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Report No: PAD 988

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$150 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

YUNNAN HIGHWAY ASSET MANAGEMENT PROJECT

March 4, 2015

Transport and ICT Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective, October 15, 2014)

Currency Unit = Renminbi Yuan (RMB)
US$1.00 = RMB6.15

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
ASEAN	Association of South East Asian Nations
BoT	Bureau of Transport
BP	Bank Procedure
CPS	Country Partnership Strategy
CQS	Selection Based on Consultants' Qualifications
DA	Designated Account
DoF	Department of Finance
DoT	Department of Transport
DRC	Development and Reform Commission
EA	Environmental Assessment
EA	Executing Agency
ECOP	Environmental Codes of Practices
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FM	Financial Management
FMM	Financial Management Manual
FYP	Five-Year Plan
GDP	Gross Domestic Product
GoC	Government of China
IA	Implementation Agencies
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
IFI	International Financial Institutions
IP	Indigenous Peoples
IPF	Investment Project Financing
LG	Leading Group

LIBOR	London Interbank Offered Rate
M&E	Monitoring and Evaluation
MoF	Ministry of Finance
MoT	Ministry of Transport
NCB	National Competitive Bidding
NDRC	National Development and Reform Commission
NPV	Net Present Value
O&M	Operation and Maintenance
OP	Operational Policy
ORAF	Operational Risk Assessment Framework
PCR	Physical Cultural Resources
PDO	Project Development Objective
PIU	Project Implementation Unit
PMO	Project Management Office
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
RAMS	Road Asset Management System
RAP	Resettlement Action Plan
SOEs	Statement of Expenditures
SSs	Summary Sheets
WA's	Withdrawal Applications
YHB	Yunnan Highway Bureau
YPAO	Yunnan Provincial Audit Office
YHSTRI	Yunnan Highway Science and Technology Research Institute
YNTATS	Yunnan Transport Advanced Technician School
YNTVTC	Yunnan Transport Vocational Technology College

Regional Vice President:	Axel van Trotsenburg, EAPVP
Country Director:	Bert Hofman, EACCF
Senior Global Practice Director:	Pierre Guislain, GTIDR
Practice Manager:	Michel Kerf, GTIDR
Task Team Leader:	Xiaoke Zhai, GTIDR

YUNNAN HIGHWAY ASSET MANAGEMENT PROJECT

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DATA SHEET

CHINA: Yunnan Highway Asset Management Project

Basic Information			
Project ID P132621	EA Category B - Partial Assessment		Team Leader Xiaoke Zhai
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [ ]		
Project Implementation Start Date 16-March-2015	Project Implementation End Date 30-June-2020		
Expected Effectiveness Date 26-August-2015	Expected Closing Date 31-Dec-2020		
Joint IFC No			
Practice Manager Michel Kerf	Sr. Practice Director Pierre Guislain	Country Director Bert Hofman	Regional Vice President Axel van Trotsenburg

Borrower: People's Republic of China			
Responsible Agency: Yunnan Highway Bureau			
Contact:	Mr. Ma Xianzhi	Title:	Deputy Director
Telephone No.:		Email:	yngljshb@163.com

Project Financing Data(in US$ Million)					
[X]	Loan	[ ]	Grant	[ ]	Guarantee
[ ]	Credit	[ ]	IDA Grant	[ ]	Other

Total Project Cost:	280.83	Total Bank Financing:	150.00
Financing Gap:	0.00		

Financing Source	**Amount**
Borrower	130.83
International Bank for Reconstruction and Development	150.00
Total	280.83

Expected Disbursements (in US$ Million)

Fiscal Year	2016	2017	2018	2019	2020	2021
Annual	5.0	10.0	40.0	50.0	30.0	15.0
Cumulative	5.0	15.0	55.0	105.0	135.0	150.0

Proposed Development Objective(s)

To improve the efficiency and cost-effectiveness of highway asset management in Yunnan.

Components

Component Name	Cost (US$ Millions)
Highway Asset Management Improvement	58.28
Maintenance and Emergency Response Capacities Enhancement	161.69
Pilot of Cost-Effective Maintenance Technologies	25.38
Strengthening Institutional Capacities	8.13

Institutional Data

Sector Board

Transport

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Transportation	Rural and Inter-Urban Roads and Highways	75	15	60
Public Administration, Law, and Justice	Sub-national government administration	25		
Total		100		

☐ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Financial and private sector development	Infrastructure services for private sector development	65
Public sector governance	Managing for development results	25
Social protection and risk management	Natural disaster management	10
Total		100

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ] No [X]

Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01	X	
Natural Habitats OP/BP 4.04	X	
Forests OP/BP 4.36		X
Pest Management OP 4.09		X
Physical Cultural Resources OP/BP 4.11		X
Indigenous Peoples OP/BP 4.10	X	
Involuntary Resettlement OP/BP 4.12	X	
Safety of Dams OP/BP 4.37		X
Projects on International Waterways OP/BP 7.50		X
Projects in Disputed Areas OP/BP 7.60		X

Legal Covenants

Name	**Recurrent**	**Due Date**	**Frequency**
Mid-Term Review Report		**December 31, 2017**	

Description of Covenant

Project Agreement, Section II, Clause B(b)&(c): YHB will prepare, under terms of reference satisfactory to the Bank, and furnish to the Bank on December 31, 2017 or another date agreed with the Bank, a mid-term report integrating the results of the monitoring and evaluation activities performed and the progress achieved in the carrying out of the project during the period preceding the date of said report and setting out the measures recommended to ensure the efficient carrying out of the project and the achievement of the objectives during the period following such date.

Conditions

Source Of Fund	**Name**	**Type**
IBRD	Subsidiary agreements	Disbursement

Description of Condition

Loan Agreement, Section IV, Clause B.1(b). YHB has entered into subsidiary agreement for implementation with each of Yunnan Transport Advanced Technician School (YTATS), Yunnan Transport Vocational Technology College (YTVTC), and Yunnan Highway Science and Technology Research Institute (YHSTRI), to assist in the implementation of Sub-Component A1 and Sub-Component D4 of the project, under the terms and conditions satisfactory to the Bank, prior to disbursement.

Team Composition			
Bank Staff			
Name	**Title**	**Specialization**	**Unit**
Xiaoke Zhai	Sr. Transport Specialist	Task Team Leader	GTIDR
Binyam Reja	Lead Transport Specialist	Transport Economics	GTIDR
Christopher R Bennett	Lead Transport Specialist	Road and Pavement Management	GTIDR
Deepak T. Bhatia	Lead e-Government Specialist	Public Administration	GTIDR
Alejandro Alcala Gerez	Sr. Counsel	Legal Services	LEGES
Junxue Chu	Sr. Finance Officer	Loan Operation	CTRLN
Jens Chr. Helbech Hede	Sr. Transport Specialist	Highway Asset Management	GTIDR
Yi Dong	Sr. Financial Management Specialist	Financial Management	GGODR
Rodrigo Archondo-Callao	Sr. Highway Engineer	Road Asset Management	GTDIR
Songling Yao	Sr. Social Development Specialist	Social safeguard	GURDR
Eric R. Lancelot	Sr. Transport Specialist	Highway Maintenance	GTIDR
Yuhui Jiao	Transport Specialist	Intelligent Transportation	GTIDR
Ning Yang	Environmental Specialist	Environmental Safeguard	GENDR
Rohit Gawri	IT Analyst	Information System	ITSCR
Jingrong He	Procurement Specialist	Procurement Management	GGODR
Limei Sun	Program Assistant		EACCF
Lei Wu	Program Assistant		EACCF
Maya Sheli Port	E T Consultant	Legal Service	LEGES

Non-Bank Staff			
Name	**Title**	**Office Phone**	**City**
Hongye Fan	Transport Consultant		Beijing
Ian Greenwood	Road Asset Management Consultant		Auckland, NZ
Graham Smith	Transport Consultant		Washington, D.C.
Jian Xu	Highway Maintenance Consultant		Beijing
Chuntai Zhang	Transport Economy Consultant		Beijing
Yan Wang	Public Accounting Policy Consultant		Beijing

Locations					
Country	**First Administrative Division**	**Location**	**Planned**	**Actual**	**Comments**
China	Yunnan Province	Yunnan		X	

I. STRATEGIC CONTEXT

A. Country Context

1. China has achieved remarkable economic growth in the past three decades and lifted more than 600 million people out of poverty. The Government's priorities in the 12th Five-Year Plan (FYP, 2011-2015) are to: support economic development in the lagging western and central regions; provide more assistance to poor regions and regions with ethnic minorities; promote green and low carbon development; enhance capacity for resilience to natural disasters; and encourage innovations in governance mechanisms.

2. Yunnan Province, located in the southwest of China and bordering Laos, Vietnam and Myanmar, is one of the least developed provinces in China in terms of GDP per capita. Yunnan's GDP per capita in 2012 was only US$3,530, about 58% of the national average. It has a population of 46 million, 394,000 square km of territory, and rich natural and cultural resources. Yunnan's economic development is partially constrained by less developed transport infrastructure that is costly to build and maintain, as 94 percent of Yunnan's territory is mountainous and is vulnerable to landslides, floods and earthquakes. The Government considers Yunnan as a priority in its Western Region Development Strategy and a gateway connecting China to the Association of South East Asian Nations (ASEAN). The provincial government has placed transport infrastructure improvement at the top of its development agenda.

B. Sectoral and Institutional Context

3. China's highway system has significantly expanded from about 900,000 km in 1981 to 4.24 million km in 2012. Of this, about 96,200 km were expressways and the rest were ordinary highways. The Ministry of Transport (MoT) has projected that by 2015 the total length of the highway system would be over 4.5 million km.

4. The responsibilities and funding sources for highway development and maintenance are as follows:

a) **Central government.** The Ministry of Transport (MoT) is responsible for the overall administration of the highway sector and the development of national sector plans, strategic programs, policies, and technical standards. Funding sources include vehicle purchase tax (VPT), general revenues and fuel tax.

b) **Provincial governments.** The Department of Transport (DoT) in each provincial governments is responsible for developing provincial level sector policies and technical standards, as well as managing, constructing, and maintaining national and provincial highways. Funding source include general revenues, bank loans, private investments and road maintenance fees and tolls (prior to fuel tax reform and cancellation of tolls on Class II highway in 2009).

c) **County governments.** The Bureau of Transport in each county government is responsible for managing, constructing, and maintaining rural roads. Funding sources include general revenues, bank loans, private investments and other miscellaneous sources.

5. The annual budget for highway development increased from RMB6 million (US$0.98 million) in 1979 to RMB1.15 billion (US$188.52 billion) in 2010. Until 2009, the central government contributed about 14.9% to the annual highway budget, and the remaining amount was covered by subnational levels of governments. As a result of the strong need to expand the highway network, subnational governments often used a large share of the collected road maintenance fees for road construction and other requirements. With the fuel tax reform in 2009[1], the central government replaced six different fees, including road maintenance fees, with a fuel tax, and required subnational governments to cancel all the tolls on Class II Highways. Since then, the central government has been providing about RMB26 billion per year to compensate subnational governments for the loss of revenues from Class II Highway tolls and provide support for the repayment of debts from road construction. However, this amount only covers about 40% of the annual debt services of subnational governments.

6. With the aging of the highway network, maintenance needs have increased gradually. In the 1990s, the MoT already found that highway maintenance lagged behind highway construction, and encouraged provincial DoTs to explore institutional reform and improve maintenance services and efficiency. DoTs launched a variety of institutional reforms. One of the key reforms was to separate road planning and policy functions by the Highway Bureaus and DoTs from road maintenance, rehabilitation and construction activities, which were contracted to stand-alone maintenance companies.

7. The outsourcing of road maintenance to separate companies caused some problems with the maintenance of roads as these companies were often equally concerned about their financial situation and making some profit. As a result, in the 12th Five-Year Highway Maintenance and Management Plan, the MoT required provincial Highway Bureaus to strengthen maintenance systems for national and provincial level highways. A set of objectives are listed in the Plan, including: the development of a more rational decision-making system for maintenance management; improvement of maintenance technologies; enhancement of network operation monitoring; and, improvement of emergency response capacity. Computerized maintenance management tools, such as China Pavement and Bridge Management Systems, have been introduced in over 20 provinces, and a national highway network monitoring and emergency response center was established by MoT in 2012. However, China still lacks policies and procedures for highway asset evaluation and accounting, which makes it difficult to evaluate the effectiveness of these massive investments in infrastructure management.

8. **Yunnan Highway Sector Development and Challenges.** Yunnan Department of Transport (DoT) is the responsible agency for transport management in Yunnan Province, and Yunnan Highway Bureau (YHB), a subsidiary of DoT, is responsible for trunk highway development and management. Yunnan's highway system expanded from about 42,000 km in 1978 to 222,940 km in 2013, reaching a density of 56.6 km per 100 square kilometers, i.e., above the national average of 44 km per 100 square kilometers. However, Yunnan still lags behind the average of 101 km per 100 square kilometers in the Eastern region and has a strong development demand.

[1] Financing Road Construction and Maintenance after Fuel Tax Reform , TA 7456-PRC, ADB

9. According to a survey conducted by YHB in 2012, about 50 % of trunk highways in Yunnan were in good or fair condition, about 1,400 km remained unpaved, and 59% of the trunk highways were below Class II Highway standard. In addition, the total length of the trunk highway system will increase from about 26,000 km to near 39,000 km after the 2013 adjustment of national and provincial highway master plans, and this will increase the demand for upgrading works.

10. YHB, which is responsible for administration and maintenance of trunk highways, is a well-established organization with a management structure in place, clearly defined responsibilities, 14,377 staff, and 550 Emergency Response and Maintenance Centers and Stations around the province. YHB separated administration and maintenance functions in 1998. YHB's prefecture-level General Sections and county-level Sections are responsible for the administration of trunk highways, while the Emergency Response and Maintenance Centers and Stations are responsible for emergency rescue and routine maintenance works. Large periodic maintenance and rehabilitation works are carried out through contracts awarded on a competitive basis.

11. YHB's managerial and implementing capacities need to be improved to adequately perform its duties. Key issues facing YHB include:

a) YHB lacks an asset management system to assist in analyzing maintenance demands, providing a robust budget plan, optimizing maintenance strategies, planning and programming, and reducing life cycle costs.
b) YHB lacks a road network monitoring and emergency command system to deal with frequent natural disasters. Yunnan is situated in a mountainous area at the far eastern edge of the Himalayas and is vulnerable to floods, landslides and earthquakes.
c) YHB does not have an integral database and management system. The existing databases and business systems are operated by different units, resulting in data having to be shared manually among systems and units.
d) Many frontline staffs of YHB lack adequate equipment and rely on simple tools to carry out maintenance works, which leads to low productivity and compromised maintenance quality.
e) Emergency Response and Maintenance Centers and Stations have limited equipment and some of them are in poor condition.
f) YHB has piloted various maintenance technologies, e.g., asphalt pavement recycling, chip seal, and slurry seal in recent years, but some proven cost-effective technologies are yet to be scaled up or introduced to improve maintenance quality and lower costs.
g) YHB staffs need more on-the-job training in new technologies and skills to meet growing maintenance demands.
h) YHB lacks tools to identify safety-related characteristics of physical assets and systematically collect accident data for analysis and asset improvement.

