ECONOMIC AND FINANCIAL ANALYSIS

A. General

1. Roads are the main mode of transport in Pakistan, accounting for 96% of all inland freight and 92% of all passenger traffic. According to the Pakistan Economic Survey, 2012–2013, Pakistan has a total of 263,415 kilometers (km) of public roads, of which 9,324 km are national highways and 2,280 km are motorways; the remainder is classified as provincial highways or local roads. The motorway and highway network comprises approximately 5% of the total road length, but caters to about 80% of total traffic. Despite the high levels of reliance on the road transport mode, the quality of the existing infrastructure is still cause for concern. Although since 2005 there has been considerable investment in national highways, the overall road condition needs further improvement—only 7% is in good condition while 26% is in poor or very poor condition.[1]

2. Pakistan is strategically located between the Arabian Sea and landlocked Afghanistan, Central Asia, and the province of Xinjiang, the People's Republic of China. Pakistan provides the shortest route to a seaport for these locations, so it should be strategically positioned to benefit from its geographic location. However, various factors such as security and the state of the existing transport infrastructure have prevented Pakistan from maximizing the benefits of its geographical location. Nonetheless, trade could increase if the physical transport infrastructure is improved.

3. Balochistan in southwest Pakistan is the country's largest province—with in excess of 40% of the landmass. It is also the least densely populated province, with 8 million people, equivalent to only 12 persons per square km. Balochistan shares a border with Iran to the southwest and Afghanistan to the northwest, and should benefit from additional trade arising from its location as the nearest route to port for many parts of Afghanistan in particular. However, despite its geographic location, the security situation and poor transport infrastructure limit its use as an important trade route.

4. Balochistan is the least developed province in Pakistan. Its economy is dominated by the production of natural gas, coal, and minerals, with limited farming in the east and fishing on the Arabian Sea providing livelihoods for some. Poverty is endemic, with 45.2% of all persons in Balochistan below the poverty line.[2] Quetta is both the largest city and the capital of Balochistan, and has a population of about 565,000 people. Quetta is linked to both Karachi and Afghanistan via National Highway No. 25 (N-25), and to Iran via the N-40. To the east and north of Quetta, three roads serve important functions: (i) the N-65 connects Quetta, and Balochistan, to the N-5 and onward to the major cities of Hyderabad and Karachi to the south; (ii) the N-50 provides a key link to northern Pakistan, in particular Peshawar; and (iii) the N-70 connects with the N-5 and onward to the key cities of Lahore to the northeast, and the capital, Islamabad, to the north.

1. Without-Project Scenario: N-50

5. The N-50 starts at Kuchlak to the north of Quetta and runs east via the urban areas of Muslim Bagh, Qila Saifullah, Zhob, and Mughal Kot, ending at an intersection with the Indus highway near Dera Ismail Khan. Much of the N-50 has been substantially improved; the

[1] Data provided by NHA based on their Road Asset Management System.
[2] The number is even higher for urban centers only. See: Social Policy and Development Center. 2013. *Predicting Sub-National Poverty Index for Pakistan*. Karachi.

Kuchlak–Muslim Bagh, Muslim Bagh–Zhob, and Mughal Kot–Dera Ismail Khan sections were upgraded to an appropriate standard (7.3 meters [m] wide).

6. The remaining section, Zhob–Mughal Kot, was widened from 3.78–4.0 m to 5.5–6.0 m and surface treated, but it is still considered below standard in terms of lane width and speeds—providing poor service to users, with low speeds and difficult overtaking opportunities (given the narrow road). It also acts as an impediment to growth by increasing the cost of transport for the local population, and for the movement of goods to market. The existing drainage facilities are also substandard.

2. Without-Project Scenario: N-70

7. The N-70 connects the N-50 at Qila Saifullah to the N-5 at Multan, passing through the urban areas of Loralai, Bewata, Dera Ghazi Khan, and Muzaffargarh. The N-70 is being substantially upgraded, with the Muzaffargarh–Multan section completed, and the Waghum Rud–Bewata section under implementation. Bidding is in process for the Bewata–Rakhi Gajj section, while detailed engineering design has been completed for the D.G. Khan–Muzaffargarh section. Narrow road widths and poor vertical and horizontal alignments on parts of these sections limit the maximum size of vehicles that can use the N-70—few buses and large trucks use the N-70, from Qila Saifullah to Dera Ghazi Khan, for long-distance travel.

