Regional Road Development and Maintenance Project

Road Asset Maintenance Appraisal (Final)

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CURRENCY EQUIVALENTS

Refer to main project report for currency equivalents in use for the project

ABBREVIATIONS

ADB	-	Asian Development Bank
AM	-	Asset Management
BCP	-	Border crossing point
BOM	-	Bank of Mongolia
CAREC	-	Central Asia Regional Economic Cooperation
C/B	-	Cost benefit ratio
COMO	-	Community Outreach and Monitoring Officer
DEIA	-	Domestic Environmental Impact Assessment
DI	-	Design Institute
EA	-	Executing Agency
EARF	-	Environmental assessment and review framework
EIA	-	Environmental Impact Assessment
EIR	-	environmental impact report
EIRF	-	environmental impact registration form
EIRR	-	Economic Internal Rate of Return
EMP	-	Environmental Management Plan
EMS	-	Environmental Monitoring Specialist
ERRC	-	Eastern Regional Road Corridor (Baruun-Urt to Bichigt)
ETCS	-	electronic toll collection system
FSI	-	Fatal and seriously injured
GAP	-	gender action plan
GDP	-	Gross Domestic Product
GRM	-	grievance redress mechanism
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
iRAP	-	International Road Assessment Programme
IRI	-	International roughness index (IRI m/km)
LAR	-	land acquisition and resettlement
M&E	-	monitoring and evaluation
MOF	-	Ministry of Finance
MRTD	-	Ministry of Road and Transport Development
NRAP	-	National Road Action Plan
PBC	-	Performance Based Contract
PCU	-	Public Complaints Unit
PD	-	Preliminary Design
PIU	-	Project Implementation Unit
PMB	-	polymer modified bitumen
PMS	-	Pavement Management System
PPP	-	Public Private Partnerships
PPTA	-	Project Preparation Technical Assistance
PRC	-	People's Republic of China
RAM	-	Road Asset Management
ROW	-	Right of Way

RF	-	Resettlement Framework
RRP	-	Report and Recommendation of the President
RP	-	Resettlement Plan
RTDC	-	Road and Transport Development Centre
SDAP	-	social development action plan
SPA	-	Social and poverty assessment
SPS	-	Safeguard Policy Statement
TA	-	Technical Assistance
TIP	-	Trafficking in persons
UBDOR	-	Ulaanbaatar Department of Roads
Veh.h	-	Vehicle hours
VOC	-	Vehicle Operating Costs
VOT	-	Value of Time

WEIGHTS AND MEASURES

Ha	-	hectare
km	-	kilometer
km^2	-	square kilometer
m	-	meter
m^2	-	square meter
m^3	-	cubic meter

NOTES

(i) The fiscal year (FY) of the Government and its agencies ends 31 December.

(ii) In this report, "$" refers to US dollars.

CONTENTS

APPENDIX

1. Road map progress since September 2013

LIST OF TABLES

Revision Sheet

Release No.	Date	Revision Description
Rev. 1	November 2016	First draft to team for comment
Final	April 2017	Final document for inclusion in project deliverables

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The TA is being performed by a team of ADB sourced consultants, referred to in the report as “the Consultant”.

The Consultant thanks those who have provided their time and advice.

I. INTRODUCTION

A. Background

1. This report presents the outputs from the international road maintenance specialist tasks as part of the overall PPTA team. The deliverables to be completed are listed in Table I-1.

Table I-1 : Road Maintenance Specialist Deliverables

TOR Task Description	Discussion / Proposed Outputs As Per August 2016 Inception Report
(i) Analyze the findings and recommendations of the ADB TA 7844-MON: Road Sector Capacity Development and other road sector projects in Mongolia;	The primary issue identified since the 2014 report is that the use of the dTIMS system has ceased, along with associated data capture and entry. In 2014 the statement was "*Data from recent road conditions surveys has been entered by the MRTD. System operational. Key data available*". This not only precludes the efficient development of a works program, but calls into question the sustainability of the prior initiative. Road Law (including establishment of Road Fund and Road Board) is yet to be enacted by parliament. Unclear how this will work if ability to generate a robust periodic works program is not present, as draft Road Law prescribes the requirement to use a PMS to manage the road network. Overloading of vehicles continues to be a major issue, with advice of loads in excess of 100Tonnes (versus limit of 44Tonnes). Essential to find a way to control this issue as current initiatives are largely ineffective. UBDOR are no longer implementing the SMEC pavement management system. Other initiatives are being followed in general. Contract Management Systems are no longer used
(ii) Update the Road Asset Management (RAM) sections of the Road Sector Roadmap, and road information, and contract management system databases, and consolidate and assess the required documentation on road maintenance service standards, road	a) **Road Sector Roadmap**: Initial indications are that several MRTD related initiatives have reverted since the 2014 update of the Road Sector Roadmap (contained as Appendix 6 of TA7844 final report). In particular the Roadmap identifies greater use of systems (including dTIMS) and automated condition data collection (ROMDS) in the management of the road network – both of which are no longer in use. A decision on the sustainability of the proposed Roadmap will have to occur. UBDOR advise that they no longer use the PMS provided owing to the cost of software licensing.

TOR Task Description	Discussion / Proposed Outputs As Per August 2016 Inception Report
maintenance manual, guide on supervising routine road maintenance, and undertaking road maintenance and road condition surveys;	b) **Road information**: The MRTD maintain an Excel spreadsheet of basic inventory data (25 data fields). This is checked annually by the road maintenance companies. Therefore, there is no need to update the road information as envisaged. Instead propose to do an audit of some road sections across at least two road maintenance companies to confirm quality of data, identify issues and make recommendations; but no actual data collection or updating to be undertaken.
	c) **Contract management system (CMS)**: Is no longer used by either MRTD or UBDOR. Need to further understand why and how this can be addressed.
	d) Consolidate and assess documentation on road maintenance service standards: Key documents to include in the assessment are: • *UBB80-201-00 Basic Normative of Road and Bridge Maintenance* • *TA5744: Maintenance Strategy and Levels of Service* Approach is to identify the gaps in the above documents with respect to road maintenance service standards, and from this propose the improvement actions to address the identified gaps. A key consideration is around the form of maintenance contract that the service standards are to be used. For instance, a performance based contract often uses a different form of defining service standards than does a prescriptive (input or output) type contract in order to provide the flexibility for the contractor to innovate.
	e) Consolidate and assess road maintenance manual: Key documents to include in the assessment are: • *UBB80-201-00 Basic Normative of Road and Bridge Maintenance* • *TA5744: Maintenance Strategy and Levels of Service* • *TA5744 provided road maintenance manual for UBDOR.* Approach is to identify the gaps in the above documents with respect to road maintenance service standards, and from this propose the improvement actions to address the identified gaps. At present (and for the foreseeable future) there is a significant underfunding of road maintenance (15% approved in 2016 budget) such that benefit would be

TOR Task Description	Discussion / Proposed Outputs As Per August 2016 Inception Report
	greater to help prioritize the expenditure of the limited funds approved, rather than seeking to otherwise add complexity.
	f) **Consolidate and assess guide on supervision of routine maintenance**: No existing guideline exists within MRTD for the supervision of routine maintenance. Will need to determine what form of maintenance contract is to be supervised, as traditional maintenance contracts require significantly different supervision approach to performance based contracts.
	g) Consolidate and assess guides on undertaking road maintenance: Key documents to include in the assessment are: • *CCM13-03-00 Methodology and technology for the maintenance of road and road structure* • *AD-13-202-00 Regulation for the management of maintenance of road and road structures* • *CCM 80-04-00 Regulation to determine the normative period for maintenance of road and road structures* • *Xxx Technical specifications for the maintenance of road and road structures* • *UBB80-201-00 Basic Normative of Road and Bridge Maintenance* • *TA5744: Maintenance Strategy and Levels of Service* The above documents will be reviewed and comments made on deficiencies in them[1].
	h) Consolidate and assess guide on road condition surveys: Key documents to include in the assessment are: • *UBB80-201-00 Basic Normative of Road and Bridge Maintenance* • *TA5744: Maintenance Strategy and Levels of Service* Current practice is to only identify defects that warrant inclusion onto the maintenance plan, as opposed to the rating of all assets in order to permit a move from maintenance management into asset management. With the extreme underfunding of routine maintenance (only 15% of request is approved) there is little merit in seeking to add complexity to this item at this stage.

[1] As the above are in Mongolian the comments will likely be at a higher level, rather than detailed work instructions that would necessitate the translation to English of all documents.

TOR Task Description	Discussion / Proposed Outputs As Per August 2016 Inception Report
(iii) Identify a range of technical solutions for road maintenance, including minor repairs, surface dressing, asphalt concrete overlay, pavement reconstruction, drainage systems repairs or reconstruction, installation of signs and markings, safety measures for bends, long steep grades and junctions, roadside safety treatment and traffic calming;	Measures relating to the maintenance of the existing pavement are not perceived to be an issue as MRTD are well aware of what needs to be done. Unfortunately, MRTD are unable to convince Ministry of Finance (and Parliament) to fund routine maintenance fully (only 15% funded) or any funding for preventative funding. A lack of equipment resulted in a poor outcome for a trial of surface dressing as it was necessary to complete all aspects manually. A range of technical solutions will be identified, however without access to a stable level of sufficient funding these are unlikely to be implemented in a quantity that would provide for quality or cost effective outcomes. Question is around the financial affordability of adding more assets to the network (safety measures, traffic calming etc.) when basic maintenance is such that in many cases the road is impassable after only a few years, resulting in vehicles not using the roads. A listing of measures will be developed, along with conditions under which they would potentially be beneficial – however no recommendation to install will be made owing to lack of funding to maintain assets.
(iv) Identify, develop and schedule a 3 year periodic maintenance program prioritized based on the economic returns of such works;	Despite putting forward a request to fund a periodic maintenance program each year, MRTD have not been successful in receiving any funding for periodic maintenance activities. Without understanding of the benefits of the periodic maintenance within MOF the development of a program will add little (if anything) to the state of the road network. MRTD have a map indicating which lengths of road a likely requiring periodic maintenance, reconstruction or routine maintenance on the basis of the age of the asset. This task is to add more technical inputs to the development of the work program. It is noted that there is a lack of network level condition data (roughness, rutting, cracking etc.) to undertake this exercise, such that the focus will be using the available maintenance defect data to develop the program (in conjunction with existing inventory data). Without the detailed data being available, the economic returns of each treatment cannot be determined, however the overall economics of the strategy of implementing periodic maintenance will be estimated with a focus on MRTD costs. Aligned to the works program will be the annual budget cost (by treatment type), along with the estimated level of service for the network will be prepared.

TOR Task Description	Discussion / Proposed Outputs As Per August 2016 Inception Report
	It is proposed to only undertake a field validation of the route from Ulaanbaatar to Sukhbaatar[2].
(v) Prepare a legal and technical framework for piloting outsourced performance-based area-wide routine maintenance contract and corporatization of state-owned maintenance units or other forms of commercialization of road maintenance;	It is noted that performance based contracts were made with 4 private road maintenance companies in 2010 for four years. A review of these will be undertaken to ascertain the success of these and what (if any) issues were identified with regard to legal and technical issues. Corporatization of state-owned maintenance units will include consideration of a number of options (maintain existing, implement PBC contract with the road maintenance companies, sell to private sector with guaranteed work, and shut down/merge), along with the associated costs and risks to implement. Funding is an issue for all road maintenance contracts. One option is to install tolls such that road maintenance (and periodic works) would be self-funded on the road section. This would remove the need for Police to be involved in controlling overloading – especially where tolls were set relative to the cost of damage they were imparting.
(vi) Explore possibilities to outsource collection of road condition data;	Interest will be sought from MRTDs Road and Transportation Development Company, along with a minimum of three international firms known for data collection to ascertain interest in undertaking annual automated data collection of the paved road network. The output will be a report describing under what conditions the market would be interested in undertaking the data collection for the MRTD network.
a) a results framework that will include the investment program targets, as well as intermediate indicators and milestones at the outcome, output, input, and activity levels to enable tracking of investment program progress;	Cannot be finalized until decision over form of road maintenance contracts is determined (e.g. added on to road construction task or a separate dedicated RAM contract).
b) a medium-term investment program that will describe the target	Refer above items that address this task.

[2] The field validation will only be undertaken if weather (snow in particular) permits this to occur. This route was selected as it is understood to be the most probable for a performance based contract to be implemented.

TOR Task Description	Discussion / Proposed Outputs As Per August 2016 Inception Report
levels of service of the road network, the maintenance strategy, technical specifications, annual budget allocations, and the list of roads to be maintained and rehabilitated during the investment program implementation period;	
c) a sector reform plan that will include a set of actions such as piloting road maintenance good practices, corporatization of the state-owned road maintenance companies, private sector participation, training, and capacity building on road asset management; and	Based upon the notion that the MRTD will move towards a governance and regulation function, and that in time all physical works will be undertaken by the private sector – a sector reform plan will be produced.
d) an operational manual that will include technical standards; performance targets and indicators; environmental, social and safety evaluation methods and standard management plans; and terms of reference and contract documents for design, supervision and construction.	
(i) assessment and update of the road sector maintenance plan and investment program;	Refer above
(ii) medium-term road maintenance strategy,	Refer above for strategy and associated works plan for network as a whole.

TOR Task Description	Discussion / Proposed Outputs As Per August 2016 Inception Report
investment, financing and procurement plan;	Investment, financing and procurement plans will be developed to support the agreed project scope of works (subset of the network). Will depend upon agreeing where (if any) a dedicated PBC will be implemented.
(iii) operational manual, results framework, draft contracts and TOR for design and supervision of works;	Need to determine if the base contract is to be that implemented between 2010-2014, or the World Bank Sample OPRC bidding documents.
(iv) completed feasibility study reports, agreed project scope, costs, financing and procurement plans;	
(v) economic and financial analysis, project cost estimates, financing plan, financial evaluation, financial analysis (financial statement analysis of road maintenance entities, incremental recurrent cost analysis); and	
(vi) road maintenance sections of the bidding documents for procurement of civil works, equipment and construction supervision consulting services.	

B. Current Road Maintenance Scenario in Mongolia

2. The background to Road Asset Management (RAM) within the Ministry of Road and Transport Development (MRTD) is:

a) MRTD do not appear to have any real interest in asset management. The prior ADB funded technical assistance project implemented the dTIMS asset management (AM) system (with a Mongolia front end) and provided MRTD with data collection equipment. Subsequently MRTD transferred the system and equipment to the Road and Transport Development Centre (RTDC) where it is not used. While outsourcing data collection and even data analysis is common in many international jurisdictions, to give away the system that stores what should be the master data set on the nation's roads indicates a significant lack of appreciation of the benefits of what AM can offer. Not only is there a need to re-establish systems and practices, but there is also a more urgent need to get MRTD to understand the importance of AM and to appropriately staff an AM unit (division) within the ministry;

b) Most road maintenance is undertaken by state owned road maintenance companies, who identify needs, submit budget requests and complete the approved works. There are 8 contracts let to the private sector. These contracts are multiyear contracts, with annually approved work programs;
c) Routine maintenance is funded by Ministry of Finance (MOF) at 15% of identified need from MRTD – such that basic items like potholes are not addressed (and levels of service even if in existence are largely irrelevant). MOF have advised that this is purely a result of budget constraints and not that they don't appreciate the benefits of higher funding;
d) MOF do not approve any funds for periodic works, even though MRTD request them each year. MOF advise this is because of budget constraints and that they would fund these works if funds were available. MOF's current priority is the funding of new construction to finish connecting all the provincial centers with paved roads;
e) Life cycles are relatively short due to the low level of maintenance and no periodic maintenance, with many roads needing reconstruction within 8-10 years (some fail sooner where overloaded vehicles are prevalent and construction quality is poor);
f) Reconstruction is funded at about 60% of requested need – so some roads not only fail early, but then stay in a poor state for a long time. It is not uncommon for vehicles to drive over the countryside parallel to the road, as it is smoother than the road itself;
g) Budgets are allocated annually. While MOF can commit to three years of funding, with the current state of Mongolian economy they would not do so;
h) There is a lack of equipment to undertake treatments such as surface dressing – the road maintenance companies tried doing this manually with resultant poor quality and results;
i) Vehicle load limits are 44Tonnes, but we are advised of regular loading of 100-150 Tonnes as enforcement is lacking. Even where enforcement exists, operators have found ways to cheat the system through combining loads after passing through weigh stations;
j) No network level condition data is collected. They have the equipment (ROMDAS) but don't use it for network level data. The only data that is collected is that of the number of faults that need fixing under routine maintenance, such that many early signs of deterioration that could be used to trigger preventative maintenance are not identified;
k) They have a pavement management system (dTIMS software running HDM-4 models) but they don't use it at all – instead they just use Excel. Under recent restructuring the PMS (dTIMS) was transferred to the control of the RTDC, a subsidiary of the MRTD. It is understood the system was set up to predict periodic maintenance needs, but the MRTD thought it should do routine maintenance prediction. When it didn't, they lost confidence and hence stopped using it. Then with no data being collected it basically became useless. Of note is that the draft Road Law specifically requires the use of a PMS system, which MRTD do not currently have in operation.
l) There are 720km of roads in Ulaanbaatar with UBDOR directly responsible for the 280km of main roads. UBDOR advised that they no longer use the SMEC pavement management system as they could not afford the annual licensing fee. Instead they have reverted to the use of Excel. As UBDOR's budget for road maintenance is insufficient to cover all aspects of routine, periodic and rehabilitation works, they have essentially adopted a 'worst first' approach to managing the network. They do have a working road fund, although the revenue into it from road user charges and vehicle licensing fees is insufficient as rehabilitation works envisaged to be funded by MOF has not occurred.
m) The provided Contract Management System (from the ADB TA-7844 capacity development project) for both MRTD and UBDOR is no longer in use.

II. ROAD SECTOR UPDATES

A. Road Sector Roadmap

3. In 2013 under CDTA7844, a Road Sector Roadmap was prepared by the consultant, outlining several initiatives that were proposed to significantly improve the performance of the Mongolian road sector (both the public and private sector components). In 2014, a final update of the Roadmap was produced indicating successes that had been achieved against the recommendations.

4. Since the conclusion of the CDTA assignment in 2014, several those prior achievements have ceased to be in effect – such as the use of the pavement management system. **Appendix 1** contains the full Roadmap, along with the status for those components relating to road maintenance and management.

5. It is felt that all the original recommendations are still valid today, even though many initiatives have stalled (or reversed) in the period since the CDTA concluded. While the final achievement of those recommendations may end up taking longer than originally foreseen to be permanently embedded into routine practice, the achievement of those objectives should remain.

6. The one item where the CDTA approach to achieving the desired outcome would appear to require some revision is that of item 2.1.1 which is repeated below. There appears to be little enthusiasm (or sufficient understanding) of what the dTIMS system was trying to achieve, and with no regular data collection occurring it makes this aspect virtually impossible. However, the draft Road Law does require a Pavement Management System (PMS) to be used to justify the allocation of the road funds.

Table II-1: Roadmap Item 2.1.1 (extract from Appendix 1)

No.	Activity/Outcome	Status
2.1.1	Develop and implement a road maintenance plan for government roads and capital city roads. Obtain sources of funding for overall road maintenance and its facilities. Research current road conditions, which is required to develop and implement a plan of periodic maintenance and reconstruction. Get accustomed to periodic maintenance or reconstruction of capital city paved roads every year in accordance with the plan.	The key component for this task is to functionalize the existing road assets management system or dTIMS at MRTD. The CDTA has developed the front end application in Mongolian to assist MRTD to make use of the system. The system deployment at the Road Research and Supervision Center (RRSC) in addition to operation of the newly purchased road conditions survey equipment will serve a basis for road maintenance program for 2015. Despite, periodic maintenance programs for 2013 and 2014 were developed by the CDTA, no budgets were provided in the subsequent years. **August 2016 Update** dTIMS system is no longer in use by MRTD, owing to the perception that it is too complex and that they could not afford the cost of maintaining the data. Additionally, the road condition survey equipment (ROMDAS) is no longer used for full network level surveys, but rather being used solely for confirming roads have been built within standard.

		MRTD will be unable to meet their legal obligations under the draft Road Law as a result of not having a PMS in place.

