SPT1 2.80 - 3.25				
4.0						UD2 4.00 - 4.80		0	0	0	0		SPT2 4.80 - 5.25				
6.0						UD3 6.00 - 6.80		0	0	0	0		SPT3 6.80 - 7.25				
8.0						UD4 8.00 - 8.80		0	0	0	0		SPT4 8.80 - 9.25				
10.0						UD5 10.00 - 10.80		0	0	0	0		SPT5 10.80 - 11.25				
12.0						UD6 12.00 - 12.80		0	0	0	0		SPT6 12.80 - 13.25				
14.0						UD7 14.00 - 14.80		0	0	1	1		SPT7 14.80 - 15.25				
16.0						UD8 16.00 - 16.80		0	0	1	1		SPT8 16.80 - 17.25				
18.0						UD9 18.00 - 19.80		0	0	1	1		SPT9 18.80 - 19.25				
20.0						UD10 20.00 - 20.50		1	1	2	3		SPT10 20.50 - 20.95				
22.0						UD11 22.00 - 22.50		1	1	2	3		SPT11 22.50 - 22.95				
24.0						UD12 24.00 - 24.50		1	1	2	3		SPT12 24.50 - 24.95				
26.0	2b	-31.20	27.0	21.7		UD13 26.00 - 26.50	Bùn sét màu xám đen, xám xanh	1	2	2	4	SPT13 26.50 - 26.95					
28.0						UD14 28.00 - 28.30		10	18	16	29	SPT14 28.30 - 28.75					
30.0						UD15 30.00 - 30.30		9	14	18	32	SPT15 30.30 - 30.75					
32.0						UD16 32.00 - 32.30		8	15	20	35	SPT16 32.30 - 32.75					
34.0						UD17 34.00 - 34.30		11	16	20	36	SPT17 34.30 - 34.75					
36.0						UD18 36.00 - 36.30		9	15	18	33	SPT18 36.30 - 36.75					
38.0						UD19 38.00 - 39.30		12	16	21	37	SPT19 38.30 - 38.75					
40.0						UD20 40.00 - 40.30		9	13	19	32	SPT20 40.30 - 40.75					
42.0						UD21 42.00 - 42.30		11	16	18	34	SPT21 42.30 - 42.75					
44.0																	

HÌNH TRƯ LỒ KHOAN

LỒ KHOAN : BR-OK01

TOẠ ĐỘ LỒ KHOAN :

X : 1180877.47

Y : 618167.64

MỨC NƯỚC DƯỚI ĐẤT : XUẤT HIỆN : 0.000 M

ỔN ĐỊNH : 0.000 M

CAO ĐỘ LỒ KHOAN : 2.760 M

TỶ LỆ : 1:200

NGÀY KHỞI CÔNG : 18/9/2009





































LÝ TRÌNH : KM 34+620.0

TRÁI :

TÌM : 0.00 M

PHẢI :

NGÀY HOÀN THÀNH : 21/9/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐỊA TẢNG	THI NGHIỆM SPT										Số hiệu mẫu Độ sâu mẫu (m)
						Độ sâu (m)	Số búa 15 cm			N / 30 cm	Đồ thị SPT					
							N1	N2	N3		0	10	20	30	40	
1a	0.54	3.30	3.30			Bùn sét, màu xám xanh, xám đen	2.00 2.45	0	0	0	0		UD1 1.40-2.00			
2			4.10			Sét pha, màu xám trắng, nâu đỏ, dẻo mềm - dẻo cứng	4.00 4.45 6.00 6.45	0	0	1	1		UD2 3.40-4.00 UD3 5.80-6.00			
3a	-4.64	7.40	15.40			Cát sét, màu nâu vàng, xám trắng	8.00 8.45	4	7	9	16		D4 7.80-8.00			
						Cát sét, màu nâu vàng, xám trắng	10.00 10.45	5	8	10	18		D5 9.80-10.00			
						Cát sét, màu nâu vàng, xám trắng	12.00 12.45	4	8	10	18		D6 11.80-12.00			
						Cát sét, màu nâu vàng, xám trắng	14.00 14.45	4	8	11	19		D7 13.80-14.00			
						Cát sét, màu nâu vàng, xám trắng	16.00 16.45	5	9	12	21		D8 15.80-16.00			
						Cát sét, màu nâu vàng, xám trắng	18.00 18.45	6	8	13	21		D9 17.80-18.00			
						Cát sét, màu nâu vàng, xám trắng	20.00 20.45	6	9	14	23		D10 19.80-20.00			
							22.00 22.45	6	8	12	20		D11 21.80-22.00			
TK1	-20.04	22.80	2.90			Sét màu nâu đỏ, xám trắng, trạng thái nửa cứng	24.00 24.45	4	7	9	16		UD12 23.80-24.00			
3b	-22.94	25.70	6.80			Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	26.00 26.45	5	8	10	18		UD13 25.80-26.00			
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	28.00 28.45	5	9	12	21		D14 27.80-28.00			
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	30.00 30.45	6	11	14	25		D15 29.80-30.00			
3u	-29.74	32.50	4.80			Cát sét, màu nâu vàng, xám trắng	32.00 32.45	6	12	16	28		D16 31.80-32.00			
						Cát sét, màu nâu vàng, xám trắng	34.00 34.45	7	11	17	28		D17 33.80-34.00			
TK2	-34.54	37.30	3.30			Sét màu nâu vàng, xám trắng, trạng thái nửa cứng	36.00 36.45	7	12	17	29		D18 35.80-36.00			
							38.00 38.45	6	10	14	24		UD19 37.80-38.00			
3c	37.84	40.60	3.30			Sét màu nâu vàng, xám trắng, trạng thái nửa cứng	40.00 40.45	6	11	14	25		UD20 39.80-40.00			
							42.00 42.45	9	12	21	33		D21 41.80-42.00			

HÌNH TRƯ LỖ KHOAN

LỖ KHOAN : BR-OK01

TOẠ ĐỘ LỖ KHOAN :

X : 1180877.47

Y : 618167.64

MỨC NƯỚC DƯỚI ĐẤT : XUẤT HIỆN : 0.000 M

ỔN ĐỊNH : 0.000 M

CAO ĐỘ LỖ KHOAN : 2.760 M

TỶ LỆ : 1/200

NGÀY KHỞI CÔNG : 18/9/2009

LÝ TRÌNH : KM 34+620.0

TRÁI :

TÌM : 0.00 M

PHẢI :

NGÀY HOÀN THÀNH : 21/9/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐỊA TẢNG	THI NGHIỆM SPT										Số hiệu mẫu Độ sâu mẫu (m)					
						Độ sâu (m)	Số búa 15 cm			N / 30 cm	Đồ thị SPT										
							N1	N2	N3		0	10	20	30	40		50				
3c	-73.24	76.00	35.40		Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	44.00 44.45	9	12	24	36								D22 43.80-44.00			
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	46.00 46.45	9	13	23	36										D23 45.80-46.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	48.00 48.45	9	13	24	37										D24 47.80-48.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	50.00 50.45	9	11	20	31										D25 49.80-50.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	52.00 52.45	8	14	24	38										D26 51.80-52.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	54.00 54.45	10	15	25	40										D27 53.80-54.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	56.00 56.45	10	14	21	35										D28 55.80-56.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	58.00 58.45	10	16	22	38										D29 57.80-58.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	60.00 60.45	10	16	23	39										D30 59.80-60.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	62.00 62.45	10	16	26	42										D31 61.80-62.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	64.00 64.45	11	16	28	44										D32 63.80-64.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	66.00 66.45	12	17	25	42										D33 65.80-66.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	68.00 68.45	12	18	27	45										D34 67.80-68.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	70.00 70.45	17	25	32	>50										D35 69.80-70.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	72.00 72.45	19	27	35	>50										D36 71.80-72.00	
					Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	74.00 74.45	22	28	37	>50										D37 73.80-74.00	
						76.00 76.45	25	31	38	>50											D38 75.80-76.00

HÌNH TRƯ LỖ KHOAN

LỖ KHOAN : BR-OK02 TOA ĐỘ LỖ KHOAN :

X : 1180919.53

Y : 61R499,54

MỨC NƯỚC DƯỚI ĐẤT : XUẤT HIỆN : 0,000 M

ỔN ĐỊNH : 0.000 M

CAO ĐỘ LỖ KHOAN : 0,530 M TỶ LỆ: 1:200

NGÀY KHỞI CÔNG : 23/9/2009



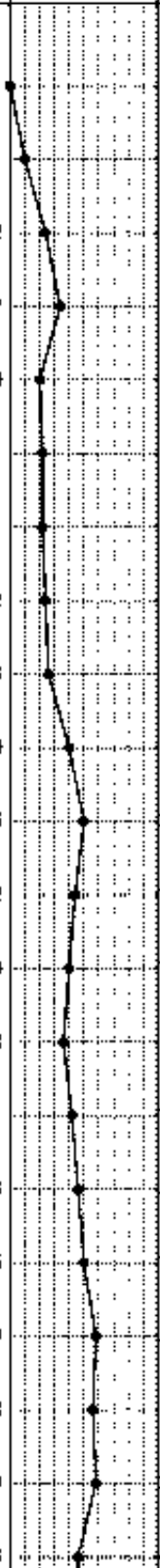






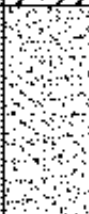

LÝ TRÌNH : KM 35+200.0

TRÁI:

TIME: 0.00 M

PHAL:

NGÀY HOÀN THÀNH : 25/9/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐỊA TẦNG	THI NGHIỆM SPT										Số hiệu mẫu	Độ sâu mẫu (m)
						Độ sâu (m)	Số búa 15 cm			N / 30 cm	Đồ thị SPT						
							N1	N2	N3		0	10	20	30	40		
1a	2.77	3.30	1.30			Bùn sét, màu xám xanh, xám đen	2.00 2.45	0	0	0	0		UD1 1.40-2.00				
2			5.40			Sét pha, màu xám trắng, nâu đỏ, dẻo mềm - dẻo cứng	4.00 4.45	1	2	3	5		UD2 3.20-4.00				
3b	8.17	8.70	26.10			Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	6.00 6.45	4	5	7	12		UD3 5.80-6.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	8.00 8.45	5	7	10	17		UD4 7.80-8.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	10.00 10.45	3	4	6	10		D5 9.80-10.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	12.00 12.45	3	4	7	11		D6 11.80-12.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	14.00 14.45	4	5	6	11		D7 13.80-14.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	16.00 16.45	4	5	7	12		D8 15.80-16.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	18.00 18.45	3	6	7	13		D9 17.80-18.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	20.00 20.45	7	9	11	20		D10 19.80-20.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	22.00 22.45	5	10	15	25		D11 21.80-22.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	24.00 24.45	5	9	13	22		D12 23.80-24.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	26.00 26.45	4	8	12	20		D13 25.80-26.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	28.00 28.45	4	8	10	18		D14 27.80-28.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	30.00 30.45	5	9	12	21		D15 29.80-30.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	32.00 32.45	5	10	13	23		D16 31.80-32.00				
TK2	34.27	34.80	2.20			Sét màu nâu vàng, xám trắng, trạng thái nửa cứng	34.00 34.45	6	11	14	25		D17 33.80-34.00				
						36.00 36.45	8	12	17	29	D18 35.80-36.00						
3b	36.47	37.00	30.00			Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	38.00 38.45	8	11	17	28		D19 37.80-38.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	40.00 40.45	9	12	17	29		D20 39.80-40.00				
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	42.00 42.45	9	10	13	23		D21 41.80-42.00				

HÌNH TRƯ LỖ KHOAN

LỖ KHOAN : BR-OK02 TOA ĐỘ LỖ KHOAN :

X : 1180919.53

Y : 61R499,54

MỨC NƯỚC DƯỚI ĐẤT : XUẤT HIỆN : 0.000 M

ỔN ĐỊNH : 0.000 M

CAO ĐỘ LỖ KHOAN : 0,530 M TỶ LỆ: 1:200

NGÀY KHỞI CÔNG : 23/9/2009







LÝ TRÌNH : KM 35+200.0

TRÁI:

TIME : 0.00 M

PH₂I :

NGÀY HOÀN THÀNH : 25/9/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐỊA TẦNG	THI NGHIỆM SPT										Số hiệu mẫu	Độ sâu mẫu (m)			
						Độ sâu (m)	Số búa 15 cm			N / 30 cm	Đồ thị SPT									
							N1	N2	N3		0	10	20	30	40			50		
3b	-66.47	67.00	30.00			Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>44.00</u> 44.45	9	11	13	24							D22	43.80-44.00	
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>46.00</u> 46.45	10	11	13	24								D23	45.80-46.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>48.00</u> 48.45	10	12	14	26								D24	47.80-48.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>50.00</u> 50.45	10	11	14	25								D25	49.80-50.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>52.00</u> 52.45	9	12	15	27								D26	51.80-52.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>54.00</u> 54.45	10	13	15	28								D27	53.80-54.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>56.00</u> 56.45	10	14	17	31								D28	55.80-56.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>58.00</u> 58.45	11	15	17	32								D29	57.80-58.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>60.00</u> 60.45	11	16	18	34								D30	59.80-60.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>62.00</u> 62.45	12	16	19	35								D31	61.80-62.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>64.00</u> 64.45	13	17	19	36								D32	63.80-64.00
						Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	<u>66.00</u> 66.45	13	17	20	37								D33	65.80-66.00
3c	-70.67	71.20	4.20			Cát hạt mịn đến hạt trung, nâu hồng, xám trắng, rất chặt	<u>68.00</u> 68.45	20	30	35	>50						D34	67.80-68.00		
							<u>70.00</u> 70.45	15	17	25	42							D35	69.80-70.00	
4b	-77.47	78.00	6.00			Sét cát, màu nâu đỏ, trạng thái cứng	<u>72.00</u> 72.45	9	15	17	32						UD36	71.80-72.00		
						Sét cát, màu nâu đỏ, trạng thái cứng	<u>74.00</u> 74.45	10	16	20	36							UD37	73.80-74.00	
						Sét cát, màu nâu đỏ, trạng thái cứng	<u>76.00</u> 76.45	12	17	21	38							UD38	75.80-76.00	
							<u>78.00</u> 78.45	10	15	21	36							UD39	77.80-78.00	

HÌNH TRU LỖ KHOAN

LỖ KHOAN : BR-TV02

TOA ĐỘ LỖ KHOAN :

X: 1180515.20

Y : 635402.37

MỨC NƯỚC DƯỚI ĐẤT : $\frac{\text{XUẤT HIỆN : 0.000 M}}{2}$

ÖN DENEY: 0,000 M

CAO ĐỘ LỖ KHOAN : -3.34M

TỶ LỆ: 1/200

NGÀY KHỞI CÔNG : 2/10/2009

LÝ TRÌNH : KM 52+932.5

TRÁE :

TIM : 0.00 M

PEIA :

NGÀY HOÀN THÀNH : 9/10/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐỊA TẦNG	THI NGHIỆM SPT										Số hiệu mẫu	Độ sâu mẫu (m)
						Độ sâu (m)	Số búa 15 cm			Đồ thị SPT							
							N1	N2	N3								
1a	-18.20	14.80	14.80		Bùn sét, màu xám xanh, xám đen	2.00	0	0	0	0		UD1	1.40-2.00				
						2.45	0	0	0	0		UD2	2.40-2.45				
						4.00	0	0	0	0		UD3	3.40-4.00				
						4.45	0	0	0	0		UD4	4.40-4.45				
						6.00	0	0	0	0		UD5	5.40-6.00				
						6.45	0	0	0	0		UD6	6.40-6.45				
						8.00	0	0	0	0		UD7	7.40-8.00				
2	-24.60	21.20	6.40		Sét pha, màu xám trắng, nâu đỏ, dẻo mềm - dẻo cứng	10.00	0	0	0	0	UD8	9.40-10.00					
						10.45	0	0	0	0	UD9	10.40-10.45					
						12.00	0	0	0	0	UD10	11.40-12.00					
3b	-27.90	24.50	3.30		Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	14.00	0	0	0	0	UD11	13.40-14.00					
						14.45	0	0	0	0	UD12	14.40-14.45					
TK1	-30.60	27.20	2.70		Sét màu nâu đỏ, xám trắng, trạng thái nửa cứng	16.00	2	2	3	5	UD13	15.80-16.00					
						16.45	4	5	7	12	UD14	16.40-16.45					
3a	33.60	33.20	6.60		Cát sét, màu nâu vàng, xám trắng	18.00	4	5	7	12	UD15	17.80-18.00					
						18.45	5	6	7	13	UD16	18.40-18.45					
						20.00	5	6	7	13	UD17	19.80-20.00					
						20.45	5	6	7	13	UD18	20.40-20.45					
4b	44.70	41.30	8.40		Sét cát, màu nâu đỏ, trạng thái cứng	22.00	6	8	10	18	UD19	21.80-22.00					
						22.45	6	9	12	21	UD20	22.40-22.45					
						24.00	10	14	18	32	UD21	23.80-24.00					
						24.45	10	14	18	32	UD22	24.40-24.45					
6a	47.20	44.00	2.70		Đá Riolit phong hóa RQD=0% nứt nẻ mạnh TCR=15%	26.00	8	10	12	22	UD23	25.80-26.00					
						26.45	8	10	12	22	UD24	26.40-26.45					
						28.00	8	10	12	22	UD25	27.80-28.00					
						28.45	8	10	12	22	UD26	28.40-28.45					
6a	47.20	44.00	2.70		Đá Riolit phong hóa RQD=0% nứt nẻ mạnh TCR=15%	30.00	8	10	12	22	UD27	29.80-30.00					
						30.45	8	10	12	22	UD28	30.40-30.45					
						32.00	9	11	15	26	UD29	31.80-32.00					
						32.45	9	11	15	26	UD30	32.40-32.45					
6a	47.20	44.00	2.70		Đá Riolit phong hóa RQD=0% nứt nẻ mạnh TCR=15%	34.00	10	15	18	33	UD31	33.80-34.00					
						34.45	10	15	18	33	UD32	34.40-34.45					
						36.00	11	15	19	34	UD33	35.80-36.00					
						36.45	11	15	19	34	UD34	36.40-36.45					
6a	47.20	44.00	2.70		Đá Riolit phong hóa RQD=0% nứt nẻ mạnh TCR=15%	38.00	17	22	36	58	UD35	37.80-38.00					
						38.45	17	22	36	58	UD36	38.40-38.45					
						40.00	19	25	38	63	UD37	39.80-40.00					
						40.45	19	25	38	63	UD38	40.40-40.45					

HÌNH TRƯ LỖ KHOAN

LỖ KHOAN : BR-V01 TOA ĐỘ LỖ KHOAN : $X: 1181122.06$ MỤC NƯỚC DƯỚI ĐẤT : XUẤT HIỆN :
 $Y: 637348.58$ ỒN ĐỊNH : NG NƯỚC
 CAO ĐỘ LỖ KHOAN : -0.710 M TỶ LỆ: 1/200 NGÀY KHỞI CÔNG : 27/9/2009
 LÝ TRÌNH : KM 55+000.0 TRÁI : TÌM : 0.00 M PHẢI : NGÀY HOÀN THÀNH : 4/10/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐỊA TẢNG	THÍ NGHIỆM SPT					Số hiệu mẫu	Độ sâu mẫu (m)
						Độ sâu (m)	Số búa 15 cm			Đồ thị SPT		
							N1	N2	N3			
1a	8.21	7.50	7.50		<p>Bùn sét, màu xám xanh, xám đen</p> <p>Bùn sét, màu xám xanh, xám đen</p>	2.00 2.45	0	0	0	0	0	UD1 1.40-2.00
						4.00 4.45	0	0	0	0	0	UD2 3.40-4.00
2b	-28.21	27.50	20.00		<p>Sét, xám xanh, nâu đỏ, cứng</p> <p>Sét, xám xanh, nâu đỏ, cứng</p> <p>Sét, xám xanh, nâu đỏ, cứng</p> <p>Sét, xám xanh, nâu đỏ, nửa cứng</p> <p>Sét xám xanh, nâu đỏ, dẻo cứng</p> <p>Sét xám xanh, nâu đỏ, dẻo cứng</p> <p>Sét xám xanh, nâu đỏ, dẻo cứng</p> <p>Sét xám xanh, nâu đỏ, dẻo cứng</p> <p>Sét xám xanh, nâu đỏ, dẻo cứng</p> <p>Sét xám xanh, nâu đỏ, dẻo cứng</p>	6.00 6.45	0	0	0	0	0	UD3 5.40-6.00
						8.00 8.45	10	14	16	30	30	UD4 7.40-8.00
						10.00 10.45	9	13	18	31	31	UD5 9.40-10.00
						12.00 12.45	10	13	19	32	32	UD6 11.40-12.00
						14.00 14.45	8	11	14	25	25	UD7 13.40-14.00
						16.00 16.45	5	6	7	13	13	UD8 15.40-16.00
						18.00 18.45	4	6	6	12	12	UD9 17.40-18.00
						20.00 20.45	5	5	6	11	11	UD10 19.40-20.00
						22.00 22.45	6	6	7	13	13	UD11 21.40-22.00
						24.00 24.45	5	6	8	14	14	UD12 23.40-24.00
5	-32.71	12.00	4.50		<p>Hột sét, cứng, sản phẩm của đá phong hóa hoàn toàn</p>	28.00 28.45	>50	>50	>50	>50	UD13 25.40-26.00	
						30.00 30.45	>50	>50	>50	>50	UD14 27.40-28.00	
6a	-40.71	40.00	8.00		<p>Đá Riolit phong hóa RQD=10% nứt nẻ mạnh TCR=80%</p> <p>Đá Riolit phong hóa RQD=0% nứt nẻ mạnh TCR=30%</p> <p>Đá Riolit phong hóa RQD=7% nứt nẻ mạnh TCR=30%</p>	32.00 32.45	>50	>50	>50	>50	UD15 29.40-30.00	
											UD16 31.40-32.00	

Phụ lục :
Tờ :

Lỗ khoan :	BR-BN02	Tỷ lệ :	1/200
Lý trình :	Km56+0000	Tọa độ:	1180954.72, 638331.49
Cao độ :	+0.920 m	Cao độ nước ngầm :	-0,6m
Máy khoan :	XJ-100		

Ngày khoan: 28/09/2009-30/09/2009
Tổ trưởng: PHẠM VĂN UẤN
Kỹ sư giám sát: LÊ DUY HÙNG
Phương pháp khoan: Xoay sử dụng bentonit

[illegible]

HÌNH TRƯ LỖ KHOAN

LỖ KHOAN : BR-RN01 TOA ĐỘ LỖ KHOAN :

X: 1180766.42

..... XUẤT HIỆN : 0.500 M

Y : 639057.46

ỐN ĐỊNH : -0.500 M

CAO ĐỘ LỖ KHOAN : 1.090 M TỶ LỆ: 1:200

NGÀY KHỞI CÔNG : 28/9/2005

LÝ TRÌNH : KM 56+750.0

TRÁI:

TIM : 0.00 M

PHAL:

NGÀY HOÀN THÀNH : 30/9/2008

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐỊA TẦNG	THI NGHIỆM SPT										Số hiệu mẫu	Độ sâu mẫu (m)
						Độ sâu (m)	Số búa 15 cm			N / 30 cm	Đồ thị SPT						
							N1	N2	N3		0	10	20	30	40		
2	-4.51	5.60			Sét pha, màu xám trắng, nâu đỏ, dẻo mềm - dẻo cứng	2.00 2.45	3	4	5	9		UD1 5.60-2.00					
3a		2.90			Cát sét, màu nâu vàng, xám trắng	4.00 4.45	3	4	6	10		UD2 3.80-4.00					
3b	17.20				Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	6.00 6.45	4	6	7	13		UD3 5.80-6.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	8.00 8.45	5	7	8	15		D4 7.80-8.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	10.00 10.45	4	5	6	11		D5 9.80-10.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	12.00 12.45	4	6	8	14		D6 11.80-12.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	14.00 14.45	4	7	8	15		D7 13.80-14.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	16.00 16.45	5	7	9	16		D8 15.80-16.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	18.00 18.45	5	6	9	15		D9 17.80-18.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	20.00 20.45	5	6	8	14		D10 19.80-20.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	22.00 22.45	5	7	9	16		D11 21.80-22.00					
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	24.00 24.45	6	8	10	18		D12 23.80-24.00					
4a	25.70	1.30			Sét, xám xanh, nâu tím, trạng thái cứng	26.00 26.45	5	7	9	16		D13 25.80-26.00					
5	5.50				Bột sét, cứng, sản phẩm của đá phong hóa hoàn toàn	28.00 28.45	10	12	18	30		UD14 27.80-28.00					
					Bột sét, cứng, sản phẩm của đá phong hóa hoàn toàn	30.00 30.45	9	12	17	29		UD15 29.80-30.00					
6a	8.10				Đá Riolit phong hóa nứt nẻ mạnh	32.00 32.45	15	25	35	>50		UD16 31.80-32.00					
						33.90 34.35	>50	>50	R17 33.75-33.90								
						36.60 37.05	>50	>50	R19 36.45-36.60								
						39.00 39.45	>50	>50	R20 38.95-39.00								
	-39.53	40.60															

	HÌNH TRỤ LỖ KHOAN	
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LỖ KHOAN : BR-RN02 TOẠ ĐỘ LỖ KHOAN : $X: 1180728.76$ MỤC NƯỚC DƯỚI ĐẤT : XUẤT HIỆN : -1.800 M
 $Y: 639202.66$ ỔN ĐỊNH : -1.800 M

CAO ĐỘ LỖ KHOAN : 3.470 M TỶ LỆ: 1/200 NGÀY KHỞI CÔNG : 28/9/2009

LÝ TRÌNH : KM 56+900.0 TRÁI : TỈM : 0.00 M PHẢI : NGÀY HOÀN THÀNH : 30/9/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐIỂM TẦNG	THI NGHIỆM SPT										Số hiệu mẫu Độ sâu mẫu (m)	
						Độ sâu (m)	Số búa 15 cm			Độ thị SPT N / 30 cm							
							N1	N2	N3								
K1	2.07	1.40	1.40		Đất đắp, đất mặt												
2b			1.30		Sét dẻo cứng, nửa cứng	2.00 2.45	3	4	5	9							UD1 1.80-2.00
					4.00 4.45	2	4	5	9							UD2 3.80-4.00	
3a	2.23 3.03	5.70 6.50	0.80		Cát sét, màu nâu vàng, xám trắng	6.00 6.45	3	4	6	10							UD3 5.80-6.00
3b			9.20		Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	8.00 8.45	3	4	5	9							D4 7.80-8.00
						10.00 10.45	4	6	7	13							D5 9.80-10.00
						12.00 12.45	4	6	8	14							D6 11.80-12.00
						14.00 14.45	4	5	7	12							D7 13.80-14.00
18.1	12.23 13.03	15.70 16.50	0.80		Sét màu nâu đỏ, xám trắng, trạng thái nửa cứng	16.00 16.45	3	4	5	9						D8 15.80-16.00	
3b			9.30		Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	18.00 18.45	3	5	6	11							D9 17.80-18.00
						20.00 20.45	5	6	7	13							D10 19.80-20.00
						22.00 22.45	3	5	8	13							D11 21.80-22.00
						24.00 24.45	3	4	7	11							D12 23.80-24.00
4a	22.33	25.80	1.00		Sét, xám xanh, nâu tím, trạng thái cứng	26.00 26.45	5	7	9	16						D13 25.80-26.00	
5	26.33	29.80	3.80		Bột sét, cứng, sản phẩm của đá phong hóa hoàn toàn	28.00 28.45	7	10	15	25						UD14 27.80-28.00	
						30.00 30.45	8	10	16	26							UD15 29.80-30.00
6a	30.13	33.60	8.40		Đá Riolit phong hóa nứt nẻ mạnh Đá Riolit phong hóa nứt nẻ mạnh Đá Riolit phong hóa nứt nẻ mạnh Đá Riolit phong hóa nứt nẻ mạnh	32.00 32.45	8	13	16	29							UD16 31.80-32.00
						34.00 34.45	>50			>50							R17 33.80-34.00
						36.00 36.45	>50			>50							R18 35.80-36.00
						38.00 38.45	>50			>50							R19 37.80-38.00
	38.53	42.00				40.00 40.45	>50			>50							R20 39.80-40.00

HÌNH TRỤ LỖ KHOAN

LỖ KHOAN : IC-NH5 | TOA ĐỘ LỖ KHOAN :

X: 1180582.33

Y : 639885.44

MỨC NƯỚC ĐƯỢC ĐẤT : XUẤT HIỆN : M

ÔN ĐỀ: M

CAO ĐỘ LỖ KHOAN : 9.400 M TỶ LỆ: 1/200

NGÀY KHỞI CÔNG : 24/9/2009



























LÝ TRÌNH : KM 57+600.0

TRÁI :

TIM : 0.00 M

PHÂN :

NGÀY HOÀN THÀNH : 26/9/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề dày lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐIỂM TẦNG	THI NGHIỆM SPT						Số hiệu mẫu Độ sâu mẫu (m)	
						Độ sâu (m)	Số búa 15 cm			Đồ thị SPT			
							N1	N2	N3				
K1	7.70	1.70	1.70		Đất đắp, đất mặt								UD1
2	6.10	3.30	1.60		Sét pha, màu xám trắng, nâu đỏ, dẻo mềm - dẻo cứng	2.00 2.45	2	3	4	7			UD2
1K1	4.90	4.50	1.20		Sét màu nâu đỏ, xám trắng, trạng thái nửa cứng	4.00 4.45	3	4	6	10			UD3
2	6.20	9.60	5.10		Sét pha, màu xám trắng, nâu đỏ, dẻo mềm - dẻo cứng	6.00 6.45	3	4	5	9			UD4
						8.00 8.45	3	3	6	9			UD5
3b	-25.60	35.00	25.40		Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	10.00 10.45	3	5	6	11			UD6
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	12.00 12.45	3	4	5	9			UD7
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	14.00 14.45	4	6	6	12			UD8
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	16.00 16.45	3	5	6	11			UD9
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	18.00 18.45	5	7	8	15			UD10
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	20.00 20.45	6	8	8	16			UD11
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	22.00 22.45	5	9	9	18			UD12
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	24.00 24.45	7	10	11	21			UD13
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	26.00 26.45	6	9	14	23			UD14
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	28.00 28.45	7	8	11	19			UD15
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	30.00 30.45	6	10	12	22			UD16
					Cát hạt mịn, màu xám vàng, nâu đỏ, chặt vừa	32.00 32.45	6	12	15	27			UD17
					3a	-27.70	37.10	2.10		Cát sét, màu nâu vàng, xám trắng	36.00 36.45	7	12
					Sét, xám xanh, nâu tím, trạng thái cứng	38.00 38.45	5	8	10	18			UD19
					Sét, xám xanh, nâu tím, trạng thái cứng	40.00 40.45	6	9	11	20			UD20
					Sét, xám xanh, nâu tím, trạng thái cứng	42.00 42.45	8	15	18	33			UD21

	HÌNH TRỤ LỖ KHOAN	
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LỖ KHOAN : IC-NH51

TOẠ ĐỘ LỖ KHOAN :

X : 1180582.33

Y : 639885.44

MỨC NƯỚC DƯỚI ĐẤT :

XUẤT HIỆN : M

ỔN ĐỊNH : M

CAO ĐỘ LỖ KHOAN : 9.400 M

TỶ LỆ: 1/200

NGÀY KHỞI CÔNG : 24/9/2009

LÝ TRÌNH : KM 57+600.0

TRÁI :

TÌM : 0.00 M

PHẢI :