12. The revenues of YHB have more than doubled from RMB4.2 billion (US$688 million) in 2010 to RMB9.4 billion (US$1.54 billion) in 2013. In 2013 YHB spent about 54.5% of its revenues on improvement and rehabilitation and 18.7% on routine maintenance. However, the funding level is insufficient to improve the overall condition of the trunk highway network.

Yunnan considers international experience and loans from multi-lateral organizations as a way to improve highway maintenance efficiency and complement domestic funds.

Rationale for Bank Involvement

13. An integrated highway asset management approach is relatively new in China. The Bank will not only provide funds, but also share international good practices with Yunnan on road asset management, evaluation, maintenance, and performance monitoring, as well as fiduciary management. The project will take a comprehensive approach to improve YHB's asset management capacity relating to policy goals and objectives, data collection, planning and budgeting, program delivery, information and automated techniques, emergency response, maintenance technologies and skills, performance evaluation and monitoring.

14. The project has a comprehensive ICT component, which will provide a solid foundation for asset management and integrates all business systems in a single database, where data will be shared for analysis and decision-making. The Bank will assist YHB in adopting suitable tools and applications, implementing these in appropriate sequence, and applying the acquired tools in decision-making processes.

15. Through improving asset management and data collection capacity, the project will complement and increase the sustainability of the Asian Development Bank (ADB)-financed Yunnan Sustainable Road Maintenance Project, which supports periodic maintenance and rehabilitation, performance-based maintenance pilots, and introduction of the Highway Development and Management Model (HDM-4).

C. Higher Level Objectives to which the Project Contributes

16. The project is aligned with China's 12th FYP that gives priority to the development of the Western Region, provides more support to poor regions and regions with ethnic minorities, enhances capacity for resilience to natural disasters, and encourages innovations in governance. It will contribute to the achievement of Yunnan's 12th FYP to meet the increasing demand for highway maintenance, preserve the trunk highways, and provide a foundation for future social and economic development.

17. Highway asset valuation and accounting experience gained from the project, which is not yet available in China, can be shared with other provinces in China to better manage transport infrastructure assets.

18. **Relationship to the CPS**. The project is consistent with Outcome 2.4 of Strategic Theme Two "*Improving Transport Connectivity*" of the Bank Group's China Country Partnership Strategy (CPS) for FY2013-2016. By improving trunk highway condition and emergency management, the project will enhance transport connectivity and facilitate the movement of goods and people between rural and urban areas, between Yunnan and the rest of China, as well as between China and neighboring countries.

19. **Twin Goals**. The project will also contribute to the achievement of the Twin Goals. In 2013, Yunnan Province had 73 national poverty counties and about 6.61 million people living in

extreme poverty[2]. Most of the poor live in rural and very mountainous regions. They make a living from farming, and rely on highways to access markets as well as education and health care facilities. Because of transport constraints, it is difficult for them to sell products, have access to better education and job opportunities in larger cities, and attract investors and tourists. Maintenance and emergency centers/stations to be enhanced by the project will cover 88% of the poverty counties and 98% of the population in extreme poverty. The project will benefit the poor in the following ways: (a) savings in transport costs to make their products more competitive and basic commodities cheaper; (b) convenient access to jobs as well as to better education and health facilities; (c) safer travel and reduced vulnerability to natural disasters; and (d) new job opportunities brought about by investors and increased tourism. In addition, the project will help better manage the trunk highways and support overall economic development in Yunnan, which will increase fiscal revenues and enhance government capacity to eliminate poverty. Both China's and international experience shows that a quality transport network is vital to economic growth and productivity increase.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

20. The Project Development Objective (PDO) is to improve the efficiency and cost-effectiveness of highway asset management in Yunnan.

B. Project Beneficiaries

21. The entire population of 46 million in Yunnan Province (of whom 22.54 million are women) will benefit from the project, including consumers and producers, tax payers, and relevant government agencies.

C. PDO Level Results Indicators

22. Achievement of the PDO will be measured by the following indicators:

a) Percentage of highways in good/fair condition.

b) Percentage of periodic and rehabilitation maintenance funds allocated based on the recommendations of the asset management system.

c) Length of road network per routine maintenance staff.

III. PROJECT DESCRIPTION

A. Project Components

23. ***Component A – Highway Asset Management Improvement (US$58.28 million).*** This component will improve asset management decisions by establishing and operating an integrated highway asset management system. It includes three sub-components:

[2] Measured by national poverty standard of RMB2,300 net income per year, equivalent to US$1.03 per day.

a) ***Sub-Component A1 – Establishing an Integrated Management Information System.*** This sub-component will finance the establishment of an integrated management information system and the related IT infrastructures and hardware for the system, including: (i) a data management center; (ii) data exchange platform; (iii) road asset management system; (iv) road network monitoring and emergency command center, with related systems and equipment; (v) upgrade of existing databases and management systems and their incorporation into an integrated management information system; and (vi) improving and expanding the existing IT infrastructure and connections to operate the integrated management information system.

b) ***Sub-Component A2 — Supporting Data Collection for Management System Operation.*** This sub-component will fund equipment and instruments for data collection, including: (i) upgrade of two existing vehicles and adding a new vehicle for pavement condition data collection and an automatic deflectometer; (ii) nine bridge and eight tunnel inspection vehicles; (iii) 63 permanent automatic traffic recording stations and 80 portable counting sets; (iv) 30 sets of instruments and related software for monitoring large landslides, key bridges and extremely large tunnels; and (v) 35 sets of portable maintenance inspection equipment (patrol vehicles equipped with relevant software and hardware for data collection and information transmission to control center).

c) ***Sub-Component A3 — Adoption of Asset Management Approach.*** This sub-component will provide technical assistance to YHB in adopting the asset management approach, making necessary process changes for operating the asset management system, applying asset management principles to business processes, and using the system outputs into decision making and performance evaluation.

24. ***Component B — Maintenance and Emergency Response Capacities Enhancement (US$161.69 million).*** This component, comprising the following two sub-components, will improve performance evaluation and enhance YHB's capacity to carry out maintenance works and emergency rescue activities:

a) ***Sub-component B1 — Improving Performance Evaluation System and Indicators***. This sub-component will provide technical support to YHB to improve its performance management and objectively measure efficiency and effectiveness of maintenance delivery. It will focus on: identifying new and improved management objectives with enhanced management strategies, tools and facilities; updating YHB's evaluation system and indicators; enhancing performance monitoring and feedback mechanism; and increasing accountability.

b) ***Sub-component B2 — Providing Equipment and Facilities to Maintenance Stations and Emergency Centers***. This sub-component will enhance staff maintenance delivery and emergency response capacity through: (i) provision of adequate equipment for routine and minor maintenance as well as emergency response capacity at Maintenance and Emergency Response Centers and Stations; and (ii) expansion/construction of equipment shelters, administration and production buildings, and staff dormitories at the Centers and Stations.

25. ***Component C — Pilot of Cost-Effective Maintenance Technologies (US$25.38 million).*** This component will support the reduction of life-cycle maintenance costs by piloting cost-effective maintenance techniques, including cold recycling of asphalt pavement for base course, modified asphalt chip seals, asphalt slurry seals, and micro-surfacing, at seven typical and suitable road segments with a total length of 290 km.

26. ***Component D — Strengthening Institutional Capacities (US$8.13 million).*** This component will enhance the capacities of YHB's management and staff through four sub-components:

a) ***Sub-component D1 — Highway Asset Evaluation Manual and Highway Asset Accounting Guideline***. This sub-component will provide technical assistance to review domestic and international road asset valuation practices and accounting policies, develop a highway asset valuation manual and accounting guideline in compliance with acceptable accounting standards, evaluate highway assets, and record asset values in YHB's balance sheet.

b) ***Sub-component D2 — Highway Maintenance Manual***. This sub-component will provide technical assistance to develop a highway maintenance manual contextualized to the specific Yunnan geographic and highway conditions.

c) ***Sub-component D3 — Highway Safety Study***. This sub-component will study the road safety condition of the trunk highway system and will provide recommendations on road safety policy and management improvements.

d) ***Sub-component D4 — Study Tours and Training***. This sub-component will support training and study tours to help YHB staff to adapt to the new asset management approach and business systems, learn to operate and maintain new equipment, and master innovative maintenance technologies.

B. Project Financing

27. **Lending Instrument**. The lending instrument for this project is Investment Project Financing (IPF). The Borrower has selected a US Dollar denominated, commitment-linked variable spread loan based on six-month LIBOR plus an additional variable spread. It has also selected all the conversion options, annuity repayment of principal, and final maturity of 30 years, including a grace period of 5 years.

28. The total project cost is estimated to be RMB1,727.13 million, equivalent to US$280.83 million.[3] It will be financed through an IBRD loan of US$150 million and counterpart funds of US$130.83 million. Table 2 below presents the distribution of project costs and financing by component. Details of the project cost and financing plan are in Annex 2.

[3] At the exchange rate of US$1.00 = RMB6.15.

Table 1: Project Cost and Financing Plan

Cost Items	Total Cost		Financing Plan (US$ million)		
	US$ million	RMB million	IBRD	Counterpart	IBRD %
Base Cost					
1. Highway Asset Management Improvement	58.28	358.40	58.28	-	100.0%
2. Maintenance and Emergency Response Capacities Enhancement	161.69	994.40	46.81	114.88	29.0%
3. Pilot of Cost-Effective Maintenance Technologies	25.38	156.11	25.38	-	100.0%
4. Strengthening Institutional Capacities	8.13	50.01	8.13	-	100.0%
Total Base Cost	**253.48**	**1,558.92**	**138.60**	**114.88**	**54.7%**
Physical and price contingencies	15.95	98.10	-	15.95	0.0%
Total Project Cost	**269.43**	**1,657.02**	**138.60**	**130.83**	**51.4%**
Front-end Fee	0.38	2.31	0.38	-	100.0%
Commitment Fee	0.34	2.08	0.34	-	100.0%
Interest during Construction	10.68	65.72	10.68	-	100.0%
Total Financing Requirement	**280.83**	**1,727.13**	**150.00**	**130.83**	**53.4%**

C. Lessons Learned and Reflected in the Project Design

29. Lessons and experience from Bank-financed road maintenance projects and asset management projects, as well as international good practices, have been considered in the design of the project.

30. **Institutional challenges**. Commitment of management and staff to the asset management approach is one of the most critical success factors. Changes to road asset management, such as institutional goals, policies, decision-making procedures, skills, and performance measures, are required to shift away from conventional road maintenance. The new concept of road asset management was discussed at length with senior leaders of DoT and YHB during project preparation and their support has been confirmed. In addition, adequate funds have been allocated for training and study tours to help YHB's management and staff to update knowledge and adapt to the new approach.

31. **Operational challenges.** Road asset management relies on effective operation of the asset management system, which requires systematic collection, management, analysis of data, making budgeting and programming decisions, and monitoring performance results. It also depends on reliable IT infrastructure, professional skills, and a stable management team. The project has allocated funds to upgrade existing IT infrastructure, develop IT management policies and procedures, purchase data collection equipment and vehicles, and provide relevant

training. YHB has set up a data management center with adequate budget and qualified staff to manage the system. To mitigate operational risk, commercial off-the-shelf software will be utilized in the development of the asset management system. YHB's business process needs will also be fully considered in developing the system.

32. **Funding.** Availability of funds is critical for collecting data and implementing the system to achieve management objectives. This has been intensively discussed during project preparation. Maintenance funding targets have been agreed as a monitoring indicator of the project, and operational costs of the system will be included in YHB's annual budget.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

33. Yunnan Province will implement the project through its Department of Transport (DoT) and the Yunnan Highway Bureau (YHB). The DoT will be responsible for overall guidance and coordination with provincial Development and Reform Commission (DRC) and Department of Finance (DoF) for project implementation. YHB will implement the project, manage World Bank loan utilization, and repay the loan.

34. **Leading Group**. A leading group (LG) has been formed up within YHB, which is led by the YHB General Director and consists of three YHB deputy directors and representatives from related divisions of YHB. The LG will provide oversight and coordination on key project implementation issues and ensure the availability of counterpart funds and other resources required for project implementation.

35. **Project Management Office (PMO)**. A consolidated project management office (PMO) has been established under YHB for day-to-day project management and implementation. The PMO is headed by a director and composed of six divisions for engineering, procurement and contract management, social safeguards, coordination and liaison, asset and financial management, and training.

36. **Project Implementation Units (PIUs)**. PIUs will be set up at each of YHB's sixteen prefecture level units, called "General Sections", to implement civil works under their jurisdiction. In addition, PIUs will be established at two affiliated agencies of DoT - Yunnan Transport Vocational Technology College and Yunnan Transport Advanced Technician School, to provide training courses to workers and technicians, and at Yunnan Road Science and Technology Research Institute (an affiliated agency of YHB), to collect asset data and provide technical support.

37. Details of project implementation arrangements are provided in Annex 3.

B. Results Monitoring and Evaluation

38. A results framework, including baseline data and end-of-project targets, has been developed for the project (see Annex 1) and provides the basis for project monitoring and

evaluation (M&E). The PMO will be responsible for regular collection of data for each indicator and for periodic reporting on implementation progress.

C. Sustainability

39. DoT and YHB have exhibited strong commitment to achieve the PDO. Both management and staff have participated in project preparation and have shown a willingness to seriously adopt the asset management approach, by investing in software and hardware and by the allocation of a large share of project funds to training and adoption of the asset management approach. Sustainability of project outcomes depends on YHB's capacities being developed to operate the asset management system and implement recommendations made by the system on an on-going basis. Project design takes into account both institutional arrangements and capacity building needs, and their implementation will be monitored during project implementation.

40. The proposed technologies are well known and proven either in Yunnan or elsewhere in China. For example, the proposed pavement management system has been developed since 1985 and has been introduced in over 20 provinces. DoT has already utilized ICT components similar to those proposed under the project. Survey technologies and innovative maintenance technologies already exist in Yunnan and/or elsewhere in China. The project will add value through the integration of these technologies so information can be readily and easily shared between stakeholders, equipping them with data and tools for efficient and effective operation.

41. Financial sustainability is expected to be sound. Financial analysis showed that YHB's total revenue increased 122% from 2010 to 2013, mainly due to the fast growth of Vehicle Purchase Tax, Fuel Tax, and the fiscal budgets. Vehicle sales and fuel consumption will continue to grow in the coming years. Given an average 17% annual increase of funds for periodic maintenance and rehabilitation and 5% reduction of maintenance costs with improved efficiency, the percentage of trunk highways in fair or good condition is expected to be over 60% by 2020, 80% by 2025, and 90% by 2030 based on scenarios tested in the HDM-4[4].

42. Long-term sustainability will depend on the mainstreaming of cost-effective technologies and management practices successfully implemented under the project into YHB operations. MoF and MoT have been consulted on highway asset valuation and accounting policy issues during project preparation, and their advice and endorsement will be continually sought during implementation.

V. KEY RISKS AND MITIGATION MEASURES

A. Risk Ratings Summary Table

Risk Category	Rating
Stakeholder Risk	Moderate
Implementing Agency Risk	

[4] Technical Assistance Report, PPTA Maintenance Management Consultant, ADB-financed Yunnan Sustainable Road Maintenance Project.