7. A revised approach to the generation of a works plan that is sustainable from a business point of view needs to be introduced, or alternatively a refresh of the prior dTIMS (and associated data program) is required. The existing dTIMS[3] model has been coded to reflect the HDM-4[4] model. While theoretically robust, many road authorities around the world have found that the human resource and data requirements needed to implement HDM-4 are very difficult to maintain. Furthermore, the concept of optimization can be difficult to appreciate (akin to a 'black box') for those trying to progress from basic maintenance planning into a more asset management approach. When combined with a financial scenario in which there has been no funding for periodic works for several years, the complexity of the current approach is likely unjustified.

8. Some countries have successfully implemented approaches that are much less data hungry, and which have a much more transparent approach to the optimization/prioritization component. For example,

9. **Figure II-1** is based on the approach implemented in the Democratic Republic of Laos, which is proposed to also be implemented in Cambodia. Like Mongolia, Cambodia had an implementation that consisted of a ROMDAS data collection unit, along with HDM-4 delivering the optimization. Under such a scenario the complexity of HDM-4 (either as a standalone software or coded into dTIMS) is only undertaken every 5-10 years to generate treatment options for representative sections. Then using basic levels of data (the model can be set to run on purely visual inspections if desired), the system can generate a works program and associated condition projections.

10. The advantage of this approach is that it combines the simplicity of basic data collection, the transparency of optimization, with the trustworthiness that HDM-4 provides. Yet the road agency does not need to maintain a capability to run HDM-4, as this can readily be contracted in on a 5-10 year basis to refresh calibration factors and regenerate the necessary outputs. This approach would also appear to meet the requirements of the draft Road Law – meaning that MRTD could demonstrate compliance with the law.

11. On the basis that this approach is supported, then the steps to implement would be as follows:

(i) Agree what data sets will be collected on an annual basis;
(ii) Create representative road sections based on the available data sets;
(iii) Run HDM-4 (or the current dTIMS setup) to model the representative sections; and
(iv) Put in place the procedures to complete the optimization process[5].

12. All of the above can only be considered as being worthwhile if MRTD are operating in an environment where there is a commitment to undertaking data collection, and there are funds

[3] dTIMS is an internationally used asset management system produced by Deighton Associates of Canada (www.deighton.com).

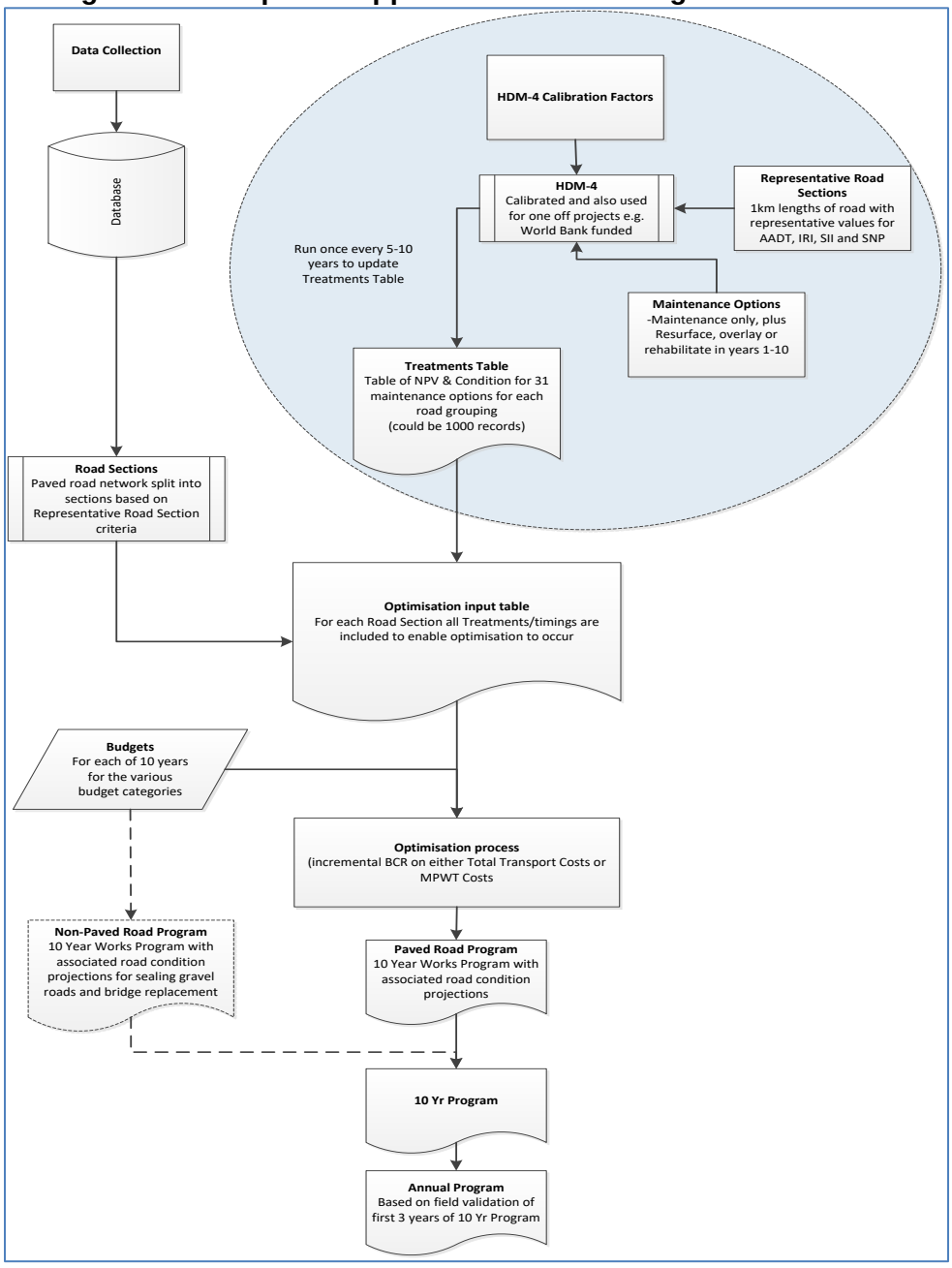
[4] HDM-4 is a tool to generate an optimised works program (www.hdmglobal.com).

[5] As the strategies are already generated, this is a relatively straight forward task to achieve.

available for periodic maintenance and rehabilitation works. Without these fundamental items being in place, there is no point in further investing in asset management systems.

13. To achieve the funding requirement, it is strongly recommended that the draft Road Law be modified to permit the road fund to also include periodic maintenance, and ideally a limited investment in the rehabilitation of roads. There is little chance of MRTD becoming a strong asset management based organization if the ultimate decision on which roads receive periodic works is being made by those in MOF who have no technical knowledge in this field.

Figure II-1: Simplified Approach to Works Program Generation



B. Road Information

14. The MRTD maintain an Excel spreadsheet of basic inventory data (25 data fields). This is checked annually by the road maintenance companies. Therefore, there is no need to update the road information as envisaged. The data currently held includes the following fields – reported for each 1 km of the network in the form of strip maps.

Table II-2: Existing Road Information Held by MRTD

1. Gradient
2. Curvature
3. Pavement Type
4. LHS strip map
5. RHS strip map
6. Corridor Width (m)
7. Pavement Width (m)
8. Shoulder Width (m)
9. Color of surface
10. Base course
11. Soil Embankment
12. Bridges and Culverts
13. Snow risk
14. Sandy/marshy
15. Estimated speed
16. Quality of pavement
17. Roughness IRI (m/km)
18. Skid resistance
19. Pavement Strength (MPA)
20. Traffic (AADT)
21. Left Hand Shoulder width (m)
22. Right Hand Shoulder width (m)
23. Site distance
24. Construction date
25. Original cost

15. Additionally, a current MRTD contract is under implementation that is validating all field data as part of a project to estimate the value of the current assets. With both annual updates occurring and the current network level validation underway (due for completion in June 2017) there may be little need for further work to be completed on this task.

C. Contract Management System

16. Under the CDTA, a Contract Management System (CMS) was implemented for both MRTD and UBDOR. The CMS was noted in 2014 as having the following capability:

17. “Capacity to link with the Contractor and Consultants Registration system and the Project Progress program within the CMS to identify through GIS the road program progress, including the construction and supervision consultants per project. All now fully functional and data entered

by RSRC[6] under supervision. Staff trained in data entry and system management. Significantly increased capacity for integrated management"

18. It appears that the system fell in to disuse as a result of there being no projects to manage through it. Re-establishing the CMS (and the associated Contractor Registration System) to manage works should be part of the implementation of RAM for MRTD.

D. Road Maintenance Service Standards

19. Road maintenance service standards pertain to the specifications of what constitutes a defect and how quickly it should be fixed. The key MRTD documents relating to this topic are:

- UBB80-201-00 Basic Normative of Road and Bridge Maintenance
- TA5744: Maintenance Strategy and Levels of Service

20. The Basic Normative of Road and Bridge Maintenance is in Mongolian and consequentially has not been viewed in detail. It is used within the current road maintenance contracts and is therefore likely to be fit-for-purpose.

21. The TA5744 Maintenance Strategy document includes proposed routine maintenance intervention levels based on a 4-tier road hierarchy as per the example in

22. Figure II-2. While the use of response times (the Rectification Standard) is very common internationally, there is a body of knowledge that suggests using a density based approach (i.e. how many potholes are permitted per km) drives a better asset management attitude into the contractor and are much simpler to manage under a performance based maintenance contracting regime.

[6] Road Supervision and Research Centre, now the RTDC

Figure II-2: TA5744: Routine Maintenance Intervention Levels

Routine Maintenance Intervention Levels and Standards and Rectification Standards				
Intervention and Rectification Standards are defined under 4 separate levels, (i.e. 1 to 4) with time and physical criteria specified for each level. The Intervention and Rectification Standard for each Maintenance Task and level is detailed in this table.				
National and State Highways – Within Towns and City roads		Level 1		
National and State Highways – Rural Areas		Level 2		
Major Arterial Roads		Level 3		
Other Arterial Roads		Level 4		
Maintenance Task Description	**Level**	**Intervention Standard**	**Rectification Standard**	**Unit of Work**
RM100 Sealed Pavement				
RM101 POTHOLE PATCHING Treatment of isolated failed pavement areas <0.25 m2 in traffic lanes using appropriate materials to repair the defect and restore the riding surface to a smooth condition.	All	All potholes which are a hazard to the public	Immediately make safe	No.
	1	Repair all potholes	Rectify within 2 days	
	2		Rectify within 7 days	
	3		Rectify within 14 days	
	4		Rectify within 28 days	
RM102 REGULATION OF WHEEL RUTS AND DEPRESSIONS Application of a levelling course of bituminous materials to depressed or rutted areas of pavement <5 m^2.	1	All defects >50 mm depth measured with 1.2 m straightedge transverse, or under a 3 m straightedge longitudinal	Rectify within 1 week	Rm
	2		Rectify within 2 weeks	
	3		Rectify within 4 weeks	
	4		Rectify within 12 weeks	

23. Based on the work completed under TA5744, it is recommended that a density based routine maintenance performance standard be prepared and used within the proposed physical works contracts. An example format for the density based measure is shown below.

A. Surface Integrity
i) There is no loose bitumen surface material visually observed on the sealed pavement or reported to be dispersing onto shoulders or adjoining properties.
ii) The maximum surface area of raveling or visually evident (≥3mm) cracking within any continuous **1km centerline length** shall be less than **5%.**
[Note: For determining the surface area, a single isolated crack will be assessed as having an equivalent surface area of 0.5m^2 per meter length.]

B. Potholes (Sealed Surface)
i) There is no more than 1 pothole within any continuous **1km centerline length** with a diameter greater than 150mm.
ii) The maximum diameter of any single pothole shall be less than 300mm.
iii) No pothole shall be more than 50mm in depth when measured by tape measure or calibrated steel probe.

C. Heaves, Rutting and Shoves
i) There are no pavement heaves and/or shoves greater than 50mm (when measured by tape measure or steel ruler from peak to trough) **within any continuous 1km centerline length.**
ii) There is no pavement rutting greater than 20mm when measured under a 3m straight edge within any **continuous 1km centerline length**.

D. Edgebreak
i) Within **any continuous 1km centerline length** the aggregated longitudinal edge line length of deficient sealed width **must be less 5m** when measured by measuring tape.

E. Road Maintenance Manual

24. The current manuals are in Mongolian and have not been translated for the purposes of this PPTA. From discussions with local engineers the manuals appear to provide a good prescriptive approach to the repair of road defects.

25. One observation from the field inspections is that the very limited funds available do not appear to be allocated in the most beneficial manner. For instance. while there are plenty of road sections that require urgent crack sealing (to prevent road deterioration) or pothole repairs (for ride quality and safety), there were instances where other parts of the network were undertaking shoulder maintenance works on roads where the shoulders would be considered some of the better ones on the network. Equally the sealing of cracks is inconsistent across the network, with some road maintenance companies focusing heavily on this, while adjacent road maintenance companies have not.

26. It is therefore quite likely that the existing road maintenance manuals do not provide a means of how to prioritize funds to deliver the best benefit. A guide that could be used to better direct the limited maintenance funds to deliver the maximum benefit should be considered a high priority to improve the routine maintenance activities.

F. Supervisions of Road Maintenance

27. There are no existing guidelines within MRTD for the supervision of routine maintenance activities. With the current contracts being largely input based, the supervision of them is essentially akin to a ‘measure and value’ contract, such that there is likely little need for a dedicated guide on supervision of them.

28. However should the MRTD move towards the use of performance based contracts (PBCs) where the focus is on delivering an outcome (rather than inputs or outputs) then it would be worthwhile establishing a guideline for the way these are to be supervised. One of the issues that often occurs when first moving to a PBC environment is that the client (including the supervising consultant if engaged) fail to appreciate that they can no longer direct the contractor to do works, and can only enforce on a performance basis.

G. Guides on Undertaking Road Maintenance

29. The key documents that prescribe the means of undertaking road maintenance within Mongolia are:

(i) CCM13-03-00 Methodology and technology for the maintenance of road and road structure
(ii) AD-13-202-00 Regulation for the management of maintenance of road and road structures
(iii) CCM 80-04-00 Regulation to determine the normative period for maintenance of road and road structures
(iv) Xxx Technical specifications for the maintenance of road and road structures
(v) UBB80-201-00 Basic Normative of Road and Bridge Maintenance
(vi) TA5744: Maintenance Strategy and Levels of Service

30. Unfortunately these guides are all in Mongolian and without full translation it is not possible to comment on detailed aspects of the documents. However on the basis of discussions with the domestic road maintenance specialist (via translator) it would appear that the current documents cover the full scope of maintenance activities, and that they have a focus on methods of repair.

31. If moving to a performance based contracting environment, then it will likely be necessary to develop a new specification that defines what is the defect, and what performance is required in terms of its repair – but leaves the method of repair more open for the contractor to innovate.

H. Road Condition Surveys

32. Road condition surveys can be readily divided into three groups:

(i) Annual (or some regular interval) traffic speed automated data collection using lasers or ultrasonic sensors to yield measurements of roughness, rutting and similar indicators;
(ii) Annual visual condition assessments of cracking, potholes, edgebreak etc. that records all defects (even those that do not warrant works); and
(iii) Regular maintenance inspections that identify defects warranting repair.

33. At present the MRTD engage the RTDC to undertake the automated data collection program. The RTDC have been previously supplied with industry recognized equipment for this purpose. It is unclear how much network level data is collected by RTDC, as no network level data was forthcoming when requested and instead it is believed that only project specific data requests are undertaken (post construction or for investigative purposes).

34. The conducting of a regular visual condition assessment for determining the overall condition of the network is not undertaken, such that it is not possible to currently gain an understanding of the condition of the network.

35. The road maintenance companies (state and private) undertake the 3rd grouping of inspections to generate a budget request, and to then allocate the budget to the network.

36. The documents that guide how the visual inspections are to be undertaken are:

- UBB80-201-00 Basic Normative of Road and Bridge Maintenance; and
- TA5744: Maintenance Strategy and Levels of Service

37. Once again, the key documents are in Mongolian and have not been translated for review purposes. There does appear to be a good understanding of how to undertake visual condition rating, although the way this information is then recorded onto paper and not input to an information management system means that much of the value of this data is lost.

I. Control of Overloaded Vehicles

1. Background

38. Overloaded vehicles are a significant issue in Mongolia, with the result being not only excessive wear and tear of the pavements, but also creating congestion through their slow speeds, along with creating safety issues – particularly on long downgrades. While Mongolia has

laws and weigh bridges to prevent overloading, the enforcement of these laws is not effective owing to the lack of involvement of the police in this matter.

39. The permissible weights and lengths of the various vehicles are shown in Table II-3 and Table II-4.

Table II-3: Permissible Gross Vehicle Weight

Vehicles' categories	Gross weight, ton
2 axles vehicle	18.0
3 axles vehicle	24.0
4 axles vehicle	38.0
5 axles vehicle	40.0
6 axles vehicle	44.0

Table II-4: Permissible Vehicle Length

Vehicles' categories	Length, m
Vehicles other than bus with more than 9 seats and gross weight of more than 5 ton	12.0
Bus with more than 9 seats and gross weight of more than 5 ton	13.7
Trailer	12.0
Combination truck with semi-trailer	16.5
Combination vehicles comprising tractor truck and trailer	18.75
Other combination vehicles	18.5

2. Overloading Legislation

40. **Legal references regarding overloading.** Article 17.3.4 of the Mongolian Law on Roads stipulates that "Users of the roads and road infrastructure facilities shall be prohibited to travel in chain tires with no protection or to travel in chain tires or in a vehicle which is overloaded or which has axle load in excess of the maximum of technical and utilization capacity of such road and road infrastructure facility." Articles 8.1 and 23.3.3 of the Law also state that "The state supervision of roads shall be exercised by state road inspectors" and "Any person who violates Article 17, paragraph 3 of this law shall be fined up to 50000 tugrik, and in the case of business entities and organizations shall be fined from 100000 to 250000."

41. Also, Article 10.2.5 of the Mongolian Law on Transport states that roads and road infrastructure facilities shall be used as per technical specifications and requirements. Article 10.2.6 states that all transport shall meet the vehicle usage standards and requirements; while Article 20.1 of the same law stipulates supervision and control of the transport sector shall be exercised by the state transport inspector in addition to the state central administrative institute. Article 23.1.1 of this law also imposes fines up to 30000-60000 tugrik on officers, 5000-30000 on individuals and 100000-250000 on institutions and business entities, who violated Article 10.2 of the same law.

42. The State Inspection Agency is the operating name of the state central administrative institute. State Transport Inspectors are certified by the Agency and can (and has previously) included MRTD staff such that full control of overloading is within the authority of MRTD.

Unfortunately under budget constraints and restructuring, those MRTD staff were made redundant, such that only police remain in place to undertake the enforcement of the laws.

43. The state inspection and monitoring for compliance of laws, regulation and other public legal acts are being implemented by the Professional Inspection Institute through its state inspectors in accordance with the Law on the State inspection and monitoring.

3. Procedure on Operation of Digital Axle Weigh Pad/Bridge

44. To prevent overloading, the *Procedure on Operation of axle load weigh pad/bridge* has been approved under the Order No. 109 of 2014 of the then Minister of Road and Transport (now MRTD). Four weigh bridges were installed at Khoolt pass toll station, Ulziit village toll station, Baganuur-Kherlen bridge toll station and Zamyn-Uud toll station respectively. There are two types of digital weigh pad/bridge: portable and fixed. Under law, the locations are determined by the sector Ministry (MRTD) based on traffic volume, location of toll station, volume of freight transport, flow and directions, with operation of the weigh bridges the responsibility of the RTDC.

45. Road and transport inspectors must be present at axle weigh locations for any weighing to be legitimate. State inspectors then exercise their powers such as disallowing modes of transport that do not comply with the proper technical standards set for a certain classification of road in accordance with Article 8.2.3 of the Law on Roads, imposing fines as per 23.1.1 of the same law and setting fines with regard to overloading in addition to road tax fixed under Annexure 2 of the Decree No. 103 of 2016 specified in Section 3.4 of the Regulation. Axle weighing point operation expenses shall be financed from Road fund as stipulated in Article 18.3 of the Law on Roads.