NGÀY HOÀN THÀNH : 26/9/2009

Ký hiệu lớp	Cao độ đáy lớp (m)	Độ sâu đáy lớp (m)	Bề đáy lớp (m)	TRỤ CẮT LỖ KHOAN	MÔ TẢ ĐIỂM TẮNG	THI NGHIỆM SPT						Số hiệu mẫu Độ sâu mẫu (m)	
						Độ sâu (m)	Số búa 15 cm			N / 30 cm	Đồ thị SPT		
							N1	N2	N3				
4a			12.90		Sét, xám xanh, nâu tím, trạng thái cứng	42.45						UD22	
					Sét, xám xanh, nâu tím, trạng thái cứng	44.00	9	16	20	36		43.80-44.00	
					Sét, xám xanh, nâu tím, trạng thái cứng	46.00						UD23	
					Sét, xám xanh, nâu tím, trạng thái cứng	46.45	10	15	17	32		45.80-46.00	
					Sét, xám xanh, nâu tím, trạng thái cứng	48.00						UD24	
					Sét, xám xanh, nâu tím, trạng thái cứng	48.45	14	18	22	40		47.80-48.00	
					Sét, xám xanh, nâu tím, trạng thái cứng	50.00						UD25	
					Sét, xám xanh, nâu tím, trạng thái cứng	50.45	16	21	30	51		49.80-50.00	

APPENDIX C7: QUANTITIES AND LETTERS

TA 7155-VIE PREPARING THE BEN LUC - LONG THANH EXPRESSWAY PROJECT
SUMMARY MAIN QUANTITIES - BẢNG TỔNG HỢP KHỐI LƯỢNG CHÍNH

Description		Miêu tả	Unit Đơn vị	Quantity Khối lượng	Remark ghi chú
Earthworks Công tác đất	Clearing and Grubbing	Dọn dẹp và phát quang	m2	2,540,200	
	Topsoil Removal & Storage	Đào bỏ lớp mặt	m3	487,000	
	Excavation & Relagline Channels	Đào đất và chỉnh tuyến kênh	m3	366,700	
	Embankment	Đất đắp	m3	1,980,200	
	Surplus Soils	Đất thừa	m3	366,700	
	Slope protection	Gia cố bảo vệ mái dốc taluy	m2	436,800	
	Cohesive Soil for slope	Đất dính bảo vệ mái dốc taluy	m3	360,000	
	Soft Soil treatment	Xử lý nền đất yếu	m2	360,000	
	Sodding	Trồng cỏ	m2	362,500	
	Other Earthworks	Các công tác đất khác	km	57.1	
Drainage Works Thoát nước	Side Ditch & Chutes	Rãnh thoát nước	lm	63,958	
	Pipe Culverts	Cống tròn các loại	lm	7,727	
	Box Culverts & Underpasses	Cống hộp và cống chui	each	64	
	Other Drainage Works	Công tác thoát nước khác	km	57	
Bridge Works Phần cầu	BR 01 Ong Thoan	BR 01 Ong Thoan Channel 02+090 - 02+350	m2	6,370	
	BR 02 NH1A Flyover	BR 02 NH1A Flyover 03+070 - 03+770	m2	17,150	
	BR 03 Phuoc Ly	BR 03 Phuoc Ly Flyover 06+050 - 06+610	m2	13,720	
	BR 04 Haison Viaduct	BR 04 Haison Viaduct 07+995 - 09+565	m2	38,465	
	BR 05 Ong Thin River	BR 05 Ong Thin River 12+125 - 13+095	m2	25,235	
	BR 06-01 Viaduct #01	BR 06-01 Viaduct #01 16+690 - 17+045	m2	8,698	
	BR 06-02 Viaduct #02	BR 06-02 Viaduct #02 17+045 - 17+245	m2	4,900	
	BR 06-03 Viaduct #03	BR 06-03 Viaduct #03 17+245 - 21+445	m2	102,900	
	BR 06-04 Viaduct #04	BR 06-04 Viaduct #04 21+445 - 23+019.5	m2	38,575	
	BR 06-05 Binh Khanh	BR 06-05 Binh Khanh 23+019.5 - 23+880.5	m2	20,234	
	BR 06-06 Viaduct #06	BR 06-06 Viaduct #06 23+880.5 - 25+305.3	m2	34,908	
	BR 06-07 Viaduct #07	BR 06-07 Viaduct #07 25+305.3 - 26+020.3	m2	17,518	
	BR 06-08 Viaduct #08	BR 06-08 Viaduct #08 26+020.3 - 26+340.3	m2	7,520	
	BR 06-09 Viaduct #09	BR 06-09 Viaduct #09 26+340.3 - 28+529	m2	53,562	
	BR 06-10 Viaduct #10	BR 06-10 Viaduct #10 28+529 - 30+029	m2	36,750	
	BR 06-11 Phuoc Khanh	BR 06-11 Phuoc Khanh 30+029 - 30+771	m2	17,437	
	BR 06-12 Viaduct #12	BR 06-12 Viaduct #12 30+771 - 32+021	m2	30,625	
	BR 06-13 Viaduct #13	BR 06-13 Viaduct #13 32+021 - 32+376	m2	8,698	
	BR 07 Ong Keo	BR 07 Ong Keo 34+245 - 35+155	m2	22,295	
	BR 08 Bau Sen	BR 08 Bau Sen 35+639.4 - 35+738.6	m2	2,426	
	BR 09 Vung Gam	BR 09 Vung Gam 43+110 - 43+143	m2	809	
	BR 10 Phuoc An	BR 10 Phuoc An 50+279.2 - 50+834.2	m2	13,598	
	BR 11 Thi Vai River	BR 11 Thi Vai River 52+479.2 - 56+134.2	m2	89,548	
	BR 12 Ngoai River	BR 12 Ngoai River 56+823.5 - 56+856.5	m2	809	
	IC#01 Bridges	IC#01 Bridges	m2	20,103	
	IC#03 Bridges	IC#03 Bridges	m2	10,975	
	IC#04 Bridges	IC#04 Bridges	m2	5,579	
Interchanges & Other Costs Nút giao và hạng mục	Interchanges x 6	Nút giao	PS	6	
	Realign Existing Roads	Chỉnh tuyến đường hiện hữu	km	17	
	Toll Facilities System	Hệ thống thu phí	LS	1	
	Administration Centre	Trung tâm hành chính	ls	1	
	Service Centre & Weight Station	Trung tâm dịch vụ và trạm cân	ls	1	
Pavement Works Kết cấu áo đường	Subgrade	Đất đắp nền K98	m3	343,000	
	Subbase	Lớp móng dưới (CPĐD loại 2)	m3	458,500	
	Base	Lớp móng trên (CPĐD loại 1)	m3	317,200	
	Asphalt Concrete Wearing & Binder	Bê tông nhựa và lớp dính bám	m2	113,600	
	Other Pavement Works	Các công tác mặt đường khác	km	31,979	
Miscellaneous Works Các công tác khác	Guardrail	Tôn lượn sóng	lm	127,916	
	Traffic Signboard	Biển báo giao thông	each	1,800	
	Line Marking	Sơn kẻ đường	m2	69,400	
	Expressway Lighting	Hệ thống chiếu sáng	lm	39,000	
	Noise Barrier	Tường chống ồn	lm	15,800	
	Guard Fence	Hàng rào	lm	66,346	
	Center Median	Dải phân cách giữa	lm	31,979	

MINISTRY OF PLANNING AND INVESTMENT

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SOCIALIST – REPUBLIC OF VIETNAM

Independence – Freedom – Happiness

No.122/BKH-KCHT&DT

Hanoi, 07 January 2010

Sub: *Comments on draft final report of Ben Luc – Long
Thanh Expressway Project*

To: Ministry of Transport (MOT)

In response to Ministry of Transport (MOT)'s Correspondence No.8869/BGTVT-KHDT dated 16 December 2009 on request of "Comments on final report of Ben Luc – Long Thanh Expressway Project", Ministry of Planning and Investment would like to have the following opinions:

- Regarding scope, alignment and specifications of Ben Luc – Long Thanh Expressway: Ministry of Transport approved and gave comments for the Consultant's modification on some items of the Project.
- Regarding the fund:
- + Pursuant to Memorandum of Understanding (MOU) signed by and between ADB Mission and the Government of Vietnam on May 2009, Ben Luc – Long Thanh Expressway Project is recognized as the official project under ADB's Loan Program in 2011. Total estimated investment cost is 900 millions USD (of which 300 millions USD from OCR, 500 millions USD from co-sponsor and 100 million USD is shared by the Government)
- + According to Draft final report prepared by ADB, total investment cost of Project increased to 1.66 billion USD, of which the Government shall contribute 300 millions USD in order to ensure financial efficiency of Project (about 20% of total investment cost) for land acquisition and resettlement; Internal tax of potential co-sponsors; Bomb and mine clearing. Structure of capital contribution which was submitted to the Government is reasonable; however, balance of such a big capital for Project is difficult for State Budget. Ministry of Transport is requested to prepare capital mobilization options from other sponsors so that Project purpose can be assured.

Especially, MOT is requested to review and check cost estimates of Project, providing detailed comparison with on-going other projects under similar geological condition. Consideration and mobilization of additional fund for Project shall be based on specific calculation and analysis.

Besides, MOT should clearly define whether the cost mentioned above includes compensation for expressway extension in Phase 2 or not; And management method on acquired land for Phase 2. Ministry of Transport is requested to co-operate for implementation.

Addressee:

- As above
- The Government office;
- Ministry of Finance, MONRE;
- State Bank;
- PC of Hochiminh City, Dong Nai Province
and Long An Province;
- Department of Foreign Economic;
- Files

FOR MINISTER

VICE-MINISTER

(signed and sealed)

DANG HUY DONG

THE STATE BANK OF VIETNAM

=====

SOCIALIST – REPUBLIC OF VIETNAM

Independence – Freedom – Happiness

No.189/NHNN-HDQT

Hanoi, 08 January 2010

Sub: *Comments on Final report of Ben Luc – Long
Thanh Expressway Project*

To: Ministry of Transport (MOT)
(Department of Planning and Investment)

In response to Ministry of Transport (MOT)'s Correspondence No.8869/BGTVT-KHDT dated 16 December 2009 regarding "Comments on final report of Ben Luc – Long Thanh Expressway Project which is financed by Asian Development Bank (ADB)", The State Bank of Vietnam would like to have the following opinions:

1. In 2008, ADB financed Technical Assistance (TA) Loan of 26 millions USD for detailed design work of 3 Expressways, including Ben Luc – Long Thanh Expressway Project. Ministry of Transport is requested to clarify differences between the output – detailed design of Ben Luc – Long Thanh Expressway under TA Loan and Design for Road (Item 3, Volume 1 – Main report) and Engineering report (Volume 5 – Engineering report) in the attached Technical Assistance carried out by the Consultants.
2. According to RRP of TA Loan for 3 Expressways, main purpose of the attached TA is to analyze and evaluate technical feasibility, including alignment determination, design based on efficiency-expense, evaluation on economic and financial feasibility.... However, Draft final report prepared by the Consultants does not satisfy requirement on a logic and clear layout. Moreover, its content is not sufficient as required in RRP.
3. In order to assist MOT to complete Feasibility Report of Ben Luc – Long Thanh Expressway Project which is scheduled to capitalize in 2010, it is recommended to clarify and supplement the following contents into Final report:
 - Estimated financial plan: total investment cost (TA loan for detailed design should be separated), fund, scheduled co-sponsors, planning on distribution of Project items, supplementing Option 2 of financial plan (only Option 1 is available in Draft final report, page 154)
 - Detailed analysis, evaluation on economic and financial feasibility as well as recommendation for alternatives.
 - To clarify VEC's competence on ensuring counterpart fund for Ben Luc – Long Thanh Expressway Project. Actually, VEC found many difficulties in bond issuance in Noi Bai – Lao Cai Highway Project. Therefore, the Consultants should prepare other feasible alternatives to ensure counterpart fund of VEC.
 - Project management and implementation: Management mechanism as well as the relation between MOT, VEC and relevant Ministries, Branches shall be clarified.

The foregoing is the State Bank of Vietnam's comments on Draft final report of Ben Luc – Long Thanh Expressway Project for summarization of MOT.

Addressee:

- As above
- Ministry of Planning and Investment,
MOF;
- VEC;
- State Bank;
- Files

UNDER AUTHORIZATION OF GOVERNOR

FOR DEPARTMENT MANAGER

VICE MANAGER

(signed and sealed)

NGUYEN VINH HUNG

**PEOPLE'S COMMITTEE OF LONG AN
PROVINCE**

SOCIALIST – REPUBLIC OF VIETNAM
Independence – Freedom – Happiness

=====

No.144/UBND-CN

Tan An, 12 January 2010

Sub: *Comments on final report of Ben Luc – Long
Thanh Expressway Project (section passing Long An
Province area)*

To: Ministry of Transport (MOT)

Pursuant to Ministry of Transport (MOT)'s Correspondence No.8869/BGTVT-KHDT dated 16 December 2009 regarding "Comments on draft final report of Ben Luc – Long Thanh Expressway Project financed by ADB".

After reviewing draft final report of Ben Luc – Long Thanh Expressway Project provided by MOT, People's Committee of Long An Province would like to give the following opinions:

- Regarding alignment: It is in accordance with Long An PPC's Correspondence No.5414/UBND-CN dated 03 November 2006 and Correspondence No.3219/UBND-CN dated 22 September 2009; Viaducts are arranged at sections passing Phuoc Ly resettlement site and Hai Son industrial zone.
- In order to facilitate traffic demand of local people in Project area, it is recommended to additionally arrange local road along 2 sides of the alignment, with 7m-wide embankment and 6m-wide bituminous pavement. (Similar with Ho Chi Minh – Trung Luong Expressway).

Long An PPC would like to report MOT for consideration and approval. .

Addressee:

- As above
- Chairman. Vice-Chairman of PPC;
- Transport Department;
- Department of Technical Studying
- Files

PEOPLE'S COMMITTEE OF LONG AN PROVINCE

(signed and sealed)

CHAIRMAN

DUONG QUOC XUAN

PEOPLE'S COMMITTEE OF HO CHI MINH
CITY

SOCIALIST – REPUBLIC OF VIETNAM
Independence – Freedom – Happiness

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No.6784/UBND-DTMT

Hochiminh City, 18 December 2009

*Sub: Relation and connection between Rung Sac
Road (Can Gio district) and Ben Luc – Long
Thanh Expressway Project.*

To: Minister of Transport (MOT)

People's Committee of Ho Chi Minh City assigned Director of Transport Department to attend the meeting presided by leader of MOT and Finding Mission from Asian Development Bank (ADB) on studying results of Ben Luc – Long Thanh Expressway Project (the meeting is presided by Vice Minister – Ngo Thinh Duc on 01 December 2009).

Based on results of the meeting and reviewing Draft final report of the mentioned-above Project, People's Committee of Ho Chi Minh City would like to give the following opinions:

- Total length of Ben Luc – Long Thanh Express which is under MOT's studying is about 58km; in which section passing Ho Chi Minh city area is about 26km with 03 important interchanges, namely NH1 Interchange, NH5 Interchange and Interchange with existing Nguyen Van Tao road. Thus, there is no interchange with Rung Sac road (Can Gio district, Ho Chi Minh city).
- If Long Thanh - Ben Luc Expressway does not connect with Rung Sac road in Ho Chi Minh city area by one grade-separated interchange, Can Gio district will be isolated due to no linkage to Rung Sac road other than Binh Khanh ferry. Economic development (tourist, sea economy) in Can Gio district will not be facilitated, causing effects on tasks of security-national defense of Ho Chi Minh city, in particular and this area, in general.
- Moreover, according to the approved alignment of Ben Luc - Long Thanh, intersecting point between this Expressway and Rung Sac road is about 10.5km far from the edge of biosphere reservation zone of the world (Can Gio protective forest). If the Expressway is connected with Rung Sac road by one grade-separated interchange, there will have no effect on Can Gio protective forest. On the other hand, in surrounding area of this interchange, Ho Chi Minh City planned the Binh Khanh urban area with estimated population of 160.000 people.

From mentioned-above reasons, People's Committee of Ho Chi Minh City would like to recommend for consideration of Minister of Transport as follows:

1. Ben Luc - Long Thanh Expressway Project shall be connected to Rung Sac road (Can Gio district) right in Phase 1 and Phase 2 of Project.
2. For any reason, if ADB and Japan International Cooperation Agency (JICA) refuse financing for this interchange instruction, MOT is recommended to mobilize another fund for its implementation as separated project (Ben Luc - Long Thanh and Rung Sac

road Interchange Project) and to invest for carrying out at the same time with Ben Luc - Long Thanh Expressway Project.

We are looking forward to obtaining your approval.

Addressee:

- As above
- The Government office;
- Ministry of Planning and Investment;
- Standing Board of Centre (Minister, Vice Minister/Leader);
- Departments of Planning and Investment, Construction, Natural Resources and Environment, Transport;
- People's Committee office;
- Expert departments;
- Files

FOR CHAIRMAN
STANDING VICE-CHAIRMAN
(signed and sealed)
NGUYEN THANH TAI

PEOPLE'S COMMITTEE OF DONG NAI
PROVINCE

SOCIALIST – REPUBLIC OF VIETNAM
Independence – Freedom – Happiness

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No.254/UBND-CNN

Bien Hoa, 13 January 2010

*Sub: Comments on Draft final report of Ben Luc
– Long Thanh Expressway Project, section
passing Dong Nai province area.*

To: Ministry of Transport (MOT)

In response to Ministry of Transport (MOT)'s Correspondence No.8869/BGTVT-KHDT dated 16 December 2009 regarding "Comments on final report of Ben Luc – Long Thanh Expressway Project, section passing Dong Nai province area", People's Committee of Dong Nai Province would like to have the following opinions.

- Regarding Project alignment and interchange located in section passing Dong Nai province area: It is approved by PPC via Correspondence No.8709/UBND-CNN dated 26 October 2009. The Consultants studied and prepared draft document on technical assistance based on Dong Nai PPC's comments. However, according to the master plan on construction of the Ho Chi Minh city region which is approved by the Prime Minister at Decision No.589/2008/QĐ-TTg dated 20 May 2008, at the ending point of Ben Luc - Long Thanh Expressway Project, it is scheduled to newly construct connection road to National Highway 1A. Thus, MOT is requested to work with the Consultant of Asian Development Bank (ADB) in order to review and arrange completed cloverleaf interchange (crossing) to provide for planned road in the future.
- According to the master plan of Nhon Trach - a new city approved by the Prime Minister, Ben Luc - Nhon Trach - Long Thanh is planned with Right of Way (ROW) of 70m, however, it is proposed with 73m wide of ROW in the report for Project preparation. MOT is requested to review and report the Prime Minister for approval on ROW adjustment from 70m to 73m.
- Regarding land acquisition work, it is requested to study and apply regulations on assistance, compensation price in accordance with prevailing regulations of Vietnam.
- Regarding resettlement work for affected households who must relocate: Resettlement work shall be concentrated and promptly prepared in order to facilitate implementation work of Project.
- Further studying on Project impacts is requested for hydrological and drainage work in local area as well as main drainage of Nhon Trach urban zone, avoid local flooding when Project to be completed and put into operation.

- Toll fee proposed by the Consultants for motorcar (1.000 VND/km) is too high, comparing with general existing toll level. It is requested to reviewe for suitability.

The foregoing is Dong Nai PPC's comments on draft final report of Ben Luc - Long Thanh Expressway Project, section passing Dong Nai province area, which are submitted to MOT for reviewing and summarization.

Addressee:

- As above
- Chairman and Vice-Chairman of PPC;
- Department of Transport;
- Manager of CNN;
- Files

FOR CHAIRMAN OF PPC

VICE-CHAIRMAN

(signed and sealed)

TRAN VAN VINH

NOTICE

Conclusions of Deputy Minister Ngo Thinh Duc at the meeting with the TA Inception Mission of ADB and on approval of inception report of the PPTA: Ben Luc - Long Thanh Expressway Project

On 20th June 2009, at Ministry of Transport's Office, Deputy Minister Ngo Thinh Duc chaired the meeting with the TA inception mission of ADB and approved the TA inception report of Ben Luc-Long Thanh Expressway Project carried out by Katahira & Engineering International in association with other consultants. Participants of the meeting comprised of ADB inception mission, representative from JICA, Department of Planning and Investment, Department of Science and Technology, Department of Environment, Department of Finance, Department of Infrastructures, Transport Engineering Construction and Quality Management Bureau (TCQM), Major Projects Steering Committee, VEC and KEI Consultant.

After hearing the brief inception report and the proposed alignment of the project presented by KEI and the brief contents of Minutes of Understanding presented by ADB inception mission, the Deputy Minister had concluded the followings:

- Ben Luc-Long Thanh Expressway is the first priority project as it will be the main route to connect inter-regional traffic system, help improve transport capacity from the Western area to sea ports in the East, and contribute to the efficiency of the sea port system in HCMC, Ba Ria-Vung Tau under investment and construction.

- Agree to the alignment Alternative 1 proposed by the Consultants. The scope of works and phasing of investment shall be in accordance with the Decision No. 1734/QĐ-TTg dated 01/12/2008 of the Prime Minister on "Approval of Vietnam expressway network development plan up to 2020 and the Orientation after 2020".

- The start point of the expressway is at the interchange with Ho Chi Minh - Trung Luong expressway, and will connect with Ring Road No.3 of HCMC. The end point of the expressway is the interchange with the planned Bien Hoa-Vung Tau Expressway. Scope of works includes: (i) Land acquisition and resettlement, (ii) construction works for the expressway including the related works, such as (a) Toll collection system, (b) Information and communication system, (c) Electric system, (iv) Operation and Maintenance system, (v) ITS, and (iii) supervision consultant services for the project.

- At the middle section of the expressway, the alignment runs to the South crossing Soai Rap and Long Tau rivers (the downstream of Nha Be river as branched) and runs through the buffer zone of Can Gio Biosphere Reserve. The total length is 58km.

- For the river crossing section, the bridge construction option (Binh Khanh Bridge crossing Soai Rap river and Phuoc Khanh Bridge crossing Long Tau river) has been selected, and the study of tunnel option will be stopped.

- VEC will instruct the Consultants to set out the Works in detail to have basis for preparing EIA report, especially for the section passing through Can Gio so that MOT can work with HCMC People's Committee and concerned agencies on the impacts of the Project to the environment of the buffer zone of Can Gio Biosphere Reserve; besides, careful investigation and survey should be conducted on soft soil area to propose detailed solutions.

- This is an important project to the development of traffic and economic in the area, thus, ADB and JICA are kindly requested to study and put it in ODA-financed projects, minimize OCR loan so as to increase efficiency of the project.

- To ensure that the Project will be carried out as per planned schedule, ADB and JICA are kindly requested to put the Project in work program and complete approval procedure for loan by September 2010.

By order of the Minister, MOT office would like to notify the above contents to concerned parties and agencies for information and implementation.

**BY ORDER OF THE MINISTER
OFFICE MANAGER**

(signed and sealed)

Nguyen Van Cong

Distributions:

- MOT Minister;
- Deputy Minister Ngo Thinh Duc;
- Participants;
- File.

No.: 458/TB-BGTVT

Hanoi, 18th October 2009

NOTICE

**Summary meeting with the TA Interim Mission of ADB
on the PPTA: Ben Luc – Long Thanh Expressway Project**

On 19th September 2009, at Ministry of Transport's Office, Deputy Minister Ngo Thinh Duc chaired the meeting with the TA interim mission of ADB and approved the TA interim report of the PPTA: Ben Luc-Long Thanh Expressway Project. Participants of the meeting comprised of ADB interim mission, representatives from JICA, Department of International Cooperation, Department of Planning and Investment, Department of Science and Technology, Department of Environment, Department of Finance, Department of Infrastructures, Vietnam Maritime Administration, Vietnam Road Administration, Transport Engineering Construction and Quality Management Bureau (TCQM), Major Projects Steering Committee, VEC and KEI Consultant.

After hearing the content of MOU presented by ADB mission and the brief interim report by KEI Consultant, the Deputy Minister had concluded the followings:

- MOT highly appreciated the results achieved by ADB mission through the checking stage as well as the results carried out by KEI Consultants as of the time of the interim report of the Project.
- Regarding scope of the expressway: Ben Luc-Long Thanh expressway will have 6 to 8 lanes in accordance with the plan of Vietnamese Government. In the immediate stage, the expressway will be constructed with 4 lanes. The Government will expand the expressway to 8 lanes when having enough conditions according to actual status. The width of lane is 3.75m per lane; the width of two emergency lanes is 3mx2; central reserve is 3m on the whole route, for both road and bridge sections. The design speed is 100-120km per hour for embankment road sections and 80km per hour for bridge and viaduct sections.
- Agreed to the recommendation of ADB, the interchange in the area of Can Gio will not be invested and constructed in the Project, due to the concern of ADB about environment matters.
- Vietnam Maritime Administration was requested to consider the master plan of port system on Soai Rap river to study and report to MOT on method for reducing spans and navigation clearances of Binh Khanh bridge so as to reduce project cost.
- MOT will study and give out proper financial model, organization structure and has preferential policies to VEC to ensure project implementation capacity, give assistance to develop national expressway network and improve VEC's financial condition.

- Regarding cost for carrying out technical design work for Ben Luc-Long Thanh Expressway (under the loan VIE-2460 from ADB) which has increased from 5.9 million USD to 13 million USD : it was agreed that adjustment should be made, at the same time VEC was requested to explain in detail to ADB and MOT about the reasons of cost increase.
- ADB was kindly requested to make a financing commitment for 50% of total project cost (about 850 million USD). The interim mission of ADB has agreed to find ways to increase the loan amount for the Project and arrange an option of Multitranche Financing Facility (MFF).
- VEC and the PPTA Consultant were requested to ensure progress of consultancy service for the Project. As per the required progress, the draft final report will be submitted in November 2009.

By order of the Minister, MOT office would like to notify the above contents to concerned parties and agencies for information and implementation.

**BY ORDER OF THE MINISTER
OFFICE MANAGER**

(signed and sealed)

Nguyen Van Cong

Distributions:

- MOT Minister;
- Deputy Minister Ngo Thinh Duc;
- Participants;
- File.

**PEOPLE'S COMMITTEE OF
LONG AN PROVINCE**

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

Ref. No.: 3219/UBND-CN

Tan An, 22nd Sept. 2009

Re.: agreement on alignment of Ben Luc-Long Thanh
Expressway Project.

To: - **Ministry of Transport**

We were in receipt of your letter No. 5308/BGTVT-KHDT dated 05/8/2009 regarding request for agreement on alignment of Ben Luc-Long Thanh Expressway Project.

Based up on the document and brief report on alignment of Ben Luc-Long Thanh Expressway Project.

After consideration of actual conditions, we have comments as follows:

Agree with the alignment proposed by the Consultant as the alignment is in accordance with the comments made by Long An People's Committee in the letter ref. no. 5414/UBND-CN dated 03/11/2006. However, the Consultant is requested to continue studying and resolve the following matters:

- The alignment should avoid crossing through religion areas (communal houses, temples, pagodas...), residential areas, especially the areas belonging to My Yen Commune (Ben Luc District), and Phuoc Ly Commune (Can Giuoc District).

- For the Projects: Nguyen Minh Residential area (My Yen Commune), Phuoc Ly Resettlement area (Five Stars International JSC), Hai Son Industrial Zone (Long Thuong Commune), due to difficulty in adjustment of the alignment, the Consultant is requested to study carefully to find measures to minimize effects on these projects as well as the life and customs of people living in the alignment area and the existing infrastructures along the alignment such as construction of viaduct for the whole alignment section in Long An, other areas of Ho Chi Minh city (Binh Chanh, Nha Be, Can Gio), supplement of ancillary works such as communication, power, emergency, rescue etc. along the alignment.

- For the Technical Works (power, optical cable, water ...): the Consultant, the Employer should contact relevant management units for agreement and to be provided with related documents, data, maps during the Project preparing.

- During survey and setting out of the Works: we shall instruct the concerned local agencies and provincial departments to facilitate the Consultant, the Employer so that they can update enough data on residential status, master plans, environment, social status, population etc. to their study for the Project to prepare the Project suitable with the practice and will soon carry out the Project.

- Regarding ROW: agree with the ROW of 100m, suggest that the land acquisition will be carried out for the whole ROW area (100m) right at Phase I.

MOT is kindly requested to direct the Employer and the Consultant to complete preparing the Project following the above agreement, comments of Long An People's Committee.

Distributions:

- As dino;
- SEPML;
- Long An PC;
- Long An Dept. of Transport;
- File.

ON BEHALF OF LONG AN PC
PP. CHAIRMAN
VICE CHAIRMAN
(signed and sealed)

Nguyen Thanh Nguyen

HCMC PEOPLE'S COMMITTEE

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

Ref. No.: 5652/UBND-DTMT

HCMC, 29th October, 2009

Re.: on alignment of Ben Luc-Long Thanh Expressway
Project, section passing through HCMC

To: - **Ministry of Transport**

We were in receipt of your letter No. 5308/BGT-VT-KH/DT dated 05/8/2009 regarding request for agreement on alignment of Ben Luc-Long Thanh Expressway Project.

After taking into consideration, we have agreed to the alignment of Ben Luc-Long Thanh Expressway, section passing through HCMC as per the alignment alternative 1 recommended by SEPMM (letter No. 02/KTGSM-T-PIU3.1 dated 15/6/2009) and Katahira & Engineers International joint venture with Oriental Consultants Co., Ltd in association with Asia Pacific Engineering Consultants (letter No. BLCT-VEC-P017 dated 12/6/2009).

MOT is kindly requested to instruct the Employer and Consultants to continue updating and dealing with comments in writing received from relevant units, departments so as to finalize the project prior to submission to authorized authority for approval.

Sincerely yours,

Distributions:

- As ditto;
- DPI, DOC;
- Dept. of Planning and Architecture;
- DOT;
- DONRE;
- File.

**PP. CHAIRMAN
STANDING VICE CHAIRMAN**

(signed and sealed)

Nguyen Thanh Tai

**PEOPLE'S COMMITTEE OF
DONG NAI PROVINCE**

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

Bien Hoa, 26th Oct. 2009

Ref. No.: 8709/UBND-CNN

Re.: agreement on alignment of Ben Luc-Long Thanh
Expressway Project, section passing through Dong Nai
province.

To: - Ministry of Transport

We were in receipt of your letter No. 5308/BGTVT-KHDT dated 05/8/2009 regarding request for agreement on alignment of Ben Luc-Long Thanh Expressway Project, section passing through Dong Nai province. After consideration, we have comments as follows:

1. Agreed to the alignment of Ben Luc-Long Thanh Expressway, section passing through Dong Nai province, as per the alignment alternative recommended by the Consultant, specifically as follows:

The southern inter-regional expressway section passing through Dong Nai province starts at Station Km29+750 (the location of Phuoc Khanh Bridge) and ends at Station Km58+000 (at the intersection point with Bien Hoa - Vung Tau expressway), of which, the section passing through Nhon Trach district area starts at Km29+750 to Km52+500, the section passing through Long Thanh district area starts at Km52+500 to Km58+000. On the alignment, there will have Phuoc Khanh bridge crossing Long Tau river (Km29+750), avoided Phu Huu 1 Port under construction, bridge crossing Thi Vai river (Km52+500) and some small bridges.

Regarding the alignment, from Km29+750 (Phuoc Khanh Bridge), the alignment runs parallel with 500KV power line (about 130m away from the power line), then crosses 500KV and 220KV power lines at Km31+500.

From Km31+500 to Km52+500, the alignment runs in between 110KV power line and Nhon Trach outer road in accordance with the master plan of Nhon Trach new urban area approved by the Prime Minister.

From Km52+500 to Km58+500, the alignment crosses Thi Vai river (Km55+500), then crosses NH51 at Km57+500 and connects to future Bien Hoa-Vung Tau expressway by an interchange (Km58+500).

2. According to the master plan of Nhon Trach new city approved by the Prime Minister, the Ben Luc-Long Thanh Expressway is planned with ROW of 70m, we would like to request MOF to consider and regulate the ROW of the alignment section passing through Dong Nai province in accordance with the planned ROW approved by the Prime Minister, to avoid effect on the related projects.

