



Technical Assistance Report

Project Number: 42513-01
Capacity Development Technical Assistance (CDTA)
August 2009

India: Karnataka State Highway Network Improvement Strategy (Financed by the Japan Special Fund)

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 24 July 2009)

Currency Unit	–	Indian rupee/s (Re/Rs)
Re1.00	=	\$0.020
\$1.00	=	Rs48.450

ABBREVIATIONS

ADB	–	Asian Development Bank
CRN	–	core road network
GHG	–	greenhouse gas
GIS	–	geographic information system
GOK	–	government of Karnataka
HDM	–	highway development and management
HR	–	human resource
IT	–	information technology
KPWD	–	Karnataka Public Works Department
KRDCL	–	Karnataka Road Development Corporation Limited
KSHIP	–	Karnataka State Highways Improvement Project
KSHTTA	–	Karnataka State Highways, Traffic, and Transport Authority
OPRMS	–	output performance road maintenance system
PPIAF	–	Public–Private Infrastructure Advisory Facility
PSP	–	private sector participation
RAM	–	road asset management
RIS	–	road information system
TA	–	technical assistance

TECHNICAL ASSISTANCE CLASSIFICATION

Type	–	Capacity development technical assistance (CDTA)
Targeting Classification	–	General intervention
Sector (Subsectors)	–	Transport, and information and communication technology (road transport)
Themes (Subthemes)	–	Economic growth (widening access to markets and economic opportunities), capacity development (institutional development)
Location Impact	–	State wide in the state of Karnataka

NOTES

- (i) The fiscal year (FY) of the Government of India begins on 1 April and ends on 31 March. FY before a calendar year denotes the year in which the fiscal year begins, e.g., FY2009 begins on 1 April 2009.
- (ii) In this report, "\$" refers to US dollars.

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I. INTRODUCTION

1. The Government of India has requested technical assistance (TA) from the Asian Development Bank (ADB) for capacity development to support the proposed Karnataka State Highway Network Development Strategy. The Fact-Finding Mission visited the state from 17 to 21 November 2008 and met with senior officials of the government of Karnataka (GOK), Karnataka Public Works Department (KPWD), the project implementation unit of the Karnataka State Highways Improvement Project (KSHIP), Karnataka Road Development Corporation Limited (KRDCL), and subsequently with officials of the Department of Economic Affairs, Ministry of Finance, Government of India. The fact-finding mission was supplemented by a consultation mission on 25 March 2009 which met with GOK and KSHIP officials. This capacity development TA was developed based on the Government's concurrence with its impact, outcome, outputs, implementation arrangements, cost, financing arrangements, and terms of reference. The design and monitoring framework is in Appendix 1.¹

II. ISSUES

2. The road network in Karnataka totals 209,905 kilometers (km) and comprises 3,978 km of national highways, 20,738 km of state highways, 37,943 km of major district roads, and 147,212 km of village roads. The length of the state highway network has recently increased. The total length of primary roads (i.e., state highways and major district roads) in the state is 62,659 km. GOK has formulated the concept of a core road network (CRN) that encompasses the road links considered important for the economic and social development of the state. The long-term goal is for the CRN to cover the most vital 20% of the entire road network, or approximately 40,000 km. The medium-term term goal is a CRN of 25,000 km comprising both national and state highway roads.

3. The CRN was determined based on existing data and without analyzing the future traffic and socioeconomic needs of the state. Hence there is a need for master planning to draw up a future CRN for the state. The process must assess the current and future socioeconomic development of the state for agriculture, mining, industry, and tourism, and how best to provide connectivity to other transport modes (rail, air, and inland waterway terminals and ports), to identify the required corridors for road infrastructure and estimate the likely traffic demand on each corridor for the next 10 years. This will help ensure that the CRN identified after this analysis will serve the needs of the state for the next 10 years, not just its current needs. The process must also formulate standards for traffic signs and other road fixtures, roadside amenities, enforcement needs, etc.

