MYANMAR TRANSPORT SECTOR POLICY NOTE
TRUNK ROADS

ASIAN DEVELOPMENT BANK

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Foreword

Myanmar is at a historic milestone in its transition into a market economy and democracy. After decades of isolation and stagnation, the country has, since 2011, been undergoing a fundamental political, economic, and social transformation at unprecedented speed and scope. Achieving the country's high growth potential will require continued reforms and structural transformation, especially in advancing major investments in infrastructure, developing relevant capacities and skills, and enhancing the business environment. This will enable Myanmar to reach the ranks of upper middle income economies by 2030.

Due to massive underinvestment and neglect in recent history, Myanmar's infrastructure lags behind its Association of Southeast Asian Nations neighbors, and hinders access to markets and social services. High transport costs and associated limited access to markets and services are among the main causes of poverty and regional inequality. Twenty million people still live in villages without access to all- season roads. The questions then are: how can basic transport services be provided to all? What does it take to improve the quality of the transport infrastructure and services for the private sector? How can Myanmar reduce the economic and social costs of transport?

The Government of the Republic of the Union of Myanmar is committed to addressing these questions, and the underlying issues. Towards this end, the Government has commissioned from the Asian Development Bank (ADB) the preparation of a *Transport Sector Policy Note*. The Transport Sector Policy Note takes stock of the transport sector challenges, provides a strategic framework for reforms that could assist Myanmar's policymaking, and identifies the areas where international financial and technical assistance could make the highest contribution to the development of Myanmar's transport sector.

The *Transport Sector Policy Note* is composed of nine reports, including this one, and a summary for decision-makers. The first two—*How to Reform Transport Institutions*, and *How to Reduce Transport Costs*—provide an overview and framework for policy reform, institutional restructuring, and investments. These are accompanied by separate reviews of key subsectors of transport: *Railways*, *River Transport*, *Rural Roads and Access*, *Trunk Roads*, and *Urban Transport*. These reports summarize and interpret trends on each transport sector to propose new initiatives to develop them. The thematic report *Road Safety* builds a first assessment of road safety in Myanmar. The thematic report *How to Improve Road User Charges* is a stand-alone study of cost-recovery in the road sector.

The research was organized by ADB and the then Ministry of Transport, with the active participation of the Ministry of Construction and the then Ministry of Railway Transportation. A working group comprising senior staff from these government ministries guided preparation. The work stretched over the period of 24 months, and was timed such that the final results could be presented to the new government that assumed office in April 2016, as a contribution to its policy making in the transport sector.

As the *Transport Sector Policy Note* demonstrates, Myanmar can, and should, develop a modern transport system that provides low-cost and safe services, is accessible to all including in rural areas and lagging regions, and connects Myanmar with its neighbors by 2030. The Government has the determination to doing so, and can tap the support from development partners, the private sector and other stakeholders. It can take inspiration from good practices in the region and globally.

The *Transport Sector Policy Note* provides a rich set of sector data, is meant to be thought-provoking, presents strategic directions, and makes concrete reform recommendations. It stresses the need to strengthen the role of planning and policy-making to make the best use of scarce resources in the transport sector. It highlights the need to reexamine the roles of the state—and particularly state enterprises—and the private sector in terms of regulation, management, and delivery of services in the sector. It identifies private sector investment, based on principles of cost-recovery and competitive bidding, as a driver for accelerated change. Finally, it aims at a safe, accessible, and environmentally friendly transport system, in which all modes of transport play the role for which they are the most suited.

We are confident that the *Transport Sector Policy Note* will provide value and a meaningful contribution to Myanmar's policymakers and other key stakeholders in the transport sector.

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The Transport Sector Policy Note was prepared at the initiative of Hideaki Iwasaki, director of the Transport and Communications Division of the Southeast Asia Department of the Asian Development Bank (ADB). It was prepared by ADB staff and consultants. Adrien Véron-Okamoto (ADB) coordinated the study, prepared the notes *How to Reduce Transport Costs*, *How to Improve Road User Charges* and the overall *Summary for Decision-Makers*, drafted the executive summaries, and contributed substantially to the notes *How to Reform Transport Institutions*, *River Transport*, *Trunk Roads*, and *Urban Transport*. Gregory Wood prepared the note *How to Reform Transport Institutions*. The *Railways* note was prepared by Paul Power. It also benefited from analytical research and suggestions by Richard Bullock. Eric Howard prepared the Road Safety note. Kek Chung Choo prepared the *River Transport* note. Paul Starkey and Serge Cartier van Dissel prepared the *Rural Roads and Access* note. Serge Cartier van Dissel also prepared the *Trunk Roads* note. Colin Brader (of Integrated Transport Planning) prepared the *Urban Transport* note.

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Assistance from the Government of Myanmar, especially of the Ministry of Transport and Communications, the Ministry of Construction, and the Ministry of Agriculture, Livestock and Irrigation, is gratefully acknowledged. A first draft of these notes was presented and reviewed by government's study counterparts in 2015. This final version benefited from the comments and suggestions received.

Abbreviations

AADT	annual average daily traffic
ADB	Asian Development Bank
AH	Asian/ASEAN Highway
ASEAN	Association of Southeast Asian Nations
BOT	build–operate–transfer
DOB	Department of Bridges
DOH	Department of Highways
DRD	Department of Rural Development
ft	foot
GLC	government-linked company
GMS	Greater Mekong Subregion
IC/UR	international communication and union roads
IT	information technology
IRI	international roughness index
JICA	Japan International Cooperation Agency
km	kilometer
km^2	square kilometer
kph	kilometer per hour
LLC	limited liability company
m	meter
MOALI	Ministry of Agriculture, Livestock and Irrigation
MOC	Ministry of Construction
MOPF	Ministry of Planning and Finance
MOTC	Ministry of Transport and Communications
NTDP	National Transport Development Plan
PPP	public–private partnership
PRC	People's Republic of China
PW/DOH	Public Works/Department of Highways
RAMS	Road Asset Management System
RRL	Road Research Laboratory
RTAD	Road Transport Administration Department
SEE	state-owned economic enterprise
UECC	United Engineering Construction Corporation
US	United States

Currency Equivalents

(as of December 2014)

Currency unit	=	kyat (MK)
MK1.00	=	$0.0001
$1.00	=	MK1,000

Notes

(i) The fiscal year of the Government of Myanmar begins on 1 April and ends on 31 March. "FY" before a calendar year denotes the year in which the fiscal year starts, e.g., FY2014 begins on 1 April 2014 and ends on 31 March 2015.

(ii) In April 2015, the Government of Myanmar restructured Public Works, under the Ministry of Construction, into several departments. Most of its road-related responsibilities and its local offices were transferred to the new Department of Highways (DOH), with the exception of bridges, which are managed by the new Department of Bridges (DOB). Actual arrangements had not yet been finalized at the time of drafting. "PW/DOH" in the report refers to the entities responsible for the road sector under the Ministry of Construction, except when the distinction between Public Works, DOH, and DOB is useful.

Executive Summary

Overview

This report reviews how the road sector in Myanmar can make the greatest contribution to the country's national ambitions as possible. It seeks to identify bottlenecks and attempts to formulate possible policy answers. Myanmar's road network needs rehabilitation, improvement and ultimately, total modernization. The issue is what to prioritize. Whichever approach is taken, the country's current road sector is unlikely to be able to scale up and deliver upon the population's expectations without a comprehensive modernization of its financing mechanisms, its institutional organizations, and the business processes used for planning, construction, and road maintenance. This report therefore argues that Myanmar should make both sector reform and capacity development a medium-term agenda of equal priority to that of road network modernization.

A 15-Year Modernization Agenda

Myanmar has an extensive but low-quality road network. As of 2013, Myanmar had 157,000 kilometers (km) of roads, of which only 34,700 km were paved. Although the road network is less dense than in other Southeast Asian countries, this number is large relative to the country's population, vehicle fleet, and economic size. The country's Public Works until 2015, and subsequently the Department of Highways (DOH)—under the Ministry of Construction (MOC)—manages the trunk roads, which is a network extending over 40,000 km. Despite significant investment over the past decade, only 53% of the trunk road network is currently paved, two-thirds of the paved trunk roads are only 12 feet (ft) wide, and approximately 80% of the paved roads have a rough-penetration macadam surface. As of 2015, half of the 21,000 km paved trunk roads were in poor condition. Road alignments are often dangerous, and basic safety features are generally missing.

This situation finds its roots in how and how much the government has invested in the road sector in the last decades. Myanmar has spent about 1% of its gross domestic product (GDP) on trunk roads, compared with 2%–3% in similar countries. Also, most spending has long been for remote areas rather than the core network, while standards were kept low. More recently, the government has dedicated resources to road widening, but generally without improving alignments. Paved roads have been maintained and repaired, but generally maintenance and repair fall short of what is needed to make lasting improvement. For most road works, the Public Works has applied low-quality standards and relied on labor-intensive techniques. This has kept costs and technology requirements low, and enabled a large expansion of the network. However, the impact on the economy has been muted: transport by road remains costly and slow, even on Myanmar's main roads.

Traffic is increasing rapidly but from a very low level and as a result, upgrading needs are still moderate. Myanmar's vehicle fleet consists of 640,000 vehicles, not including motorcycles. Only 5,000 km of roads have traffic above 1,000 vehicles per day. Up to 74% of the trunk road network—including half of the paved roads—experiences a low traffic volume of below 200 vehicles per day, a level often used internationally as a threshold for justifying sealing a road. Even though most paved roads are narrow (3.6 meters [m] or 12 feet [ft]), only 10% have traffic levels that justify widening. For many roads, traffic levels do not justify sealing. Needs will increase rapidly, however, as road traffic is expected to rise at about 10% a year.

Modernizing the road network will require breaking from past practices and will require the following:

- **Investments in road infrastructure should increase**. We put *minimum* annual investment requirements for trunk roads at 1% of GDP initially ($600 million in 2014). Investments as a share of GDP should later rise if Myanmar is to follow the examples of Thailand or Viet Nam to at least 2%.
- **Investments should focus on main roads**, where traffic is already important. In order of economic importance, these are the Yangon–Mandalay corridor, the Northern and East–West Greater Mekong Subregion (GMS) road corridors linking with the People's Republic of China (PRC) and Thailand, the congested roads around Yangon and Mandalay, and major national highways with already significant built-up traffic, linking Pathein, Pyay, Mawalamyine, Monywa, and Taunggyi.
- **Higher quality standards should be applied**. Trunk roads utilized by high traffic will need to be reconstructed to improve alignment, and given stronger pavement. Asphalt concrete should be utilized, except on low-volume roads. Pavements should be rehabilitated rather than given short-term fixes. Safety engineering should become the norm.
- **Equipment-intensive techniques should become the norm**, and labor intensive ones be phased out. This will likely require *generalizing contracted-out construction and maintenance works.*

The new National Transport Development Plan (NTDP) gives sound direction on what should be done regarding main road corridors. Works to improve the East–West GMS corridor linking Myanmar with Thailand are under way, or will soon start. MOC should also launch a prefeasibility study to review potential alignment improvements on the GMS Northern corridor linking Myanmar with the PRC and conduct a design review of the Yangon–Mandalay expressway to identify the need, if any, for improvements to allow usage by trucks. Looking ahead, all highways with important traffic (i.e., above 2,000 vehicles per day) should be upgraded.

In parallel, MOC should launch a large program of pavement rehabilitation and periodic maintenance. Improving trunk roads with significant traffic would have high economic benefits. Such a program would, over time, involve all national highways, except those with the lowest traffic levels. The DOH road asset management strategy and database—developed with Asian Development Bank (ADB) technical assistance—should help define treatments to apply and identify priority road segments. This program would likely generalize asphalting or machine-laid surface dressings.

A minimal program of high return road investments would cost $3 billion during 2016–2020. Based on the priorities identified above, such a program would improve about 13,000 km of highways, i.e., one-third of the trunk road network. As it would be focused on roads with high traffic, it would benefit a much larger share of road users. Only if more resources are obtained should the government consider investing in trunk roads with limited traffic (Table E1).

Table E1: 'Minimum' Five-Year Program

	Length (kilometer)	Cost ($ million)
Paved network		
- Major improvements	1,300	850
- Widening	1,000	520
- Rehabilitation	2,500	500
- Periodic maintenance	4,000	480
- Routine maintenance		80
Unpaved network		
- Paving	890	125
- Periodic maintenance	3,200	145
- Routine maintenance		75
- Bridges		240
Total	**12,890**	**3,015**

Source: ADB estimates.

Within 15 years, Myanmar could have a modern trunk road network, maintained to good quality and fully meeting its economic development needs. This can happen if it concentrates on high-priority investments and invests at least 1.5% of its GDP on trunk roads. We estimate that by 2030, Myanmar's trunk road network could include

- 1,000 km of expressway or four-lane roads,
- 6,000 km of trunk roads meeting modern Class II or Class III standards,
- an additional 5,000 km of trunk roads with asphalt concrete surfacing,
- 10,000–15,000 km of trunk paved roads with machine-laid surface dressing and proper shoulders, and
- proper maintenance of this 22,000–27,000 km trunk road network to keep it in good condition.

To deliver a modern road network within 15 years, the sector has to overcome several capacity bottlenecks and conduct major reforms. The public institutions and financing framework need to be revised and a much larger and dynamic private sector is needed, coupled with improved technologies and a more skilled workforce.

Bottlenecks Ahead

Road Sector Financing Channels

Current road sector financing channels cannot adequately finance the modernization of the national network. After a decade of low investments, road sector resources are set to increase in FY2014 from 1% to 2% of GDP. This is a very positive change. However, most of the additional resources come from state and regional budgets, and only a minor share is going into the national highways and planned financing remains insufficient to meet the improvement needs of the national network. Budgets are also becoming more volatile, and there is a growing mismatch between resource availability (at the subnational level) and needs (in the national network).

Road-user financing is an insufficiently tapped resource. Myanmar's road users finance a significant share of road sector costs. We estimate that Myanmar collects $450 million a year from road users, mainly from car owners (through registration fees) and heavy trucks (through tolls), while other users make only very small contributions. However, most fees are collected by the Ministry of Transport and Communications (MOTC), and all fees (including those collected directly by MOC) go into the national treasury. Annual allocations from the national treasury are not directly linked to the amount of user fees collected.

The placing of tolls on roads has not emerged as a viable alternative for financing needs. Myanmar tolls 22,000 km of roads, including 5,545 km under private build–operate–transfer (BOT) contracts. This is an exceptional achievement among developing countries. While all key trunk roads are locked into 40-year BOT contracts, the BOT model seems severely flawed. Contracts are not enforceable, investments that are viable for financing are minimal, and performance is generally poor. User payments are significant ($120 million a year), however, they do not seem to achieve value for money. As it stands, the BOT model appears to hamper the modernization of the road network where it matters most. The rest of the tolled road network (16,500 km) is covered by toll gates where revenue collection is "auctioned" out. In practice, the system amounts to little more than a lottery and has high collection costs. Most toll gates generate very little revenue, and there is no link between the revenue collected and the costs of collection.

Road Sector Institutions and Business Processes

Road sector institutions are ill-adapted to the delivery of a modernization agenda. MOC has been efficient in extending the road network and maintaining the basic operating conditions, but has not been able to modernize its practices. As an organization, the DOH (Public Works until 2015) seems reactive and accountable. However, it is structured under an operating concept where works identified by the political management are delivered by its own workforce. Its policy formulation and planning capacity are limited. A reorganization that took place in 2015 introduced new units in charge of procurement, safety, policy, etc. However, it also split the DOH from the Department of Bridges (DOB), creating new coordination problems and diluting responsibilities. Finally, a number of strategic functions that a national road agency should have are placed outside of MOC's hands. The MOTC regulates road vehicles and collects fees. Road industry development is under the responsibility of the Ministry of Commerce. Investment choices and main policies originate in the Cabinet.

The efficiency of MOC spending has been limited by the way it selects, designs, and carries out works. The DOH does not have a refined culture of planning. In practice, plans have followed budgets. Planning has been either left to politicians (for large investments), or understood as a budget process (cutting down bottom–up "wish lists" to fit the available budget). The road sector has three new investment plans that are reasonably articulated and generally sound, but the DOH lacks a process for prioritizing investments within the framework of those plans. Another limitation is that the government has delivered all works in-house until now. In other words, DOH staff design, implement, and maintain the roads. This system shows limited efficiency and quality. For instance, most upgrade works are carried out without design and quality control, due to the small scale of the DOH road research laboratory. In-house delivery has also come with an excessive reliance on labor-based techniques, which it cannot scale up to match modernization needs.

Current structures will require almost complete reengineering. The move toward private sector delivery has been enacted by the government, and appears necessary in order to rapidly deliver a large set of modern works. However, most of the DOH staff are involved in road works delivery, and the remainder does not have the tools and skills needed to operate in a commercial environment (e.g., within procurement and supervision

processes). In parallel, the government-wide imperative to decentralize is putting into question the existence of the DOH as a single, national entity. Since 2012, MOC has set up an arrangement whereby local staff are paid by the state and/or regional governments but set hierarchically under national government control. This transition structure seems unbalanced, and will be put under additional stress as decentralization progresses.

There is now an opportunity to create an organizational structure that is able to meet the road sector requirements for at least the next 10 years, rather than simply trying to respond in a minimal fashion to a government-wide imperative to reform. A restructuring that goes beyond the reorganization that happened in 2015 is a medium-term necessity. Changes need to be carefully considered rather than rushed, because of the long-term implications they will have on the effectiveness of the sector, on the industry, and on the relationships with the regional and/or state governments.

Main Policy Suggestions

The road sector's present organization and long-standing policies are obstacles to the rapid modernization of the trunk road network. This policy note is the first to identify the policy options and capacity development needs, and where possible, identifies policy suggestions that could be implemented over the coming years. Altogether, **its main suggestion is that the government undertakes an ambitious program of reforms and capacity development efforts over the next 5 years**. This program could set the foundations for transforming Myanmar's current road institutions into a high-performing sector, able to deliver quality services to users. The implementation of a number of reforms will involve other ministries, particularly in the financial area, while some reforms will require legal changes. For these reasons, it is recommended that such a program be approved by the Cabinet.

A New Financial Framework

Financial resources for the national highways need to be increased, made more sustainable, and put under the control of the central government. In the short term, this could be achieved through simple budget reallocation and negotiations with regional and/or state governments. **In the long term, a preferred strategy would rely on a new set of road user fees that are suitable for generating more resources, that are more aligned with user costs, and that are allocated to the sector.**

Myanmar's government should create two new road-user fees. The first is a **fuel tax**, which would be enforced on all road users. This report proposes an initial level of about $0.10 per liter (MK375 per gallon). The second would be a **heavy vehicle license fee** for trucks, set at a level that covers the pavement damage caused by this type of vehicle. Together, these would raise about $400 million annually (subject to annual increases). This would be sufficient to pay for all road network maintenance and rehabilitation needs in non-tolled highways. Another advantage is that these fees would improve the efficiency and fairness of road user charges, making users contribute to the costs they impose on the government or the rest of society.

MOC should revise its toll rates and structure. To finance modernization works, **toll revenues need to be raised**. These should also be more fairly distributed among users, as the current rate structure is highly skewed toward heavy trucks, which is unique by international standards. MOC should introduce two toll schedules, depending on whether the works financed are small (e.g., maintenance, rehabilitation) or large (e.g., widening, reconstruction). A new principle would be that vehicles should pay according to the costs they cause, and the benefits they get. An example of such a structure is provided in Table E2. At the same time, most highways

Table E2: **Potential New Toll Rate Structure**
(MK per mile)

Vehicle Type	Current BOT Rates	Alternative Toll Rates		
		Toll Structure	Low Rates	High Rates
Motorbike	0	0.0	0	0
Car	5–10	1.0	30	70
Light truck (and small/medium-sized buses)	20–30	1.4	45	100
Medium-sized truck	75–100	3.9	120	260
Heavy truck	150–200	4.1	130	280
Articulated truck	300–350	5.6	180	380
Large bus	50–55	2.5	75	175
Average toll gate revenue for 1,000 AADT ($ per year)	**840,000**		**1,000,000**	**1,940,000**

AADT = annual average daily traffic, BOT = build–operate–transfer, MK = Myanmar kyat.
Source: ADB estimates based on model developed for the study.

have too little traffic for tolls to finance any meaningful investments. MOC should cancel tolls on all roads with low traffic, potentially covering up to 18,000 km of roads. This would marginally reduce road sector revenues, but could form a very visible compensation for the new road fees and higher tolls.

Resources should be earmarked and distributed to each level of government according to needs. A key element is that some road user fees should be earmarked to the road sector. The benefits in terms of better spending, improved accountability, and financial leverage easily exceed the potential fiscal disadvantages that seem limited in a context where the needs are significant. Once correct earmarking is ensured, a new funding transfer mechanism would be required, covering vehicle registration fees, the fuel tax, and the heavy vehicle license fee. Designing it will be a complex process but there is much international experience that can be used as a basis. This policy note reviews the main options available and starts analyzing how a new framework could operate. A more in-depth study is required to select options, analyze legal feasibility, and set appropriate parameters (e.g., cost-sharing rations, funds allocation formulas).

Building Modern Institutions

Beyond the 2015 reorganization of the Public Works, international experience suggests further possible improvements, as follows:

Corporatize delivery units. The corporatization of the MOC's construction units should go ahead, but realistically, the transition period before privatization should be 5 not 2 years, as reportedly considered. Instead of creating a single company—which would be unmanageable and would constrain road industry development—the existing units should be grouped into at least three to five companies. A second phase of reform could already be prepared, covering the corporatization of the maintenance units, and possibly the Yangon–Mandalay expressway unit and the design branches of the DOH and DOB.

Clarify the situation of local units. Three models seem possible. First, separate organizations should be created to deal with national highways and with local roads. Second, the management of all roads should

be transferred to the regional level, with the DOH head office remaining solely responsible for funding management and policy development. Third, the DOH should become a service provider, with the central and regional and/or state governments acting as its clients. These three options involve trade-offs, and many transitional arrangements are possible.