8. The remaining section of the N-70, Qila Saifullah–Waghum Rud, was upgraded from 3.65–4.00 m width to its current width of 5.50–6.00 m. Some geometric improvements have already been carried out at sharp or narrow curves, but the existing drainage facilities are poor and the section is still considered substandard and in need of an upgrade.

3. With-Project Scenario: N-50 and N-70

9. The project consists of the online reconstruction of a total of 201 km of roads, 81 km of the N-50 from Zhob to Mughal Kot, and 120 km on the N-70 from Qila Saifullah to Waghum Rud. The proposed improvements to the N-50 Zhob–Mughal Kot section and the N-70 Qila Saifullah–Waghum Rud section will be undertaken according to National Highway Authority (NHA) specifications for national highways with carriageway width of 7.3 m, constructed with aggregate base course and asphaltic layers with surface treated shoulders. Drainage will be improved through the construction of reinforced cement concrete box culverts, as well as the construction of new bridge structures as required. Road safety works—including signage, lane marking, and road furniture—will be carried out in accordance with NHA standards for national highways. By improving lane widths and providing paved hard shoulders, the new roads will reduce the costs of transport of both people and goods (to market).

10. The completed routes are likely to attract additional demand, either in terms of traffic generation (i.e., new trips) or traffic rerouting from competing routes (e.g., the N-65). Furthermore, when the entire N-70 has been improved to a uniform standard, some traffic may divert from competing routes (i.e., either from the N-65 and N-55 and/or from the N-65 and N-5 routes).

11. The location and connectivity of the proposed scheme does not provide an alternative for consideration as part of the project preparatory process; as the project involves widening the existing road, only the existing alignment was studied. Furthermore, the application of pavement design standards (from Transport Research Laboratory Road Note 31), geometric design standards (based on the American Association of State Highways and Transportation Officials

[AASHTO] policy on design of highways and streets), and bridge design standards (based on the West Pakistan Code of Practice for highway bridges 1967, conforming to the American Concrete Institute codes of practice and AASHTO bridge design codes) are based on standard practice prevalent in Pakistan. The highway design industry, in general, does not undertake a detailed options analysis based on the application of different technical standards. While a detailed least-cost analysis or multi-criteria analysis has not been undertaken, the detailed design undertaken considers different (minor) technical options and inputs (including traffic numbers and axle loads) and selection of the optimal solution, so it can be considered to reflect an optimal design.

B. Traffic Studies

12. The NHA has undertaken annual traffic counts on the N-50 and N-70, which showed higher traffic volumes on the N-70 than on the N-50. However, recent improvements to both the N-70 and in particular the N-50 were thought to have diverted traffic from competing routes (e.g., the N-65), so the NHA undertook revised traffic counts in November 2013 to estimate current traffic patterns on both roads.

13. The 9-hour counts undertaken on 26 November 2013 were factored from 9-hour counts to 24-hour counts, and then to annual average daily traffic (AADT) by application of factors provided by the NHA. Table 1 shows the current traffic estimates for all sections. The current state of the N-70 (from Qila Saifullah to D.G. Khan) means that it is used by a limited number of large vehicles (i.e., buses or goods vehicles with four or more axles). The traffic flow on Zhob–Mughal Kot has increased since 2008, with a slight reduction in flows on the N-70 sections.

Table 1: Current Demand, N-50 and N-70

Location	AADT (2013 base)	Motor cycle	Cars, Jeeps, Taxis	Minibus, Vans, Pickups	Bus	Trucks (2–3 axles)	Trucks (4 + axles)
N-50 Zhob–Mughal Kot	4,410	797	744	741	474	970	684
N-70 Qila Saifullah–Loralai	2,297	378	1,043	347	9	520	0
N-70 Loralai–Waghum Rud[a]	1,766	291	802	267	7	400	0

AADT = annual average daily traffic.

[a] Calculated using counts from the Qila Saifullah–Loralai section and application of the historic average ratio of flows on the Qila Saifullah–Loralai section to those on the Loralai–Waghum Rud section.

Source: National Highway Authority counts.

14. Gross domestic product (GDP) growth rates in Pakistan averaged 4.45% over 2005–2012.[3] Forecasts of GDP growth for 2013–2018 have been sourced from the International Monetary Fund (IMF),[4] and a GDP growth rate of 4.00% for 2019 onward has been assumed, based on recent trends. GDP per capita growth rates have been calculated based on projections outlined above, combined with United Nations population projections, which project the population of Pakistan to grow by an average of about 0.83% per annum. Therefore, the economic analysis is based on a projected long-term GDP per capita growth rate of less than 3.2% per annum.