Table II-5: Road Usage Tax (tolls)

Type of transport mode	Classification	Tariff /MNT/
Passenger transport	Up to 12 seats	1000.0
	12-24 seats	2000.0
	More than 24 seats	3000.0
Freight transport	With 2 axles and up to 3.5 tn net weight	2000.0
	With 2 axles and 3.5-18 tn net weight	3000.0
	With 3 axles and 18 tn net weight	4000.0
	With 3 axles and 18-25 tn net weight	5000.0
	More than 4-axles and up to 25 tn net weight	6000.0
	More than 4-axles and more than 25 tn net weight	10000.0
Others	Equipment & machineries	10000.0
	Motorcycle	500.0

Table II-6: Penalty Tariff for Overload Vehciles

Classification	An Individual	Body Corporate /MNT/
With 2 axles and up to 3.5 tn net weight	Up to MNT50000 plus MNT2000 for every additional ton of the allowable weight	MNT100000 to 250000 plus MNT2000 for every additional ton of the allowable weight
With 2 axles and 3.5-18 tn net weight	Up to MNT50000 plus MNT3000 for every additional ton of the allowable weight	MNT100000 to 250000 plus MNT3000 for every additional ton of the allowable weight

Classification	An Individual	Body Corporate /MNT/
With 3 axles and 18 tn net weight	Up to MNT50000 plus MNT4000 for every additional ton of the allowable weight	MNT100000 to 250000 plus MNT4000 for every additional ton of the allowable weight
With 3 axles and 18-25 tn net weight	Up to MNT50000 plus MNT5000 for every additional ton of the allowable weight	MNT100000 to 250000 plus MNT5000 for every additional ton of the allowable weight
More than 4-axles and up to 25 tn net weight	Up to MNT50000 plus MNT6000 for every additional ton of the allowable weight	MNT100000 to 250000 plus MNT6000 for every additional ton of the allowable weight
More than 4-axles and more than 25 tn net weight	Up to MNT50000 plus MNT10000 for every additional ton of the allowable weight	MNT100000 to 250000 plus MNT10000 for every additional ton of the allowable weight

4. Operation and current state of axle weighing facilities.

46. As mentioned above 4 axle weighing points have become operational since 2014. They are located at the toll stations. 19 employees of the toll stations who have been trained are operating axle weighs. 23 state inspectors of the Transport and Road Departments of Tuv and Dornogobi provinces have been contracted to supervise axle loads of vehicles under Order No. 181 of 2014 of the MRTD, however nominated inspectors were laid off due to merging of Transport and Road Departments with National Transport Center in accordance with Government of Mongolia's Decree of 2015 "Actions on Organizational structure of state institutions". Since then, axle load control operation (i.e., forbidding overload vehicles to use road and imposing other administrative measures) has ceased. Currently, operators are responsible for axle weighing operation by detecting and recording overloaded vehicles only, allowing vehicles to continue their journey with no fines. Additionally, some drivers of overloaded vehicles avoid toll stations and axle weighing points by taking alternative routes.

47. Revenue from toll stations continue to increase in last 5 years and 30 percent of total revenue is allocated for operational expenses out of which 85 percent is paid out for employees' wages. Employees working at axle weighing stations are paid from this.

Table II-7: Revenue of total toll gates for last five years

Years	Revenue, million MNT	Operational Cost, million MNT	Salary, million MNT	Total Percentage of Operational Cost
2011	1414.8	455.3		
2012	2205.0	691.6		
2013	2300.03	826.1	710.15	30.8
2014	2901.5	962.7	825.7	28.5
2015	3057.8	962.7	851.5	27.8

Table II-8: Load measurement data at Khoolt axle weigh point

Period	Vehicle type	Vehicle weighed	Vehicle found to be overloaded and prohibited	Percentage of vehicle prohibited

January to August, 2016	Heavy goods vehicle	5455	1013	18.5

Table II-9: Revenue collected at Khoolt axle weigh point

Period	Vehicle type	Vehicle weighed	Vehicle found to be overloaded and prohibited	Total amount of fines collected over the period /million MNT/
August, 2014	Heavy goods vehicle	4150	548	15.1

5. Future Expansion of Toll and Weight Stations

48. Despite MRTD's planning in 2013 for the establishment of 34 axle weighing stations between 2014-2015 with associated approval by the Government of Mongolia and incorporation in the Minutes of Cabinet meeting No. 51 dated 4th October 2014 as *"… optimization and intensification of monitoring of weight and load of various vehicles, implement by allocating necessary funding into annual budget*", the same was never materialized. The current iteration of the MRTD and associated government has not progressed this original plan.

49. Instead a new plan for the implementation of 53[7] combined toll and weigh stations across the paved state highway network is proposed (refer to Figure II-3). In association with the new proposal is a plan to hold overloaded vehicles at the weigh stations until another vehicle arrives to take the excess load – but not to issue fines for the damage that would have already been caused to the road network. The new plan is based on work completed by the Korean's on the introduction of an electronic toll collection system (ETCS) to replace the current manual system[8].

[7] MRTD provided location plan only shows 38 sites.

[8] ETCS Feasibility Study for Mongolia, Final Report December 2015. Prepared by National IT Industry Promotion Agency, Republic of Korea.

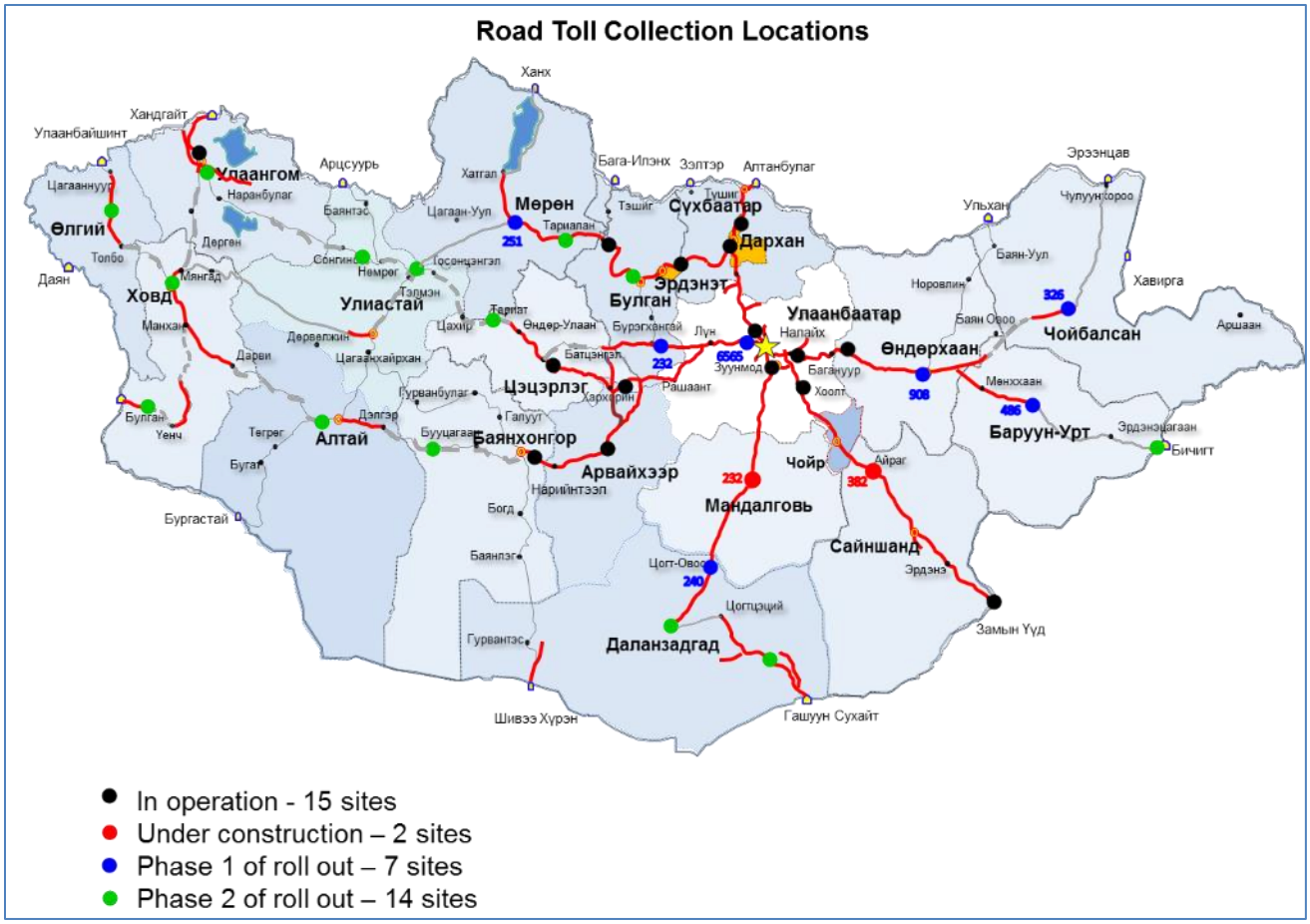


Figure II-3: Location of Proposed Toll Booths / Weigh Stations

50. The cost estimate of the proposed toll and weigh station is reported at MNT3b/booth (approximately US$1.5m/booth). While a review of the proposed system is not within PPTA scope, the following points are noted regarding this proposal:

(i) Tolling on roads that do not have restricted access (such as expressways) is not that common internationally, and is difficult to enforce as drivers can readily circumvent the toll booths and rejoin the road. The report does not appear to reference any countries where tolling has been successful for non-restricted access roads. This therefore makes the Mongolian situation a high-risk implementation;

(ii) The report considers non-tolling options, which are widely used for charging on unrestricted access roads – such as fuel taxes and pre-paid weight based road user charges. These would appear to avoid much of the costs of the proposed system, and would also avoid the significant vehicle operating costs, emissions, and travel time costs associated with stopping all vehicles at toll booths;

(iii) The ability to issue a large fine to those who deliberately avoid the toll booths should be initiated;

(iv) The proposal is to not fine overloaded vehicles, but to just stop them travelling further. This approach neglects to reflect the cost of damage already done by the overloaded vehicle in getting to the weigh bridge. Overloaded vehicles should incur both a fine and the inability to continue with their journey;

(v) The intent is to force overloaded drivers to wait for another vehicle to offload the excess load. What happens when a driver only has one vehicle? Do they off load at the weigh bridge? And if they do, then the dumping of low worth goods could be commonplace as has happened in other countries;
(vi) ETCS's often have a high maintenance cost owing to the prevalence of electronic componentry – this would expect to be worse in Mongolia owing to the severe weather. MRTD may well be better placed to contract out on a performance basis for the installation and maintenance of the electronic components, rather than endeavor to maintain the equipment themselves;
(vii) The proposed design in the report for the combined tolling and weight measuring system is impractical for locations where overloading occurs, as vehicles will be trapped in the TCS lane and need to back up. A separate weigh station to the side of the road in advance of the toll booth would be more practical;
(viii) Using pairs of ETCS the MRTD can determine the average speed of drivers over the length of road, from which speeding tickets should be issued to improve road safety;
(ix) To be effective, the weigh bridges and toll system needs to operate 24 hours per day, otherwise drivers will just travel during non-operational hours; and
(x) The success of the system ultimately requires the Police to support MRTD. Experience in the past few years with the existing ADB funded weigh bridges indicates that gaining the necessary support to man 53 stations (many for 24 hours per day) will be a challenge.

6. Approach within this TA Project

51. The implementation of the full ETCS is unlikely to be affordable within the context of this project. However, the control of overloading is essential to ensure that any investment made in the road network is protected. It is therefore recommended that for those project roads that overlap with the proposed toll booth / weigh station locations, the following be considered for installation:

- Construct the basic physical infrastructure that would facilitate future installation of ETCS (outside of this project);
- Facilities to implement manual tolling as occurs at present are installed (booth etc.); and
- Weigh bridge is installed to permit the stopping (and ideally fining) of overloaded vehicles.

52. The above would permit MRTD and the police to enforce overloading controls, without the significant cost of the full ETCS concept.

III. TECHNICAL SOLUTIONS

A. Background

53. This section presents recommendations on technical solutions that MRTD could trial to address issues experienced on the Mongolia highway network. Options for maintenance of the unpaved and unformed road network have not been addressed here, as aside from regular grading (and regravelling) to maintain ride quality and cross-section, the options are limited. At present the funding for routine maintenance of the road network is around 15% of need, with funds for periodic and rehabilitation also severely limited. It is therefore difficult to determine if the issues identified below and solutions proposed to those issues are because of not being aware of them, or not being able to implement them.

1. Road Maintenance Solutions

54. As noted in the inception report, only 15% of the requested maintenance funds for repairing basic defects (potholes, crack sealing etc.) was provided for in the 2016/17 budget by the Ministry of Finance (MOF). Discussions with the MOF indicate that this is not through a lack of understanding of the importance of road maintenance, but rather reflects the significant financial constraints that Mongolia is operating under.

55. The nature of road maintenance observed on the highway network is primarily of pothole patching and crack sealing. Observations are that when undertaken, that the works appeared to be of a suitable quality. However, there is clearly a lack of consistency in approach towards the allocation of available routine maintenance funds, with some lengths of road having substantial quantities of crack sealing, while the adjacent road length (of similar condition and age profile) has none. This inconsistency in prioritizing available funds is addressed further in Section II.G above (Guides on Undertaking Road Maintenance).

Figure III-1 : Evidence of Crack Sealing

56. The general absence of drainage assets because of the highway being built on a raised embankment, along with the generally low levels of rainfall across the network, greatly reduces the maintenance issues associated with such assets compared to that observed in other countries.

57. Greater focus could be placed on the following items:

(i) **Roadside vegetation/shoulder maintenance**: In particular, that which has been allowed to grow on the shoulder very close to the edge of the paved surface, as

illustrated in Figure III-2, is a problem on parts of the network. Not only does this create safety issues (drivers move to the centerline when physical obstructions are close to the edge of the road), but also undermines the integrity of the road structure and can lead to moisture entering the pavement. Furthermore, the lack of site-lines to improve passing opportunities on some routes because of poor vegetation control also reduces the effective capacity of the highway network leading to increased congestion. There may also be a slight reduction in animals wandering onto the highways if vegetation was less prevalent; and

(ii) **Road Markings**: There is inconsistent installation and maintenance of road markings as per the section below.

58. In general, other maintenance deficiencies (unfilled potholes, cracks unsealed etc.) appear to be more a lack of funds than a lack of knowledge or ability to undertake the works.

Figure III-2: Example of Vegetation on the Road Shoulder

2. Minor Repairs

59. While many repairs appear to be well constructed, there are many locations on the network where patches have failed within a relatively short period of time, indicating that the repair did not address the underlying cause of the failure. Figure III-3 illustrates examples of the sort of failed repairs witnessed during site visits, with both the top and bottom figure indicative of a situation where new asphalt surfacing was placed without the pavement being repaired. Such approaches can be considered a waste of what limited maintenance funds are available.

60. A further issue with some of the repairs is the lack of ride quality. In extreme cases such as Figure III-4, the repair is sufficiently poor that the decision has been made to paint hazard

warning marking on the patch. Instead the contractor should have been required to correct this at their cost – either redoing the patch, or applying a gradual ramping up to the patch through further placement of asphalt in advance of (and after) the current patch. The uneven surface not only creates a rough ride, with associated increase in vehicle operating costs, but also causes impact loading resulting from vehicles bouncing.

61. The accepted and documented practice for minor repairs does include the fix of the underlying pavement defects as per the photographs in Figure III-5. From the photographs it is evident that the damaged pavement is removed, new materials placed, and the surface reinstated. Assuming the quality of materials and workmanship is controlled, then a repair of this nature should not readily fail as per the evidence in Figure III-3. While not related to the quality of the minor repairs, the photographs also show that the original pavement appears not to have a good clean aggregate as a basecourse, with a high level of clay particles present – which may well explain the reason for the failure in the first instance.

Figure III-3: Examples of Failed Minor Repairs

Figure III-4: Patch that Is Not at Correct Level

Figure III-5: Examples of Good Minor Repair Works

3. Surface Dressing

62. Surface dressing is one area where there appears to be significant scope to reduce the cost of periodic maintenance works in Mongolia. With the vast majority of the network being low traffic volume (<1000 AADT) a suitably designed surface dressing (polymer modified bitumen (PMB) to handle the temperature extremes) should be able to survive comfortably in the 8-10 year range, and potentially longer if quality is maintained. Given the length of the road network that has not had a resurfacing treatment in over a decade, the ability to protect greater lengths using surface dressing is a high priority alternative to trial. This treatment is proposed in Output 1 of the Project.

63. With an expected unit cost only 30-40% of asphalt concrete resurfacing, the introduction of surface dressing on a major scale would enable for greater lengths of the network to be protected. This would in turn significantly decrease the quantity of routine maintenance for crack sealing and in turn reduce pothole repairs. The downside to surface dressing is that it has a lower tolerance to low quality control. Everything from the quality of the aggregate, to the design of the PMB, to the rate of bitumen and chip application, through to the rolling to embed the chip is essential to get good results.

64. A prior trial of surface dressing in Mongolia was noted by the local counterparts, however this was undertaken using essentially manual labor and equipment techniques, with the resulting quality not being great. If surface dressing is to be implemented again, then it is essential that quality control that covers all aspects of the treatment be in place – this will also necessitate the use of appropriate equipment.

4. Slurry Seals and Microsurfacing/Micropaving

65. As an alternative to surface dressing, slurry seals and microsurfacing (also known as micropaving) can be used to rejuvenate the surface and restore a waterproof surface. Figure III-6 provides technical details on these two products. Unlike surface dressing where currently there is no equipment in Mongolian to undertake the treatment, it is understood that suitable equipment is available for these products.

Slurry Seals

A slurry seal is a homogenous mixture of emulsified asphalt, water, well-graded fine aggregate and mineral filler that has a creamy fluid-like appearance when applied. Slurry seals are used to fill existing pavement surface defects as either a preparatory treatment for other maintenance treatments or as a wearing course. There are three basic aggregate gradations used in slurry seals:

1. **Type I (fine)**. This type has the finest aggregate gradation (most are smaller than the 2.36 mm (No. 8) sieve) and is used to fill small surface cracks and provide a thin covering on the existing pavement. Type I aggregate slurries are sometimes used as a preparatory treatment for HMA overlays or surface treatments. Type I aggregate slurries are generally limited to low traffic areas (ISSA, 2001a[1]).
2. **Type II (general)**. This type is coarser than a Type I aggregate slurry (it has a maximum aggregate size of 6.4 mm (0.25 inches)) and is used to (1) treat existing pavement that exhibits moderate to severe raveling due to aging or (2) to improve skid resistance. Type II aggregate slurry is the most common type.
3. **Type III (coarse)**. This type has the most coarse gradation and is used to treat severe surface defects. Because of its aggregate size, it can be used to fill slight depressions to prevent water ponding and reduce the probability of vehicle hydroplaning.

Microsurfacing

Microsurfacing is an advanced form of slurry seal that uses the same basic ingredients (emulsified asphalt, water, fine aggregate and mineral filler) and combines them with advanced polymer additives.

Source: http://www.pavementinteractive.org/article/slurry-seals/

Figure III-6: Slurry Seal and Microsurfacing

66. Within Mongolia a 36km length of slurry seal was completed in the south Gobi area in 2015 by domestic contractors. During the following winter season areas of the slurry had delaminated and required repairing. This repair occurred in summer of 2016. Further monitoring is required to determine the long-term durability of slurry seals in the Mongolian climatic conditions and/or if a refined specification is required.

5. Asphalt Concrete Overlay

67. Asphaltic Concrete (AC) overlay is the standard approach to periodic resurfacing works in Mongolia. There is however an observable variation in the design of the AC mixes being used on the network – with some appearing as a well graded aggregate, while on nearby sections the mix uses a much greater proportion of large stones – with the result being a somewhat ‘ugly’ product that would be expected to yield a poorer performance.

68. It is observed that the current lifecycle of many of the AC surfacings on the network are well over 10 years old, with many lengths still in relatively good condition after 15 years. This suggests that the ability to design and place a good quality AC surface exists within the local construction industry.

69. Reflective cracking – especially of the thermal expansion cracks that typically occur at 5-10m intervals – will remain an issue due to the harsh environment of Mongolia. As a ‘rule of thumb’ reflective cracking will move up through a new surfacing at approximately 25mm/year. So for a

50-75mm resurfacing overlay, it can be expected that the cracks will begin to reappear on the surface after 2-3 years. AC overlay should therefore not be considered as a remedy for cracking, but rather is undertaken to address an aging AC surface that is at risk of unravelling, or to address surface irregularities – rutting or short wavelength roughness.

70. Options to control reflective cracking include geotextiles, and specialized coatings under the AC such as NovaChip® or Stress absorbing membrane interlayer (SAMI) seals. While these approaches will reduce the cracking from the bottom reflecting up (or at least retard the time before it reappears), the thermal cracking of the new surface will reoccur after a few winter cycles.