Pursue the creation of a unified DOH or a Highway Authority, but align internal organization with new agendas. The 2015 creation of the DOH and DOB is an improvement over the previous structure. However, the split has created new issues. In the short term, the following ought to be priorities:

- Units that fulfill "new" functions should receive rapid guidance and training on how to operate road safety agendas, information technology, safeguards, procurement, quality assurance, planning, policy, public–private partnerships, and statistics.
- The corporatization of construction units, just initiated, should be actively pursued.
- Operational arrangements between the DOH and DOB should be identified to avoid unnecessary duplication of structures (e.g., for administration), and clearly allocate responsibilities at the local level and for project preparation and/or execution.

Reconsider the separation of the DOH and DOB. A separation between bridges and highways may be suitable for a construction company or a university because skills and equipment differ. However, it makes much less sense for a government, which is tasked to manage and develop the network. Inevitably, strong inefficiencies will appear in project planning, project preparation and execution, and maintenance management. Our review could not find a similar separate arrangement anywhere else, worldwide.

Merge the DOH and DOB, as originally intended. This could be achieved either immediately after the new government takes office in 2016, or after the corporatization of the construction units necessitates another restructuring. Should the desire to keep two different departments remain, a workable solution would be for the DOB to refocus exclusively on large bridges.

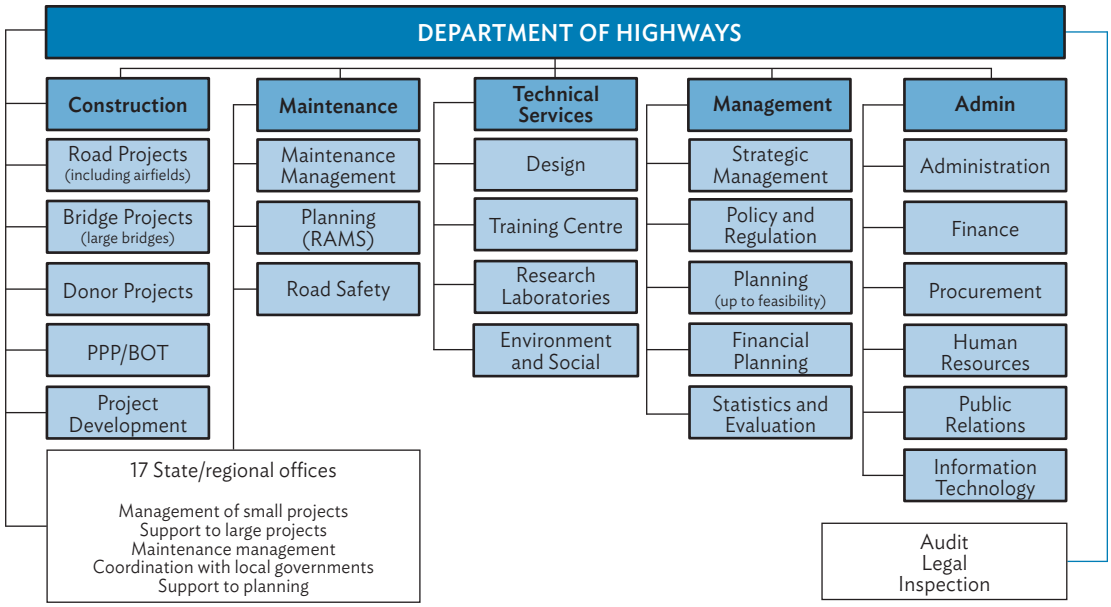
Should the government decide to prepare another restructuring, a rethinking of the internal organization of the entity to be created seems preferable to a simple reshuffling. Meeting needs, planning, procurement, and funding mobilization should receive much higher status in the organization. Transformation into a performance-driven autonomous road agency should be considered as a long-term objective, however, this is not recommended at this stage. A proposed and/or possible organizational structure is presented in Figure 1.

Strengthening of Planning Processes

Implement modern investment planning processes. As the amount of investment grows, implementation of plans will increasingly depend on the quality and strength of the management processes used. Technical and economic planning processes should be formalized. For instance, the government should give legal status to long-term and medium-term investment plans. This would strengthen compliance of budgets with plans. Also, feasibility and detailed designs should become legal requirements for large-scale works. This new feasibility study step would include an analysis of economic feasibility. Myanmar should also introduce an inter-ministry administrative review process for works financed by the budget.[1] Initially, this could be carried out under the authority of the MOC–MOTC committee set up to coordinate the implementation of the National Transport Development Plan. Finally, MOC should maintain a 3-year rolling investment program.

[1] A process already exists for foreign investments.

Figure 1: **Possible Long-Term Organization Structure for the Department of Highways**



BOT = build–operate–transfer, PPP = public–private partnership, RAMS = Road Asset Management System.
Source: Author.

Asset management should become a central process of the DOH and DOB. With ADB support, the DOH has been developing a road database and an asset management program. This effort should be continued. Gradually, maintenance and rehabilitation spending should be mainly based on the operational priorities defined by the program. Road condition data should be regularly updated. Information should feed into the DOH reporting documents, and serve as an input for setting targets.

Gearing Up for Private Sector Delivery of Works

Development of new procurement and supervision processes. MOC has been considering contracting out construction works through open bidding. This is a priority reform measure that should receive attention as it will bring significant benefits. It is also challenging, requiring the DOH and DOB to fully change their business processes. Both would need to develop a new practice of contractual relations and independent supervision. This requires new bidding documents, procurement and supervision guidelines, and further staff training. This area should be a priority target for capacity-building efforts. A first step, just initiated in this policy note, will be to draw a clear road map and action plan for delivering this major reform.

Encourage further involvement of the private sector. MOC should gradually outsource part of the design and supervision activities, opening them to national and international consultants. Maintenance could also be outsourced, but the priority is to corporatize existing units, increase mechanization, and create the basis for performance management.

This policy note does not review the nascent private road industry, nor does it attempt to advise on how to develop maintenance procedures and/or programs, beyond applying good international practices in the procurement of works and careful attention to the future market management. This matter is not crucial to policy making in 2015—as MOC currently dominates the road industry—but should be considered in later phases of reform.

A More Focused Build–Operate–Transfer Model

The BOT model is valuable and should be preserved, but needs to undergo substantial improvements. Tolls should be raised, contract durations should be shortened, and investment requirements need to be made more realistic. BOT contractors would then make reasonable profits, and would have the resources to finance quality upgrading and maintenance. Potentially, BOT contractors could then finance most of the needed modernization works on Myanmar's key corridors. In parallel, contracts should be improved to raise incentives for performance, competition should be introduced, and supervision by the Public Works should be strengthened. This would ensure quality and cost efficiency. This policy note identifies the areas of the current model contracts being used that are not in line with international practices and need improvement.

The most efficient way to deliver these changes may be to propose to all current BOT contractors to transfer to a new regime, on the basis of an objective audit and financial model. A more radical approach would see the cancellation of all contracts and their bidding on new terms.

Introduce other ways of involving the private sector. Some roads are not suitable for tolling on a cost-recovery basis. We put the threshold at a minimum of about 1,000 vehicles per day, a limit that only 5,000 km of highways met in 2014. Other contract forms such as performance-based contracts could be considered for these roads. When a fuel tax is implemented, we suggest cancelling all auction toll gates. This is because as a tax collection mechanism, tolling is less efficient. Until then, the "auction" model could be transformed into a proper auction system whereby candidates bid on the basis of the highest payment to the government.

Suggested Next Steps

After presenting the first version of this draft report in early 2015, MOC has set up a working group to review the study, assess its policy propositions, and conduct a dialogue with ADB. The working group's objectives are to propose a restructuring plan for the road sector, consisting of a set of actions that could result in quick wins in the short term, as well as a series of deeper reforms that would be implemented over several years, with support from donors where appropriate.

Based on this review, the government should convene stakeholder meetings, including with representatives of user groups, local governments, and the industry to share the findings, obtain stakeholder involvement, and finalize a restructuring program. The program would include concrete action plans, milestones and targets, outlines of the technical assistance activities necessary, as well as reporting mechanisms. The government that will emerge from the 2015 general elections could, after a careful review of the program, start its implementation.

Program implementation would span a 5-year period to give sufficient time to the sector to adjust to the changes. While the process could be supported by donor financing, it would need to be championed by the sector leadership and management.

Myanmar Road Network

International Road Corridors

ASEAN = Association of Southeast Asian Nations, GMS = Greater Mekong Subregion.

1 A Modernization Agenda for Trunk Roads

Key Findings and Suggestions

Findings

Myanmar has an extensive road network, which is of low quality and is underutilized. Few roads are paved, and most pavements are rough. Even though traffic grows at about 10% a year, it starts from a very low base, meaning that—for the moment—few roads need widening.

Overloading control was recently tightened, so overloading is mainly an issue for the older, medium-sized trucks that are still commonly seen on secondary road networks. Legal axle loads are actually low; if pavements are strengthened, limits should be raised.

Road safety is quickly becoming a major issue. The number of casualties from car crashes reached 4,300 in 2014. One of the reasons is that the roads are not designed to any safety standard, and lack even basic safety features.

Suggestions

Myanmar's road network needs rehabilitation, improvement, and in the long-term, complete modernization. The issue is what should be prioritized. Limited funds available mean investments should be directed where they will have the highest economic impacts, otherwise, there is a risk that road infrastructure may hamper, rather than foster, Myanmar's economic development.

The new National Transport Development Plan gives sound directions on what should be done on the main trunk corridors. Particular priority is given to the improvement of the two international corridors linking the country with Thailand and the People's Republic of China, and of the Yangon–Mandalay expressway—the latter with the objective to allow it to be used by trucks.

Significant resources are also needed to improve the pavements of those roads that have high volumes of traffic, gradually generalizing the use of asphalt concrete. The Department of Highways should lead a major pavement rehabilitation and periodic maintenance program, which would over time involve all national highways, except those with the lowest traffic levels. These investments would bring much higher returns than new construction, widening or paving works, to which the government has put most of its resources to date.

If it delivers these high-priority investments, Myanmar could have, within 15 years, a modern trunk road network that is maintained to good standards and which meets the country's needs for economic development.

1.1 Trunk Road Network

Myanmar has approximately 40,000 kilometers (km) of trunk roads that are managed by the Department of Highways (DOH) on behalf of the Ministry of Construction (MOC) and the state and/or regional governments. Close to 97,000 km of its total of 157,000 km of roads are village and border roads managed by the Ministry of Agriculture, Livestock and Irrigation (MOALI), the Ministry of Border Affairs and the Township Development Committees. The remaining 20,000 km are urban roads managed by city development committees and other roads managed by the Ministry of Electrical Power and the Army Corps of Engineers (Table 1).

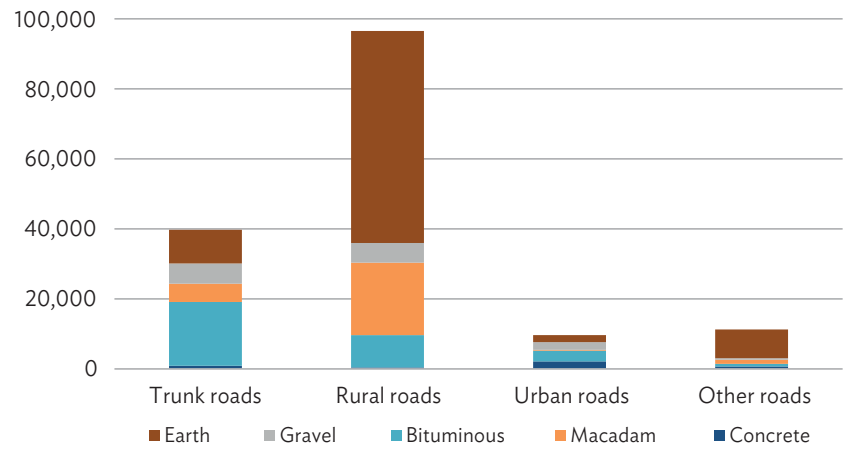
Table 1: **Road Lengths by Road Type and Responsible Agency, 2013**
(km)

Responsible Agency	Concrete	Bituminous	Macadam	Gravel	Earth	Track	Total
DOH for MOC + state/regions	695	18,286	5,255	5,793	8,567	1,106	**39,702**
MOALI + MOBA + TDCs	193	9,294	20,807	5,638	60,848	0	**96,780**
Yangon CDC	1,108	1,766	0	551	1,032	0	**4,457**
Mandalay CDC	55	1,034	172	0	491	0	**1,752**
Naypyitaw CDC	795	276	67	1,652	476	0	**3,266**
Army Corps of Engineers	393	685	1,035	171	8,142	0	**10,426**
MEP	79	64	181	250	103	0	**676**
Total	**3,319**	**31,406**	**27,517**	**14,053**	**79,658**	**1,106**	**157,059**

CDC = City Development Committee; DOH = Department of Highways; km = kilometer; MEP = Ministry of Electrical Power; MOALI = Ministry of Agriculture, Livestock and Irrigation; MOBA = Ministry of Border Affairs; MOC = Ministry of Construction; TDC = Township Development Committee.

Source: ADB estimates based on Ministry of Construction data.

Figure 1: **Road Lengths by Type, 2013**
(km)



km = kilometer.

Source: ADB estimates based on Ministry of Construction data.

Myanmar's road network is less dense than that of neighboring countries, and of a lower quality. Myanmar's road density is 0.23 km per square kilometer (km^2), only half of the region's average. Because Myanmar has a smaller share of roads that are paved (20%) than the region (34% average), paved road density is four times lower than the regional average.

Myanmar's road network extension, however, seems adequate at this stage of its development. Myanmar's population density is only half that of the rest of the region, and its motorization rates are only 40% of the regional average. This implies that Myanmar will require fewer roads than its area suggests. By regional comparisons, the quantities of roads and paved roads in Myanmar are very much in line with averages when compared with the population and number of motor vehicles in use (Table 2).

For Myanmar to reach the current level of road network as in Thailand, it would need to have twice as many roads (300,000 km) and five times more paved roads (160,000 km). To reach this level within 30 years would imply the construction of 2,000 km of rural roads and the paving of 1,700 km of roads each year.

Myanmar has been developing its road network at a fast pace. As of 2014, the annual network expansion rhythm is that of about 8,000 km new roads a year, and 2,500 km of new paved roads. This is faster than what our earlier benchmark suggests. The length of the trunk road network managed by the Public Works/ Department of Highways (PW/DOH) has increased by 10,600 km in the past decade, indicating an average of 1,000 km of new construction and transfers each year. Between 2004 and 2014, the road network extension

Table 2: **Myanmar's Road Network—International Benchmarks**

	Myanmar	Viet Nam	Lao PDR	Cambodia	Indonesia	Philippines	Yunnan Province	Thailand	Average
Area ('000 km^2)	**675**	331	236	181	1,904	299	394	513	**n/a**
Population (million)	**51**	91	6.5	14.9	248	103	46	67	n/a
Motor vehicles (million)	**4.6**	37	0.6	1.1	85	6.5	2.8	25	n/a
Motor vehicles per 1,000 people	**79**	407	92	72	343	63	61	373	**202**
Roads ('000 km)	**157**	210	40	38	340	200	215	396	**n/a**
Roads (km) / 100,000 people	**308**	231	615	255	137	194	467	591	**356**
Roads (km) / 100 km^2	**23**	63	17	21	18	67	55	77	**45**
Roads (km) / 1,000 vehicles	**34**	6	67	36	4	31	77	16	**34**
Paved roads ('000 km)	**31**	122	5.6	2.5	201	58	47	208	**n/a**
Paved roads (km) / 100,000 people	**67**	134	86	17	81	56	101	310	**112**
Paved roads (km) / 100 km^2	**5**	37	2	1	11	19	12	41	**18**
Paved roads (km) / 1,000 vehicles	**7**	3	9	2	2	9	2	8	**8**
Share of roads that are paved (%)	**20**	58	14	7	59	29	22	53	**34**

km = kilometer, km^2 = square kilometer, Lao PDR = Lao People's Democratic Republic, n/a = not applicable.
Source: ADB estimates from various sources.

Table 3: **Road Network and Trunk Road Length, 2004–2013**
(km)

Year	Total Road Length	Total Paved Road Length	Trunk Road Length	Trunk Paved Road Length
2004	90,713	22,153	29,497	14,126
2005	92,859	22,830	29,825	14,356
2006	104,058	23,955	30,433	14,956
2007	111,737	24,670	30,711	15,213
2008	125,355	25,553	30,902	15,387
2009	127,942	26,333	32,070	15,583
2010	136,749	28,569	34,178	16,550
2011	142,395	30,879	37,784	17,260
2012	148,690	31,464	39,083	17,846
2013	157,059	34,724	39,702	18,981
2014	n/a	n/a	40,097	21,361

km = kilometer, n/a = not available.
Source: Ministry of Construction.

has increased by 73%, the trunk road network by 35%, and the paved road network by 57%. A large share of the expansion is taking place on networks that are not managed by PW/DOH. The size of the nontrunk road networks, both paved and unpaved, has doubled in size in the same period (Table 3).

1.2 Vehicle Fleet

The number of registered vehicles quadrupled between 2009 and 2014 as a result of government market liberalization and better enforcement of registration requirements (Table 4 and Figure 2). Various reasons explain the quick increase in registered vehicles. In 2011, the government launched a program to scrap old vehicles and substitute them with new, imported vehicles. The government then liberalized the import of vehicles and strongly reduced import duties in 2012 and again in 2013. As a result, the number of registered passenger cars increased by 62% in that period, and that of trucks by 84%. For motorcycles, volumes increased suddenly in 2009 and then again in 2013, but this was mainly due to the government's vehicle registration campaigns. Real growth in motorcycle volumes has likely been brisk (the rate in 2014 was 12%), but perhaps less than what registration numbers suggest.

Despite this sharp increase in vehicle numbers, the number of vehicles per 1,000 people remains low at 12.5[1], compared with Thailand (206) and the People's Republic of China (PRC) (183). As the increase in vehicle registration is primarily due to motorcycles, the effect is mainly seen in terms of congestion, rather than damage to roads.

[1] Based on 642,200 registered vehicles in March 2014, excluding motorcycles, and a population of 51.4 million as per the 2014 census.

Table 4: Number of Registered Vehicles by Type and Year

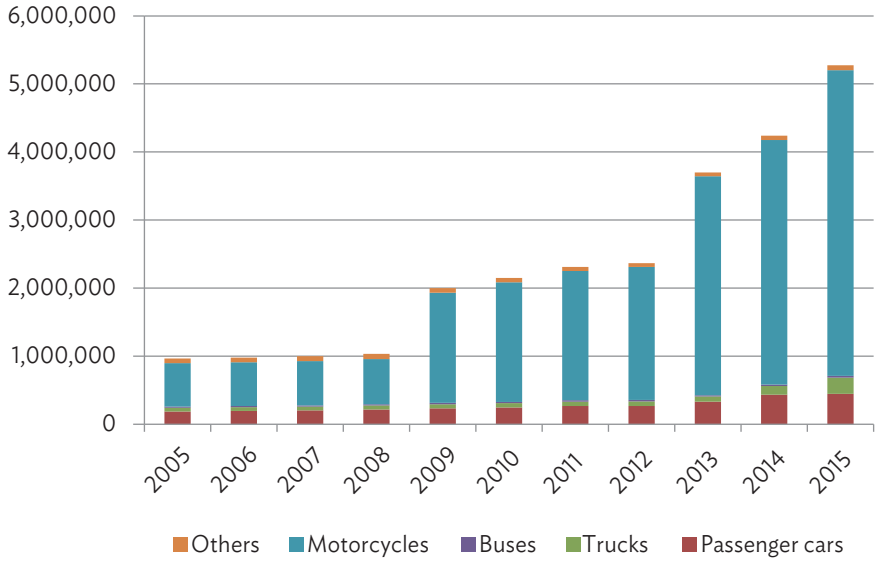
Year	Passenger Cars		Trucks		Buses		Motorcycles		Others		Total	
	Number	Growth (%)	Number	Growth (%)	Number	Growth (%)	Number	Growth (%)	Number	Growth (%)	Number	Growth (%)
2005	186,908		52,748		17,973		639,851		66,789		964,269	2
2006	193,940	4	54,801	4	18,038	0	644,151	1	68,358	2	979,288	2
2007	202,068	4	55,382	1	18,857	5	650,824	1	69,625	2	996,756	4
2008	217,018	7	57,211	3	19,291	2	664,640	2	74,682	7	1,032,842	94
2009	233,227	7	58,857	3	19,683	2	1,619,091	144	68,102	(9)	1,998,960	7
2010	245,921	5	61,132	4	19,807	1	1,757,959	9	62,585	(8)	2,147,404	8
2011	265,642	8	64,888	6	20,944	6	1,897,382	8	59,665	(5)	2,308,521	2
2012	267,561	1	67,750	4	19,579	(7)	1,955,505	3	53,352	(11)	2,363,747	56
2013	331,468	24	74,546	10	19,812	1	3,219,213	65	54,070	1	3,699,109	9
2014	434,169	31	124,597	67	22,151	12	3,595,474	12	61,291	13	4,237,682	15

( ) = negative.

Note: Data are for the end of March of each calendar year.

Source: ADB estimates based on data from the Road Transport Administration Department.

Figure 2: Number of Registered Vehicles by Type and Year

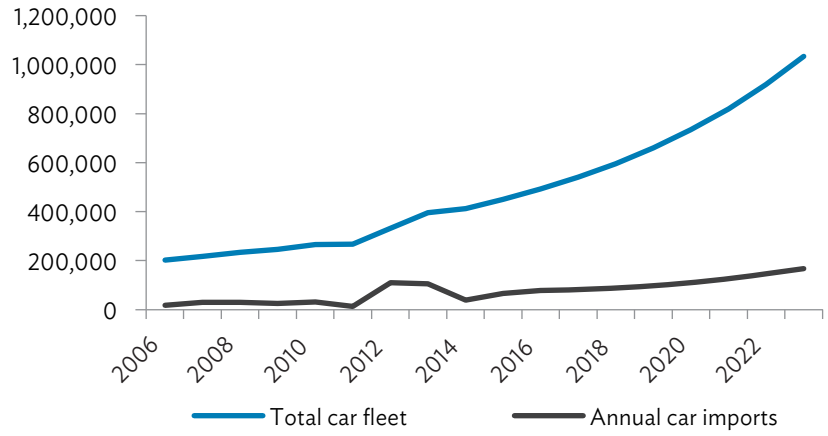


Source: Road Transport Administration Department.