3. Regarding interchanges along the alignment: agreed to the location, scope and type of the four interchanges under Ben Luc-Long Thanh Expressway, section passing through Dong Nai province, as per the Consultant's proposal, specifically:

- Interchange at Km33+000 with the planning road of Nhon Trach New City. The interchange is designed in Trumpet type, the planning road runs over the expressway. The interchange branch crosses the expressway by a flyover.

- Interchange at Km50+530 with the road to Phuoc An Port. The interchange is designed in Diamond type, the expressway runs over the road to Phuoc An port, under is roundabout, the road to Phuoc An port is connected to the expressway by ramps. Roundabout is circle. This alternative has less effect on the approved master plan of Phuoc An Port logistics area.

- Interchange at Km56+600 with the existing National Highway No. 51. The interchange is designed in Diamond type, the expressway runs over National Highway 51, under is roundabout, National Highway 51 is connected to the expressway by ramp of turn right. Roundabout is circle.

- Interchange at Km58+420 with Bien Hoa-Vung Tau Expressway. The interchange is designed in Trumpet type, the Ben Luc-Long Thanh expressway runs over Bien Hoa-Vung Tau expressway./.

Distributions:

- As ditto;
- SEP/MU;
- Chairman and Vice Chairmen of PC;
- Departments;
- PC of Long Thanh, Nhon Trach districts;
- File

**PP. CHAIRMAN
VICE CHAIRMAN**

(signed and sealed)

Tran Van Vinh

MINISTRY OF TRANSPORT
VIETNAM MARITIME ADMINISTRATION

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

No.: 1534/CHHVN-KHTC

Re.: information on navigation clearance, vessel impact load and plans of Nha Be, Long Tau and Thi Vai rivers

Hanoi, 24th July 2009

To: - Vietnam Expressway Corporation

We were in receipt of your letter No. 662/VEC-PIU3 dated 05/6/2009 and letter No. 801/VEC-PIU3 dated 26/6/2009 requesting us to provide data on navigation clearance, vessel impact load and plans of Nha Be, Soai Rap, Long Tau, Thi Vai rivers and Song Cha Channel. At your request, we have instructed Port Design and Maritime Technique Consultancy JSC (the consultant made the master plan for seaport development in Vietnam to 2010, and the Orientation up to 2030) to check and review the port plans on Soai Rap, Long Tau, Nha Be and Thi Vai rivers and hereby provide you with the related information as follows:

1. Navigation clearance:

a) Long Tau, Soai Rap and Nha Be rivers have been planned for vessels of 20000DWT of full load and 30000DWT of decreasing load, the existing width of shipping channel is 150m with the vessel speed of around 5m/s. With such shipping channels, the required horizontal navigation clearance will be determined in accordance with the Technical requirements for port and harbor development (attached to the Decision No. 109/QĐ-CHHVN dated 10/3/2005 by General Director of Vietnam Maritime Administration) with at least 242m, the vertical navigation clearance determined according to AASHTO is 55m. During construction, you are kindly requested to contact Maritime Safety Company II to be provided with the exact locations of the shipping channels.

b) For Song Cha Channel: presently only serve for local waterway traffic with no plan for upgrading for large DWT vessels.

c) For Thi Vai river: according to your provided documents, the bridge of Ben Luc-Long Thanh Expressway crossing Thi Vai river will be located in the upstream of Phuoc Thai Port, where there is no plan for port development up to 2020.

2. Vessel impact load: the calculation of vessel impact load on bridge structure is of the Design Consultant's responsibility, not under our competence to consider.

For your information and implementation.

Distributions:

- As ditto;
- General Director (to report);
- Port Authorities of HCMC, Dong Nai, Vung Tau
- Maritime Safety Company II
- File

PP. GENERAL DIRECTOR
DEPUTY GENERAL DIRECTOR

(signed and sealed)

Nguyen Ngoc Hue

Ref. No.: 74 /TB-SGTVT

Tan An, 08th June 2009

NOTICE

**Meeting on construction option for
the Ben Luc – Long Thanh Expressway Project**

At 08:30AM, on 04th June 2009, Department of Transport of Long An Province held the meeting with Southern Expressway Project Management Unit (SEPMU) and provincial agencies of Long An on the construction option for the Ben Luc-Long Thanh Expressway reported by the Consultants (KEI and TediSouth).

Participants:

- + Mr. Luu Dinh Khan : Director/Department of Transport – Chairman
- + Mr. Dang Van Sang : Deputy Director of Department of Planning and Investment
- + Mr. Phan Ngoc Hung : Vice Chairman of Can Giuoc PC
- + Mr. Huyen Quoc Viet: Vice Chairman of Ben Luc PC
- + Mr. Nguyen Van Thanh : Manager of Power Management Div./Dept. of Commerce & Industry
- + Ms. Chau Thi Le: Deputy Manager of Planning&Finance Div./Dept. of Commerce & Industry
- + Mr. Luu Van Khanh : Department of Construction
- + Mr. Huynh Anh Tuan : Department of Natural Resources and Environment
- + Mr. Le Xuan Hai: Deputy Manager of Transport Management Div./Department of Transport
- + Mr. Nguyen Hoai Phong: Expert/ Transport Management Div./Department of Transport
- + Mr. Nguyen Thanh Son : Expert/ Department of Transport
- + Mr. Dinh Cong Khanh : Department of Transport
- + Mr. Huynh Khai Phong : Deputy Director of Civil Works PMU
- + Mr. Bui Van Canh : Director - SEPMU
- + Mr. Thai Dinh Dung : Deputy Director - SEPMU
- + Mr. Timothy Collett: Team Leader – KEI
- + Mr. Nguyen Anh Tuan : Technical Department - TediS
- + Other Staff from the Consultants.

Contents:

After the report on the proposed alignment for Ben Luc-Nhon Trach Expressway and contribution comments from the participants, Mr. Luu Dinh Khan – Director of Department of Transport concluded as follows:

- Agree with the alignment proposed by the Consultants as the alignment is in accordance with the comments made by Long An People's Committee in the letter ref. no. 5414/UBND CN dated 03rd November 2006. However, the Consultants were requested to continue studying and resolve the following matters:

- The alignment should avoid crossing through religion areas (communal houses, temples, pagodas...), residential areas, especially the areas belonging to My Yen Commune (Ben Luc District), and Phuoc Ly Commune (Can Giuoc District);
- For the Projects of Nguyen Minh Residential area (My Yen Commune), Phuoc Ly Resettlement area (Five Stars International JSC), Hai Son Industrial Zone (Long Thuong Commune), due to difficulty in adjustment of the alignment, the Consultants shall study carefully to find optimal option to minimize the effects on these projects such as construction of viaduct, Exits for the section passing through Industrial Zone to be supplemented, connecting the expressway with the industrial zone etc.;
- For the Technical Works (power, optical cable, water ...): the Consultants, the Employer were kindly requested to contact relevant units for agreements and to be provided with related documents, data, maps during preparing the Project.
- The local agencies, where the alignment passes through, as well as provincial agencies are kindly requested to facilitate the Consultants, the Employer during the survey work and setting out for the Project so that they can update enough data on residential status, master plans, environment, social status, population etc. to their study for the Project to prepare the Project suitable with the practice.
- Due to urgent need for progress of preparing the Project, Department of Transport will send an official letter to Long An People's Committee by 10th June 2009 to request for agreement on the proposed alignment. The concerned agencies are to continue reviewing relevant matters and issues after this meeting so as to give additional comments and feedback if necessary before Department of Transport sends the letter to the People's Committee.

The meeting ended at 10:30AM on the same day.

DIRECTOR

(signed and sealed)

Distributions:

- Long An PC (to report);
- Participants,
- File.

Luu Dinh Khan

NOTICE

**from the Meeting on Report on the Ben Luc – Long Thanh Expressway Project,
section passing through HCMC**

At 08:30AM, on 03rd June 2009, at HCMC Department of Transport's Office (163 Ly Tu Trong, District 1), the meeting on report on the Ben Luc-Long Thanh Expressway Project, section passing through HCMC was held.

- Chairman: Mr. Le Toan - Deputy Director of HCMC Department of Transport (DOT).
- Participants comprised of representatives from Dept. of Planning and Investment, Dept. of Planning and Architecture, Dept. of Natural Resources and Environment, Dept. of Finance, Dept. of Construction, Dept. of Commerce & Industry, Dept. of Information and Communication, People's Committees of Binh Chanh, Nha Be, Can Gio Districts, Association of Science and Technology, SAWACO, Power Transmission Company No. 4, SEPМУ, Urban Traffic Management Division No. 4, and Divisions of Traffic Management, Planning and Investment, Waterway Traffic Management, Water Supply and Sewage Management under HCMC DOT.

After the contribution comments from the participants, Mr. Le Toan – DOT Deputy Director concluded the contents agreed by the participants as follows:

1/ The alignment proposed by the Consultants and ROW for the expressway are basically agreed by all the relevant agencies. To have basis for official implementation, SEPМУ is kindly requested to provide documents, alignment options for HCMC DOT so that HCMC DOT will forward to authorities of relevant districts and concerned departments to get their official comments prior to submission to HCMC People's Committee for approval.

Note: Regarding phasing of investment, the Employer is advised to consider to arrange carriageways on both sides of the expressway to ensure that the proposed ROW is preserved for the next phase of investment. In addition, Phase 1 currently proposed as 4-lane road is not likely to meet the traffic demand, the section passing through HCMC city should have parallel road in order to separate the local traffic and the expressway.

2/ People's Committee of Nha Be District is requested to issue an official letter indicating that the alignment option to pass over Nha Be River is not feasible.

3/ Department of Natural Resources and Environment is requested to give comments, in writing, on the effects (if any) of the alignment on the Can Gio Biosphere Reserve.

4/ Based on the contribution comments from the participants, SEPMMU is kindly requested to update the related data to prepare an official document and final proposal of the alignment for the Ben Luc-Long Thanh Expressway, section passing through HCMC (including the issues that require the coordination of relevant authorities and agencies, solutions to the issues, drawings showing the areas where the alignment passes through etc.) and send to HCMC DOT before 15th June 2009 so that HCMC DOT can issue a letter asking for final comments on the alignment from the relevant agencies. Then, HCMC DOT will summarize the comments received and report to HCMC People's Committee for their review and decision.

By order of the Director of HCMC DOT, the Office Manager of HCMC DOT would like to notify to the participants and the relevant authorities and agencies the above contents for information and implementation.

**BY ORDER OF DIRECTOR
OFFICE MANAGER**

(signed and sealed)

Distributions:

- Participants;
- DOT (Director, Deputy Director);
- DOT Divisions;
- File.

Dang The Trung

Ref. No.: 1020/TB-SGFVT

Bien Hoa, 18th June 2009

NOTICE

the result of meeting with Southern Expressway Project Management Unit on the alignment of the Southern inter-regional expressway (Ben Luc-Nhon Trach-Long Thanh), section passing through Dong Nai province

In implementation of the guidance by Dong Nai People's Committee (PC) at the letter No. 4154/LUBND-CNN dated 29/5/2009 requesting Dong Nai Department of Transport (DOT) to chair a meeting with the provincial agencies, departments and SEPMPU to coordinate study and determine the alignment of the Southern inter-regional expressway.

On 02/6/2009, Dong Nai DOT chaired a meeting with the provincial agencies, departments and relevant local authorities to consider and reach agreement on the alignment of the Southern inter-regional expressway, section passing through Dong Nai Province. The contents of the meeting are as follows:

I/ Participants:

1/ Representatives from Department of Transport

- Mr. Nguyen Van Ly - Deputy Director
- Mr. Vu Xuan Du - Expert

2/ Representatives from Department of Planning and Investment

- Ms. Tran Thi Tuyet Mai - Expert

3/ Representatives from Department of Natural Resources and Environment

- Mr. Phan Van Linh - Deputy Director

4/ Representatives from Department of Construction

- Mr. Tran Thanh Liem - Expert
- Mr. Nguyen Phu Kien - Expert

5/ Representatives from Department of Commerce & Industry
Invited, but absent

6/ Representatives from Long Thanh PC

- Mr. Nguyen Minh Hoang - Vice Chairman
- Mr. Le Van Tiep - Deputy Manager/Department of Urban Management

7/ Representatives from Nhon Trach PC

- Mr. Pham Manh Dung - Deputy Manager/Department of Urban Management

8/ Representatives from Ba Ria-Vung Tau Department of Transport

- Mr. Luong Viet Thang - Manager/ Department of Planning

9/ Representatives from SEPMPU

- Mr. Le Manh Hung - Director
- Mr. Thai Dinh Dung - Deputy Director
- Mr. Timothy Collett - K&I Consultant
- Mr. Tran Trong An - Specialist
- Mr. Laong Van Liem - Deputy General Director - T&DS

- 10/Representatives from Phuoc An Port -Petroleum Investment Company*
 Mr. Nguyen Van Cong - Manager of Planning Department
11/ Representatives from Vietnam Petroleum Transportation Company
 - Mr. Vu Duc Loi - Chief of Project Department

IV/ Contents:

At the beginning, representatives from SEPML, KED Consultant, TEDIS had presented the scope and the alignment of the expressway, section passing through Dong Nai Province, specifically as follows:

- In Dong Nai province the alignment runs through Nhon Trach district (Km29+750-Km52+500) and Long Thanh district (Km52+500-Km58+00). The alignment crosses Long Tau river by Phuoc Khanh Bridge, avoiding Phu Hieu I port under construction and running parallel towards the South of the 500KV power line (about 130m away), crossing 500KV and 220KV power lines at Km31+500. From Km31+600-Km52+500, the alignment runs in between the right side of 110KV power line and Nhon Trach outer road in accordance with Nhon Trach Master Plan approved by the Prime Minister. The alignment crosses Thi Vai river at Km 52+500, crosses NH51 at Km57+000 and connects to the future Bien Hoa-Vung Tau expressway (Km58+000) by an interchange.
- Ending point located in Dong Nai province is one of studying objects, for phase I the Constant will study ending point to link to Ring Road 3 (RR3) or Bien Hoa-Vung Tau expressway.
- Scope of the Works: to construct the road with 04 lanes in Phase I, 08 lanes upon completion of Phase II; land acquisition work will be carried out in one time with ROW of 100m.
- Interchanges: there are three tentative interchanges in Dong Nai province at RR3, Phuoc An Port road, NH51 and Bien Hoa-Vung Tau expressway.

III/ Conclusions:

After contribution comments from the participants, the meeting came to the following conclusions:

- Agree with the alignment of the Southern inter-regional expressway project (Ben Luc-Nhon Trach-Long Thanh) in Dong Nai province as presented and recommended by the Consultant.
- The RR3 (Nhon Trach-District 9 Road and Bridge Project) is under seeking for investment, the construction is not yet carried out. Thus, the phasing of investment for the expressway proposed by the Consultant, i.e. in phase I the alignment connects to HCMC-Long Thanh-Dau Giay expressway to RR3, and the section from RR3 interchange to the crossing point with Bien Hoa Vung Tau expressway will be constructed in Phase II, is not proper. In addition, Ba Ria-Vung Tau DOT and Dong Nai DOT are coordinating to construct the inter-ports road from Cai Mep-Thi Vai port (Ba Ria-Vung Tau) to the link with the Southern inter-regional expressway; its basic design has been submitted to MOI for approval. As planned, this project will connect to the access of Phuoc An port and

link to the expressway. Therefore, we would like to suggest to invest and construct the Southern inter-regional expressway to the connection with Bien Hoa- Vung Tau expressway right in Phase I.

- According to the master plan of Nhon Trach new urban area, RR3 will connect to the Southern inter-regional expressway through the 25C Extension Road. The interchange between RR3 and the expressway as proposed by the Consultant is not included in Nhon Trach new urban area. This area is residential area of parishioners/religious people; thus, the Consultant is kindly requested to coordinate with PC of Nhon Trach district to carry out field survey so as to consider and determine location of RR3 interchange which can limit the effects on the households in this area.
- For the locations of interchanges, tunnel, flyover bridge, the Consultant is requested to survey and study carefully, and discuss and reach agreement with Dong Nai PC in the next meeting; in which, the interchanges at RR3, Ong Keo Industrial Zone, Inter-ports road, Phuoc An port road...should be paid due attention to.
- Land acquisition work is suggested to be done completely in Phase I.
- SEPMU is kindly requested to cooperate with the PC of Long Thanh and Nhon Trach districts to update the master plans of the districts to the project, by 25/6/2009.
- After getting the approval letter from Dong Nai PC, the Consultant is requested to discuss and get agreement with Nhon Trach and Long Thanh districts on the document of the project site prior to setting out the works at site.

The above are contents of the meeting with SEPMU on the alignment of the Southern inter-regional expressway. We would like to notify to the relevant units for studying and implementation accordingly.

Distributions:

- Dong Nai PC (to report);
- Participants;
- DOT Board of Directors;
- File

**FOR DIRECTOR
DEPUTY DIRECTOR**

(signed and sealed)

Nguyen Van Ly

APPENDIX D: TRANSPORT ECONOMICS

I. VEHICLE OPERATING COSTS AND TIME COSTS

The road users' savings in vehicle operating costs (VOC) and travel time costs (TTC) are the most direct economic benefits of a new or improved road, although not necessarily the largest.

TABLE 1 on the next page summarizes different unit costs for nine different vehicle types, as estimated by this consultant in June 2009. The following method was used:

- Each of the nine vehicles types is represented by the vehicle of that type believed to be the most commonly used in Ho Chi Minh City.
- The economic costs of each such vehicle was obtained by subtracting the import duty, excise duty and VAT from the financial purchase price. The purchase prices were obtained from the sales agencies and the current duty levels.
- Vehicle characteristics such as weights, normal tyre sizes, capacity for passengers or goods, passenger occupancies and goods loads were collected from the sales agencies and experienced users.
- Unit prices for fuel and engine oil were obtained from current price index, and the typical consumptions from own experience or interviews with filling stations. The same technique was used for the prices and typical life lengths of tyres.
- The extent and costs of necessary vehicle maintenance were estimated after interviews, mainly at workshops and of truck or bus operators.
- The utilisation of the respective vehicles, and the average mileage per year, was estimated by comparing with known, similar VOC estimates from some other South-East Asian countries (the Philippines, Malaysia, Indonesia and southern China).
- The costs of vehicle taxes and insurance were obtained through the Circular Letter 126/TT-BTC; 22/12/2008 from the Ministry of Finance.

Not all the user costs in Table 1 are operating costs, i.e. related to the driving of the vehicles. Some are 'fixed costs', depending only on the ownership of the vehicle but not on the costs of its use. The fixed costs include the cost of purchasing the vehicle, the annual tax and insurance, and the overhead costs for trucks and buses.

TABLE 1 also provides a summar of the key factors, as can be used to estimate the approximate vehicle operating costs in \$ per km.

TABLE 2 on the same page shows estimates of the value of lost time for travelling or transporting goods in different vehicles, during 2016 when the Expressway will be opened. The table is based on JETRA's "Study in Southern Inter-Regional Highway", March 2008, which also refers to some earlier data from HOUTRANS.

The value ('cost') of lost time while travelling obviously depends on the travel distance and the vehicle speed, but for the national economy also on the value of the work that the traveller could otherwise have done in the meantime. This value is related to the person's income, which is the main factor in assessing the value of time for passenger travel.

For goods transport, the value of lost time is often less than for passenger transport along the same route, at least unless the route is long or the goods sensitive to damages. Otherwise, the time value will be limited to the (theoretical) loss in interest rate for the goods during the transport time. Professional transport companies might also add the value of customer satisfaction.

TABLE 1. Characteristics and operating costs for different vehicle types

	Motor cycle	Passenger Car	Minibus	Standard Bus	Small Truck	Big Truck	Container Truck
Financial cost 2009 US\$	\$883	\$30,000	\$32,000	\$95,000	\$28,750	\$51,090	\$70,000
Import Duty		83%	30%	30%	70%	20%	18%
Excise Duty		45%	15%	15%	15%	15%	15%
VAT	5%	5%	5%	5%	5%	5%	5%
Economic Cost	\$550	\$12,876	\$15,102	\$12,750	\$15,264	\$36,493	\$50,725
Assumed average value	\$330	\$7,082	\$11,773	\$34,833	\$8,396	\$20,071	\$27,899
Assumed average age	10 yrs	15 yrs	15 yrs	15 yrs	15 yrs	15 yrs	15 yrs
Gross vehicle weight kgs	100	1,630	11,500	14,500	7,925	25,000	25,480
Capacity-passengers	2	5	16	34	3	3	3
Capacity-goods kgs	0	0	0	0	3,750	12,000	16,500
Average no. of crew	0	0	2	2	2	2	2
Passenger Occupancy	1.5	2.4	12.0	28.0	0.0	0.0	0.0
Average load (tonnes)					2.5	7.0	11.0
Type of Fuel (P or D)	Petrol	Petrol	Diesel	Diesel	Diesel	Diesel	Diesel
Fuel Price (US\$/L) Fin.	\$0.79	\$0.79	\$0.67	\$0.67	\$0.67	\$0.67	\$0.67
Fuel Price (US\$/L) Econ.	\$0.59	\$0.79	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50
Oil Price (US\$/L) Fin.	\$3.32	\$3.32	\$3.32	\$3.32	\$3.32	\$3.32	\$3.32
Oil Price (US\$/L) Econ.	\$3.02	\$3.02	\$3.02	\$3.02	\$3.02	\$3.02	\$3.02
Fuel Consumption (L/100 km)	2.2	10.0	20.0	30.0	26.0	38.0	60.0
Oil Consumption (L/1000 km)	0.3	2.5	8.0	12.0	12.0	17.0	25.0
No. of Axles	2	2	2	2	2	3	5
No. of Tyres	2	4	6	6	6	10	18
Typical Tyre Size	250x17	195x15	195x15	825x16	825x16	1100x20	1100x20
Price per Tyre (US\$) Fin.	\$10	\$56	\$256	\$400	\$182	\$400	\$403
Price per Tyre (US\$) Econ.	\$9	\$48	\$222	\$348	\$158	\$348	\$350
Maintenance hours/year	5	20	100	150	100	120	150
Maintenance labour cost (US\$/hr)	\$1	\$3	\$3	\$3	\$3	\$3	\$3
Spare parts consumption US\$/yr	\$26	\$900	\$960	\$2,850	\$960	\$1,533	\$2,100
Insurance (US\$/yr)	\$3	\$19	\$185	\$212	\$71	\$98	\$125
Crew Wages (US\$/month/person)			\$215	\$300	\$240	\$325	\$400
Hourly Utilization Ratio	30%	40%	60%	60%	50%	45%	60%
Productive time (hrs driven/yr)	450	500	1,000	1,200	1,200	1,200	1,600
Average Mileage (km/year)	10,000	15,000	40,000	60,000	30,000	40,000	45,000
Overhead costs (% of fixed cost)			15%	15%	10%	10%	12%
Annual Vehicle Tax (US\$/year)	\$0	\$4	\$4	\$6	\$6	\$9	\$9
Vehicle use US\$/km	\$0.010	\$0.032	\$0.020	\$0.039	\$0.016	\$0.033	\$0.041
Fuel cost US\$/km	\$0.022	\$0.059	\$0.101	\$0.151	\$0.101	\$0.192	\$0.303
Oil cost US\$/km	\$0.002	\$0.008	\$0.023	\$0.036	\$0.024	\$0.052	\$0.076
Tyre cost US\$/km	\$0.003	\$0.006	\$0.030	\$0.047	\$0.021	\$0.046	\$0.035
Crew cost US\$/km	\$0.000	\$0.000	\$0.118	\$0.110	\$0.072	\$0.179	\$0.195
Maintenance cost US\$/km	\$0.022	\$0.064	\$0.032	\$0.055	\$0.034	\$0.047	\$0.057
Total Vehicle cost US\$/km	\$0.059	\$0.169	\$0.324	\$0.438	\$0.268	\$0.549	\$0.707

TABLE 2: Time Costs in \$ per hour, per Passenger and per Vehicle

Vehicle Type	Motorcycle	Passenger Car	Mini Bus	Standard Bus	Small Truck	Big Truck	Container Truck
Passenger monthly wage rates	3,000,000	6,000,000	3,000,000	3,000,000			
Hourly wage rate in \$	\$0.97	\$1.94	\$0.97	\$0.97			
Driver monthly wage rate		3,500,000	3,500,000	3,500,000	3,500,000	4,000,000	5,000,000
Assistants			2,500,000	2,500,000	1,750,000	3,000,000	3,000,000
Driver +Assistant hourly rate \$	\$0.00	\$1.13	\$1.94	\$1.94	\$1.70	\$2.26	\$2.58
Percentage work time passengers	40%	40%	40%	40%			
Passenger Time Cost \$	\$0.39	\$0.77	\$0.39	\$0.39			
Vehicle Occupancy & Freight Tons	1.5	2.5	10	28	3	10	20
Freight Value per ton hour \$					\$0.17	\$0.17	\$0.22
Time Cost per hour by vehicle type \$	\$0.58	\$3.07	\$5.81	\$12.79	\$2.12	\$3.96	\$6.98

Note: The vehicle occupancy rates from HOUTRANS Study

II. REGISTERED MOTOR VEHICLES IN HCM CITY 2002 - 2008

VEHICLE TYPE	2002	2003	2004	2005	2006	2007	2008
Passenger vehicles							
Cars, <10 seats	65,894	108,495	117,318	128,545	138,518	155,968	178,286
% increase per year		65%	8%	10%	8%	13%	14%
Minibuses, 10-30 seats	20,949	26,373	27,648	31,739	33,549	35,707	37,814
% increase per year		26%	5%	15%	6%	6%	6%
Standard buses, >30 seats	4,186	5,587	6,045	6,631	7,127	7,771	8,266
% increase per year		33%	8%	10%	7%	9%	6%
Trucks							
<3.5 tonnes	29,562	39,252	49,541	53,564	58,998	66,863	76,586
% increase per year		33%	26%	8%	10%	13%	15%
3.5-10 tonnes	12,586	16,225	20,347	21,955	22,795	23,997	25,490
% increase per year		29%	25%	8%	4%	5%	6%
> 10 tonnes	6,238	7,379	8,246	8,950	9,362	10,288	11,361
% increase per year		18%	12%	9%	5%	10%	10%
Motorcycles							
	2,284,870	2,305,415	2,428,989	2,619,525	2,917,502	3,338,868	3,685,648
% increase per year		1%	5%	8%	11%	14%	10%

Source: Poliche Headquarters in HCM City

III. EXPORT PROCESSING ZONES AND INDUSTRIAL PARKS IN HO CHI MINH CITY AND ITS SURROUNDINGS

1. Ho Chi Minh Industrial Zone

Until 30 June 2008, the three export processing zones and twelve industrial parks in Hồ Chí Minh City attracted 1,156 investment projects, including 472 foreign investments with a total capital of 2.57 billion USD. The exports have been valued to about 16 billion USD, with the main markets in Japan, Europe, USA, Taiwan and China; but with products exported to more than 50 countries. No less than 249,881 workers are currently working in the export zones.

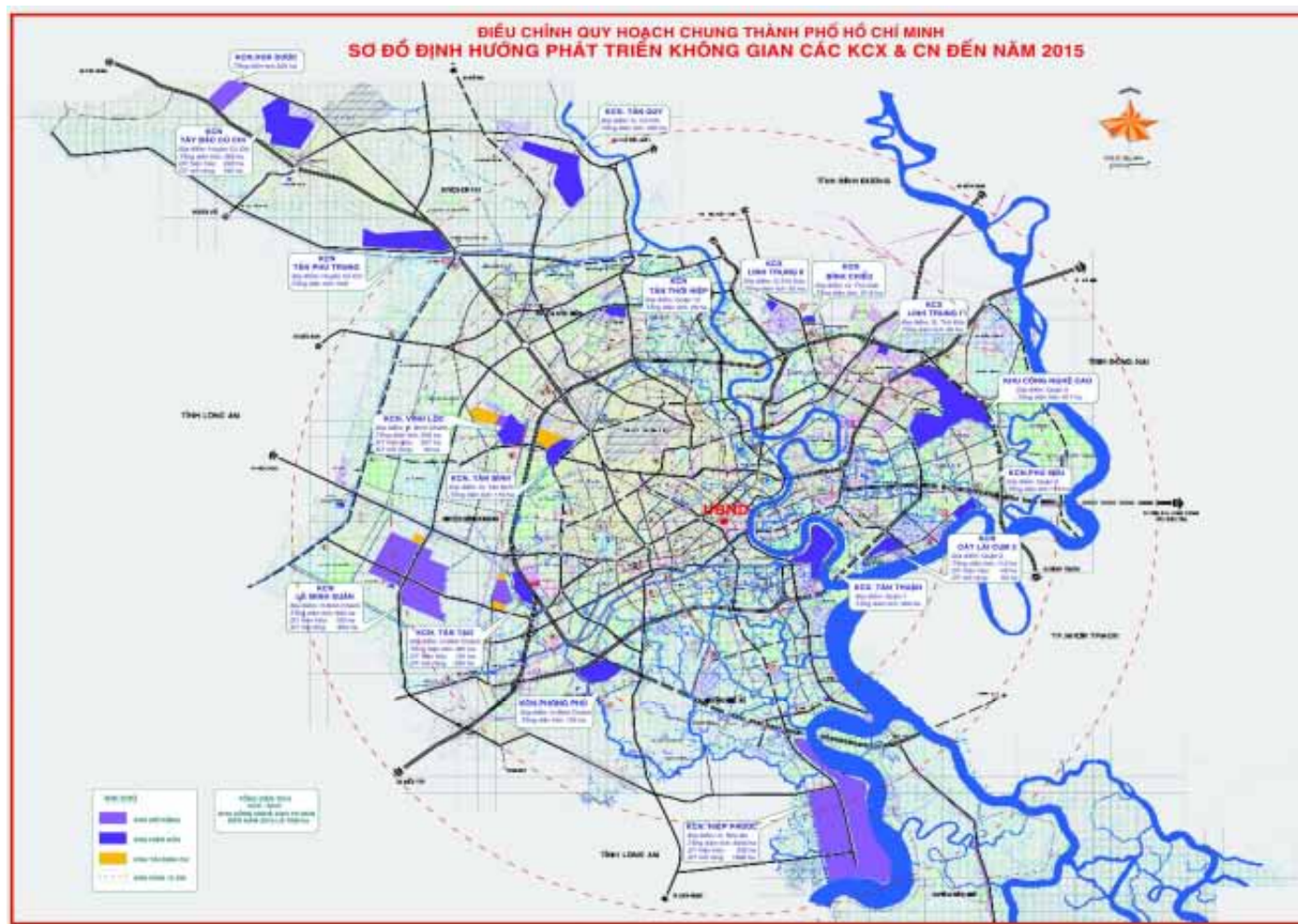
According to the Prime Minister's Decision No.188/2004/QĐ-TTg, regarding the master plan of industrial development by Hồ Chí Minh City for the period up to 2010 and 2020, land reserved for export processing zones and industrial parks measure 7,000 ha, out of which 4,000 ha are already exploited. The present development orientation of the HCMC. export processing zones and industrial parks focuses on investors willing to invest in modern and high tech fields, such as mechanical engineering, electronics and chemistry.

Hồ Chí Minh City is a vibrant, dynamic city offering a stable manufacturing base and an increasingly affluent population as a potential market. Up to now, Ho Chi Minh City has regularly contributed to about 20% of the national GDP, including 30% of the industrial production and 40% of the export revenues. The City also takes the first place in GDP average per capita.

After the Law on foreign investment in Vietnam had been promulgated in 1987, foreign investment into Vietnam increased rapidly. Most of them focused on services such as hotels, restaurants and offices in Ha Noi and Ho Chi Minh City. Foreign investment in industry, especially the industry for exports, met three main obstacles: bad infrastructure, difficult formalities of getting an investment license, and slow deployment of investment projects. Based on experience from other countries, the Government developed a new economic model for 'open door policies' regarding industrialisation and export processing zones.