6. Pavement Reconstruction

71. Based on the substantial lengths of road construction and rehabilitation that has been undertaken in Mongolia over the past decade – much of which was under the design and supervision of international specialists and built by international contractors – it is reasonable to conclude that the most appropriate means off construction roads in Mongolia have been used considering the materials and equipment available within Mongolia and neighboring countries.

72. MRTD are also very familiar with cement stabilization for the rehabilitation of pavements, especially where there is a higher clay content in the granular materials.

7. Drainage Systems Repairs and Reconstruction

73. As noted previously, there is very little formal drainage infrastructure on the road network. This is a consequence of the low rainfall in the country, in combination with the practice of building roads on embankments. Many of the cross-carriageway drainage structures are large box culverts that also serve as animal underpasses.

74. Based on the observed assets and low rainfall conditions, there is little to be gained from refining current practices.

8. Signs and Markings

75. Based on site visits, the implementation of signs and markings on the newly constructed roads appears to be of a high standard. The presence of snow and associated need to plough roads limits the viability of installing profiled edge lines and raised pavement markings.

76. Beyond the use of long-life pavement markings such as thermoplastic that could potentially last the life of the road surface, there are few other new initiatives that have not already been implemented within Mongolia.

9. Safety Measures

77. From the completed site visits, the following observations have been made in relation to safety on the network:

(i) While the open road speed limit is 80km, vehicles were regularly in the100-130km/hr range when the road condition and alignment was good, and only got close to the speed limit if traffic or road condition dictated it;
(ii) There is no apparent enforcement of speed limits or traffic offences by police, unless there is an accident to investigate;

(iii) There is isolated guardrail on various corners and steep grades (refer to Figure III-7 and Figure III-9), although none was observed to have any end terminal treatments installed. There are many lengths of guardrail on the approach to bridges that have not been connected to the bridge (refer to Figure III-8). This would result in vehicles being directed into the end of the concrete abutment. Numerous lengths of guardrail had been damaged and would appear to have been unrepaired for some time (presumably owing to budget constraints);

(iv) Steep down grades generally have 'steep grade' warning signs. Additionally many relatively minor up grades have warning signs that appear to be unnecessary;

(v) Some curve advisory chevrons are in place as per Figure III-9. There did not appear to be consistent usage and the signs are very small versions;

(vi) Concrete edge marker posts painted red/white are installed to indicate curves, intersections and to indicate culverts as illustrated in Figure III-10;

(vii) The standard cross-section involves the road being built up on an embankment, typically around 1m above the surrounding countryside. The clear majority of these embankments have shoulders/drains that are non-traversable should a vehicle leave the carriageway. Maintenance of the shoulders and berms appears to be a very low priority under current financial constraints – although some large trees would suggest that maintenance of the shoulder was not a priority even in better financial times;

(viii) Line marking is variable between good and non-existent (refer to Figure III-13). In general, only centerlines are marked, although on newly constructed roads the edge lines are also marked (refer to Figure III-12); and

(ix) To reduce speeds into towns/cities it is common practice to install speed humps/bumps – sometimes there is even advance warning that they are there (refer to Figure III-14).

78. Overall it would be fair to summarize the situation as being highly variable, from what could be considered equivalent to world best practice, all the way to lacking basic safety markings and in some cases the unmarked speed humps could well be more of a safety hazard than a safety device.

Figure III-7: Guardrail and Culvert Markers

Figure III-8: Guardrail Not Connected to Bridge Abutments

Figure III-9 : Very Small Chevrons Warning of Curve

Figure III-10: Edge Marker Posts / Culvert Markers

Figure III-11: Signage in Approach to Major T-Interesction

Figure III-12 : Line marking On Newly Constructed Road

Figure III-13: Lack of Nighttime Delineation on Older Section of Road

Figure III-14: Example of Poorly Marked Speed Hump

79. The addition of specific safety measures (outside of signs and markings) will add both implementation and maintenance costs. With the current funding constraints for road maintenance, along with the observation that many existing safety assets (guardrails, guideposts at intersections, hazard markers at culverts, etc.) are not able to be repaired when damaged, it is reasonable to presume that only safety measures that have very low (and preferably no) ongoing maintenance costs will deliver benefits over the longer term. This situation means that the primary means of delivering a safe network will need to be through the geometric design of alignments that don't require additional safety assets, along with implementing vehicle and driver controls to ensure safe usage of the roads.

80. The team have not been provided with data to confirm the primary accident types, however anecdotal evidence suggests the safety issues in Table III-1 are prevalent on the network.

Table III-1 : Suggest Safety Measures with Low Maintenance Costs

Safety Issue	Possible Safety Measures
Overloaded vehicles losing control on long steep grades	• Enforce vehicle weight limits to reduce occurrence of vehicles losing control • Ensure all long steep grades are signed in advance to warn drivers to use a correct gear/speed • Install 'run away lanes' up the side of hills • Install truck arrester beds (these require maintenance to be effective)
Crashes at junctions	• Ensure road markings and signage is maintained • Ensure vegetation is maintained to provide maximum visibility of intersections

Safety Issue	Possible Safety Measures
Night time crashes	• Ensure delineation (centerline, edge line and edge marker posts) are installed and maintained
Hazards adjacent to the carriageway	• Where possible remove hazards within 8m of the edge line, but at a minimum ensure shoulder is clear of all hazards (including trees) to the base of the side drain or base of embankment • Install hazard markers on the hazard • Guardrail should only be installed as a last resort given it can have high maintenance costs
High speeds through urban areas	• Have police enforce speed limits in urban areas • Introduce speed cameras as a legal means of enforcing speed limits • Install threshold treatments to create a physical entrance to the urban area, and repeat at 200m intervals through the urban area
Dangerous overtaking maneuvers	• Ensure roadside vegetation is maintained to provide for clear sight lines • Enforce no overtaking line markings • Provide passing lanes

IV. THREE YEAR PERIODIC MAINTENANCE PROGRAM

A. Background

81. Despite putting forward a request to fund a periodic maintenance program each year, MRTD have not been successful in receiving any funding for periodic maintenance activities for several years. Discussions with MOF indicate that there is an understanding of the importance of undertaking periodic maintenance (along with routine maintenance) and that the issue is simply a lack of funds to allocate to these works. Investing significant time in effort into developing a 3-year periodic maintenance program is therefore of limited value, as the likelihood of the program being implemented is very low; and by the time the works would finally occur a different program of work (or nature of work) may be more appropriate.

82. It is noted that there is a lack of network level condition data (roughness, rutting, cracking etc.) to undertake this exercise on the basis of robust predictive modeling that would permit the program to be economically prioritized. Initial plans were to instead use the maintenance defect data to develop the program (in conjunction with existing inventory data), however this too is unavailable at a level of detail to support program development. In any case periodic works are more typically undertaken to reduce life cycle costs, than they are to yield an economic return.

B. Existing Works Program

83. MRTD have a map indicating which lengths of road a likely requiring periodic maintenance, reconstruction or routine maintenance based on the age of the asset (refer to Figure IV-1). While age is a good basic indicator of need, site visits along various routes indicate that the quality of construction is highly variable – with some roads under 3 years of age requiring reconstruction, while others are 16 years old and require only periodic works.

№	Хатуу хучилттай авто замын насжилт, засварын төрөл		Урт /км/	Эзлэх хувь
1	2-5 жилийн насжилттай авто зам	Арчлалт, урсгал засвар	825.4	28%
2	5-13 жилийн насжилттай авто зам	Ээлжит засвар	1621.3	55%
3	13-аас дээш жилийн насжилттай авто зам	Их засвар, шинэчлэлт	501.2	17%
Хатуу хучилттай авто замын нийт урт дүн			2947.9 км	100%

Legend: Green=2-5yrs old (routine maintenance); Blue=5-13yrs old (periodic maintenance); Black=13+yrs old (rehabilitation); Red=Under construction

Figure IV-1: MRTD Periodic Works Program

84. In advance of the inspection of the road from Ulaanbaatar to Zamyn-Uud the road maintenance companies prepared a works program. Comparison of the maintenance companies program with that from our own inspections, as well as looking for consistency between maintenance companies when faced with similar road conditions indicates there is a need for better guidance and training in the selection of treatments.

85. It is suggested that within the capacity development aspect of the project that a simple decision tree for treatment selection is developed, and an associated training program for MRTD and maintenance company staff is prepared. Along with ongoing auditing this should result in more optimal and consistent programs of work being prepared. A simplistic example of a treatment selection algorithm is presented in Figure IV-2. Once such a process was in place, the road maintenance companies could be tasked with preparing the 3-year field based works program for their road network.

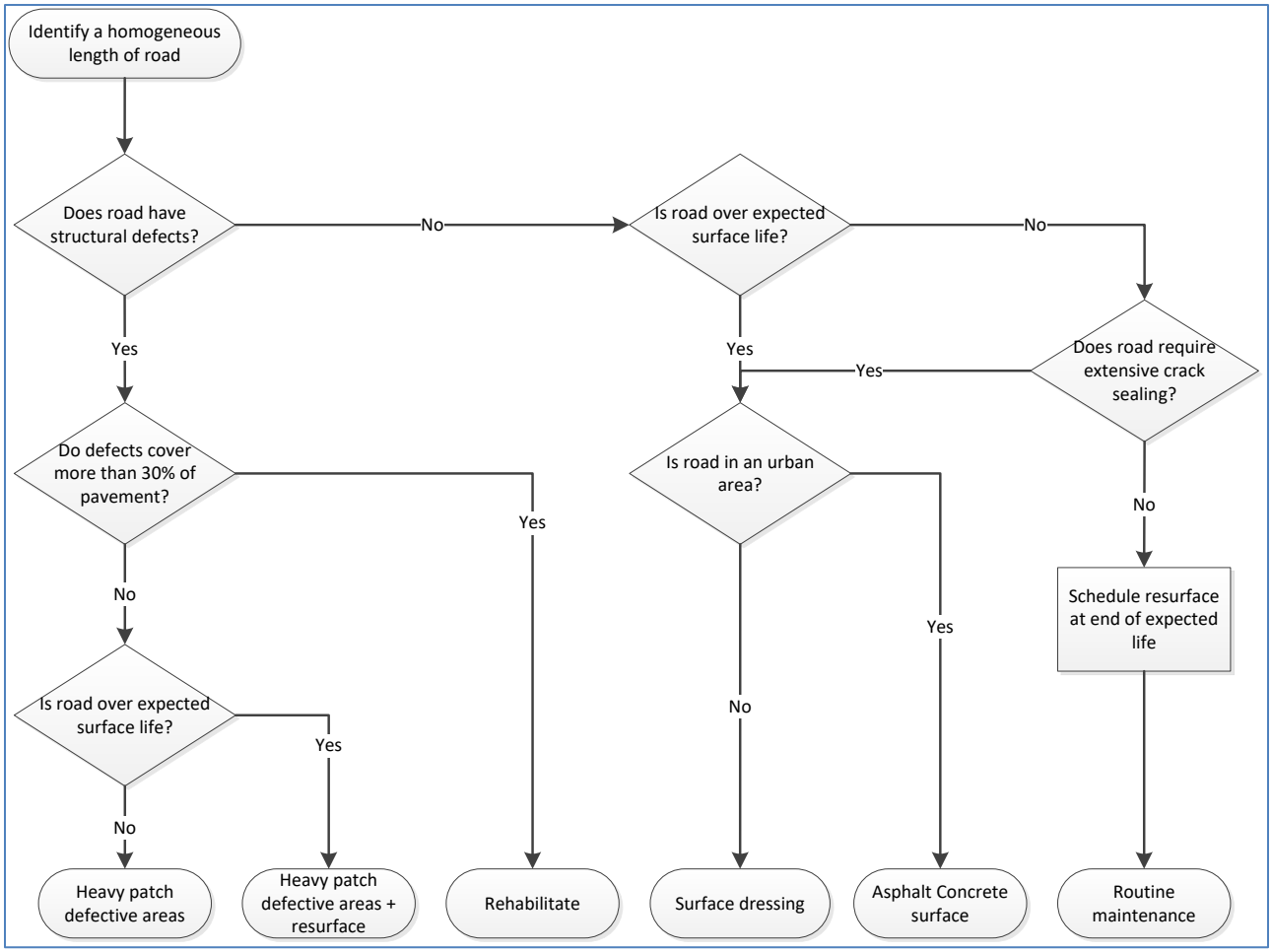


Figure IV-2: Example Treatment Selection Algorithm

C. Field Based Works Program

86. Owing to the lack of condition data, site visits were undertaken of the following three key routes:

(i) Ulaanbaatar-Darkhan-Altanbulag
(ii) Ulaanbaatar-Chinggis-Baruun Urt-Bichigt
(iii) Ulaanbaatar-Choir-Sainshand-Zamyn-Uud

87. From these site visits and available inventory data, a program of works was prepared that has informed the project design. The program only covers the periodic and rehabilitation needs of the existing asset. Suggested upgrading works to address safety or congestion issues are discussed in the following section.

88. Unit costs are based on provided rates from MRTD. In general, the program is considered to be slightly conservative, such that it is possible that some areas identified for rehabilitation may

be downgraded to a mill and replace treatment should testing indicate that the deficiencies are just in the surface layer.

D. Upgrading Works

1. Completion of Road at Zamyn-Uud

89. For a variety of reasons there is a length of unformed road just north of Zamyn-Uud. In total the unformed length comprises approximately 3.9km, which consists of a 0.7km length from the end of the existing road (when heading south) to the privately built road 4-lane link to a freight logistics center, and then a further 3.2km from the 4-lane road to the end of the paved road exiting Zamyn-Uud town center.

90. As this time the completion of this is outside the scope of the project. However in the broader interest of inter-country connectivity and creating an overall quality transport network to support the economy, completion of the missing link should be included in MRTD work programs.

2. Widening of Paved Surface

91. There are several roads on the network where considering traffic, vertical and horizontal alignment, anecdotal accident history, and road condition – the existing paved width is sub-standard resulting in safety and congestion issues. For example, the road between Ulaanbaatar and Darkhan has a nominal paved width of 6.7-7m on a 10.5m embankment. By comparison the more modern roads (with comparatively lesser traffic and better geometric standards) have paved widths of 9-9.5m on an embankment of 12m.

92. When undertaking road rehabilitation works, opportunities to widen the paved road to closer to a 10m width (2 x 3.5m lanes, plus 1.5m paved shoulders) should be considered.

3. Construction of Climbing (Passing) Lanes

93. It was observed during the site visits that there was an apparent need for some passing lanes on the various long moderate-steep grades, wherein the combination of overloaded and underpowered trucks resulted in very slow speeds with associated high levels of congestion and unsafe passing maneuvers.

94. Using data collected during the site visits[9], it was possible to generate a longitudinal profile of the route, and from this to identify grades where passing lanes could be required. It is important to note that the methodology is only examining gradient impacts, and is not identifying lengths of road where capacity is insufficient owing to traffic demand.

a. Methodology

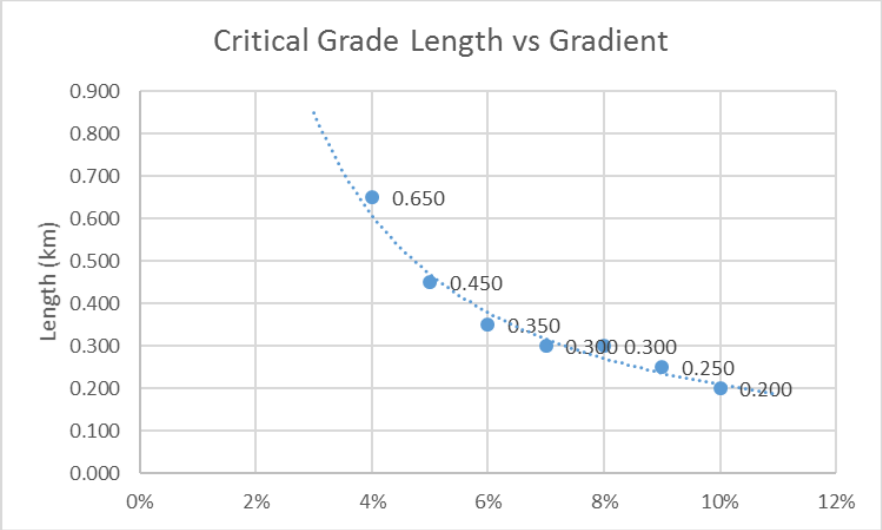
95. The methodology is not aimed to determine the total lengths of passing lane that is required, but rather to identify lengths of road that should be further investigated by a design consulting firm. Where successive lengths of road were identified near each other, it may be that

[9] The team recorded all their site inspections using a NAVMAN Mivue560 camera that also collects GPS data at 1 second intervals.

only passing lane would be required. Furthermore, construction issues could readily filter out those sites that are going to be costly or have unfeasibly high social or environmental issues (noting of course that saving lives and reducing congestion have high social and environmental benefits).

96. There has been no formal study of the need for passing lanes undertaken that the Consultant was aware of, and the Mongolian codes appear to be completely unhelpful for the identification and design of these. Therefore an approach has been developed to identify likely locations for the installation of such facilities. Note that this approach only reflects the need based on gradient and the slowing of heavy vehicles, and does not include purely congestion related demand where high traffic volumes or poor horizontal alignment (irrespective of gradient) could warrant additional lanes.

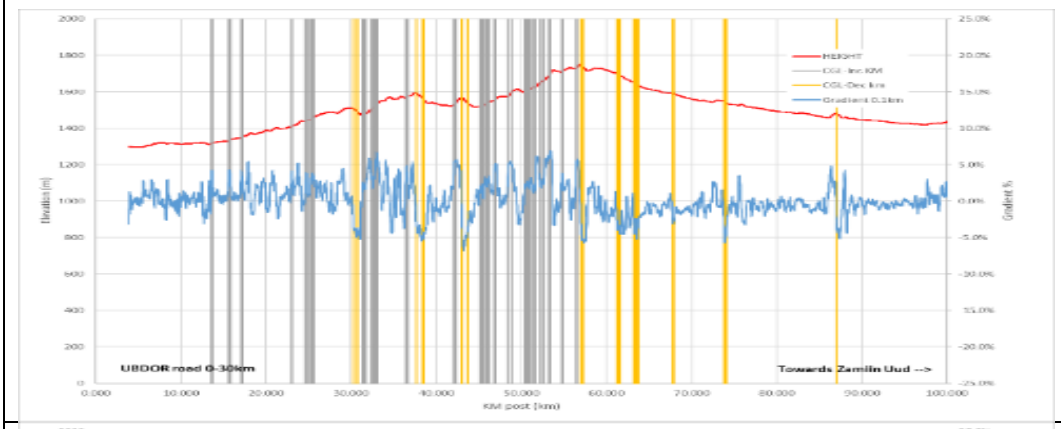
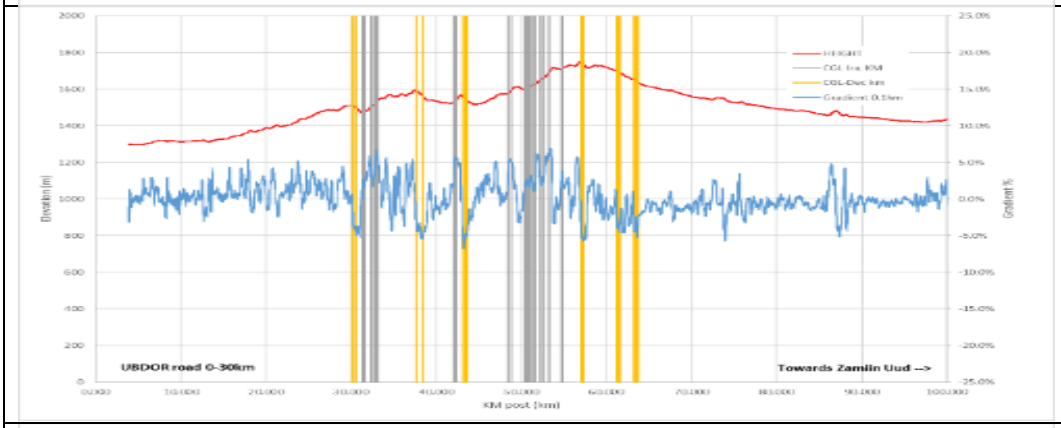
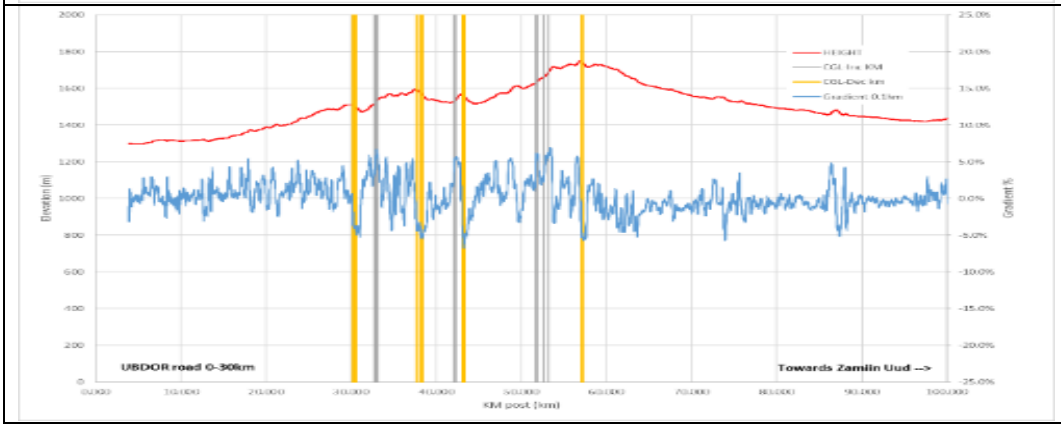
97. For any gradient, there is a critical grade length beyond which heavy vehicles would slow significantly and cause delays. The New Zealand guide (based on Austroads Rural Road Design Guide) has been adopted for determining the critical grade length. This provides the following function for an 80km/h zone, which aligns to the Mongolian open road speed limit. In reality it could be expected that the critical grade length would be lesser in Mongolia owing to the perception that vehicles are lower powered and more overloaded. While the New Zealand guide only covers the range from 4-10%, this has been extrapolated to include 2% (1.4km length), 3% (0.85km), 15% (0.15km) and 20% (0.10km).