- Capacity	Substantial
- Governance	Moderate
Project Risk	
- Design	Substantial
- Social and Environmental	Moderate
- Program and Donor	Moderate
- Delivery Monitoring and Sustainability	Substantial
Overall Implementation Risk	**Substantial**

B. Overall Risk Rating Explanation

43. The overall risk for project implementation is rated as "Substantial" due to the following considerations:

a) Yunnan DoT and YHB have no experience with Bank-financed projects and are not familiar with the Bank's fiduciary and safeguards policies.

b) Yunnan DoT and YHB will need to maintain their commitment to the new highway asset management approach during project implementation and build their capacity to do so.

c) The project includes activities at a large number of small but dispersed sites to be managed and supervised.

d) To benefit from the new tools and innovations, YHB needs to allocate maintenance funds based on the recommendations of the asset management system.

44. Appropriate mitigation measures have been included in the project design, including:

a) Training on Bank procurement, financial management and safeguards policies will continue throughout project implementation and compliance will be monitored by the Bank during project implementation.

b) Allocation of adequate funds to training, workshops, and study tours to help YHB management and staff adapt to the road asset management approach.

c) Engagement of experienced consultants by the PMO to supervise construction and provide training to PIUs at General Sections.

d) Inclusion of indicators in the Results Framework to increase in maintenance funding and apply the asset system in maintenance decision-making.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

45. Economic analysis of the project was carried out in accordance with the World Bank's *Economic Analysis Guidance Note*, and focused on the analysis of economic impacts as well as

the rationale for public sector involvement and for World Bank support. Table 3 below summarizes the results of the economic evaluation: the project EIRR is 16.1%, which is higher than the World Bank recommended discount rate of 12%. Details of the economic evaluation are in Annex 6.

Table 2: Summary of Economic Evaluation

Component	EIRR (%)	ENPV@12% (RMB million)
Whole Project	**16.1%**	**442.54**
Establishing Integrated Management Information System	13.6%	21.65
Adoption of Asset Management Systems	15.9%	32.77
Maintenance and Emergency Response Capacities Enhancement	17.3%	376.01
Pilot of Cost-Effective Maintenance Technologies	16.3%	52.33

EIRR = economic internal rate of return, ENPV = economic net present value

46. Yunnan Provincial Government will repay the Bank loan through YHB from: (a) government fiscal allocation to YHB; and (b) YHB's operational revenues. Financial analysis has been conducted to ensure that sufficient funds from these sources would be available for project implementation, loan repayment, and YHB's other responsibilities. Counterpart funding for project implementation will primarily come from fiscal allocations and YHB's discretionary portion of operation revenues. Project implementation will require less than 14.5 % of YHB's total discretionary funds during the project implementation period, and will not have a negative financial impact on YHB's ongoing operations. Details of financial capability analysis are in Annex 6.

B. Technical

47. The road asset management approach has been introduced in Yunnan during project preparation and has been embedded in the project design. The project will assist YHB to acquire the necessary technologies, tools, and skills for efficient asset management and in-time preventive maintenance, and to respond quickly to emergencies and disasters. The types and numbers of equipment, hardware and software proposed under the project are the result of studies of existing equipment, national standards and expected workloads. Project design reflects the Bank's experience, international good practice, and domestic experience in road maintenance and asset management. The selected technologies under the project are sound and feasible.

48. Road safety will be addressed by the project through improving physical asset condition, enhancing emergency response management, making timely information available to road users (such as traffic conditions, construction activities and emergency events), and periodically collecting asset condition data and black spot data for analysis and improvements. A study will be carried out by the project to analyze traffic accidents on trunk highways and will provide recommendations on safety improvements. Traffic enforcement, vehicle management, and safety education will be implemented by other responsible agencies under separate programs.

49. Maintenance materials and technologies to be piloted have been selected based on the local climate, typical pavement conditions, cost-benefit analysis, and performance in China and other countries. Road condition data of the proposed pilot segments will be collected and analyzed to ensure appropriate timing and type of preventive maintenance.

50. The proposed Maintenance and Emergency Centers and Stations are located at places which are geologically sound and conveniently accessible for highway management and maintenance. In addition, equipment proposed is commonly used in highway maintenance and spare parts and technical support are readily available.

51. The project will complement the ADB–financed maintenance project and build on its achievements by focusing more on developing YHB's strategic capacity to efficiently manage the trunk highway system, respond to emergency events, and provide better service to road users.

52. The project includes a sizeable training component to support YHB's adoption of the asset management approach and for putting into use the technologies and tools acquired under the project. This will also include improving and reforming relevant business processes, especially those related to asset management, force account maintenance, and emergency response.

C. Financial Management

53. Bank loan proceeds, including overseeing the Designated Account, will be managed by DoF. The financial management capacity assessment of DoF and YHB identified the following principal risks: (a) YHB is new to Bank operations; and (b) counterpart funds will be from the sectoral budget allocated to YHB on an annual basis and the funding level each year is uncertain. Agreed mitigation measures to address the above risks include: (a) financial management training (formal and *ad hoc*) has been provided to project financial staff; (b) a project implementation manual (PIM) has been prepared to standardize project implementation procedures; (c) close monitoring and supervision from the Bank, DoF and PMO during project implementation; and (d) alternative measures to be worked out by YHB if the required funds are not committed in the sectoral budget and verification of the availability of counterpart funds by the project annual audit. With the implementation of the agreed actions, the project financial management arrangements will satisfy the Bank's requirements under OP/BP 10.00.

54. YHB is expected to set up a robust highway asset accounting system under the project to enable proper recording of fixed assets in the books of account and for these assets to be fairly presented in the annual financial statements. This will be the first time in China that an asset accounting system is established for public infrastructure, and the proposed innovation will set a good example for public sector accounting reform in preparing for accrual basis financial reporting.

D. Procurement

55. The PMO at YHB will be responsible for overall procurement management and implementation of all procurement activities under the project. The principal procurement risk is

the potential large workload of the PMO, coupled with weak staff capacity and lack of familiarity with the Bank's procurement procedures and requirements. Other risks include: (a) large value procurement of various road maintenance equipment, with potential for complaints from bidders; (b) challenges of large value procurement for supply and installation of information systems, including major telecommunications, hardware, and software components, as well extensive technical services for design, development, customization, installation, system integration, operations and technical support; and (c) developing the technical content of diverse range of contract packages and contract management.

56. To mitigate the above risks, the following measures have been taken/agreed: (a) a Procurement Management Manual for the project has been adopted and the PMO staff have been trained in its use; (b) a qualified procurement agent with experience in procurement of ICT in Bank-financed projects has been hired by the PMO; (c) a training plan has been agreed to provide continuous training to PMO staff on Bank procurement policies and requirements; (d) the PMO to involve technical staff and end users in the preparation of technical/functional requirements; (e) PMO to identify its staffing needs and to assign or hire qualified individual consultants/project management consulting firm to assist with procurement document preparation and quality control; and (f) PMO to conduct market survey and analysis for major and critical contracts to ensure that an optimal procurement strategy is adopted.

57. A Procurement Plan for the first 18 months of project implementation, acceptable to the Bank, has been prepared by the PMO.

E. Social (including Safeguards)

58. The project triggers OP 4.12, Involuntary Resettlement, and OP 4.10, Indigenous Peoples, because Components B and C may require land acquisition and project activities are scattered around 16 prefectures where there are ethnic minorities.

59. **Resettlement Policy Framework (RPF)**. No permanent land acquisition is currently envisaged for project implementation, as land currently owned by the road authorities is planned to be utilized. A due diligence review has been carried out on the past acquisition of land to be used for project activities, which confirmed that there are no pending legacy issues. An RPF, acceptable to the Bank, has been prepared to address potential land acquisition and resettlement that may be required during project implementation under Components B and C.

60. **Ethnic Minority Development Plan (EMDP)**. An EMDP has been prepared based on social assessment in the project areas and after a free, prior and informed consultation with ethnic minorities. Ethnic minorities expressed their broad support to the project. Project impacts on ethnic minorities are mostly expected to be positive and adverse impacts relate to potential temporary land use and localized construction-related disturbance. The EMDP identifies potential positive and adverse impacts and includes measures to enhance positive impacts and mitigate adverse impacts. It also includes the budget required for each measure and the agencies responsible to implement them. Implementation of the EMDP will be monitored semi-annually by an experienced independent monitor.

61. **Consultation and disclosure.** Information on the project was disclosed during project preparation and public consultations were held through questionnaire survey, interviews and public meetings in project counties, townships and villages, in particular in ethnic minority villages. Comments and suggestions received, especially from ethnic minority villagers, have been incorporated in the project design, RPF and EMDP. The RPF and EMDP were disclosed locally and in the InfoShop on September 3, 2014.

62. **Gender.** The project approaches gender from three entry points. First, the EMDP and the RPF include gender differentiated investigations, analysis and measures to reduce adverse impacts on women and enhance positive impacts. For example, the RPF gives priority to train women on skills and production technologies. The project will disaggregate the indicators measuring the coverage and satisfaction of the related training by gender. Secondly, the project is expected to improve maintenance effectiveness and reduce physical labor for frontline maintenance workers, about 35% of whom are female, by introducing new maintenance equipment. Thirdly, the provision of facilities for frontline staff is expected to improve the working environment for both men and women and will provide gender separate sanitary and dormitory facilities.

F. Environment (including Safeguards)

63. The project is expected to benefit the environment by reducing damage from natural disasters and routine road operation, reuse of pavement materials, and lowering emissions. Potential negative environmental impacts are mainly associated with construction activities, including dust and noise, construction wastewater, social disturbance, and materials processing. During the operational stage, some negative environmental impacts are expected from waste management and processing of maintenance materials. Two environmental safeguards policies are applicable to the project, i.e., OP4.01 Environmental Assessment and OP4.04 Natural Habitats. The project has been assigned Category B due to the limited environmental and social impacts.

64. Construction under the project will take place within existing facilities or right of way, with no expansion or land acquisition. An Environmental Management Plan (EMP)[5] acceptable to the Bank has been prepared. The EMP covers institutional arrangements, types of typical physical activities, environmental monitoring and supervision, capacity building, and a training plan.

65. **Natural Habitats**. The project will support 13 emergency centers and management stations in environmentally sensitive areas, including: Baima Snow Mountain Natural Reserve; Class III protection zone of the Shilin (stone forest) Natural Heritage Reserve; and Sanjiangbingliu (three parallel rivers) Reserve. Construction activities will take place within existing facilities, with no land acquisition. The EMP includes appropriate mitigation measures during design, construction and operation phases respectively to avoid, reduce or eliminate the potential adverse impacts on the reserves. The project will not result in significant degradation or conversion of natural habitats.

[5] EMP includes Environmental Codes of Practices (ECOP).

66. **Public Consultations and Information Disclosure** were carried out during project preparation through questionnaire survey, interviews and public meetings. Opinions expressed and suggestions provided during consultations have been incorporated in the project design and the EMP, as appropriate. The full EMP was disclosed locally on July 15, 2014 and disclosed in the InfoShop on August 19, 2014.

ANNEX 1. RESULTS FRAMEWORK AND MONITORING

CHINA: Yunnan Highway Asset Management Project

Project Development Objective (PDO): Improve the efficiency and cost-effectiveness of highway asset management in Yunnan.

PROJECT DEVELOPMENT OBJECTIVE INDICATORS

Indicator Name	Core	Unit of Measure	Baseline 2013	Target Values						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition, etc.)
				2015	2016	2017	2018	2019	2020				
Indicator One (*Core Indicator*)**:** Percentage of highways in good/fair condition.	**X**									Annual	Progress report (Pavement condition Survey).	PMO and YHB	Pavement in good/fair condition as defined in national code.
Sub-Indicator 1.1: National highways		%	50.2	50.2	52.2	54.7	57.2	60.2	60.2				
Sub-Indicator 1.2: Provincial highways		%	50.0	50.0	52.0	54.5	57.0	60.0	60.0				
Indicator Two: Percentage of periodical and rehabilitation maintenance funds allocated based on the recommendations of the asset management system.		%	0	0	0	0	20	75	75	Annual	Progress report (Review of maintenance funds, program planning, and delivery).	PMO and YHB	Funds allocated to periodical and rehabilitation maintenance works based on recommendations of asset management system as % of total funds for periodical and rehabilitation maintenance works.
Indicator Three: Length of network per routine maintenance staff member.		Km/staff	3.7	3.7	3.7	4.2	4.5	4.8	4.8	Annual	Progress report (Staff numbers as well as length of network under each station).	PMO and YHB	Average length of network per routine maintenance staff after the provision of new equipment.

INTERMEDIATE RESULTS INDICATORS													
Indicator Name	Core	Unit of Measure	Baseline	Target Values						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition, etc.)
				2015	2016	2017	2018	2019	2020				
Component A: Highway Asset Management Improvement													
Indicator One: Establishment of an integrated highway asset management information system.		Yes/No	No	-	-	yes	yes	yes	yes	Annual	Progress report	PMO/YHB	Includes RAMS and other management systems.
Indicator Two: Annual maintenance funds.		RMB/km	38,800	40,600	42,400	44,400	46,400	48,500	48,500	Annual	Progress report	PMO/YHB	Funds for routine and minor maintenance allocated to YHB, divided by network length.
Indicator Three: Percentage of paved road network surveyed.										Annual	Progress report	PMO/YHB	% of total km of paved roads and number of bridges surveyed to apply the asset management system.
□ Road		%	60	60	60	70	80	80	80				
□ Bridge		%	60	60	60	70	80	80	80				
Component B: Maintenance and Emergency Response Capacities Enhancement													
Indicator Four: Percentage of Maintenance Stations and Emergency Response Centers enhanced.										Annual	Progress report	PMO/YHB	Maintenance stations/centers enhanced as % of the total.
□ *Stations (408 total)*		%	45	62	78	95	100	100	100				
□ *Centers (16 total) at prefecture level*		%	6	36	66	96	100	100	100				
□ *Centers (126 total) at county level*		%	50	65	80	95	100	100	100				
Indicator Five: Time to respond to emergency events.		Hours	4	4	4	3.5	3	3	3	Annual	Progress report (Review of emergency event	PMO and YHB	Maximum time for YHB staff to arrive at the site after reporting a Class III emergency event

											records).		(defined in the *Emergency Response Plan for Emergency Events of Highway Traffic* issued by MoT in 2009).
Component C: Pilot of Cost-Effective Maintenance Technologies													
Indicator Six: Number of innovative technology contracts piloted		Number	0	0	0	4	4	4	4	Annual	Progress report	PMO/YHB	
Component D: Strengthening Institutional Capacities													
Indicator Seven: Percentage of technical assistances completed and adopted		%	-	-	-	50%	100%	100%	100%	Annual	Progress report	PMO/YHB	Including technical assistance of highway asset evaluation guideline, highway asset accounting guideline, highway maintenance manual, and highway Safety Study.
Indicator Eight: Staff trained and satisfactory rate of training programs.		Person·time (%)	0	0	995 (80%)	2,986 (80%)	3,956 (80%)	4,977 (80%)	4,977 (80%)	Annual	Progress report	PMO/YHB	Feedback on training will be collected each time at the end of training.
□ *of which, female staff trained*			0	0	338 (80%)	1,015 (80%)	1,345 (80%)	1,692 (80%)	1,692 (80%)				

Annex 2: Detailed Project Description

CHINA: Yunnan Highway Asset Management Project

1. The project comprises the following four components: (a) Highway Asset Management Improvement; (b) Maintenance and Emergency Response Capacities Enhancement; (c) Pilot of Cost-Effective Maintenance Technologies; (d) Strengthening Institutional Capacities. Detailed costs of each component, project preparation and management as well as financing plan are shown in Table 2.1 below.