Vehicle market perspectives. Past the initial impact of market liberalization, vehicle fleet growth is expected to stabilize at a more sustainable pace. We project that Myanmar's car fleet could reach 1 million vehicles by 2023, and 2.6 million by 2030, a 10%–15% annual growth rate (Figure 3).[2] In our projections, the annual car

[2] Determined using a logistic model of car ownership calibrated to Myanmar, and assuming a 7% economic growth rate.

Figure 3: **Car Fleet and Import Projections**



Source: ADB estimates based on model developed for the purpose of the study.

imports are expected to remain stable until 2020 at around 100,000 units annually, which is the level that was first reached in 2012 after the liberalization. After 2020, the imports are expected to gradually grow to become a market of 400,000–500,000 units each year by 2030. While we expect long-distance freight transport demand to grow at about 8% a year, the fleet of trucks will grow more slowly, as average loading and utilization rates rise, perhaps only at half of this rate (4% a year). The bus fleet could grow at 8% a year in line with demand until 2025, but by then the completion of the Yangon–Mandalay rail line upgrade may reduce the market for long-distance buses. Motorcycle utilization rates are still low when compared with Viet Nam or Indonesia. These could rise at 10%–12% a year in the future unless city governments replicate the example of Yangon, which already banned their use in the city center.

1.3 Infrastructure Condition

In 2014 and 2015, the Asian Development Bank (ADB) supported the preparation of the first inventory and condition survey of the trunk road network.[3] The results of the surveys are presented below.

Overview

Overall, the trunk road network has low standards, is generally in poor condition, and traffic remains low (Figure 4 and tables below). The main findings are as follows:

- **Only 53% of the network is sealed**, most of which has a penetration macadam surface (only 10% of the network has asphalt or cement concrete pavement).
- **Most roads are very narrow.** Of the 21,400 km of bituminous roads, 61.1% (13,000 km) are only 12 feet (ft) wide (3.7 meters [m]).

[3] ADB. 2014. *Technical Assistance to Myanmar for Developing the Asset Management Program for Myanmar Roads.* Manila.

- **The majority (57%) of the network is in poor to very bad condition**, with only 43% in good to fair condition. Of the paved roads, 42% is in poor to very bad condition, and 74% is unsealed.
- **Most of the network (87%) has traffic below 500 vehicles per day**. Only 4,000 km has traffic volume exceeding 1,000 vehicles per day. More than half of paved roads have traffic less than 200 vehicles per day, and 95% of unsealed roads.

Paved Road Network Condition

Penetration macadam. Out of the 21,366 km of trunk roads that are paved, 18,343 km (86%) have a penetration macadam pavement. These pavements are constructed in Myanmar with minimal equipment, design, and materials testing. The nature of the penetration macadam and the often limited construction quality and maintenance makes pavements initially rougher than what asphalt overlays would produce, and deterioration speed is also faster, especially where traffic volumes are higher. About one-third (6,300 km) of penetration macadam roads have an international roughness index (IRI) of above 8, which signifies a very poor condition, and probable need for rehabilitation.

Table 5: Network by Traffic Volume

Traffic	Length	%
<50	17,731	44
50–200	12,105	30
200–500	5,052	13
500–1,000	1,351	3
1,000–2,500	1,606	4
>2,500	1,686	4
Expressway	586	1
Total	**40,117**	**100**

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Table 6: Network by Surface Type

Surface Type	Length	%
Penetration macadam (PM)	17,362	43
Cement concrete (CC)	942	2
Gravel (GR)	5,566	14
Metaled (DBM)	4,626	12
Earth (ER)	8,565	21
Asphalt concrete (AC)	3,056	8
Total	**40,117**	**100**

DBM = dry bound macadam.

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Table 7: Condition of Paved Network

Roughness	Length	%
Good (IRI<4)	6,769	32
Fair (4<IRI<6)	5,651	26
Poor (6<IRI<8)	2,725	13
Bad (8<IRI<10)	1,525	7
Very bad (IRI>10)	4,689	22
Total	**21,359**	**100**

IRI = international roughness index.

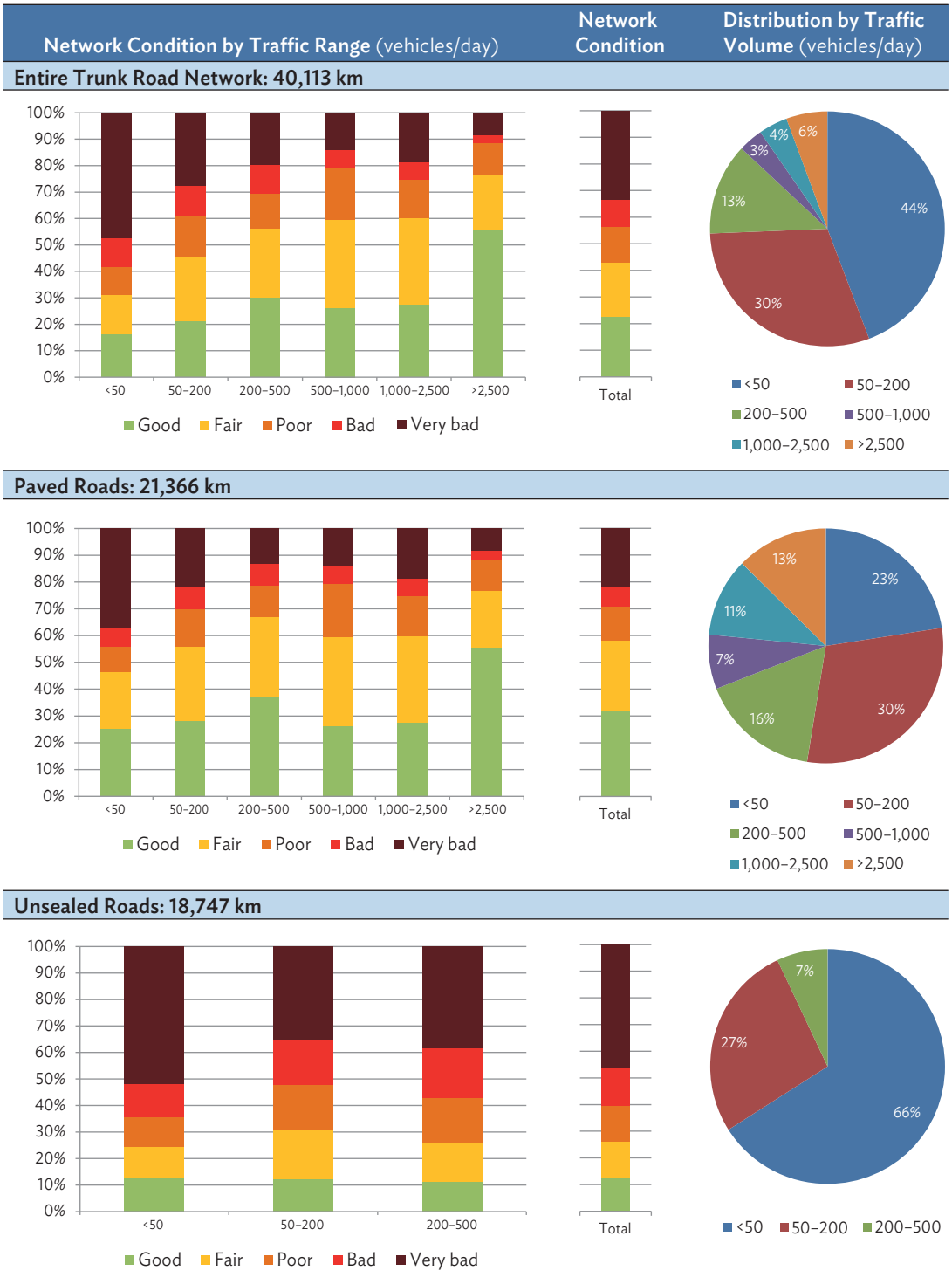
Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Table 8: Condition of Unsealed Network

Condition	Length	%
Good	2,314	12
Fair	2,573	14
Poor	2,531	13
Bad	2,615	14
Very bad	8,722	47
Total	**18,755**	**100**

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Figure 4: Trunk Road Network Condition and Traffic

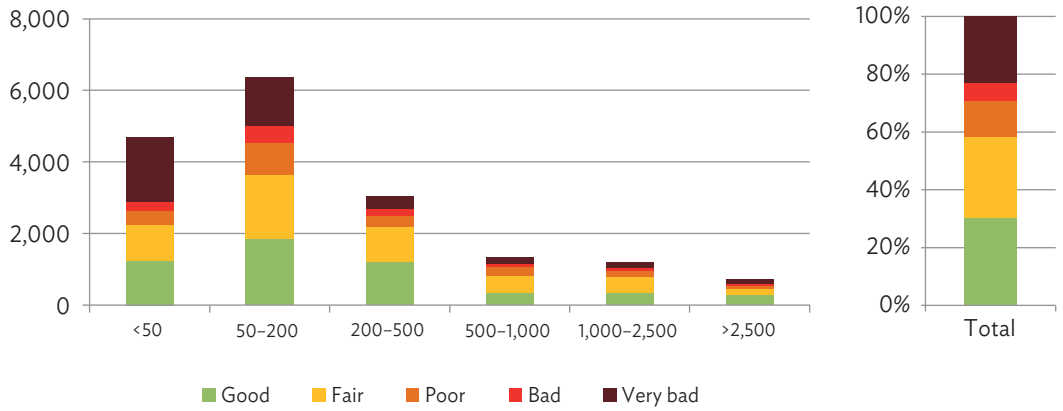


IRI = international roughness index, km = kilometer.

Notes: Condition ranges are as follows: Good: IRI<4; Fair: 4<IRI<6; Poor: 6<IRI<8; Bad: 8<IRI<10; Very Bad: IRI>10. Traffic does not include motorcycles or nonmotorized vehicles.

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Figure 5: **Condition of Penetration Macadam Pavements**
(km)



km = kilometer.
Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads.* Final Report. Naypyitaw.

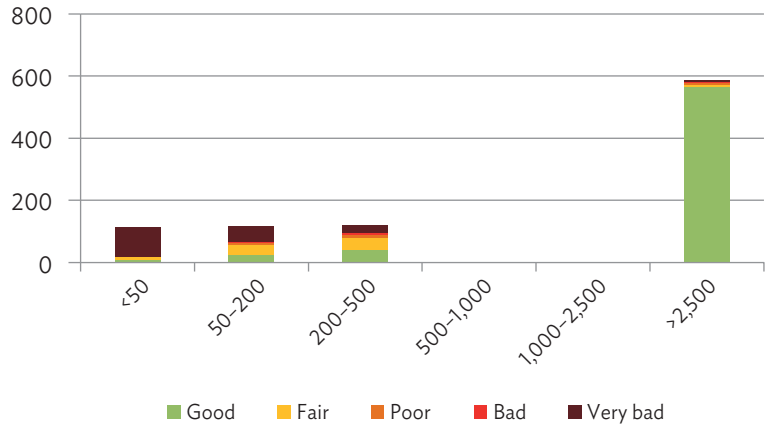
MOC has generally been able to maintain penetration macadam pavements, but not to concentrate resources on areas where traffic is the highest (Figure 5). The condition of these pavements is very similar regardless of traffic volume. Although more attention is currently being paid to maintenance, this tends to focus on pavement patching and resealing. As a result, surface distress tends to be more acceptable in many roads. However, the roughness is not significantly improved by the patching, resulting in increased vehicle operating costs that make up a major portion of the total transport costs for roads.

While asphalt or cement concrete is becoming more common, MOC has not yet established a sustainable maintenance regime for these pavements. Myanmar's trunk road network includes about 4,000 km of asphalt concrete or concrete pavements. While 51% of these roads are in good condition, 20% are in poor or very poor condition. Asphalt concrete is used on 3,000 km of highways, sometimes as asphalt concrete overlays over an existing concrete pavement. The condition of these pavements is generally good but mainly because they are recent. A large share (32%) is already in poor condition. Cement concrete is used only for the Yangon–Mandalay expressway.[4] Two-thirds of these pavements (66%) are in good condition. Outside of the expressway, most cement concrete highways are in poor condition. Figure 6 and Figure 7 provide an illustration on the conditions of the two types of concrete used.

The condition is generally better for trunk roads with a higher administrative class and higher traffic levels (Figure 4). Roads with 1,000–2,500 vehicles per day that are under build–operate–transfer (BOT) are an exception to this rule, because low toll revenues limit investments. The condition of these roads are worse than those of roads with 100–1,000 vehicles per day where investments are from the national and state and/or regional budgets. BOT roads with traffic levels over 2,500 annual average daily traffic (AADT) are in markedly better condition, reflecting the higher toll revenues for these roads and the ability of contractors to invest in maintenance. This shows a need to improve the profitability of BOT contracts in low-volume roads to ensure higher investments and proper road conditions.

[4] The expressway was constructed between 2005 and 2010 with a 2-layer, 18-inch thick cement concrete pavement reportedly able to carry 80 tons, providing a 25-foot wide (7.6 m) two-lane carriageway in both directions. The expressway has some serious design deficiencies, however, resulting in road safety concerns.

Figure 6: Cement Concrete Pavements (km)



km = kilometer.

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Figure 7: Asphalt Concrete Pavements (km)

km = kilometer.

Note: About 1,680 km of asphalt concrete pavements are reported to carry less than 500 vehicles per day. Condition data are not available.

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Unsealed Network Condition

Close to half of the highway network (47%) remain unsealed. Several state capitals lack a fully paved road connection to the rest of the network (Rakhine, Thaninthary, Kachin, and Chin). **Earthen roads** still account for 20% of the network, reaching over 40% in some states (Figure 8). The length of tracks has halved in the past 3 years (from 1,400 km in 2011), indicating nearly 250 km of track improvement each year. Only in Kachin State do tracks continue to form a significant portion of the trunk road network (18%). A fifth of the trunk road network still consists of earthen roads, reaching over 40% in Kayin, Kachin, and Chin states (compared with an average of 3% in Yangon and Mandalay regions). While **gravel road l**engths have remained more or less the same since 2011 (5,600 km), **water-bound macadam road**[5] lengths have been reduced (from 5,600 km in 2011 (Table 9), indicating that many of these roads have been upgraded to a bituminous standard.

Table 9: **Trunk Road Lengths by Surface Type and State and/or Region, 2014**

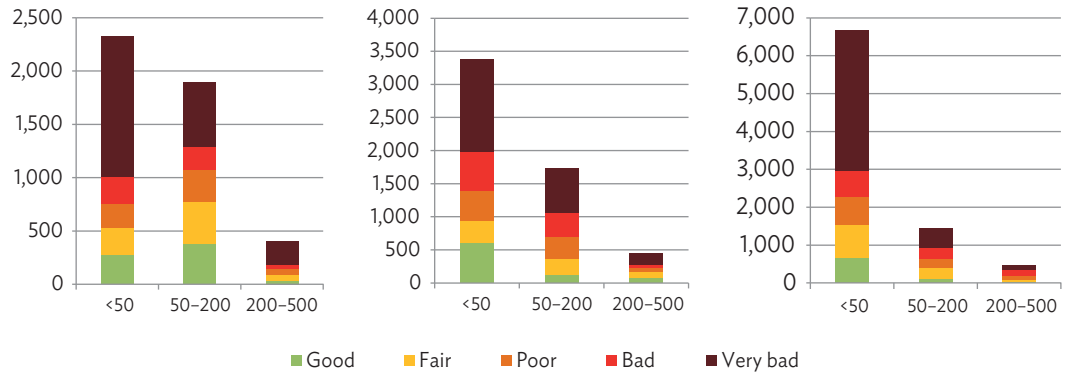
State/ Region	Cement Concrete		Asphalt Concrete or Penetration Macadam		Water-Bound Macadam		Gravel		Earth		Track		Total	Of Which Paved
	km	%	km	%	km	%	km	%	km	%	km	%		
Kachin	25.3	1	587.9	16	541.9	14	970.7	26	967.4	26	693.4	18	3,786.8	16
Kayah	–	0	472.0	49	60.5	6	100.0	10	329.1	34	0.0	0	961.6	49
Kayin	–	0	831.8	46	87.6	5	176.2	10	723.5	40	0.0	0	1,819.2	46
Chin	–	0	555.6	28	528.3	27	–	0	861.6	44	26.6	1	1,972.0	28
Sagaing	32.2	1	2,091.5	47	519.9	12	716.0	16	1,124.2	25	0.0	0	4,483.8	47
Tanintharyi	–	0	744.7	55	323.3	24	206.6	15	81.9	6	0.0	0	1,356.5	55
Bago	263.2	12	1,467.8	66	199.6	9	122.3	6	158.1	7	0.0	0	2,211.0	78
Magway	–	0	2,586.3	73	341.4	10	352.3	10	260.7	7	0.0	0	3,540.7	73
Mandalay	203.0	9	1,861.6	85	98.8	4	12.2	1	23.1	1	0.0	0	2,198.7	94
Mon	–	0	729.8	83	2.4	0	65.4	7	82.3	9	0.0	0	879.9	83
Rakhine	36.4	2	991.4	53	439.3	24	182.3	10	215.9	12	0.6	0	1,865.8	55
Yangon	97.5	9	787.4	75	87.4	8	12.1	1	59.9	6	0.0	0	1,044.3	85
Shan (East)	2.2	0	2,116.3	55	336.2	9	799.3	21	563.0	15	0.0	0	3,817.0	56
Shan (South)	57.3	1	2,154.1	43	531.1	11	923.3	18	1,382.9	27	0.0	0	5,048.7	44
Shan (North)	6.4	0	632.6	30	368.9	18	419.7	20	660.4	32	0.0	0	2,088.1	31
Ayeyarwady	19.3	1	1,592.2	61	158.8	6	488.6	19	361.8	14	0.0	0	2,620.8	61
Naypyitaw	191.5	44	223.7	52	–	0	–	0	18.5	4	0.0	0	433.7	96
Total (2014)	**934.4**	**2**	**20,426.8**	**51**	**4,625.3**	**12**	**5,547.0**	**14**	**7,874.4**	**20**	**720.6**	**2**	**40,128.6**	**53**
Total (2011)	638.4	2	16,622.9	44	5,561.8	15	5,636.0	15	6,087.1	16	1,409.8	4	37,785.3	46

– = not available, km = kilometer.

Source: ADB estimates based on Ministry of Construction data.

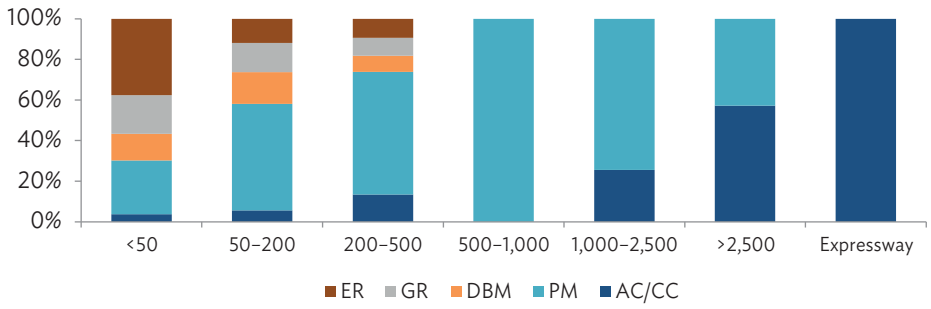
[5] Macadam roads are also referred to as metaled roads. These generally have one layer of 2–4 inch broken aggregate, a second layer of 1.5–3.0 inch broken aggregate, and a final layer of coarse sand.

Figure 8: Unsealed Network
(km)



km = kilometer.
Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Figure 9: Road Surface as a Function of Traffic Volume



AC = asphalt concrete, CC = concrete, DBM = dry bound macadam, ER = earth, GR = gravel, PM = [bituminous] penetration macadam.
Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Unsealed roads are generally very rough, with more than half in very poor condition. In terms of condition for the users, there does not seem to be much difference between an earthen road and a macadam (metaled) road (Figure 9). A 1991 UNDP study (comprehensive transport study) had already recommended discontinuing this practice, since benefits were small. Gravel roads fare only moderately better, indicating insufficient maintenance.

Pavement Surfacing Practices

There is a clear move toward sealed and more durable surface types as traffic levels increase, moving from unsealed roads to penetration macadam, and ultimately asphalt or cement concrete. What is surprising is that there is still a significant portion (22%) of roads with traffic volumes of 100–500 AADT that remain

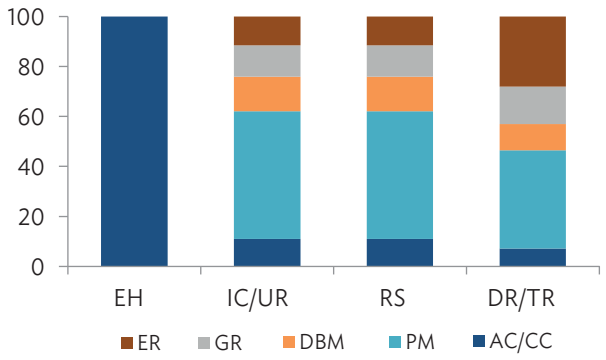
unpaved, while the majority of roads with traffic volumes of 50–100 AADT have a sealed surface. This implies that insufficient account is taken of traffic volumes in selecting roads for sealing. Although all roads with more than 500 AADT are sealed, this predominantly involves penetration macadam. The use of asphalt and cement concrete is still very limited, even for roads with traffic levels exceeding 1,000 AADT where penetration macadam is considered less suitable (there are currently 2,400 km of penetration macadam roads with traffic volumes exceeding 1,000 AADT that should be considered for upgrading to asphalt concrete).

Administrative Classes

Roads with a higher administrative class tend to have higher traffic volumes and more durable surface types. This is not always the case, however, as there are several district and township roads with traffic volumes exceeding 1,000 vehicles per day (especially around Yangon and Mandalay), while a significant portion of international communication and union roads (IC/UR) have traffic volumes below 100 vehicles per day (43%). Similarly, there are several district roads and township roads with asphalt or cement concrete surface, while a significant portion of IC/UR remains unsealed (18%). This would imply that these roads may not be properly classified, and that the classification should not only take into account the function of the road (what the road connects), but should also consider the importance of the road in terms of traffic volumes.