4. Several GOK agencies are involved in the road sector. KPWD is a government department and has historically been responsible for developing and maintaining the entire network of state highways and major district roads in the state using funds from the state government budget. However, in 1999, GOK set up KRDCL to undertake the construction and maintenance of the state highway network. KPWD then became responsible for maintaining the major district road network using only GOK allocations. In October 2008, GOK decided that maintaining the state highway network (with the exception of newly constructed roads) would once again become the responsibility of KPWD. The original objective was for KRDCL to mobilize non-GOK financing for maintaining the state highway network. However, after taking one loan, KRDCL perceived the financing costs of outside borrowing to be high and has not taken out any other loan. The funding source for KRDCL now is exactly the same as for KPWD

¹ The TA first appeared in the business opportunities section of ADB's website on 4 December 2008.

i.e. GOK allocations. The Infrastructure Development Department is a department of GOK established to play a significant role in promoting increased private investment in public infrastructure. In the road sector, it has identified four state highway projects with a total length of 2,000 km for upgrading under annuity and/or design–build–operate–transfer schemes. It is also considering upgrading other roads with private sector participation. The Karnataka State Highways, Traffic, and Transport Authority (KSHTTA) was set up in 2001 as the Karnataka State Highways Authority to fulfill a World Bank loan processing requirement that the GOK establish a State Highways Authority. KSHTTA is an advisory body consisting of 11 GOK officials and five nongovernment members. It has no permanent staff assigned to it.

5. KPWD established in 2001 a project implementation unit to undertake the KSHIP. It is responsible for implementing all externally aided state highway projects in Karnataka. It is headed by a project director who reports administratively to the principal secretary of KPWD through the secretary of KPWD. However, for the purpose of implementing the KSHIP, the project director reports to the chief project officer. Under KSHIP, 2,413 km of roads across 19 districts of the state were improved, 901 km of which were upgraded and 1,512 km of which were rehabilitated. GOK is currently discussing with the World Bank a second KSHIP loan (KSHIP II) to upgrade another 559 km of state highways. An institutional strengthening action plan was implemented under the first KSHIP loan (KSHIP I). A follow-on institutional action plan is under discussion between GOK and the World Bank for implementation under KSHIP II.

6. KPWD is the single largest road sector agency in the state, with responsibility for buildings as well as roads. Its responsibilities in the road sector will further increase with the GOK decision of October 2008 to entrust again the maintenance of most of the state highway network to KPWD. However the organizational structure of KPWD does not provide an institutional functional focus on the road sector. It would be better if, at the zonal level, there were a clear-cut division of responsibilities, with some circles and divisions being responsible for KPWD's road sector responsibilities and other circles and divisions responsible for its other responsibilities. This could be done if a zonal superintending engineer under the chief engineer could be tasked to look exclusively after roads. The circles and divisions could then be reorganized such that there are circles and zones dedicated exclusively to the road sector while others are dedicated exclusively to other KPWD functions (e.g., buildings). Such rearrangements of the institutional structure could be carried out within KPWD's existing personnel ceiling.

7. As GOK is likely to implement a toll policy soon, the need exists to build capacity in it to prepare a tolling strategy and undertake a campaign to provide correct and timely information to the public to build support for it. Furthermore, although transaction advisors have been provided by ADB to the Infrastructure Development Department² and will also be provided by the World Bank under the Public-Private Infrastructure Advisory Facility, once the contracts are signed, they will have to be administered by the road agencies themselves. Hence there is a need to provide training at suitable institutions and agencies in India that have the experience and capability to train GOK officials to negotiate contracts and administer private sector participation (PSP) projects using actual case studies.

8. It is clear that there are many agencies are involved in the road sector. As road infrastructure is a networked system, the optimum benefits from any investment in the road sector can best be obtained by considering network impacts and effects. This means that sector

² ADB. 2006. *Technical Assistance to India for Mainstreaming Public-Private Partnerships at State Level*. Manila (TA 4890-IND).

planning, project planning, and policy formulation for the road sector have to be done in an integrated and consolidated manner by one agency. The execution of components or elements of the approved plan can be carried out by individual agencies, as is done under current practice. The GOK approved a road sector policy and identified KSHTTA as the nodal agency for planning and policy formulation in the roads sector³. However, for KSHTTA to play this role, it has to be converted from an advisory body into an executive body with planning powers and a role in budget allocation. This will require KSHTTA to have staff assigned to it. GOK and ADB have analyzed the policy and institutional-strengthening efforts that have been, and will be, carried out under various initiatives, to identify the gaps that need to be addressed to make these efforts more effective. A summary of the policy and institutional gap analysis is shown in Appendix 2.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

9. The impact of the TA will be enhanced efficiency in the planning, programming, policy formulation, and monitoring of the road sector in Karnataka such that the percentage of links on the CRN where volume exceeds capacity is reduced by 30% in the next 5 years and by 70% in the next 10 years. The outcome of the TA will be that KSHTTA and KPWD effectively implement their mandated responsibilities to plan, manage, and maintain Karnataka's state road network. Identifying, planning, and financing a 25,000 km CRN is necessary to support the state's socioeconomic development and will be done taking into account the future needs of the state. This TA will serve as the foundation for another follow-on capacity development TA as well as a project preparatory TA to prepare possible projects for ADB financing.