Table 2.1: Project Costs and Financing Plan by Cost Items

Cost Items	Total Cost		Financing Plan (US$ million)		
	US$ million	RMB million	IBRD	Counterpart	IBRD %
I. Base Cost					
A. Highway Asset Management Improvement	**58.28**	**358.40**	**58.28**	**0.00**	**100.0%**
A1. Establishing integrated management information system	32.94	202.55	32.94	0.00	100.0%
A2. Supporting data collection for Asset Management System operation	24.82	152.66	24.82	0.00	100.0%
A3. Adoption for Asset Management Systems	0.52	3.19	0.52	0.00	100.0%
B. Maintenance and Emergency Response Capacities Enhancement	**161.69**	**994.40**	**46.81**	**114.88**	**29.0%**
B1. Improving performance evaluation system and indicators	0.21	1.28	0.21	0.00	100.0%
B2. Providing equipment and facilities at maintenance stations and emergency centers	161.48	993.12	46.60	114.88	28.9%
C. Pilot of Cost-Effective Maintenance Technologies	**25.38**	**156.11**	**25.38**	**0.00**	**100.0%**
C1. Road rehabilitations	25.38	156.11	25.38	0.00	100.0%
D. Strengthening Institutional Capacities	**8.13**	**50.01**	**8.13**	**0.00**	**100.0%**
D1. Highway Asset Evaluation Manual and Highway Asset Accounting Guidelines	3.62	22.26	3.62	0.00	100.0%
D2. Highway Maintenance Manual	0.51	3.11	0.51	0.00	100.0%
D3. Highway safety study	0.67	4.15	0.67	0.00	100.0%
D4. Study tour and trainings	3.33	20.49	3.33	0.00	100.0%
Subtotal (I)	**253.48**	**1,558.92**	**138.60**	**114.88**	**54.7%**
II. Physical and Price Contingencies	15.95	98.10	0.00	15.95	0.0%
Subtotal (II)	**15.95**	**98.10**	**0.00**	**15.95**	**0.0%**
III. Financial Charges					
A. Front-end fee	0.38	2.31	0.38	0.00	100.0%
B. Commitment charges	0.34	2.08	0.34	0.00	100.0%
C. Interest during construction	10.68	65.72	10.68	0.00	100.0%
Subtotal (III)	**11.40**	**70.11**	**11.40**	**0.00**	**100.0%**
Total (I+II+III)	**280.83**	**1,727.13**	**150.00**	**130.83**	**53.4%**

IBRD = International Bank of Reconstruction and Development
Source: The World Bank task team, the Feasibility Study Report in October 2014

2. **Component A – Highway Asset Management Improvement (Estimated cost US$58.28 million, which will be fully financed by the IBRD Loan).**[6] This component will improve asset management decisions by establishing and operating an integrated asset management system. It includes three sub-components.

3. **Sub-Component A1 – Establishing an Integrated Management Information System (Estimated cost US$32.94 million, which will be fully financed by the IBRD Loan).** YHB has developed IT infrastructure and operational systems that include a transport industry network, GIS database, business systems, office system, and a public service system. These databases and systems are in different units and do not have an effective information sharing mechanism. The scope, response velocity, and information processing of each system cannot meet the increasing operational needs of YHB. In addition, information derived from these systems is not directly linked to the decision-making process for highway maintenance and emergency response.

4. This sub-component will upgrade existing system functions, establish a core road asset management system and supporting databases, set up an emergency response system, and integrate all systems into a comprehensive management information system. It will optimize resource allocation strategies and decisions, reduce life-cycle costs of highway assets, increase value-for-money of scarce maintenance funds, enhance emergency management, and generally improve YHB's ability to manage its road assets and provide better service to road users. This sub-component will finance: (a) a data management center; (b) a data exchange platform; (c) a road asset management system; (d) a road network monitoring and emergency command center, with related systems and equipment; (e) upgrade of existing databases and management systems and their incorporation into an integrated management information system; and (f) improvement and expansion of existing IT infrastructure and connections to operate the integrated management information system. The scope of work includes the procurement of computer hardware, software, installation, customization, integration, adaptation, calibration, training, and operation for an initial period.

5. **Data management and exchange.** Data collection and processing in YHB is currently dispersed among various information systems and divisions, without integrated management or effective exchange mechanisms. Divisions of YHB still exchange and share data manually, which results in low efficiency.

6. This component will establish a data management center to host data repositories, a data management platform, and a data exchange platform that enable real time data exchange between databases and applications, resulting in integrated data management. The data management center will standardize data collected through different channels, categorize them into data repositories, unitarily manage the data through the data management platform and exchange them through the data exchange platform. The data management center will connect to the application systems in YHB and relevant institutions to achieve effective data processing and exchange.

7. **Road Asset Management System.** Decision making mechanisms on highway maintenance are still experience-oriented rather than objective analysis based. YHB determines

[6] This is the base cost and does not include the contingency and financial charges.

the annual maintenance plan, fund allocations and maintenance technical design without a thorough demand analysis based on adequate data and statistical support. With the expansion and ageing of the highway network, YHB is increasingly facing the following challenges: (a) inadequate maintenance funds and maintenance investment structures that do not appear to be rational; (b) outdated highway maintenance and management mindset; (c) incomplete technical guidance and standards for highway maintenance; (d) under-developed maintenance performance evaluation mechanisms; and (e) limited qualified human resources.

8. By introducing the highway asset management system, the project will allow YHB to develop a complete inventory of its highway assets and periodically collect physical asset condition data for following up on maintenance results, analyzing needs for maintenance and rehabilitation, and optimizing management strategies. It will also provide YHB with an analytical tool for budgeting and decision making, and predicting the consequence to the road network under different funding decisions. This will allow YHB, DoT, and provincial leaders and policy makers to objectively decide on maintenance budgeting and resource allocation. The highway asset management system will function to: (a) inventory highway assets by establishing a highway asset database; (b) periodically inspect and evaluate the asset condition of sub-grade, pavement, bridges, culverts, tunnels, and traffic facilities in compliance with national standards; (c) predict asphalt and cement pavement conditions under different traffic scenarios; (d) analyze the impacts of different maintenance strategies on pavement condition during its life cycle; (e) analyze the economic return on investments; (f) rationalize decision-making on highway maintenance, based on demand and objective analysis; (g) optimize the fund utilization plan and arrangements among different types of maintenance; (h) carry out maintenance project management, including routine, periodic, rehabilitation, construction, emergency, and dedicated maintenance projects; (i) perform maintenance equipment management; (j) manage disasters and other emergency events; (k) manage technical standards, policies and regulations; and (l) issue statistics and management reports in compliance with government and management requirements.

9. Commercial-off-the-shelf systems have been given a priority in selecting the asset management system. A comprehensive Road Asset Management System will be introduced by the project, which is currently used by 25 provinces in China on trunk highway management and has 11 modules classified into four categories: (a) asset database; (b) demand analysis and planning and programming decision tools; (c) maintenance management tools (which can also be used to manage maintenance projects and equipment); and (d) evaluation, monitoring and reporting. The system covers physical assets, such as roads, bridges and tunnels, culverts, traffic facilities and greening. For roads, it is able to predict pavement conditions, optimize decision-making under funding constraints, resulting in optimized and prioritized annual and multi-year maintenance programs. The models for bridges and tunnels are simpler and mainly manage inspection data and provide asset condition evaluation in compliance with national standards.

10. **Road network monitoring system and emergency command center.** MoT set up a national highway network monitoring and emergency response center in 2012 to monitor the national highway network and required provincial governments to connect in. YHB does not have an emergency system to meet the requirement and deal with emergency events. From 2010 to 2012, the trunk highway system of Yunnan had a total of 2,095 blockages. Of these, unexpected events and construction activities accounted for 96% and 4% respectively. 78.4% of

the unexpected events were caused by landslides and extreme weather. An earthquake in Ludian on August 3, 2014 caused serious landslides and damage to highways, which delayed rescue teams from reaching the affected areas. However, YHB is not adequately equipped to respond to emergency events and road blockages. Cross-department and inter-regional coordination is neither efficient nor well-organized, mainly because of limited information collection, reporting and handling capacities.

11. The coverage, scope and density of monitoring facilities on the highway network are limited, which impede uncovering safety hazards and accidents in time, and also result in slow response to emergency issues. It is difficult to dispatch emergency supplies across regions/areas. Emergency supplies are only available within the locality where they are registered. In addition, the level of information provision is low and late. Each department collects, edits and publishes information separately without collaboration and integration, which sometimes leads to inconsistent public information.

12. The project will finance a highway network monitoring and emergency system that provides real-time monitoring of critical road sections, major bridges, overload inspection stations, and potential landslides. The system includes field monitoring facilities that collect and deliver information on emergency events, an emergency response command center where emergency information will be processed and emergency response instructions can be provided, and mobile command platforms that accordingly direct the emergency response team and distribute emergency materials.

13. **Yunnan Trunk highway GIS database.** The applicability and efficiency of geographical information resources on the trunk highway network in Yunnan are currently limited. There is no unified standard for geographical information utilization. The data lack precision, lack clear resources, and are updated late. Data reporting procedures are inconsistent among different cities/counties, which result in higher costs and lower efficiency in processing GIS data. The project will support upgrading the highway GIS system by enabling integration of data from all sub-systems, data presentation in graphic and statistical modes, their incorporation in the data management center, as well as strengthen statistical support to other application systems within YHB.

14. **YHB business systems**. Different divisions of YHB have individually established divisional business systems. However, these systems are not integrated and lack effective data exchange mechanisms, and cannot sufficiently support decision making. A comprehensive management system will thus be supported by the project to integrate the operations of various divisions of YHB, promote information sharing and operational coordination, and enhance efficiency of decision-making and operational management of YHB.

15. **YHB office system**. The existing YHB office system disperses its resources among different divisions without effective inter-division sharing mechanisms. The system cannot support telecommuting, which slows document approval processes when staffs are out of office. There is no unified user rights management mechanism in the existing system, leading to different business systems needing repetitive logins. In addition, an incomplete file management system for electronic documents and archives also lowers system efficiency. The project will develop a comprehensive system that integrates all office resources, facilitates document

approval procedures, and strengthens inter-division coordination. Specifically, it will provide Yunnan YHB with: (a) a collaborated portal that establishes a unified application to access various application systems for users; (b) unified user management mechanism; (c) an upgraded file system based on standard archive databases with regulatory requirements; and (d) a mobile office system that uses mobile wireless networks and mobile terminals connected with the government systems to achieve telecommuting system access.

16. The business and office systems will be based on commercial-off-the-shelf systems which will be customized and adapted to the needs of YHB. DOT already operates similar systems, and it will be reviewed to check if the same systems can be adopted for YHB, ensuring smooth information sharing between DOT and YHB, as well as access to common training facilities.

17. **Yunnan trunk highway public information system**. Currently YHB provides limited public information, which is not updated in a timely manner. The project will improve the public information system by connecting it to DoT's traffic service system, enabling real-time notice to the public on traffic, highway maintenance activities, as well as emergency events.

18. **Yunnan transport industry network.** Currently, the network only connects to General Sections at prefecture level and Sections at county level. Most operational units and physical locations at lower levels are not connected to the IT communication network facilities. With the introduction of more efficient processes through computerized systems comes also the need for linking all units to the same networks and databases. Only if this is achieved will it be possible to share important and needed information. Hence, the project will increase capacity where needed, expand connection to all maintenance stations and emergency centers, and improve the capability and features for mobile access.

19. **Sub-Component A2 — Supporting Data Collection for Asset Management System Operation (Estimated cost US$24.82 million, which will be fully financed by the IBRD Loan).** In order to enable objective and effective evaluation, analysis and decision making on highway asset management, YHB and its affiliated institutions need to collect a series of data and information that indicate maintenance activities, traffic flow, deterioration of roads, bridges and tunnels, and emergency events. This sub-component will finance: (a) upgrade of two existing vehicles and adding a new vehicle for pavement condition data collection and an automatic deflectometer; (b) nine bridge and eight tunnel inspection vehicles; (c) 63 permanent automatic traffic recording stations and 80 portable counting sets; (d) 30 sets of instruments and related software for monitoring large landslides, very large bridges and tunnels, and overload control stations; and (e) 35 sets of portable maintenance inspection equipment (patrol vehicles, equipped with relevant software and hardware for data collection and information transmission to the control center).

20. Except for the road asset management system and the emergency patrol cars that are new to Yunnan, most of the proposed equipment is either additional to the existing stock or improvements or upgrades to technologies that are already in use in the province, operated by YHB or other similar agencies. The types and numbers are based on a needs review documented in the feasibility study report.

21. **Asset data collection.** Currently, YHB has two pavement inspection vehicles, a bridge inspection vehicle, and a tunnel inspection vehicle, which are operated by Yunnan Highway Science and Technology Research Institute, a subsidiary of YHB. At the end of 2013, Yunnan had 13,205 bridges with a total length of 1,453 km and 783 tunnels with total length of 297 km. The length of highways for annual inspection is expected to increase to 39,000 km in the coming years. To meet the growing inspection load and intensity as well as the data requirements of the proposed asset management system, the project will support the upgrade of the existing vehicles and supplement their capacity with extra equipment to meet the increased demand for inspecting roads, bridges, and tunnels.

22. **Emergency data and information**. Due to the geographic conditions, Yunnan experiences frequent natural disasters, causing emergency impacts on the trunk highway network, e.g., earthquakes, flooding, landslides, and snow. To address these emergencies effectively, this project will support eight sets of emergency commanding platforms, 25 sets of portable emergency communication equipment and 30 sets of field monitoring instruments with related software for monitoring large landslides and key bridges. The equipment will collect and send real-time information to the control center, which are needed for suitable and swift reaction to disasters or emergency events.

23. **Traffic volume**. Traffic volume is recorded mainly through manual observation rather than automatic traffic recording stations. Of the 1,987 traffic volume observation stations in Yunnan, only 34 are automatic traffic recording stations, of which three are used for the trunk highway network. The project will support 63 permanent automatic traffic recording stations and 80 portable counting sets to collect traffic data for operation and maintenance decisions.

24. **Sub-Component A3 — Adoption of Asset Management Approach (Estimated cost US$0.52 million, which will be fully financed by the IBRD Loan).** This sub-component will provide technical assistance to YHB in the adoption of the asset management approach, making necessary changes for operating the asset management system, applying asset management principles to business processes, and using system outputs for decision making and performance evaluation.

25. This sub-component will include policy development, raising awareness, assistance with establishing the unit overseeing the system operation and applications (this also includes developing job descriptions for the roles and responsibilities needed to implement the tasks, as well as operational manuals that list and link all tasks to be undertaken in the asset management cycle), assistance with development of an annual asset report, as well as assistance with system operation. It is envisaged that this assistance will be hands-on during the first part of the project, and will evolve into a more coaching role during the latter period.

26. **Component B — Maintenance and Emergency Response Capacities Enhancement (Estimated cost US$161.69 million, of which US$46.81 will be financed by the IBRD Loan).** Yunnan has limited capacity for highway maintenance and emergency response. Maintenance and emergency response centers and stations are widely dispersed. Existing facilities and equipment in maintenance stations and emergency centers are also not adequate to support immediate and effective maintenance and emergency response.