15. Traffic forecasts were made for the 20-year period from 2018 to 2037. Demand was predicted to increase in line with changes in GDP per capita, with an assumed income elasticity

[3] World Bank. World Development Indicators Dataset. http://data.worldbank.org/data-catalog/world-development-indicators (accessed 10 February 2014).

[4] International Monetary Fund. World Economic Outlook Dataset. http://www.imf.org/external/pubs/ft/weo/2014/01/weodata/index.aspx (accessed 10 February 2014).

of demand of 2.0 for motorcycles, 1.2 for cars and light vehicles, and 1.1 for buses and goods vehicles, as recommended in ADB's *Cost-Benefit Analysis for Development: a Practical Guide*.[5] Table 2 shows the forecast demand on the N-50 Zhob–Mughal Kot and the N-70 Qila Saifullah–Waghum Rud sections.

Table 2: Forecast Average Annual Daily Traffic on the N-50 and N-70, 2018–2037

Road Section	2018	2028	2037
N-50 Zhob–Mughal Kot	5,735	8,150	11,186
N-70 Qila Saifullah–Loralai	3,068	4,645	6,814
N-70 Loralai–Waghum Rud	2,360	3,573	5,242

Source: Asian Development Bank estimates.

C. Economic Costs

16. The economic costs of the project comprise (i) capital investment, including civil works, as well as consulting services for design review, construction supervision, and a social safeguard management consultant; and (ii) road maintenance. Costs related to taxes, duties, and financing charges during implementation have been excluded. Financial costs were converted into economic costs by applying appropriate conversion factors, in accordance with the ADB guide. Table 3 breaks down the investment costs for the project by package.

17. The total investment cost is about $235.0 million, comprising $119.5 million for the N-50 Zhob–Mughal Kot, $110.3 million for the N-70 Qila Saifullah–Waghum Rud, and $5.2 million for the community center development. The civil works cost per km, excluding the community center development, amounts to $1.47 million/km for the N-50 Zhob–Mughal Kot and $0.92 million/km for the N-70 Qila Saifullah–Waghum Rud. The higher cost on the N-50 is attributable to the more difficult terrain, in particular the northern part, which is quite hilly and challenging. The civil works cost per km for the N-70, at $0.92 million/km, is comparable with that of the N-50 Qila Saifullah–Zhob project,[6] $0.77 million/km, which is under construction.

Table 3: Financial Cost Estimate, N-50 and N-70

($ million)

Item	N-50 Zhob–Mughal Kot	N-70 Qila Saifullah–Waghum Rud	Total
Length	81 km	120 km	201 km
Construction	98.10	90.10	188.20
Physical Contingencies	9.90	9.10	19.00
Price Contingencies	3.80	3.50	7.30
Consultant	4.70	4.20	8.90
Resettlement Cost	0.20	0.80	1.00
IDC	2.80	2.60	5.40
Total	**119.50**	**110.30**	**229.80**
Civil works, cost per km	1.47	0.92	1.14

IDC = interest during construction, km = kilometer.
Sources: Asian Development Bank and National Highway Authority estimates.

18. Unit rates for maintenance were sourced from the NHA and are shown in Table 4. These rates are based on equivalent expenditures on similar types of roads.

[5] Asian Development Bank. 2013. *Cost Benefit Analysis for Development: A Practical Guide*. Manila.
[6] ADB. 2009. *Periodic Financing Request Report for Project 2 of National Highway Development Sector Improvement Program.* Manila.

Table 4: Unit Rates for Maintenance, N-50 and N-70
(2013 PRs prices)

Item		Cost (PRs/km)	Cost ($/km)
Routine Maintenance	Without Project	561,000–637,000	5,300–6,000
	With Project	337,000–383,000	3,200–3,600
Periodic Maintenance	Without Project	5,000,000	47,200
	With Project	3,000,000	28,300
Structural Maintenance	Without Project	10,000,000	94,300
	With Project	6,000,000	56,600

Source: Asian Development Bank and National Highway Authority estimates.

19. A conversion factor of 1.0 has been applied to consulting services. A shadow wage rate factor of 0.75 and a shadow exchange rate factor of 1.11 were used in the analysis. As the economic analysis is undertaken in 2013 prices, it excludes price contingencies.