B. Methodology and Key Activities

10. **Formulating the Core Road Network.** The TA will formulate a CRN for the state for the next 10 years with the development of the road sector master plan. The required corridors and standards for road infrastructure and road amenities will be identified through traffic surveys and reviews of existing plans for the current and future socioeconomic development of the state for agriculture, mining, industry and tourism, as well as with an eye toward providing connectivity to other transport modes (i.e., rail, air, and inland waterway terminals and ports). The likely traffic demand on each corridor for the next 10 years will be estimated using traffic surveys and origin–destination surveys and modeling. This will be done in close consultation with the relevant GOK officials overseeing the TA to ensure that the final output as the ownership of the GOK.

11. **Institutional Strengthening of KSHTTA.** GOK recently approved a state road policy that identifies the new role of KSHTTA as the planning and regulatory body for the roads sector. The TA will carry out capacity development to strengthen KSHTTA so that it can act as the nodal agency for planning and programming the road sector. It will carry out an organizational analysis to recommend the organizational structure and skill mix required to fully operationalize KSHTTA, as well as to develop and implement databases and systems within KSHTTA to enable it to maintain the statistical databases necessary for carrying out maintenance planning and programming, project planning. The major outputs of institutional strengthening during the TA will be (i) the formulation of the CRN and (ii) the development of management information systems for planning and programming work. As KSHTTA does not now have any staff, GOK will create an “embryo unit” of the future, strengthened KSHTTA in the project implementation

³ GOK issued an order regarding this approval on 6 March 2009.

unit for the KSHIP. This embryo unit will be in place before the TA starts so that consultants will have a core group of people to work with while developing the systems that will be used by KSHTTA. Training the staff assigned to KSHTTA will be done using a learning-by-doing approach so that KSHTTA can build upon what was done during the TA after it is completed. Officials from the "embryo unit" will be fully involved in developing the various plans, including organizational restructuring proposals, systems and procedures necessary for the effective functioning of the KSHTTA.

12. **Reorganization of KPWD.** The objective of this component is to strengthen the institutional focus of KPWD on the roads sector, considering that it will be the agency to carry out the maintenance of the state highway network. The TA will study the current organizational structure of KPWD and the sanctioned and current staffing pattern to better assess the staff requirement for road sector activities. It will prepare a draft implementation plan for reorganizing KPWD such that the major focus of the KPWD in the future will be on road sector activities. This objective has already been accepted by KPWD management. It will also formulate an appropriate training curriculum. After approval by KPWD and ADB, it will be implemented by KPWD.

C. Cost and Financing

13. The TA is estimated to cost \$1,875,000 equivalent. The Government has requested ADB to finance \$1.5 million equivalent. The TA will be financed on a grant basis by the Japan Special Fund, funded by the Government of Japan. GOK will finance the balance equivalent to \$375,000 in kind by providing office accommodation, support facilities, counterpart staff, maps, reports, and other logistical support. Appendix 3 shows details of the cost estimates and financing plan.

D. Implementation Arrangements

14. The project implementation unit for the KSHIP of KPWD will be the Executing Agency. The chief project officer of the KSHIP will appoint a project director who will be responsible for the day-to-day supervision of the TA. GOK assured the mission that all required counterpart staff, office space, furniture, equipment, support facilities for surveys, maps, reports, and other support services will be made available to the consultants in a timely manner. All equipment for the TA (principally office and survey equipment and software) will be procured according to ADB's *Procurement Guidelines* (2007, as amended from time to time) and turned over to the Executing Agency upon TA completion.