27. **Sub-Component B1 – Improving Performance Evaluation System and Indicators (Estimated cost US$0.21 million, which will be fully financed by the IBRD Loan).** This sub-component will provide technical assistance to YHB to improve its performance management and objectively measure efficiency and effectiveness of maintenance delivery. The support will identify new management objectives with enhanced management strategies, tools, and facilities; update YHB's evaluation system and indicators; enhance the performance monitoring and feedback mechanism; and increase accountability.

28. **Sub-Component B2 – Provide Equipment and Facilities to Maintenance Stations and Emergency Centers (Estimated cost US$161.48 million, of which US$46.60 million of equipment costs will be financed by the IBRD Loan).** This sub-component will enhance frontline staff's maintenance productivity and emergency response capacity through provision of adequate equipment and facilities.

29. **Maintenance and Emergency Center and Stations**. YHB currently has planned 16 prefecture-level maintenance and emergency response centers, 126 county-level maintenance and emergency response centers, as well as 377 maintenance stations and 31 tunnel maintenance stations. These maintenance and emergency response centers and stations have dual responsibilities of maintenance and emergency response. On average, the coverage of each maintenance station is about 68 km; emergency center coverage at the county level is over 200 km, some up to 449 km; and emergency center coverage at the prefecture level is over 1,000 km. The average coverage will increase about 48.5% in future with the take-over of newly-added trunk highways. With the upgrade of highway standards, requirements on maintenance quality will increase.

30. Of the 16 prefecture-level maintenance and emergency response centers, only one is completely built, nine centers need to be built, and six need to be improved. Of the 126 county-level maintenance and emergency response centers, 26 centers need to be built and 37 need to be improved. Of the 408 maintenance stations, 31 stations need to be built and 194 need to be improved. These centers and stations to be built and improved are identified in the feasibility study report. Most of them are located in the less developed counties and many of the existing centers and stations were built many years ago and cannot meet current work and living requirements.

31. YHB currently has about 3,000 sets of maintenance and emergency equipment, of which 1,252 sets have been used for over 10 years and are awaiting disposal; only 223 sets are emergency rescue equipment (on average there are 1.6 sets of equipment in each center). Many frontline staff lack adequate equipment and rely on simple tools to carry out maintenance works. Due to the heavy physical work, YHB allows male and female frontline staff to retire at 55 years and 45 years respectively.

32. This sub-component will enhance staff maintenance productivity and emergency response capacity through: (a) provision of equipment for routine and minor maintenance and emergency response at the 304 selected Maintenance and Emergency Response Centers and Stations; and (b) expansion/construction of equipment shelters, administration and production buildings, and workers dormitories at the Centers and Stations. Specifically, it will provide adequate equipment and improve the work quality, service coverage scope and efficiency of

maintenance stations in carrying out recurrent maintenance and emergency response. It will procure specialized maintenance equipment, emergency rescue equipment, maintenance machinery and vehicles. Together with improved performance management, these equipment and facilities will contribute to increased incumbent staff productivity.

33. **Component C — Pilot of Cost-Effective Maintenance Technologies (Estimated cost US$25.38 million, which will be financed by the IBRD Loan).** In recent years YHB has introduced innovative maintenance materials and technologies to lower maintenance costs and improve maintenance efficiency, e.g., asphalt pavement recycling technologies, slurry seal, chip seal, and micro-surfacing. Some of these maintenance technologies have shown the promised results, while some others need to be improved. YHB does not have sufficient funds to scale up the proven technologies. This component will support the pilot of four proven maintenance technologies - cold recycling of asphalt pavement for base course, modified asphalt chip seals, asphalt slurry seals, and micro-surfacing - at seven typical and suitable road segments with a total length of 290 km. Three of the piloted technologies focus on preventive maintenance and the other focuses on asphalt pavement recycling.

34. **Component D — Strengthening Institutional Capacities (Estimated cost US$8.13 million, which will be financed by the IBRD Loan).** This component will strengthen YHB's institutional capacities through training, study tours, and technical assistance on highway asset evaluation and accounting, as well as highway maintenance manual.

35. **Sub-Component D1 — Highway Asset Evaluation Manual and Highway Asset Accounting Guideline (Estimated cost US$3.62 million, which will be fully financed by the IBRD Loan).** GoC has no highway asset valuation and accounting requirement in its government financial reporting system. This sub-component will research domestic and international highway asset valuation and accounting practices, develop a highway asset valuation manual and accounting guideline, carry out a valuation of trunk highway assets, and record their values in the balance sheet.

36. **Sub-Component D2 — Highway Maintenance Manual (Estimated cost US$0.51 million, which will be financed by the IBRD Loan).** This sub-component will support the development of a highway maintenance manual and the related training for adopting the manual. The manual will be contextualized to the specific Yunnan geographic and highway conditions, will standardize maintenance operation processes, and will be used to improve maintenance design and management.

37. **Sub-Component D3 — Road Safety Study (Estimated cost US$0.67million, which will be financed by the IBRD Loan).** This sub-component will analyze traffic accidents on trunk highways, identify key safety weaknesses of the trunk highway system by incorporating the results of the assessment under the ADB-financed project China RAP, and provide safety management recommendations for asset management.

38. **Sub-Component D4 — Study Tour and Training (Estimated cost US$3.33 million, which will be financed by the IBRD Loan).** The aim of this sub-component is to develop a comprehensive training program to update YHB staff's managerial knowledge and technical

skills and help them adapt to the new management systems, learn to maintain and operate the new equipment, and master the innovative maintenance technologies. It will support the preparation of an initial training needs assessment review, on which a multi-year Bureau-wide training program will be developed and implemented.

39. The PMO acknowledges that training is not a one-off exercise and will thus include retraining and refresher training. The program will build on the training program implemented under the parallel ADB program. It will emphasize the involvement of local training institutions in the design and delivery of the training programs.

Annex 3: Implementation Arrangements

CHINA: Yunnan Highway Asset Management Project

1. YHB has established an institutional framework for implementing the project, comprising a Leading Group (LG); Project Management Office (PMO); and Project Implementation Units (PIU) for implementing civil works and regular training programs.

2. **Leading Group**. The leading group in YHB is led by the YHB General Director and consists of three YHB deputy directors and representatives from related divisions of YHB. The LG will provide oversight and coordination for project implementation, and ensure the availability of counterpart funds and other resources required for project implementation.

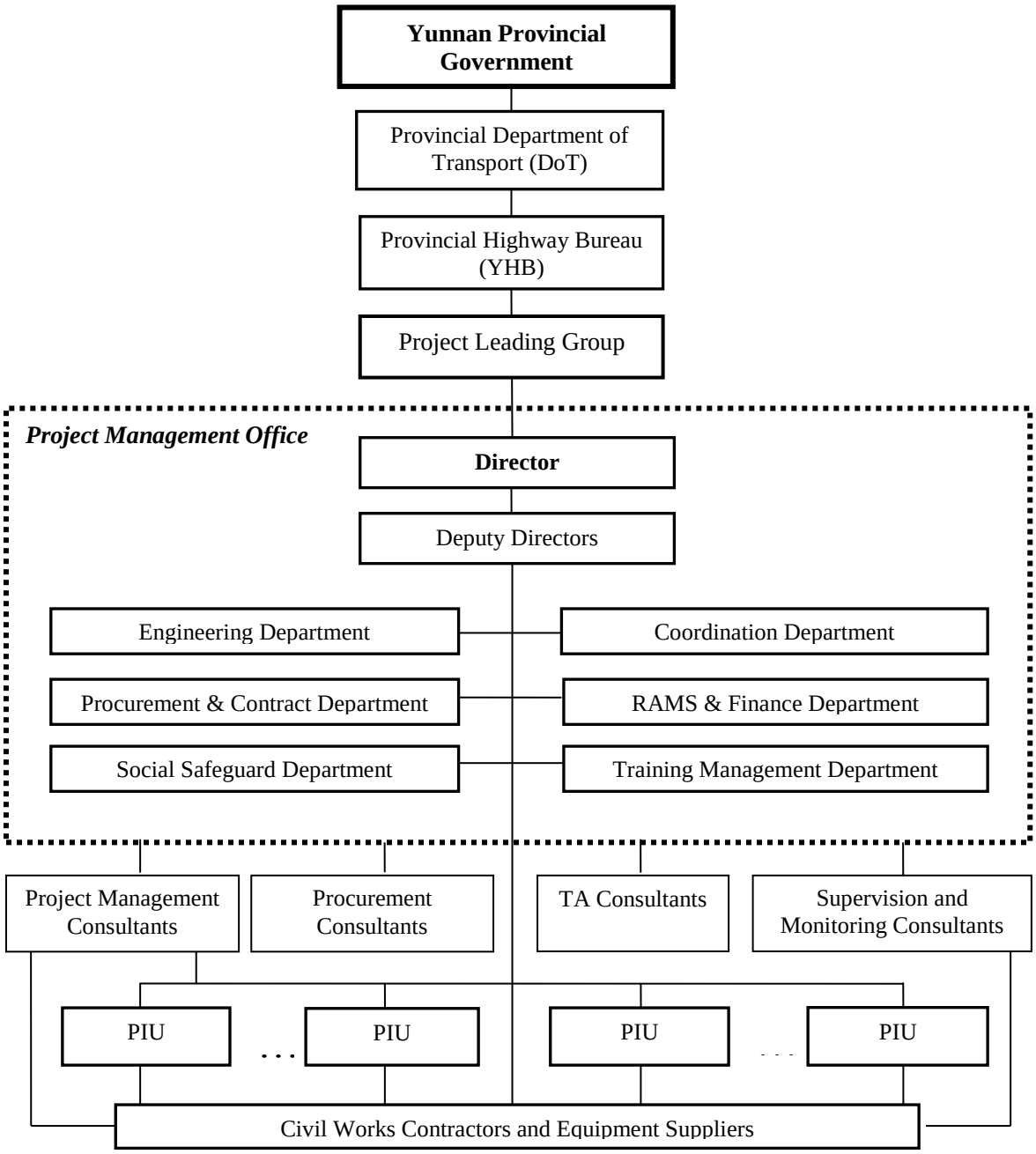
3. **Project Management Office.** A consolidated project management office (PMO) has been established under YHB for overall project coordination, day-to-day management, and implementation of study tours, workshops and training. The PMO is headed by a director of the Planning Division, who is supported by a deputy director and a senior consultant. The PMO comprises six functional departments for different aspects of project implementation, including engineering, procurement and contract management, social safeguards, coordination and liaison, asset and financial management, and human resources development. The PMO has about 34 technical and operational staff, mainly from YHB headquarters. The PMO will be supported by YHB divisions and institutions, including for dispatching and recruiting required staff and providing technical support as needed.

4. **Project Implementation Units.** PIUs will be established at sixteen General Sections at prefecture level to implement civil works under Components B and C of the project, and at Yunnan Transport Vocational College and Yunnan Transport Advanced Technician School, which are two affiliated agencies of DoT, to provide regular training under Component D4 to workers and technicians. In addition, Yunnan Highway Science and Technology Research Institute, an affiliated agency of YHB, will participate in establishing and operating the asset management system and collecting data under Component A1, and providing technical support to YHB on the pilot of cost-effective maintenance technologies under Component C.

5. **Consultants.** Consulting services will be provided to the PMO for project management, procurement, engineering design, construction supervision, safeguard monitoring, adaption of the asset management approach, performance evaluation system improvement, and technical assistance.

6. The following organogram summarizes the institutional arrangements for the project.

Figure 3.1: Diagram of Project Implementation Arrangement



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Financial Management

7. The financial management capacity assessment identified the following principal risks: (a) YHB is new to Bank operations; and (b) counterpart funds will be from the sectoral budget allocated to YHB and this funding varies with annual budget allocations.

8. Agreed mitigation measures to address the above risks include: (a) financial management training (formal and *ad hoc*) has been provided to project financial staff; (b) a project implementation manual (PIM) has been prepared to standardize project implementation procedures; (c) close monitoring and supervision from the Bank, DoF and PMO during project implementation; and (d) alternative measures to be worked out by YHB if the required funds are not committed in the sectoral budget and verification of the availability of counterpart funds by the project annual audit.

9. The residual financial management risk for the project, after implementation of the agreed mitigating measures, is assessed as Moderate.

10. **Budgeting.** The annual project implementation plan, including the funding budget and resources, will be prepared by the PMO. Budget variance analysis will be conducted on a semi-annual basis by the PMO to identify variances from the plan that require management attention and action. The Bank will provide implementation support to the PMO to enhance budget preparation and execution.

11. **Funds Flow.** The Bank loan proceeds will flow from the Bank into a project Designated Account (DA) to be set up at and managed by DoF. DoF will be directly responsible for the management, maintenance and reconciliation of DA activities. The PMO will be responsible for preparing withdrawal applications as well as the supporting documents and submitting them to DoF for review and approval. Bank loan proceeds will be delivered to the PMO or paid to the contractor directly based on the PMO's request. The 16 General Sections will only be responsible for civil works to be financed by counterpart funds and the flow of these funds will follow domestic procedures.

12. **Accounting and Financial Reporting.** The administration, accounting and reporting of the project will be set up in accordance with Circular #13: "Accounting Regulations for World Bank-financed Projects" issued in January 2000 by MoF. The standard set of project financial statements has been agreed between the Bank and MoF, and includes:

(a) Balance sheet of the project
(b) Statement of sources and uses of fund by project components
(c) Statement of implementation of loan agreement
(d) Statement of designated account
(e) Notes to the financial statements (required only for annual financial statements).

13. YHB will manage, monitor, maintain the project accounting records and prepare interim financial reports and financial statements for the activities they execute. The PMO will consolidate project financial statements prepared by YHB, which will then be submitted to the Bank for review and comment on a regular basis. The consolidated interim unaudited project financial statements will be prepared and furnished to the Bank by the PMO no later than 60 days following each semester (the due dates will be September 1 and March 1), in form and substance satisfactory to the Bank.

14. **Internal Control.** An internal control system has been established within YHB in accordance with internal control standards issued by MoF. Internal control requirements related

to the Bank financed project will be integrated in the PIM. All withdrawal applications are subject to the detailed review conducted by DoF.

15. Training will be provided to workers by the two vocational colleges managed by DoT, and asset data collection will be carried out by Yunnan Highway Science and Technology Research Institute of YHB. To strengthen the management of these activities, YHB will sign subsidiary agreements with the colleges as well as the research institute, specifying the activities to be conducted, the required criteria, the responsibility of each party, and payment terms. The PMO will verify the successful delivery of each training course before paying the colleges and the research institute, either based on unit costs or costs incurred.

16. **Audit.** Yunnan Provincial Audit Office (YPAO) has been identified as auditors for the project. The annual audit report of project financial statements, to be issued by YPAO, will be due to the Bank within 6 months after the end of each calendar year. The Bank will make the audited financial statements available to the public in accordance with the World Bank Policy on Access to Information.

Disbursements

17. Four disbursement methods are available for the project: advance, reimbursement, direct payment and special commitment. The primary Bank disbursement method will be advances to the DA. Withdrawal Applications (WAs) will be prepared to request Bank disbursements and to document the use of Bank financing. WAs will include supporting documents in the form of Statement of Expenditures (SOEs) and Summary Sheets (SS), as well as source documents identified in the Disbursement Letter issued by the Bank.

18. A segregated DA in US dollars will be opened at a commercial bank acceptable to the World Bank and will be managed by DoF. The ceiling of the DA will be determined and documented in the Disbursement Letter.