D. Economic Benefits

20. Savings in vehicle operating costs (VOCs) are the primary benefit calculated for both projects, and derive from improved conditions and levels of service on the proposed new stretches of the N-50 and N-70. Unit rates for VOCs per km, which vary according to the International Roughness Index (IRI), for the N-50 and N-70 have been sourced from the NHA based on Highway Development and Management-4 (HDM-4) model outputs. VOCs for the without-project scenario are based on default unit rates for roads with an average IRI value of 5.5 (for the N-50) and 6.0 (for the N-70), while in the with-project scenario the unit rates used are those of an average road with IRI value of 2.5. The unit rates provided by the NHA were in 2011 economic prices, so they reflect market prices less any taxes, duties, and subsidies. The NHA unit rates were converted to 2013 prices by assuming the fuel component of VOCs moved in line with real changes to average fuel prices (excluding the effects of fuel taxes, duties, and subsidies) over 2011–2013, and the non-fuel component varied in line with consumer price inflation. Table 5 lists the VOC unit rates used in the analysis.

Table 5: Unit Rates for Vehicle Operating Costs, N-50 and N-70
(2013 PRs domestic prices)

Vehicle Type		VOC (PRs/km)	VOC ($/km)
Motorcycles	With Project	4.2	0.04
	Without Project N-50	4.6	0.04
	Without Project N-70	5.2	0.05
Cars	With Project	13.3	0.12
	Without Project N-50	13.8	0.13
	Without Project N-70	15.4	0.15
Pickups	With Project	65.5	0.61
	Without Project N-50	71.1	0.66
	Without Project N-70	75.4	0.71
Bus	With Project	90.9	0.85
	Without Project N-50	105.8	0.99
	Without Project N-70	114.5	1.08
Trucks (2–3 axles)	With Project	146.3	1.37
	Without Project N-50	172.7	1.61
	Without Project N-70	177.9	1.68
Trucks (4+ axles)	With Project	253.6	2.37
	Without Project N-50	277.5	2.59
	Without Project N-70	298.3	2.81

km = kilometer, VOC = vehicle operating cost.
Source: Asian Development Bank estimates based on National Highway Authority HDM-4 data.

21. The average car speeds assumed in the economic analysis are shown in Table 6.

Table 6: Average Car Speeds, N-50 Zhob–Mughal Kot and N-70 Qila Saifullah–Waghum Rud

Road Section	With Project	Without Project
N-50 Zhob–Mughal Kot	35 km/hour	60 km/hour
N-70 Qila Saifullah–Loralai	35 km/hour	60 km/hour
N-70 Loralai–Waghum Rud	35 km/hour	60 km/hour

km = kilometer.
Source: Asian Development Bank and National Highway Authority estimates.

22. As the projects involve widening of the existing road, the calculation of time savings was not based on any reduction in vehicle-km traveled, but only the expected increase in speeds. The calculation of time savings benefits did not include crew costs (the costs of the driver and any other working passenger), as they form part of the VOC calculations. Benefits from generated trips have been estimated to equal half of those from existing trips.

23. The value of business travel time adopted was based on recently released average wage data for Balochistan.[7] The value of non-working time was taken as 30% of the value of working time. The economic analysis used hourly values of time of PRs86 for work travel and PRs26 for non-work travel (both in 2013 prices). These values of time are hypothesized to increase over time by reference to changes in forecast real GDP per capita.

24. Average vehicle occupancy was derived from NHA estimates of an average of two persons per car, eight occupants for pickups/minibuses, and 30 for buses. As the VOC unit rates shown in Table 5 above include a crew cost component, the time savings calculation did not include any savings in terms of vehicle crew, as this would represent double-counting. Some 25% of all occupants (including crew) of cars, light vehicles, and buses were assumed to be in working time.

25. Potential impacts in terms of accidents and impact on the environment have not been included in the economic analysis due to lack of data.

E. Results of Economic Analysis

26. An economic assessment of the project has been carried out in accordance with ADB's *Guidelines for the Economic Analysis of Projects*.[8] The methodology used compares the benefits derived from reductions in VOCs and travel times arising from the project's construction, against the up-front investment cost and any incremental changes in maintenance costs over the 20-year appraisal period.

27. Table 7 presents the results of the economic analysis, covering the full length of the project, for the N-50 Zhob–Mughal Kot and N-70 Qila Saifullah–Waghum Rud, and a combined analysis of both projects. The economic indicators provided are the economic internal rate of return (EIRR), project benefit–cost ratio, and net present value (NPV) at a 12% discount rate. The results are presented in the domestic price numeraire.