15. An appropriate international consulting firm that can supply a team with expertise in transport planning, and the institutional strengthening of transport sector agencies will be recruited for the TA. National consultants will be engaged by the international consulting firm, which will be responsible for these TA components. Individual consultants may also be recruited under the TA to advise KSHTTA in its formative stages. It is anticipated that 16 person-months of international and 64 person-months of national consulting services will be required. The consultants will be engaged by ADB in accordance with *Guidelines on the Use of Consultants* (2007, as amended from time to time). Disbursements under the TA will be made in accordance with ADB's *Technical Assistance Disbursement Handbook*.⁴ The TA will help GOK to develop the capacity to implement its recently approved road sector policy by transforming the way road sector activities are carried out with the separation of planning, programming, and policy

⁴ ADB. 2008. *Technical Assistance Disbursement Handbook*. Manila.

formulation from implementation and the development of institutions charged with implementing this new policy. The TA will develop the capacity of an entirely new agency, i.e. the KSHTTA, refocus the orientation of the KPWD to be primarily a road maintenance agency and formulate the plan that will guide the strategic development of the roads sector in the state. These are all activities which will have a high impact for the sector. This is especially because since new institutions are being set up to carry out a new policy, the assignment is complex and it is critical that all these activities are carried out successfully in the first instance to ensure the credibility of the new policy and new institutions and the major reorientation of focus in existing institutions. The quality of the consultants should be the paramount selection criterion. The consulting firm will therefore be selected according to quality-based selection procedures, and a full technical proposal will be requested from shortlisted firms. The outline terms of reference for consultants are in Appendix 4. Should the consulting firm's performance be satisfactory, they may be selected for the follow-on capacity development TA using single-source selection. This is because the follow-on capacity development TA will be a natural continuation of this TA and will require extensive use of not just the results but also the raw data developed under this TA. The TA is expected to commence in October 2009 and be completed after 12 months, in October 2010. Seminars and workshops will be held to disseminate the output of the TA.

IV. THE PRESIDENT'S DECISION

16. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$1,500,000 on a grant basis to the Government of India for the Karnataka State Highway Network Improvement Strategy, and hereby reports this action to the Board.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>Impact Enhanced efficiency in the planning, programming, policy formulation, and monitoring of the road sector in Karnataka.</p>	<p>Percentage of links on CRN where volume exceeds capacity reduced by 30% in next 5 years and 70% in next 10 years.</p>	<p>Road transport statistics Traffic surveys Progress reports</p>	<p>Assumptions Projects identified will be implemented on time.</p> <p>Risks Financing requirements to meet capacity expansion works are not available.</p>
<p>Outcome KSHTTA and KPWD effectively implement their mandated responsibilities to plan, manage, and maintain Karnataka's state road network.</p>	<p>Identification of links in the CRN totaling 25,000 km that needs to be improved.</p> <p>Development of management information system for planning and programming work.</p>	<p>Progress reports Final reports Draft budget submissions</p>	<p>Assumptions Annual approved budget funds are released to enable KSHTTA and KPWD to perform their functions in a timely manner.</p> <p>Annual approved budget funds are released to enable KSHTTA and KPWD to perform their functions in a timely manner.</p> <p>GOK decides to implement approved policy on institutional strengthening of KSHTTA and KPWD in a timely fashion.</p>
<p>Outputs</p> <ol style="list-style-type: none"> 1. CRN formulated. 2. KSHTTA plans and regulates road sector operations in the state. 3. KPWD manages road maintenance according to agreed standards. 	<p>Master plan for CRN.</p> <p>Organizational structure prepared showing staffing needs and skill sets for KSHTTA.</p> <p>MIS data used to inform road management decisions.</p> <p>Organizational structure prepared showing staffing needs and skill sets for KPWD.</p> <p>KPWD fully staffed in accordance with approved organization structure. Application of agreed road maintenance standards by KPWD.</p>	<p>Tripartite meetings TA progress reports KSHTTA reports KPWD reports</p>	<p>Assumptions Consultants' performance is satisfactory.</p>