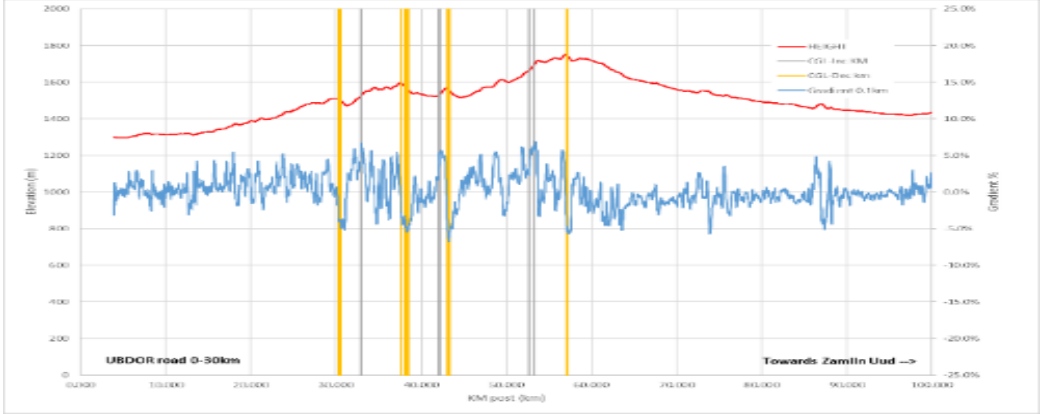


98. The methodology used firstly establishes the gradient over a moving 100m sample along the route. This removes short bumps and other oddities in the data sets.

99. The next challenge is to make an assessment as to when a gradient has ended – does it have to get back to 0%, or is under 2% or 4% effectively flat enough to render the gradient over? The New Zealand manual effectively defines under 3% as flat, 3-6% as rolling, and above 6% as mountainous. To indicate the impact of this, the following example shows the prevalence of lengths of road requiring a passing lane for different cutoff values. In Figure IV-3 the vertical grey lines represent lengths of the road where lanes could be required in the increasing direction of travel, and the yellow are the southbound lengths of road.

100. For the purposes of the analysis presented in this memo, a figure of 3% has been used as the cutoff – which means that once a hill starts, until the gradient drops below 3% it is still assumed to be part of the same hill. The methodology has a weakness in that it doesn't account for very long grades that may alternate between steep sections and short flat (<3%) lengths.

	Using 0% as cut-off for end of a gradient
	Using 1% as cut-off for end of a gradient
	Using 2% as cut-off for end of a gradient



Using 3% as cut-off for end of a gradient

Figure IV-3: Impact of Cutoff Value on Passing Lane Need

b. Results

i. Ulaanbaatar to Altanbulag

101. For the UB to Darkhan to Altanbulag Road, the analysis indicates the potential need for multiple passing lanes as far north as Sukhbataar. Beyond Sukhbaatar the road is essentially flat in nature, such that no passing lane requirements were identified. Split by the two road sections the results are presented in the figures on the following page and indicate that:

<u>UB-Darkhan:</u>

- 9 northbound locations (vertical grey lines) amounting to 5.1km
- 7 southbound locations (vertical yellow lines) amounting to 2.9km

<u>Darkhan-Altanbulag:</u>

- 6 northbound locations (vertical grey lines) amounting to 1.7km
- 7 southbound locations (vertical yellow lines) amounting to 2.8km

102. Of note is that the average length of the required passing lanes is around 300-500m, such that the methodology is very much identifying key gradients. It is good practice to extend crawler lanes to some 100-200m beyond the crest of the hill to permit trucks to regain speed before the merging occurs. Therefore, the above estimates of length should be increased if using them for costing purposes.

103. For the length of road between Ulaanbaatar and Darkhan there is a substantial portion (87%) that requires rehabilitation or resurfacing. Many of the proposed sites for passing lanes would likely overlap with these other works and should be considered for inclusion. For the section between Darkhan and Altanbulag there is a need for resurfacing (suggested surface dressing) between the 259-321km marks. The construction of passing lanes in conjunction with these works would address most the identified needs.

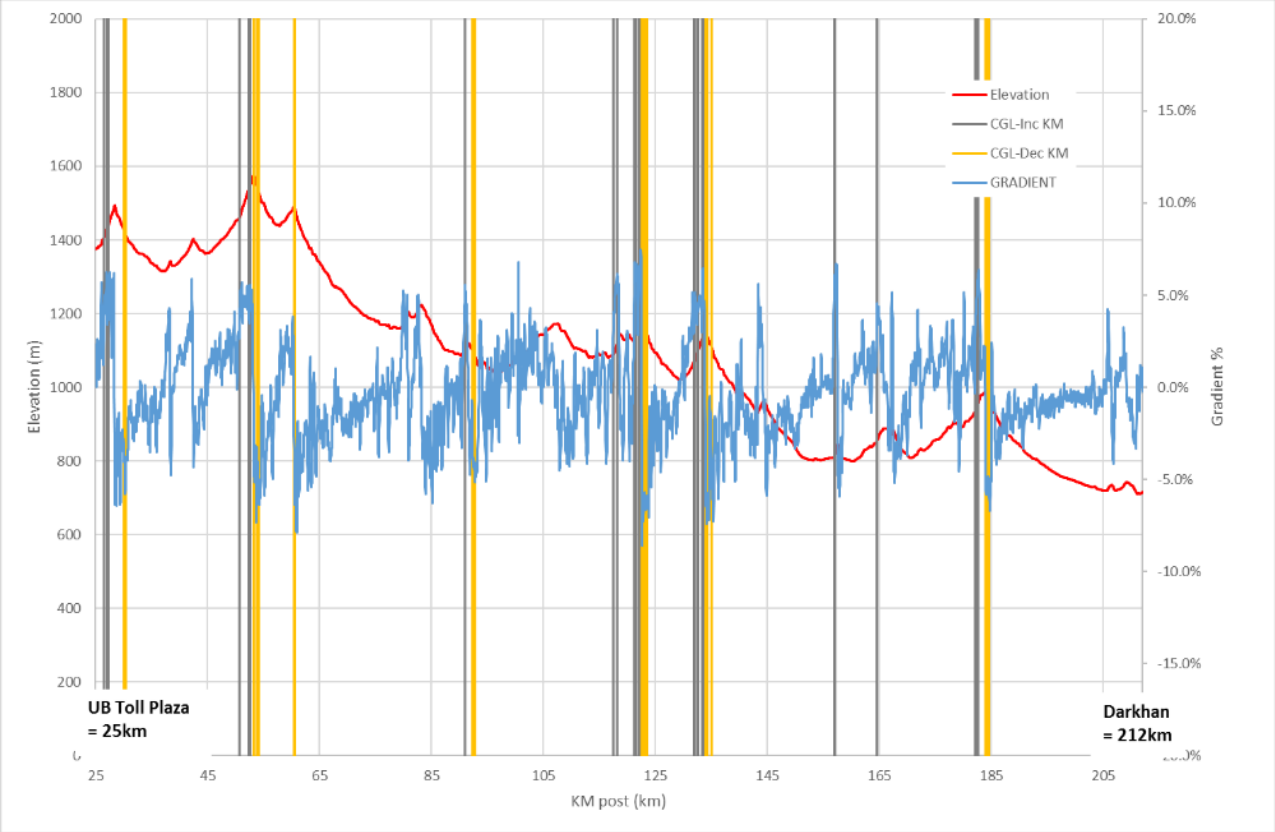


Figure IV-4: Passing Lanes Need Ulaanbaatar to Darkhan

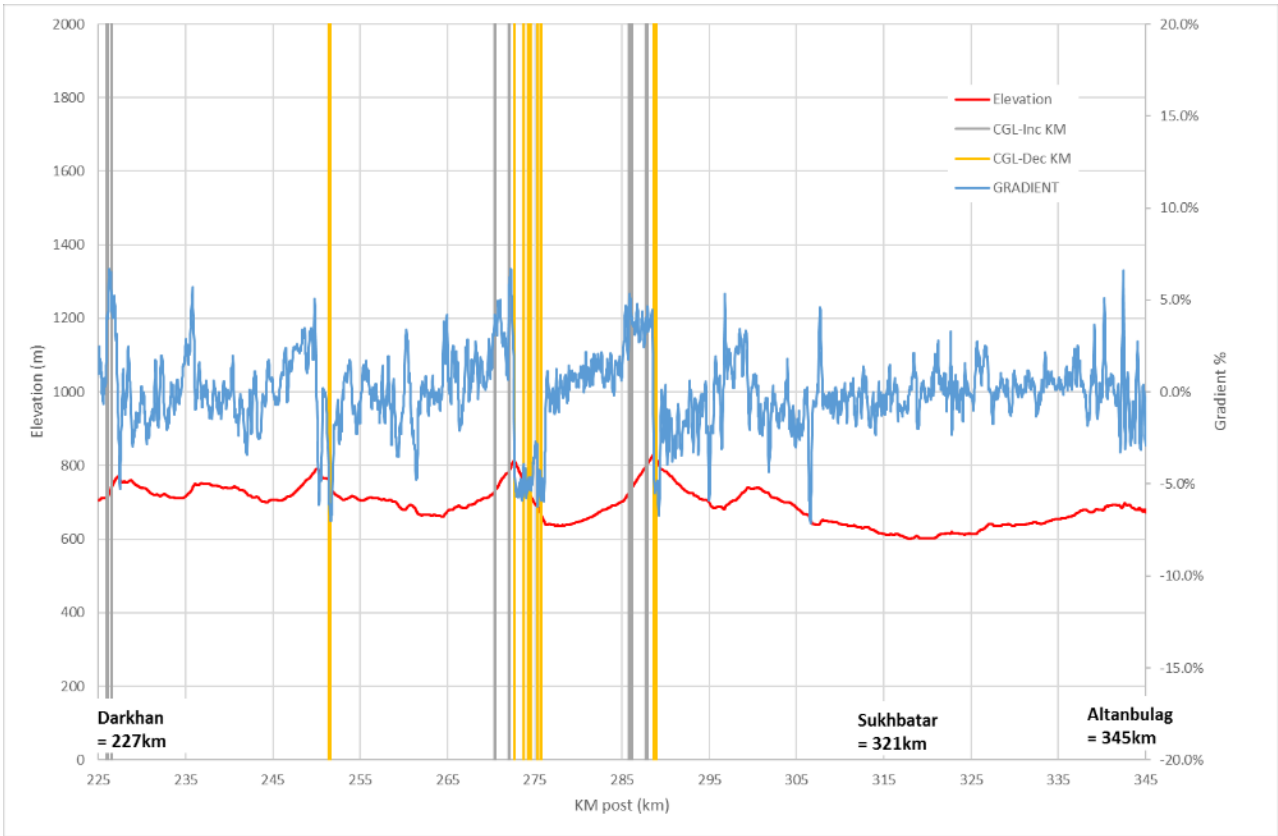


Figure IV-5 Passing Lanes Need Darkhan to Altanbulag

ii. Ulaanbaatar to Zamyn-Uud

104. For the Ulaanbaatar to Zamyn-Uud road, once beyond approximately 100km from Ulaanbaatar, the road becomes much more open with better vertical and horizontal alignment and lower traffic volumes – such that the need for passing lanes is much less. The first 200km of this road is presented below and indicates the potential for 3 passing lanes in the southbound (increasing km) direction amounting to 700m, and up to 4 in the northbound (decreasing km) direction amounting to 1.4km. These are all located in the 30-60km section of the road, with the results of the analysis aligning well with observations in the field.

105. Again for cost estimation purposes, the above lengths should be increased by around 200m per site to account for extension beyond the crest of the hill.

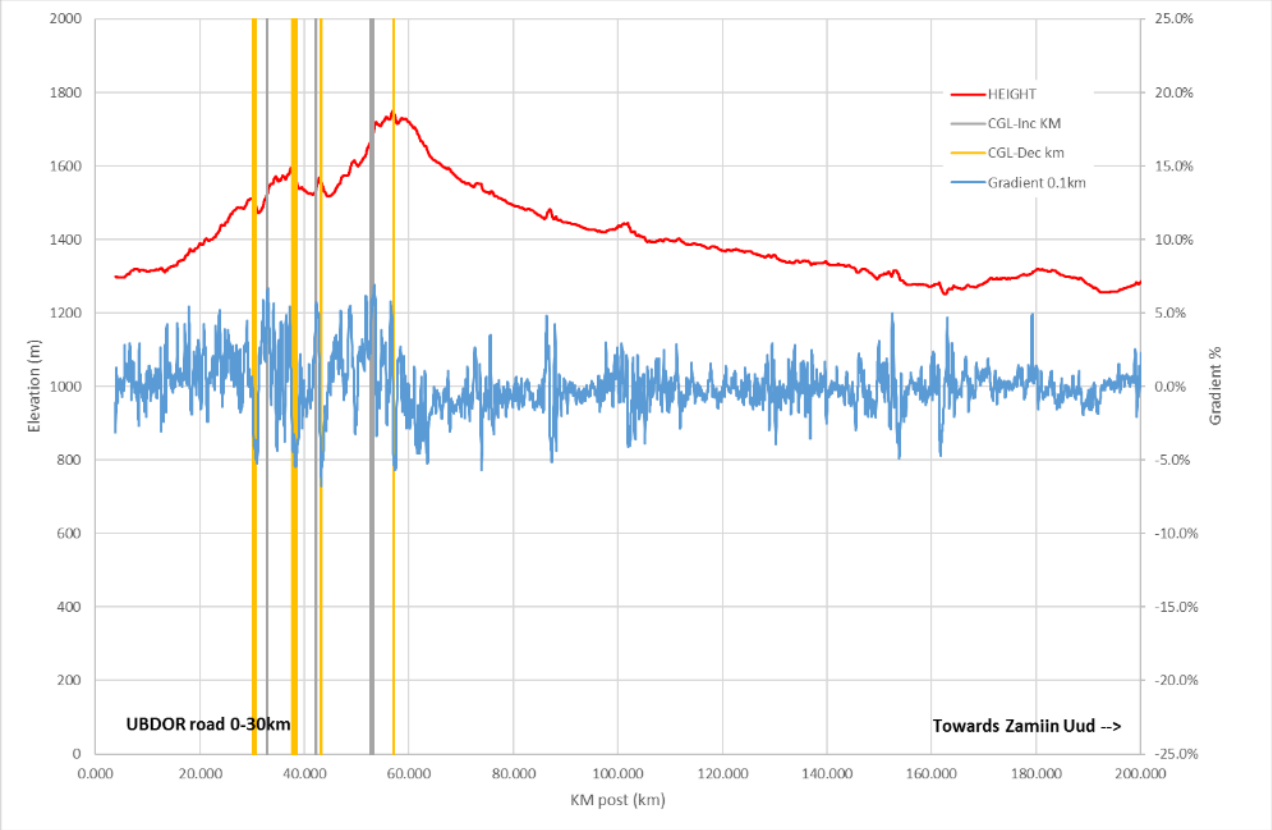


Figure IV-6: Passing Lane Need Ulaanbaatar Towards Zamyn-Uud

c. Cost Estimates

106. For discussion purposes only, a unit rate of US$400,000/km has been used. This is at the higher end of previous construction projects to reflect the more difficult terrain that these sites are located in. The rate is not based on any design or site investigations or other associated activity that would suggest a level of certainty. It is purely provided to give an indication of the sort of budget that would be required.

Table IV-1: Indicative Costs for Passing Lanes

Road	Direction	No Sites	Length (km)	Average (km)	+ 0.2km	Estimate per site	Cost	Sub Total
Ulaanbaatar to Darkhan	Northbound	9	5.1	0.567	0.767	306,667	2,760,000	4,480,000
	Southbound	7	2.9	0.414	0.614	245,714	1,720,000	
Darkhan to Altanbulag	Northbound	6	1.7	0.283	0.483	193,333	1,160,000	2,840,000
	Southbound	7	2.8	0.400	0.600	240,000	1,680,000	
Ulaanbaatar to Zamyn-Uud	Northbound	4	1.4	0.350	0.550	220,000	880,000	1,400,000
	Southbound	3	0.7	0.233	0.433	173,333	520,000	
							8,720,000	**8,720,000**

d. Way Forward

107. The above is an initial analysis to identify the broad locations for constructing climbing lanes. These locations can then be used to provide guidance to the design consultant to refine locations and complete associated analysis to provide optimum impact on traffic congestion.

108. Social and environmental safeguard analysis was completed on proposed sites to ensure negative impacts would be mitigated.

V. FRAMEWORK FOR PILOTING PERFORMANCE BASED MAINTENANCE CONTRACTING

A. Background to Maintenance Contracting in Mongolia

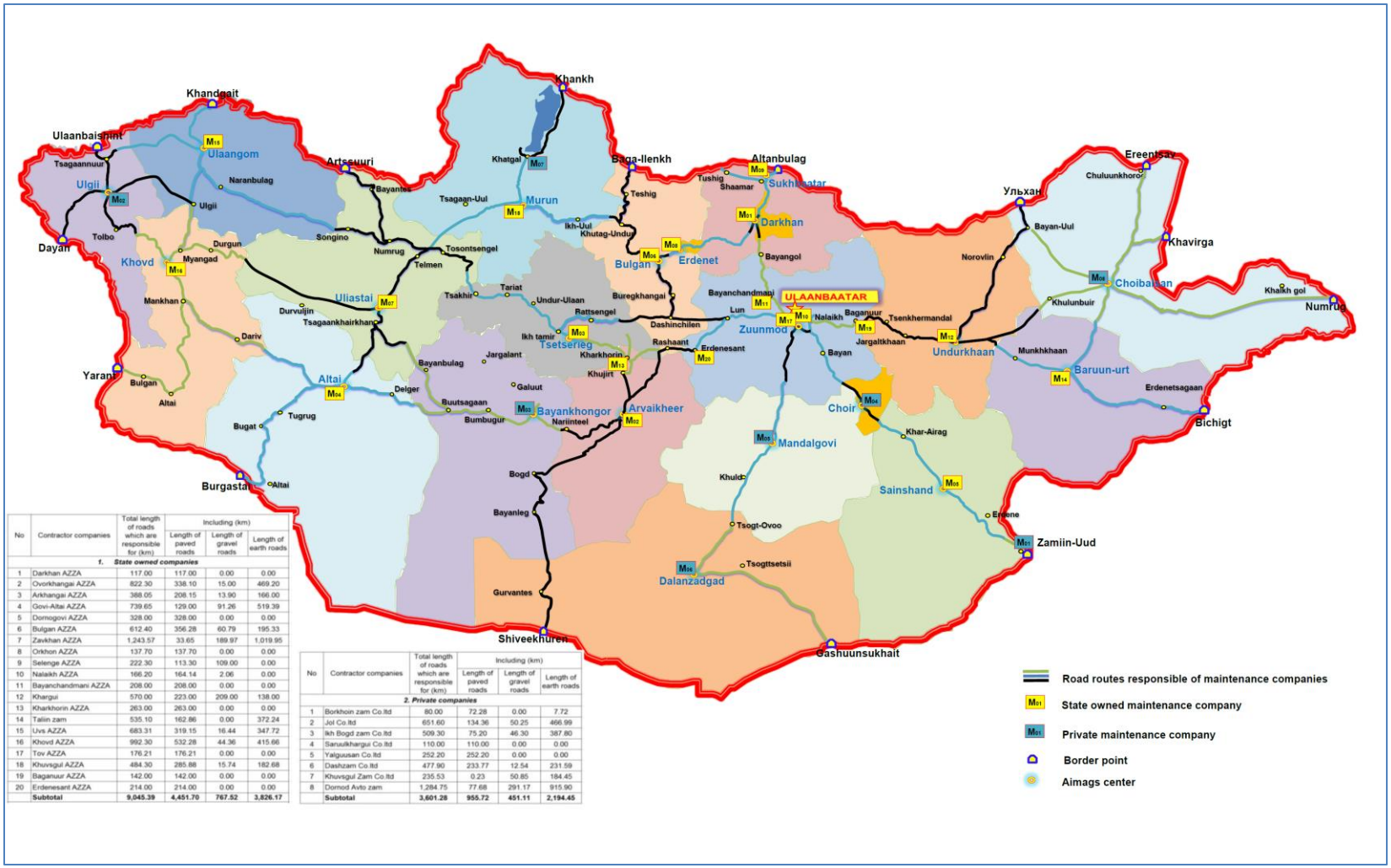
109. While the contracting out of major construction works and rehabilitation works is common in Mongolia (both with domestic funds and those from development partners such as the ADB), there is lesser experience in contracting out road maintenance activities. One of the domestic hurdles to the contacting out is that of the current financial law that prohibits committing future year budgets ahead of time.