19. The World Bank loan would be disbursed against eligible expenditures (taxes inclusive) as in the following table.

	Disbursement Categories	**IBRD Loan**	
		Allocated amount (US$)	Percentage of Expenditures to be financed
1.	Civil works, goods, consulting services, training, study tours, and incremental operating cost (except for those covered under Category (2) below).	132,380,000	100%
2.	Data collection for Sub-component A.1 (e) and training for Sub-component D.4	6,220,000	100%
3.	Interest and commitment fees*	11,025,000	100%
4.	Front-end fee	375,000	100%
	Total	150,000,000	

* Yunnan has requested that loan interest and commitment fees during project implementation be disbursed from the Bank Loan proceeds.

20. Eligible expenditures incurred on or after January 1, 2015 (up to a ceiling of US$30 million) may be financed retroactively.

Procurement

21. **Capacity.** The PMO at YHB will be responsible for overall procurement management and all procurement activities under the project. Under the PMO, there are sixteen PIUs located in the respective general sections, two PIUs located at Yunnan Transport Vocational Technology College (YNTVTC) and Yunnan Transport Advanced Technician School (YNTATS), and one PIU located at Yunnan Highway Science and Technology Research Institute (YHSTRI). The PIUs at general section level will be responsible for the implementation of civil works at maintenance stations and emergency centers in the jurisdiction of the respective general sections, which will be financed by counterpart funds. No executive procurement role will be played by PIUs in the Bank-financed components. The two PIUs at YNTVTC and YNTATS will be responsible for providing training courses to workers and technicians under Component D4. The PIU at YHSTRI will be responsible for asset data collection under component A1. Disbursements will be made for these training and data collection costs as agreed in the Subsidiary Agreement (SA) between the PMO and the three PIUs. Other training, workshops and study tours to management level staff will be provided as planned on an annual basis and will be disbursed through SOEs.

22. A procurement capacity and risk assessment of the PMO found that it has no previous experience in implementing a Bank-financed project and is therefore unfamiliar with Bank procurement policies and procedures, which could lead to delays in processing procurement and non-compliance. In addition, the project involves procurement packages of large value for (i) supply and installation of integrated information system and (ii) road maintenance equipment, for which PMO staff may not have the relevant technical and management skills.

23. To mitigate the above risks, the following measures have been/will be taken: (a) a Procurement Management Manual for the project has been adopted and PMO staff have been trained in its use; (b) a qualified procurement agent with experience in procurement of ICT in Bank-financed projects has been hired by the PMO; (c) a training plan has been agreed, which will provide continuous training to PMO staff on the Bank's procurement policies and requirements; (d) the PMO will identify its staffing needs and assign or hire qualified individual consultants/a project management consulting firm to assist with procurement document preparation and quality control; (e) the PMO will involve technical staff and end users in the preparation of technical/functional specifications; and (f) the PMO will conduct market survey and analysis for major/critical contract to ensure an optimal procurement strategy is adopted. The overall procurement risk for the project is rated as Substantial.

24. **Applicable Guidelines**. Procurement will be carried out in accordance with: "Guidelines: Procurement of Goods, Works and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011 (revised July 2014); "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011; and the provisions stipulated in the Loan Agreement. NCB will be carried out in accordance with the Law on Tendering and Bidding of the People's Republic of China, promulgated by Order of the President of the People's Republic

of China on August 30, 1999 subject to the modifications stipulated in the Legal Agreement in order to ensure consistency with Bank Procurement Guidelines.

25. **Procurement of Works**. Works procurement will be carried out under Component C for piloting of cost-effective maintenance techniques to reduce life-cycle maintenance costs, including cold recycling of asphalt pavement for base course, modified asphalt chip seals, asphalt slurry seals, and micro-surfacing, at seven selected road segments with a total length of 290 km. Procurement will be conducted using the Bank's Standard Bidding Documents for all International Competitive Bidding (ICB) and National Model Bidding Documents agreed with or satisfactory to the Bank for all National Competitive Bidding (NCB).

26. **Procurement of Goods.** ICT and goods procurement will be carried out under Component A for highway asset management improvement and under Component B for maintenance and emergency response capacity enhancement. Procurement will be done using the relevant Bank Standard Bidding Documents for all ICB and National Model Bidding Documents agreed with or satisfactory to the Bank for all NCB.

27. **Selection of Consultants.** Consultants for various consulting services assignments will be hired under the project for strengthening institutional capacities. The Bank's Standard Request for Proposals will be used for all QCBS and QBS. Universities and research institutes may be included in shortlists as a source of consultants, provided they possess the relevant qualifications and they are not in a conflict of interest situation. In such cases, QBS or CQS (for small assignments) would be used, if the shortlist also includes consulting firms which operate as commercial entities. The shortlist may comprise entirely national consultants (firms registered or incorporated in the country), if the assignment is below US$500, 000.

28. **Training and Workshops.** Plans for training and workshops will be developed by the PMO, and included in the project annual work plan for Bank review. Except for training courses to be provided by the two PIUs, expenditures incurred in accordance with the approved plans for training and workshops organized by the PMO will be the basis for reimbursement. For training, workshops and study tours to be organized by third party service providers, the Bank Guidance Note on Planning, Budgeting, Implementing, Reporting and Accounting for Expenditures related to Training & Workshops in Bank-financed Projects in China & Mongolia will apply.

29. **Procurement Plan.** A Procurement Plan for the first 18 months of project implementation, acceptable to the Bank, has been prepared by the PMO. It will be made available on the Bank's external website. The Procurement Plan will be updated annually or as required to reflect implementation needs and improvements in institutional capacity.

30. **Thresholds for Procurement Methods and Prior Review**. The indicative thresholds are shown in the table below.

Thresholds for Procurement Methods and Prior Review

Expenditure Category	Contract Value Threshold (US$ thousands)	Procurement/Selection Method	Prior Review Threshold (US$ thousands) [1/2/]
1. Goods and Non-Consulting Services	⩾10,000	ICB	All
	<10,000	NCB	First NCB contract regardless of value and all contracts valued ⩾1,000
	<100	Shopping	First contract
	<3,000	Framework Agreement	First contract regardless of value and all contracts valued ⩾1,000
	--	Direct Contracting	All
2. Works and Supply and Installation of Plant and Equipment	⩾40,000	ICB	ALL
	<40,000	NCB	First NCB contract regardless of value and all contracts valued ⩾10,000
	<200	Shopping	First contract
3. Consultants Services	⩾300	QCBS/QBS	The first contract for each selection method and all contracts valued⩾500
	<300	CQS	First contract
	--	Individual Consultant	Only in exceptional cases.
	--	Single-Source Selection (firm)	⩾100
	--	Single-Source Selection (individual)	⩾50

1/ All contracts to be financed through retroactive financing will be subject to prior review. A contract whose cost estimate was below the Bank prior review threshold is subject to prior review if the price of the lowest evaluated responsive bid (or, in the case of consulting services, the financial offer of the selected firm) exceeds such threshold at the bid/proposal evaluation stage.
2/ Procurement post review may be carried out by the Bank, its consultant/auditors.

31. **Direct Contracting**. The following three contracts may be procured through direct contracting, provided that in each case the PMO provides to the satisfaction of the Bank a sufficiently detailed justification, including the rationale for direct contracting instead of a competitive selection: the proprietary Road Assets Management System (RAMS) developed by the China Road High-tech Maintenance Science and Technology Co. Ltd specifically for use in China, at an estimated cost of US$ 2.17 million; Beidou satellite bridge monitoring equipment contract; and system upgrade of two existing comprehensive road condition survey vehicles. In

addition, for each of contract, the PMO should furnish to the Bank for its review, the scope of the contract, the specifications, the draft contract and a detailed cost breakdown, together with evidence that the cost does not exceed the price charged other Purchasers by the Supplier.

32. **Advance Contracting and Retroactive Financing.** The Procurement Plan sets forth all contracts that will be procured in advance, together with the relevant Bank review procedures. Retroactive financing for contracts signed prior to loan signing will be within the limits specified in the Loan Agreement.

Environment (including safeguards)

33. **OP4.01 Environmental Assessment**. Construction under the project includes improvements to or construction of equipment shelters, administration and production buildings, and workers' dormitories at road management and emergency response centers and stations (Component B1), and road pavement maintenance pilots (Component C). Construction under Component B1 will take place within existing sites with no expansion or permanent land acquisition needed. No road alignment change or permanent land acquisition is involved for Component C.

34. Overall, the project is anticipated to bring positive impacts by reducing damages from natural disasters and routine road operation, and reuse of pavement materials. Potential negative environmental impacts are mainly associated with construction activities, such as dust and noise, construction wastewater, social disturbance, and materials processing. The main negative impacts during the operational stage are expected to result from domestic waste management and maintenance material processing within these facilities and on the roads.

35. Based on the nature of construction activities and anticipated impacts that are expected to be site-specific and limited in scale, the project is rated Category B under per OP4.01. The EMP, acceptable to the Bank, has been prepared by an accredited EIA Consultant and covers institutional arrangements, types of typical physical activities, environmental monitoring and supervision, capacity building, and a training plan. The EMP also covers cross-cutting issues such as soil erosion control, social disturbance management, wastewater treatment, management of cultural relics, health and safety, and solid waste management.

36. During project preparation, the EMP was shared and discussed with relevant project management staff and design engineers to ensure proper incorporation of the EMP into engineering designs. The EMP will be included in the bidding document and in the civil works contracts. Supported by the project, the project owner will hire an environmental management consultant during project implementation to enhance the PMO's capacity in ensuring environmental safeguards compliance.

37. **OP4.04 Natural Habitats**. Thirteen existing emergency centers and management stations supported by the project, which are responsible for road maintenance under their jurisdictions, are located in environmentally sensitive areas. Specifically:

- Shusong management station is located in Baima Snow Mountain Nature Reserve in Diqing Prefecture. The nature reserve covers an area of around 2,816 km^2. The

management station is located by national highway G214 which was built in the 1960s and is the only national highway in the prefecture.

- Shilin management station is located in the Class III protection zone of Shilin (stone forest) Natural Heritage Protection Area in Kunming Municipality. The Protection Area has an area of 350 km^2. The management station is located by national highway G326 and serves two other major highways (S209 and G324) nearby.
- Moli management station is located in the Class II protection zone of Ruili River-Daying River Scenic Area in Dehong Prefecture. The Scenic Area covers about 600 km^2. The management station is located by national highway G320 which was built in the 1930s.
- Ten emergency centers and management stations are located in Sanjiangbingliu (three parallel rivers) Reserve in Nujiang Prefecture. The reserve covers almost the entire prefecture, and has an area of 17,000 km^2. There are only two provincial highways (S237 and S309) serving the prefecture. The ten emergency centers and management stations are responsible for maintenance of the two provincial highways within the prefecture.

38. Except for the Shilin management station (which is located in a populated area with a dense road network) the other management stations maintain critical road sections in mountainous areas that are vulnerable to bad weather and/or geological conditions, such as frequent landslides during the rainy season. Strengthening the emergency response and maintenance capacity of the road management facilities are important for local communities.

39. The activities in environmentally sensitive areas are within existing sites and will not involve expansion of current facilities or land acquisition. The EMP includes appropriate mitigation measures during the design, construction and operations phases to avoid, reduce or eliminate potential residual impacts on sensitive areas. These impacts are expected to be localized, temporary, and limited, and are not anticipated to affect natural habitats in their vicinity. The project will therefore not result in significant degradation or conversion of natural habitats in these environmentally sensitive areas.

40. **Public Consultation and Information Disclosure.** During project preparation information disclosure and public consultations were carried out through posters, questionnaire survey, interviews and public meetings in project counties, townships and villages. Consultations included villagers likely to be affected, local governments and agencies. Comments and suggestions received have been incorporated in the project design and in the EMP. The draft EMP was disclosed on the websites of each project township and the websites of each prefecture government or transport bureau on July 15, 2014. The EMP was also disclosed in the InfoShop on August 19, 2014.

Social (including safeguards)

41. **Involuntary Resettlement.** The RPF will regulate possible temporary land acquisition for project construction activities. It describes the procedures, timeframe and agencies responsible for resettlement planning during detailed design and states that if needed, an RP should be prepared by the PMO, and reviewed and cleared by the Bank prior to the commencement of any related construction. The PMO will nominate dedicated and empowered resettlement staff, who will be trained prior to resettlement implementation in line with the

requirements of the RPF. An experienced external resettlement monitor will be engaged to conduct semi-annual monitoring and reporting. The RPF was disclosed locally and in the InfoShop on September 3, 2014.

42. The EMDP, which includes potential positive and adverse impacts and measures to manage negative impacts, integrates the results of consultation with ethnic minorities and relevant agencies. The PMO will finance, implement, and monitor the EMDP, and will engage an experienced external monitor to conduct semi-annual monitoring and reporting on EMDP implementation.

43. **Consultation and information disclosure.** The EMDP and the RPF were prepared with local information disclosure at the sites of the centers/stations and in ethnic minority communities, and the final draft versions were disclosed on the websites of provincial and prefecture road authorities, with an announcement on the disclosure in a local newspaper on August 19, 2014. They were also disclosed in the InfoShop on September 3, 2014. Participation and consultations will continue during project implementation, in line with the EMDP/RPF.

44. **Social Management Arrangements.** An office responsible for RPF and EMDP implementation, including at prefecture and county levels, will be set up with dedicated staff prior to the project launch workshop. These staff will be trained on the implementation of the EMDP/RPF and on the preparation of semi-annual implementation progress reports. The Office will engage experienced social monitors to monitor implementation of the EMDP/RPF.

45. **Gender.** The project approaches gender from three entry points. First, the EMDP and the RPF include gender differentiated investigation, analysis and measures to reduce adverse impacts on women and enhance positive impacts. For example, the RPF gives priority to train women on skills and production technologies. The project will disaggregate indicators measuring the coverage and satisfaction of the related training by gender. The project is expected to reduce physical labor for frontline maintenance workers, about 35% of whom are female, by introducing new maintenance equipment. Thirdly, the provision of facilities for frontline staff is expected to improve the working environment for both men and women and will provide gender separate sanitary and dormitory facilities. The EMDP and RPF describe gender related actions and indicators, which will be implemented and monitored by the PMO and by the social monitors.

Annex 4: Operational Risk Assessment Framework (ORAF)

CHINA: Yunnan Highway Asset Management Project

<table>
<tr><td colspan="7">Project Stakeholder Risks</td></tr>
<tr><td>Stakeholder Risk</td><td colspan="6">Rating Moderate</td></tr>
<tr><td rowspan="2">Description:
The key stakeholders include local residents and road users affected by the project, staff of YHB, DoT as well as relevant government agencies.

Stakeholders have been consulted during project preparation and support the project. Continued consultations will be required, especially with project affected people, including ethnic minorities, during project implementation, to address any concerns that might arise.</td><td colspan="6">Risk Management:
Consultations will be carried out with local residents, road users and staff of YHB during project implementation on an on-going basis. The Bank will confirm that any concerns raised are appropriately addressed.</td></tr>
<tr><td>Resp:
Both</td><td>Stage:
Implementation</td><td>Recurrent:
☑</td><td>Due Date:</td><td>Frequency:</td><td>Status:
In Progress</td></tr>
<tr><td colspan="7">Implementing Agency Risks (including fiduciary)</td></tr>
<tr><td>Capacity</td><td colspan="6">Rating Substantial</td></tr>
<tr><td rowspan="2">Description:
DoT and YHB are well-established organizations with rich experience of domestic projects and ADB-financed projects, but have little experience of World Bank-financed projects. They are also unfamiliar with the selected highway asset management approach. In addition, the project has a large ICT component, which is complex to procure.</td><td colspan="6">Risk Management:
YHB has set up a Project Management Office (PMO) to manage project Implementation.