District and township roads are in worse condition than higher-level roads, but this may change rapidly with the significantly increased funding allocations from states and/or regions. There is little difference between the IC/UR and the regional and/or state roads, implying that these are treated similarly by MOC (Figure 10 and Figure 11).

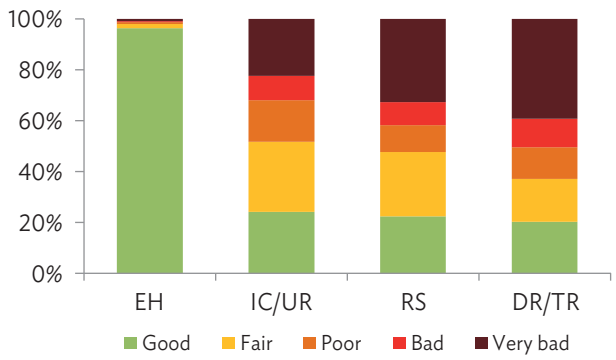
Figure 10: **Surface Type as a Function of Administrative Class**
(%)



AC = asphalt concrete, CC = cement concrete, DBM = dry bound macadam, DBST = double bitumen surface treatment, DR/TR = district roads and township roads, EH = expressway, GR = gravel, IC/UR = international communication and union roads, PM = [bituminous] penetration macadam, RS = regional and/or state roads, WBM = water-bound macadam.

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Figure 11: Pavement Condition as a Function of Administrative Class



EH = expressway, DR/TR = district roads and township roads, IC/UR = international communication and union roads, RS = regional and/or state roads.

Source: Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

Traffic and Capacity

Despite road transport being the dominant mode of transport, traffic volumes remain low on most of the trunk road network. Roads provide 85% of passenger and 88% of freight trips over land in Myanmar.[6] Nevertheless, traffic levels remain quite low on most trunk roads and the network is generally underutilized. Only 4,000 km of roads carry more than 1,000 vehicles per day (excluding motorcycles). These are the expressway and the highways connecting Yangon to Mandalay (AH1), Yangon to Pyay, Yangon to Pathein, Yangon to Myawaddy (AH1), Yangon to Mawlamyine (AH112), Mandalay to Muse (AH14), Mandalay to Monywa (AH1) and to Schwedo, Meiktila to Taunggyi (AH2), as well as some roads near Yangon (Figure 12).

In the medium term, technical standards for highways should therefore be mainly determined by traffic volumes rather than by the function of the road. Only 5,300 km of Myanmar's roads have traffic above 500 vehicles per day.

Most bituminous roads are very narrow. Of the 21,400 km of bituminous roads, 60% (12,500 km) are only 12 feet (ft) wide (3.7 m). Even in roads with relatively low traffic volumes, the presence of oxcarts, two-wheel tractor and/or trailers and other slow-moving traffic can slow down the rate of speed to 20–30 kilometers per hour (kph). This is made even worse where the condition of the pavement and road shoulder is poor, which complicates overtaking. The Department of Highways (DOH) is widening these roads to at least 18 ft and there are currently 4,800 km of road with 24 ft (7.3 m) wide pavements. In part, this widening is also aimed at complying with the Brunei Action Plan to bring the Asian/Association of Southeast Asian Nations (ASEAN) Highways to at least Class III standard (22 ft in width).

In hilly areas, roads are particularly sinuous and in poor shape, making transport very slow and costly. The average vehicle speed in the hilly states of Myanmar is around 30 kph, and often down to 20 kph. This

[6] ADB. 2016. *Myanmar Transport Sector Policy Note: How to Reduce Transport Costs*. Manila.

Figure 12: **Highways Traffic Load, as of 2013**
(vehicles per day)

Source: ADB estimates based on Ministry of Construction highway traffic data.

is primarily because the roads were built to low geometric standards and are in poor condition rather than because of congestion. Improving the situation will require complete reconstruction to higher standards on better alignments. The associated costs of an upgrading can be high,[7] so that improvement standards should be chosen to closely match traffic levels.

International Connections

The poor quality and high traffic on Myanmar's international connections with the PRC justify considering their immediate upgrading. The Mandalay–Muse road has been a lifeline for Myanmar, but is currently in very poor condition. The National Transport Development Plan (NTDP) finds that the link carries 17% of all freight moved over land in Myanmar, and 70%–90% of all Myanmar's official border trade by value.[8] The 2014 road condition surveys have shown that the average roughness (IRI) of the road connecting Lashio and Muse is above 10, reaching 15 near the border with the PRC. This is a very high number for a paved road, constraining vehicle speeds at about 20 km per hour. The road has only two lanes, and is narrow with tight curves and steep climbs in some sections. Average daily traffic is above 2,000 (one-third of which are trucks according to toll gate data) so that traffic seems to have reached the road's capacity. Basic estimates of the level of costs and benefits show that the improvement could be economically viable.[9] Given the difficulty of the terrain, a study of possible alignment improvements and needed standards would be required before committing any investment.

The Greater Mekong Subregion (GMS) East–West Road Corridor to Thailand is the second corridor in need of improvement. The road provides the shortest land route between Yangon and Thailand, and includes the main border crossing with Thailand, carrying 10%–30% of Myanmar's border trade. The section between Kawkareik and Myawaddy is only one lane and in very poor condition, so much so that circulation is alternated. This section is being improved with support from Thailand, involving the construction of a new alignment. The section between Eindu and Kawkareik has two lanes but needs full reconstruction, and its improvement is being prepared by ADB. Both improvements have demonstrated high economic returns.

Other border roads with Bangladesh, the PRC, India, and Thailand have too little traffic to justify their immediate upgrading on economic grounds. Other connections with Thailand and the PRC serve mainly local markets. In Shan State, the western section of the GMS North–South corridor may have potential for development as a second link between Yunnan and Thailand (the main one being through the Lao People's Democratic Republic [Lao PDR]), but the section is currently lightly trafficked with a limited catchment area. Myanmar maintains only marginal formal trade with India and Bangladesh, accounting in 2012 for only 0.46% and 0.71% of total border trade by value and as a result, cross-border traffic there is very low.

1.4 Road Safety

Road accident rates remain moderate in Myanmar. In 2014, there were 4,314 recorded traffic fatalities (Table 10), against 3,721 in fiscal year (FY)2013 (the World Health Organization [WHO] estimates actual numbers to be more than double this figure). This is equivalent to 8.4 fatalities for every 100,000 people,

[7] Recently examined costs by ADB in nearby hilly areas of Yunnan (PRC) are for a PRC Class II road $2–$4 million per km, for a Class III road $1.0–$1.5 million per km, and for a two-lane Class IV road $0.3–$0.5 million per km.

[8] Greater Mekong Subregion Business Forum. 2013. *Private Sector Views on Road Transport along the Yangon-Mandalay-Muse/Ruili-Kunming Corridor*. Vientiane.

[9] ADB. 2016. *Myanmar Transport Sector Policy Note: How to Reduce Transport Costs*. Manila.

Table 10: **Road Accidents and Fatalities by Year**

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Vehicles	964,269	979,288	996,756	1,032,842	1,998,960	2,147,404	2,308,521	2,363,747	3,699,109	4,237,682
Accidents	5,755	6,778	6,939	7,204	8,461	9,020	10,123	11,675	13,912	n/a
Injuries	9,620	13,354	16,067	12,626	14,700	16,013	17,080	19,684	23,378	n/a
Fatalities	1,331	1,362	1,638	1,853	2,173	2,461	2,496	3,422	3,721	4,314
Fatalities per 100,000 vehicles	138	139	164	179	109	115	108	145	101	102

n/a = not available.
Source: Road Transport Administration Department.

which puts it at the low end, comparable to many developed countries. However, this low value is the result of the relatively low level of motorization in Myanmar. The number of traffic fatalities per 100,000 registered vehicles has yet to reach 100, which is the equivalent in neighboring countries.

With rising motorization, road safety could quickly become a major health issue. Road accident rates have closely followed motorization rates in Myanmar. The ongoing increase in the number of registered vehicles will inevitably result in an increase in fatality rates unless appropriate safety measures are taken. Road fatalities reached 4,314 in 2014, a 16% increase compared with 2013 and a more than 70% increase compared with 2011. It is possible to estimate future accident volumes. Drawing from our vehicle fleet projections, and assuming that accident rates per vehicle remain as they are in 2013, we estimate that the number of fatalities from road accidents could rise to 7,500 by 2020, and 13,000 by 2025. Unaddressed, the road safety issue *could result in 75,000 fatalities between 2015 and 2024.*

While motorcycles account for almost half of the fatalities, larger vehicles are much more accident prone. Over half of the accidents and 44% of fatalities involve motorcycles, compared with 13% of fatalities involving passenger cars**.** Trucks are involved in 12% of accidents, resulting in 18% of fatalities (Table 11). Fatality rates per vehicle for a car are three times that of a motorcycle. Rates for trucks are 13 times higher, and the proportion reaches 37 times higher for buses. A surprising number of fatalities involve two-wheel tractor and/or trailers (8% in 2012), suggesting these accidents are related to overtaking on narrow roads.

Table 11: **Distribution of Road Accidents by Vehicle Type** *(%)*

	2011			2012		
Vehicle Type	Accident	Injury	Death	Accident	Injury	Death
Passenger car	15	17	12	16	17	13
Truck	12	12	18	12	11	18
Bus	9	16	10	8	12	9
Others	1	1	2	1	1	2
Two wheelers	49	42	40	52	47	44
Three wheelers	1	1	1	2	3	2
Two-wheel tractor/trailer	6	7	9	6	7	8
Heavy equipment	7	5	7	4	2	5
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: ADB estimates based on Road Transport Administration Department data.

Road infrastructure is an important part of the safety problem. Narrow roads and poor pavement conditions make Myanmar's roads dangerous. The different rates of speed of vehicles using trunk roads coupled with the narrow width of most trunk roads combine to create safety risks when overtaking. Roads are also lacking proper safety design and basic safety features. The Yangon–Mandalay expressway has become famous for its poor safety, being dubbed as the "death highway." High speeds and poor safety design caused 337 fatalities in the 4 years after its opening, despite low traffic volumes.[10]

Another issue is that responsibility for road safety is spread over various ministries, with weak coordination. Road safety is governed by the 1964 Motor Vehicle Law and 1989 Motor Vehicle Rules. Under MOC, the DOH is responsible for implementing road safety measures in the trunk road network. The Road Transport Administration Department (RTAD) under the Ministry of Transport and Communications (MOTC) is responsible for issuing traffic regulations related to road safety, for vehicle inspection and registration, and for issuing driver's licenses. The Myanmar Traffic Police under the Ministry of Home Affairs is responsible for the enforcement of traffic regulations and collection of accident data. In 1998, the government established the Traffic Rules Enforcement Supervisory Committee for education, legislation, and enforcement. This committee is also responsible for improving coordination among the different agencies involved in road safety. In 2013, a National Road Safety Action Plan was approved and a National Road Safety Council was created, chaired by the Vice-President. There is no separate budget for road safety, however, and the different ministries are each responsible for mobilizing funding for road safety.

1.5 Axle Loading and Overloading

Changing context. Overloading used to be a major problem in Myanmar. Most trucks used in the past were two-axle trucks, strengthened to carry 8, 10, or sometimes 20 tons, while their design load was only 4.0–6.5 tons. Axle load control was rare. As a result, trucks were subjected to very high rear-axle loading, causing major pavement damage. The situation changed in the late 2000s when overloading control became more systematic (partly done by toll road contractors), and as the relaxation of import controls led to an influx of larger, more efficient trucks.

Overloading remains a serious issue, but mainly with regard to medium-sized trucks. Based on a survey with 5,500 truck drivers as part of the preparation of the NTDP, we estimate that 21% of trucks are currently overloaded (Table 12). The average axle load of a truck is 4.4 times one standard axle load (18 kips), which is high. Medium-sized trucks are 25% overloaded, and their overloading is severe: for overloaded medium-sized trucks (with two axles), the overloading ratio is 58%. Medium-sized trucks account for 22.4% of the movement of goods, but cause 60% of the damage to road pavements. Larger trucks are less frequently overloaded, and their overloading is less severe. Overloading is mainly an issue on secondary road corridors. On national highways, two-axle trucks now only carry about 10% of goods, but account for 30% of the market on other corridors, and much more in areas that are difficult to access.

Many of the larger vehicles that are legally overloaded in Myanmar would in fact not be considered overloaded in other countries, suggesting that the limits could be raised. Except for medium-sized trucks, truck loading in Myanmar is moderate. If legal axle loads were strictly applied, loading impacts would be surprisingly light (except for medium-sized trucks). This is because Myanmar uses a legal axle load of 10 tons, and limits the loading of some types of large trucks below this level, e.g., four-axle trucks are limited to a total load of 25 tons. By comparison, the standard axle load for a drive axle in Europe is 11.5 tons, and the maximum allowed load for a four-axle truck is 36–40 tons.

[10] *Myanmar Business Today*. 2014. GPS Monitoring to Start along "Death Highway." 16 December.

Table 12: **Actual Truck Loading and Axle Damage Factors**

	% of Truck Movements	% of Tonnage	Average Payload (ton)	Share Overloaded (%)	% Overloading	Average ESAL	Share of ESAL	Legal Maximum Load (ton)	ESAL for Legal Maximum Load
two-axle truck (<2 tons)	5	1	1.3	0		0.2	0.2	4	0.01
two-axle truck (>2 tons)	43	22	6.4	25	58	6.7	60	15	2.6
three-axle truck	16	16	12.7	40	15	3.6	12	19–21	1.0
four-axle truck	23	31	16.5	13	16	3.5	17	25	0.6
Trailer truck	13	30	27.7	6	14	4.1	11	33–48	2.7–5.3
Average	**100**	**100**	**12.3**	**21**	**33**	**4.8**	**100**		

ESAL = equivalent standard axle load.

ESAL computations were carried out using American Association of State Highway and Transportation Officials methodology for typical truck drive and/or trailer configurations.

Source: ADB estimates using data from the Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar.* Naypyitaw.

Low axle load standards increase user costs when rigorously enforced. A study in India showed that a legal axle load of 11–13 tons was optimal in reducing user costs in exchange for a modest increase in road agency maintenance costs.[11] We separately simulated the impact of an increase to 11.5 tons per axle of the legal axle load, bringing Myanmar's standards in line with European ones (11.5 tons per axle), and found that this would reduce freight costs by as much as 13% in Myanmar, but only require a limited increase in pavement standards and costs.[12] Using a higher axle load of 11.5 tons, medium-sized trucks would still be considered overloaded, but most large trucks would not, implying they could increase their loads and reduce their costs.

Adjustment of these legal load limits would allow better control of overloading. Once axle loads are raised, overloading fines could then be substantially raised. According to the Highway Law (2000), the Public Works/Department of Highways (PW/DOH) is responsible for defining acceptable vehicle weights and dimensions, as well as the inspection and enforcement of those limits. DOH has approximately 200 weigh scales distributed throughout the country. The larger toll gates operated by the private sector also have weigh scales, at which overloaded vehicles are charged extra.

1.6 Network Development Priorities

Government Strategies

Road infrastructure development has played an important part in Myanmar's national development strategy. The speed of development of the road network attests to the political importance given to road investments.

Most efforts have been directed toward remote areas with little demand rather than toward improving the quality of roads where traffic is the highest. With the exception of the Yangon–Mandalay expressway completed in 2010, most investments have been outside of areas where demand is concentrated. The strategy used has

[11] World Bank. 2005. *India Road Transport Service Efficiency Study*. Washington, DC.
[12] ADB. 2016. *Myanmar Transport Sector Policy Note: How to Reduce Transport Costs*. Manila.

relied generally on progressive improvements, from track to earth, then to gravel, then to macadam, then to bitumen-bound penetration macadam, and in a few cases, to asphalt concrete. The government seems to have sought to balance investments between states and regions. Since 1990, 40% of trunk roads have been built in Myanmar's states, which is higher than their population share (30%). Since 2010, the government equally expanded road networks in states and regions.

Since 2010, the government has dedicated more resources into road widening. However, widening is often carried out without changing the alignment, and often without improving the existing pavement. This gradual improvement strategy is low-cost and generally efficient, but tends to spread resources and does not raise the quality of the roads to modern standards. At some point, it needs to be abandoned to provide for better alignments and pavement strength.

Looking ahead, there is little doubt that Myanmar's road network needs modernization. In the long term, most of the trunk network should be brought to Class II-IV standards with asphalt concrete surfacing, following better alignments in hilly areas. However, very few links currently have sufficient traffic to justify such high standards, meaning that resources would be poorly used if spent without prioritization criteria. **The issue is what should come first and what can be postponed to a later time when traffic has picked up and more resources are available**.

Various planning exercises have recently been completed or are under way to define what investments should be carried out to (i) improve the main transport corridors (national transport development plan), (ii) build a full-fledged modern expressway and arterial and/or subarterial road network (arterial road development plan), and (iii) modernize the existing road network (road asset management program). Their main features and principles are reviewed in section 4. The plans will provide a sound basis for DOH to consider short- and long-term investments. There is, however, a risk that long-term plans seem to exceed available resources, and as a result become only wish lists. There is, therefore, a need to prioritize principles to allow priority to be given to the most important investments.

Optimizing Pavement Improvement and Maintenance

The ADB asset management technical assistance (TA8327) assisted MOC to prepare a road maintenance and improvement strategy. The study indicated that the threshold for paving roads was around 200 AADT and the threshold for using asphalt concrete rather than penetration macadam was about 1,000 AADT.

In the medium term, the basic strategies that minimize the long-term costs—to users and to MOC—and optimize the use of MOC resources are the following:

- **High priority**
  - Roads in poor condition with high traffic (more than 1,000 vehicles per day) should be rehabilitated, and if these currently are paved with penetration macadam, the surface should be improved to asphalt concrete. After rehabilitation, these should receive periodic maintenance.
  - Roads still in fair condition with high traffic should receive preventive asphalt overlays (at IRI 4 for traffic above 2,500 vehicles per day, at IRI 6 for traffic between 1,000 and 2,500 vehicles per day).
  - Penetration macadam roads in very poor condition with medium traffic (500–1,000 vehicles per day) should be rehabilitated, but keeping their current surface.
  - Unsealed roads reaching traffic of 500 vehicles per day should be paved.

- **Medium priority**
  - Periodic maintenance of medium traffic bituminous roads (500–1,000 AADT) in poor condition.
  - Rehabilitation of low traffic bituminous roads (200–500 AADT) in very poor condition.
  - Periodic maintenance of unsealed medium traffic roads (200–500 vehicles/day).

- **Low priority**
  - Any significant work on roads with less than 50 AADT except routine maintenance.
  - Periodic maintenance of medium traffic bituminous roads (200–500 AADT)
  - Rehabilitation of low traffic bituminous roads (50–200 AADT).
  - Periodic maintenance of unsealed low traffic roads (50–200 AADT).

If applied consistently over the next 5 years (2016–2020), this strategy would require MOC to spend about $1.45 billion over 5 years ($280 million/year) for the periodic maintenance and pavement improvements of about 11,600 km roads (Table 13). Within 5 years, all pavements of roads hosting high volumes of traffic should receive periodic maintenance and rehabilitation.

Table 13: **Optimized Improvement and Maintenance Needs, 2016–2020**

2014 Traffic Range*	Total Network	Unsealed Periodic Maintenance	Paving	Overlays	Rehabilitation / Upgrade to AC
<50	18,242	0	0	0	0
50–200	10,765	3,200	0	0	1,400
200–500	4,497	0	890	620	700
500–1,000	1,599	0	0	570	400
1,000–2,500	2,314	0	0	1,150	720
>2,500	2,699	0	0	1,660	300
Total	**40,116**	**3,200**	**890**	**4,000**	**3,520**
Cost	**1,450**	**145**	**125**	**480**	**700**

AC = asphalt concrete.

* Note that because of increased traffic, some roads currently with low traffic levels will move to a different category.

Source: ADB estimates based on data from Sweroads. 2015. *Developing the Asset Management Program for Myanmar Roads*. Draft Final Report. Naypyitaw.

Widening Requirements

About 1,550 km roads require widening to accommodate current traffic. An analysis of paved road network shows that 8% of the roads have reached traffic levels that exceed capacity (Table 14). We estimate that

- The threshold for widening a road from 12 ft to 18 ft is between 400 and 500 vehicles per day (not including motorcycles).[13] With a tight budget constraint, a higher threshold of 500 vehicles per day would be appropriate.

[13] This assumes a cost of $300,000 per km to reconstruct a road to 18 ft and provide a good surface condition, and a traffic growth rate of 5%. With a higher growth rate of 8% annually, the threshold becomes 300 vehicles per day.

Table 14: **Distribution of Trunk Paved Road Network by Traffic and Pavement Width**
(%)

	Pavement Width				
AADT	**12 ft**	**18 ft**	**24 ft**	**36 ft or more**	**Total**
<50	27.7	2.4	0.4	0.1	30.6
50< <100	16.3	4.5	0.8	0.2	21.8
100< <300	13.0	5.3	0.5	1.0	19.8
300< <500	1.9	3.4	0.5	0.2	6.0
500< <1,000	1.3	3.1	1.5	0.1	6.0
1,000< <2,000	0.5	3.1	1.1	0.0	4.7
2,000< <5,000	0.4	2.0	4.0	3.4	9.8
5,000< <10,000	0.0	0.0	0.5	0.8	1.3
Total	**61.1**	**23.8**	**9.3**	**5.8**	**100.0**
Total with V/C>1	**2.3**	**5.1**	**0.5**	**0.0**	**7.9**

AADT = average annual daily traffic, ft = feet, V/C = vehicle to capacity ratio.

Note: Shaded cells have traffic exceeding capacity.

Source: ADB estimates based on data from Sweroads. 2015. *Developing the Road Asset Management Program for Myanmar Roads*. Final Report. Naypyitaw.