110. To date MRTD have addressed this issue through the letting of multiyear contracts (four years), but wherein the value of works is approved each year. In essence the approach is that the right to undertake work on a length of road is awarded on the basis of technical skills and experience; however the quantity of work to be undertaken is subject to the annual budgeting process.

111. In 2010 MRTD let four contracts to the private sector for maintenance of portions of the national road network. In 2014 at the end of these contracts, they were retendered with three out of the four contractors retaining their areas. In addition, a further 4 contracts were let to the private sector.

112. In all 8 contract areas, the private sector was brought in to undertake the maintenance at the time the road was constructed to a paved standard. In no case has the outsourcing of maintenance to the private sector involved taking a paved road off the state road maintenance companies – although in one case the length of road maintained by a state road maintenance company was halved when the road was upgraded to a paved standard.

113. The current maintenance company locations and associated roads they are responsible for is indicated in Figure V-1.



No	Contractor companies	Total length of roads which are responsible for (km)	Including (km)		
			Length of paved roads	Length of gravel roads	Length of earth roads
	1. State owned companies				
1	Darkhan AZZA	117.00	117.00	0.00	0.00
2	Ovorkhangai AZZA	822.30	338.10	15.00	469.20
3	Arkhangai AZZA	388.05	208.15	13.90	166.00
4	Govi-Altai AZZA	739.65	129.00	91.26	519.39
5	Dornogovi AZZA	328.00	328.00	0.00	0.00
6	Bulgan AZZA	612.40	356.28	60.79	195.33
7	Zavkhan AZZA	1,243.57	33.65	189.97	1,019.95
8	Orkhon AZZA	137.70	137.70	0.00	0.00
9	Selenge AZZA	222.30	113.30	109.00	0.00
10	Nalaikh AZZA	166.20	164.14	2.06	0.00
11	Bayanchandmani AZZA	208.00	208.00	0.00	0.00
12	Khargui	570.00	223.00	209.00	138.00
13	Kharkhorin AZZA	263.00	263.00	0.00	0.00
14	Taiiin zam	535.10	162.86	0.00	372.24
15	Uvs AZZA	683.31	319.15	16.44	347.72
16	Khovd AZZA	992.30	532.28	44.36	415.66
17	Tov AZZA	176.21	176.21	0.00	0.00
18	Khuvsgul AZZA	484.30	285.88	15.74	182.68
19	Baganuur AZZA	142.00	142.00	0.00	0.00
20	Erdenesant AZZA	214.00	214.00	0.00	0.00
	Subtotal	**9,045.39**	**4,451.70**	**767.52**	**3,826.17**

No	Contractor companies	Total length of roads which are responsible for (km)	Including (km)		
			Length of paved roads	Length of gravel roads	Length of earth roads
	2. Private companies				
1	Borkhoin zam Co.ltd	80.00	72.28	0.00	7.72
2	Jol Co.ltd	651.60	134.36	50.25	466.99
3	Ikh Bogd zam Co.ltd	509.30	75.20	46.30	387.80
4	Sanuulkhargui Co.ltd	110.00	110.00	0.00	0.00
5	Yalguusan Co.ltd	252.20	252.20	0.00	0.00
6	Dashzam Co.ltd	477.90	233.77	12.54	231.59
7	Khuvsgul Zam Co.ltd	235.53	0.23	50.85	184.45
8	Dornod Avto zam	1,284.75	77.68	291.17	915.90
	Subtotal	**3,601.28**	**955.72**	**451.11**	**2,194.45**

Road routes responsible of maintenance companies
State owned maintenance company
Private maintenance company
Border point
Aimags center

Figure V-1: Current Maintenance Company Locations

114. As noted previously, domestic budget law limits committing funds to a single year – although projections for future expenditure on multiyear contracts is possible. Given the inability to commit to the multi-year funding of a contract where domestic funds are used (including from the road fund), it is not plausible to implement performance based contracts in terms of delivering a fixed quality of network outcomes over a medium term (5-7years).

115. At present, once a length of road is assigned to either a state road maintenance company or a private contractor, agreed annual quantities of work are approved based on the budget received from the MOF and the contractors undertake the works to the required standard and within the agreed timeframe.

116. What is observed from comparison of the condition of the road network with the requested maintenance needs (and ultimately the approved funds), is that there is a wide variation in the approach of prioritizing works on the network. Some of the best sections of road also have the highest funding request, while poorer sections of the road also have lower funding requests. While essential pavement repairs (potholes and crack sealing) go unfunded in one contract area, other contract areas are observed undertaking much lower priority shoulder maintenance on what are ostensibly shoulders that are already in good condition relative to much of the network.

117. Figure V-2 illustrates the key factors that determine the form of PBC contract that could be awarded under existing domestic arrangements – should they be funded from domestic sources. For projects funded by the ADB (or other development partners) these restrictions do not apply. Notably there are a combination of laws, regulations and guidelines (many outside the control of MRTD) that place restrictions on what can/can't be achieved:

- While a contract can have projected costs beyond one year, no contractual commitment to these can be made. This is a major challenge for a PBC that would typically involve rehabilitation or periodic works in the first year, in parallel with the 2-3 year maintenance requirement;
- Procurement law precludes letting contracts for more than 5% above the normative cost estimate. However, the normative cost estimate is not based on delivering a defined level of service. Given that the service levels and risk allocation under a PBC may well drive a different response to that in the normative estimates, it is quite likely that the normative cost estimate is not relevant for implementation in a PBC;
- It is not possible to include rehabilitation works into a PBC alongside periodic and routine maintenance works; and
- If a contract is to include either reconstruction or periodic works, then it must be contracted to the private sector.

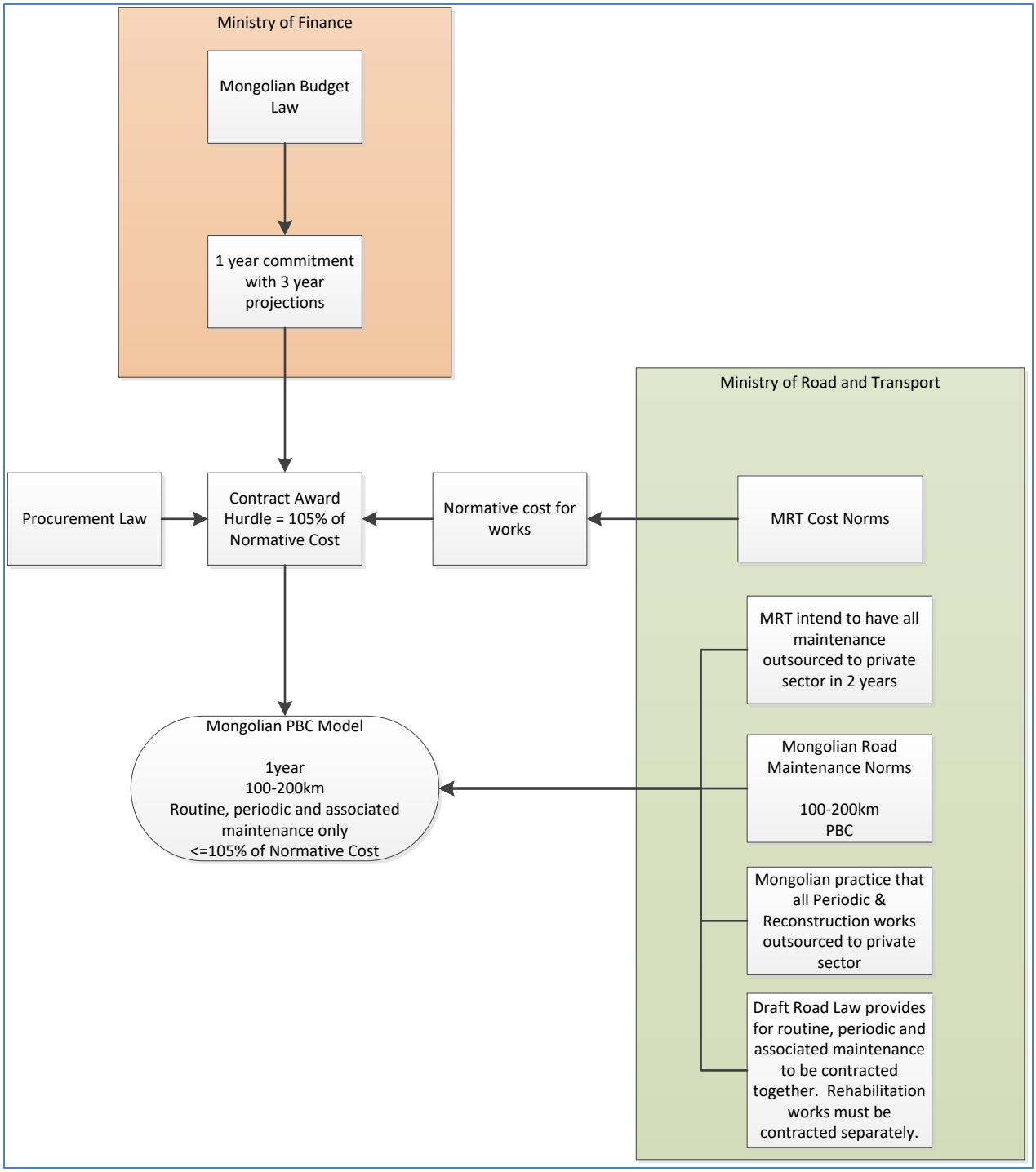


Figure V-2: Current PBC Arrangements

118. Should MRTD wish to implement PBCs beyond any contracts delivered under ADB (or other development partner) funding, then addressing the above constraints will be necessary. Specific tasks that would be required are:

(i) Amendment of the budget law to enable multiyear contracts to have financial commitments be made;
(ii) Develop/adopt a performance specification suitable for PBC, including risk sharing schedules; and
(iii) Develop a normative cost process that aligns to the performance specification.

B. Factors for a Successful Implementation of PBC

119. In the report "*A Guide to Delivering Good Asset Management in the Road Sector through Performance Based Contracting*[10]" completed for the World Bank, a number of success factors were identified for implementing performance based contracts. While not all factors need be present to ensure success, the more that are met the greater the chance that a successful outcome will occur. Table V-1 presents those factors along with an assessment of how Mongolia meets each factor.

Table V-1: Assessment of PBC Success Factors

Critical Success Factor	Situation in Mongolia for Development Partner Funded PBCs	Situation in Mongolia for Domestically Funded PBCs
1. **Road Agency Institutional Buy-in:** There must be a genuine institutional desire within the road agency and belief that PBC procurement options will offer significant achievements of given objectives for an agency. This buy-in should also be linked to specific individuals in an organization who will be prepared to champion the PBC process.	MRTD has a stated intent to outsource all maintenance to the private sector within 2 years using a form of PBC.	MRTD has a stated intent to outsource all maintenance to the private sector within 2 years using a form of PBC.
2. **Financial:** Two aspects were identified regarding the financial aspect of a successful PBC: a. Assurance (Guarantee) of Funding: Where there is not clarity regarding the long-term availability of funding to support the contract, then the contracting industry will be concerned as to the prospect of being paid and may seek to "front load" bids to endeavor to recover as much of his costs as possible during the term of the loan. b. Financing Costs: There is a need to fully understand the payment model and how this imparts potentially significant financing costs on the contractor. While this may be entirely appropriate (and necessary) to meet agency financing constraints, it is essential that the impact be understood.	Addressed through the ADB loan.	Current domestic budget law precludes committing to multiyear payments. Therefore, without a change in budget law or modification of the use of the Road Fund, any PBC will be limited to a single year.

[10] Report was completed by Opus International Consultants and is available at https://openknowledge.worldbank.org/handle/10986/18646.

Critical Success Factor	Situation in Mongolia for Development Partner Funded PBCs	Situation in Mongolia for Domestically Funded PBCs
3. **Legal:** The legal issues tend to be more of an enabler than an identifier of likely PBC success or failure. If the legal framework is not conducive to a PBC then either it will not be possible to implement at all, or the risk pricing will potentially be very high (making the PBC financially unattractive).	There does not appear to be a legal impediment to issuing multi-year contracts to the private sector, as these are already in place (albeit with annual budget approvals).	There does not appear to be a legal impediment to issuing multi-year contracts to the private sector, as these are already in place (albeit with annual budget approvals).
4. **Institutional Knowledge in both the Transport Agencies and the Lending Institutions**: While some shortcomings in institutional knowledge can be addressed via the use of consulting advisors, it is essential that the basics of asset management are soundly understood.	Good understanding within ADB and their consultants to support PBC.	Some knowledge of PBC is evident within various parts of MRTD and their documents. However, this is not understood to be an advance level of understanding.
5. **Bidding Process:** Successful implementation of PBC (especially in the early years of implementation of PBC into a country/organization) requires the selection of a contractor with the right skill mix to deliver the project. If selected on a lowest price basis, there is a reduced chance of selecting a competent contractor who fully understands the principles and risks of a PBC. To mitigate this, one of two approaches is recommended: a. Include a significant non-price weighting into the contractor selection process, or b. Implement a pre-qualification stage to the bidding process, where only those contractors that have clearly demonstrated their competency to do the work are invited to bid. Either of these approaches should be considered alongside industry engagement to both gain knowledge on the perceptions of risk within industry, and ensure a correct understanding of expectations is in place.	Current MRTD approach for physical works is to use a 'lowest price conforming' approach to tender evaluation. In addition, there is a process to eliminate underpriced tenders, but this is seldom used.	Current MRTD approach for physical works is to use a 'lowest price conforming' approach to tender evaluation. In addition, there is a process to eliminate underpriced tenders, but this is seldom used.
6. **Performance Measurement:** Both the ability to measure performance and clear consequences of non-conformance are essential to PBC success. Management regimes that use a predominance of response time measures tend to be more cumbersome to enforce when compared to the "density of defect" type measures and this latter (density) approach should be encouraged.	Would be via a contracted monitoring consultant	The lack of regular independent data collection (network level or routine maintenance defects) along with limited systems means performance measurement would be difficult under current practices.

Critical Success Factor	Situation in Mongolia for Development Partner Funded PBCs	Situation in Mongolia for Domestically Funded PBCs
7. **Performance Payment:** The consequences of non-conformance need to be graduated and equitable with the level of non-conformance. The traditional approach of "three strikes and you are out" has not worked to drive performance and should be discouraged from use.	Would be a core part of the contract model.	Could be implemented, but requires the performance data to be in place first.
8. **Risk Sharing:** The allocation of risk (except at the extremes such as force majeure) was not observed to be a major identifier of success or failure of a PBC. If risk was clearly apportioned and the contracting party was sufficiently experienced to manage (and price) the risk, then "inappropriate" risk allocation tended to result in higher bid prices. If the occurrence of a risk would render the contract financially non-viable (i.e. the risk would remove all profit from the contract), then there is an increased chance of default on the part of the contractor – a scenario under which neither party wins.	Risk allocation table would form part of the contract document.	There does not appear to be any concept of risk sharing in current contract documents, nor is there an active targeting of grossly overloaded vehicles to reduce risks.
9. **Timing:** The process to implement a PBC in an agency which does not have experience will typically take 3-5 years, although there are examples (e.g. Serbia which took one year) where this is much less.	With external consultants, this can be fast tracked	With external consultants, this can be fast tracked, but little indication of a desire to do so.
10. **Sufficient technical support during implementation:** There are examples of PBC implementation where neither the client, nor the contractor had prior experience of PBCs. In such cases the inclusion of an experienced third party consultant for assistance during the bidding and initial stage of the contract is essential.	ADB will ensure technical support is in place	Would build upon initial ADB funded pilot, so technical skills would be developed.
11. '**Control' of underpricing** of bids through a mechanism to disqualify unsustainable low bid prices. No contractor can be successful on a contract without receiving sufficient compensation for work being undertaken. While the direct control of underpricing is difficult, a significant amount of risk can be mitigated by applying a conformance hurdle that requires demonstrable skills and capability in asset management (refer item 5 above) such that any low-pricing is a deliberate bidding tactic and not an inadvertent oversight of contractual costs.	While education of industry and more guidance on how the PBC works can assist to prevent inadvertent underpricing, there are limited avenues to prevent deliberate underpricing of works.	While Mongolian procedures permit the exclusion of underpriced tenders, in practice this is seldom used.

Critical Success Factor	Situation in Mongolia for Development Partner Funded PBCs	Situation in Mongolia for Domestically Funded PBCs
12. **Control of the minimum level of improvement work** required to maintain Levels of Service in the long-term. Underpinned (contractual minimum) quantities, with an associated robust quality control program, can be used to ensure that no consumption of the network takes place during the contract term. Current technical measures to address residual life of pavement assets, such as FWD data, can have a high degree of variability with certain pavement/geology/weather combinations and if used, needs to be supported by other methods to avoid unintended consumption of the asset.	Will be part of the contract	Would be part of the contract

120. As it currently stands there are significant impediments to the successful implementation of PBCs under MRTD's domestic rules and regulations. For projects funded by the ADB, these impediments can be largely mitigated through the design of the project.

C. Framework for Piloting Outsourced Performance Based Contracts

121. With the current budgetary constraints (substantial underfunding at 15% of identified need, along with single year budget commitments) the implementation of modern multi-year performance based contracts are a non-viable concept beyond externally funded projects (e.g. ADB and similar).

122. Given the significant hurdles that would be required to change to a multiyear contractual arrangement, along with the need for there to be an appropriate level of funding made available to attract the private sector – the outsourcing of road maintenance using a model beyond that current in place is likely to be many years away. Furthermore, with no cash flow or return on investment, it is unlikely that privatization of the current state owned road maintenance companies is a viable proposition.

123. Based on the above it was deemed that a detailed legal and technical framework for piloting outsourced performance-based area-wide routing maintenance contracts was not a priority. However, within the context of externally funded (i.e. through ADB loans or similar) where domestic funding rules do not apply the following PBC conceptual model is recommended:

(i) A total contract duration of 5 years is targeted, with all major works (periodic, rehabilitation or upgradation works) completed within the first 2 years of the contract;
(ii) Major works be paid based on outputs (e.g. per km of resurfacing) and not inputs (e.g. m^3 of materials). In doing so this helps develop skills within the contractors to estimate the inputs necessary to complete the works;
(iii) Routine maintenance be on a performance based regime, with the contractor paid a lump sum per month to deliver the road in compliance with all performance measures. Deductions then apply for non-conformances; and

(iv) The works be scoped in value to encourage participation of the domestic industry as the lead contractor, rather than as subcontractors to international participants.

VI. OUTSOURCING DATA COLLECTION

124. MRTD's current data collection regime can best be described as sporadic since the prior technical assistance program ended. While MRTD's RTDC is in possession of the necessary equipment to undertake network level data collection this does not occur on a regular basis. The RTDC do undertake post construction data collection and one-off project data collection tasks.