South East Asia represents a potential market of 700 million consumers and Vietnam is close to its heart. Vietnam's population is estimated to reach 100 million by 2010, and its burgeoning marketplace is poised for explosion. A rapid recovery after the recession will be the ideal time to invest in the future growth. Vietnam's government is very much aware of the potential of the growing markets. Legislation allows for liberal trade activities. and most licensing formalities can be completed within a matter of days. The taxation policy is more favourable for investments in foreign enterprises, than the taxes in some neighbouring countries.

Master Planning & schedule of development for the Hồ Chí Minh City
Export Processing Zones & Industrial Parks until 2020



According to the master plan of development to 2020, Hồ Chí Minh city will have 22 export processing and industrial zones with 5.809 ha of area.

Presently, HEPZA is managing 3 EPZs and 12 IPs with more than 3.620 ha. Most of the Ips have been occupied from 60 percent and 100 percent of land lease

List of EPZs & IZs established and new IZs planned to establish according to the master plan of development to 2020 in Ho Chi Minh City

No	Name	Location	Quare (ha)
I. List of EPZs & IZs established			3,620
01	Tan Thuan EPZ	Dist. 7	300
02	Linh Trung I EPZ	Thu Duc Dist.	62
03	Linh Trung II EPZ	Thu Duc Dist.	62
04	Tan Tao IZ (1 st & 2 nd Stages)	Binh Tan Dist.	381
05	Vinh Loc IZ (1 st & 2 nd Stages)	Binh Tan Dist. & Binh Chanh Dist	259
06	Binh Chieu IZ	Thu Duc Dist.	27
07	Hiep Phuoc IZ (1 st & 2 nd Stages)	Nha Be Dist.	962
08	Tan Binh IZ (1 st & 2 nd Stages)	Tan Phu Dist. Binh Tan Dist.	134
09	Tan Thoi Hiep IZ	Dist.12	28
10	Le Minh Xuan IZ	Binh Chanh Dist.	100
11	Tay Bac Cu Chi IZ	Cu Chi Dist.	207
12	Cat Lai IZ	Dist. 2	124
13	Phong Phu IZ	Binh Chanh Dist.	148
14	Tan Phu Trung IZ	Cu Chi Dist.	543
15	Dong Nam Cu Chi IZ	Cu Chi Dist.	283
List of new IZs planned to establish			1,569
16	Vinh Loc III IZ	Binh Chanh Dist.	200
17	Phu Huu IZ	Dist. 9	114
18	Phuoc Hiep IZ	Cu Chi Dist.	200
19	Xuan Thoi Thuong IZ	Hoc Mon Dist.	300
20	Bau Dung IZ	Cu Chi Dist.	175
21	Le Minh Xuan II IZ	Binh Chanh Dist.	338
22	Le Minh Xuan III IZ	Binh Chanh Dist.	242
List of IZs planned to expand			620
	Hiep Phuoc IZ		500
	Le Minh Xuan IZ		120
	Total		5,809

LAND LEASE RATE AND PRICE

N O.	IZs/EPZs	AREA	LEASED LAND RATE	LAND LEASE PRICE (FOR REFERENCE)
1	Tan Thuận EPZ	300 ha	90%	168 USD/m ² /lease period
2	Linh Trung 1 EPZ	62 ha	100%	-
3	Linh Trung 2 EPZ	61.7 ha	100%	-
4	Tân Tạo IZ	380 ha	96,57%	220 – 250 USD/m ² /lease period
5	Tân Bình IZ (phase 1)	109 ha	100%	-
6	Lê Minh Xuân IZ	100 ha	100%	-
7	Vĩnh Lộc IZ (phase 1)	207 ha	100%	-
8	Tân Thới Hiệp IZ	215.4 ha	100%	-
9	Tây Bắc Củ Chi IZ	220 ha	96.63%	48 USD/m ² /lease period
10	Bình Chiểu IZ	27.34 ha	100%	-
11	Hiệp Phước IZ (phase 1)	311.4 ha	100%	-
12	Cát Lái II IZ	111 ha	100%	-
13	Phong Phú IZ	148.60 ha	0%	110 USD/m ² /lease period
14	Tân Phú Trung IZ	543 ha	59,48%	70 – 75 USD/m ² /lease period
15	Đông Nam Củ Chi IZ	-	-	-

Source: Ho Chi Minh City Export Processing And Industrial Zones Authority Website

You can get more information about development of industrial parks on website: <http://www.hepza.gov.vn>

2. DONG NAI INDUSTRY ZONE

Dong Nai has over 787 foreign direct investment (FDI) projects from 31 countries and territories with investment capital of US\$ 8.4 billion, ranking third after Ho Chi Minh City and Ha Noi Capital.

Order number	Industrial Zones	Foundation	Total (ha)
1	AMATA IZ.	31/12/1994	494 ha
2	BIEN HOA II IZ.	08/06/1995	365 ha
3	GO DAU IZ.	18/10/1995	184 ha
4	LOTECO IZ.	10/04/1996	100 ha (including 13 ha for export processing zone).
5	NHON TRACH III IZ.	02/07/1997	688 ha (1st phase: 337 ha; 2nd phase 2: 351 ha)
6	NHON TRACH II IZ.	02/07/1997	347 ha
7	NHON TRACH I IZ.	30/08/1997	430 ha
8	SONG MAY IZ.	07/04/1998	474 ha (1st phase: 250 ha; 2nd phase: 224 ha)
9	HO NAI IZ.	08/04/1998	497 ha (1st phase: 226 ha, 2nd phase: 271 ha)
10	BIEN HOA I IZ.	12/05/2000	335 ha
11	DET MAY NHON TRACH IZ.	26/06/2003	184 ha
12	NHON TRACH V IZ.	06/10/2003	302 ha
13	TAM PHUOC IZ.	06/10/2003	323 ha
14	LONG THANH IZ.	13/10/2003	488 ha
15	AN PHUOC IZ.	27/10/2003	130 ha
16	DINH QUAN IZ.	11/10/2004	54 ha
17	NHON TRACH VI.	01/06/2005	315 ha
18	NHON TRACH II - NHON PHU IZ.	16/12/2005	183 ha
19	NHON TRACH II - LOC KHANG IZ.	03/03/2006	70 ha
20	XUAN LOC IZ.	02/06/2006	109 ha
21	THANH PHU IZ.	23/08/2006	177 ha
22	BAU XEO IZ.	29/12/2006	500 ha
23	TAN PHU IZ.	26/03/2007	54 ha
24	AGTEX LONG BINH IZ.	26/06/2007	43 ha
25	LONG DUC IZ.	16/10/2007	283 ha
26	ONG KEO IZ.	12/03/2008	823 ha
27	LONG KHANH IZ.	04/06/2008	264 ha
28	Dau Giay IZ	27/08/2008	331 ha
29	Giang Dien IZ	27/08/2008	529 ha
Total area			9076 ha

Source: www.diza.vn

INDUSTRY ZONES of Dong Nai will be constructed in 2015

Order number	Industry Zone	Total (Ha)
1	Long Thanh Hi-Tech Industry Zone	500
2	Phuoc Binh IZ	190
3	Cam My	300
4	KCN Lộc An – Bình Sơn	500
5	Gia Kiem	330
6	Suoi Tre	150

Source: Decision 1107/QĐ-TTg on 21/08/2006 and letter 964/TTg-KTN on 17/06/2009 of PM

INDUSTRY ZONE MAP OF DONG NAI PROVINCE



3. LONG AN INDUSTRY ZONE

According to master plan, Long An has 18 IP with the total areas of 7.221,18 ha, such as:

- To date, Long An province has 14 established Ips with the area of 4.367 ha: Đức Hòa I, Xuyên Á, Tân Đức, Thuận Đạo, Vĩnh Lộc 2, Thanh Đức, Nhứt Chánh, Tân Kim, Long Hậu, Đông Nam Á, Cầu Tràm, An Nhứt Tân, Bắc An Thạnh and a part of Đức Hòa III
- Of which 10 have been in operation including: Đức Hòa I, Xuyên Á, Tân Đức, Thuận Đạo, Nhứt Chánh, Tân Kim, Long Hậu, Cầu Tràm, Bắc An Thạnh and a part of Đức Hòa III.
- According to the Master Plan of IP development to 2015 and vision 2020 approved by the Prime Minister, 4 IP will be established: Thế Kỷ, Nam Tân Tập, Tân Thành, Tân Bửu – Long Hiệp and a part of Đức Hòa III

To 6/2009, in 18lps, 4.436,51 ha were compensated for land owner. In 14 lps established, there were 3.587,55 ha compensated

4. Binh Duong Industry zone

- 27 IP have been established within the total area of 8.877 ha, distributed in four districts: Ben Cat has 9 IPS with 4.114,4 ha, Di An has 6 lps - 713,6 ha, Thuận An has 3 lps - 654,6 ha; Tân Uyên has 3 lps - 1.751,8 ha and 6 lps in coplea industry- service – urban area - 1.642,7 ha.
- Up to 9/2008, 23 lps have been in operation,.

5. Baria – Vung tau industry zone

SN	IP	Ratio of leasing (Up to 31/12/2008)	Area left (ha)
1	Đông Xuyên	99,93%	0,09
2	Phú Mỹ I	90,83%	63,76
3	Mỹ Xuân A	73,02%	61,53
4	Mỹ Xuân A2	44,92%	161,01
5	Mỹ Xuân B1	30,52%	109,58
6	Cái Mép	40,64%	266,52
7	Phú Mỹ II	25,51%	467,32
8	Mỹ Xuân B1 - Tiến Hùng (*)		139,75
9	Mỹ Xuân B1 - Đại Dương	6,62%	86,28
10	Phú Mỹ III (*)		630,07
11	Long Sơn	49,44%	450
12	Châu Đức	0,38%	964,36
	Tổng cộng	35,81%	3.400,27

(*): Invested in the near future

Up to 2015, Long Huong Industry park will be operated

IV. BINH KHANH FERRY

TABLE 1: The Ferries and their Characteristics

SN	Ferry	Year	Capacity	Crew
1	Binh Khanh A	1988	60 tons (200 Passengers & 40	4
2	Binh Khanh B	1988	60 tons (200 Passengers & 40	4
3	Binh Khanh C	2002	100 Tons (200 passengers & 80	4
4	Binh KhanhD	2004	200 Tons (350 passengers & 177	6
5	Binh Khanh E	1973	100 Tons (350 passengers & 70	4
6	Binh Khanh H	2007	100 Tons (350 passengers & 56,5	4
7	Binh Khanh I	2007	100 tons (500 passenger)	4
8	Cano	2007		1
9	Tug boat	1987		2

Source: The Consultant. **Note:** Binh Khanh A & B only used when others are maintained or repaired

TABLE 2: Number of Passengers and Vehicles on the Ferry 2005 - 2008

SN	Ferry used by:	2005	2006	2007	2008
1	Pedestrian	1,638,747	1,723,900	2,734,286	2,879,810
2	Passenger & bicycle	34,321	45,325	40,146	38,937
3	Passenger & motorcycle	1,599,305	1,610,388	1,712,002	2,000,576
4	3 wheel Non motor vehicle	4,384	6,477	4,434	4,901
5	3 wheel motor vehicle	5,159	5,162	3,277	3,647
6	Pass car under 7 seats	59,776	66,148	5,096	3,873
7	Pass vehicle: under 20 seats	0	0	55,452	63,7
8	Pass vehicle: From 20 to 30 seats	66,655	73,144	10,294	9,122
8	Pass vehicle: more than 30 seats	6,423	5,105	4,029	4,33
9	Truck: from 3 tons to 5 tons	2,936	4,429	4,029	4,33
10	Truck: from 5 tons	51,949	59,897	0	0
11	Truck: from 5 tons to 7 tons	0	0	2,496	2,757
12	Truck: from 7 tons to <10 tons	0	0	2,418	2,037
13	Truck: from 10 tons to <13 tons	0	0	733	771
14	Truck: from 13 tons to <15 tons	0	0	194	125
15	Truck: from 15 tons	0	0	113	217
16	Container truck with trailer	0	0	128	186
TOTAL per year		3,469,655	3,599,975	4,577,959	4,945,660

Source: The Consultant. **Note:** The classification of some vehicle types was changed from 2007.

TABLE 3: Prices for using the ferry

SN	FERRY RATE FOR:	UNIT	PRICE
----	-----------------	------	-------

1	Pedestrian	VND/Pass	500
2	Passenger & bicycle	VND/pass-vehicle	1.000
3	Passenger & motorcycle	VND/pass-vehicle	3.000
4	Non motor vehicle without goods	VND/vehicle	4.000
5	Non motor vehicle with goods	VND/vehicle	8.000
6	Lamboro three wheel	VND/vehicle	5.000
7	Pass car under 7 seats	VND/vehicle	15.000
8	Pass vehicle: From 7seats to 20 seats	VND/vehicle	18.000
9	Pass vehicle: From 20seats to 30 seats	VND/vehicle	20.000
10	Pass vehicle: over 30 seats	VND/vehicle	30.000
11	Truck under 3 tons	VND/vehicle	25.000
12	Truck: from 3 tons to 5 tons	VND/vehicle	30.000
13	Truck: from 5 tons to 7 tons	VND/vehicle	50.000
14	Truck: from 7 tons to under 10 tons	VND/vehicle	60.000
15	Truck: from 10 tons to under 13 tons	VND/vehicle	70.000
16	Truck: from 13 tons to under 15 tons	VND/vehicle	80.000
17	Truck: from 15 tons	VND/vehicle	120.000
18	Container truck with trailer	VND/vehicle	150.000

Source: The Consultant. Information collected July 2009.

OPERATIONS OF THE FERRIES:

- 24 hours per day
- 47 – 53 round trips during normal days, 61 - 75 during weekends and holidays,
- Three big ferries (100 or 200 tons) will be used during peak hours
- Time per round trip 45 minute running and 20 waiting for a 100 ton ferry, 40 minute running and 20 waiting for a 60 ton ferry

APPENDIX E1:

VEC

EVALUATION

CURRENCY EQUIVALENTS

(as of 29 July 2009)

Currency Unit – dong (VND)

VND1.00 = \$0.000056

\$1.00 = VND17,800

ABBREVIATIONS

ADB	-	Asian Development Bank
ADF	-	Asian development fund
BEDC	-	BIDV Expressway Development Company
EBC	-	engineering base cost
DS	-	debt service
CIT	-	Corporate income tax
DSCR	-	debt service coverage ratio
FC	-	foreign cost component
FCDD	-	financing cost during development
FS	-	feasibility study
IA	-	implementing agency
IDC	-	interest during construction
IBRD	-	International Bank for Reconstruction & Development
JBIC	-	Japan Bank for International Cooperation
LA	-	loan agreement
LC	-	local cost component
MOF	-	Ministry of Finance
MOT	-	Ministry of Transport
OCR	-	ordinary capital resources
ODA	-	official development assistance
O&M	-	operation and maintenance
PC	-	People's Committee
PCU	-	passenger car unit
PMU	-	project management unit
SOE	-	state owned enterprise
TA	-	technical assistance
TEDI	-	Transport Engineering and Design Incorporated
TOR	-	Term of Reference
VAT	-	value added tax
VEC	-	Vietnam Expressway Corporation
VND	-	Vietnamese dong
WACC	-	weighted average cost of capital
WB	-	World Bank

NOTE

- (i) In this report, "\$" refers to US dollars

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I. INTRODUCTION

1. Ben Luc – Long Thanh Highway Technical Assistance Project (the Project) is to assist the Government of Viet Nam in preparing the Ben Luc – Long Thanh Highway Project. The scope of the Project includes (i) to determine general expressway alignment, (ii) to undertake engineering, economic, financial, social, and environmental feasibility studies, and (iii) to prepare social and environmental safeguard plans for the Project. The Project is financed by ADB Loan TA 7155-VIE, and the implementing agency for the Project is the Vietnam Expressway Corporation (VEC).
2. The Consultants for the Project is Katahira & Engineers International, in association with Oriental Consultants, and Apeco of Hanoi. The Consultant commenced work on May 2009 with a 09 month schedule for Feasibility Study (FS).
3. This report is produced following completion of FS and finalizing of the horizontal alignment. It has the aim of summarizing all information required in support of a loan application to ADB.
4. Reference is made to previous or related studies including
 - VIE-4695 Expressway Network Development Plan Project, Final Report, Finnroad, April 2007
 - VIE-40198 Report and Recommendation of the President to the Board of Directors for Ho Chi minh City – Long Thanh – Dau Giay Expressway Project, September 2008
 - Report and Recommendation of the President to the Board of Directors on Proposed Loans to the Socialist Republic of Viet Nam for the Greater Mekong Sub region: Kunming–Hai phong Transport Corridor–Noi Bai–Lao Cai Highway Project. Manila (Loans 2391/2392[SF]-VIE, 2007
 - Project Administration Memorandum: Socialist Republic of Viet Nam: Ho Chi Minh City– Long thanh– Dau Giay Expressway Construction Project, Project Number: 40198, Loan Number: 2451 (OCR), June 2009
 - VIE 2009-28 Asian Development Bank Support for the Transport Sector in Viet Nam, August 2009

II. LEGAL AND INSTITUTIONAL DEVELOPMENT BACKGROUND OF VEC

5. The Vietnam Expressway Corporation (VEC) was established in October 2004 as a state-owned enterprise (SOE) under the direct control and supervision of the Ministry of Transport (MOT). VEC is the designated entity to become the eventual owner and perhaps also operator¹ of selected² expressway assets in Viet Nam. Hence, VEC is apparently not the only “player” in the development of expressways in Viet Nam.

6. VEC’s present main institutional characteristics in terms of vision and business objectives are that the organization has a “provisional” organization structure as well as a “provisional” charter³. The provisional charter defines VEC’s institutional mandate and functions quite broadly in Article 4 as:

- “Investment in expressway construction, management, maintenance and organizing toll collection on the national expressways
- Investment in construction of other transport infrastructure by different modalities
- Operation and doing business by providing services along expressways; such as: rest houses, restaurants, filling stations, advertisement and construction materials
- Transport engineering consultancy: studying the national expressway network development; preparing pre-feasibility studies and feasibility studies; designing and supervising transport infrastructure construction works; and
- Studying development of service in the adjacent areas to the expressways”⁴.

7. VEC’s current core activities consist of the promotion of the expressway “Master Plan” and the development of four out of seven (07) active expressway projects, out of which the “Cau Gie – Ninh Binh, Noi bai – Lao cai and Hochiminh – Longthanh - Dauguiay expressways are under construction with the supervision of VEC.

8. VEC’s total charter capital promised by the state at its establishment in 2004 was about US dollar 56.12 million⁵. The Ministry of Finance (MOF) transferred around US dollar 2.8 million by the time of its foundation. However, VEC’s charter capital increased as of January 1st, 2005 and reached in December 31st, 2005 a level of US dollar 15.80mil, of which US dollar 8.56 million is additionally provided by MOF, US dollar 4.43 million originates from toll collections, transferred by MOF from toll collected on tolled national highways, which are administered by “Viet Nam General Road Administration (VGRA)”, a division of MOT. It is envisaged that the remaining charter capital of around US dollar 40.32million will be provided by granting VEC toll collection rights for the Cau Gie and Phu Dong toll plazas for ten years. **To date 31 December 2008 charter capital of the Company is US dollar 56.27 million.** VEC has issued some government backed-bond for financing the construction of the Cau Gie – Ninh Binh and Noi bai – Lao cai Expressways.

9. VEC in its current start-up phase is provisionally organized in accordance with the provisions of the “Law on State Enterprises”⁶ along three (3) hierarchical levels, seven (7) divisions with functional responsibilities. In addition, there are two (3) project implementing units (PIUs) for the Cau gie - Ninh binh, Noi bai - Lao cai projects and Southern projects and two (02) subsidiaries including the Expressway Consulting Joint Stock Company and the Expressway Servicing Joint Stock Company . Total staff on VEC’s payroll was 243 people in June 2009. The organization’s operational principles are regulated by the “Temporary Operational and Organization Regulation”, approved by MOT with decision No. 3446/QD-

¹ The discussion as to whether O&M of the expressways should be outsourced under concessionaire contracts is ongoing and no final decision seems to have been taken yet.

² See Section 7.3 for details. According to information received from VEC, not all expressways identified presently in the Prime Minister’s approval list will be constructed and operated by VEC,

³ The recent FINNROAD-Study (April 2007) analyses VEC’s prevailing institutional set-up in relative detail in Chapter 2.6 of Volume 2 of the Final Report. The detailed findings, conclusions and recommendations stated in the FINNROAD-Study do not need to be repeated here, but rather form the starting point for more detailed deliberations.

⁴ MOT decision No. 3033/QD-BGTVT dated October 6th, 2004: VEC Charter; MOT Decision 3446/QD-BGTVT dated November 12th, 2004.

⁵ The charter capital is 1,000 billion VND, equivalent to US dollar 56.12 million at an exchange rate of VND 17,800 to one US dollar. All US dollar quotes are using this exchange rate unless explicitly stated otherwise.

⁶ Details of the current organization structure are presented and discussed in the FINNROAD-Study; Vol. 2; Chapter 2.4, pp. 13 ff.

BGTVT dated November 12th, 2004. The financial management of VEC as a SOE is regulated in the “Financial Regulations Of The Vietnam Expressway Corporation” promulgated by Decision 2547/QD-BGTVT dated November 22nd, 2006 by MOT⁷.

10. However, Viet Nam’s prevailing law requires that VEC-type SOEs be converted no later than July 1st, 2010 either into a limited liability or shareholding company. The legal conversion requirement will have a profound impact on VEC’s institutional and commercial performance opportunities and risks, since the date falls into the peak years of planned investment activities⁸.

11. A full-scale institutional capability and capacity analysis is beyond the scope of the present investigation. However, selected current institutional capacities and capabilities of VEC are presented based on the analyses in the FINNROAD report, selected interviews with VEC core staff as well as “birds-eye-view” institutional analyses. They are presented in the matrix in Table 1.

12. VEC even under the prevailing regulatory framework for SOE’s must be a profitable entity, in order to enable MOF to on-lend ODA loan receipts. A converted VEC that takes either the legal form of a limited liability or shareholding company must be even more considerate to ensure its long-term commercial viability, in order to ensure and maintain high levels of credit-worthiness and credibility with lending institutions and/or potential private sector investors.

13. Major issues, in order to achieve and sustain such high levels are:

- The almost total absence of in-house demand modeling expertise which results in having to rely on other entities
- VEC’s lack of practical experience as an expressway owner and operator, and
- VEC’s lack of practical experience in asset management and full commercial orientation of its activities.

⁷ An unofficial English translation is attached in Appendix 2.

⁸ VEC plans presently to invest around US dollar 1,844 million up to 2011, equivalent to about 42.86 per cent of the total investment volume up to the year 2020.

Table 1 Selected VEC Institutional Capabilities & Capacities

Issues	Observations	Preliminary capability and capacity rating
Transport Sector Policy Formulation	Currently outside mandate & playing field of VEC. However, this may become important once VEC is converted into a limited liability or shareholding company that must be commercially viable. After conversion, VEC must make contribution, inter alia, to policy fields such as "road transport sector competitive environment", "toll rate determination" and "toll rate adjustment mechanisms".	Currently not applicable
Project Identification & Planning	The actual process during which expressway and/or "other transport infrastructure" are identified and formulated is not clear. That leaves VEC little room to select projects with high "profitability"	Low
Business Plan Development, Monitoring & Verification	The current investment program which reflects a prioritized long-list of projects was undertaken by an out-house consultant. VEC appears to have, at present, little in-house expertise to verify the proposed investment program.	Low
Review of F/S: Technical Aspects	VEC's "Project Technical Division" is presently responsible for project preparation & implementation, construction supervision and QM. The Division is staffed with 21 persons in Ha Noi.	Medium
Review of F/S: Economic & Financial Analysis	VEC relies currently on the economic and financial results received from other institutions, such as TEDI. A critical review of such results appears not to be undertaken.	Low
Demand Modeling & Demand Analysis	Accurate demand analysis is the central key to ensure accuracy of the economic and financial viability of and individual project. VEC does not undertake its own "sector" and/or "project-related" demand modeling. This is a core-deficiency.	Low
Construction Supervision & Construction Quality Management	After conversion issues that may become critical are, inter alia, construction supervision and QM (claims management).	Medium to High
Customer's Service Orientation	Will become important once VEC becomes the owner & operator of expressways.	Currently not applicable
Toll collecting	VEC has presently no toll collecting experience & little in depth knowledge of modern toll collecting systems and their operational implications.	Low
Road Maintenance	VEC has presently no experience in this type of activity, but needs to develop in-house expertise.	Low
Management Information System (including a FMIS)	Is at present not institutionalized, but will be needed once VEC becomes a commercial expressway investor and operator.	Low
Staff Motivation	Staff motivation levels are high but need to be tailored more toward a "commercial thinking".	Medium to High

III. SUMMARY OF EXPRESSWAY INVESTMENT PLAN 2008 TO 2025

14. Recently, MOT has submitted the expressway master plan on November 2007, (No. 7056/TTg-BGTVT) and the approval by Prime Minister has been given on December 2008 (No. 1734/QD-TTg). The outline is that the total length is 5,873 km (including 120 km on operation), of which 2,512 km up to year 2020, and 3,241 km after year 2020. The expressways of Cau Gie – Ninh Binh, Noi Bai – Lao Cai, Long Thanh – Dau Giay, and Ben Luc – Long Thanh are included into the category of planned section up to 2020.

15. VEC is mandated with the implementation of selected expressway priority projects that form part of the recent expressway master plan (MP) attached to the Decision 1734/QD-TTg dated 01 December 2008 signed by the Prime Minister. The master plan comprises thirty-nine (39) expressway investment projects that are prioritized by the period before 2020 and afterwards as summarized in Table 2.

Table 2 Viet Nam Proposed Expressway Network Development Plan up to 2020 and beyond

Before 2020	Beyond 2020
22 projects	17 projects
Total length: 2,512 km	Total length: 3,241 km
Total cost: US \$ 18890 million	Total cost: US \$ 24,156 million

Source: Decision 1734/2008/QD-TTg dated 01 December 2008

Note: Total cost is defined as cost before financing and expressed in 2009 US dollar constant price base (1US\$ = VND 17,800).

16. Out of the twenty two (22) expressway projects listed in the expressway master plan for implementation before 2020, seven projects are approved for VEC management. Out of the seven projects, only four (4), namely:

- Cau Gie – Ninh Binh (presently under construction)
- Noi Bai - Lao Cai (presently under construction and tender stage),
- Hochiminh - Long Thanh – Dau Giay (presently under construction and tender stage)
- Ben luc - Long thanh (presently in its FS)

are covered by the present financial viability consideration of VEC. The other three are the Da nang – Quang ngai, the Ha noi – Lang son and the Ha long – Mong cai expressways. The Da nang – Quang ngai is designed with a feasibility study conducted in 2007 which is required to be reviewed by one of the sponsors (WB). The feasibility study of the Ha noi – Lang son and the Ha long – Mong cai expressways has been started since November 2009. The management of the Da nang – Quang ngai project is assigned to the PIU3 of VEC while that of the Ha noi – Lang son and Ha long – Mong cai roads is expected to be outsourced to consulting firms. The seven projects under VEC management are summarized in Table 3.

Table 3 Expressway Projects Approved for VEC management

Expressway Name	Status		Tentative Sources of Funds (US\$ millions)				
	Start constr	Start operat	Length (km)	Gvt.	Gvt. bonds	ODA	Invst. Cost
Cau Gie - Ninh Binh	on-going	2013	50	x	x		482.17
Noi Bai - Lao Cai	on-going	2013	244	x		ADB	1,216.05
HCM - Long Thanh - Dau Giay	on-going	2013	55	x		ADB, JBIC	932.40
Ben Luc - Long Thanh	2012	2016	58	x		ADB, JICA	1,674.30
Ha Noi - Lang Son	2010*	tbd	130	x		Chinese ODA/ BOT	740.00
Ha Long - Mong Cai	2010*	tbd	128	x		Chinese ODA/ BOT	837.60
Da nang – Quang ngai	2010	2013	130	x		WB/JICA	2,480.00
Total			795				8,362.52

Sources: Decision 1734/2008/QĐ-TTg dated 01 December 2008

Decision 412/2007/QĐ-TTg dated 11 April 2007

* Oriental Consultants Co. Ltd. started PPTA on Nov 2, 2009 and but construction date has not been decided

tbd = to be determined; Investment cost of HN-LS and HL-MC is without FCDD.

17. Table 4 provides the tentatively estimated drawdown schedule. It is tentatively estimated that the four projects, if implemented as planned, will have a total investment cost of US dollar 4,304.9 million with the peak for investment financing falling into the years 2011 (US dollar 751.38 million) and 2012 (US dollar 1,179.6 million), equivalent to 44.86 per cent of the total approved investment cost for VEC's expressway package over the period. The four expressway projects have a total length of 407 km, equivalent to 51 per cent of total length of VEC managed expressways planned under the Prime Minister's approval list.

IV. BASIC ASSUMPTIONS FOR CONSOLIDATED INSTITUTIONAL FINANCIAL VIABILITY ANALYSIS

18. The results of indicators regarding individual project's financial viability indicators and VEC profitability are dependent variables of (i) the magnitude of engineering base cost estimates; (ii) the engineering draw down schedules, including the construction methods; (iii) the financing plans underlying each individual project and the financing charges arising from the selected financing plans, (iv) potential delays in project realization; (v) projected physical traffic demand, (vi) the gross revenue streams that result from the physical demand and its related toll rate, (vii) the operating and maintenance costs during project lifetime, and (viii) the value added tax (VAT) as well as corporate income tax (CIT) regime applicable to the Vietnam Expressways Corporation (VEC).

Table 4 VEC Tentative Expressway Draw-Down Schedule & Related Investment Cost*Unit: US\$ million*

Express way Project	Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
	Length														
CG-NB	50	131.56	38.37	100.29	105.22	106.73									482.17
NB-LC	244	0.00	1.18	298.54	316.49	374.18	165.49	28.47	29.31	2.40					1,216.05
HCM-LT-DG	55	66.92	294.88	161.41	171.85	183.32	26.78	6.67	6.76	6.86	6.95				932.40
BL-LT	58				144.60	514.93	289.49	304.65	320.70	8.19	8.30	8.42	8.53	8.65	1,616.47
TOTAL	407	198.48	334.43	560.24	738.17	1,179.17	481.76	339.79	356.77	17.44	15.25	8.42	8.53	8.65	4,247.09

- [1] So far, 131.56mil was disbursed for the construction of CG-NB expressway. Although the construction has started since 2006, this amount was assumed to be spent in 2008. The drawdown schedule for the rest of expected investment cost in the next 4 years (2009 - 2012) is assumed at: 2009 = 10%; 2010 = 30%, 2011 = 30% and 2012 = 30% for remaining construction cost. The disbursement of other three projects is taken from respective FSs.
- [2] A review of the Noi bai – Lao cai feasibility study has been taken since September 2009 and data is taken from tentative estimations of consultants.
- [3] The Ho chi minh – Long thanh – Dau giay (HLD) expressway data is collected from the local financial consultant of the Ho chi minh – Long thanh – Dau giay Technical Assistance Project and ADB's Project Administration Memorandum in June 2009.
- [4] It is assumed that the FC is 46% of the engineering base cost and the LC the balance of 54%.
- [5] During construction period, bond interest is treated as FCDD, capitalized into investment cost and financed by extra bond issuance.

19. The following fundamental assumptions were used to determine the consolidated financial viability of VEC:

20. *Engineering base cost.* Engineering base cost (EBC) for the CG-NB is taken from the Prime Minister's decision approving CG-NB total investment cost. EBC of NB-LC, HCM-LT-DG and BL-LT expressways is taken from the cost estimate undertaken from the project's FSs.