- The threshold for widening a road from 18 ft to 24 ft is between 800 and 900 vehicles per day. With a tight budget constraint, a higher threshold of 1,000 vehicles per day would be appropriate.[14]

There are 280 km of 12 ft-wide roads with traffic volumes between 500 and 1,000 vehicles per day that require at least an 18 ft pavement and 1,250 km of 18 ft roads with traffic above 1,000 vehicles per day that require a full-scale 24 ft pavement. Assuming a cost per km of $600,000 for widening to 24 ft, and $300,000 for widening to 18 ft, the total widening costs would reach $835 million. If these works are carried out when the road requires rehabilitation, the additional cost would be $500 million.

As traffic grows, the share of trunk roads that requires widening will rise. Within the next 10 years, an additional 9% of the paved road network (1,900 km) would likely require widening, assuming a 5% traffic growth rate.

Major Improvements

The National Transport Development Master Plan (2015–2030) identified a program of large-scale investments in the road sector (section IV and Appendix 1). This study's economic review[15] identified the three following major investment needs as likely to generate significant benefits:

- **Yangon–Mandalay expressway improvements with the purpose being to allow trucks**. The National Transport Development Master Plan recommends opening the expressway to trucks, but

[14] This assumes a cost per km of 600,000 km (for widening and pavement improvement), and a 5% traffic growth rate. With a higher rate of 8%, the threshold becomes 700 vehicles/day.

[15] ADB. 2016. *Myanmar Transport Sector Policy Note: How to Reduce Transport Costs*. Manila.

also considers widening it. Even when adding trucks on the Yangon–Mandalay highway, total traffic is unlikely to exceed the current expressway capacity until 2025. A simple improvement (e.g., safety and surfacing) may be sufficient. This policy note estimates the total benefits over the next 15 years to be $10 billion. Taking an estimated cost range of $200 million for the overlay of the 640 km expressway, the benefit-to-cost ratio would reach 18.5, an extremely high level of economic viability by any standard.

- **GMS North Road Corridor to the PRC improvements**. The costs of improving this road are placed at $475 million by the National Transport Development Master Plan. This study estimates that it would generate benefits in the range of $225 annually, reaching $7.7 billion over 15 years for a benefit-to-cost ratio of 5.9, also suggestive of a very high level of viability. ADB has already been financing the construction of an expressway between Kunming and Ruili on the PRC side.
- **GMS East–West Road Corridor to Thailand improvements**. Altogether, the improvement of the corridor between Eindu and Myawaddy could bring benefits in the order of $50 million annually, reaching $1.7 billion over 15 years, for a benefit-to-cost ratio of 2.8.

1.7 A Medium-Term Modernization Agenda

Short- to Medium-Term Investment Priorities

In the short to medium term, this policy note believes that economic considerations should dominate decision-making given the gap between needs and resources and the need to support accelerated national economic growth. Under a strategy to use road investments to support economic growth, (i) investments should, in the medium term, be concentrated on the road sections with the highest traffic; (ii) standards should be based on the traffic levels; and (iii) selection of upgrading, rehabilitation, and even periodic maintenance works should be primarily based on economic returns.

Based on the findings of our economic analysis (presented in a separate policy note), and the review above, this policy note suggests using the following operational priorities:

- **Prioritize the upgrading to modern standards of roads with very high traffic levels that can foster economic growth**, over investments that mainly contribute to national integration. Roads with the highest traffic levels should be rehabilitated or reconstructed as needed, paved with asphalt concrete, and where required, alignments should be improved. Standards should initially remain moderate. The widening to four lanes or more seems unnecessary given the volumes of traffic on the network except around a few urban areas. Priority segments would be the Yangon–Mandalay corridor (improvement of the expressway and its opening for trucks), the GMS Northern Corridor between Mandalay and Muse (options for improvement of the alignment and strengthening of the pavement should be analyzed), and the GMS corridor between Myawaddy and its connection with the Yangon–Mandalay corridor (improvement to international corridor standards with better alignments, and the potential upgrade to four lanes of the section between Payagyi and Thaton). This program would initially concern about 2,000 km of road and expressway that already have traffic levels of 2,000 or more vehicles per day, potentially increasing to 6,000 km within 15 years. The construction of short segments of expressway should also be considered near Yangon and Mandalay urban areas. In summary, these are the priorities of the NTDP.

- **Prioritize periodic maintenance or rehabilitation of road sections with high traffic levels over reconstruction and upgrading**. Candidates would be trunk roads with traffic levels of 500–2,000 vehicles per day. Asphalting should be considered for roads with traffic above 1,000 vehicles per day. Either scheduled periodic maintenance would be carried out (if the pavement is still maintainable) or asphalt improvements would be carried out as part of their rehabilitation (if the pavement is in poor condition). Most of the roads meeting these criteria already do not require widening, but do need proper shoulders. However, with time, the need for widening from 12 ft to 18 or 24 ft pavements will become necessary. As of 2014, 2,250 km roads meet the criteria, of which 820 km also need widening. This will increase to 5,000 km in the medium term. Sections with the highest traffic levels may later become candidates for upgrading to modern standards. Pavement standards should be chosen to gradually allow higher truck loadings.
- **Prioritize mechanized periodic maintenance of road sections with moderate traffic before they deteriorate too much, over rehabilitation with hand-laid penetration macadam**. This would typically involve roads utilized by 200–500 vehicles per day. Mechanized maintenance techniques should be used increasingly (machine-laid macadam and surface dressing). The sections under worst condition should also be rehabilitated. This program could potentially cover 4,000 km of road sections, initially.
- **For unsealed roads, priorities should be to pave any road with traffic reaching 500 vehicles per day, and the grading of those with traffic above 200 vehicles per day**. When resources allow it, paving could be considered for unsealed roads with traffic above 200 vehicles per day, and periodic maintenance extended to those with traffic above 50 vehicles per day.
- **A limited number of exceptions to these priorities may be needed** to improve access to states and/or hilly areas and achieve social and/or national objectives even though current traffic levels are still low (below 200 vehicles per day). This may be particularly important in postconflict areas. A few low-volume paved roads in very poor condition (<200 AADT) will also need rehabilitation. Finally, low-cost improvements on roads with low traffic could also be considered part of a rural road improvement program.

Road safety issues could be addressed in parallel. Road accidents and fatalities are already high in relation to the number of registered vehicles, and are increasing sharply as vehicle numbers and traveling speeds increase. Safety engineering needs to be improved immediately on the expressway. A safety survey (e.g., using International Road Assessment Program) needs to be carried out on the rest of the trunk road network to identify other safety issues. These should subsequently be addressed through a stand-alone safety improvement program with earmarked funding. Future road works should include minimal safety requirements to address safety issues.

Possible 'Minimum' Five-Year Program

Table 15 summarizes the investments suggested by this policy note for the period 2016–2020. It amounts to $3 billion, or about 1% of Myanmar's gross domestic product (GDP). This is similar to what has been spent to date. However, because it focuses exclusively on high-return investments, the economic impact should be higher.

This program is similar in magnitude to what is allocated by the National Transport Development Master Plan, but priorities differ. The master plan focuses in the 2016–2020 period on the paving of long corridors in

Table 15: **'Minimum' Five-Year Program**

	Length (kilometer)	Cost ($ million)
Paved network		
- Major improvements	1,300	850
- Widening	1,000	520
- Rehabilitation	2,500	500
- Periodic maintenance	4,000	480
- Routine maintenance	19,000	80
Unpaved network		
- Paving	890	125
- Periodic maintenance	3,200	145
- Routine maintenance	21,000	75
Bridges		**240**
Total	**12,890**	**3,015**

Notes: (i) Major improvements include the Yangon–Mandalay Expressway, Mandalay–Lashio–Muse, and Thaton–Eindu –Kawkareik–Myawaddy; (ii) widening considered only for roads with traffic exceeding capacity; (iii) periodic maintenance and rehabilitation requirements are based on the results of TA8327, and adjusted as some roads are already planned for improvements; and (iv) bridge requirements draw on the master plan figures (Annex 3).
Source: ADB estimates.

remote areas.[16] It does not consider rehabilitation and periodic maintenance needs. This review suggests giving a higher priority to the trunk network, and to launch a program of periodic maintenance and rehabilitation.

Possible Investment Targets

Within 15 years, Myanmar could build the base of a modern trunk road network able to meet its development needs. Building on the review above, Myanmar's trunk road network could include the following by 2030:

- 1,000 km of expressway or four-lane roads,
- 6,000 km of trunk roads meeting modern Class III or Class II standards,
- additional 5,000 km of trunk roads with asphalt concrete surfacing,
- 10,000–15,000 km of paved roads with machine-laid surface dressing surfacing and proper shoulders, and
- proper maintenance of this 22,000–27,000 km trunk road network to keep it in good condition.

[16] The master plan considers for the 2016-2020 period the paving and upgrading of the following highways: (i) Minbu (Magway)–Ann–Kyauktaw–Sittwe, (ii) Thanbyuzayat–Dawei–Myeik–Kawthoung, (iii) Thanbyuzayat–Three Pagoda Pass, and (iv) Kengtong–Mongla (PRC border in Eastern Shan State). Most of these however have minimal traffic to justify significant works on an economic basis. The master plan also considers a major improvement of the Yangon–Mandalay Expressway. This may have limited positive impacts before 2020 because traffic remains low. It also considers the construction of a new expressway at Yangon City–Thilawa Port. This need is not considered here as it belongs to the Yangon area urban transport development. The master plan concurs with this review regarding the need to upgrade the GMS East–West corridor to Thailand, but postpones to 2021 the upgrade of the GMS Northern Corridor to the PRC, despite an already high volume-to-capacity ratio.

Addressing Bottlenecks

To achieve this goal, the existing road sector will require a thorough transformation. It will need to provide answers to the following questions, which are analyzed in subsequent sections of this policy note.

- **How to finance the modernization and the maintenance of a higher-quality road network?** Financing for road upgrading and maintenance has long been below the needs and has only recently increased, but in a way that makes it less predictable. Stable financing channels are needed to finance long-term modernization (section II).
- **How to give the road sector the institutional organization and capacity it needs to deliver these objectives?** At the central level, the Department of Highways (DOH) needs a new structure to strengthen its planning, resource mobilization, and procurement capacity. Its construction and maintenance units should be corporatized and gradually divested. At the local level, a new arrangement is required that acknowledges the increased role of local governments (section III).
- **How to develop robust and modern processes for planning works and implementing them?** The public sector lacks a planning culture and observed practices lead to inefficient spending. Much should be done to improve procedures and standards. Also, most large-scale construction works in Myanmar have been done in-house by the Public Works, using labor-based techniques. In the future, DOH will need to rely mainly on private sector delivery as the volumes of works expand. However, the basic requirements for efficiently managing private sector contractors are lacking (section IV).
- **How to mobilize private sector financing through toll roads in an efficient manner?** Trunk roads with the highest traffic levels are managed by the private sector under so-called build–operate–transfer (BOT) contracts, but this program has only yielded moderate results. Improvements are needed to raise the quality and channel more private investments (section V).

This policy note does not describe the nascent road sector industry, nor does it attempt to advise on how to develop it beyond applying good international practices in the procurement of works and paying careful attention to the future market when corporatizing MOC's construction units. This matter is not crucial to policy making at this moment in time as MOC dominates the road industry, but should be considered in later phases of reform.

2 Financing Road Sector Development

Key Findings and Suggestions

Findings

Myanmar has historically invested insufficiently in its trunk roads, dedicating an average 1% of its gross domestic product (GDP) compared with 2%–3% in comparable countries. In FY2014, Myanmar may double the resources, a jump from 1% to 2% of GDP, thanks to much larger budgets from the states and regions.

Myanmar's planned financing remains insufficient to meet the estimated construction and improvement needs of the national road network. Budgets are also becoming less predictable, and there is a growing mismatch between resource availability (at the subnational level) and needs (in the national network).

Myanmar's road users finance a significant but minority share of road sector costs. We estimate that Myanmar collects $450 million a year, mainly from car owners and heavy trucks, while other users make only very small contributions. This is because toll rates are uniquely skewed to bear on heavy trucks and because car registration is very expensive.

Suggestions

To ensure that proper levels of financing are sustained for the main trunk highways, budget allocations to the Ministry of Construction need to be increased and build–operate–transfer contracts need to be made more profitable, making use of debt funding to bridge financing gaps.

To raise more resources and improve the efficiency of the road user charging system, Myanmar should introduce a fuel tax of approximately $0.10 per liter, as well as a heavy vehicle license fee for trucks to cover the pavement damage caused by heavy vehicles. These two fees would raise around $400 million annually, covering maintenance and rehabilitation needs for nontolled highways. The toll rates should be revised to bear more fairly on all vehicles. Higher toll rates could be introduced in specific roads to finance major investments. Altogether, Myanmar would then collect $850 million in road user charges.

To make the changes more acceptable, tolls could be removed on roads with low traffic levels where revenue is very limited, potentially covering up to 18,000 kilometers of trunk roads.

A funding transfer mechanism should be created that allocates funds to the level where they are most needed. This is a complex process but there is significant international experience to build upon. A key element is that road user charges should be earmarked to the road sector. The benefits in terms of better spending, better accountability, and financial leverage far exceed the possible fiscal disadvantages, which seem limited in a context where needs are large.

2.1 Road Sector Expenditures

As of 2015, it is exceedingly difficult to accurately answer the most basic questions:

- How much is Myanmar spending on trunk roads?
- Who is spending? (or, more accurately, *who has decision-making power* over spending?)
- For what purpose?

This is because

- **Public Works used to function both as a government department and a state economic enterprise (SEE)**. As such, the Public Works (government department) channeled government resources to Public Works (SEE). Public Works (SEE) executed government works, but also executed works for third parties, pays taxes and makes profits, which are channeled back to the treasury. Public Works (SEE) may also store some materials and invest in equipment to prepare for future works. Budgets could then be reported from the SEE point of view on an accrual basis, or from the Public Works point of view, on a cash basis.[17]
- **Resources from central and state and/or regional governments are largely pooled**. Since FY2012, the regions and/or states receive block grants from the central government and use them to finance road works and maintenance. These funds are exclusively used for the trunk roads managed by the Public Works/Department of Highways (PW/DOH). These are pooled with central government funds for works on the national trunk road network on the basis of cost-sharing arrangements negotiated on an ad hoc basis, if not after the fact. Some resources (e.g., materials used for maintenance) are pooled without clear attribution to where they are being used.
- **Decision-making authority is not clearly allocated**. Block grants have been used to finance not only PW/DOH civil works, but also the salaries of local PW/DOH staff. The decision-making authority for state and/or regional budgets theoretically lies with the local governments, but in practice, this is largely in the hands of the PW/DOH local agencies, which are deconcentrated units of the central government.
- **The Ministry of Construction (MOC) does not have a clear classification of works by type**. For instance, the "special maintenance" category covers road widening and the "construction" category can include heavy maintenance works.
- **Bookkeeping practices are all paper-based**. Information collection is time-consuming and error-prone. A same number can be reported in different ways depending on the context. Some information is also only available with a delay. As a result, the numbers reported can vary by a large margin.

We believe that Myanmar's decision makers have likely been facing similar difficulties as experienced by our team when working with PW/DOH to obtain comprehensive and comparable budget information. It reflects a confusing way in which the sector is organized. This needs to be addressed to ensure efficient allocation of resources and sound management. Some simplification is bound to occur as decentralization proceeds and

[17] PW/DOH receives its road sector budget through two different channels. The first budget is allocated directly to PW/DOH and is used for equipment, buildings, and land. A second operating budget is allocated to the Road and Bridge Sections under the Works Division of PW/DOH, of which 9.09% is allocated to overhead and the remaining 90.91% to implementation. The overhead is used for salaries, pensions, and administration (this does not include the salaries of local staff, which are paid by the states and regions). Any remaining funds from the overhead are seen as profit and after payment of 25% profit tax and 20% to the national treasury, the net profit is used for purchases.

as PW/DOH is transformed into a highway department (section 3). As such, this situation is partly transitory. Subsequent paragraphs present a preliminary analysis of road sector expenditures, past trends, and patterns of spending in the road sector. This analysis concentrates on trunk roads, as rural roads are the object of a separate policy note.

Overall Expenditures

Myanmar's road sector expenditures have historically been below what other developing countries have spent at a comparable stage of development. We estimate that Public Works spent on average 1% of its gross domestic product (GDP) on trunk roads between FY2005 and FY2013.[18] Investments reached about 1% of GDP in FY2005, decreased to a low of 0.5% in FY2009 before rising to 1.3% in FY2013. The allocation between construction and maintenance has been about 85% for construction (49% road, 35% bridges) and 15% for maintenance.

By comparison, in middle-income countries that are in the process of improving and expanding their transport infrastructure, investments in transport tend to form 2%–3% of GDP, reaching 4% or even higher in countries with a strong focus on improving the transport sector as a means of stimulating economic growth (e.g., the PRC, India, Thailand, and Viet Nam). In high-income countries such as the United States and Western Europe, investments in the transport sector tend to form only 1% of GDP due to the well-developed transport infrastructure and high GDP levels. In low-income countries, investments in the transport sector tend to be high due to the poorly developed transport infrastructure and the low GDP levels, although they are generally curtailed by investment needs in other sectors. By far, the largest part of these investments in the transport sector goes to roads, which receive 70%–80% of all transport investments.

Table 16: **Public Works Expenditures on Trunk Roads in Local Currency**
(MK million)

Budgets	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014[a]
Spending by Origin of Funds										
Central government	102,250	105,741	96,520	106,691	181,915	314,717	596,171	510,070	281,901	300,929
State/Region governments	n/a	n/a	n/a	n/a	n/a	n/a	n/a		399,866	839,583
Donors	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	72,321
Expressway tolls	n/a	n/a	n/a	n/a	n/a	n/a	9,000	10,000	10,780	10,500
Total	**102,250**	**105,741**	**96,520**	**106,691**	**181,915**	**314,717**	**596,171**	**510,070**	**681,767**	**1,212,833**
Spending by Works										
Road construction	35,164	48,460	47,030	51,546	101,615	179,175	303,907	238,701	421,818	796,062
Bridge construction	52,300	33,297	33,779	27,549	53,703	107,802	205,110	168,077		
Maintenance	14,786	23,984	15,711	27,596	26,597	27,740	87,154	103,292	259,949	416,771
Total	**102,250**	**105,741**	**96,520**	**106,691**	**181,915**	**314,717**	**596,171**	**510,070**	**681,767**	**1,212,833**
Share of GDP (%)	1.1	1.0	0.6	0.5	0.7	1.2	1.3	1.0	1.3	2.0

n/a = not applicable, FY = fiscal year, GDP = gross domestic product, MK = Myanmar kyat.

[a] Budgeted.

Source: ADB estimates based on various Ministry of Construction sources compiled for the purpose of the study.

[18] This amount does not include all road sector investments, which also includes build–operate–transfer contractor spending, and spending on rural roads and in urban areas.

Table 17: Public Works Expenditures on Trunk Roads in United States Dollars
(2014 constant $ million)

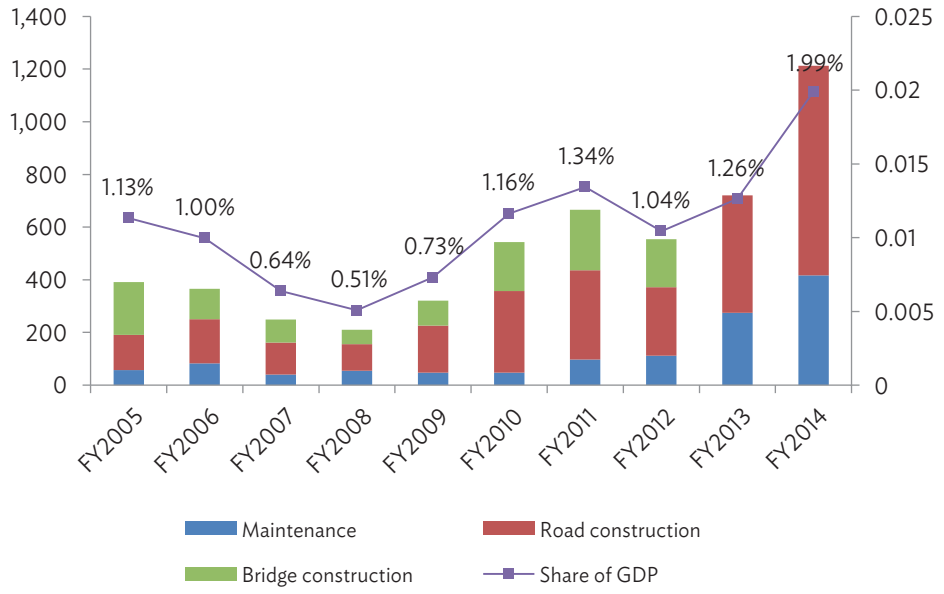
Budgets	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014[a]
Spending by Works										
Road construction	57	83	40	54	47	48	97	112	445	796
Bridge construction	135	167	121	101	179	309	339	259		
Maintenance	200	115	87	54	95	186	229	183	274	417
Total	**391**	**365**	**249**	**210**	**321**	**543**	**665**	**554**	**720**	**1,213**

[a] Budgeted.

Notes: (i) FY2014 data are budgeted, not executed, (ii) amounts were converted to constant $ using market exchange rate as of 2014, official local inflation data, and a composite index reflecting that before 2012, Public Works only paid a fraction of its fuel and import costs such as bitumen.

Source: ADB estimates based on Ministry of Construction data.

Figure 13: Trunk Road Expenditures by Type
(2014 constant $ million)



FY = fiscal year, GDP = gross domestic product.

Note: Bridge spending included with road after 2013.

Source: ADB estimates based on Ministry of Construction data.

Expenditures were set to increase strongly from FY2014, as regional government and donor financing are ramping up. Since the new Constitution took effect in 2012, the share of resources channeled through local government budgets has risen rapidly. Regional and state governments have become the largest source of funding for PW/DOH since FY2013. Development partner financing is still limited but also on the rise. Central government budgets, on the other hand, are on the decline, reflecting a reduced emphasis of the government on transport, as well as a reaction to increased funding availability from states and/or regions and international donor agencies.