[7] Pakistan Bureau of Statistics. 2014. *Labor Force Survey 2012–2013 (Annual Report)*. Islamabad.
[8] Asian Development Bank. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

Table 7: Project Economic Indicators

Road Section	Benefit to Cost Ratio	NPV (2013 PRs million, domestic price numeraire)	EIRR (%)
N-50 Zhob–Mughal Kot	2.18: 1	7,397	23.8
N-70 Qila Saifullah–Waghum Rud	1.27: 1	1,708	15.1
Combined N-50 and N-70	1.72: 1	9,104	19.7

EIRR = economic internal rate of return, NPV = net present value.
Source: Asian Development Bank estimates.

28. Sensitivity tests and calculations of switching values were carried out to determine the effect on the key economic indicators of variations in key input parameters. Table 8 shows a switching value of +112% with respect to construction costs for the N-50 Zhob–Mughal Kot section and +26% for the N-70 Qila Saifullah–Waghum section.

Table 8: Result of the Sensitivity Analysis

Item	Benefit–Cost Ratio	NPV (2013 PRs million, domestic prices)	EIRR (%)	Switching Value (%)
Base	N-50 2.18 : 1 N-70 1.27 : 1	N-50 7,397 N-70 1,708	N-50 23.8 N-70 15.1	
Construction Cost + 20%	N-50 1.80 : 1 N-70 1.05 : 1	N-50 6,074 N-70 396	N-50 20.4 N-70 12.6	N-50 +112 N-70 +26
Vehicle Operating Costs – 20%	N-50 1.74 : 1 N-70 1.02 : 1	N-50 4,661 N-70 111	N-50 19.8 N-70 12.2	N-50 –54 N-70 –21
Reduction in Long-Term GDP Growth Rate by 1%	N-50 2.00 : 1 N-70 1.16 : 1	N-50 6,280 N-70 1,007	N-50 22.7 N-70 14.0	N-50 –12 N-70 –3
Delay of 1 year	N-50 2.02 : 1 N-70 1.18 : 1	N-50 6,411 N-70 1,149	N-50 21.0 N-70 13.9	

GDP = gross domestic product.
Source: Asian Development Bank estimates.

29. In summary, the economic analysis was undertaken in line with the 1997 ADB *Guidelines for Economic Analysis of Projects*. The detailed economic analysis is considered to represent a conservative estimate of the likely return on the project, as the demand forecasts are considered conservative. Each project constituent yields an EIRR in excess of the 12% threshold, so the N-50 Zhob–Mughal Kot and the N-70 Qila Saifullah–Waghum Rud sections are considered economically viable. However, sensitivity analysis indicates that the N-70 section is particularly sensitive to cost escalation. Therefore, appropriate steps should be taken to ensure that the project is delivered on budget.

F. Results of Financial Analysis

30. There are no plans to toll either the N50 Zhob–Mughal Kot or the N-70 Qila Saifullah–Waghum Rud sections. The project will therefore not be revenue-generating.

31. Road investment in Pakistan is mainly funded through annual allocation from the federal public sector development program. The federal budget allocation has not been sufficient for the timely and necessary expansion of road capacity, and maintaining the quality of existing road infrastructure. However, in 2003, the government established a road maintenance fund that is financed by toll revenue from motorways and national highways, federal grants, and other road revenues—providing more stable funding for maintenance of the national road network, and facilitating more effective planning of maintenance expenditures.

32. The total maintenance expenditure has increased from PRs10.1 billion in fiscal year (FY) 2008 to PRs16.3 billion in FY2013. However, resources generated by the road maintenance fund are still 30%–40% short of the total needed to maintain the existing network adequately. Increasing toll rates (above the rate of inflation) on tolled roads would help ensure that funds are sufficient to maintain the entire road network adequately.

33. The budget deficit for Pakistan in FY2013 is estimated at 8% of GDP, equivalent to PRs1.8 trillion. The most recent IMF country report on Pakistan contains two scenarios regarding evolution of the deficit: (i) a baseline scenario where, in the absence of corrective measures, the budget deficit increases to 10.4% of GDP in 2018; and (ii) an alternate scenario based on adaptation of the IMF program where the budget deficit shrinks to 3.5% of GDP by FY2018.[9]

34. Annual expenditure on routine maintenance averaged about PRs81.6 million over 2010–2013 for the N-70 Qila Saifullah road, and PRs44.3 million for the N-50 Zhob–Mughal Kot section. In the with-project scenario, annual expenditure on routine maintenance is projected to fall by about PRs50 million per year, which is about 0.3% of the total NHA budget. Completion of the project will therefore have a slight positive effect on NHA's maintenance budget.

[9] International Monetary Fund. 2013. *Pakistan: IMF Country Report No. 13/287*. Washington.