125. There is no domestic data collection industry with the necessary equipment for collecting road condition data. Therefore, any outsourcing of data collection would involve international players, who would import the necessary equipment, complete the data collection for the year, then export the equipment again.

126. It is most unlikely that the international industry would be interested in undertaking the one-off post construction audit or project data collection tasks, such that the discussion of outsourcing is practically confined to the annual network level data collection task.

127. To ascertain if industry would be interested in undertaking the data collection task, contact was made with several international providers. The following table contains the details of those contacted and the nature of their response. Providers were identified based on the author's knowledge of providers, along with recommendations of others who work in this region. In no way should those contacted be considered as a short listing or an endorsement.

Table VI-1: Response on Outsourcing Data Collection

Provider	Response
Indian Road Survey & Management Pvt Ltd, India	Positive response and would be interested in any tendering of this work
Kumpulan IKRAM Sdn Bhd, Malaysia	Positive response and would be interested in any tendering of this work
Data Collection Ltd (ROMDAS), New Zealand	Owing to the short survey season thought it may be more practical to survey 50% each year. Otherwise a positive response.
ARRB TR, Australia	Would decline as they mostly support third parties in the region, rather than take the lead
RoadMaint Co. Ltd, China	No response
Selia Group, Malaysia	No response

128. What the above indicates is that there would be interest by the private sector in outsourcing the data collection tasks. It is also thought to be likely that one of the Chinese firms would tender for this work given their proximity. If outsourcing were to occur then the key items to address would include how many years the contract is for and what portion of the network is to

be surveyed each year. These two factors would likely determine the ultimate competitiveness of any tenders.

129. Whether the RTDC should be permitted to also tender[11] for this work requires further clarification around their status as a company. Current understanding is that they are sufficiently operating as a company that they do not receive any direct funding from the government, however they also operate sufficiently as a government department that they are unable to get a bank performance bond and the government approves pay rates of the staff. Unlike private sector companies, the RTDC also appear to have been given their equipment under prior development partner projects – such that they may have a financial advantage when tendering. The awarding of this work to the RTDC however would be consistent with the desire to strengthen the domestic capacity, such that if it is reasonable for them to undertake this work then they should not be unduly excluded.

VII. RESULTS FRAMEWORK

e) a results framework that will include the investment program targets, as well as intermediate indicators and milestones at the outcome, output, input, and activity levels to enable tracking of investment program progress;	Included in overall project documentation and not included in this report.

VIII. MEDIUM TERM INVESTMENT PROGRAM

f) a medium-term investment program that will describe the target levels of service of the road network, the maintenance strategy, technical specifications, annual budget allocations, and the list of roads to be maintained and rehabilitated during the investment program implementation period;	Refer above items that address this task.

IX. SECTOR REFORM PLAN

130. A medium to long term goal for sector reform within Mongolia would likely yield a three tier model of:

(i) MRTD as the road owner, providing governance and asset management direction;
(ii) Consulting firms involved in the preparation of work programs and supervision/monitoring of works; and
(iii) Private sector contractors undertaking all physical works – preferably using multiyear performance based contracts that cover routine, periodic and rehabilitation works.

131. To achieve the above outcome will necessitate several reforms. As noted in Section V.C earlier, steps to reform the contractors are largely impeded by the current lack of funding and budgetary rules around multiyear contracts. Furthermore, the current draft Road Law does not

[11] The RTDC, like many of the other domestic contractors (state owned and private) do not have strong written English language capabilities or knowledge of tendering practices that are likely to exist for contracts let under this project. Consideration of how to structure the tender documents, and what level of support is appropriate, will need to be determined to ensure that they are not disadvantaged and that the domestic market has a chance to develop – as is a goal under the roadmap.

include the capacity to spend the Road Funds on the rehabilitation of the network. Collectively these items make achievement of reforms in the delivery of the physical works extremely difficult in the foreseeable future.

132. In order to promote and support reform, the following training is recommended. While some of this training will have immediate benefit, others are part of gaining senior level buy-in of the need to reform. Some of the priority training initiatives identified in the table - such as the asset management training - could well involve multiple training courses over a period of many months, rather than a single short training course. Further discussions on modernizing the Mongolian road sector is provided in Chapter *XVII. Modernization of the Mongolian Road Maintenance Arrangements.*

Table IX-1: Priority Training Initiatives

Training Activity	Purpose
Study tour	To demonstrate to senior management of MRTD the benefits of reform, including what skills MRTD need to retain (or acquire) and what skills can be transferred to the private sector. Such a study tour should focus on countries where all physical works are provided by the private sector, and ideally where the use of multi-year performance based contracts are in place. Attendance of MOF staff on the study tour could well be beneficial to help gain support for reform of current funding rules that preclude letting multiyear road maintenance contracts.
Asset management training	For MRTD, RTCD (on the presumption they continue to play a significant role in the collection and analysis of data) and consultants to advise on the benefits of asset management, what the various components are, the production of asset management plans and the like.
Prioritizing road maintenance activities	To ensure that whatever funds are available for road maintenance (including once the road fund is fully established) are being used in an optimal way.
Winter maintenance	To provide training to contractors on modern means of delivering winter maintenance activities, including mechanized application of road grit and di-icing chemicals.
Performance based road maintenance contracts	Training to MRTD and industry on what variants of PBCs exist, the benefits and weaknesses of each model, what skill sets MRTD and industry would require, and the scope of a PBC (routine, periodic, rehabilitation and emergency works).

X. OPERATIONAL MANUAL

g)	an operational manual that will include technical standards; performance targets and indicators; environmental, social and safety evaluation methods and standard management plans; and terms of reference and contract documents for design, supervision and construction.	Included in overall project documentation and not included in this report.

XI. ROAD SECTOR MAINTENANCE PLAN

(vii)	assessment and update of the road sector maintenance plan and investment program;	Refer above

XII. ROAD MAINTENANCE STRATEGY

(viii)	medium-term road maintenance strategy, investment, financing and procurement plan;	Refer above for strategy and associated works plan for network as a whole. Investment, financing and procurement plans will be developed to support the agreed project scope of works (subset of the network). Will depend upon agreeing where (if any) a dedicated PBC will be implemented.

XIII. OPERATIONAL MANUAL

(ix)	operational manual, results framework, draft contracts and TOR for design and supervision of works;	Need to determine if the base contract is to be that implemented between 2010-2014, or the World Bank Sample OPRC bidding documents.

XIV. FEASIBILITY STUDY

(x)	completed feasibility study reports, agreed project scope, costs, financing and procurement plans;	Included in overall project documentation and not included in this report.

XV. ECONOMIC AND FINANCIAL ANALYSIS

(xi)	economic and financial analysis, project cost estimates, financing plan, financial evaluation, financial analysis (financial statement analysis of road maintenance entities, incremental recurrent cost analysis); and	Included in overall project documentation and not included in this report.

XVI. BIDDING DOCUMENTS

(xii)	road maintenance sections of the bidding documents for procurement of civil works, equipment and construction supervision consulting services.	Included in overall project documentation and not included in this report.

XVII. MODERNIZATION OF THE MONGOLIAN ROAD MAINTENANCE ARRANGEMENTS

A. Introduction

133. This section covers a range of initiatives that the Consultant believes should be addressed to modernize the Mongolian road maintenance arrangements. It draws on observations made throughout this report. Addressing many these items would fall into the category of Capacity Development.

B. Funding

134. Without an adequate and stable level of funding, all other initiatives are largely a waste of time and effort. While full funding all needs may not be possible, the current level of funding means that the network cannot be managed in an optimal manner. Inadequate and inconsistent funding levels send a message to industry that the maintenance of the road network is not critical, and industry in return do not invest in the skills and equipment to deliver road maintenance in a cost-effective manner. Equally without funds being available, there is little desire by MRTD to undertake sound asset management practices such as a routine data collection program; optimized works programs and the like.

135. Specific actions to improve funding (including the allocation of whatever funding is present include):

- The charges to road users should be based on the funds needed, rather than on what it is felt people can afford. If parliament determines that lower charges are required, then they should directly contribute to the Road Fund needs from the general taxes;
- The current use of toll booths to collect road user charges is inefficient. The proposal to expand the current booths and implement electronic tolling has never been delivered on an unrestricted road network – tolls have only ever worked successfully on dedicated (and fenced) expressways and tollways. Instead the internationally tested and proven approach based on fuel taxes, vehicle registration fees and road user charges (distance and weight based for heavy vehicles) should be implemented;
- The Road Fund should cover all costs associated with the management, maintenance (routine & periodic), and rehabilitation of the built road network. These are all part of the life-cycle of a road. The Road Fund should not be used for the construction of any new roads, although limited use of the funds to address safety issues could be considered;
- It is to the detriment of the network to have MOF involved in rehabilitation and periodic maintenance selection decisions. They have no skills in this area, and separating these decisions from routine maintenance (currently in the road fund) makes a mockery of good decision making. The essence of asset management is making sound decisions around the life-cycle of the asset. This cannot be achieved if those with no knowledge of the issue are involved in critical decisions about part of the process.

C. Data Collection

136. Data collection typically will consist of two distinct types of data, namely 1) Network level data used in the programing of renewal works; and 2) Identification of routine maintenance defects for short term repair.

137. A regular program of data collection on the condition of the network is required to enable long term decision making to occur. This may involve collecting the data over a 2 year period as for most roads the traffic volumes are such that changes in condition should not be too rapid. Data collection should be via traffic speed automated machines – collecting roughness (IRI), rutting and cracking data as a minimum;

138. Routine maintenance companies (or others) can be responsible for maintenance level defects and physical inspection of drainage, bridges etc. This data should also be loaded into a centralized database such that in generating a renewal program the MRTD can optimize investments;

139. Data collection is routinely outsourced to the private sector in many parts of the world. Several the international providers have expressed interest in tendering for such work in Mongolia if a contract were let. This is likely to be a more sustainable approach in the longer term, as it removes the need for MRTD to maintain and operate expensive equipment, which for many months of the year would be unusable owing to weather conditions.

D. Road Maintenance Contracting

140. The current road maintenance contracts are simplistic in nature and do not drive efficient or effective outcomes for the road network. While the current lack of funds will hamper any significant improvement in the form of contracts, on the presumption that funding will be resolved (the alternative is that there will be no road network to maintain) then MRTD should look to adopt a more progressive style of contract that encourages industry to invest in skills and equipment.

141. MRTD should move to 100% outsourcing of all physical works to the private sector. International experience shows that this will deliver between a 20-40% efficiency saving when compared with use force account or state owned maintenance companies.

142. While it is not necessary to implement a medium term (5 year) performance based contract on 100% of the network, this should be a goal for the core parts of the road network. To facilitate such an outcome, it is essential that for some portion of the Road Fund multi-year contracts are permitted. This should include routine maintenance (up to a 5 year term), periodic maintenance and possibly even some limited rehabilitation. These contracts may also include data collection of routine maintenance defects.

143. A mix of contract styles should be considered while building up a competitive market place – some just routine maintenance, others to include periodic works, and some also to include rehabilitation works and possibly minor safety works. Such a mix will also provide MRTD with the necessary flexibility in budgeting until the Road Fund becomes fully funded and sustainable.

144. Monitoring (not supervision) of the maintenance contracts can also be delivered by the private sector. This could be a role for RTDC in the short term, but later devolved to the consulting industry.

145. MRTD needs to understand that Defect Liability is not the same as Routine Maintenance. Just because a road is under a defect liability period, that does not mean that there is not a need to undertake routine maintenance on it. Drains will require maintaining, vegetation trimming, and potholes caused by external damage are not defects that the contractor is liable for. Equally when defects do occur then the contractor must be forced to undertake the repairs.

E. Software

146. To manage the road network appropriately (assuming an annual data collection program is in place, along with capture of routine maintenance defects) MRTD require the use of a modern information management system.

147. MRTD (via RDTC) have the dTIMS software package that was customized for Mongolia under the CDTA project, with effectively a simplified HDM-4 routine coded inside it. This software is internationally regarded and should be key to the way MRTD manage the network. It is unclear as to why core asset management software that should be informing all aspects of MRTD management of the network has been transferred to RDTC, however the core issue is that the system must be used.

148. Comments were passed during meetings with MRTD officials that the software was not predicting routine maintenance well. The software was setup to help generate an optimized resurfacing and renewal program and not for routine maintenance. No software package is exceptionally good at predicting routine maintenance needs, especially with the scant level of data currently collected in Mongolia;

149. The current setup inside dTIMS could be simplified, but without both a regular data collection program and funding being available for periodic and rehabilitation works – any effort to improve software use is likely a waste of time and effort.

F. Planning

150. MRTD should have in place a minimum of a 5-year program of works (periodic and rehabilitation), and ideally a 10-year program. This program should be fully aligned to the funding from the Road Fund. Routine maintenance does not require a long-term program, but does require a program of when contracts are due for rebidding and the level of funding required along with the performance levels that the funding should be delivering.

151. MRTD should have a separate program of capital improvements – safety upgrades, climbing/passing lanes, new road construction etc. These projects will be subject to MOF funding arrangements and not from the Road Fund;

152. MRTD should be required to produce an Asset Management Plan based on internationally accepted good practice. This document should be publicly available to show how the Road Fund is being spent and what the resulting performance of the network is.

XVIII. APPENDIX

Appendix 1 - Road Map Progress Since September 2013

153. August 2016 Update on Implementation of the Mid-Term Road Sector Capacity Building Program

Table XVIII-1 Road Map Progress Since September 2013

No	Activity	Implementation Status (Change since Sept 2013)
OBJECTIVE 1: Strengthen road sector industrial capability and develop skilled Human Resources		
1.1	Strengthening road sector industrial capability	
1.1.1	Step up the capacity of the national road construction industry and create national road construction companies with the ability to carry out international competitive bidding.	MRTD and ADB have undertaken contractor's capacity assessment in the first quarter of 2014 to compare the sector capacity for the last three years. August 2016 Update Many road construction companies are in financial difficulties as a result of the downturn in the Mongolian economy and are unlikely to be in a position to tender for international works. Without a sustainable level of investment by the Mongolian government into the road sector, it is unlikely that the national contractors will develop the skills and experience necessary to compete internationally. The proposed project could assist this through the way the contracts are structured in order to encourage domestic competition.
1.1.2	Upgrade registration and qualification criteria for national companies. Build a national road construction contractors' association that could ensure road construction standards.	MRTD is drafting procedure for registration, qualification and classification system for contractors. With assistance from the CDTA, contractors and consultants registration system application is being developed. August 2016 Update No progress on the establishment of a national road construction contractor's association. Owing to lack of work in the sector, this is unlikely to occur in the near future.

No	Activity	Implementation Status (Change since Sept 2013)
1.1.3	Identify a tax policy approach to supporting the national road construction companies. Set up a proper legal environment to exempt companies from customs tariffs and value-added taxes on imported equipment with advanced technology.	MRTD is drafting a legal document on the exemption of road construction projects from fees and taxes for the use of local mineral deposits.
1.1.4	Create various opportunities for national road construction companies to develop their businesses by taking out loans with minimum interest rates. Support the merger of national contracting companies, to increase their financial, equipment and human resources capacity.	At the moment, road contractors have access to commercial credits and leasing for capital investments and recurrent costs.
1.1.5	Enable national consulting firms to supervise road design and construction in order to gain experience and bring their performance in these areas to international levels.	Starting from 2012, construction supervision roles have gradually been shifted to private sector companies. The new guidelines for the quality certification of road and structure design works have been developed for mobilization of independent experts.
1.2	Strengthening the sector's human resources capacity	
1.2.1	Demand for study and training will be identified, planned, and implemented. Identify the number of engineers and professional workers needed in the road sector, and develop and implement training programs for engineers and professional workers with different professional backgrounds. Furthermore, identify a number of trainees for upgraded professional qualifications and retraining.	The CDTA has prepared a fully costed capacity building and training plan for 2014-2017 covering both MRTD and UB Department of Roads. The first 12 months of training covering 2014-2015 has been drafted as a plan by MRTD and is currently being reviewed by MRTD senior management. Ongoing activity is being conducted within the Office of the Prime Minister concerning the current skills shortage of engineers and general road workers. As road construction activity has expanded the sector continues to experience a shortage of fully trained and qualified civil engineers and general roads workers trained in road construction and maintenance. The demand for work ready engineers continues to be unmet. The number of new TVET graduates in road construction is small as are graduates from the School of Civil Engineering and Architecture (MUST). Most civil engineers at MRTD and

No	Activity	Implementation Status (Change since Sept 2013)
		UBDoR are MUST graduates. As the Bachelor of Science in Civil Engineering is not a quality curriculum program it needs to be understood that all engineers require re-training and a professional upgrading of their existing qualification/s. This also implies that graduates although trained are not qualified according to international norms in engineering education. This situation extends to engineers employed in the private sector. Opportunities to provide up-to-date and quality engineering education are limited as the most relevant professional training is in English. Current plans for a rapid escalation in provisions for engineering education involve the delivery of courses and conducting assessment in English. The Government of Japan has plans to train or re-train 1,000 new engineers with most training conducted in Japan and in Japanese. 600 secondary school students will be trained in Japanese with a view to them continuing on to a new engineering degree with two years conducted at MUST and the final two years at a university in Japan. A situation is developing that existing engineering education in Mongolia will be steadily superseded by undergraduate and postgraduate courses and qualifications from overseas universities and delivered in English or Japanese. Within Mongolia most up-to-date training in engineering will be conducted in English including courses imported from Germany.
1.2.2	Upgrade the curriculum and study programs of university, colleges, and professional training faculty to meet the demand for professionals to implement middle- and long term programs in the road sector. The target is no fewer than 80 trained engineers and 350 trained professional workers every year.	The university sector is currently being taken through a process of national reform. Using UNSECO classifications as a benchmark, the major universities are being re-structured. This involves (i) reducing the number of Faculties and Schools, (ii) reducing the number of courses and qualifications, (iii) eliminating course repetition across numerous schools, (iv) de-commissioning redundant courses and staff, and (v) putting in place new accreditation and certification regulations and statutes. The re-structuring is expected to be completed by September 2014. This will be followed by a second phase of

No	Activity	Implementation Status (Change since Sept 2013)
		higher education reform involving the quality improvement of teaching, strengthening the qualifications and research capacity of academics and upgrading/updating curriculum programs. Taking account of 1.2.1, all current Faculty in the School of Civil Engineering and Institute of Engineering and Technology will require intensive training in English for academic purposes followed by new professional training in a Master of Engineering or similar postgraduate course and qualification. Since the preparation of the Mid-Term Road Sector Capacity Building Program significant progress in modernizing provisions for education and training have been put in place by private sector firms. This has involved a large investment in those trades central to mining, mine operations and the mining supply chain. This has included engineering trades and numerous automotive and transportation trades. New provisions for upgrading engineering education is gathering momentum by means of ongoing or new investments in the sector including Rio Tinto, GIZ, JICA and DFAT (Australia). The German-Mongolian Institute for Resources and Technology is now in place and will commence academic programs in September 2014 in three engineering degrees. Total student enrolment as full-time students will be 120 and this will ensure that the target of 80 newly trained engineers per annum is met.
1.2.3	Prepare skilled teachers and trainers and upgrade the curriculum for retraining and postgraduate training. Increase the number of trained professionals to about 150 engineers and technical workers every year.	MRTD in cooperation with the Mongolian Road Association (MRA) is implementing re-training and qualification program for road engineers, technicians and operators. 435 persons in 2011, 608 persons in 2012 and 358 persons were involved in various qualification training sessions. As advised under 1.2.2 new curriculum programs in engineering trades have been introduced. New undergraduate training in engineering will commence in 2014 and

No	Activity	Implementation Status (Change since Sept 2013)
		includ es: • B.Sc. in Mineral Resources Engineering • B.Sc. in Mechanical Engineering • B.Sc. in Environmental Engineering These courses represent upgraded curriculum and qualifications. The CDTA is proposing a the introduction of a range of postgraduate training for MRTD, UBDoR and the private sector drawn from the following qualifications: • Associate Degree in Engineering Technology: 12 months • Diploma in Engineering Technology (Highways): 12 months • Diploma in Road Management and Engineering: 8 months • Graduate Certificate in Engineering (Management): 5 months • Graduate Certificate in Road Engineering and Construction: 5 months • Graduate Diploma in Engineering (Management): 12 months • Graduate Diploma in Road Engineering and Construction: 12 months • Graduate Diploma in Engineering (Highways): 12 months • Master in Road Management and Engineering: 12 months • Master of Engineering Management: 12 months • Master of Engineering (Management): 12 months
1.2.4	Strengthen the study and training environment and its resources by providing textbooks, equipment, and on-the-job training	The CDTA delivered the translated and dubbed DVD training materials developed by the International Road Federations (IRF). The Mongolian University of Science and Technology is hosting online and web based training under the contract with