21. *FC and LC components.* All expressways follow the technical design standards for 4L expressways. It is assumed, therefore that the share FC: LC is a constant of EBC at FC = 45% and LC = 55%

22. *Management and tender assistance.* This component was estimated as a share of EBC.

23. *Engineering Draw down schedule.* So far, 131.56mil was disbursed for the construction of CG-NB expressway. Although the construction has started from 2006, this amount was assumed to be spent in 2008. The drawdown schedule for the rest of expected investment cost in the next 4 years (2009 - 2012) is assumed at: 2009 = 10%; 2010 = 30%, 2011 = 30% and 2012 = 30% for construction cost.

24. Although loan agreement between the Government of Vietnam and ADB was signed in 2007, only small amount is disbursed due to project delay. Data for the Noi bai – Lao cai expressway is extracted from the financial review part in the Noibai – Lao cai FS Review TA, which has been started from September 2009 and due in 03 months. The disbursement of other two projects is taken from respective project's FSs.

25. *Government contribution.* US dollar 56mil equity of VEC was spent on the construction of the CG-NB expressway. A grant (or subsidy) is assumed to be provided by the Government in three projects including NB-LC (US dollar 120mil), HCM-LT-DG (US dollar 5.7mil) and BL-LT (US dollar 337mil). It is also assumed that the Government's financial support in the form of equity contribution can be treated in the analyses as "sunk cost"¹¹, since the Government does not expect any "return-on-equity" (ROE).

26. *IDC.* The basis for computing interest during construction (IDC) is the engineering draw down schedule and the terms & conditions of ADB's ADF and OCR lending facilities for the Noi Bai – Lao Cai

¹¹ In this analysis, terms including grant, subsidy, equity, government contribution and sunk cost are replaceable. These terms can be understood as forms of financial support from the Government aiming at raising the projects' financial viability and showing the Government's strong commitment in developing expressways.

and HCM-LT-DG expressways. Also JBIC's conditions are applied for the calculation of JBIC's portion in HCM-LT-DG. Besides, terms and conditions of a co-financier (currently unknown) are applied in the estimation of ICD in BL-LT project. In CG-NB project, ICD of bonds is assumed to be financed by extra bonds.

27. *Financing requirements.* IDC and financing cost during development (FCDD) are a dependent variable of (i) the engineering draw down and (ii) lending terms & conditions.

28. *Interest and loan repayment schedule considerations.* For internationally funded sources, interest starts accruing with the date of signature under the loan agreement (L/A). For 15-year-maturity bond, interest is paid by annual coupon and principal is returned after 15 years since the issuance date.

29. The assumed loan conditions are shown in the following Table.

Table 4.1 Assumed Loan Conditions

Loan	Condition
ADF (NB-LC)	Interest rate: 1.0% during grace period, and 1.5% for the remaining years Total Repayment 32 years: Grace period of 8 years and net repayment of 24 years On-lending interest rate: 0.2% (After On-Lending: 1.2% (during grace period), and 1.7% for the remaining years) Amortization schedule: equal amortization
OCR (NB-LC)	Interest rate: 5.63% (5 Years Libor 5.01% plus Spread 0.6%) On-Lending interest rate (0.2%) After On-lending interest rate : 5.83% Total Repayment 30 years (Grace period: 5 years and net repayment of 25 years) Commitment charge: 0.35% on un-disbursed balance Amortization schedule: Installment schedule is determined using annuity basis with 10% discount rate.
OCR (HCM-LT-DG)	Interest rate: 4.98% (5 Years Libor 4.78% plus Spread 0.2%) On-Lending interest rate (0.2%) After On-lending interest rate : 5.18% Total Repayment 25 years (Grace period: 5 years and net repayment of 20 years) Commitment charge: 0.35% on un-disbursed balance Amortization schedule: Installment schedule is determined using annuity basis with 10% discount rate.
OCR (BL-LT)	Interest rate: 3.01% (5 Years Libor 2.81% plus Spread 0.2%) On-Lending interest rate (0.2%) After On-lending interest rate : 3.21% Total Repayment 25 years (Grace period: 5 years and net repayment of 20 years) Commitment charge: 0.35% on un-disbursed balance Amortization schedule: Installment schedule is determined using annuity basis with 10% discount rate.
JBIC (civil work) (HCM-LT-DG)	Interest rate: 1.2% during grace period and the remaining years On-lending interest rate: 0.2% (After On-Lending: 1.4%) Total Repayment 28 years: Grace period of 8 years and net repayment of 20 years Amortization schedule: equal amortization
JBIC (consultancy) (HCM-LT-DG)	Interest rate: 0.01% during grace period and the remaining years On-lending interest rate: 0.2% (After On-Lending: 0.21%) Total Repayment 28 years: Grace period of 8 years and net repayment of 20 years Amortization schedule: equal amortization

Co-financier of BL-LT (civil work)	Interest rate: 1.2% On-Lending interest rate (0.2%) After On-lending interest rate : 1.4% Total Repayment 30 years (Grace period: 10 years and net repayment of 20 years) Amortization schedule: Equal amortization
Co-financier of BL-LT consultancy)	Interest rate: 0.01% On-Lending interest rate (0.2%) After On-lending interest rate : 0.21% Total Repayment 30 years (Grace period: 10 years and net repayment of 20 years) Amortization schedule: Equal amortization
Bond	15 Years bond with interest rate of 11%/year (The interest rate during construction period is capitalized)

30. *The Noi Bai – Lao Cai expressway.* Project cost will be funded by ADB's OCR, ADF, and a government subsidy. ADF can and will only be used for the Noi Bai – Lao Cai Expressway in the ceiling amount of US dollar 200 million because of its poverty alleviation target. The funding needed apart from government subsidy and ADF will be met by OCR from ADB. For ADB's OCR and ADF loans, VEC will borrow the funds from Ministry of Finance on an on-lending basis. The on-lending premium of 0.2% per annum additional to the interest rate of ADB loans is assumed.

Table 4.2 Financing Drawdown for Noi Bai – Lao Cai Project

Unit: US\$ million

	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016	Total
OCR	1.18	139.76	255.39	302.23	142.39	26.13	26.94		894.02
ADF		38.79	61.11	71.95	23.1	2.34	2.37	2.4	202.06
Subsidy		120							120
Total	1.18	298.55	316.5	374.18	165.49	28.47	29.31	2.4	1216.08

31. The Long Thanh – Dau Giay expressway project costs are financed by a US dollar 516.5 million JBIC loan (with FCDD), US dollar 410 million from ADB (with FCDD) and US dollar 5.72 million to be funded by the Government.

Table 4.3 Financing Drawdown for Long Thanh – Dau Giay Project*Unit: US\$ million*

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
ADB (OCR)	66.916	182.309	43.468	46.706	50.597	20.202					410.198
JBIC	110.11	116.909	124.065	131.597	6.578	6.67	6.763	6.857	6.953		516.502
Govt contribution	2.46	1.03	1.08	1.13							5.7
Total	179.486	300.248	168.613	179.433	57.175	26.872	6.763	6.857	6.953		932.4

32. The Cau Gie –Ninh Binh expressway is funded totally domestically by the government contribution (US dollar 56 million) and bond issuance with annual coupon rate of 11%.

Table 4.4 Financing Drawdown for Cau Gie – Ninh Binh Project*Unit: US\$ million*

	2008	2009	2010	2011	2012	Total
Equity	56.002					56.002
Bond	75.562	38.369	100.287	105.225	106.728	426.169
Totals	131.564	38.369	100.287	105.225	106.728	482.171

33. In the Ben Luc – Long Thanh expressway project, it is assumed that the Project cost will be funded by the basic scheme of co-financing between ADB and Co-financiers. The assumed financing sources are ADB's OCR, Co financier's Loans (for civil work component and for consultancy component), and government contribution through VEC. The government contribution is assumed to be granted by the state budget to improve the project feasibility. It is assumed that regarding ADB's OCR and Co financier's Loans, VEC will borrow the funds from Ministry of Finance on an on-lending basis, with the assumed on-lending premium of 0.2% per annum additional to each loan. Although the road construction is expected to start from 2012 within four years, some disbursement is to be made in 2011 on land acquisition, compensation and resettlement as well as in the input VAT portion.

Table 4.5 Financing Drawdown for Ben Luc – Long Thanh Project*Unit: US\$ million*

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
ADB (OCR)	4.44	178.23	143.10	151.72	160.87	0.00	0.00	0.00	0.00	0.00	638.35
Co financier (Civil)	0.00	168.23	131.49	137.89	144.63	8.15	8.27	8.38	8.50	8.62	624.14
Co financier (Consul)	0.00	5.03	3.87	4.01	4.16	0.04	0.04	0.04	0.04	0.04	17.25
Govt contribution	140.16	163.45	11.04	11.04	11.04	0.00	0.00	0.00	0.00	0.00	336.72
Total	144.60	514.93	289.49	304.65	320.70	8.19	8.30	8.42	8.53	8.65	1,616.47

34. Tax. VAT (10%) is assumed to be charged to the toll revenues. In term of corporate income tax, VEC is subject to a tax preferential scheme according to the Decree 164/ND-CP dated December 22, 2003 as shown in the Table below. Whenever negative profit occurs, the loss is deductible from positive profit before tax of the following (maximum five) year(s).

Table 5 VEC's CIT tax preferential scheme

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0%	0%	50%	50%	50%	20%	20%	20%	20%	20%	25%	25%	25%
		x 20%	x 20%	x 20%								
exempti on	exempt ion	reducti on	reducti on	reducti on	reducti on	reducti on	reducti on	reducti on	reducti on	commo n	commo n	common

35. Depreciation. Depreciation of the expressway assets is computed over 40 years.

36. Physical demand. Is measured in “PCU units”. The estimated demand forecast for the individual expressway projects was taken from the following data sources:

- Cau Gie – Ninh Binh. The demand is based on the data stated in the 2002 feasibility study undertaken by Transport Engineering Design Incorporated (TEDI)
- Noi Bai – Lao Cai. The demand is based on modeling exercise undertaken by the technical assistance project implemented by PCI.
- Long Thanh – Dau Giay. The demand is based on modeling exercise undertaken by the current technical assistance project
- Ben Luc – Long Thanh: The demand is based on modeling exercise undertaken by the current technical assistance project

37. Demand projections for the individual expressways using VND 365/km; VND 601/km and VND 800/km are summarized in Table 6.1. Table 6.2 summarizes estimated demand after adjusting the toll rates for all expressways to VND 800/km by using an elasticity factor between toll rate level and number of trips

Table 6.1 Traffic Demand Projections at Various Toll Rates

(Unit: PCU/day)

Expressway Name	2009	2012	2013	2022
Cau Gie - Ninh Binh [VND 372/km]	38,241	55,937	63,327	116,578
Noi Bai - Lao Cai [VND 800/km]		9,400		27,300
Long Thanh - Dau Giay [VND 602/km]		49,641		117,187

Table 5.2 Traffic Demand Projections at Toll Rate of VND 800/km

(Unit: PCU/day)

Expressway Name	2009	2012	2013	2022
Cau Gie - Ninh Binh	27,281	39,905	45,177	83,167
Noi Bai - Lao Cai		9,400		27,300
Long Thanh - Dau Giay		40,999		96,785

38. Toll rate and revenue estimations. The demand estimations produce PCU/daily traffic. The daily traffic is converted into PCU/km/day and multiplied by 365 calendar days. This seems justified, since actual traffic counts show very little hourly and weekday variations. The annual traffic demand is then converted into gross toll revenues by using the assumed toll rate. Annual revenues in VND are adjusted for inflation by 5% annually and converted into US dollar base. However, the toll adjustment is made once every five years to avoid objection from road users. The conversion into US dollar is undertaken by using the assumed exchange rate with an assumed depreciation rate of the VND against the dollar of 1.3% per annum. The revenue stream is capped once the physical

traffic reached technical design capacity for a 4-lane expressway. In projects' FS, there are different assumptions of toll rate level applying to different projects, as follows:

Table 6.3 Toll rate level applied to projects in their FSs

CG-NB	VND 800/km
NB-LC	VND 1,100/km
HCM-LT-DG	VND 900/km
BL-LT	VND 1,000/km

39. O&M cost. O&M cost assume (i) toll collection cost and routine maintenance; (ii) Periodic maintenance. For the Noi Bai – Lao Cai expressway, the routine O/M costs at 2007 price were approximately US\$ 4.57 million per annum, and the periodical maintenance including overlay was US\$ 21.31 million every 8 years. Using price adjustment, the routine O/M costs at 2009 price are estimated to be approximately US\$ 5.95 million per annum. The periodical maintenance including overlay at 2009 price is estimated to be US\$ 27.70 million.
40. The projected O&M costs of Hochiminh-Longthanh-Daugiay expressway, also comprising annual routine costs and periodic road maintenance costs, are based on the results of engineering studies. The annual O&M costs are approximately \$0.6 million at 2007 prices. The cost of periodic maintenance to overlay the highway is assumed to be \$6 million every 8 years starting in 2020. It is assumed that these O&M costs will increase in accordance with the domestic inflation rate of 5% per annum.
41. In the BL-LT project, periodic maintenance also takes place every 7 years, but actual disbursement is made equally in each of the seven-year period. The routine O/M costs at 2009 price are approximately US\$ 5.908 million per annum. The periodical maintenance including overlay is assumed to be US\$ 23.975 million every 7 years. The actual disbursement of periodical maintenance cost is assumed to be done partially in annual average basis from year 2021 (annual amount of US\$ 3.425 million). The O/M costs are assumed to be increased in accordance with the inflation rate of 5% per annum.

V. VEC'S FINANCIAL POSITION 2006 - 2008

A. VEC's Income Statement

(Unit: USD)

ITEM	2006	2007	2008
Income from Sales & Services	270,607	0	0
Deduction of Revenue	0	0	0
Net income from Sales & Services	270,607	0	0
Cost of Goods Sold	270,607	0	0
Gross Incomes from Sales & Services	0	0	0
Income from Financial Activities	541,076	160,155	357,134
Financial Activities Expenses	0	0	0
Sales Cost	0	0	0
Administrative Cost	196,214	160,155	357,134
Net Profit from Business Activities	344,862	0	0
Other Income	0	0	0
Other Expenses	0	0	0
Other Profit	0	0	0
Gross Profit before Tax	344,862	0	0
Current Corporate Income Tax	0	0	0
Deferred Corporate Income Tax	0	0	0
Profit after Income Tax	344,862	0	0

B. VEC's Cash Flow Statement

(Unit: USD)

ITEM	2006	2007	2008
I. Net Cash Flow of Business Activities			
1. Income of Sale, Services	604,349	124,294	1,181,427
2. Payment to Suppliers	(18,168,698)	(27,300,758)	(71,166,744)
3. Payment to Employees	(195,441)	(277,503)	(367,946)
4. Payment of Loan Interest	0	0	(2,052,529)
5. Other Income from Business Activities	8,351,651	33,916,562	2,409,466
6. Other Payment for Business Activities	(3,789,855)	(24,041,427)	(1,197,746)
Net Cash Flow of Business Activities	(13,197,994)	(17,578,832)	(71,194,072)
II. Cash Flow Investment Activities			
1. Payment for Procurement	(123,255)	0	(207,022)
2. Payment for Loan	0	0	(73,899,837)

3. Receipt from Loans	0	0	63,929,612
4. Contribution into Other Companies	0	0	(1,278,090)
Net Cash Flow Investment Activities	(123,255)	0	(11,455,336)
III. Cash Flow Financial Activities			
1. Receipt from Stocks Issuance	5,117,748	17,480,207	10,865,720
2. Payment for Contribution	0	(4,152)	0
3. Receipt of Loans	0	0	77,143,867
4. Payment for Loan Principal	0	0	(4,499,337)
Net Cash Flow Financial Activities	5,117,748	17,476,055	83,510,251
Net Cash Flow in Period	(8,203,501)	(102,777)	860,842
Cash & Cash Equivalent at Opening Balance	8,829,296	625,796	523,019
Effect of Change in Exchange Rate	0	0	12,812
Cash & Cash Equivalent at Closing Balance	625,796	523,019	1,396,673

C. VEC's Balance Sheet

(Unit: USD)

Assets	31/12/2006	31/12/2007	31/12/2008
A. SHORT-TERM ASSETS	14,749,780	37,944,936	90,604,692
I. Cash and Cash Equivalents	625,796	523,019	1,396,673
II. Short-term Financial Investment	561,798	14,243,258	24,213,483
III. Receivables	13,395,315	22,482,626	63,786,933
IV. Inventories	0	0	0
V. Other Short-term Assets	166,872	696,033	1,207,603
B. LONG-TERM ASSETS	6,870,759	29,130,287	65,819,031
I. Long-term receivable			0
II. Fixed assets	6,870,759	29,130,287	64,540,941
III. Long-term Investments	0	0	1,278,090
TOTAL ASSETS	21,620,539	67,075,223	156,423,723
LIABILITIES AND EQUITY			
A. DEBTS	133,674	24,690,884	99,819,264
I. Short-term debts	131,480	2,213,729	8,029,616
II. Long-term debts	2,194	22,477,155	91,789,648
B. EQUITY	21,486,865	42,384,339	56,604,459

I. Equity	21,334,177	42,197,597	56,279,985
II. Others state-funded sources and funds	152,688	186,742	324,474
TOTAL LIABILITIES AND EQUITY	21,620,539	67,075,223	156,423,723

42. The financial management system in VEC is in its early stage of development, due to VEC's short life in existence (starting from October 2004). Most of the financial activities are performed by the Accounting and Financial Department, which has 11 staff including 1 chief accountant, 2 deputy chief and other 08 accountants whose work load is related to cash payment and infrastructure accounting. The code of conduct or job description for each position have not been clearly stated.
43. Based on accounting and financial regulation issued by MOF applying to companies in general (Decision 15/2006/QĐ-BTC dated March 20, 2006) and the financial regulation issued by MOT in November 2006 specifically applicable to VEC (Decision 2547/2006/QĐ-BGTVT dated November 22, 2006), financial statements including Income Statement, Cash Flow, Balance Sheet and Explanatory Note are formulated. This report extracts main parts of the first three years (2006-2008), all of which are audited by an independent auditor (Auditing & Informatic Services Company Limited – AISC). Regulations are strictly followed during the development of these reports.
44. The finance and accounting department is responsible for funds and asset management, and implementation of financial accounting and bookkeeping. Financial reports are prepared by accountants using a computerized accounting system connected to all transactions in an online general ledger. The reports are reviewed by an internal auditing control board, and audited by an independent external auditor annually. External auditor has reviewed the audited financial statements of the past years and rated satisfactory. The financial management system and VEC staff are considered adequate for accounting purposes.
45. Over the last three years, VEC totally depends on deposit interest to spend on their administrative costs. This source of income, although fluctuates through years, is unsustainable. The rise in 2008 came from higher interest rate (doubled the rate in 2007) and undisbursed amount of issued bonds. In the future, when borrowing by issuing long-term bond (normally 1- to 15 years), VEC has to pay higher interest rate despite of the Government guarantee, that may exceed demand interest rate earned from banks. Similarly, disbursement rate will be higher in coming years when expressway plans are implemented leading to lower unused cash and interest earnings.
46. Assets of the company have increased over time, partially from higher equity gained from road fee collection at Cau gie Southern Station and mostly from long-term bonds. In 2007, VEC issued US \$ 22.47mil 15-year bond with 9% interest rate. In 2008, another US \$ 39.33mil 5-year bond was issued with the same rate. In mid 2008, due to high inflation, the company had to pay 16% interest rate for US \$ 28.09 mil bond with maturity ranging from 3 to 24 months. Although the short maturity put the company in liquidity risk, VEC can refinance that with cheaper funding when the high inflation is over. Currently, annual market rate decreased to 10-11% for long-term bond.
47. In contrast of the increase in assets, equity share decreases sharply (from 63% in 2007 to 36% in 2008) and the trend will continue resulting from huge borrowing on expressway construction. Loan, especially with long-term maturity, has risen from 0.01% in 2006 to 33% in 2007 and 58% in 2008. Currently, VEC's ability to pay is moderate with the current ratio and quick ratio standing at 11.28 and 3.18, respectively (in 2008). Cash closing balance is positive and increasing in the last three years which is strongly attributed to borrowing inflow. Net cash flow from business and investment activities is negative in all three years. In the coming years, when payments are made to contractors for completed works, the company may have less cash in hand and face a severe liability risk. Given this situation, lenders may be reluctant to provide more loans without government guarantee.

48. To ensure its financial viability in the future, VEC is to diversify services. One of the main revenue sources is toll collection, which is currently regulated to be decided at VEC discretion in expressways under their management (see Appendix 3). However, due to expressways' funding sources mainly from borrowings, the rate is expected to raise two or threefold to make them financially attractive to investors and lenders. Moreover, other activities like motels, restaurants, petrol station, and so on for road users are to be invested synchronously along with the road construction to generate extra income to the company when roads are put into use.
49. However, at the initial step of project preparation, the company needs more financial support from the Government. Currently, VEC is managing the construction of four (04) expressways, which cost more or less US dollar 1 billion each. The equity amount (US dollar 56 million) granted by the state obviously too small, creating too high debt ratio when all expressways are constructed. The Government encourages VEC to issue government-guaranteed long-term bonds, of which interest rate is controlled by the Ministry of Finance (MOF) and unattractive to investors. Since the beginning of the year (2009), VEC continuously failed to issue 3 and 5-year-maturity due to low offered interest rate. MOF seems to be currently reluctant to raise the rate aiming at avoiding conflict with the low-interest-rate policy of the Government as a measure stimulating domestic business.
50. Given the importance of expressways contributing to the country's infrastructure, which is an essential requirement of both domestic and foreign investors, it is necessary for the Government to grant more equity to VEC in line with the number of expressway assigned to VEC management. Even though all borrowings are backed by the Government, higher equity ratio will bring more trust to lenders regarding state commitment in constructing and operating expressways efficiently, as well as to increase projects' efficiency.
51. VEC will be operating in expressway management, which is in itself a new concept in Viet Nam. Despite of the fact that the staff has experience of donor-financed projects, the complexity of expressway projects in the medium- and long-run will require new approaches to financing. Large occupational training is needed to improve their capability in handling these complicated projects in the future.

VI. VEC FINANCIAL VIABILITY ANALYSIS 2008 TO 2033

52. The following step-by-step methodology is employed to assess the institutional financial viability of VEC under the given master plan investment scenario for the four expressway projects with financial drawdown given in Table 4.2, 4.3, 4.4, 4.5 and toll rate level applied to each project stated in Table 6.3.
53. Step 1. Based on FS of each project, the financial drawdown schedule with FCDD is extracted. Total investment cost into the proposed four expressways over the period 2008 to 2020 are estimated at US dollar 4,247.06 million (including FCDD). Details of financing amount and sources of each project as well borrowing/equity share are shown in Table 7.

Table 7 Financing amount and sources and borrowing & equity share of each project

Project	ADB (OCR)	ADB (ADF)	JBIC	Co-financier	Bond	Total loan	Equity	Total	Loan share	Equity share
CG-NB					426.17	426.17	56.00	482.17	88.39%	11.61%
NB-LC	894.02	202.04				1,096.05	120.00	1,216.02	90.13%	9.87%
HCM-LT-DG	410.20		516.50			926.70	5.70	932.40	99.39%	0.61%
BL-LT	638.35			641.39		1,279.75	336.72	1,616.47	79.17%	20.83%
Total	1,942.57	202.04	516.50	641.39	426.17	3,728.67	518.42	4,247.06	87.79%	12.21%

54. Step 2. O&M estimations comprise (i) cost for the main maintenance office and sub-maintenance offices, (ii) cost for toll collection, (iii) cost for maintenance of electric facilities, (iv) routine maintenance cost and periodic maintenance cost. O&M cost are also inflation adjusted over the life span of the projects.
55. Step 3. Consolidated gross revenues are estimated after physical demand measured in PCU and/or PCU/km/year is adjusted for different toll rate assumption. It is assumed that VEC will obtain the toll collection rights for the Cau Gie – Ninh Binh expressway that is under construction. Toll collection on that expressway is assumed to commence in 2013 in the first three projects and in 2016 in Ben Luc – Long Thanh expressway. Gross revenue streams are capped when physical demand reaches design capacity. Table 8 identifies gross revenue streams by expressway and consolidated revenue of VEC.
56. Step 4. The loan repayment schedule is determined based on lending terms & conditions as identified in Table 4.1. Table 9 presents the consolidated loan repayment schedule for the four expressway projects.

Table 8 Consolidated Toll Gross Revenue Streams

Unit: US\$ million

Year	Cau Gie - Ninh Binh	Noi Bai- Lao Cai	Long Thanh- Dau Giay	Ben Luc – Long Thanh	Total of 4 expressways
2013	47.90	13.41	38.29		99.60
2014	55.34	35.35	41.59		132.28
2015	62.58	42.09	45.18		149.85
2016	69.62	48.65	57.54	32.39	208.20
2017	76.47	55.04	61.04	38.45	231.01
2018	106.11	61.25	64.76	44.71	276.83
2019	114.38	90.05	82.47	51.15	338.06
2020	122.43	97.92	87.49	58.12	365.96
2021	130.25	105.57	92.09	86.96	414.86
2022	137.84	113.01	114.96	96.34	462.16
2023	184.59	120.24	121.00	105.93	531.76
2024	193.00	170.31	127.36	115.69	606.36
2025	198.05	178.70	157.54	125.62	659.91
2026	202.93	186.84	160.14	181.61	731.53
2027	207.66	194.75	162.91	195.31	760.62
2028	270.86	202.42	195.51	208.91	877.70
2029	276.50	280.84	199.18	218.77	975.29
2030	281.95	290.50	203.05	226.79	1,002.29
2031	287.21	299.87	232.04	309.86	1,128.99
2032	287.04	308.95	229.07	314.24	1,139.29
2033	366.07	316.99	226.13	314.97	1,224.16
2034	365.75	429.67	258.41	311.27	1,365.10
2035	365.37	434.92	255.09	307.40	1,362.78
2036	364.94	439.97	251.82	406.25	1,462.97
2037	364.46	444.81	287.77	401.03	1,498.08
2038	459.18	449.46	284.08	395.89	1,588.61
2039	453.29	607.45	280.43	390.80	1,731.97
Total	6,051.75	6,019.06	4,316.97	4,938.45	21,326.24

Table 9 Consolidated Principal Loan Repayment Schedule

(Unit: m US\$)

Year	Cau Gie – Ninh Binh	Noi Bai – Lao Cai	HCM-Long Thanh – Dau Giay	Ben Luc – Long Thanh	Total of 4 expressways
2008					
2009					
2010					
2011					
2012					
2013					
2014			7.16		7.16
2015			7.88		7.88
2016		15.61	8.67		24.28
2017		25.59	9.53		35.12
2018		27.31	36.31	11.15	74.76
2019		29.19	37.36	12.26	78.81
2020		31.27	38.51	13.49	83.27
2021		33.56	39.78	46.90	120.24
2022		36.07	41.18	48.39	125.64
2023	75.56	38.84	42.71	50.02	207.13
2024	38.37	41.88	44.40	51.81	176.46
2025	100.29	45.22	46.26	53.79	245.56
2026	105.22	48.90	48.30	55.96	258.39
2027	106.73	52.95	50.55	58.35	268.58
2028		57.41	53.02	60.98	171.41
2029		62.31	55.74	63.87	181.92
2030		67.69	58.73	67.05	193.48
2031		73.62	62.02	70.55	206.19
2032		80.14	65.64	74.39	220.18
2033		87.31	69.63	78.63	235.57
2034		95.20	25.83	83.28	204.31
2035		103.88	25.83	88.40	218.11
2036		8.42	25.83	94.04	128.28
2037		8.42	25.83	100.23	134.48
2038		8.42	0.00	32.07	40.49
2039		8.42		32.07	40.49
2040		8.42		32.07	40.49
Total	426.17	1,096.05	926.70	1,279.75	3,728.67

57. Step 5. Table 10 summarizes the consolidated institutional picture for VEC as “the owner and operator” of all four expressways with toll rate applied shown in Table 6.3. In the initial analytical step the following performance indicators are assessed:

- Is the net revenue stream sufficient to cover O&M expenditures, and
- Is the cash flow after O/M cost and tax sufficient to cover debt service?