Activities with Milestones	Inputs
<ol style="list-style-type: none"> 1. Determine CRN and required investment needs <ol style="list-style-type: none"> 1.1 Collate all existing data; review existing systems requiring updating (3 months from commencement of services). 1.2 Complete field surveys and investigations; prepare and develop database for study of road network on GIS platform (9 months from commencement). 1.3 Develop project selection criteria; analyze capacity of the existing network (9 months from commencement). 1.4 Conduct economic evaluation of projects (11 months from commencement). 1.5 Recommend new road construction, major improvement, and maintenance; prepare cost estimates; and prioritize projects (11 months from commencement). 2. Institutionally strengthen KSHTTA <ol style="list-style-type: none"> 2.1 Recommend organizational structure and skill mix required for fully operationalizing KSHTTA (3 months from commencement). 2.2 Develop management information system for planning and programming (10 months from commencement). 2.3 Update geographical information system (GIS)- road information system (RIS) database and prepare procedures and systems for regular updating of this database (10 months from commencement). 2.4 Develop traffic and incident management system and pilot its implementation in selected districts. 3. Reorganization of KPWD <ol style="list-style-type: none"> 3.1 Study the current organizational structure of KPWD and the sanctioned and current staffing pattern to better assess the staff requirement for road sector activities (2 months from commencement). 3.2 Prepare draft implementation plan for reorganizing KPWD and prepare training curriculum (5 months from commencement). 3.3. Prepare draft implementation plan to institutionalize training in KPWD (5 months from commencement). 	<p>ADB: About 16 person-months of international consulting services, and 64 person-months of national, costing not more than \$1.5 million.</p> <p>Government: Services in kind on transport, office accommodation, and local counterpart support, estimated to cost \$375,000 equivalent.</p> <p>All relevant reports made available as needed.</p>

ADB = Asian Development Bank, CRN = core road network, FY = fiscal year, GIS = geographic information system, GOK = government of Karnataka, HDM = highway development and management, KSHTTA = Karnataka State Highways, Traffic, and Transport Authority, KPWD = Karnataka Public Works Department, PSP = private sector participation, TA = technical assistance.

Source(s): Asian Development Bank TA Fact-finding Mission

Approved by

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**SUMMARY OF GAP ANALYSIS OF POLICY AND INSTITUTIONAL STRENGTHENING MEASURES FOR THE ROAD SECTOR
IN KARNATAKA**

Activities	WB KSHIP I	GOK	WB KSHIP II	WB PPIAF	Gap	Proposed ADB CDTA (2009)	Proposed Follow-on ADB CDTA (2010)
Preparation of road development plan	Not applicable.	CRN identified based on current traffic data.	CRN to be updated by January 2009.	Not applicable.	CRN updating based on current situation without analysis of future needs.	Update CRN plan for next 10 years based on master planning process to act as the road sector development plan.	
Increased private sector participation	Implementation of performance-based maintenance contracts for KSHIP I roads.	Prepared relevant policy documents Piloting OPRMS for road maintenance.	Financing strategy for CRN projects emphasizing PPP to be determined by June 2009.	Identification of suitable CRN links for PSP.	Since CRN has not been based on master planning process, it necessarily does not fully consider future needs.		Identify potential for PSP based on updated CRN prepared as part of master planning process and results of PPIAF study
Institutional Strengthening of road sector agencies	Use of IT infrastructure and support services. Effective PWD structure and operating procedures.	Implemented e-procurement and e-governance. Implemented Road Information System (RIS). Draft revised PWD code prepared.	New asset management, environmental, human resources and IT functions regularized in PWD and KRDC in 33 months.	Not applicable.	RIS not being used for planning and policy formulation purposes. No institutional strengthening plan for KSHTTA	Restructure RIS database to make it compatible for analysis and decision-making. Operationalize KSHTTA as nodal agency with database systems for planning and analysis, project planning	Review and if necessary update database systems to based on work done in ADB CDTA I and WB KSHIP II. Review and if necessary identify and operationalize additional systems to further strengthen

Activities	WB KSHIP I	GOK	WB KSHIP II	WB PPIAF	Gap	Proposed ADB CDTA (2009)	Proposed Follow-on ADB CDTA (2010)
	<p>Upgrade human resource management</p> <p>Appropriate training</p> <p>Sector governance risk assessment</p>	<p>Ongoing activity</p> <p>Ongoing activity</p>	<p>Dedicated human resource functions, unit and operating procedures established in PWD and KRDC.</p> <p>Action plan for strengthening PWD-linked training centers and facilities.</p> <p>To be carried out as part of processing activities.</p>		<p>No emphasis on road maintenance activities in PWD.</p> <p>Training is done on an ad-hoc basis and is not institutionalized.</p>	<p>capability, maintenance planning and resource allocation systems as well as road safety activities coordination systems.</p> <p>Establish PWD road-focused organization at zonal level.</p> <p>Implement organizational structure to embed training within PWD.</p>	<p>KSHTTA</p> <p>Identify additional systems needed to upgrade PWD's maintenance management systems.</p> <p>Provide training and environmental and social safeguards.</p>
Road Fund	Road Fund study completed.	Establishment of Road Fund approved in March 2009.	Road Fund to be operational by August 2010.	Operationalization of Road Fund.	Not Applicable		Provide support to implement tolling strategy as part of PSP component.