The PMO will be supported by experienced consultants to carry out design, social and environment monitoring, procurement, project management, and construction supervision. The Bank will monitor the timely mobilization of these consultants and the quality of their work.

Project implementation manual has been prepared to guide the PMO and PIUs on project implementation.

The Bank will provide intensive training and technical support, especially on the new asset management approach and ICT component, as well as Bank procurement and safeguards requirements, during project implementation.</td></tr>
<tr><td>Resp:
Both</td><td>Stage:
Implementation</td><td>Recurrent:
☑</td><td>Due Date:</td><td>Frequency:</td><td>Status:
In Progress</td></tr>
</table>

<table>
<tr><td>Governance</td><td>Rating</td><td colspan="5">Moderate</td></tr>
<tr><td rowspan="3">Description:

The governance structure for the project is in place with Implementing Agency, the PLG, PMO and supporting consultants. This structure will need to implement a Bank project for the first time.</td><td colspan="6">Risk Management:

The Bank will work closely with the PLG and other actors to facilitate the successful implementation of the project in line with Bank and government requirements. The Bank will pay special attention to ensuring the compliance with Bank fiduciary and safeguards requirements, as well as ensuring that YHB is ready to implement the new asset management system in business processes.

YHB and the PMO will enhance staff awareness of the potential risks and will tighten internal controls.

The Bank will provide training to the PMO and YHB on Bank fiduciary policies as well as project procedures, ensure that the PMO’s information disclosure policy is operational, and will monitor key risks in project implementation, in particular on issues raised in audit report.</td></tr>
<tr><td>Resp:</td><td>Stage:</td><td>Recurrent:</td><td>Due Date:</td><td>Frequency:</td><td>Status:</td></tr>
<tr><td>Both</td><td>Implementation</td><td>☑</td><td></td><td></td><td>In Progress</td></tr>
<tr><td colspan="7">Project Risks</td></tr>
<tr><td>Design</td><td>Rating</td><td colspan="5">Substantial</td></tr>
<tr><td rowspan="3">Description:

YHB has little experience with advanced highway asset management and it will be a challenge to establish the asset management system and tune the organization to adapt to the system.

The project involves a large number of small contracts dispersed over the province.</td><td colspan="6">Risk Management:

The Bank will provide on-going advice and guidance on the technical aspects of the project and on the introduction of international highway asset management approaches in YHB.

Project management consultants will assist the PMO in managing project implementation and adapting to the system.</td></tr>
<tr><td>Resp:</td><td>Stage:</td><td>Recurrent:</td><td>Due Date:</td><td>Frequency:</td><td>Status:</td></tr>
<tr><td>Both</td><td>Implementation</td><td>☑</td><td></td><td></td><td>In Progress</td></tr>
<tr><td>Social and Environmental</td><td>Rating</td><td colspan="5">Moderate</td></tr>
<tr><td rowspan="3">Description:

The project will have limited negative environmental impacts during construction and future operation. No permanent land acquisition or resettlement is expected. EMP, RPF and EMDP, acceptable to the Bank, have been prepared and disclosed.
Adherence to agreed safeguard documents will need monitoring as YHB has limited experience with WB safeguard policies.</td><td colspan="6">Risk Management:

The PMO will establish a team with sufficient resources to implement EMP, RPF and EMDP and engage experienced consultants to assist with safeguard implementation and monitoring.

The Bank will provide training to the PMO and other relevant project personnel on implementation of the approved safeguard documents and will monitor their satisfactory implementation through discussions, site visits, and review of reports.</td></tr>
<tr><td>Resp:</td><td>Stage:</td><td>Recurrent:</td><td>Due Date:</td><td>Frequency:</td><td>Status:</td></tr>
<tr><td>Both</td><td>Implementation</td><td>☑</td><td></td><td></td><td>In Progress</td></tr>
</table>

<table>
<tr><td>Program and Donor</td><td colspan="6">Rating Moderate</td></tr>
<tr><td rowspan="2">Description:

ADB is financing another highway maintenance project in Yunnan, which is under implementation. The Bank has reviewed the design of the ADB-financed project to ensure the integration of the asset management approach.</td><td colspan="6">Risk Management:

The PMO will coordinate the two project designs and ensure that the two projects are complementary.

The Bank will maintain close liaison with ADB on operational and policy guidance provided to YHB on highway maintenance.</td></tr>
<tr><td>Resp:
Both</td><td>Stage:
Implementation</td><td>Recurrent:
☑</td><td>Due Date:</td><td>Frequency:</td><td>Status:
In Progress</td></tr>
<tr><td>Delivery Monitoring and Sustainability</td><td colspan="6">Rating Substantial</td></tr>
<tr><td rowspan="2">Description:

YHB has experience in managing the delivery of government projects and the on-going ADB project.

Maintaining and operating the system requires commitment of the organization, varied expertise and a stable team.

Adequate funds will need to be made available to implement the maintenance strategies of the project.</td><td colspan="6">Risk Management:

PMO will assign qualified staff and experienced consultants to implement the project and supervise the timely and efficient delivery of project activities.

The establishment of an Information Management Center at YHB has been approved. Both staff and budget for managing the system have been secured. The PLG will, inter alia, address maintenance funding issues.

The Bank will monitor progress on delivery quality, project M&E, and sustainability issues on an on-going basis.

Indicators have been agreed to monitor maintenance fund growth and the application of the asset management system for maintenance planning.

Technical assistance will be provided during project implementation to help YHB adopt the asset management system.

MoF and MoT have been engaged to endorse and advise on the development of highway asset evaluation and accounting guidelines.</td></tr>
<tr><td>Resp:
Both</td><td>Stage:
Implementation</td><td>Recurrent:
☑</td><td>Due Date:</td><td>Frequency:</td><td>Status:
In Progress</td></tr>
<tr><td colspan="7">Overall Risks</td></tr>
<tr><td colspan="2">Implementation Risk Rating:</td><td colspan="5">Substantial</td></tr>
<tr><td colspan="7">Project activities involve a large number of small contracts in dispersed sites, a large ICT component, adoption of the new asset management approach by YHB, and funding commitment to implement the maintenance recommendations. Project design includes appropriate mitigation measures, including the provision of consulting support to the PMO, training and study tours, establishment of a LG to address maintenance funding issues, etc. The Bank will provide on-going implementation support, focusing on mitigation measures for the main risks identified.</td></tr>
</table>

Annex 5: Implementation Support Plan

CHINA: Yunnan Highway Asset Management Project

Strategy and Approach for Implementation Support

1. The implementation support plan (ISP) has been developed taking into account the risks identified and the agreed risk management measures listed in the ORAF (see Annex 4). The focus of Bank implementation support will be on strengthening the capacity of the agencies for project implementation.

Areas of focus	Supporting measures
Strengthening implementing capacity.	
Yunnan Department of Transport and Highway Bureau have little experience with World Bank financed projects and are unfamiliar with advanced highway asset management approaches.	The Bank will provide necessary training on Bank policies, procurement, financial management (FM), safeguards, and contract management to the PMO and YHB. The project implementation manual (PIM) includes detailed procedures and guidelines for project implementation. Specific training will be provided to the project implementation agency to ensure that the PIM is understood and implemented.
Since there is limited domestic experience in highway asset management, international experience will be a very useful resource.	The Bank will engage highway asset management specialists to introduce international practices and lessons to the LG and the PMO, and will provide intensive training and technical support.
The DoT and YHB staff are not sufficiently prepared for the changes demanded by the new management system.	The Bank will help counterpart staff in adopting the necessary improved business processes.
Technical design and variations	
YHB has very little experience with advanced highway asset management. Substantial efforts are required to help YHB to establish the asset management system, and to attune the organization to adapt to the system.	The Bank will arrange for experts with the required expertise to introduce international highway asset management approaches, assist YHB in defining the key functions of its asset management system, and to review the design of the highway asset management system and other components.
The project includes a large ICT component, including management systems (software), hardware and IT infrastructure.	In addition to local ICT specialists, who will review and design the ICT components, the World Bank will include national and international ICT specialists in its supervision team, to assist and guide YHB in this complex task.
Delivery, Monitoring and Sustainability	
YHB has experience with civil works but has very limited experience with the highway asset management information system and ICT systems.	The Bank will review the TORs of the consultants hired by the PMO and will also review project outputs to ensure good quality and sustainability.
Adequate funds have to be available to implement the maintenance strategies recommended by the system.	The Bank will monitor funds allocated for maintenance and compare them with the targets.
The project includes a large number of small but dispersed sites to be managed and supervised during implementation.	Domestic supervision consultants and a project management consultant will be procured, and they will be tasked with supervising all sites regularly. The Bank will make sample reviews/site visits during each supervision mission.

Implementation Support Plan

2. The focus areas and resources needed for implementation support are presented in the table below. Specialized resources will be needed for the asset management and ICT components. In addition, inputs reflect the significant task of the procurement of diverse and highly technical components.

Time	Primary Focus	Skills Needed	Resource Estimate (staff weeks/ year)	Number of Trips (no. per year)
Year One	1. Capacity building 2. Engineering design 3. Safeguard 4. Procurement 5. Financial management 6. ToR preparation	Task leadership	6	2
		Road Asset Management	5	2
		ICT	5	2
		Road Asset Evaluation & Accounting	3	2
		Financial Management	2	2
		Procurement	4	2
		Environmental	1	2
		Social Development	1	2
		Pavement Maintenance	2	2
		Maintenance equipment	2	2
		Civil engineering	2	2
Year Two to Five	1. Capacity building 2. Project implementation 3. Monitoring and supervision	Task leadership	4	2
		Road Asset Management	3	2
		Road Asset evaluation & Accounting	2	2
		Financial Management	2	2
		ICT	2	2
		Procurement	2	2
		Environmental	1	2
		Social Development	1	2
		Pavement technologies	2	2
		Maintenance equipment	1	2
		Civil engineering	1	2

Annex 6: Economic and Financial analysis

CHINA: Yunnan Highway Asset Management Project

A. ECONOMIC ANALYSIS

1. Economic analysis of the project was carried out in accordance with the World Bank's *Economic Analysis Guidance Note*[7], which focused on the analysis of economic impacts (traditional cost-benefit analysis) as well as the rationale for public financing and World Bank involvement. In the economic analysis, project background and formulation were described; project financial costs were converted into economic costs; economic benefits were estimated by comparing the "with-project" and "without-project" cases; economic internal rate of returns (EIRR) of the project were calculated and analyzed; and sensitivity analysis was carried out. This Annex summarizes the economic analysis methodology and results, including the sensitivity analysis.

2. **The project.** It is anticipated that the project would substantially improve road asset management in the province, especially in road information management, road maintenance and asset evaluation, emergency response, and operation management capacities. Implementation of the project would bring substantial economic benefits in the project areas by ensuring timely and cost-effective maintenance of the road network, as well as improving emergency response during road damages and traffic blocks. During the feasibility study, alternatives analyses of the project were carried out by considering the technical feasibility, least cost, social and environment impacts, and sustainability.

3. **Economic Costs of the Project.** According to the FSR[8], the total project investment cost was estimated at RMB1,727.13 million (US$280.83 million equivalent)[9]. Investment costs were estimated in 2014 constant prices, and cover base costs, contingencies, and financial charges for the World Bank loan. Contingency costs were estimated at an average of 6.29% of base costs. Financial charges were estimated at the latest World Bank lending terms in China, including front-end fee, commitment fee, and interest during construction. Financial project costs were converted into economic costs by applying shadow prices and standard conversion factors to the detailed cost items. Taxes and duties, price contingencies, financial charges, and the cost for capacity building were excluded. As a result, an average conversion factor was calculated at 0.9. The table below indicates the total and annual investment costs by project components.

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7 The World Bank. April 9, 2013. *Guidance Note of Economic Analysis for Investment Project Financing*. OPSPQ

8 Winlot Engineering Consulting Company Ltd. October 2014. *Feasibility Study Report for Yunnan Highway Asset Management Project*. Kunming

9 At the exchange rate of US$1.00 = RMB6.15.

Table 6.1: Annual Investments of the Project (RMB million)

Components	2015	2016	2017	2018	2019	Total
Information Platform Construction	93.69	70.26	70.26	-	-	**234.22**
RAMS Development	-	180.23	-	-	-	**180.23**
Maintenance and Emergency Response Capacities Enhancement	637.62	266.48	100.12	-	-	**1,004.22**
Pilot of Cost-Effective Maintenance Technologies	125.38	30.59	24.76	-	-	**180.53**
Strengthening Institutional Capacities	11.57	14.46	14.46	11.57	5.78	**57.83**
Total	**868.25**	**561.82**	**209.61**	**11.57**	**5.78**	**1,657.02**

Note: Above costs are the base cost plus contingencies only, (not include the financial charges)
Source: The Feasibility Study Reports, October2014

4. Operations and maintenance (O&M) costs were estimated for each project component.

- **Information Network and Platform**. O&M cost was estimated and calculated separately for hardware, software, network, and application systems. O&M costs of the Information Network and Platform were estimated to be about RMB12.9 million per year with a 3% annual increase. System hardware and some software would be replaced every 5 years at 40% of the original investment cost.[10]

- **Road Asset Management System (RAMS)**. Annual O&M cost was estimated at RMB13.3 million per year, including RMB10 million for data collection and processing, RMB2.55 million for maintaining equipment and vehicles, and RMB0.75 million for operating equipment and vehicles (about 5 operators). System hardware, software, and equipment for RAMS need to be replaced and/or upgraded in the seventh year of operation at a cost of 50% of the original investment cost.[11]

- **Maintenance and Emergency Response Capacity Enhancement**. Annual O&M costs of infrastructure and equipment were estimated at RMB2.25 million for the prefecture centers and RMB2.00 million for the county centers. O&M costs would be increased by 3% annually to account for increasing workloads and equipment deterioration. Periodical maintenance was scheduled for every 10 years at average 8% of investment costs (5% for civil works and 20% for equipment).

[10] The information platform is composed of information center, hardware, software, network, and other supporting facilities and data. After 5 years, most of the hardware and software need to be upgraded or replaced. The infrastructure, network, and data need partially replaced. So, it is assumed that the periodical maintenance cost was about 40% of original investment cost.

[11] The original investment cost includes for hardware, software, traffic monitoring stations, and vehicle and equipments for data collections. After 7 years, the hardware, software, and some equipment need to be fully replaced. The traffic monitoring stations and vehicles will be partially rehabilitated or replaced. So, it was assumed that the period maintenance was about 50% of the original investment cost.

- **Pilot of Cost-Effective Road Maintenance**. Selected road sections would be maintained under the project by using new technologies and prevention approach, which included seven road segments with total length of 290 kilometers. Maintenance costs of the test road segments were estimated at RMB74,500 per kilometer. This maintenance cost would increase by 3% per year based on estimated road deterioration. Periodic maintenance would take place every 10 years at 80% of original investment costs (mainly for resurfacing).

5. **Economic Benefits of the project.** The completed project would effectively increase the capacity of road asset management in Yunnan Province, which would bring substantial economic benefits to the project areas. Economic benefits were calculated by comparing the "with-project" and "without-project" cases. Following is a summary of the assumptions and calculation of the economic benefits.