Spending Patterns

A division of roles between central government and state and/or regional governments for road network financing is emerging but remains far from clear. Central government mostly finances works on national roads and about 60% of staff and pension costs. State and/or regional governments finance all works on the state and/or regional roads, a share of maintenance and construction costs on the national highways, about 40% of staff and pension costs, and most of costs of temporary workers. For FY2014, state and/or regional governments are set to finance an average of 17% of construction costs on the national network and 64% of maintenance costs. The shares are very variable, however, ranging from nothing in several states (Sagaing, Mandalay, Yangon, and Shan states [South]) to the majority of construction costs and almost all maintenance costs in some others (e.g., Tanintharyi, Kachin, Kayah, and Ayeyarwady).

The devolution of resources to state and/or regions has not yet improved the allocation of road sector resources. Local budget allocations have tended to follow much less clear rules than PW/DOH ones. An analysis of central and local government budgets reveals the following:

- Central government construction budgets tend to be spread evenly between states and/or regions, except for Yangon, which receives a larger share. This is only moderately efficient, as it does not allocate according to needs, and as a result, some states receive disproportionately high investments by population.
- Central government's routine maintenance budgets are based on the length of the network, with PW/DOH allocating, in practice, a fixed amount per kilometer (km) of road to be maintained, with variations depending on local costs and types of roads. Central government special maintenance budgets are a function of the condition of the roads and the traffic and/or population. These practices are efficient.
- State and/or regional budgets follow much less clear rules, neither in their size nor in their allocations. Local construction budgets in US dollars per capita are $0 in Rakhine, $0.9 in Mandalay, $1.8 in Yangon, $29 in Kachin, $42 in Kayah, and $84 in Chin State (Table 19). The local maintenance expenditures on the regional and/or state network vary between $3,000 per km (Shan State East and South) and $20,000–$30,000 (Kachin, Sagaing, Tanintharyi, and Rakhine). Some states heavily cofinance maintenance and construction works on the national network while others do not. As a result, in FY2014, state and/or regional roads will receive for their maintenance the amount of $10,500 per km (Table 20) while national roads will receive $5,330 per km (when including both local and central government contributions).

Table 18: Distribution of Financing Responsibilities between Central and Local Governments

Type of Expenditure	Central Government	State/Region Government
Construction of national highways	Yes	Depends on states (0%–57% share)
Construction of state/regional roads	No	Yes
Maintenance of national highways	Yes	Depends on states (0%–89% share)
Maintenance of state/regional roads	No	Yes
Staff salaries	HQ staff and special units (57% share of total)	Staff in local offices (43% share of total)
Pensions	Yes (60% share)	Yes (40% share)
Temporary workers	Some (12% share)	Most (88% share)

HQ = headquarters.

Source: ADB estimates based on discussions with the Ministry of Construction staff and analysis of FY2013 and FY2014 budgets.

Table 19: Origin and Destination of Budgets by State, FY2014
($ million)

	National Roads				State/Regional Roads		
	Construction		Maintenance		Construction	Maintenance	
Financing Source	Central	Local	Central	Local	Local	Local	Total
Kachin State	14.8	20.9	7.1	18.2	28.9	36.7	126.7
Kayah State	8.3	6.3	1.5	1.9	5.8	2.7	26.6
Kayin State	10.7	4.6	3.2	1.3	20.3	12.4	52.6
Chin State	8.0	2.7	2.3	0.0	37.7	5.0	55.6
Sagaing Region	19.3	0.0	9.1	0.0	37.4	56.3	122.2
Tanintharyi Region	17.0	13.2	5.9	49.9	7.1	17.5	110.7
Bago Region	11.6	0.0	3.1	0.0	21.7	12.5	49.0
Magway Region	11.4	3.7	2.3	12.9	70.5	15.4	116.2
Mandalay Region	10.3	0.0	5.4	0.1	5.3	5.6	26.8
Mon State	8.1	5.7	1.4	0.8	12.1	3.0	31.1
Rakhine State	10.2	0.0	4.9	30.1	0.0	23.7	69.0
Yangon Region	52.2	0.0	4.1	0.0	13.3	7.2	76.9
Shan State (East)	12.1	0.0	1.7	0.0	23.7	4.1	41.6
Shan State (South)	11.9	3.9	3.9	0.2	55.4	7.5	82.9
Shan State (North)	4.1	1.9	2.5	1.3	10.7	17.3	37.7
Ayeyarwady Region	16.2	16.2	8.4	2.7	54.4	9.4	107.5
Naypyitaw Union Territory	7.0	0.0	2.5	0.0	0.0	0.0	9.5
Total	**233.5**	**79.3**	**69.4**	**119.5**	**404.4**	**236.4**	**1,142.5**

Central = central government budget, Local = state and/or regional budgets.
Source: ADB estimates based on Ministry of Construction data.

Table 20: Expenditures of Network and Population per Kilometer
($)

	Central Budgets		Region/State Budgets	
State/Region	Maintenance Budget/km	Construction Budget/pop	Maintenance Budget/km	Construction Budget/pop
Kachin State	4,061	8.8	18,073	62.0
Kayah State	3,661	29.0	5,066	58.5
Kayin State	3,464	6.8	12,583	24.6
Chin State	3,293	16.6	3,864	94.9
Sagaing Region	5,450	3.6	20,512	17.6
Tanintharyi Region	7,246	12.1	32,244	62.4
Bago Region	2,425	2.4	13,638	7.0
Magway Region	1,726	2.9	7,018	26.2
Mandalay Region	3,335	1.7	9,848	1.8
Mon State	2,690	4.0	9,951	10.5
Rakhine State	5,950	3.2	22,846	16.9
Yangon Region	7,584	7.1	14,392	2.8
Shan State (East)	2,222	8.7	3,023	20.0
Shan State (South)	2,934	5.5	2,960	31.0
Shan State (North)	1,401	1.8	5,249	13.8
Ayeyarwady Region	8,310	2.6	5,950	13.4
Naypyitaw Union Territory	5,844	6.0		0.0
Total	**3,923**	**4.5**	**10,547**	**16.3**

km = kilometer, pop = population.
Note: Only region and/or state network and expenditures were considered for region and/or state ratio.
Source: ADB estimates based on Ministry of Construction data.

Table 21: **Public Works Cash Flow Budget, FY2014**
(MK billion)

	Union	State and Division	Total
Staff salaries	12.5	9.2	21.7
Pensions	4.3	2.6	6.9
Hired labor	2.7	20.4	23.1
Raw materials	194.0	467.5	661.5
Work expenditures	76.5	124.9	201.4
Administration and research expenses	2.3	11.2	13.4
Financial expenses	0.2	0.0	0.2
Income tax	4.0	8.7	12.7
Contribution to state	3.2	7.0	10.2
Equipment[a]	0.0	0.0	17.6
	299.7	**651.4**	**968.6**

MK = Myanmar kyat.

[a] Equipment figures are for FY2013. Data based on budget law FY2014, which does not reflect final allocations.

Source: Ministry of Construction.

PW/DOH has kept down management costs. For FY2014, PW/DOH is set to spend 93% of its resources on work items and equipment, and only 7% on staff, pensions, and other overheads (Table 21). This is a low level by international standards, reflecting the low levels of PW/DOH salaries, its reliance on labor-intensive techniques and in-house delivery, and generally a good capacity to keep costs down and avoid unnecessary expenditures.

Budget execution only partly follows initially approved budgets. Construction expenditures are systematically increased during the year, while maintenance expenditures have consistently fallen short of budget allocations. The Public Works maintenance allocation for FY2013 reached MK118 billion, but actual expenditure amounted to only MK69 billion. As a result of the low expenditure, the budget allocation for maintenance for 2014–2015 was reduced to MK70 billion in line with actual expenditure in the previous year. This budget does not include additional allocations for backlog special maintenance or emergency maintenance that are received from the special project budget managed by the President's Office.

A detailed analysis of budgets as approved and executed would be necessary to better understand issues associated with operational planning and implementation. The list of FY2014 planned capital works under the Ministry of Construction (MOC) included 354 investments in all states for a total budget of $172 million. The average budget per investment was only $490,000, with most works ranging between $100,000 and $1 million. The two largest investments were a $15 million bridge in the Yangon area and a $6.2 million improvement work on the expressway. This high fragmentation of budgets may imply that PW/DOH's large-scale works are implemented over several years depending on budget availability.

International Financing Institutions

External financing is small but has the potential to become a large source of funding for trunk roads. Four international financing institutions are currently active in financing investments in the trunk road sector. These include the China EXIM Bank, India EXIM Bank, Japan International Cooperation Agency (JICA), and the Asian Development Bank (ADB). The funding foreseen by PW/DOH for FY2014 included $143.8 million from

the India EXIM Bank (for the road from Shwebo to Myitkyina in Kachin State and a second road in Rakhine State), $294 million from the China EXIM Bank (for the AH112 from Mawlamyine to Kawthoung in Tanintharyi Region), $62.5 million from JICA (for a number of different roads and bridges across different states and regions), and $9.8 million from ADB (Maubin–Pyapon Road Rehabilitation Project in Ayeyarwady Region). Total funding from international financing institutions for 2014–2015 was foreseen to reach $509.4 million, more than double the funding available from the central government.

Private Sector—Build–Operate–Transfer

The private sector is already an important source of financing for the necessary improvements and widening. PW/DOH maintains 5,545 km of its main roads under build–operate–transfer (BOT) arrangements. BOT contractors have mainly been required to carry out widening works, as well as basic maintenance. Based on the total length of BOT contracts and assuming a minimum average investment of $150,000/km for widening, total private sector investment since the introduction of BOT contracts in 1996 would be in the range of $800 million, an average $45 million per year. Actual data on spending by BOT contractors are, however, not available. As of 2014, a number of widening works were being implemented, so that average annual investments may be higher, in the order of $100 million per year. Field visits to various BOT contracts showed that spending on maintenance was very limited, less than what PW/DOH would spend on similar roads. For the purposes of this study, the annual investment in maintenance by BOT contractors is put at $2,000 per km per year, or approximately $11 million per year for all BOT roads.

2.2 Costs and Investment Needs

Upgrading and Rehabilitation Needs

The estimated costs for construction and improvement of the main corridors are estimated in the National Transport Development Plan (NTDP) to be $11.3 billion over 15 years (2016–2030). Based on the investment priorities outlined in section 1, we put (minimum) upgrading needs lower, at $7–$8 billion over 15 years, not including large bridge works ($500 million in the NTDP). Road rehabilitation and/or upgrading to asphalt concrete needs could reach $2 billion over 10 years, and a program of periodic maintenance with asphalt overlays an additional $2 billion over 10 years.

Altogether, we estimate that Myanmar should spend a minimum of $600 million each year on trunk road network investments and rehabilitation. This is an *annualized* estimate. It is based on the assumption that Myanmar's annual growth rate would be 7% in the next 10 years, and that resources can rise each year in line with GDP. Spending should rise to $1 billion a year by 2025 to finance all needs.

At the time of writing, a proper estimation of the construction and improvement needs of the lower-level trunk roads did not yet exist. The NTDP only includes international communication and union roads (IC/UR), and does not include state and/or regional roads. The Arterial Road Development Plan and the Road Asset Management Program are expected to give estimates of upgrading and rehabilitation and/or periodic maintenance needs on the network, which will need to be reconciled. For the purpose of this policy note, the costs for the upgrading of these roads is estimated to be $100 million per year and $45 million for their rehabilitation.

Maintenance Needs

We estimate the long-term annual costs for maintenance to about $100 million per year for the roads managed directly by PW/DOH and $50 million per year for the roads managed by the states and regions. As part of this study, an estimation of required maintenance funding was carried out using the Road User Charges model developed by the World Bank.[19] This model distinguishes between fixed maintenance costs that are the same for all roads, and variable maintenance costs that depend on the traffic volumes. Annual fixed routine maintenance costs were assumed to be $850 per km for paved roads, $250 per km to $50 per km for macadam or gravel roads, and $125 per km to $250 per km for earthen roads.[20] Annual variable routine maintenance costs were assumed to consist mainly of additional patching for paved roads and additional grading for unpaved roads, whereby the volumes of work per km depend on the traffic volumes. Periodic maintenance costs (overlays, seals, regravelling) were determined based on the optimal strategy to maintain the roads in good condition depending on their surface type and traffic volume (this is predefined in the model

Table 22: **Estimated Maintenance Requirements**
($ million per year)

Road Network	Surface Type	Routine Maintenance			Periodic Maintenance			Administrative + Others	Total
		Fixed	Variable	Total	Fixed	Variable	Total		
National roads	Paved	10.5	0.4	**10.8**	39.0	27.4	**66.4**	5.1	82.3
	Gravel	2.6	2.6	**5.2**	4.7	1.9	**6.6**	2.1	13.9
	Earth	0.5	0.7	**1.2**	0.0	0.0	**0.0**	0.8	2.0
	Total	**13.6**	**3.7**	**17.2**	**43.7**	**29.3**	**73.0**	**8.0**	**98.2**
State and region roads	Paved	4.7	0.1	**4.8**	12.3	10.7	**23.0**	2.0	29.7
	Gravel	3.1	3.3	**6.4**	5.7	2.4	**8.1**	2.2	16.8
	Earth	1.0	1.4	**2.4**	0.0	0.0	**0.0**	2.8	5.2
	Total	**8.8**	**4.7**	**13.5**	**18.0**	**13.1**	**31.1**	**7.0**	**51.6**
All trunk roads		**22.4**	**8.4**	**30.7**	**61.7**	**42.4**	**104.1**	**15.0**	**149.8**

Source: ADB estimates based on model developed for the study.

Table 23: **Estimated Funding Needs for the Trunk Road Network**
($ million per year)

	Roads Managed by Ministry of Construction	Roads Managed by States and Regions	Total
Improvement	450	100	550
Rehabilitation	150	45	195
Maintenance	100	50	150
Total	**700**	**195**	**895**

Source: ADB estimates based on model developed for the study.

[19] ADB. 2016. *Transport Sector Policy Note. How to Improve Road User Charges*. Manila.
[20] The higher fixed costs were applied to highways managed by the Ministry of Construction, and the lower fixed costs were applied to roads managed by the states and regions.

and draws from a Highway Design Model-IV analysis). Together with data on road lengths, traffic volumes, and surface types, the Road User Charges model provided the following estimated maintenance needs:

Total funding needs for the trunk road network are estimated to be at $900 million per year. This includes $550 billion per year for construction and improvement of the trunk road network, $195 million for rehabilitation and partial upgrading to asphalt concrete standard, and $150 million for maintenance.[21]

Financing Adequacy

Myanmar has, in FY2013 and FY2014, allocated slightly below the minimum it should have done, on its trunk road network. In FY2013—the last executed budget at the time of writing this report, Myanmar spent $680 million from government resources, and potentially $780 million including investments by BOT contractors. This is 85% of our minimum estimated needs of $900 million per year.

Although total planned financing for FY2014 is sufficient to initiate a catch-up, allocation and efficiency of spending are now becoming prime issues. In FY2014, total resources are set to be 50% higher than the needs we identified, which should be considered to be very satisfactory. However, the allocation is not appropriate. Allocation to maintenance, which rose the most, is now triple the long-term needs. Upgrading works are not directed to highways and pavement improvements, but mainly to widening of lower volume roads. While traffic remains moderate, more budgets should be dedicated to rehabilitation and improvement of the road pavements rather than to short-term fixes and to capacity expansion. Casual observations, news reports, and discussions with PW/DOH staff also indicate that the quality of the widening works carried out by BOT contractors is poor.

Control over resources is not matched with management responsibility. Currently, the financing for the states and regional roads far exceeds the needs, while in the case of the national roads, the needs are barely being met (and then only thanks to funding from the states and/or regions). The budgets managed by the states and/or regions are inconsistent with current needs on the network under their responsibility. In contrast, MOC does not allocate sufficient resources to maintaining the national network, so that PW/DOH has to rely on contributions from state and/or regional budgets. Resources for improvement and rehabilitation of the national highways are insufficient to cover the expected needs despite the budget allocations from state and/or regional level. In the case of maintenance, financing from PW/DOH and the BOT contractors alone is insufficient, and the funding needs are only exceeded due to the budget allocations from state and/or regional level. In the long term, this would lead to lower-level trunk roads being in better condition than the trunk highways.

Financing for the trunk road network is insufficiently stable and predictable. About 60% of the financing comes from the state and/or regional budgets. This financing has increased sharply in recent years (doubling since FY2013), and may easily fall away again as political priorities in the states and regions change. Without this funding, and especially the budget transfers to the roads managed by PW/DOH, there would be a serious financing shortage. Financing for the trunk road sector, and especially the main highways, needs to be more predictable, allowing for better planning and more efficient use of funding. However, the road sector does not have many earmarked resources, and even a large part of the toll revenue is transferred to the national treasury. This issue is analyzed in the next paragraphs.

[21] The part of the analysis takes a long-term approach to estimating needs, which explains limited deviations over the figures presented in section 1.

Table 24: **Planned Financing for Trunk Roads, FY2014**
($ million)

Intervention Type	National Roads	State and Region Roads	Total
Construction and improvement	**461**	**404**	**915**
National government	233	0	233
States/regions	79	404	483
International financing institutions	49	0	49
BOT	~100	0	~100
Maintenance	**199**	**236**	**435**
National government	70	0	70
States/regions	119	236	355
International financing institutions	–	0	0
BOT	10	0	10
Total planned financing	**660**	**640**	**1,346**
Funding needs	**700**	**195**	**896**
Improvement	450	100	550
Rehabilitation	150	45	195
Maintenance	100	50	150

– = not available, BOT = build–operate–transfer.
Source: ADB estimates based on model developed for the study.

2.3 Road User Charges

Road user charges are internationally considered the norm for making users pay for the road network and its maintenance (user pay principle). These charges normally provide a predictable source of funding for the road sector. These include access fees that are not related to the amount of usage (e.g., annual vehicle registration fees) and usage fees that are related to the degree in which use is made of the road network (e.g., tolls). Given the nature of road transport, the analysis was carried out for the entire road network. This section presents the main results as these relate to the trunk road network.

The amount that Myanmar levies on road users is significant, but still well below the costs associated with road usage and network development. Total annualized revenue from existing road user charges (excluding customs tax and duties applied to vehicles) is estimated to be $460 million (Table 25). Several road user charges already exist in Myanmar, the most relevant of which are the tolls collected by PW/DOH ($155 million per year), and the vehicle registration tax collected by the Road Transport Administration Department (RTAD) under the Ministry of Transport and Communications (MOTC) ($274 million per year). Tolls are collected through BOT toll gates and through auctioned toll gates as described in a separate section. The vehicle registration tax is collected only for new vehicles and forms 30%–80% of the cost, insurance, and freight value. MORC furthermore collects an annual vehicle registration fee, a vehicle inspection fee and a business license fee, although these involve considerably smaller amounts and are partly used to cover the costs of the service provided. Custom duties and custom taxes for vehicles are collected by the Ministry of Commerce, and

Table 25: **Annualized Revenue from Road User Charges, 2014**
($ million per year)

Vehicle Type	Registration Tax	Registration Fee	Inspection Fee	License Fee	Tolls	Total	Total/Vehicle ($/year)
Motorcycles	0.0	12.4	5.2	0.0	0.7	**18.3**	5
Cars	197.0	4.0	1.6	0.0	5.1	**207.7**	287
Taxis	50.0	2.4	0.4	0.1	0.0	**53.0**	356
Light trucks	11.0	0.6	0.4	0.4	15.0	**27.4**	228
Medium trucks	4.1	0.8	0.2	0.1	16.0	**21.4**	756
Heavy trucks	6.7	0.8	0.2	0.2	62.2	**70.1**	3,035
Articulated trucks	2.9	0.2	0.1	0.1	39.4	**42.7**	5,875
Bus	2.3	0.6	0.2	0.2	6.1	**9.5**	418
Total	**274.0**	**21.8**	**8.3**	**1.1**	**144.5**	**450.1**	

Note: Toll data do not include here expressway tolls of about $10 million annually, for which a breakdown by user group was not available.
Source: ADB estimates based on model developed for the study.

although this revenue is considerable, these are not necessarily considered road user charges as similar rates are also applied to the import of other luxury items.

Most of these resources are not controlled by road authorities or earmarked for the road sector. Public Works has only $10 million of earmarked revenues from the Yangon–Mandalay expressway. BOT tolls are controlled by contractors and their revenues are closely associated with road sector expenditures. This is not the case for "auction" tolls, which are channeled back to the treasury by PW/DOH. The bulk of road sector revenues (65%) is collected by RTAD, which sits under a different ministry (MOTC); these proceeds are pooled with other government resources.

The charging system is not very fair and is inefficient from an economic point of view. Our detailed analysis shows that some users—mainly of cars and heavy trucks—are disproportionately charged, while small trucks, motorcycles, and buses are only covering a fraction of their costs. This particularly discourages using large trucks, even though they are more cost-efficient and cause less damage to pavements. The charges also put a premium on personal vehicle ownership, but do not charge for the damage vehicles actually cause, or how much they will actually use the roads that are being rehabilitated or upgraded (Table 26).

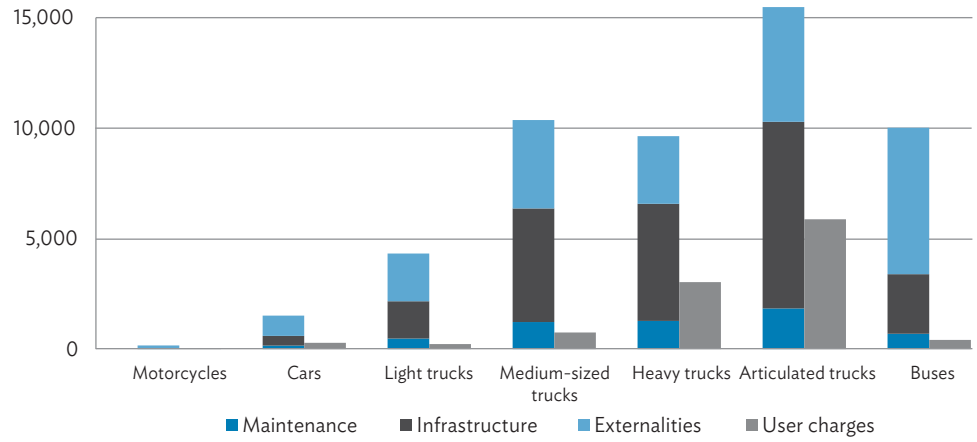
With the exception of cars and heavy trucks, current road user charges are insufficient to cover even the maintenance costs. For cars, the new vehicle registration tax covers maintenance costs and a significant portion of rehabilitation and improvement costs, while in the case of larger trucks these costs are covered by the tolls. The user charges for motorcycles, light and/or medium-sized trucks, and buses are insufficient to cover even the maintenance costs, let alone the rehabilitation and improvement costs. For none of the vehicle types are the road user charges sufficient to also cover the costs of externalities (Figure 14).