Table 10 VEC Financial Viability 2008 to 2035

(Unit: m US \$)															
Year	Inv. Stream 4 projects	Gross revenue stream	VAT 10%	O&M Cost	Depre- ciation	Interest	Profit before tax	Profit after tax	Acc. Profit after tax	Net cash flow	Acc. Net CF	Cash avail. for debt service	Total debt service	DSCR	Debt Ratio
2008	198.48														
2009	334.43														
2010	560.23														
2011	738.17														
2012	1,179.16														
2013	481.76	99.60	9.05	9.38	45.92	46.88	-11.63	-11.63	-11.31	34.29	34.64	81.17	46.88	1.73	93.7%
2014	339.79	132.28	12.03	9.98	61.13	67.94	-18.80	-18.80	-30.11	35.17	69.81	110.28	75.10	1.47	94.1%
2015	356.77	149.85	13.62	10.63	61.13	67.55	-3.09	-3.09	-33.20	50.17	119.98	125.60	75.43	1.67	94.2%
2016	17.44	208.20	18.93	20.18	94.45	94.77	-20.13	-20.13	-53.33	50.04	170.02	169.09	119.05	1.42	94.4%
2017	15.25	231.01	21.00	21.43	94.45	96.82	-2.69	-2.69	-56.02	56.63	226.65	188.57	131.94	1.43	94.5%
2018	8.42	276.83	25.17	22.76	94.45	95.61	38.84	38.84	-17.18	58.53	285.18	228.90	144.55	1.58	94.0%
2019	8.53	338.06	30.73	24.17	94.45	102.18	86.53	69.28	52.09	84.91	370.09	265.90	180.99	1.47	93.1%
2020	8.65	365.96	33.27	33.12	94.45	100.34	104.78	78.58	130.68	89.76	459.85	273.37	183.61	1.49	92.2%
2021		414.86	37.71	155.75	94.45	106.93	20.02	15.02	145.69	-10.78	449.07	289.07	227.17	1.27	91.9%
2022		462.16	42.01	36.39	94.45	104.38	184.93	139.37	285.06	108.18	557.25	345.50	230.01	1.50	90.2%
2023		531.76	48.34	38.70	95.40	101.66	247.66	185.74	470.80	74.01	631.26	390.55	308.79	1.26	87.9%
2024		606.36	55.12	41.17	96.35	90.47	323.25	242.44	713.25	162.32	793.59	437.46	266.93	1.64	85.1%
2025		659.91	59.99	43.79	96.35	83.17	376.62	282.46	995.71	133.25	926.84	470.68	328.73	1.43	81.8%
2026		731.53	66.50	46.52	96.35	68.85	453.31	339.98	1,335.69	177.93	1,104.77	514.40	327.25	1.57	77.9%
2027		760.62	69.15	49.49	96.35	53.76	491.87	368.90	1,704.59	196.67	1,301.44	528.79	322.34	1.64	73.8%
2028		877.70	79.79	63.65	96.35	38.25	599.67	449.75	2,154.34	374.69	1,676.13	594.71	209.66	2.84	69.5%
2029		975.29	88.66	247.15	96.35	34.20	508.94	381.71	2,536.05	296.14	1,972.26	625.46	216.11	2.89	65.9%
2030		1,002.29	91.12	59.74	96.35	29.83	725.26	543.94	3,079.99	446.81	2,419.08	681.77	223.31	3.05	61.4%
2031		1,128.99	102.64	63.17	96.35	25.13	841.70	631.28	3,711.27	521.43	2,940.51	765.10	231.33	3.31	56.6%
2032		1,139.29	103.57	66.81	96.35	20.06	852.51	639.38	4,350.65	515.54	3,456.05	768.87	240.24	3.20	52.1%
2033		1,224.16	111.29	70.66	97.33	14.57	930.31	697.73	5,048.38	559.50	4,015.55	823.51	250.14	3.29	47.6%
2034		1,365.10	124.10	74.73	98.32	9.89	1,058.06	793.54	5,841.92	687.55	4,703.10	916.45	214.20	4.28	43.3%
2035		1,362.78	123.89	79.04	98.32	6.07	1,055.45	791.59	6,633.51	671.80	5,374.90	911.57	224.19	4.07	39.3%

Minor differences are due to rounding

58. The following preliminary findings can be drawn from the picture that emerges, if all four expressway projects are implemented in accordance with the investment schedule as indicated in Table 4, if all financing plan assumptions are kept as assumed in the analysis and if the time horizon for calculations is 27 years since the first year of construction (2008-2035).
59. Finding 1 Toll rate assumptions. Physical demand in PCU and/or PCU/km/year is a dependent variable of (i) toll rate assumptions and (ii) expressway influence area and network demand. Due to interest conflict, the stand alone viability considerations by TEDI and VEC are based on different toll rates with a view to ascertain that individual expressways are “viable” from a debt service point of view only, i.e. they must be able to pay back debts from the first operational year onwards. The relationship between toll rate and traffic demand should be modeled using proven software.
60. Finding 2 Toll rate determination. Toll rate determination is at present based on tolls levied on national highways under the prevailing toll regulation and consultants’ selection from various levels varying from VND 500/km to VND 1,500/km. It is unclear whether the toll rate is or is not within the limits of user benefits. Even though, according to Government decision VEC is able to select a rate at their discretion for expressways under their management (see Appendix 3), a realistic toll rate should be based on user benefits and willingness-to pay, which can only be measured by a carefully taken survey and reliable model.
61. Finding 3 Toll rate increases. Viet Nam has at present no law/decreed that would allow for transparent toll rate increases. However, the above financial considerations increase net revenue streams every five years by the assumed inflationary factor, thereby expressing gross revenues in nominal terms. Such assumption is theoretically correct and allowed under viability considerations. However, in reality and as the example in other countries shows, increasing nominal toll rates can be a troublesome exercise, since the public does not easily understand that the nominal price of tolls should keep pace with general inflation in the economy. Hence, gross revenue and therefore net revenue streams are overestimated in the above base case.
62. Finding 4 Demand estimations. As was observed above, Viet Nam has presently only limited capability to undertake network-wide demand estimations for the proposed network configuration. That leaves demand estimations undertaken on a “stand alone” basis highly vulnerable to unacceptable error margins. Physical demand, assumed toll rates and therefore estimated gross/net revenue streams are the “lifeline” when it comes to financial viability, either on a “case-by-case” basis and/or on a consolidated basis.
63. Finding 5 Financing plan. The Cau gie – Ninh binh expressway was decided to be constructed by sharing funding between VEC equity and domestically issued bonds with Government’s guarantee. ADB also pledged to support the construction of the Noi bai – Lao cai by a combination of ADF and OCR sources additional to a government subsidy (US\$120mil). Financing plans of these roads are basically determined¹. Financial plan of the Hochiminh-Longthanh-Daugiay expressway is discussed in paragraph 29 with terms and conditions shown in Table 4.1. Final decisions on fund sharing have not been made in the Benluc-Longthanh project (though basically agreed between the ADB and Vietnamese governmental agencies by end of January 2010). The financing plan should be based on (i) a viable business development plan of the implementing entity; (ii) the financial capacities of the implementing entity and (iii) the “merits” in economic and financial terms of each individual investment project.
64. Finding 6. Revenue and profits. VEC’s annual net revenue streams are either insufficient to cover O&M expenditures, interest and depreciation or slightly above costs over the first 05 years after

¹ The Noi bai – Lao cai FS is under a review with a TA funded by ADB due to out-of-date construction costs using 2007 price. According to tentative result of the review, in order to improve the project’s financial viability, US\$ 120million (previously assumed to be financed by Government-backed VEC-bond) should be funded in form of a subsidy from the Government of Vietnam with no requirement of interest and principal payment. Results of this review are applied to this analysis.

putting the first three expressways (CG-NB, NB-LC and HCM-LT-DG) into operation. Profit after tax only climbs to a comfortable level from 2019 onwards.

65. Finding 7. Cash flow. Annual net cash flow is positive since the first year of operation (2013), except for 2011 when the BL-LT project has to start returning principal to the Co-financier and first periodical maintenance is made in all projects. This encouraging result might come from the assumption of a substantial free money from the Government in both the Noibai-Laocai and Benluc-Longthanh expressways.
66. Finding 8. DSCR. Together with increasing annual net revenues streams over years, debt service coverage ratio satisfies ADB requirement (1.2) in all years under consideration.
67. Finding 9. Financial leverage. After putting these expressways into operation, VEC debt ratio is considerably high (around 94% in the 2013 – 2018 period). The ratio remains at the high level above 80% till 2022 when VEC start paying back JBIC and other lenders (e.g. the co-financiers in the BL-LT project). From 2022 onwards, the debt ratio decreases steadily and continuously to 39.3% in 2035. However, this picture may change if VEC continues borrowing to finance other expressways in the future such as the Hanoi – Langson or Halong – Mongcai.
68. Finding 10. Domestic debt burden. In early 2009, due to the economic recession occurring worldwide and in Vietnam, the Government introduced an interest rate support program with a 4% interest rate reduction for borrowing in working capital. VEC was eligible to borrow VND 1,000 billion (equivalent to US dollar 56.18 million) from a commercial bank paying 6% after-reduction interest rate. Besides, because of the high inflation rate, VEC had to issue VND 500 billion (equivalent to US dollar 28.09 million) bond with maturity ranging from 3 to 24 months in 2008, paying 16% yearly interest rate. These borrowings are to be matured very soon which will require VEC to continue issuing more bonds which are used to repay matured debts and finance new construction. If the amount, which is now assumed to be funded by a government subsidy in the Noi bai – Lao cai projects as agreed between ADB and governmental agencies last month (January 2010), comes from government-back VEC bonds as initially assumed, the financial situation of VEC will be much worse due to difficulties in issuing bonds and repayment burden.
69. Finding 11. Domestic borrowing difficulties. The current economic situation in Vietnam is unstable and difficult to forecast. Due to the global economic crisis which negatively affected Vietnam socio-economic situation, the Government has to apply expansionary fiscal and monetary policies to stimulate domestic demand supporting business and rural/disadvantaged areas. The consequence of such policies might be a pressure on inflation and exchange rate. The gold price in both international and domestic markets is another issue causing distortion and difficulties to the economy. Both institutional and individual investors tend to select more safety investment options in real estate, gold, etc. and require higher interest rate for bonds, especially bonds with high maturity. Since the beginning of 2009, VEC has failed many times while trying to sell 3-year and 5-year maturity Government-guaranteed bonds in the capital market. Their bond interest rate which is capped by the Ministry of Finance (MOF) is usually lower than market requirement.
70. Given the current situation and macro-economic concerns in Vietnam, it will be very difficult to borrow by bonds, especially with long maturity or VEC has to pay higher rate as they did in 2008. This is not a easy solution to VEC because the rate is control by MOF, who is reluctant to increase interest to avoid creating pressures to the raise domestic interest rate. Moreover, high rate will erode VEC profit and harm its ability to pay which is very important to a company carrying high debt ratio like VEC.
71. Finding 12. Financial management system. Under the Hochiminh-Longthanh-Daugiay TA from ADB, a financial information system (FIS) is developed to help VEC in making a financially sustainable expressway investment plan that takes into account monitoring and planning cost-recovery tariff levels, forecasting traffic levels, making projected financial statements, and developing a debt-management strategy. The FIS setup is necessary and helpful

to VEC in projecting and monitoring expressway plans. Currently, FIS is in the progress of transferring from the software developer.

72. In the present VEC organization, there is an internal audit/inspection committee reporting to the Management Board, which is directed by a graduate in finance. There is also a Finance and Accounting Department with the majority work load relating to accounting. The company lack a division specialized in financial management. The current Finance and Accounting Department is doing well in accounting and forming financial reports, collecting accounts receivable, formulating annual budget. However, they lack necessary skills in long-term budgeting and risk management which are essential for large company involving in infrastructure investment as VEC.
73. Finding 14. In summary, VEC under the given basket of assumptions with considerable government subsidy in the Noibai-Laocai (US\$ 120mil) and the Benluc-Longthanh (US\$ 336mil) expressways will be financial unstable and unprofitable over the period 2013 to 2017, and then enter a period of relatively high profitability. Its ability to pay is also positive with high DSCR since the first year of expressway operation. However, there is no firm confirmation of the Government regarding the mentioned subsidy, and data is unreliable far in the future.

VII. ASSESSMENT OF VEC'S PREVAILING FINANCIAL MANAGEMENT SYSTEM**A. VEC Background as Implementing Agency (IA)**

74. VEC is already the designated operating entity with toll collection rights for the Cau Gie – Ninh Binh expressway project that is under construction and for which VEC will be granted toll collecting rights for at least ten years. As was observed in Section 7.1, VEC is at present a SOE that needs in accordance with prevailing law to be converted before mid-2010 into either a limited liability or shareholding company. That conversion requirement falls into a high investment period for VEC and the actual legal and operational consequences have so far not been investigated in detail.
75. VEC was in the past the implementing agency for TA 4695-VIE and has therefore practical experience with externally/ADB funded projects.
76. VEC is at present governed by the regulatory framework established for SOEs as well the operational and financial guidelines identified in Section 7.1 above. The regulatory framework and the position of VEC under the guidance and supervision of MOT makes a reporting system mandatory that requires VEC to provide monthly, quarterly and annual reports not only to MOT, but also to relevant ministries as well as the tax authorities.

B. Organizational Structure

77. The detailed organization structure of VEC has been described in detail in the recent FINNROAD study in Chapter 2.6, Vol. 2, Final Report. VEC has a provisional charter with a broad mission statement. However, the required conversion in 2010 as well the fundamental change into an expressway asset owner and (perhaps) operator² needs careful consideration once VEC's mission statement has been defined in more commercial terms.
78. For the time being, VEC's provisional organization structure is sufficient for the tasks at-hand. However, it is apparent that once VEC assumes full responsibility for its commercial success and VEC gets deeper involved with financial transactions that additional in-house capacity needs to be established and nourished through targeted capacity building measures.

C. Future Staffing of Financial Management System

79. VEC has at present 11 staff members in the accounting and finance department. Five people have over 15 years professional experience and six have professional experience of less than ten years. In general and at present levels of activity (i.e. mainly master plan promotion, supervision of detailed designs, tendering for construction and supervision of construction supervision consultants) it is fair to observe that the present quantity and quality of VEC's accounting and finance department is at a sufficient level. In addition, five of the eleven staff members have received training in ADB procedures.
80. However, once the tasks of the finance department become more complex with an increasing number of investment projects and financial planning, evaluation and monitoring needs, it is reasonable to assume that additional personnel will be needed in particular for the areas of financial planning, evaluation, monitoring and risk assessment. It is essential that VEC establishes core expertise in the formulation of financing plans, including more sophisticated financing tools, such as bonds. These activities must be supported by a strong management information system (MIS), of which financial management is only one element.

² The aspect of being itself an operator or outsourcing such function by concessionaire agreement needs in depth investigation from an institutional financial profitability point-of-view that is so far lacking.

D. Accounting Policies & Procedures

81. VEC has presently a computerized finance system that records all transaction to an on-line general ledger. All cost allocations are examined and made in accordance with established rules and procedures.

E. Budgeting System

82. VEC's budget is prepared by the Finance and Accounting Department and approved by the Director General. The procedures are in accordance with Vietnamese accounting standards and comply with ISO 9001-2000 provisions. VEC's budget includes physical and financial targets. Parts of the budget are targeted to invest into fixed assets (see Section 7.4 above) and retained earnings are used to earn interest through other financial activities, such as short-term money deposits (see Section 7.4 above). The budgets are prepared in detail to allow for an assessment of planned versus actual performance. Actual expenditures are monitored on a monthly basis against actual budgets. Should there be any deviation of actual expenditures over budgets, prior approval for "overspending" must be obtained.

F. Safeguards over Assets

83. VEC has a system in place that protects its present assets against fraud, waste and abuse. Subsidiary records of fixed assets are kept, stock is taken and checked and kept up-to-date and the data are reconciled with control accounts. Assets are covered in a sufficient manner by insurance policies.

G. Internal Audit

84. VEC has an internal audit department that is called "Control Board". The Control Board is staffed by three members and headed by a person with over twenty years experience in internal audit. The control Board reports directly to VEC's Management Board. It is the intention of VEC that all expressway projects will also fall under the internal jurisdiction of the Control Board. In case of need, the Management Board takes swift action upon recommendations of the Control Board.

H. External Audit

85. VEC's financial statements are audited regularly by hired outside independent auditors. Audit reports are issued annually. External audits comply with the requirements of the "International Standards on Auditing". During the five-year existence of VEC, no major accountability issues were identified in the external audit reports.

VIII. CONCLUSIONS & RECOMMENDATIONS

86. The present institutional viability analysis undertaken for VEC had to make fundamental assumptions as regards project cost, traffic demand, toll rates, draw down schedule and financing plans, operational and maintenance cost. Hence, while the emerging picture is quite positive, the following “caveats” should be taken into account in an assessment of the institutional viability that should be undertaken in more detail in the near future:
87. **Realistic revenue projections.** VEC should establish an in-house capability and capacity to model demand on the road/expressway network, in order to achieve its own and independent estimations on “most likely revenue” scenarios. Revenues from tolls and retained earnings derived from such revenues³ are the long-term life-line of VEC’s financial viability. Project-wise and/or institution-wise financial viability is typically very sensitive to demand or revenue overestimations. There is out-house expertise that is currently charged by the GoV with undertaking pre-feasibility and/or feasibility studies for the proposed expressway projects. However, the data and recommendations of these studies are not critically checked and it appears to be unclear to what extent they comply with standard error margins allowable: pre-feasibility study error margin equal or < 25%; F/S error margin equal or < 10% and bankable F/S error margin equal or < 3%.
88. **Toll rate setting.** As the case under consideration shows, the individual expressways are investigated under different toll rate assumptions. This is unsatisfactory from a policy point of view, since it implies that “in reality” toll expressway users are charged differently for expressways of the same technical design standards. Toll rates should be determined based on realistically estimated user benefits. Also, while an attempt has been made to adjust the physical demand in this investigation to the assumed toll rate ranging from VND 800/km to VND 1,000/km, this can be hardly more than a very rough proxy.
89. Moreover, in all projects, traffic demand is converted from projected number of vehicles by vehicle type to PCU (passenger carrying unit) per kilometer per day before multiplying with the assumed toll rate to estimate revenue. However, in practice vehicles are to pay different toll rate levels depending on their types (e.g. car <8 seats, bus 8-15 seats, bus 16+ seats, truck <2.5t, truck 2 axles, truck 3 axles, truck 4+ axles, motorcycle, etc.). VEC should establish an in-house capability and capacity to project toll rate level by vehicle type making each project sufficiently viable in terms of finance.
90. **Equity contributions.** Currently, out of the three expressways under construction including Cau gie – Ninh binh, Noi bai – Lao cai and, the Government contributed only US dollar 56 million to the Cau gie – Ninh binh project in forms of VEC equity accounting for 11.62% project costs. Share of assumed Government contribution in the Hochiminh – Longthanh – Dauguiay projects is marginal with 0.54%. The equity share in the Noibai-Laocai and Benluc – Longthanh is an assumption without firm commitment from the Government. The GoV through MOF considers an equity contribution as “sunk cost”, i.e. no return-on-equity (ROE) is expected. Hence, from a VEC point-of view the equity contribution is actually a subsidy and it improves therefore VEC’s overall financial picture by reducing initial investment cost (with lower FCDD) and financial performance criteria. It should be investigated from a “project-stand-alone” and then “institutional point-of-view” what happens if (i) the equity portion is increased and treated as a subsidy (as is the case), or (ii) the equity portion is kept and/or increased and treated as equity that needs to generate a certain percentage in ROE.
91. Expressways are critical infrastructure to economic development as a basis for investment from both state and private sources. Investment in expressways themselves, nonetheless, is substantially high. The costs to construct all projects assigned to VEC (see Table 3) are about US

³ Revenues from other infrastructure facilities, such as for example gasoline stations and rest areas, are typically a very small fraction of the toll revenues only. They are therefore not considered here.

dollar 8 billion⁴. Carrying investment in all these expressways by a high portion of borrowings creates a burden of interest and principal payment liability to VEC and reduces projects' financial feasibility and sustainability. High debt ratio also worries donors who provides not only concessional loans but also requires commercial terms in some loans. Although all loans are backed by the Government, VEC financial sustainability and ability-to-pay are important criteria for project selection by lenders.

92. Given the advantages of Government subsidy and the importance of investment in expressways, it is essential for governmental financial and state management agencies (MOF and MOT) to consider contributing higher government share in expressways investments as well as to increase VEC's equity, as expressway management companies in some countries⁵. This will help to improve project financial viability, VEC profitability and financial sustainability as well as lenders' confidence in the Government's commitment as regards expressway development support.
93. **Institutional privilege requirements.** Some preferential policies has been issued to support VEC's operation such as corporate income tax exemption and reduction, right to decide toll rate in expressways under their management, on-lending borrowing through MOF from international donors, etc (see Decision 1202/QD-TTg dated September 2007). However, further review of these privileges needs to be made to evaluate their sufficiency. The model applied in VEC currently is unique and newly introduced in Vietnam without prior domestic experience.
94. **Financial management system.** The current FM system in VEC is doing well in accounting daily transactions and developing annual plan, but lack expertise in long-term budgeting and risk management. In order to fully develop the system in financial management, there should be an manager (e.g. deputy general director) holding the responsibility of a Chief Financial Manager (CFO) as well as a strengthened financial department with more staff engaging in budgeting and risk management.
95. **Loan considerations.** Under the given terms & conditions the OCR loan is relatively "cheap money" when compared with market rates. The annual borrowing rate is also diminished from 5.63% (without on-lending fee charged by MOF) in 2007 when loan agreement for the Noi bai – Lao cai project was signed to 2.92%% (without on-lending charge) currently required by ADB due to the global economic crisis. However, as the investigation shows, the amount borrowed should be "minimized", in order to minimize the considerable debt service burden that occurs when toll revenue generating capacity is still at lower levels, due to low traffic demand.
96. **Other financing tools.** It should be investigated whether the issuing of bonds could considerably increase project and/or institutional financial performance. As other participants in the bond market, VEC has to pay market rate as to be successful in mobilizing money by bonds, which trends to increase above the assumed 11% in this analysis. However, VEC's offered rate should be lower than a cap regulated by MOF. As such, bond is considered as the most expensive funding source. This source is also unreliable due to lack of commitment to lend since the starting point of project's construction as other borrowings from institutional donors like ADB or JBIC. This unreliability may delay project progress or force VEC to either issue more expensive bonds or temporally borrow with high interest rate from commercial banks to redeem their financial obligation to contractors.
97. Also, investment cost contains a sizeable share in taxes (about 10% for VAT) and in land acquisition/compensation that is not returned by depreciation. MOF together with VEC should

⁴ Investment costs of the Hanoi – Langson and Halong Mongcai expressways shown in Table 3 are roughly estimated without FCDD. If FS for these projects are developed with more precise data and methodology, investment cost of each project may exceed US dollar 1 billion.

⁵ The Korean Expressway Company (KEC), established in 1969 and owed by the Korean Government, plays the role as investment owner and manager of the whole expressway network in Korea (3,113 km in operation). The current register capital of KEC is valued at US dollar 25 billion in addition to US dollar 20 billion accumulated surplus. KEC's main shareholder is the Koran Government (holding 86.95% of capital together with other three Korean banks.

investigate the financial performance benefits that can be obtained by granting, for example, VAT waivers or government subsidy to be spent on land acquisition/compensation as the hypothesis given in the Ben luc – Long thanh project. The tradeoff between equity contributions and tax waivers may result in better project and/or institutional financial performance.

98. Beside asking for lending from financial institutions or using state budget to finance road construction, the Government and VEC can think of other financing options such as build-operate-transfer (BOT), build-transfer (BT), build-operate-own (BOO) and public-private partnership (PPP). These investment tools has been applied in road development in many countries including Vietnam's neighbors as China, Singapore, Indonesia, South Korea, etc. Funds mobilized from non-state sources will help to reduce the government's and VEC's financial burden in financing expressway projects.
99. Presently, the Binhminh Import Export Production and Trading Company (Bitexco) was approved by the Government to develop the Dau giay- Phan thiet road (128km) under the BOT form. BEDC (BIDV Expressway Development Company), a consortium established by large corporations and economic groups, including Vinashin, PetroVietnam, Bitexco, VNPT, and Song Da Corporation, was allowed by the Government to construct the Trung luong – My thuan – Can tho expressways (82km). The BEDC also waiting for the Government to approve their proposal to acquire the right of toll collection on the near-completion HCMC-Trung Luong Expressway (62 km) over 40 years. In return, the consortium will refund the investment (US dollar 581 million) to the Government in four years after the handover of the commercial right over the expressway linking HCMC with Mekong Delta' Tien Giang Province.
100. Given these examples, the financial contribution of private investment in expressways is insubstantial with several pilot forms. The role of private participation in expressway development in Vietnam has not been emphasized. Some main causes are raised to explain the situation, which are the unattractiveness of transportation projects, large capital requirement, long payback period and high risk involved.
101. In order to promote further this model, a more detail study is needed, which is beyond the scope of this report. In general, because of the challenges faced by private investors, the Government should introduce preferable incentives such as high state capital share (that may probably decrease over time with more confidence built from private parties), tax waivers/reduction, more transparent legal framework, etc.
102. **VEC investment and business plan.** VEC needs to prepare a business plan that is based on realistic appraisals of traffic demand and the economic and financial viability of the individual expressway projects. Based on such a plan, a phasing of expressway implementation could be undertaken from the view-point of financial viability and sustainability of VEC.

APPENDIX 1 TERMINOLOGY AND DEFINITIONS

1. Expressway. Expressways in terms of physical characteristics are defined in article 3(10) of the “Law on Land Road Traffic” as “roads reserved only for high-speed vehicles, with median strips dividing carriageways for vehicles to run in opposite directions and without crossing other roads on the same level”. (See also design standards TCVN 5729-1997) An additional requirement has to be added from Decree No. 186/2004/ND-CP that stipulates that expressways have to be bordered by a twenty (20) meters safety corridor. Hence, not all national highways are expressways, nor are expressways a sub-class of national highways (example: provincial roads could also be expressways).
2. National Expressways. This expression combines two elements: (1) administrative jurisdiction and (2) physical characteristics (see item 1. above).
3. VEC Provisional Charter. The VEC Charter was promulgated by MOT Decision No. 3446/QĐ-BGTVT of 12 November 2004 and the “Law on State enterprises” (Law No. 14/2003/QH11 of 26 November 2003). State enterprises can be organized in form of a State company (= the state holds the entire charter capital or a dominant share), a joint stock company or a limited liability company. VEC is organized in form of an independent State Company. An independent State company is defined in article 3(9) of the “Law on State Enterprises” as “a company which does not belong to the organizational structure of State corporations”.
4. Business Objectives of VEC. They are defined in article 3 of the VEC Provisional Charter. They are defined as:
 “The Corporation’s business objectives are to develop production, to improve investment effect and management quality, to make joint operation, joint venture, to enhance prestige and competitive capacity in domestic and international market, to promoting capital accumulating and concentrating process, to gradually develop for enhancing a key role in national expressways’ investment, construction, operation management.”
5. Business Scope of VEC. The business scope is defined in article 4 of the VEC Provisional Charter as:
 - Investing in construction, management, maintenance and toll collection on the national expressways
 - Investing in construction of other traffic infrastructure in all forms
 - Developing, doing business in services along the expressways such as: guesthouse, restaurant, petrol station, advertising board, construction material
 - Transport technical consultancy: studies how to develop national expressway network; make pre-feasibility study; feasibility study; design; supervising traffic infrastructure works
 - Carry out the study to develop new kind of services along the expressways.
6. Conversion of VEC. The present form of VEC-type State company will cease to exist as such no later than 1 July 2010. This is explicitly provided for in article 166 of the “Law on Enterprises. Article 166 (1) provides two choices for VEC conversion: (a) into a limited liability company or (b) into a shareholding company (for this option a minimum of three (3) shareholders are required).
7. VEC forms of capital mobilization. Article 10(a) of the VEC Provisional Charter allows VEC to: “...mobilize capital for business in forms of issuing bonds, credit bills, promissory notes; borrowing capital of banks, credit institutions and other financial organizations, of individuals and organizations outside the Corporation; borrowing capital of laborers, and other forms of capital mobilization under the provision of law.”
8. “Basic” Enterprise Bonds. Are governed by Decree No. 52/2006/ND-CP of 19 May 2006. Among other prerequisites, issuing entity must have generated profits in the year proceeding the year of issuance.

9. “Government-Guaranteed Enterprise Bonds. Are governed by chapter III of Decree No. 141/2003/ND-CP dated 20 November 2003.
10. Enterprise Bonds issued to the general public. Are governed by Decree No. 144/2003/ND-CP dated 28 November 2003 on securities and security markets. In addition, the provisions of MOF Circular 75/2004/TT-BTC dated 23 July 2004 apply. Registration with the State Securities Commission for registration certification is obligatory.
11. Tolling Perspective. The tolling perspective for national expressways are subject to two different regimes. (A) Expressways invested with State budget capital are subject to the provisions of point 2 of Section 1 of Part II of MOF Circular 90/2004/TT-BTC. It states that; “ the toll rates for roads invested with State budget capital shall uniformly apply to all booths according to the toll rate table promulgated together with this Circular.” (B) Expressways built by private investors are subject to point 1 of Section IV of Part II of Circular No. 90/2004/TT-BTC. It permits road-using charges to be twice the level of those collected on expressways invested with State budget capital.
12. National Expressway Master Plan. Means the expressway master plan proposed by FINNROAD in Volume 3 of their final report, in particular Chapter 3.11.
13. Investment Plan. Means the tentative investment outlay undertaken by the consultant based on Chapter 3.11 of the FINNROAD study.
14. Financing Structure. Financing structure and/or financing mechanism means the different weight of financing instruments in the financing plan.
15. Revenue instruments. Refers to all revenue generating instruments currently and in future at the disposal of VEC.
16. Debt-Service Coverage Ratio (DSCR). Is defined as “net operating income/total debt service.
17. O&M. Means all operation & maintenance cost of VEC pertaining to its on-going business operations.

APPENDIX 2 FINANCIAL REGULATIONS OF VIETNAM EXPRESSWAY CORPORATION

*(Attached to the Decision 2547/QĐ-BGTVT dated November 22, 2006)*CHAPTER I
GENERAL PROVISIONS**Article 1. Scope of regulation**

This regulation states guidelines for the financial management of the Vietnam Expressway Corporation (VEC).

Article 2. Accounting and Financial principles, regulations to be applied

VEC is a state-owned company, financially independent, subject to effectiveness principle in business, and responsible for maintaining, developing state capital delivered to the company.

VEC is allowed to open bank accounts in the State Treasury, domestic and foreign banks according to legislative provisions. The company is subject to tax obligations and benefits as regulated by laws.

VEC should comply with the current accounting and statistical regulations.

Article 3. The company's subsidiaries

VEC has some subsidiaries financially independent and some others dependent. The company invests capital transferred from the State to its subsidiaries consistent with each subsidiary's business activities and capital-using plan approved by the Management Board. The subsidiaries bear responsibilities before the State and the company for the effectiveness of transferred capital.

Article 4. Supervision

The company is supervised by the MOT who acts as the ownership representative and financially monitored by MOF; subsidiaries are supervised by the company in accordance with the company's charter and state financial agencies regarding the financial management of the state's capital and assets.

Article 5. Responsibilities of the Management Board and General Director

The Management Board and General Director are responsible for the effectiveness of the state's capital and assets assigned to the company; and for the compliance of financial management regulations stipulated in the Decision and other current relevant financial regulations of the State.

The power, obligations and responsibilities of the Management Board and General Director in the company's financial management are subject to Item 6 of the Financial Regulations accompanying the Decree 199/2004/ND-CP dated December 03, 2004 of the Government and the company's charter.

CHAPTER II
THE MANAGEMENT AND UTILIZATION OF (LIABILITIES + EQUITY) AND ASSETS**Article 6. The company's liabilities and capital**

1. Charter capital
 - a) The initial charter capital of the company is VND1,000bil granted by the state.
 - b) Any increase/decrease of the company's charter capital should be approved by MOT after receiving writing suggestion from MOF.
 - c) The company should disclose any change in its charter capital.
2. Liabilities: The company is allowed to mobilize other sources of fund subject to the Corporate Law, including:
 - a) Borrowing from banks, domestic and foreign credit institutions
 - b) Borrowing from local and international individuals/organizations (direct lending or bond issuance,...)
 - c) Assistance from local and international individuals/organizations
 - d) Others
3. The State contribution to expressway construction
The State contribution is clarified specifically in every expressway project.

Article 7. State capital transfer to the company

1. The State transfers its capital to the Management Board. The transfer should be subject to Article 7 Decree 199/2004/ND-CP.
2. The General Director transfer capital to subsidiaries in accordance with projects approved by the Management Board.

Article 8. The company's rights and responsibilities in the utilization of its capital and funds

1. The company has discretion regarding the utilization of state capital and other funds under its management for project investment and business activities. The company takes responsibilities for the preservation, development and effectiveness of the capital before the MOT, and ensures benefits of relevant bodies such as lenders, customers, employees subject to contracts.
2. In case that the company uses its funds for purposes that are different from regulations, it should ensure sufficient fund if needed. The utilization of investment fund is to follow legislative provisions in investment and construction.
3. In case that the company is assigned by the State with a special mission, its capital and other funds should be gathered to fulfill the mission.

Article 9. Capital and fund utilization forms of in the company's operation

1. The capital is invested in the construction of national expressways and other transportation infrastructure facilities: the company is allowed to invest its funding sources in the construction of national expressways and other transportation infrastructure facilities according to projects approved by competent authorities.
2. The capital is invested in the procurement and improvement of fixed assets serving the company's operation and subject to the following principles:
 - a) appropriate to the company's operating demand
 - b) compliant with current legal framework in infrastructure construction investment and fixed assets procurement in state-owned companies.
3. Capital investment in other business activities: the company is allowed to invest in registered activities subject to capital preservation and development principles.
4. Out-going investment
The company is permitted to invest its capital/assets under its management in outside activities. Out-going investments relating to land use should be subject to legal provisions in land use.
Out-going investments should comply with legal regulations and principles of capital preservation, development and effectiveness, create higher income and do not negatively affects the company's operating targets. Forms of out-going investment vary depending on actual context and may take the following:
 - a) An establishment of a new one-member limited liability state-owned company
 - b) A set up of a new domestic joint stock company, limited liability company, partnership company, joint venture company; or a BCC without a foundation of a new legal entity.
 - c) Buying shares or contributing to joint stock companies, limited liability companies, partnership companies and joint venture companies.
 - d) Acquisition of another company
 - e) Bond purchase,
 - f) Others as regulated by the laws.

Article 10. Authorities in capital mobilization and investment

1. *Authorities in capital mobilization*
 - a) The Management Board shall approve projects or borrowing contract which have value exceeding the company's charter.
 - b) The General Director approve projects or borrowing contract which have value equal or less than the company's charter
2. *Authorities in capital investment*
 - a) Investment in newly established one-member limited liability state-owned companies, multi-member limited liability state-owned companies or State joint stock companies:
 - If the project works in sectors or locations where new state-owned firms are permitted, the authorities in capital investment are delegated as below:
 - + The Management Board shall approve projects which have value accounting for 30%-50% of assets reported in financial reports of the latest quarter. The General Director approves projects which have value accounting for less than 30% of assets reported in financial reports of the latest quarter.
 - + The MOT shall approve projects which have value exceeding 50% of assets reported in financial reports of the latest quarter.