Activities	WB KSHIP I	GOK	WB KSHIP II	WB PPIAF	Gap	Proposed ADB CDTA (2009)	Proposed Follow-on ADB CDTA (2010)
		Implementation of uniform tolling approved in March 2009.					

ADB = Asian Development Bank, CRN = core road network, GOK = Government of Karnataka, HDM = highway development and management, IT = information technology, KRDCCL = Karnataka Road Development Corporation Limited, KSHIP = Karnataka State Highways Improvement Project, KSHTTA = Karnataka State Highways, Traffic, and Transport Authority, OPRMS = output performance road maintenance system, PSP = private sector participation, KPWD = Karnataka Public Works Department, RIS = road information system, KSHIP = Karnataka State Highway Improvement Program, PPIAF = Public-Private Infrastructure Advisory Facility, TA = technical assistance.

Source(s): Asian Development Bank TA Fact-finding Mission

COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Amount
A. Asian Development Bank Financing^a	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	400
ii. National Consultants	448
b. International and Local Travel	30
c. Reports and Communications	15
2. Equipment ^b	20
3. Training, Seminars, and Conferences	10
4. Surveys ^c	490
5. Miscellaneous Administration and Support Costs	32
6. Government Representative for Contract Negotiations	5
7. Contingencies	50
Subtotal (A)	1,500
B. Government Financing	
1. Office Accommodation	125
2. Remuneration of Counterpart Staff	150
3. Others	100
Subtotal (B)	375
Total	1,875

^a Financed by the Japan Special Fund, funded by the Government of Japan.

^b Computers, printers, and photocopying machines.

^c Extensive traffic and road condition surveys to be carried out for the road network

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Update Core Road Network

1. The activities required include but are not limited to the following:
 - (i) Identify required corridors for road infrastructure by reviewing plans for the current and future socioeconomic development of the state for agriculture, mining, industry, and tourism; assessing how best to provide connectivity to other transport modes (rail, air, and inland waterway terminals and ports); and estimating, on a probabilistic basis, the likely traffic demand on each corridor for the next 10 years for different scenarios of economic growth.
 - (ii) Update traffic counts, conduct origin–destination surveys, and present patterns of traffic for the projects included in the core road network (CRN). The CRN will be the network that will carry 80% of the forecasted traffic volume.
 - (iii) Identify locations for count stations, including locations for installing automatic vehicle counters, and provide a manual for calibration.
 - (iv) Update the road and bridge inventory of the projects in the CRN, including the classification of roads according to soil and pavement condition, and assess the adequacy of the existing road infrastructure. The soil and pavement investigation will supplement and validate the geological and soil data available through satellite imagery mapping undertaken by the India Space Research Organization.
 - (v) Update the database on the condition of roads and bridges in the CRN through a visual survey of conditions of the road network and a sample roughness survey. The existing geographic information system-based road information system (GIS-RIS) will be augmented using the updated database.
 - (vi) Estimate the capacity of current road infrastructure in the identified corridors for the estimated traffic, update the existing CRN by reviewing studies already carried out or currently being carried out by the government of Karnataka (GOK), and, where necessary, supplement these studies. The CRN will recommend requirements for new road construction including expressways and bypasses, major improvement and/or upgrading of existing roads, and maintenance or minor upgrading of existing roads required to handle the estimated traffic volume.
 - (vii) Recommend the inclusion of major district roads and village roads in the CRN, taking into account socioeconomic criteria besides the traffic criterion.
 - (viii) Study the road classification system and suggest a balanced hierarchy.
 - (ix) Develop project-selection criteria, including significant environmental and social impacts, to identify priorities for each of the three categories of investment needs identified in activity (vi) above and so that the projects listed in the CRN can be prioritized together with indicative dates of proposed operations.
 - (x) Develop standards for roadside and road user amenities for the different categories of roads based on functional classification and traffic volume.
 - (xi) Prepare recommendations for new roads and major improvement works for roads included in the CRN. Give priority to including projects identified by the GOK as priorities, subject to these projects' satisfying the socioeconomic viability criteria, including the connectivity needs of remote and isolated communities.
 - (xii) Prepare cost estimates for capital expenditure and regular and periodic maintenance for all projects included in the CRN by reviewing and verifying the costs of local and imported materials and equipment required for highway construction, construction supervision, and road network maintenance.
 - (xiii) Carry out capacity analysis of the existing road network and assess (a) the impacts of the capacity constraints; (b) changes in vehicle operating costs; and