No	Activity	Implementation Status (Change since Sept 2013)
		the CDTA. Strong progress has been made in introducing new engineering education instructional programs including structured webinars, online learning (eLearning) provisions and the use of self- paced study. There are more opportunities by means of eLearning and video conferencing through the E-Open School (MUST), the National Learning Resource Center (Mongolian-Korean College) and various Regional Training Centers that have been funded for eLearning by MCC. This includes Erdenet VTPC, the Govisumber Polytechnic in Mining and Darkhan VTPC. The CDTA provided some twelve separate professional education and training programs. They included: • Periodic Road Maintenance, September 2012 (20 participants) • A study tour to the Ontario Good Roads Association (OGRA), Ontario, Canada, December 2012 (2 participants) • Training-of-trainers in adult teaching and learning, December 2012 (20 participants) • Road Construction Contract Management, December 2012 (39 participants) • Construction Contract Management for Senior Management and Senior (iv) Engineers, January 2013 (17 participants) • Procurement Management, February 2013 (25 participants) • Specialized Engineering for Road Construction, March-April 2013 (30 participants) • Supervision Engineers in Road Construction, April 2013 (30 participants) • Elementary Training of Quantity Surveyors, May 2013 (30 participants) • Cold Climate Road Engineering and Construction, OGRA, May 2013 (42 participants) • Pavement Management System Training, June 2013 (6 participants)

No	Activity	Implementation Status (Change since Sept 2013)
		• Federation of Consulting Engineers[4]: Conditions of Contracts, October 2013 (20 participants) Translation, dubbing and review of training DVDs prepared by the International Roads Federation for dissemination through the E-Open School at the MUST.
OBJECTIVE 2: Provide a high-quality road network		
2.1	Upgrade road maintenance management	
2.1.1	Develop and implement a road maintenance plan for government roads and capital city roads. Obtain sources of funding for overall road maintenance and its facilities. Research current road conditions, which is required to develop and implement a plan of periodic maintenance and reconstruction. Get accustomed to periodic maintenance or reconstruction of capital city paved roads every year in accordance with the plan.	The key component for this task is to functionalize the existing road assets management system or dTIMS at MRTD. The CDTA has developed the front end application in Mongolian to assist MRTD to make use of the system. The system deployment at the Road Research and Supervision Center (RRSC) in addition to operation of the newly purchased road conditions survey equipment will serve a basis for road maintenance program for 2015. Despite, periodic maintenance programs for 2013 and 2014 were developed by the CDTA, no budgets were provided in the subsequent years. August 2016 Update dTIMS system is no longer in use by MRTD, owing to the perception that it is too complex and that they could not afford the cost of maintaining the data. Additionally the road condition survey equipment (ROMDAS) is no longer used for full network level surveys, instead being used solely for confirming roads have been built within standard. MRTD will be unable to meet their legal obligations under the draft Road Law as a result of not having a PMS in place.
2.1.2	Introduce contracts that base financing on road condition and establish cost norms for road maintenance work. Introduce international practice so that financing is predicated on road condition and quality, rather than on just a background of completed work, and on the	The work is initiated in 2012 with the creation of a Working Group for revising the basic tariffs for road maintenance to reflect market conditions. Performance based contracts have been made with 4 private road maintenance companies in 2010 for four years.

No	Activity	Implementation Status (Change since Sept 2013)
	basis of established normative cost per kilometer of routine maintenance work.	August 2016 Update Substantial underfunding of routine maintenance (MNT 8 billion funded from identified need of MNT 55 billion) has resulted in piecemeal approach to the funding (and rectification) of defects. The prior PBC contracts have not been continued, although the private sector is still involved in maintenance using standard contract model (same as state road maintenance companies)
2.1.3	Perform road maintenance work using road asset management systems. Identify required investment for road maintenance and plan it in keeping with the road asset management database established by the DOR, taking into consideration road length, specific location features, and current road condition, with assistance from ADB consultants.	The Pavement Management System (PMS) is installed and functionalized in UBDOR for the purpose of developing a city wide road maintenance program and capacity within DOR for evaluating the capital city road maintenance needs. The pilot Road Conditions Survey (RCS) is carried out in Ulaanbaatar to be formed as replicable and expandable model for data entry. August 2016 Update The PMS (SMEC system) is no longer in use and RCS is not undertaken. UBDOR have reverted to the use of an Excel spreadsheet to manage the network.
2.1.4	Upgrade and develop a legal environment and procedures for the Road Fund and its disbursement. At present, the Road Fund's legal environment and disbursement procedures are unclear and not optimal. Funding from Road Fund should be exclusively dedicated to routine and periodic maintenance, planned on the basis of the road asset management system. The road maintenance budget will be no less than MNT40 billion per year by 2016.	The CDTA has prepared a discussion note for the Road Fund and further incorporated into the draft new law. Road maintenance budget for 2014 is 22.4 billion with increase above 19 billion in 2013. August 2016 Update Draft Road Law has yet to be passed by Parliament. Routine maintenance budget for 2016 is 8billion versus a request of 55 billion, with no funding of periodic maintenance. MOF have advised this is owing to the state of the economy and not through lack of understanding of the important of maintenance and that 2017 budget is likely to be less than 2016.
2.1.5	Establish a new road maintenance company for every 100–200 km of roads, in keeping with the increasing volume of paved road construction.	Two new road maintenance (Bayanchandman and Nalaikh) companies have been created to maintain the completed North and South road corridor. MRTD will further create 2 two road maintenance units in the Western Road Corridor by 2016.

No	Activity	Implementation Status (Change since Sept 2013)
		The CDTA has advised that this action is not appropriate and that greater consolidation of State Road Maintenance Companies is needed and not the creation of new ones.
2.1.6	Clarify the duties and obligations of the road maintenance companies, and improve companies' management structure and contract administration.	The CTDA has undertaken assessment on the current performance of the road maintenance companies. Starting from 2014, operational supervision of the road maintenance companies has been delegated to the local governors' offices to improve performance control. The CDTA advice has been to bring these companies within the MRTD function and much higher level supervision. The recommendation has also been to reduce the number from 19 to 6 because the current structure is highly inefficient. August 2016 Update 20 state road maintenance companies are in existence.
2.1.7	Upgrade the current management structure and methodology for routine maintenance of Ulaanbaatar roads. An organization specifically in charge of road maintenance should take over the related duties currently assumed by the current comprehensive city road maintenance contractor.	The UB City is in the process of creating a consolidated public service company with component of the road maintenance service. UBDOR will still act as client and supervisory body for road maintenance in the city. The CDTA has provided road maintenance manual for UBDOR.
2.2	Ensure competitive participation of the public and private sectors in the implementation of road maintenance work	
2.2.1	Develop a favorable legal environment and conduct research on public–private participation in routine and periodic maintenance of roads and facilities.	Private sector companies will maintain road sections in Dundgobi, Umnigobi, Bayanulgii, Gobisumber and Zamyn-Uud on performance based contracts in accordance with the Government Resolution dated on January 11, 2014. August 2016 Update 6 private sector companies are involved in road maintenance, alongside the 22 state road maintenance companies. Private sector work is competitively won for a period of 4 years on the basis of capability, then annual contracts signed to deliver works based on available funds. State road maintenance

No	Activity	Implementation Status (Change since Sept 2013)
		companies have no competitive element to them, but have annual contracts.
2.2.2	Provide an opportunity for the private sector to execute some routine road maintenance on the basis of good accountability. Evaluate the performance of the private sector during execution of routine maintenance.	No formal decision. Only 4 of the 23 road maintenance companies are private sector. There has been no expansion of that arrangement. The CDTA has made strong recommendations to: • Consolidate the State Road Maintenance Companies into no more than 6; • Create significant opportunities for the private sector to undertake road maintenance on major corridor roads given the failure of the maintenance regime on the Darkhan and Choyr roads. August 2016 Update Consolidation of State Road Maintenance Companies has not occurred, with 22 in operation. 6 private sector road maintenance companies are in operation.
2.2.3	Ensure competitive participation of the public and private sectors in implementation of periodic road maintenance. In selecting a road maintenance company for periodic maintenance, priority should be given to human resources qualifications, appropriate machinery and equipment, work experience, and capability.	In periodic road maintenance plan for 2014, it is proposed that 50% of the total works will be tendered out to private sector companies. Periodic road maintenance was not agreed by the MED and so no budget provision was made and the private sector is not involved in delivery of maintenance except for the 4 maintenance companies carrying out routine maintenance. August 2016 Update Periodic road maintenance continues to be unfunded (either at all, or to any significant level), such that there is no opportunity for the private sector to participate meaningfully in these works.
2.3	Assess the current axle loads of road users and develop strategies to prevent overloading on roads	
2.3.1	Develop an action plan to prohibit overloaded traffic from running on state paved roads. Set up proper devices to measure load capacity at main points on state paved roads, forcing users to	The CDTA has recommended a specific overloading strategy for the major corridor roads that involves: • The MRTD administering overloading laws

No	Activity	Implementation Status (Change since Sept 2013)
	follow proper standards. Address overloading issues incrementally and ultimately stop it.	• Trucks that carry loads outside their actual dimensions be included in the definition of overloaded • Introducing CCTV monitoring cameras as part of the enforcement approach The recommendations are still with government. August 2016 Update Overloading continues to be a significant issue. Current approach of MRTD maintaining weigh stations, and police enforcing does not appear to be a viable proposition.
2.3.2	Study the possibility of increasing the load capacity of roads. Conduct field experiments in two locations traveled by heavily loaded vehicles within 2012. Install devices to measure load capacity, observe pavement deterioration, and recommend measures to improve pavement design.	The construction of complex control and service (weigh and inspection) stations is under way at the existing toll gates of Ulaanbaatar in 5 locations to control overloading. Furthermore, MRTD plans to mobilize inspectors equipped with portable weighing scales at 15 strategic road segments. August 2016 Update Enforcement of the load limits and operation of the weigh stations is variable, resulting in continued overloading.
OBJECTIVE 3: Increase return on investment for the road sector		
3.1	Plan investment in road construction based on prioritization of socioeconomic significance and return on investment	
3.1.1	Update the Road Master Plan to be consistent with the policy of regional development, mining, and tourism. A master plan on road network development in harmony with state policy on regional development, mining, and tourism is needed.	The key objective of road sector is to connect Ulaanbaatar with all provincial centers by paved roads as declared in Action Plan for 2012-2016 of the Government. The current investment projects include 3,321 kilometers of paved roads and 2,984 meters of bridges financed by the national budget, the Development Bank of Mongolia and international donor agencies.
3.1.2	Elaborate midterm and yearly investment plans within the context of state development policy and strategy. Eliminate decreasing returns on investment and disruption of plans due to unexpected projects and activities not reflected	A draft road master plan for 2008-2020 was prepared in 2007 with technical assistance from the World Bank. Update of the Road Master Plan is underway.

No	Activity	Implementation Status (Change since Sept 2013)
	in the approved policy and strategy but reflected in midterm and yearly plans.	
3.2	Encourage private investment in the road sector	
3.2.1	Formulate a favorable legal environment and proper procedures to encourage private investment in the road sector.	
3.2.2	Improve the regulations on contracting procedures for concessions and evaluate and track contract achievements. Develop standard contracts for concession and craft regulations for bidding. Develop qualification criteria for contract evaluation, to be followed by the road sector in accordance with the Concession Law in Mongolia.	The implementation of the Concession Law is handled by Ministry of Economic Development and 14 packages of 'Concessions' for build and transfer contracts have been issued in 2014. for 14 Aimag to UB roads.
3.2.3	Develop, endorse, and improve state policy documents about road sector–related transportation of mining products. A comprehensive government policy and coordination is needed for the biggest projects and programs in the mining sector and for the transportation of these mining products, given the initiation of road construction by private companies.	MRTD is developing plan for coordination of mining roads. The key concept of the plan is to define the main arterial alignment for roads between strategic mining locations, entry ports and transport hubs. The plan will serve as basis for review of the technical feasibility for concessional roads.
3.3	Improve contract administration and procurement procedures	
3.3.1	Improve documents related to procurement procedures. Study the bidding documents of countries with internationally recognized bidding experience and customize these to Mongolian conditions. Upgrade and follow regulations for bidding.	The CDTA has developed documents on the procurement process for works and consulting services or fast track competitive bidding. These documents need to be elaborated as operation procedure by MRTD.
3.3.2	Reflect more specific feature of the road sector and increase the involvement of professional organizations. Make the procurement procedures more efficient and simple.	

No	Activity	Implementation Status (Change since Sept 2013)
3.3.3	Develop and follow rules and regulations for supervisory consultants in road construction and design.	Construction supervision manual is developed by the CDTA team for review and approval by MRTD.
3.3.4	Study and introduce international best practices for quality assurance in road construction contracts.	
3.3.5	Develop and implement consulting service agreements for road construction on the basis of International Federation of Consulting Engineers standard contracts and consistent with Mongolian conditions.	MRTD has signed License Agreement with FIDIC to publish and distribute a translation of the following contract documents: • Client/Consultant Model Service Agreement, 4th Edition, (2006 White Book) • Conditions of Contract for Plant and Design-Build, 1st Edition, 1999 • Conditions of Contract for EPC/Turnkey Projects, 1st Edition, 1999 • MDB Harmonized FIDIC General Conditions of Contracts, 2010
3.3.6	Study and implement proper cost estimation procedures for road design, construction, and maintenance, and their enhancement. Apply real market costs in calculating estimates for road design and construction.	Report and recommendations on price escalation clause for FIDIC Contracts is provided by the CDTA.
3.3.7	Apply equal fees for consulting services in road construction and maintenance by increasing consulting service fees independently of contractors' fees. Increase the supervision fee for road construction consulting services to not less than 4% of total construction cost. Such fees should be projected separately and spent independently from contractor fees.	An indicative budget for construction supervision is increased up to 5% out of the total contract cost. The supervision cost is established at 4-5% out of the total construction budget by the Government Resolution No.124 dated on March 30, 2013 approving the list and budget for road construction projects funded by bond proceeds.
3.4	Strengthen sector capacity for scientific research and laboratory testing	
3.4.1	Establish a road research institute and provide related human resources, equipment, tools, and laboratory space. Present scientific research and survey of new techniques, technology,	Research roles have been delegated to the newly established Road Inspection and Research Center. MRTD encourages the participation of private sector and NGO in promoting new technologies in forms of EXPO, trade shows, demos etc.

No	Activity	Implementation Status (Change since Sept 2013)
	materials, and sophisticated design is outdated due to lack of a special independent research institute.	
3.4.2	Study and introduce advanced international technology, experience, and management of design, construction, and maintenance of roads and facilities.	MRTD is establishing the twinning arrangements with the neighboring countries, Korea, Canada and Australia for training and re-training.
OBJECTIVE 4: Strengthening road sector institutional capacity		
4.1	Update, clarify, and strengthen the objectives, obligations, and legal environment of the state agency responsible for the road sector and provide skilled human resources for the implementation of their public responsibility.	
4.1.1	Update and clarify the duties, responsibilities of government organizations connected with roads, supported by technical assistance from consultants to strengthen capacity.	The MRTD was established under the new Government in September 2012 with a mandate established by the government. That Ministry has been bedding in since that time and o review of functions has been undertaken.
4.1.2	Elaborate and implement an organizational structure for the road sector to ensure a stable management structure, right of independent decision making, transparency, and accountability.	The CDTA did develop a new organizational arrangement for the former DoR which was not adopted by the new Government. A review of the institutional approaches may be appropriate in 2015 after a period of operation of the Ministry structure
4.1.3	Clarify the duties and obligations of the state agency connected with road. The duties and Responsibilities will include preparing the investment plan for the road network, organizing procurement, ensuring contract administration, ensuring road condition quality, and housing the road asset management system.	Many of these aspects have been addressed as single items through the CDTA – for example, the implementation of the road asset management system. Procurement has now been transferred to the General Procurement Agency. Road investment planning has yet to be tackled given the sources of funds now are from Budget, Development bank of Mongolia, potential Concessions from the MED and international donors.
4.1.4	Study the possibility of establishing a regional implementation unit to supervise proper road conditions and road maintenance. Change and upgrade the existing structure of road maintenance activity for international and state road networks	Regional implementation was recommended in the DOR structure proposed by the CDTA. The regional plan was not agreed under the new Ministry structure. Regionalization needs to be investigated into the 2015 year as part of the institutional review recommended above in 4.1.2

No	Activity	Implementation Status (Change since Sept 2013)
4.1.5	Identify the human resources necessary to implement the enhanced duties and obligations of the state road organization and develop a plan for retraining and specialization of personnel. Develop and implement a training plan for personnel to strengthen the road sector until 2012, and encourage its personnel to undergo further graduate and postgraduate studies and other certified training.	The CDTA carried out a full and comprehensive skills and position assessment for MRTD. A costed training and development strategy and implementation plan has been developed for 2014-2017.
4.2	Upgrade output-based management	
4.2.1	Upgrade the output-based management system in the state road organization and clarify performance and evaluation criteria.	The Ministry approach to road sector management put this work on hold for the CDTA project period.
4.2.2	Evaluate the performance of the state road organization on the basis of the following: • creation of the midterm investment plan and its achievement; • creation of the annual investment plan and its achievement (by activity and through contractor); • road condition; and • contractual management.	The evaluation should be conducted in 2015 after 2 budget cycles of the new Ministry have been undertaken
4.2.3	Craft regulation for evaluating performance	No progress.
4.3	Expand the involvement of NGOs in the sector related activities	
4.3.1	Support and strengthen the capacity of public nongovernment organizations.	
4.3.2	Study and identify the involvement of public nongovernment organizations in sector activities, supported by technical assistance consultants.	MOU signed between MRTD and the Mongolian Road Association (MRA) in November, 2012 on the areas for cooperation. Training is the key responsibility of MRA.
4.3.3	Some government assignments and tasks will be transferred to public nongovernment organizations. Expand the cooperation between public organizations and professional	The initial review of applications for road construction licenses now is responsibility of the MRA as regulated by MRTD.

No	Activity	Implementation Status (Change since Sept 2013)
	nongovernment organizations and formulate a favorable legal environment for cooperation on any road sector activity.	
4.4	Reorganize the Road Board and intensify its activity	
4.4.1	Upgrade the legal environment of the Road Board and reorganize its management structure. Reorganize the composition of the Road Board with representatives of public, private, and civil society in 2012. Rights and duties will be regulated in accordance with the Road Act.	This task is pending for approval of the new Road Law.
4.4.2	The Road Board will support and collaborate with state road organizations. Its main activities are to give recommendations for projection of the investment plan and to collaborate with government organizations to reflect Road Board strategy on road construction supervision and maintenance, marketing the road sector's achievements to the public, and including road users' interests in road sector policies.	Same as above
4.5	Upgrade the road sector information system	
4.5.1	Formulate proper capacity building to upgrade the road information system. Identify the necessary software, hardware, equipment, tools, human resources, and funding	August 2016 Update CMS and dTIMS no longer in use owing to the non-sustainable cost of data collection and human resources to run the systems. An alternative approach that is considered sustainable needs to be developed and implemented.
4.5.2	The following information will be included in the road information system: • a database on the state road network; • midterm and long-term plans to develop the road network; • information about procurement status; • progress of project and program implementation; • reports from the Department of Roads, Ulaanbaatar DOR, and the Road Board;	The contract management system (CMS) for monitoring and assessment of contract performances is now installed at MRTD and UBDOR. Contractors and Consultants Registration System (CCRS) is developed with data over 200 road construction and consultant companies. GIS based and road network data application is developed to interface with CMS, dTIMS and CCRS. August 2016 Update

No	Activity	Implementation Status (Change since Sept 2013)
	• information from contractors and consulting firms; • information about road conditions; and • road user assessments.	CMS and dTIMS are no longer in use within MRTD. An alternative approach that is considered sustainable needs to be developed and implemented.
4.6	Support and assist the local administrative units of *aimags* in developing an aimag level road network plan	
4.6.1	Each *aimag* should identify and endorse a local road network, create a road information database, and elaborate and implement midterm and annual plans to develop the local road network. Support and assist in the creation of an administration and management methodology for local administrative units to follow in developing the local road network	Progress has not been tracked by the CDTA