- If the project works in sectors or locations where new state-owned firms are not permitted, the MOT shall approve the fund contribution plan of the newly established company.
 - b) The fund contribution to establish foreign-invested joint venture companies in Viet Nam, abroad-located firms or to undertake buyout in companies working in another sector shall be approved by MOT.
 - c) Other fund contribution plans:
 - The general Director shall approve projects which have value accounting for less than 30% of assets reported in financial reports of the latest quarter (except for investments relating to the Board's approval).
 - The Management Board shall approve projects which have value accounting for 30%-50% of assets reported in financial reports of the latest quarter
 - The MOT shall approve projects which have value exceeding 50% of assets reported in financial reports of the latest quarter
3. The company is not permitted to invest in or contribute to other firms that are mainly owned or managed by wife, husband, mother, father, children, blood brother, blood sister of members of the Management Board, the Supervision Board, Board of Directors and Chief Accountant of the company.

Article 11. The preservation of state capital in the company

The company is in charge of preserving state capital by applying the following measures:

1. complying with state regulations regarding capital and assets management, profit distribution and other financial and accounting requirements.
2. Buying asset insurance as required by the laws.
3. establishing provisions for
 - a) inventory devaluation
 - b) uncollectible receivables
 - c) long-term investment devaluation
 - d) job loss allowance
4. Liquidating non-performing loans and lost assets in accordance with current legislative provisions; accounting uncollectible receivables and lost assets in pursuant to Item 5, Section A, Chapter II of Circular 33/2005/TT-BTC dated April 29, 2005 issued by MOF (guidelines for the Financial Regulations of SOEs and state capital in companies).
5. Other measures complying with regulations.

Article 12. Payables management

For payables, the company should:

1. Fully record payables including interest
2. make payment at maturity as committed. Regularly review and analyze the company's liquidity capability aiming at proposing suitable solutions for debt payment at maturity to avoid overdue debts.
3. The amount incurred due to the foreign exchange changes in the financial period and the amount of payables in foreign currencies at the end of the financial year should be treated according to Item 4.2, Section A, Chapter II of Circular 33/2005/TT-BTC.
4. Prior to closing accounting ledgers for financial statement formulation, the company is to value and double check its obligations with lenders, account the amount of foreign currency payable change incurred due to the foreign exchange changes into to operating costs as regulated by legislative provisions. Simultaneously, it should evaluate and classify debts in accordance with regulation so as to timely detect overdue debts, analysis causes and propose appropriate remedial measures.

Section 2

THE MANAGEMENT AND USE OF THE COMPANY'S ASSETS

Article 13. Assets of the company

1. Assets of the company include current and fixed assets as regulated in the Decree 1999/2004/ND-CP funded by charter capital, borrowings and other sources. Total asset value is calculated from the Balance Sheet of the latest quarter.
2. The company has discretion in selecting projects investing in the construction, procurement, improvement or structural change of fixed assets to be consistent with business targets so as to enhance capital effectiveness.
3. Decision-making authorities regarding projects are stipulated in Item 2, Article 10 of this Decision. Projects under the Management Board's authority should not exceed the maximum limit in Group B stated in the Regulation of the management of investment and construction projects.

Implementation procedures should follow regulations of the management in investment and construction projects.

Article 14. The management and use of the company's assets

1. Fixed assets depreciation

- a) Every fixed asset in the company (including those awaiting to use, not in need to use or in liquidation process) is to be depreciated in accordance with current regulations. The depreciation of assets working on operating business is accounted to operating costs, while that of the others (waiting to use, not in need to use or in liquidation process) is accounted to costs of other activities.
- b) For assets which are not fully depreciated but lost or damaged, causes should be identified to look for compensation from the responsible individual/organization, which shall be decided by the Management Board. The difference between the residual and compensation is accounted to costs of other activities.
- c) The minimum depreciation is calculated based on the maximum utilization period regulated by the MOF. There is no maximum limit on depreciation. The General Director shall make decision on depreciation amount which should not be below the minimum limit as regulated by MOF.
Specially, for assets and mortgages as expressways and other transportation infrastructure facilities invested by the company in pursuant to competent authorities' decisions, the minimum depreciation duration is calculated subject to the payback period of the approved project and current regulations in depreciation.
- d) For infrastructure works that are completed and put into operation, but their value has not been finalized by the competent authorities, the temporary value computerized from accounting data should be used for depreciation purpose. Their base value will be adjusted following the approval of final value.
- e) Assets which are leased or pledged, the depreciation should be subject to regulations as well as recorded and recovered.

2. Inventory management

The management of inventory should be compliant with Article 17 of Decree 199/2004/ND-CP, Accounting standard #2 "Inventory" in the Decision 149/2001/QĐ-BTC dated December 31, 2001 of the MOF. At the end of the accounting period, provisions for inventory devaluation shall be made as regulated in Item 5.2, Section A Chapter II of Circular 33/2005/TT-BTC given that their base value is higher than the expected recovery.

- base value includes costs incurred from the purchase, process and other direct costs.
- Expected value is the (expected) selling price (excluding costs incurring to complete the product and sale costs).

3. Asset counting and re-evaluation

- a) The company is to count aiming at identifying asset quantity, double check at accounting books before closing the books and developing yearly financial reports. Causes for excessive or lost assets are to be identified to look for compensation from the responsible individual/organization which shall be decided by the Management Board.
- b) The company will re-evaluate their assets in the following cases:
 - a. Assets are to be re-counted and re-evaluated in pursuant to the state competent agency's decision.
 - b. Ownership of the company is changed by equitization or ownership diversification.
 - c. The company's assets are used for out-going investments

The asset re-evaluation is done while the company's ownership is changed or those assets are contributed in joint venture or business corporation projects as regulated by laws.
The increase-decrease value of re-evaluated assets is accounted in compliance with state regulations in specific cases.

4. Handling for asset loss

- a) For lost assets, the company should clearly identify causes and propose remedial measures:
 - If the asset is lost due to individuals or collectives' fault, these individuals/organizations are to be in charge of compensation which shall be decided by the Management Board in pursuant to legislative provisions.
 - The insured assets, if being lost, shall be handled according to insurance contracts.
 - The difference between the lost and compensation value will be made up by the financial provision fund (established from after tax profit). The remaining is accounted to operating costs of the period.
 - For serious lost caused by natural disasters or objective reasons that the company is unable to recover themselves, a plan shall be developed by the Management Board to be submitted to MOT and MOF. Given the MOF's comments, MOT will work out solutions for the lost within their authorities.

- b) The company takes responsibility in the recovery of lost assets, otherwise the Management Board and the General Director shall be in charge of losses to the ownership representative as in the case of unfaithful financial report.

Article 15. The management of receivables

1. The company is to develop and issue regulations for receivable management, clearly delegate responsibility to individuals or teams in the recording and collection of receivables; open accounting books for receivables by subject, periodically categorize these items (revolving, non-performing and uncollectible) and keep track of collection.
2. The company is permitted to sell their receivables as regulated by laws including unexpired, non-performing and uncollectible loans to recover the investment with negotiable price.
3. The company is to evaluate their receivables, double check at borrowers, categorize and identify non-performing loans before closing the books and developing yearly financial reports. Provisions are made for non-performing receivables.

Uncollectible receivables are solved following regulations. The difference between overdue loans and compensation coming from relevant compensators will be made by provisions for bad receivables and provisions for financial loss. The remaining is accounted to operating costs of the period.

The uncollectible receivables that are solved need to be recorded in off-balance sheet reports and collected. The recovered amount afterwards will be accounted to income before tax.

Article 16. Assets leasing, pledging, liquidating and selling

1. The company is allowed to lease, pledge, liquidate and sell assets owned by them subject to principles of capital effectiveness, preservation and development.
- a) The Management Board makes decision on leasing and pledging contracts and other economic contracts with value exceeding the charter capital. Contracts with value equal to or less than the charter capital are decided by the General Director.
- b) The liquidation of assets with residual value less than 30% of total value in financial reports of the latest quarter; from 30% to 50%, the General Director; above 50%, the MOF, based on the Management Board's suggestion.
2. The leasing and pledging of assets should comply with the Civil Code and other regulations.
3. The liquidation of assets attached to land is to be compliant with land regulations. If assets are liquidated by destruction, a Liquidation Committee should be activated by the General Director.
4. The assets liquidation is to be taken through auction or by the company themselves publicly and subject to legal provisions in assets auction. In case that the asset value is relatively small, the General Director will decide either auction or negotiation given that the price is higher its market value. Income from asset liquidation is managed, used and accounted in compliance with regulations.

CHAPTER III

OPERATING REVENUE, COST, PROJECT MANAGEMENT COST AND PROFIT DISTRIBUTION

Article 17. Revenue

The company's revenue comes from operating revenue and other income incurred at the head office, subsidiaries and at firms fully invested by the company:

1. Revenue from investment and management of expressways and transportation infrastructure facilities:
 - a) Revenue from toll collection in expressways and transportation infrastructure facilities invested by the company:
 - is the actual yearly collection if it is done by the company
 - is the fraction between the total amounts received from transferee and the year number of the transfer, if the company transfers toll collection right to other individuals/organizations.
 - b) Revenue from toll amount that is retained by the company to spend on toll collection. The percentage of retaining amount is subject to agreement between MOT and MOF.
 - c) Other revenue from investment and business activities.
2. Revenue from services: is the amount coming from sale of goods and services incurred in the period accepted by customers after subtracting commercial discount and return, including

- a) Revenue from providing services for expressways users as motels, restaurants, petrol stations, advertisements, construction materials, etc.
- b) Revenue from technical transportation consulting services as national expressway network development research; feasibility study formulation, design, supervision, testing, quality accreditation of transportation infrastructure.
- c) Revenue from services in neighboring areas of expressways
- d) Additional fees to sale price as subsidy, additional charge, etc. that are credited to the company
- e) Revenue from gifts, goods exchanged or self-consumed by the company
3. Revenue from financial activities:
 - a) Revenue from sale of propriety rights, leasing; permitting other parties to use the companies' assets, from loan interests, deposit interests, interests on deferred payment or installment payment on goods sale, the financial leasing interests.
 - b) Difference from foreign currency sale, exchange rate difference; difference profits from transfer of capital and divided profits from investment outside the companies (including after-tax profits after making deductions for various funds of the State-run one-member limited liability companies); the after-tax profits payout from subsidiaries resulting from the contribution of State capital; the after-tax profits contributed from subsidiaries to the development investment funds; income from security trading (shares, bonds) and collection from subsidiaries for management expenditures.
4. Other revenues include proceeds from liquidation and sale of fixed assets, collected insurance indemnities, debts with unidentified creditors and being inscribed as revenue increases, fines collected from customers for contractual breaches, and other collections.
5. Methodology to identify several items of revenue as well as conditions and timing for revenue calculation is regulated in Item 1, Section 1, Part C of the Circular 33/2005/TT-BTC.

Article 18. Expenses

1. *Expenses for business activities of companies of the company include:*
 - Expense for raw materials, materials, fuels, power (calculated according to the actual consumption levels and the actual cost prices),
 - a) consumption level: The General Director should construct material consumption norms for each product to be submitted to the Management Board for approval and bear responsibility for the preciseness of these norms. If actual consumption in production exceeds respective norm, causes and responsibilities are clarified for compensation, which shall be accounted to other revenues. On contrary, employees are rewarded if actual consumption falls below norm with bonus value less than material savings of the year. Rewards are accounted to operating expenses.

The General Director determines the compensation or bonus. The company should regularly review norms to be consistent with reality.

 - b) Actual cost price:
 - Price of in-coming materials includes:
 - o The price stated in receipts issued by suppliers. In case of imported materials, the price equals to buying price (in foreign currency) times foreign exchange rates quoted by the bank where the company's demand account is opened, plus import tax and other charges (if any), minus discounts.
 - o Freight, loading, keeping, loss insurance cost, warehouse rent, processing costs incurred prior to arrival, etc.
 - Price of self-produced materials
 - o Actual material cost price
 - o Processing costs of the company
 - Price of materials processed by other companies
 - o Actual material cost price
 - o Processing cost charged by the other companies

Materials taken in or out of the company's warehouse, processing costs, freight costs, etc. should be enclosed with receipts as required by regulations.

Costs of tools are allocated to expenses based on their utilization duration with the maximum of 2 years.

 - Expense for fixed asset amortization calculated according to Item 1, Article 14 of this Regulation
 - Expense for salary, wage, salary-like allowance and mid-shift meal expense. The mid-shift meal expense is decided by Management Boards depending on business effectiveness, but monthly expenses should not in excess of minimum wage.
 - Social insurance funding, trade union funding, medical insurance premiums, which must be paid for laborers by the companies according to regulations

Expenses for outside services are expenditures for business operations of the company, including:

- a) major repair expenditure of fixed assets is accounted to operating costs of the year (or allocated partially to the next year in case of negative profit). Periodical major repair expenditure of some specific fixed assets is allocated in advance to costs based on projected expenses by the end of the financial year. When the repair takes place, the difference between projected and actual, either positive or negative, is accounted to expenses.
- b) Expenses for transactions, brokerage, meetings, promotion, advertisement, etc. are recorded by actual amount. A regulation on the management of these items is to be developed and disseminated to all employees of the company for implementation and supervision. The General Director is in charge of actual expenses.

The company is not allowed to pay commission to sale agents, targeted customers, management positions and the sale staff who directly involve in product sale.

- c) Lease payment of fixed assets in lease contract. If single payment is made, the amount will be allocated to operating costs according to leasing duration.
- d) Per diem is paid in accordance with the Management Board's approved norms which are publicized to employees for supervision.
- e) Expenses on transportation, electricity, water, paper, office facilities, fire protection, auditing, consulting, insurance, commission and others

Provisions for inventory devaluation, long-term investment loss, uncollectible receivables and job loss allowance is regulated in Item 5.2, 5.3, 5.4 Article 5, Section A, Chapter II of the Circular 33/2005/TT-BTC.

- f) Other pecuniary expenses include:
 - + Natural resource tax, land tax, license tax;
 - + Land rent;
 - + Severance or job-loss allowances to laborers;
 - + Training to raise managerial capabilities, professional skills of laborers;
 - + Expense for healthcare work; expense for scientific research, technological renewal research;
 - + Innovation rewards, increased labor productivity rewards, supplies and expense saving rewards. The reward levels shall be decided by general directors, directors of companies, based on the efficiency brought about by the above things but must not be higher than the expense savings brought about by such things within one year;
 - + Expense for female laborers;
 - + Expense for environmental protection;
 - + Expense for mid-shift meals for laborers;
 - + Expenses for activities of the Party and mass organizations in the companies (expenses outside the funding of the Party and mass organizations to be spent from the prescribed sources);
 - + Other pecuniary expenses;

- 2. *Financial activity expenses*, including expenses related to investment outside the companies, payable interests on mobilized capital, exchange rate difference upon payment, payment discount expense, asset-leasing expense, long-term investment devaluation provisions

3. *Other expenses, including:*

- a) Expense for fixed asset sale, liquidation, including the remaining values of fixed assets upon their liquidation, sale;
- b) Expense for recovery of debts already deleted from the accounting books;
- c) Expense for fine collection;
- d) Payment of fines for contractual breaches;
- e) Contribution to profession associations participated by the company
- f) Other expenses

4. *The following amounts shall not be accounted to expenses:*

- a) Losses that are compensated by the Government, insurers or other compensators.
- b) Fines for law violations in administration, environment, overdue loan payment (subject to subjective causes), financial regulations.
- c) Expense for procurement, construction, improvement of fixed assets (other than expressways and transportation infrastructure in approved projects) that are invested by state fund for infrastructure construction;
- d) Expenses for repair and maintenance of welfare facilities as houses, guest houses for employees and expenditures for other welfare facilities;
- c) Contributions to local and social organizations;
- d) Other expenses funded by other sources.

Article 19. Expense management

Companies must strictly manage all expenses in order to reduce expenditures and production costs with a view to increasing profits by the following managerial measures:

1. Elaborating, promulgating, and organizing the implementation of technical-economic norms such as material consumption, labor consumption and other expenditures based on which the company's expenses are managed. Those norms are approved by the Management Board Chairman. The norms must be disseminated to implementers, publicized to laborers in the companies for application, inspection and supervision.
2. Periodically organizing the analysis of production expenditures, costs of the companies with a view to detecting shortcomings and weaknesses in management and factors that increase expenditures, costs so as to work out remedial solutions in time
3. In case of failure to achieve the norms, thus raising the costs, the causes thereof and the responsibilities therefore must be clearly analyzed for handling according to law provisions. If it is due to subjective causes, compensation must be made based on the Management Board's decision complying with legislative provisions.

Article 20. Profits and profit distribution

1. Profits earned in the year by a company mean the total of profits earned from business activities and profits earned from other activities.
 - The difference between the goods sale and service provision turnover and the total cost of consumed products and goods or service expenses in the period;
 - The difference between the turnover from financial activities and the expense for financial activities arising in the period.
 - The difference between the turnover from other activities and the expense for other activities arising in the period
2. The companies' earned profits, after being subtracted for offsetting the previous year's losses according to the provisions of the Enterprise Income Tax Law and paying the enterprise income tax, shall be distributed as follows:
 - a) Paying dividend to fund contributors according to contracts (if any),
 - b) Paying the remaining of fines due to regulation violations in taxation, transportation, accounting, economic contracts, overdue loan payment after subtracting compensations from offenders (if any); paying expenditures actually made but accounted to taxable costs
 - c) Offsetting losses of the previous years, which are no longer valid for deduction from pre-tax profits;
 - d) Deducting 10% for the financial provision fund; when the fund's credit balance is equal to 25% of the charter capital, no more deduction is required;
 - e) The amount left after the deductions prescribed at Points a, b, c and d of this Item are made shall be distributed according to the ratio between the State capital at the company and the capital mobilized by the companies themselves in the year on annual average.

The capital mobilized by the companies themselves means the money amounts mobilized by the companies through issuance of bonds, notes, loans from organizations and/or individuals within and without the country on the basis that the companies take self-responsibility for repayment of both principals and interests to lenders as committed, except for loans guaranteed by the Government, the Finance Ministry and loans provided with concessional interest rate.

3. The profits divided according to the State investment capital shall be used for reinvestment in supplementing the State capital at the company. In cases where it is not necessary to supplement the State capital at the company, the MOT shall decide to transfer them to the concentrated funds for investment in other companies.
4. Profit payout to self-mobilized capital shall be distributed as follows:
 - a) Contributing at least 30% for the development investment fund of the companies;
 - b) Contributing 5% at most for setting up reward funds for the company management team. The annual deduction level shall not exceed VND 500 million (for companies with Management Boards), provided that the ratio of pre-tax earned profits to the State capital at the company must be equal to or larger than the planned profit ratio;
 - c) The remaining profits shall be distributed into the reward and welfare funds of the company. The level of contribution for each fund shall be decided by the Management Boards after consulting with the companies' trade unions. In two years following the profit-making year, if the value of the two reward and welfare funds is less than 02-actual-month wage payment, the company may reduce contribution to the development investment fund to raise the two fund balance up to 02-actual-month wage payment. The maximum reduction is equal to the whole contribution to the development investment fund of the year.

The actual payout rate to the development investment fund and the management team reward fund is decided by MOT subject to the Management Board's suggestion.

Article 21. Purposes of funds

- a) The financial provision shall be used to make up for the remaining property loss or damage after being compensated by individual/organizational offenders, insurers or the company's security devaluation provisions, investment provisions; compensate for the company's losses as decided by the Management Boards or MOT.
- b) The development investment fund shall be used to supplement the companies' charter capital.
- c) The reward fund shall be used:
 - To make year-end or periodical rewards. The actual rewards are decided by the General Director following the Union Chairman's suggestion which is made on the basis of labor productivity and achievement of each employee in the company;
 - To make irregular rewards to individuals, teams in the company resulting from their profitable innovations. The actual rewards are decided by the General Director;
 - To reward individuals and units outside the company for their great contribution to the company. The actual rewards are decided by the General Director.
- d) The welfare fund shall be used:
 - For investment in construction or repair of public-utility works of the companies; For partial contribution in the construction of welfare facilities of the sector or with other units under contracts
 - For expenditures on public activities of employees in the companies in sport, culture, sight-seeing;
 - For contribution to social welfare fund
 - For regular or unexpected supports to employees in difficulty.
 - For other welfare activities.

The use of welfare funds shall be decided by the Management Board after consulting with the trade union.
- e) The reward funds for the management team shall be used to reward the Management Board and the Board of Directors. The rewards shall be decided by MOT based on the company's effectiveness and the Management Board's recommendation.
- f) The use of the above-mentioned funds must be publicized according to regulations on financial publicity, regulations on grassroots democracy and the State's regulations. The companies can make spending from the reward, welfare, company management and administration board-rewarding funds only after fully repaying due debts and fulfilling other property obligations.

CHAPTER IV

THE FINANCIAL RELATIONSHIP BETWEEN THE COMPANY AND FINANCIALLY DEPENDENT SUBSIDIARIES AND INDEPENDENT MEMBER COMPANIES

Article 22. The relationship with financially dependent subsidiaries

The company's financially dependent subsidiaries do not have their own capital and assets. Their capital and assets belong to the company. The company may delegate them to perform several activities in accounting and financial management. The delegation is stated in their regulations in organization, business management and the company's specific provisions.

Accounting entries of financially dependent subsidiaries are taken centrally at the company and their business performance is shown in the company's financial reports.

Article 23. The relationship with joint stock companies and limited liability companies with two or more members where the company contribute the majority of capital, and with one-member limited liability state companies and joint venture companies

1. In companies having charter capital partially invested by the company, the company shall manage this share subject to legislative provisions, charter of the company and of the destination company. As the owner of the share in other companies, the company executes the rights and responsibilities of a shareholder in joint stock companies or of a member in limited liability firms. The economic relationship in buying, selling, leasing, lending between the company and fund-receiving entity should be pursuant to contract and payment should be made as of other economic entities.
2. Depending on its contribution, the company may delegate a representative to manage or keep track of the capital invested in the others. The decision is made by the Management Board Chairman according to the General Director's suggestion. Rights, obligations, responsibilities and requirements of the representative are stipulated in Article 46, 47 and 48 of Decree 199/2004/ND-CP.

3. The company is not allowed to directly withdraw the fund invested in other independent members in any form such as cash/assets transfer without payment except for transferring the share to other investors. The authorities to withdraw investment from other companies are regulated in Item 2, Article 9 of the Decision.
4. The reinvestment of profits payout so as to raise the company's investment amount in other firms is subject to the Management Board Chairman's decision and the firms' charter.
5. The relationship with one-member limited liability state companies and joint venture companies is stipulated in Article 24, and 26 of Decree 153/2004/ND-CP.

CHAPTER V

FINANCIAL PLANS, ACCOUNTING STATISTICAL AND AUDITING REGIMES

Article 29.- Financial plans

1. The planed profit ratio of the company is decided by MOT.
2. The General Director shall develop medium and long-term financial plans compatible with the company's business plan to be submitted to the Management Board
3. The Management Board shall decide on the company's financial plan which are reported to MOT and used as bases for supervising and evaluating the business management and administration of the Management Board and the General Director. The format and sending time of financial plan to MOT are subject to requirements applied to state-owned companies.

Article 29. Accounting, statistics , reporting and disclosure in finance

1. Accounting and statistics: subject to current regulations applying to corporations
2. Financial plan: The company is to formulate and send financial statements quarterly and annually subject to requirements applied to state-owned companies

The company's final statements are to be approved by the Management Board following the verification of the Supervision Board. The Management Board takes responsibilities for the preciseness and truthfulness of these reports.

The company's final statements are to be audited pursuant to legal provisions.

3. Financial disclosure: The company is to disclose its financial status as required by laws. The disclosure of annual financial performance is guided by MOF and the company is responsible for the disclosed information.
4. Financial year: starting from January 01 to December 31

Article 26. Supervision and auditing

1. The company is to comply with financial auditing and an internal auditing subject to MOT's regulations.
 - The company's Supervision Board is in charge of monitoring business outcomes reflected in accounting books and financial statements. The Supervision Board shall approve the representative for state shareholding in member companies, perform supervision to support the management of the Management Board and the General Director and the utilization of state capital in affiliates.
 - The General Director and the assisting team execute the internal auditing in subsidiaries.
 - The MOT shall supervise and evaluate the company's business performance as well as classify the company.
2. The company is supervised by relevant state agencies in its financial activities and financial statements.

CHAPTER VI

IMPLEMENTATION

Article 27. Implementation

The Management Board and the General Director are responsible for implementing financial management regulations stipulated in this Decision and other legislative provisions.

Difficulties emerged during implementation should be timely reported to MOT for resolutions.

THE MOT MINISTER

HO NGHIA DUNG (signed)

APPENDIX 3 PRIME MINISTER'S DECISION ON PILOTING SOME MECHANISMS IN VEC

PRIME MINISTER

SOCIALIST REPUBLIC OF VIET NAM

Independence – Freedom – Happiness

No.: 1202/QĐ-TTg

Ha Noi, 10th September, 2007

DECISION

**On Piloting Some Mechanisms, Policies Applied To Expressway Investment Operation Projects of
The Employer - Viet Nam Expressway Corporation**

PRIME MINISTER

Pursuant to Law on Organization of the Government dated December 25, 2001;

Pursuant to Law on Enterprise dated November 29, 2005;

Pursuant to Law on Investment dated November 29, 2005;

At the proposal of Minister of Transport,

DECISION:

Article 1. Modification Scope and Subjects to apply

The decision prescribes the pilot of some mechanisms, policies applied to expressway investment and operation projects (hereinafter referred to as “Expressway Projects”) under management of the Employer - Viet Nam Expressway Corporation (VEC)

Article 2. Content of Pilot Mechanisms and Policies for Application

1. For the expressway projects, which are appraised by the authorized state-owned agencies to be efficient and credit-worthy, on-lending policy can be applied to the Government's ODA loan; OCR loan or commercial loan of the Governments or of the international credit organization; or to the long-term international bond of the Government.

2. Subject to each highway investment project, VEC reserves the right to issue domestic or international Bond as regulated under the Government's guarantee. In case, during the project's payback period, VEC cannot recover capital from project's income or sources to repay the loan, additional bond can be issued for repayment purpose. MOF will consider and submit to the Prime Minister's approval for each case.

3. VEC is entitled to borrow the development and investment capital as stipulated in Decree No.151/2006/ND-CP of the Government dated 20th December, 2006 on investment and export credit of the State, for investing in expressway projects

4. VEC shall decide toll level for the expressways, of which he is the Employer, to ensure repayment requirement of the project (except for the projects, which are requested by the authorized state-owned agency to apply the toll level regulated by the Government).

5. VEC is assigned to develop services along the expressway, of which VEC is the Employer (such as filling station, stopping station, advertisement and other works) in accordance with law and regulations. The outputs gained from operating these services, if any, shall be input in the investment efficiency of the project.

6. For expressway investment projects which are required by the State for investment but credit-worthiness is low, the Government may consider a subsidy for compensation, support, resettlement and land acquisition costs.

7. VEC is entitled to use his charter capital based on the principle of concentrating to complete his duties for investment operation of the expressways, of which he is the Employer, and concurrently to balance his capital for serving his business and production of the works assigned to him.

In the period of toll collection for capital payback of every project, the income gained from toll collection or transferring operation right shall be given priority for use in order to payback capital sources borrowed and/or mobilized by VEC.

8. Ministry of Finance is required to supplement the lacking amount to VEC so that by the year 2008, VEC's charter capital can reach the amount of 1,000 billion VND. From 2009, based upon status of VEC's business and capital demand, Ministry of Finance shall consider to supplement charter capital to VEC annually as regulated.

9. At the initial construction and toll collection stages, in case VEC has no any profits from all production, business and service activities in fiscal year, VEC shall be entitled to set up 2 (two) reward and welfare funds. The deduction rate shall not exceed two monthly-salaries and be post into accounts of project operation and management and toll collection management cost.

Article 3. Responsibility of Viet Nam Expressway Corporation (VEC)

1. Board of Directors, General Director of VEC take responsibility for your decision to the law and ensure that the Expressway Projects, of which VEC is the Employer, shall be implemented in due accordance with regulations stated in this decision and other relevant laws so that the project can be put into operation as scheduled, with quality assurance and investment efficiency.

2. Based upon the master plan, which is approved by authorized agencies, VEC shall take the initiative in selecting the expressway alignment to submit to the authorized agency for assigning duties and promoting the investment preparation work.

Article 4. Responsibilities of Ministries, Branches, People's Committee of Provinces, Centrally-run cities.

1. Ministry of Transport has responsibility for implementing the State management function in due accordance with the regulations and timely resolving difficulties and obstacles within his authority or reporting Prime Minister the matters beyond his authority; and instructing VEC to map out privatization plan and submit for approval as regulated.

2. Ministry of Finance shall be responsibility for acting as a guarantee for payment of domestic and international Bond issued by VEC; for cooperating with Ministry of Transport and Ministry of Planning and Investment to consider the capital payback capability of some projects assigned to VEC and propose to Prime Minister measures of subsidy from State Budget in accordance with the regulation at item 6, Article 2 of this Decision.

3. Ministries: Construction, National Defense, Natural Resource and Environment, Agriculture and Rural Development, Information and Communications, Ministry of Industry and Trade, State Bank of Viet Nam shall take responsibilities for cooperating with Ministry of Transport and facilitating VEC to implement effectively the expressway investment projects.

4. People's Committee of provinces, centrally-run cities, at which the project route runs through, shall bear responsibility to chair and cooperate with VEC in implementation of compensation, assistance, resettlement and land acquisition works in accordance with regulations; to give favour conditions to VEC to realize his right of operating services along expressway (as regulated at item 5 Article 2 of this Decision) within management scope of the locality.

Article 5. Implementation Organization

This Decision became effective as from signing date..

Ministers of Ministries: Transportation, Finance, Planning and Investment, Construction, National Defense, Natural Resource and Environment, Agriculture and Rural Development, Information and Communications, Industry and Trade; Governor of State Bank of Viet Nam, Chairmen of People's

Committee of provinces and centrally-run cities, at which the project runs through, Board of Directors, General Director of VEC and Leaders of related Agencies have responsibility for implementation of this Decision./.