- (c) differences in travel time, travel patterns, and the efficiency of traffic flow to reduce emissions of greenhouse gases (GHGs). Evaluate the benefits to be gained from alleviating GHGs.
- (xiv) Carry out economic evaluation of the projects included in the CRN at the network level, taking into account construction, operation, and maintenance costs; savings in vehicle operating costs; time savings; cost savings from reduced traffic accidents; and any other relevant quantifiable benefits and costs, including quantification of savings from GHG reduction.
 - (xv) Carry out sensitivity analysis by appropriately varying benefits, costs, implementation period, diverted traffic, and a combination of these factors. Calculate switching values.
 - (xvi) Identify suitable highway corridors using agreed selection procedures from the updated CRN for further project preparation for possible Asian Development Bank (ADB) funding.
 - (xvii) Carry out technology transfer to ensure that KSHTTA can carry out similar activities in future on its own.
 - (xviii) Design a suitable design and monitoring framework for monitoring project benefits and post evaluation. Prepare program and project frameworks including goals, purposes, outputs, and inputs in line with ADB requirements.
 - (xix) Prepare the terms of reference for project preparatory technical assistance (TA) consultants.

B. Operationalize Functioning of Karnataka State Highways, Traffic and Transport Authority as the Nodal Road Sector Planning and Policy Formulation Authority of the Government of Karnataka

2. The activities include but are not limited to the following:

- (i) Assist in operationalizing KSHTTA by formulating its organizational structure, operational rules and procedures, required staffing and skills mix, human resource policy, and business processes. Undertake training and capacity development.
- (ii) Set up an improved road inventory and traffic database system in KSHTTA so that the database can be effectively used for planning and policy formulation purposes. The database shall be based on the road information system with the Karnataka Public Works Department (KPWD) and the data collected during updation of core road network.
- (iii) Prepare data collection formats and terms of reference for outsourcing data collection to populate the database. Train KPWD in supervising data collection.
- (iv) Validate the data collected and prepare a procedures manual to help KSHTTA maintain the database.
- (v) Develop management information system and a simplified system for planning and prioritization of road development and maintenance till an advanced system is developed and made operational;
- (vi) Review the existing state policy, legislation, and regulations regarding traffic and incidents management and recommend amendments. Develop a traffic and incidents management system and pilot its implementation.
- (vii) Carry out technology transfer to ensure that KSHTTA can carry out similar activities in future on its own.
- (viii) Act as an advisor to KSHTTA during its formative stage.

C. Strengthen Institutional Focus on Road Maintenance in Karnataka Public Works Department

3. The activities required include but are not limited to the following:
- (i) Study the current organizational structure of KPWD and sanctioned and current staffing pattern to better assess the staff requirement for road sector activities.
 - (ii) Prepare an implementation plan to reorganize the zonal, circle, divisional, and subdivisional structure of KPWD such that, under the zonal chief engineer, all road sector activities are consolidated under a superintending engineer (roads) with dedicated circles and divisions.
 - (iii) Prepare a curriculum to train KPWD staff assigned to road construction and maintenance in techniques and supervision.

D. Required Expertise

4. Expertise requirements are summarized in Table A4.

Table A4: Position and Person-Month Requirements

International	Person-months
Team Leader/ Transport Sector Specialist	12
Road Asset Management Systems Specialist	4
International Total	16
National	Person-months
Road Asset Management Systems Specialist	8
Traffic Engineer 1	8
Traffic Engineer 2	8
Transport Economist	8
Highway Engineer 1	8
Highway Engineer 2	8
IT Specialist 1	8
IT Specialist 2	4
Intelligent Transportation System Specialist	2
Training Specialist	2
National Total	64

IT = information technology.

Source: Asian Development Bank estimates.

E. Other Matters

5. If performance of consultants in this capacity development TA is satisfactory, consulting firm may be considered for follow-on capacity development TA under single-source selection.