- **Information Network and Platform**. The Information Platform and its application systems would integrate most of the information equipment and resources for road administration and maintenance in YHB, which would lead to: (i) reduction in the cost of duplicated system development (about 10% of investment cost); and (ii) reduction in the cost of duplicated data collection (RMB0.86 million per year at 432 person-months and RMB2,000 per person-month). Enhanced road monitoring, traffic control, and emergency response system will provide timely announcements of road block-ups and shorten the repair time, and lead to increased efficiency, including: (i) lower vehicle operation cost (VOC) by avoiding unexpected detour (about RMB1.01 million at an average traffic of 3,000 vehicles on YHB roads, with a 3% annual increase for traffic development, about 20% of vehicles would take other roads, and average VOC savings of RMB0.14 per vehicle-kilometer); (ii) reduced passenger time cost (about RMB27.00 million per year at RMB10 per person-hour with 5% annual GDP increase); and (iii) reduction in accident loss due to timely monitoring, warning and fast emergency response (about RMB3.00 million per year at 10% of the total loss in 2013).

- **Road Asset Management System**. Utilization of RAMS would substantially improve the efficiency of road asset management and maintenance in YHB. Global experience indicates that the efficiency of budget utilization for road maintenance would increase by about 5–10%. The major economic benefits would be savings for similar maintenance activities, estimated at RMB49.19 million per year based on expenditures on road maintenance in 2013 (RMB1,118 million) and 10% increase for 2014 (RMB1,229.8 million), and a conservative saving of 4%.

- **Maintenance and Emergency Response Capacity Enhancement**. Improved road maintenance capacity (infrastructure, equipment and skills) would significantly increase efficiency in road maintenance and emergency response. In 2014, total maintenance budgets were RMB350 million for the 63 centers at the county level and RMB150 million for the 225 stations at the township level.

Budget utilization efficiency would increase by 10% and periodical maintenance could be postponed from the current four years to five years. These would lead to the economic benefits of RMB81.26 million per year. With the enhanced maintenance capacity, roads would be repaired in a timely manner and quality would be maintained, which would lead to a reduction in VOC. Total savings would be about RMB290.51 million per year, with a 3% annual increase in traffic.

- **Pilot of Cost-Effective Road Maintenance**. New technologies and materials used for the tested road segments would: (i) lengthen road rehabilitation intervals from the current 4–8 years to 10–15 years and reduce rehabilitation costs by 40% compared to normal maintenance techniques and materials (saving about RMB93.27 million per time); (ii) reduce VOC due to better road conditions at RMB42.91 million per year; and (iii) save fuel consumption due to using advanced machinery and techniques for the road maintenance, estimated at RMB0.095 million per year.

6. **Economic Evaluation and Sensitive Analysis of the project.** The economic internal rate of return (EIRR) of the project was calculated by comparing economic costs and benefits over a period of 23 years, including 5 years construction and 20 years operation (with some overlap between the construction and operation periods). The EIRR was 16.1% for the entire project, and respectively 13.6% for the Information Platform, 15.9% for RAMS, 17.3% for Maintenance Capacity Improvement, and 16.3% for Pilot Testing. The summary of the results of the economic evaluation are provided in Table 6.2 below.

Table 6.2: Economic Evaluation Results

Cases	EIRR (%)	ENPV@12% (RMB million)
Whole Project	**16.1%**	**442.54**
Establishing Integrated Management Information	13.6%	21.65
Adoption for Asset Management Systems	15.9%	32.77
Maintenance and Emergency Response Capacities	17.3%	376.01
Pilot of Cost-Effective Maintenance Technologies	16.3%	52.33

EIRR = economic internal rate of return, ENPV = economic net present value
Source: The World Bank task team, The Feasibility Study Report, October 2014

7. Sensitivity analyses found that EIRRs for most of the tested cases were higher than the economic opportunity cost of capital. Even in the worst case of increasing capital costs by 20%, increasing maintenance costs by 20%, and decreasing benefits by 20%, the EIRR was still 4.6%. The EIRR was more sensitive to changes in the benefits. Table 6.3 provides a summary of the results of the sensitivity tests.

Table 6.3: Results of Sensitivity Tests

Case	Test	EIRR	ENPV@12% (RMB million)
Base Case		**16.1**	**442.54**
Investment Cost	10%	14.6	302.42
	20%	13.3	162.30
	-10%	17.9	582.66
	-20%	19.9	722.78
Operation and Maintenance Costs	10%	14.9	306.97
	20%	13.7	171.40
	-10%	17.3	578.11
	-20%	18.4	713.68
Benefits	10%	18.8	762.48
	20%	21.3	1,082.42
	-10%	13.2	122.60
	-20%	9.9	-197.35
Combinations			
Increase Costs & Reduce Benefit	10%, -10%	10.6	-153.09
Increase Costs & Reduce Benefit	20%, -20%	4.6	-748.72

EIRR = economic internal rate of return, ENPV = economic net present value
Source: The World Bank task team

B. FINANCIAL ANALYSIS

8. Yunnan Provincial Government will repay the Bank loan through YHB from: (a) government fiscal allocation to YHB; and (b) YHB's operational revenues. Financial analysis of the project focused on YHB's financial capability and sustainability, including: (i) revenue and expenditure status; (ii) counterpart fund requirements and availability; (iii) indebtedness; and (iv) financial sustainability.

9. **Revenue and Fund Sources.** Most of YHB funds are from government fiscal allocations. In the past 4 years (2010–2013), the YHB's revenues was RMB21,595 million, of which, 94.8% was from the government fiscal allocations. Government fiscal allocations to YHB mainly included:

- **Fuel tax allocation**. This is used for YHB's daily operation and road maintenance (including routine and minor maintenance). In 2013, fuel tax allocation to YHB was RMB1,619 million, which comprised about 17.3% of total YHB revenues.

- **Punishment fee allocation**. This revenue is used for road administration. In 2013, YHB received fiscal allocations of RMB293.18 million from fees for overloading, speeding, traffic violations, etc., which amounted to about 3.1% of total revenue.

- **Vehicle purchase tax**. This was earmarked partly for construction or rehabilitation of roads and partly for YHB operations. Vehicle purchase tax goes to the MoT and is re-allocated to each province. In 2013, such fund allocation to YHB was RMB5,584 million, which comprised about 59.5% of total revenue.

- **Other government subsidies**. The provincial government also provides fiscal subsidies for road sub-sector development and important road rehabilitation and maintenance projects. In 2013, this subsidy was RMB1,661 million, about 17.7% of total revenue.

10. In addition, YHB also generates some operating revenues by selling construction material, providing engineering services, etc. These constituted 5.2% of 2013 revenues.

11. In recent years funds from the provincial government budget and MoT vehicle purchase tax allocations increased sharply from RMB402 million and RMB1,802 million in 2010 to RMB1,661 million and RMB5,584 million respectively in 2013.

Table 6.4: Financial Revenues of YHB (RMB million)

Items	2010	2011	2012	2013
1. Fiscal Allocation	3,859.51	3,421.78	4,028.10	9,158.39
1.1 Fuel tax allocation	1,357.86	1,795.59	1,529.29	1,619.10
1.2 Punishment fee allocation	296.46	294.36	287.96	293.18
1.3 Vehicle purchase tax from MOT	1,802.83	1,330.20	2,080.08	5,584.71
1.3.1 Fund for new and rehabilitation project	1,708.83	1,110.20	1,799.08	5,104.71
1.3.2 Fund for safety and disaster recovery	94.00	220.00	281.00	480.00
1.4 Other government subsidy	402.36	1.62	130.77	1,661.41
2. Operation Revenue	200.76	189.75	176.79	180.57
3. Other revenue	165.38	83.00	84.47	46.94
Total	**4,225.65**	**3,694.53**	**4,289.37**	**9,385.90**

Source: The financial division of YHB

12. **Expenditures on Road Development and Maintenance.** Government funds to YHB are generally used for: (i) day to day operations and capacity development; (ii) road construction and rehabilitation projects; and (iii) road maintenance projects.

- **Daily operations**. Daily operation costs for staff salaries, administration, and infrastructure development and capacity building of YHB, comprised 17.3% of total YHB expenditures in 2013.

- **Road improvement and rehabilitation projects**. The major financial expenditure of YHB is for road improvement and rehabilitation projects. In 2013, expenditure on road improvement and rehabilitation projects was RMB5,014 million, which accounted for 54.4% of total expenditures. Most of the funds were from the vehicle purchasing tax.

- **Road maintenance**. In 2013, expenditures for road maintenance were RMB1,759 million, about 18.7% of YHB financial expenditures. Such expenditures included the costs for routine and periodical maintenance and disaster recovery and emergency repair.

13. Expenditures on road improvements and maintenance increased sharply at about 36.8% and 37.3% annually during 2010–2013. However, funds for road maintenance were still not adequate to keep all roads in good condition. The "good and fair road ratio" for YHB administrated roads was only 49.2% in 2013.

Table 6.5: Financial Expenditures of YHB (RMB million)

Items	2010	2011	2012	2013
1. Fiscal Fund Expenditure	3,859.51	3,421.78	4,028.56	9,158.39
1.1 Operation	1,054.20	1,354.29	1,519.29	1,619.10
1.2 Improvement and rehabilitation	1,995.83	1,110.20	1,799.08	5,104.71
1.3 Road maintenance	680.12	735.67	578.96	1,759.82
1.3.1 Routine maintenance	631.08	726.15	578.96	1,759.82
1.3.2 Periodical and large maintenance	25.63	6.46	-	-
1.3.3 Disaster repairs	23.41	3.06	-	-
1.4 Others	129.36	221.62	131.23	674.77
2. Operation Expenditure	200.76	189.75	176.79	180.57
3. Other Expenditure	165.38	83.00	84.02	46.94
Total	**4,225.65**	**3,694.53**	**4,289.37**	**9,385.90**

Note: The expenditures for medium and large maintenance (1.3.2) and disaster repair (1.3.3) in 2012 and 2013 were included in the construction and rehabilitation (1.2).
Source: The financial division of YHB

14. **Counterpart Fund Requirements and Sources.** Annual counterpart fund requirements are shown in Table 6.6.

Table 6.6: Annual Counterpart Funds Requirements (in Million)

Year	Counterpart Funds	
	US$	RMB
2015	80.03	492.17
2016	38.33	235.76
2017	11.15	68.59
2018	0.90	5.55
2019	0.42	2.56
Total	**130.83**	**804.63**

Source: the Feasibility Study Report, October 2014

15. **Counterpart Fund Availability and Financial Sustainability**. Based on historical data and discussions with YHB staff, revenues of YHB were projected based on the following assumptions:

- Fuel tax allocation would increase by 5% per year;
- Punishment fee allocation would be unchanged;
- Vehicle purchase tax allocation would increase by 13% per year; and

- Provincial government subsidy would increase by 13% per year[12].

16. Although revenues from the above sources are generally earmarked for specific purposes, YHB has some discretion to allocate them for non-earmarked purposes. Based on analysis of YHB's historical financial data, discretionary funds for YHB comprise the following:

- 2% of fuel tax allocation;
- 20% of punishment fee allocation;
- 5% of vehicle purchase tax allocations; and
- 20% of the provincial government subsidy.

17. Projections for the period 2015–2019 indicate that counterpart fund requirements of the project would require only 14.5% of total discretionary funds during the project implementation period.

Table 6.7: Analysis of Counterpart Fund Availability (RMB million)

	2015	2016	2017	2018	2019	2015-19
YHB's Total Revenue	**11,331**	**12,623**	**14,076**	**15,710**	**17,549**	**71,289**
Fuel tax allocation	1,785	1,874	1,968	2,066	2,170	**9,864**
Punishment fee allocation	293	293	293	293	293	**1,466**
Vehicle purchase tax from MoT	7,131	8,058	9,106	10,289	11,627	**46,212**
Provincial government subsidy	2,121	2,397	2,709	3,061	3,459	**13,748**
Discretionary Fund Sources for the Project	**875**	**978**	**1,095**	**1,227**	**1,375**	**5,551**
Fuel tax allocation	36	37	39	41	43	**197**
Punishment fee allocation	59	59	59	59	59	**293**
Vehicle purchase tax from MOT	357	403	455	514	581	**2,311**
Provincial government subsidy	424	479	542	612	692	**2,750**
Counterpart Fund Requirement	**492**	**236**	**69**	**6**	**3**	**805**
In YHB's Total Revenue	0.2%	0.9%	1.9%	2.2%	0.3%	1.1%
in Discretionary Fund Sources	3.1%	11.0%	24.5%	28.5%	3.9%	14.5%

Source: The World Bank task team

18. **YHB Indebtedness.** An overall analysis of YHB's indebtedness has been conducted, including debts held by its subsidiary company, Highway Investment Company (HIC). HIC is not involved in this project, but as a financing arm of YHB, it is responsible for investing, constructing, and operating road projects. As such, its indebtedness is included in the analysis. In 2009–2012, HIC borrowed RMB4.62 billion from domestic banks. By the end of 2013, YHB's accumulated debt balance was RMB5.6 billion, which included HIC's loan balance. YHB's annual debt repayment obligation has been declining in relation to its revenue in part due to the large increase in revenue and a sharp decline in new loans. The 2013 debt repayment makes up only 18 percent of revenue, compared to 39 percent in 2010.

[12] As the same increase rate of the fiscal revenue of Yunnan province in the 12-5 plan period.

19. In terms of future debt sustainability, assuming an annual increase of 10 percent in debts incurred by YHB, its debt obligation will be about 17 percent of projected revenue. Tables 6.8 and 6.9 summarize YHB's debts in the past and projected future debt.

Table 6.8: YHB Debt Status 2010-2013 (RMB million)

	2010	2011	2012	2013
New debt	2,389.30	887.5	1,080.00	1,340.00
Debt repayment	1,649.30	2,118.63	433.33	1,721.32
Balance	6,609.30	5,378.17	6,024.83	5,643.51
Total YHB Revenue	**4,225.65**	**3,694.53**	**4,289.37**	**9,385.90**
Debt repayment ratio	**39%**	**57%**	**10%**	**18%**

Note: above data include the debt for the Highway Investment Company
Source: the financial division of YHB

Table 6.9: YHB Debt Projections 2015-2019 (RMB million)

	2015	2016	2017	2018	2019
New debt	1,474.00	1,621.40	1,783.54	1,961.89	2,158.08
Debt repayment	1,893.45	2,082.80	2,291.08	2,520.18	2,772.20
Balance	5,224.06	4,762.66	4,255.12	3,696.83	3,082.71
Total YHB Revenue	**11,331**	**12,623**	**14,076**	**15,710**	**17,549**
Debt repayment ratio	**17%**	**17%**	**16%**	**16%**	**16%**

Source: The World Bank task team

20. **Conclusion.** Based on above analysis, it can be concluded that:

- YHB is almost fully funded by government fiscal allocations. Government allocation for YHB has recently increased significantly. It is likely that government allocations to YHB will continue to increase as revenues from transport related charges such as vehicle purchase tax and fuel taxes are increasing in line with the rapid motorization in the province and China.

- YHB's discretionary funds will be adequate to provide the required counterpart funds for project implementation. Counterpart fund requirements for this project will not significantly impact YHB's normal operation and road maintenance budget.

- YHB's debt repayment is at a sustainable level in part due to increases in revenues.