Table 26: Annualized Costs per Vehicle and Coverage of User Charges
($ per vehicle)

Vehicle Ttype	Maintenance	Rehabilitation + Improvement	Externalities	Total Costs	User Charges	Coverage of Maintenance (%)	Coverage of Infrastructure Costs (%)	Coverage of All Costs (%)
Motorcycle	23	16	130	166	5	22	12	3
Car	159	440	920	1,520	287	185	48	19
Light truck	480	1,690	2,160	4,320	228	48	11	5
Medium-sized truck	1,230	5,140	4,000	10,370	756	62	12	7
Heavy truck	1,280	5,300	3,060	9,640	3,035	237	46	31
Articulated truck	1,840	8,450	5,190	15,480	5,875	319	57	38
Bus	700	2,690	6,630	10,010	418	60	12	4

Source: ADB estimates based on model developed for the study.

Figure 14: Annualized Road Costs and Road User Charges
($ per vehicle)



Source: ADB estimates based on model developed for the study.

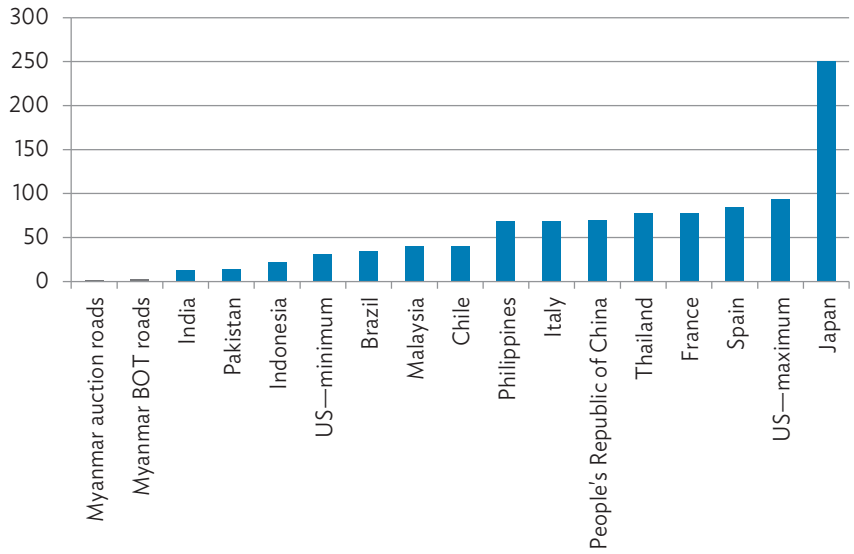
On tolled trunk roads, all maintenance costs and a significant portion of other infrastructure costs are covered, but on trunk roads without tolls, only a small portion of maintenance costs are covered. Tolls are only applied on the higher-level trunk roads. When looking at the road costs for these roads, it becomes apparent that the road user charges cover all maintenance costs except in the case of motorcycles that do not pay tolls. Looking at total infrastructure costs, including rehabilitation and improvement, heavy and articulated trucks cover nearly all costs while cars cover 40%, buses and small and/or medium-sized trucks around 20%, and motorcycles cover 12%. For the nontolled portion of the trunk road network, road user charges are only sufficient to cover 10%–20% of maintenance costs. Cars are the exception, as the high revenue from the registration tax allows nearly all maintenance costs to be covered. Other infrastructure costs related to rehabilitation and improvement are not covered on trunk roads without tolls.

Table 27: International Benchmarks for Toll Rates

Country	Car MK/km	Articulated Truck MK/km	Ratio Articulated Truck/Car	Number of Toll Rate Categories
Myanmar auction roads	1	41	33	24
Myanmar BOT roads	3	219	70	24
India	13	90	7	7
Pakistan	14	100	7	7
Indonesia	22	70	3	6
US—minimum	31	140	4	9
Brazil	35	210	6	n/a
Malaysia	40	120	3	6
Chile	40	130	3	n/a
Philippines	68	230	3	n/a
Italy	69	160	2	5
People's Republic of China	70	350	5	n/a
Thailand	78	210	3	5
France	78	230	3	5
Spain	85	340	4	n/a
US—maximum	94	430	5	9
Japan	250	380	2	5

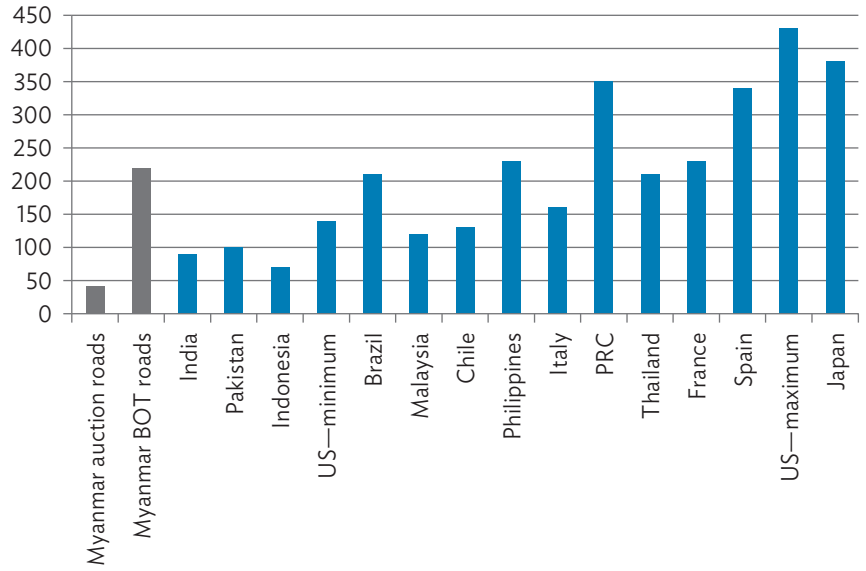
BOT = build–operate–transfer, km = kilometer, MK = Myanmar kyat, n/a = not available, US = United States.
Source: ADB estimates compiled from various sources.

Figure 15: Toll Rates for Cars
(MK per km)



BOT = build–operate–transfer, km = kilometer, MK = Myanmar kyat, US = United States.
Source: ADB estimates compiled from various sources.

Figure 16: **Toll Rates for Articulated Trucks**
(MK per km)



BOT = build–operate–transfer, km = kilometer, MK = Myanmar kyat, PRC = People's Republic of China, US = United States.

Source: ADB estimates compiled from various sources.

Toll rates in Myanmar are very low, involve a large number of vehicle categories, and apply different schedules according to the type of toll road. Two separate sets of toll rates exist for auctioned toll gates and for BOT toll gates. The reason for this distinction is not clear, as in both cases the tolls are meant to help finance improvement and maintenance of the road. In each case there are 24 toll rate categories, significantly more than in other countries where there tend to be between five and nine categories. Toll rates are defined on an annual basis by the Production Section under the Administrative Division of PW/DOH. The toll rates for articulated trucks are much higher than for cars, ranging from 33 times higher in auctioned toll roads to 70 times higher in BOT roads (compared with ratios of 1.5–7.0 in other countries). For auctioned toll roads, the toll rates for passenger cars are 10 times lower than in any other country, while toll rates for articulated trucks are five times lower than the average in other countries (Figure 15 and Figure 16). For BOT roads the situation is slightly better, due to the higher toll rates. Although rates for cars remain four times lower than in any other country, the rates for the largest trucks are more or less equal to the norm in other counties:

2.4 Reform Paths

This review of road sector financing and user charging system highlights the following concerns that need to be addressed going forward:

- How to ensure that funds available at each level of government match responsibilities;
- How to ensure a steady, predictable flow of resources sufficient to match needs;

- How to mobilize as many private investments and donor resources as possible;
- How to ensure that funds are used in the best manner at each level (e.g., avoiding under-investment on highways or under-provision of maintenance);
- How to equalize between states and regions to avoid imbalances; and
- How to improve application of the user pay principle, so that users pay their fair share of costs and receive proper economic incentives.

Restructuring the Road User Charge System

The following propositions are developed in the thematic note: review of road user charges.

Suggestion 1: Create a new heavy vehicle license fee. This fee would be designed to make trucks pay for the damage they cause to pavements, and give incentives to use the most efficient truck configurations. The costs would range from $120 per year for a medium-sized truck able to carry 4.5 tons of load, to $2,000–$4,000 per year for the largest trucks. Special rates should be created for heavier trucks in case the axle load is raised (section 1). We estimate that it would initially raise about $80 million each year. With time, the fee could be made dependent on the actual mileage during the year.

Suggestion 2: Create a fuel levy. This fee would make all road users contribute to the upkeep of the roads. At an initial rate of $0.10 per liter (MK375 per gallon), we estimate that it would raise $320 million annually. The main benefit is that it is directly linked to the number of use that is made of the road network, and that it is relatively easy to collect with a nearly negligible collection cost (compared with the 20% of toll revenue that is paid in the case of auctioned tolls).

This combination of road user fees is very common in many developed or developing countries. Together, these two fees would generate sufficient revenue to cover all the costs of road network maintenance and rehabilitation (our calculations excluded toll roads, which have separate financing sources). Their revenues would increase with traffic, and hence closely match needs. The levels chosen would give a reasonably good match between the damage and benefits associated with each type of road user, and the fees paid. To introduce the fees, a number of issues would have to be considered, e.g., Who collects the fees? How should the rates change with time? What type of fuel should it be applied to? How should evasion risks be reduced? The next subsection discusses how these fees should be allocated.

Suggestion 3: Restructure the toll rate schedule. To make road tolls more efficient at financing road improvements, and fairer to users, the toll rates and their structure should be improved. International experience suggests that (i) toll rates should be set based on both user-related costs and the benefits they get from the improvement being financed, (ii) the number of vehicle categories should be minimized, and (iii) tolls should be sufficient to finance contracted improvements. Table 28 gives an example of an alternative and/or recommended toll rate structure based on these principles. It includes only seven categories, and the ratio between the highest and the lowest toll is only 5.6. For toll rates based on benefits from minor improvement works (low rates), the total toll revenue for a road with 1,000 annual average daily traffic (AADT) would remain more or less the same as now, while rates based on benefits from major improvements (high rates) would be about twice as high. For the low rates, the toll rates would be reduced for heavy trucks and increased for lighter vehicles, putting Myanmar within the norm among developing countries. The high toll rates involve an increase in all rates except for the largest trucks, and would be comparable with the PRC, the Philippines, and Thailand. The new toll rates could be applied both in auctioned toll roads and BOT roads.

Table 28: **Alternative Toll Rate Structure**
(MK per mile)

Vehicle Type	Current BOT Rates	Alternative Toll Rates		
		Toll Structure	Low Rates	High Rates
Motorbike	0	0.0	0	0
Car	5–10	1.0	30	70
Light truck (and small/medium-sized buses)	20–30	1.4	45	100
Medium-sized truck	75–100	3.9	120	260
Heavy truck	150–200	4.1	130	280
Articulated truck	300–350	5.6	180	380
Large bus	50–55	2.5	75	175
Average toll gate revenue for 1,000 AADT ($/year)	**840,000**		**1,000,000**	**1,940,000**

AADT = annual average daily traffic, BOT = build–operate–transfer, MK = Myanmar kyat.
Source: ADB estimates based on model developed for the study.

Suggestion 4: Cancel tolls on roads with low traffic. Although tolls are suitable for trunk roads with high traffic volumes, these are not suitable for lower-level trunk roads and other roads as revenues are insufficient to cover costs and collection costs are high. To facilitate the acceptance of the new road user charges mentioned earlier, these may be accompanied by the cancellation of the majority of the auctioned toll gates on roads with low traffic volumes, and a significant share of BOT toll gates. Our analysis puts the threshold at about 1,000 vehicles per day, but a finer threshold should be worked out based on expected revenues, which depend on the types of vehicles crossing the gates and the toll rates applied. A specific threshold could also be defined for bridges. The toll gates with less traffic provide only a small portion of the total toll revenue that is not even sufficient to cover the long-term maintenance costs, and have a much higher collection cost than the proposed new user charges. Cancellation of 80% of road toll gates (auction or BOT) with the lowest revenues would only decrease total revenues by 10%. It would reduce the tolled road network from 22,000 km by about 18,000 km, removing almost all auction gates and 40% of BOT gates. This reduction would be more than compensated by the increase of tolls from the new toll schedules, so that nationwide toll proceeds would actually increase by one-third.

The vehicle registration tax on cars has been a very good tool used to keep down the number of cars in urban areas and it should be kept as is for the time being. Other fees (registration tax on other vehicles, license fee on heavy vehicles) would become unnecessary after the introduction of the fuel tax and heavy vehicle license fee. The inspection fee and the license fee on passenger transport services could be treated as a fee for service, i.e., with an amount set at level just sufficient to cover costs. At this level, these would not finance the road sector.

Designing a Funds Transfer Mechanism to Match Resources with Needs

Analysis framework. From a fiscal standpoint, in the first 3 years of the application of the 2008 Constitution, the financing of the road sector has relied on the following:

- **National road maintenance**. Central government budget resources distributed among states according to need-based formula, channeled through deconcentrated levels of PW/DOH, which were topped up with state and/or regional budget resources from their unconditional block grants, on a negotiated basis in response to insufficient resources from the central government.
- **National road construction**. Central government budget resources distributed among states according to ad hoc equalization considerations to spread resources evenly, channeled through deconcentrated levels of PW/DOH, again, topped up in the same manner with local resources.
- **State and/or regional road maintenance and construction**. State and/or regional budget resources using part of their unconditional block grants, channeled through local government treasuries into PW/DOH's local offices.
- MRT and PW/DOH have collected fees from road users that are not connected with what was spent (the collected amounts are much lower).

A better framework guaranteeing a good matching of resources with long-term needs is required. This is closely related to the issue of decentralization, which is discussed in the next section. This study believes that in the context Myanmar's current stage of development, there would be more advantages than disadvantages in earmarking road sector revenues to road sector development. This will require designing a transfer mechanism for sector resources. Options available are as follows:

- **Grant options**. Central government transfers to local governments can include unconditional grants (use is not earmarked to the road sector) or conditional grants (earmarked to road sector). These can be separated for recurrent budget (maintenance) and development (construction works). These can include performance-based elements (e.g., efficient use of spending). These can be project-based, in which case these may finance 100% of identified expenditures or match local funds at a given or negotiated share. The choice of the grant option will affect the degree of actual decentralization.
- **Revenue options**. Each level of government may be financed through separate taxes, or through the same taxes, using a revenue-sharing mechanism.
- **Formulas**. There is a need to define the basis for the transfer (defined share of revenues, cost reimbursement, or needs estimates), and the basis upon which the pool will be divided (e.g., based on length of roads, condition, population, etc.).
- **Type of earmarking**. User revenues may be linked to budgets, either informally (a practice of the Ministry of Planning and Finance [MOPF]), formally (a legal requirement, e.g., with a separate line in the budget), or directly (amounts collected go into a separate fund not managed by the MOPF).

The basic structure of a new financial framework integrating the reform of user charges mentioned above could potentially be as follows:

- **Fuel tax** resources could be collected centrally, earmarked initially to road maintenance and to rehabilitation, and allocated to each level of government (central, regional and/or state, urban, rural) based on needs (e.g., road network length, type, condition), potentially with a degree of performance monitoring (annual reports) and performance-based allocation (bonuses for good performance). Performance management and formula-based allocation could initially be carried out by DOH at the central level. Consideration could later be given to using a proper road fund structure with an independent board. Initially, it would be simpler to provide 100% financing, but this could change over time. Also, once the task of rehabilitating the network is completed, either the fees could be reduced, or the mandate of the tax could be expanded to also finance investments.
- **Heavy vehicle license fees** could be collected locally (probably by the RTAD). However, heavy vehicles make use of different types of roads and this revenue could, therefore, be pooled with fuel taxes before its redistribution along the principles defined above.

Box: International Examples of Transfer Mechanisms in the Road Sector

Centrally managed fund (New Zealand). In 1996, New Zealand established Transfund New Zealand in order to collect proceeds of the gasoline excise, a weight–distance charge and a motor vehicle registration fee. It then allocated these revenues to various central and local transport agencies. Transfund then developed a series of funding procedures and guideline documentation to assist local authorities in preparing expenditure programs and funding requests. It defined cost-sharing ratios, which are inversely proportional to the resources of the local government.

Formulas for distributing resources (United States [US]). The US federal aid highway program distributes funds according to a series of simple formulas combining population, road mileage, and traffic density. For interstate highway maintenance, the average allocation per state is about 2% of total maintenance allocations, with each state receiving a minimum allocation of 0.5%.

Source: ADB. 2012. *Mongolia: Road Sector Development to 2016*. Manila.

- **Vehicle registration taxes** are mainly taxes on cars collected at the municipal and/or district level by RTAD. A share of proceeds could be kept locally, but part could be channeled back to state and/or region and central government (e.g., with fixed percentages) to finance road investment works. For large investments, works could be cofinanced by different levels of government.
- **Tolls**. BOT toll revenues are already earmarked to the concessionaire. This note argues that the "auction" toll program could be discontinued at least for road "auction" toll gates.
- **Debt**. Sector resources could be expanded through the use of debt and/ or bond financing. International financing institutions and bilateral donors will likely finance part of the investments. In addition, the government could consider allowing emission of debt on the basis of future earmarked resources. Debt emission could be done at the central government level (e.g., if using a fund, or an autonomous road agency), and at the local level. Experience in the PRC is that debt resources can constitute up to two-thirds of road sector resources, and are an excellent tool for scaling up investments during economic catch-up. Based on financing costs in Myanmar and growth rates, our estimates are more conservative, but still we estimate that up to 30% additional resources could be generated from debt.
- **General budget**. These sector resources would give a strong basis for building a modern road network, but general budget resources at central and local levels could come as a complement, as needed.

Next steps. To further consider these proposals, a potential approach could be as follows:

- First, within MOC and MOTC, is the setting up of a senior working group to consider options and develop a proposal acceptable to the ministers (e.g., to be approved through the NTDP coordination committee).
- Second, is to set up a steering committee with other relevant ministries to present and discuss the proposal and arrive at a consensus document. This document would mainly be a concept paper defining the main lines of the financing reform.
- Third, is to implement the changes, including legal changes, full definition of formula, fund flow, etc.

Steps 1 and 2 will be supported by ADB through the Transport Sector Reform and Modernization Technical Assistance. At the government's request, ADB could assist in rolling out the reform (Step 3) through a follow-on project.

Table 29: **Road Sector Own Resources**
(Annual, $ million)

Vehicle Type	Current Framework	New Framework
Vehicle registration tax	274	247
Other fees under MRT	31	0
Tolls	155	209
Heavy-vehicle license fee	0	76
Fuel levy	0	319
Total (% earmarked)	455 (33%)	851 (100%)
Debt	0	300–500
Total	**455**	**1,150–1,350**

MRT = Ministry of Rail Transportation.
Source: ADB estimates based on model developed for the study.

3 Building Institutions for the Next Decade

Key Findings and Suggestions

Findings

In April 2015, the government disbanded the old structure of Public Works and reformed it into separate entities, from which the Department of Highways (DOH) and the Department of Bridges (DOB) were created. Despite some improvements over the previous outdated structure, the new setting is still insufficiently geared toward the long-term agenda of road network modernization, is not designed to operate through private contractors, and its existence is challenged by the imperative to decentralize.

Further restructuring is a necessity, and Ministry of Construction (MOC) is already considering how to do so. Changes need to be carefully considered rather than rushed, because of the long-term implications these will have on the effectiveness of the sector, on the industry, and on the relationships with the regional and/or state governments.

There is an opportunity to create an organizational structure that is able to meet the road sector requirements for at least the next 10 years, rather than simply trying to respond in a minimal fashion to a government-wide imperative to reform.

Suggestions

The corporatization of DOH and DOB's construction units should go ahead, but realistically the transition period before privatization should be 5 years instead of 2 years as currently being considered. Instead of creating a single company—which would be unmanageable and would constrain road industry development—at least three, or up to five companies, should be formed.

A second phase of reform could cover the corporatization of the maintenance units, and possibly the Yangon–Mandalay expressway unit and the design branch of DOH.

The way DOH operates at the local level needs to be clarified. Three models seem possible. Separate organizations could be created to deal with national highways and with local roads. Alternatively, the management of all roads could be transferred to the regional level, with DOH head office only remaining responsible for funding management and policy development. Finally, DOH could become a service provider, with the central and regional and/or state governments as its clients. These three options involve trade-offs, and many transitional arrangements are possible. They should be considered for their ability to deliver road network modernization.

The short-term absorption of DOB into a single DOH or a Highway Authority is supported. To meet these needs, planning, procurement, and fund mobilization should receive a higher status in the organization. Apart from further improvements to the organizational structure, this will require the development of proper procedures and systems (especially for procurement, project and contract management, and supervision and/or inspection). Transformation into a performance-driven autonomous road agency should be considered as a long-term objective, but is not recommended at this stage.

3.1 Institutional Organization

Myanmar is divided into seven states and seven regions, plus the Union Territory of the capital Naypyitaw.[22] Each of the 14 states and regions has a state and/or regional government with a chief minister and Parliament (*Hluttaw*), and has the same status as a ministry. Naypyitaw Union Territory is under the direct administration of the President through the Naypyitaw Council. The states and regions are divided into 63 districts, which are subdivided into 330 townships. Within each township there is a large number of villages (64,134 villages in total) that are grouped into village tracts (13,618 village tracts in total). In addition, there are five self-administered zones and one self-administered division, altogether covering a total of 18 townships.

Table 30 indicates the agencies in charge of the road network.