Address:

- *Secretary of the CPV Central Committee;*
- *PM, Deputy of PMs,*
- *MOT, MPI, MOF, MOC, MONRE, MIC, MARD, MND, MIT,*
- *PC of provinces, centrally-run cities;*
- *The Central Government Office and Dept. of the Party;*
- *SBV;*
- *Bank for Development of Viet Nam;*
- *VEC;*
- *Government Office, and departments.....,*
- *Website of the Government;*
- *Files: the Office, CN (5b).120*

**FOR PRIME MINISTER
DEPUTY PRIME MINISTER**

(Signed)

NGUYEN SINH HUNG

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APPENDIX 4 CONSOLIDATED FINANCIAL STATEMENTS OF VEC 2008 – 2035 (UNIT: US\$ MILLION)

A. INCOME STATEMENT	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
GROSS REVENUE	0.36	0.30	0.30	0.30	0.30	99.60	132.28	149.85	208.20	231.01	276.83	338.06	365.96	414.86	462.16	531.76	606.36	659.91	731.53	760.62	877.70	975.29	1,002.29	1,126.99	1,139.29	1,224.16	1,365.10	1,362.78
VAT to Revenue	0.00	0.00	0.00	0.00	0.00	9.05	12.03	13.62	18.93	21.00	25.17	30.73	33.27	37.71	42.01	48.34	55.12	59.99	66.50	69.15	79.79	88.66	91.12	102.64	103.57	111.29	124.10	123.89
TOTAL REVENUE	0.36	0.30	0.30	0.30	0.30	90.55	120.26	136.23	189.27	210.01	251.66	307.33	332.69	377.15	420.14	483.42	551.24	599.92	665.02	691.47	797.91	886.63	911.18	1,026.35	1,035.72	1,112.88	1,241.00	1,238.89
O/M Cost	0.36	0.30	0.30	0.30	0.30	9.38	9.96	10.63	20.18	21.43	22.76	24.17	33.12	155.75	36.39	38.70	41.17	43.79	46.52	49.49	63.65	247.15	59.74	63.17	66.81	70.66	74.73	79.04
Depreciation	0.00	0.00	0.00	0.00	0.00	45.92	61.13	61.13	94.45	94.45	94.45	94.45	94.45	94.45	94.45	95.40	96.35	96.35	96.35	96.35	96.35	96.35	96.35	96.35	96.35	97.33	98.32	98.32
Operating Profit	0.00	0.00	0.00	0.00	0.00	35.25	49.14	64.46	74.64	94.13	134.46	188.71	205.12	126.95	289.30	349.32	413.72	459.79	522.16	545.63	637.92	543.14	755.09	866.84	872.57	944.88	1,067.94	1,061.53
Interest (ADF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42
Interest (OCR)	0.00	0.00	0.00	0.00	0.00	0.00	21.06	20.67	47.90	46.91	45.83	44.64	43.33	41.90	40.31	38.57	36.66	34.55	32.23	29.68	26.88	23.80	20.40	16.67	12.57	8.05	4.33	1.49
Interest (JBOC)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83
Interest (co-financier)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.56	8.12	7.68	7.24	6.80	6.36	5.92	5.48	5.05	4.61	4.17	3.73	3.29	2.85	2.41
Interest (Bond)	0.00	0.00	0.00	0.00	0.00	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	38.57	34.35	23.31	11.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Interest charges	0.00	0.00	0.00	0.00	0.00	46.88	67.94	67.55	94.77	96.82	95.61	102.18	100.34	106.93	104.38	101.66	90.47	83.17	68.85	53.76	38.25	34.20	29.83	25.13	20.06	14.57	9.89	6.07
PROFIT BEFORE TAX	0.00	0.00	0.00	0.00	0.00	-11.63	-18.80	-3.09	-20.13	-2.69	38.84	86.53	104.78	20.02	184.93	247.66	323.25	376.62	453.31	491.87	599.67	508.94	725.26	841.70	852.51	930.31	1,058.06	1,055.45
Taxable Income	0.00	0.00	0.00	0.00	0.00	-11.63	-30.43	-33.52	-53.65	-56.34	-17.50	69.03	104.78	20.02	182.23	247.66	323.25	376.62	453.31	491.87	599.67	508.94	725.26	841.70	852.51	930.31	1,058.06	1,055.45
Corporate tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.26	26.19	5.01	45.66	61.91	80.81	94.15	113.33	122.97	149.92	127.24	181.31	210.43	213.13	232.58	264.51	263.86
PROFIT AFTER TAX	0.00	0.00	0.00	0.00	0.00	-11.63	-18.80	-3.09	-20.13	-2.69	38.84	69.28	78.58	15.02	139.37	185.74	242.44	282.46	339.98	368.90	449.75	381.71	543.94	631.28	639.38	697.73	793.54	791.59
ACCUMULATED PROFIT	0.32	0.32	0.32	0.32	0.32	-11.31	-30.11	-33.20	-53.33	-56.02	-17.18	52.09	130.68	145.69	285.06	470.80	713.25	995.71	1,336.69	1,704.59	2,154.34	2,536.05	3,079.99	3,711.27	4,360.65	5,048.38	5,841.92	6,633.51
B. CASH FLOW STATEMENT	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Operating Income	0.00	0.00	0.00	0.00	0.00	-11.63	-18.80	-3.09	-20.13	-2.69	38.84	69.28	78.58	15.02	139.37	185.74	242.44	282.46	339.98	368.90	449.75	381.71	543.94	631.28	639.38	697.73	793.54	791.59
Depreciation	0.00	0.00	0.00	0.00	0.00	45.92	61.13	61.13	94.45	94.45	94.45	94.45	94.45	94.45	94.45	95.40	96.35	96.35	96.35	96.35	96.35	96.35	96.35	96.35	96.35	97.33	98.32	98.32
Net CF from operation	0.00	0.00	0.00	0.00	0.00	34.29	42.34	58.04	74.32	91.75	133.29	163.72	173.03	109.46	233.82	281.14	338.79	378.81	436.33	465.25	546.10	478.05	640.29	727.62	735.73	795.07	891.86	889.91
Equity	56.00	2.46	121.03	141.24	164.58	11.04	11.04	11.04																				
Loan	140.19	313.49	409.58	550.05	949.42	405.75	275.21	284.85																				
TOTAL INFLOWS	196.19	315.95	530.61	691.29	1,114.00	451.08	328.58	353.93	74.32	91.75	133.29	163.72	173.03	109.46	233.82	281.14	338.79	378.81	436.33	465.25	546.10	478.05	640.29	727.62	735.73	795.07	891.86	889.91
Investment Cost	196.19	315.95	530.61	691.29	1,114.00	416.78	286.24	295.89																				
Bond interest payments																												
Debt Repayment							7.16	7.88	24.28	35.12	74.76	78.81	83.27	120.24	125.64	207.13	176.46	245.56	258.39	268.58	171.41	181.92	193.48	206.19	220.18	235.57	204.31	218.11
TOTAL OUTFLOWS	196.19	315.95	530.61	691.29	1,114.00	416.78	293.41	303.76	24.28	35.12	74.76	78.81	83.27	120.24	125.64	207.13	176.46	245.56	258.39	268.58	171.41	181.92	193.48	206.19	220.18	235.57	204.31	218.11
NET CASH FLOW	0.00	0.00	0.00	0.00	0.00	34.29	35.17	50.17	50.04	56.63	58.53	84.91	89.76	-10.78	108.18	74.01	162.32	133.25	177.93	196.67	374.69	296.14	446.81	521.43	515.54	559.50	687.55	671.80
ACCUMULATED NET CAS	0.34	0.34	0.34	0.34	0.34	34.64	69.81	119.98	170.02	226.65	285.18	370.09	459.85	449.07	557.25	631.26	793.59	926.84	1,104.77	1,301.44	1,676.13	1,972.26	2,419.08	2,940.51	3,456.05	4,015.55	4,703.10	5,374.90
C. BALANCE SHEET	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
CURRENT ASSETS	0.34	0.34	0.34	0.34	0.34	34.64	69.81	119.98	170.02	226.65	285.18	370.09	459.85	449.07	557.25	631.26	793.59	926.84	1,104.77	1,301.44	1,676.13	1,972.26	2,419.08	2,940.51	3,456.05	4,015.55	4,703.10	5,374.90
Fixed Assets	4,445.57	4,780.00	5,340.23	6,078.40	7,257.57	7,739.33	8,079.11	8,435.88	8,453.32	8,468.58	8,476.99	8,485.53	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18	8,494.18
Accumulated depreciation	0.02	0.02	0.02	0.02	0.02	45.95	107.08	168.22	262.66	357.11	451.56	546.01	640.46	734.90	829.35	924.75	1,021.09	1,117.44	1,213.78	1,310.13	1,406.48	1,502.82	1,599.17	1,695.51	1,791.86	1,889.19	1,987.51	2,085.83
NET FIXED ASSETS	4,445.55	4,779.97	5,340.21	6,078.38	7,257.54	7,693.38	7,972.03	8,267.67	8,190.66	8,111.46	8,025.43	7,939.52	7,853.73	7,759.28	7,664.83	7,569.43	7,473.09	7,376.74	7,280.40	7,184.05	7,087.71	6,991.36	6,895.01	6,798.67	6,702.32	6,604.99	6,506.67	6,408.35
TOTAL ASSETS	4,445.89	4,780.32	5,340.55	6,078.72	7,257.89	7,728.02	8,041.84	8,387.64	8,360.68	8,338.12	8,310.61	8,309.61	8,313.58	8,208.35	8,222.08	8,200.70	8,266.68	8,303.58	8,385.17	8,485.49	8,763.83	8,963.63	9,314.09	9,739.18	10,158.38	10,620.54	11,209.77	11,783.25
Acc. Loan	4,389.57	4,721.54	5,160.74	5,757.67	6,772.26	7,242.98	7,564.57	7,902.42	7,895.58	7,875.72	7,809.37	7,739.09	7,664.48</															

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DSCR (Debt Service Coverage Ratio)																														
Debt to Total Assets																														
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035		
TOTAL OF CASH AVAILABLE FOR DEBT SERVICE																														
Revenue	0.36	0.30	0.30	0.30	0.30		99.60	132.28	149.85	208.20	231.01	276.83	338.06	365.96	414.86	462.16	531.76	606.36	659.91	731.53	760.62	877.70	975.29	1,002.29	1,128.99	1,139.29	1,224.16	1,365.10	1,362.78	
O/M Cost	0.36	0.30	0.30	0.30	0.30		9.98	9.98	10.63	20.18	21.43	22.76	24.17	33.12	155.75	36.39	38.70	41.17	43.79	46.52	49.49	63.65	247.15	59.74	63.17	66.81	70.66	74.73	79.04	
Reinvestment (Maint Equip)	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
VAT to Revenue	0.00	0.00	0.00	0.00	0.00		9.05	12.03	13.62	18.93	21.00	25.17	30.73	33.27	37.71	42.01	48.34	55.12	59.99	66.50	69.15	79.79	88.66	91.12	102.64	103.57	111.29	124.10	123.89	
Corporate Tax	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	17.26	26.19	5.01	45.56	61.91	80.81	94.15	113.33	122.97	149.92	127.24	181.31	210.43	213.13	232.58	264.51	263.86	
Sub-Total	0.00	0.00	0.00	0.00	0.00	81.17	110.28	125.60	169.09	188.57	228.90	265.90	273.37	216.39	338.19	382.80	429.26	461.98	505.18	519.01	584.35	512.25	670.12	752.76	755.78	809.64	901.75	895.98		
TOTAL OF DEBT SERVICE																														
Principal payment																														
ADB (OCR)							7.16	7.88	24.28	26.70	40.52	44.57	49.03	53.93	59.32	65.26	71.78	78.96	86.85	95.54	105.09	115.60	127.16	139.88	153.87	169.25	138.00	151.80		
ADB (ADF)										8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	8.42	
JBIC												25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	25.83	
Co-financier													32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07		
Bond																75.56	38.37	100.29	105.22	106.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Interest payment																														
ADB (OCR)							21.06	20.67	47.90	46.91	45.83	44.64	43.33	41.90	40.31	38.57	36.66	34.55	32.23	29.68	26.88	23.80	20.40	16.67	12.57	8.05	4.33	1.49		
ADB (ADF)										3.03	2.90	2.78	2.65	2.53	2.40	2.27	2.15	2.02	1.89	1.77	1.64	1.52	1.39	1.26	1.14	1.01	0.88	0.76		
JBIC												7.88	7.48	7.07	6.67	6.26	5.86	5.46	5.05	4.65	4.24	3.84	3.44	3.03	2.63	2.22	1.82	1.41		
Co-financier														8.56	8.12	7.68	7.24	6.80	6.36	5.92	5.48	5.05	4.61	4.17	3.73	3.29	2.85	2.41		
Bond							46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	46.88	38.57	34.35	23.31	11.74	0.00								
Sub-Total	0.00	0.00	0.00	0.00	0.00	46.88	75.10	75.43	119.05	131.94	144.55	180.99	183.61	227.17	230.01	308.79	266.93	328.73	327.25	322.34	209.66	216.11	223.31	231.33	240.24	250.14	214.20	224.19		
DSCR							1.73	1.47	1.67	1.42	1.43	1.58	1.47	1.49	0.95	1.47	1.24	1.61	1.41	1.54	1.61	2.79	2.37	3.00	3.25	3.15	3.24	4.21	4.00	
DEBT RATIO							0.94	0.94	0.94	0.94	0.94	0.94	0.93	0.92	0.92	0.90	0.88	0.85	0.82	0.78	0.74	0.70	0.66	0.61	0.57	0.52	0.48	0.43	0.39	
WORKING RATIO		1.00	1.00	1.00	1.00	1.00	0.10	0.08	0.08	0.11	0.10	0.09	0.08	0.10	0.41	0.09	0.08	0.07	0.07	0.07	0.08	0.28	0.07	0.06	0.06	0.06	0.06	0.06	0.06	
O&M	0.36	0.30	0.30	0.30	0.30		9.38	9.98	10.63	20.18	21.43	22.76	24.17	33.12	155.75	36.39	38.70	41.17	43.79	46.52	49.49	63.65	247.15	59.74	63.17	66.81	70.66	74.73	79.04	
Revenue	0.36	0.30	0.30	0.30	0.30		90.55	120.26	136.23	189.27	210.01	251.66	307.33	332.69	377.15	420.14	483.42	551.24	599.92	665.02	691.47	797.91	886.63	911.18	1,026.35	1,035.72	1,112.88	1,241.00	1,238.89	

APPENDIX E2:

PPP SCHEME

Consideration of Private Sector Participation for Expressway Operation

Recently, the scheme of PPP (Public Private Partnership) has been prevailing in the field of development and operation and maintenance of infrastructure.

As for PPP scheme for development and operation/maintenance of expressway in Vietnam, the study of FINNROAD has been already discussed broadly. (Expressway Network Development Plan Project, Final Report, FINNROAD, April 2007)

In this text, the focusing point of discussion about PPP will be on the operation and maintenance of expressway which is to be constructed in terms of publicly-financed scheme. The possibility of PPP for the operation and maintenance of expressway will be sought.

3.1 Overview of Expressway Projects Related to PPP in Vietnam

Table 1 shows the overview of several samples of major expressway projects related to PPP mainly focusing on Ho Chi Minh City area and Southern area in Vietnam.

Table 1 has suggested some findings below:

- While there are expressway project with new alignment parallel to existing national highway, there are widening projects of the existing national highways.
- Majority scheme of PPP is BOT scheme.
- While majority of investors of BOT projects is Vietnamese entity, particularly State Corporation or local government basis corporation, Vietnamese private investor or foreign investor are minor.
- For example, IDICO group is the State Corporation under the MOC (Ministry of Construction), with activities of development/investment of industrial zones, urban/residential areas development, hydro power, BOT transport, etc.
And, Construction Company No.1 is also the State Corporation under MOC.
- CIENCO1 (CIENCO comprising 1 to 8) is the State Corporation under the MOT (Ministry of Transport), with activities of civil engineering, power plant, consultants, investment, financing, etc.
- BECAMEX IDC Corporation is State Corporation with relationship to local government (Binh Duong Province), with activities of infrastructure development / investment, project investment in the form of BOT, etc., financing, civil construction, industry and transportation.
- CII (Ho Chi Minh City Infrastructure Investment Joint Stock Company) has been established for the urban infrastructure development on the basis of authority of Ho Chi Minh municipality.

Table 1 Major Expressway Projects Related to PPP Focusing on HCMC and Southern Area

Outline of Expressway				Form of Private Participation	Management Body (Investor)	Project Cost (Approximate)
Name of Expressway	Section	Km in Length (Approx.)	On Operation/ Under Construction/ Planned			
1. Trung Luong - My Thuan -Can Tho	Tien Giang, Dong Thap, Vinh Long <u>va</u> Can Tho (Parallel to NH1)	92 km	Planned	BOT	BIDV	26,250 billion VND(about 1.53 billions USD)
2. My Phuoc – Tan Van	Thu Dau 1- Thuan An – Di An (Parallel to NH 13)	30 km	Planned	BOT	BECAMEX IDC	1,277 billion VND
3. Dau Giay - Phan Thiet	Dong Nai - Binh Thuan (Parallel to NH1)	120 km	Planned	BOT	BITEXCO	1.2 billion USD
4. Bien Hoa - Vung Tau	Bien Hoa (Dong Nai) - Vung Tau (Parallel to NH51)	76 km	Planned	BOT	Dasan, IDICO, BIDV	12,000 billion VND
5. Dau Giay - Lien Khuong	Dong Nai – Da Lat	200 km	Planned	BOT	IUDC	More than 1 billions USD
6. Binh Duong Boulevard, HCMC, Binh Duong	HCMC – My Phuoc – Bordering Binh Phuoc Province (Widening of NH13)	62 Km	Open in 2000	BOT	BECAMEX IDC	683 billion VND
7. Rach Mieu Bridge	Ben Tre Province (Crossing My Tho River)	2.9 km	Open in 2009	BOT	CIENCO1,5 and 6	1,400 billion VND
8. An Suaong – An Lac, HCMC	An Suong – An Lac (Widening of NH1)	14 km	Open in 2005	BOT	IDICO-IDI	832 billion VND
9. Binh Trieu 2 Bridge, HCMC	(Crossing Saigon River)	0.6 km	Open in 2006	BOT	CII	450 billion VND
10. NH 1K	Hoa An Bridge - NH 1A	10 km	Open in 2007	BOT	194 Co., Phu Tho Co.	250 billion VND

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					Rang Dong Co.	
11. Hanoi Highway	Saigon Bridge – Dongnai Bridge	15 km	2009 - 2012	BOT	CII	2,000 billion VND (= 125 million US\$)
12. NH 51	NH 1A – Vung Tau T-junction (Widening of NH 51)	73 km	Under Construction	BOT	BVEC (IDICO Group)	2,073 billion VND
13. Nguyen van Linh Expressway	NH 1A – Huynh Tan Phat	18 km	Open in 2007	BOT	Phu My Hung Joint Stock Company	100 million US\$
14. Phu My Bridge	District 7 – District 2, HCMC (Crossing Saigon River)	2 km	Under Construction (- 2009)	BOT	Phu My BOT Joint Stock Company	2,077 billion VND
15. Dongnai No. 2 Bridge	HCMC – Dong Nai	0.5 km	Under Construction	BOT	CC1	1,877 billion VND
(Northern Area)						
16. Ninh Binh – Thanh Hoa	Ninh Binh - Thanh Hoa	75 km	Planned	BOT	VICEM	12,800 billion VND
17. Ha Noi - Hai Phong	Hung Yen, Hai Duong va Hai Phong.	106 km	Under Construction	BOT	VIDIFI	21,900 billion VND (about 1.3 billions USD)
18. Hai Hung, Yen Lenh Bridge	Ha Nam – Hung Yen	2.2 km	Open in 2004	BOT	Thang Long Construction Corporation	340 billion VND
19. Noi Bai – Vinh Yen	Noi Bai – Vinh Yen (Widening of NH 2)	22 km	Open in 2008	BOT	National Highway 2 BOT Joint Stock Company	123 billion VND

(Source) Consultants, compiled based on:
Expressway Network Development Plan Project (Final Report, FINNROAD, April 2007)
Information from Web-sites.

(Note)

PPP: Public Private Partnership

BIDV: Bank for Investment and Development of Viet Nam

BECAMEX IDC: BECAMEX Investment and Industrial Development Construction Corporation (Binh Duong Province)

BITEXCO: Binh Minh Import-Export Production and Trade Company

Dasan: Consulting Company

IDICO: Vietnam Urban and Industrial Zone Development Investment Corporation (State Corporation under MOC)

IUDC: Incheon Urban Development Company (Korean company)

IDICO-IDI: Member of IDICO (IDICO Infrastructure Development Investment Company)

CII: Ho Chi Minh City Infrastructure Investment Joint Stock Company

CIENCO1: Civil Engineering Construction Corporation No.1 (State Corporation under MOT)

194 Co.,Phu Tho Co.Rang Dong Co.: Vietnamese private construction company

Phu My Hung Joint Stock Company: Taiwanese Company

Phu My BOT Joint Stock Company:

CC1: Construction Company No.1 (State Corporation under MOC)

VICEM: Viet Nam Cement Industry Corporation

VIDIFI: Vietnam Development Infrastructure and Financial Investment

Thang Long Construction Corporation: State Corporation under MOT

National Highway 2 BOT Joint Stock Company: Joint venture by five companies (State Corporation under MOC) including IDICO

3.2 Overview of World Bank Report on Road Sector PPP in Vietnam

The followings are the overview of the World Bank study report regarding Vietnam Road Sector PPP Project. ("Road Network Improvement Project: Public Private Partnership (PPP) in the Road Sector, Draft Final Report, September 2008, World Bank".)

(a) Vietnamese Experience with PPPs

Since 1994, PPP infrastructure projects in Vietnam have been concentrated in the field of energy and telecommunications sector.

According to the PPP Database of World Bank, the share percentage of investment in transport sector is estimated 3% of the total amount of PPP investment up to end of 2006.

(Sector)	(Billion US\$)	(Share Percentage)
Energy	2.72	68%
Telecommunications	0.95	24%
Water/Sewage	0.21	5%
Transport	0.12	3%
Total	4.00	100%

Source: PPI Database, World Bank 2007

PPP transport projects comprise the sector of seaport and airport terminals. No road sector projects were included in the database. At the time of the said report of World Bank study, thirteen road sector BOT projects have been found. Regarding these road sector BOT projects in Vietnam, World Bank report has evaluated that:

In the most cases, the investors of road sector BOT projects have been not a true private sector party, but an SOE (State-owned enterprise) or a joint stock company with majority shareholding by SOEs. These projects can therefore not be called as PPPs. However, the shareholders of the project company do operate on a commercial, "for profit", basis, then they can be considered as part of the "business" sector although not the "private sector". For this reason the term of Public-Business-Partnership (PBP) has been represented to describe the contract form of a "BOT" type contract between an authorized state body and a public owned company as the investor.

The review of Vietnamese experience has shown that the usage of scheme of PBP has been successful in speeding up development of Vietnamese road infrastructure by mobilizing additional capital resources.

(b) Financial Sector Review

The national commercial banking sector is, basically, not capable to participate substantially in the provision of the total amount necessary, on the terms and conditions required for the projected future financing road infrastructure projects in Vietnam.

On the international market the Vietnamese country rating by the rating agency (Standard & Poor)

has indicated that the country is not investment grade, meaning that the country is not acceptable for the mainstream international investors in terms of requirement of minimum rating level. Therefore, at this stage there is no immediate availability of substantial long term funding for road infrastructure projects in the international bond and bank market.

(c) Proposed Framework for Government Support

Creating an enabling environment for the development PPP's in the Vietnamese road sector requires a Government strategy for mobilization of public participation, the design of an accurate risks assessment and the establishment of appropriate risk allocation and (financial) support mechanism.

An appropriate toll tariff is the main instruments for allocating risks between road users and the operators during the concession period.

In general, the Government can offer a wide range of incentives and take various other measures in order to reduce the risks and uncertainties that may be associated with a PPP project. The instruments and level of support provided depend on the risks involved for transfer to the private sector and the financing requirements of the project once a risk allocation structure has been established. The incentives are offered in a way that can significantly improve the financial viability of projects and reduce their implementation risks to make them attractive for the private sector.

The proposed potential support measures are, for example:

- Grants
- Operating subsidy (for O&M Contracts)
- Tax incentives

(d) Legal and Regulatory Framework

Vietnam's current legal and regulatory framework is broadly enabling of PPPs in the roads sector. However, significant improvements are still required, especially if the Government is interested in moving beyond existing "PPP type" arrangement with domestic SOEs towards attracting more foreign private investment to the roads sector.

The BOT Decree (78/2007) is a generic PPP law which is not tailored to the specific requirement of roads sector PPPs. Nor do existing road sector laws provide a comprehensive framework for PPPs. The adoption of a specific road sector PPP legal instrument is proposed to ensure that a flexible, enabling framework is in place. A draft version of a road sector PPP Decree has been prepared under these services.

Other key legislative and regulatory proposals are:

- Removal of the constraints on toll tariffs defined in Circular 90/2004, to allow toll tariffs to be

varied in accordance with the specific characteristics of each project.

- Amendment to the law on investment to give road sector PPP projects the same special treatment as construction and development of infrastructure foundation of industrial parks, export processing zones, high tech parks and economic zones.
- Clarification on the extent to which PPP projects are exempt from the Law on Tendering and associated by-laws.
-

3.3 Possibility of Private Sector Participation PPP for Operation and Maintenance (O/M) of Expressway

In this section, the focusing point of discussion about the private sector participation will be on the operation and maintenance of expressway which is to be constructed in terms of publicly-financed scheme. The possibility of the private sector participation for the operation and maintenance of expressway will be sought.

Not only in developed countries but also in developing countries, the conventional scheme of O/M by facility owner for publicly-built infrastructure has been main stream for a long term. In this scheme, O/M services are carried out directly by facility owner, in which responsibility for O/M and O/M cost burden are shouldered by facility owner.

Recently, mainly under the following background, PPP for infrastructure development has been introduced:

- Budgetary constrains in public sector
- Consideration for method to import private sector efficiencies and technical know-how

Also for the field of O/M for existing public facilities, there is no exception.

Participation of private sector into the field of services of operation and maintenance for existing public facilities has been prevailing. Out-sourcing of O/M services to private sector is initial stage of PPP in existing public facilities.

The following four options are assumed:

- a) Service contract
- b) Management contract
- c) Lease contract
- d) O/M Concession

The main features of these options of PPP (Public-Private Partnership) scheme for operation and maintenance of existing facilities are referred to Table 2.

Table 2 PPP Scheme of Operation and Maintenance (O/M) for Existing Facilities

	(1) Service Contract	(2) Management Contract	(3) Lease Contract	(4) O/M Concession
Main Feature	<p>O/M services are out-sourced (only portions of services) to private company.</p> <p>Public remains the primary service provider.</p> <p>Private performs O/M services at the agreed cost.</p> <p>Public pay a fee for services to private.</p> <p>Public is responsible for funding capital investments required to facility expansion or improvement.</p> <p>Public remains in charge of tariff setting and assets.</p>	<p>Similar to Service Contract, but expanded the services to be contracted out, including some or all of the management and O/M of services.</p> <p>While public has ultimate obligation for service provision, daily management control is assigned to private.</p> <p>Private provides working capital, but no financing for investment for expansion or improvement.</p> <p>Private is paid by predetermined fee.</p> <p>Private interacts with customers, and public is responsible for setting tariffs.</p> <p>Useful in encouraging enhanced efficiencies and technology sophistication.</p>	<p>Private is responsible for services in its entirety.</p> <p>Except for new and replacement investments, which remain public responsibility, private provides services at his expense and risk.</p> <p>Responsibility for service provision is transferred from public to private.</p> <p>Private retains revenue collected from customers, and makes a specified lease payment to public.</p> <p>Private's profits depend on utility's sales and costs. This will provide incentive for private to achieve higher level of efficiency and higher sales.</p> <p>Useful in encouraging enhanced efficiencies and technology sophistication.</p>	<p>Private is responsible for the full delivery of services including O/M, collection, management, and rehabilitation.</p> <p>Private is responsible for all capital investment as well as for working capital. (Public may contribute to the capital investment cost (investment subsidy), if necessary.)</p> <p>Public is responsible for establishing performance standard, and monitoring. Public's role shifts from service provider to service regulator on tariff and quality of services.</p> <p>Private collect tariff directly from customers. The tariff is established by the concession contract.</p> <p>Useful in encouraging enhanced efficiencies and technology sophistication. Providing incentive to private to achieve improved level of efficiency.</p> <p>Including complexity of contract.</p>

				Public needs to upgrade his regulatory capacity related to tariffs and performance monitoring.
Ownership of Existing Facility	Public	Public	Public	Public
Responsibility for O/M	Public	Private (Ultimate obligation for service provision remains in public.)	Private by Lease Contract	Private by Concession Contract
Revenue Risk	Public	Public	Private	Private
Risk for Private	Service contract provides a relatively low-risk option for expanding the role of private sector.	No risk of capital investment borne by private sector.	Financial risk for O/M is born by private. Private's profits depend on utility's sales and costs. Private's revenues are derived from customers, hence, the question of tariff level become increasingly sensitive.	Similar to (3) Lease Contract

Source: Compiled by Consultants based on:
 Public-Private Partnership Handbook, ADB
 Expressway Network Development Plan Project No. TA 4695-VIE, Final Report, FINNROAD, April 2007
 Road Network Improvement Project: PPP in Road Sector, Vietnam, Draft Final Report, World Bank, September 2008
 Web-site of FHWA (United States Department of Transport – Federal Highway Administration)

3.4 Recent Topics on PPP Scheme of Expressway O/M in Vietnam

(1) HCMC – Trung Luong Expressway Project

HCMC – Trung Luong Expressway has been already invested by the Vietnamese Government from national budget funding. After completion of civil engineering works, BIDV (Bank of Investment Development of Vietnam) Expressway Development Company (BEDC) will be the unit who applies for buying the toll fee collection right over the above section.

Transferring model is: After having been supported by the Government with compensation for land acquisition cost, BEDC will have its responsibility to refund all remaining amount to the Government. Time for refunding to the Government is 17 years.

This can be considered as one model of PPP (O/M Concession).

(2) Plan of Study for Evaluation of PPP Pilot Projects in Vietnam

Currently, the Ministry of Planning and Investment of Vietnam (MPI) has a plan to execute a study for evaluation of PPP Pilot Projects in Vietnam for the field of thermal power, hydro power, water supply and expressway maintenance.

3.5 PPP Scheme of O/M Services for VEC

Table 3 shows the comparison of PPP scheme of O/M services for VEC in accordance with Table 3 previously shown.

Regarding the contract scheme in terms of legal stipulation, the contents of contract in the case of Lease Contract or O/M Concession will require rather strict than others. And also for the O/M service standard, the regulation in the case of Lease Contract or O/M Concession will require rather comprehensive than others.

Regarding O/M service standard, for example in Indonesia, Ministry of Public Works, Indonesia has issued a “Minimal Service Standard for Toll Road”, comprising service substances covering toll road condition, average covering speed, accessibility, mobility, safety, rescue/safety unit and service aid.

Especially, in the case of O/M service performed not by only one company but by several companies for each toll road section, united O/M service standard is required.

Table 3 Comparison of PPP Scheme of O/M Services for VEC

	(1) Service Contract	(2) Management Contract	(3) Lease Contract	(4) O/M Concession
Contract Scheme for VEC	Out-source Contract (only portion of services) of O/M services to Private Company under the prepared O/M Service Standard	Similar to Service Contract. (expanded the scope of services to be contracted out)	O/M Lease Contract between VEC and Private Company under the prepared O/M Service Standard (rather strict)	O/M Concession Contract between VEC and Private Company under the prepared O/M Service Standard (rather strict)
Accumulation of Business Experience / Know-how of O/M Services for VEC	VEC can accumulate business experience / know-how of O/M services although less degree compared to Direct O/M	Similar to Service Contract.	Degree of accumulation of business experience / know-how of O/M services are less than Direct O/M, Service Contract, or Management Contract	Similar to Lease Contract

Source: Compiled by Consultants

3.6 Recommended PPP Scheme for VEC

According to the information obtained from VEC, VEC has a mind to be reluctant for O/M Lease or O/M Concession scheme, conceiving that the price of concession would be too high to be afforded by private company, and VEC have a mind to perform toll collection by himself.

In the experience in developed countries, for example in Japan, the Japan Highway Public Corporation has initially performed “service contract” since initial operation stage.

While as a “direct O/M”, service field of “toll collection” and “highway patrol” for partial road section have been performed, as a “service contract, service field of “toll collection” and “highway patrol” as well as other service fields have been done broadly. And step by step, the share portion of “service contract” in service fields has been increased compared to “direct O/M”.

It is considered that even there will be an introduction of O/M Concession in future, the scheme of “service contract” or “management contract” as a PPP scheme is reasonable to be introduced as a first step. Through an accumulation of business experience / know-how of O/M services in the scheme of “service contract” or “management contract” as a PPP scheme, VEC will proceed to the next stage to make a decision regarding, for example, “O/M concession”.