Table 30: **Road Lengths by Administrative Category and Responsible Agency, 2014**

Responsible Agency	**Length** (in km)	Responsible Agency
National Highways		Ownership: Central government management responsibility—Ministry of Construction Execution: Department of Highways (Public Works until 2015)
Expressway	590	
International communication roads	5,918	
Union roads	4,837	
Region and states connecting roads	4,595	
Total National Roads	**15,940**	
Region and State Roads		Ownership: Central government management responsibility—Region and state Execution: Department of Highways
District and township connecting roads	11,824	
Township and villages connecting roads	12,309	
Total Region and State Roads	**24,113**	
Major city roads	9,475	Yangon, Mandalay, and Naypyitaw City Development Committees
Army roads	10,426	Directorate or military engineers
Other roads	676	Ministry of Electrical Power
Rural Roads	**Total 96,780**	
	48,696	- Department of Rural Development (Ministry of Agriculture, Livestock and Irrigation)
	36,800	- Department of Progress of Border Areas and National Race Development (Ministry of Border Affairs)
	11,500	- Town development committees
Total	**157,059**	

km = kilometer.

Note: In this table, the national and region and/or state road length was computed based on the recorded length of each road as appearing in Ministry of Construction records. Figures obtained are different from aggregated Ministry of Construction records.

Source: ADB estimates based on Ministry of Construction data.

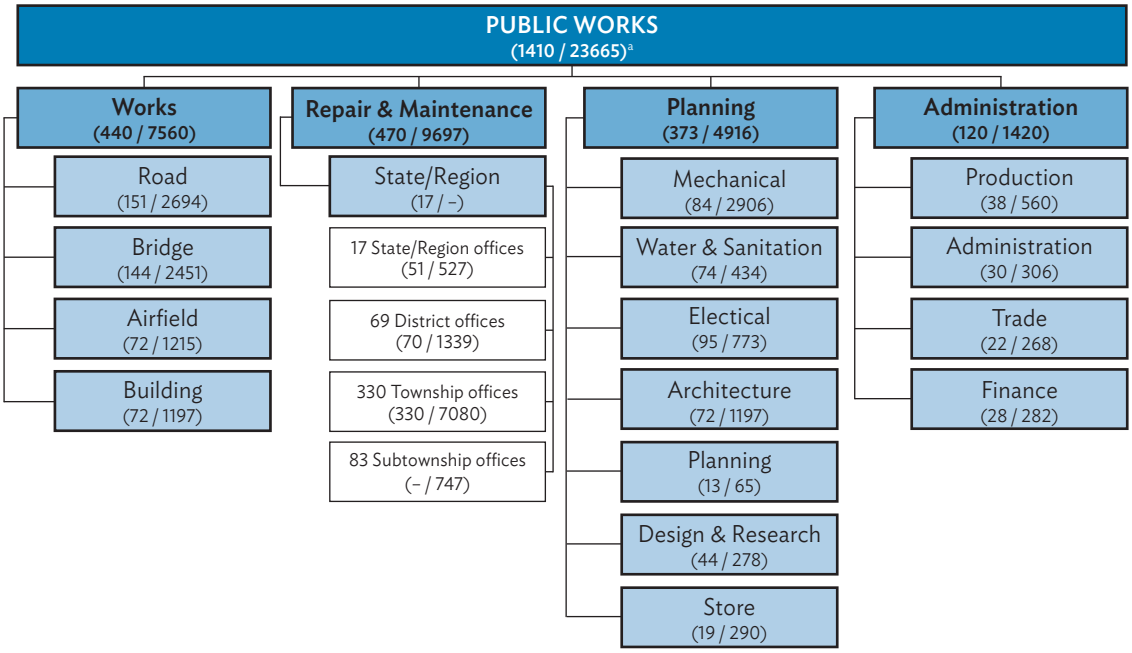
[22] These are the Chin State, Kachin State, Kayah State, Kayin State, Mon State, Rakhine State, Shan State, Ayeyarwady Region, Bago Region, Magway Region, Mandalay Region, Sagaing Region, Tanintharyi Region, and Yangon Region.

Public Works (named as such until April 2015, then renamed Department of Highways)

Trunk roads are formally the responsibility of the Ministry of Construction (MOC). MOC, until April 2015, consisted of the Public Works, which was responsible for the development, maintenance, and operation of roads, bridges, airfields, and buildings; and the Department of Human Settlement and Housing Development that was responsible for urban development. The Public Works was set up as a state-owned economic enterprise (SEE) with approximately 25,000 staff positions (including 1,400 officers). However, only some 15,000 of these positions were filled. It also hired temporary workers for construction and maintenance works. Based on the amount it spent, we estimate that the number of hired temporary workers is equivalent to about 25,000 additional full-time positions.

The organizational structure of the Public Works until 2015 is shown in Figure 17. The managing director reported directly to the minister, and was supported by a Management Board consisting of the managing director and four deputy managing directors who each headed a division (works, repair and maintenance, planning, and administration). There were 8 chief engineers (under the Works Section), and 13 deputy chief engineers (5 under the Planning Section, and 8 under the Works Section) at the head office in Naypyidaw. The Planning Section has four supporting divisions headed by general managers, who were nontechnical senior administrators. There were also 17 regional and state offices headed by a superintending engineer and 66 district offices headed by an executive engineer. Under the Works Section there were also special construction units headed by 4 superintending engineers and 58 deputy superintending engineers.

Figure 17: **Organization Chart and Staff Numbers for Public Works (until 2015)**



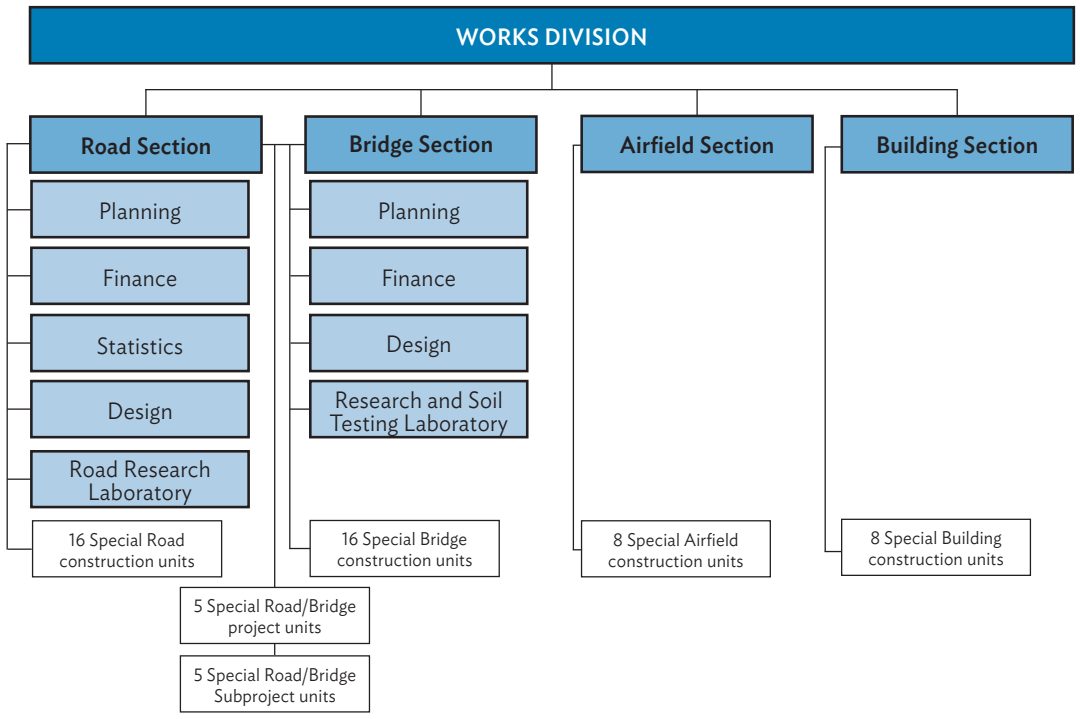
[a] Officers/Other staff.

Source: Ministry of Construction.

The **Works Division** of the Public Works was responsible for the construction and improvement of roads, bridges, buildings, and airfield infrastructure (each with separate sections). The Road Section under the Works Division included a Planning Branch (responsible for maintenance only), a Finance Branch (responsible for construction only), a Statistics Branch, a Design Branch, and a Road Research Laboratory (with locations in Yangon and Mandalay). The Bridge Section included a Planning Branch, a Finance Branch, a Design Branch, and a Research and Soil Testing Laboratory. Construction and improvement works under these two sections were largely carried out through force account by 5 road and/or bridge project units, 5 road and/or bridge subproject units, 16 road construction units, and 16 bridge construction units spread around the country. The 16 construction units are approximately one per state and/or region, while the project and subproject units move around implementing larger works. In addition to the road and bridge units, there were 8 airfield construction units and 8 building units, bringing the total to 58 construction units under the Works Division. The Statistics Branch was mainly concerned with monitoring the deployment of equipment in use by the construction units. The Planning Branch had been carrying out annual and long-term planning, which mainly involved compiling works identified at the district level and approved at the state and/or region level through a bottom–up approach. It also allocated routine and special maintenance budgets. There were approximately 8,000 staff members (including 440 officers) in the Works Division, of which over 6,000 worked in the 58 construction units (over 4,000 staff in the units related to roads and bridges). Figure 18 provides a diagram of the structure of the Works Division within the Public Works.

The Design Branch under the Roads Section of the Public Works carries out the geometric design for new road and road improvement projects. Bridge substructure designs are prepared by the Design Branch of the Bridge Section under the Public Works, which has staff in Yangon and Naypyitaw. Design of the bridge superstructure is generally tendered out together with the provision of the necessary materials. Designs are carried out by

Figure 18: **Organization Chart for the Works Division**



Source: Ministry of Construction.

hand. The branch only has a small team, and the design process is slow. In 2013, it carried out about 200 kilometers (km) of geometric designs. The design process starts early during the year, after the approval of the budget for the works.

The Road Research Laboratory (RRL), under the Roads Section of the Public Works, carries out pavement designs (following Overseas Road Note No. 31),[23] provides materials engineering, and quality control services during the construction stage if requested, and can assess pavement conditions. It has a main laboratory in Yangon and smaller laboratory in Mandalay. Road projects without geometric changes may be fully prepared by them. Simple pavement designs are sometimes carried out by the construction units under the Public Works or build–operate–transfer (BOT) contractors. RRL carries out geotechnical investigation and material testing with its equipment in Yangon, most of which were purchased in the 1980s. RRL is the only entity in Myanmar that is able to carry out pavement design. RRL does not have the staff (81 staff including 15 engineers and 23 research assistants), budget, and equipment capacity to operate on all projects. In practice, RRL is not often involved in project implementation. Projects considered simple, such as pavement rehabilitation or widening, are often carried out without testing. Quality control is the exception, even on large projects. BOT contractors and other ministries or city development committees rarely request the services of RRL.

Training is carried out by the Central Training Center in Yangon and its two branches in Insein and Mandalay. It delivers refresher training in basic engineering, vocational skills (e.g., construction work, heavy equipment operator, motor vehicle driver), and office staff skills (accountant, basic information technology [IT], storekeeping). In FY2014, it planned to train 1,400 staff, about 10% of the Public Works workforce. Its facilities are very dilapidated.

The Repair and Maintenance Division is responsible for the maintenance of the trunk road network, and has staff at state and/or regional, district, and township level. The division has over 10,000 staff (including 470 officers), of which 595 staff are in 17 offices at the state and/or regional level,[24] 1,409 staff are in the 69 district offices,[25] and 8,157 staff are in the 330 township offices and 83 subtownship offices. These staff members carry out maintenance works through force account, using their own equipment and hiring additional temporary workers according to need. The local offices are also responsible for preparing annual maintenance plans. While district offices formally report to the Repair and Maintenance Division, they also report to the Works Division as each district office also carries out capital works.

The Planning Division includes the Mechanical Section that is responsible for equipment maintenance and distribution to the different local offices. This only includes the equipment used for maintenance by the local offices under the Repair and Maintenance Division and does not include the construction units that have their own equipment. There are 5,300 staff members in the Planning Division (including 370 officers), of which 2,900 work in the Mechanical Section.

The Admin Division includes the Production Section that is responsible for setting, monitoring, and collecting the toll fees, among other things. The Admin Division has 1,540 staff members (including 120 officers), of which 560 work for the Production Section.

This structure was reformed in April 2015. The new structure that took over had just been established at the time of report writing. It is considered in section 3. This report was initially drafted before the reform and

[23] Overseas Centre. Transport Research Laboratory. 1993. *Overseas Road Note 31 (Fourth Edition). A Guide to the Structural Design of Bitumen-Surfaced Roads in Tropical and Sub-Tropical Countries.* Crowthorne, Berkshire.

[24] This includes the seven states and seven regions, whereby Shan State is further divided into three substates (North, South, and East) and a separate office exists for Naypyitaw Union Territory.

[25] This number may change with the recent reduction in the number of districts to 63.

this revised version of the report refers to the Public Works/Department of Highways (PW/DOH), except when the distinction is useful. Actual arrangements have not yet been finalized at the time of drafting, and were unlikely to quickly change. Most of road-related responsibilities of Public Works and its local offices were simply transferred to a new Department of Highways (DOH), with the exception of bridges, which are managed by a new Department of Bridges (DOB).

Ministries

The Ministry of Construction (MOC) itself consists of only a small number of staff and senior officials reporting to the Minister.

In April 2016, one of the first actions of the government that took office was to create a Ministry of Transport and Communications. The functions of the former Ministry of Communications and Ministry of Rail Transportation are described in the next paragraphs.

The Ministry of Rail Transportation (MRT) was responsible for several aspects of road transport. The Transport Planning Department under MRT was responsible for managing transport services, including issuing commercial licenses to private and cooperative-owned vehicles and vessels for freight transport, public passenger transport, contracted passenger transport (e.g., school buses), and taxis. The Road Transport Administration Department (RTAD) is responsible for road safety and carries out the vehicle inspection and registration for roadworthiness, issues drivers' licenses, levies taxes and revenues, and issues traffic regulations. It is also responsible for issuing road safety regulations. In 2015, the government merged the Transport Planning Department into RTAD. Road Transport is an SEE that provides passenger and freight transport services. Although it used to be a very important provider of transport services in the country, it is facing strong competition from the private sector and is currently primarily involved in providing transport services to the government.

The Ministry of Transport (MOT) was only marginally involved in the road sector. Formally, the Department of Transport formulated transport policies and monitors transport costs, prices, and the efficiency of the transport system, but in practice, it had had hardly any role in the road sector. In 2013 and 2014, the MOT took a more active role in transport-wide planning and policy making, by coordinating the development of the National Transport Development Plan that covers road, rail, water, and air transport.

Rural Roads

The Department of Rural Development (DRD) under the Ministry of Agriculture, Livestock and Irrigation (MOALI) is currently the main government agency responsible for rural roads. It was established in 2012 under the Ministry of Border Affairs and transferred to the Ministry of Livestock, Fisheries and Rural Development in August 2013. In April 2016, DRD was included in the newly formed MOALI. Among its tasks, DRD is responsible for the construction and maintenance of village roads and bridges connecting one village to another, to village tracts, and to towns. Other responsibilities include rural water supply, rural sanitation, rural housing, rural electrification, and rural economic development (including livelihoods and microfinance activities).

At its headquarters in Naypyitaw, DRD has an Administration and Planning Division dealing with the so-called soft functions, and a Technology and Implementation Division taking care of infrastructure activities, including the Rural Road and Bridge Section that is responsible for roads. DRD also has offices at state and/or regional level, district level, and township level, which is where the majority of staff positions are located. It expects to have approximately 10,000 staff at local level, but currently only has some 2,000 positions filled (it is in the

process of recruiting staff). DRD local offices have two units, one for administration and one for engineering. Engineers tend to be generalists, responsible for all different sectors. As a result, they do not always have specific road engineering experience (they may, for instance, be electrical engineers). DRD is mainly operational at village tract level, where village development committees are involved in planning and prioritizing works and where works are carried out by contractors or village development committees.

Dual Reporting of PW/DOH at Local Level

Since 2012, the responsibility for 60% of the trunk road network has been formally devolved to the states and regions. The Constitution of 2008 assigns responsibility to MOC for national highways, and to regions and states for "roads and bridges having the right to be managed by the Region or State."[26] As of 2014, 22,400 km of trunk roads (56% of the network)—these being district and township roads—are managed by the regions and states, with 17,700 km being managed centrally by PW/DOH—these include international highways and highways connecting several states or regions, as well as region and state connecting roads that run largely within state and/or regional borders (Table 31).

A transitory regime has been established. Its main features are (i) PW/DOH remains formally responsible for the operational management of the entire trunk road network, which involves preparing annual plans and organizing execution; (ii) the ownership of the trunk road network still lies with the central government;

Table 31: **Trunk Road Lengths by State and/or Region, 2014**

	Responsibility of MOC			Responsibility of State/Region			Total	
State/Region	No.	km	%	No.	km	%	No.	km
Kachin State	12	1,758.2	46	51	2,028.6	54	63	**3,786.8**
Kayah State	6	413.8	44	17	536.7	56	23	**950.5**
Kayin State	19	925.6	48	30	988.5	52	49	**1,914.1**
Chin State	8	687.0	35	20	1,285.1	65	28	**1,972.0**
Sagaing Region	20	1,677.7	38	51	2,747.1	62	71	**4,424.9**
Tanintharyi Region	2	812.5	60	19	544.0	40	21	**1,356.5**
Bago Region	16	1,298.1	59	27	914.4	41	43	**2,212.5**
Magway Region	22	1,324.3	38	54	2,195.5	62	76	**3,519.8**
Mandalay Region	25	1,619.6	74	35	565.3	26	60	**2,184.9**
Mon State	9	507.1	62	26	306.0	38	35	**813.1**
Rakhine State	8	828.4	44	37	1,036.6	56	45	**1,865.0**
Yangon Region	24	541.5	52	28	502.3	48	52	**1,043.9**
Shan State (East)	6	747.5	36	20	1,348.4	64	26	**2,096.0**
Shan State (South)	10	1,341.2	35	55	2,535.1	65	65	**3,876.3**
Shan State (North)	17	1,761.0	35	74	3,290.9	65	91	**5,051.9**
Ayeyarwady Region	18	1,012.7	39	58	1,587.7	61	76	**2,600.4**
Naypyitaw Union Territory	15	428.5	100	–	–	0	15	**428.5**
Total	**237**	**17,684.8**	**44**	**602**	**22,412.3**	**56**	**839**	**40,097.1**

km = kilometer, MOC = Ministry of Construction.

Note: In this table, the national and region and/or state road length is based on Public Works records.

Source: ADB estimates using Ministry of Construction data.

[26] Government of Myanmar. 2008. *Constitution of the Republic of the Union of Myanmar*. Schedule Two. Naypyidaw.

(iii) state and regional governments approve plans and funding for state and regional roads, and can cofinance works on the national highways within their borders; (iv) state and regional governments finance the salary of PW/DOH staff in local offices; and (v) national government (MOC) approves plans and allocates funding for the national highways.

3.2 Preliminary Institutional Analysis of PW/DOH

The Weight of the Past

The internal organization of Public Works barely changed between 1990 and 2015. It is telling that the structure and functions of the Public Works in 2014 were almost the same as they were in 1991 when the Comprehensive Transport Study was carried out.[27] PW/DOH still carries out most design, construction, and maintenance works in-house. It has combined road- and nonroad-related functions, and policy and management functions with commercial functions. A number of titles of divisions within it did not correspond well to the functions they carried out, e.g., statistics (does equipment management), production (collects tolls), planning (no long-term planning, no evaluation), and road research laboratory (does pavement design and testing).

A remarkable capacity to preserve, but less to modernize. PW/DOH has been very efficient at significantly expanding the trunk road network and maintaining it in basic operating condition, even though budgets were small. Outputs have been extensive, but of low quality. Staff quality and culture have been maintained, but skill sets are of basic level and not adapted to a commercial context. Methods and work assets have been carefully preserved, but not modernized. The techniques used for road construction and maintenance are still the same as they were in 1991, a time when they were already largely outdated—particularly the use of hand-laid penetration macadam, discontinued in most countries by that time. This is largely a result of international isolation. Each piece of technical assistance received has led to important improvements—e.g., bridge designs reportedly improved after assistance from the PRC in the 1990s. Many of the testing equipment received by RRL in the 1980s is still functioning. RRL, however, was unable to purchase new ones. PW/DOH has also kept most information and data filing manual, even though it owns computers and a growing number of staff members has the right skills.

PW/DOH's emphasis on delivery and its deconcentrated structure has made it surprisingly reactive and responsive. PW/DOH has given much autonomy in decision-making processes to the lower levels, and only centralize more major decisions. Many processes also seem efficient. As a result, decision making can be relatively quick, and operational decisions are made when needed. Mid-level management seems proactive. Assignment of responsibilities and accountability seem well aligned and generally strong.

PW/DOH has had difficulty, however, in piloting change. Most of PW/DOH is characterized by a strong delivery culture: it delivers works that are either being identified at the local level or requested by the political management. However, this comes at the expense of a capacity to handle policy making, planning, and change management. PW/DOH notably lacks the following:

- Common tools used for strategic planning and programming (e.g., policy statements, annual reports, and business plans). Also, PW/DOH's long-term plans seem to have had only a limited influence on actual budget allocations.

[27] The main differences are (i) there were only 10 special units dealing with road and bridge construction; (ii) administrative functions have been consolidated into a separate section, while they were under the managing director before; (iii) the new production division in charge of toll collection; and (iv) a large increase in the number of senior management positions and layers.

- A culture of technical (economic) planning. Currently, PW/DOH does not have the staff skills, the information base (as shown in our difficulty to collect information on finances and network), or a recognized institution in charge (as, for instance, the Brazilian Transport Planning Enterprise in Brazil did for many years).
- The impartiality and technical legitimacy needed to systematically lead in the definition of road sector policies and reforms, and communicate these successfully to the political management and the public.

PW/DOH does not lack people with entrepreneurship skills (in contrast with what is seen in other parts of the transport sector in Myanmar). However, the people with such skills are few, and fewer still are in positions to apply basic business or economic principles. This is the case despite PW/DOH's middle management being competent, showing great adaptability, and seemingly not fearing change.

Several functions of a modern road agency are out of PW/DOH's hands, or are simply not carried out. Most notable are the following:

- Planning for most works seems to be the product of a political decision to which PW/DOH is not associated;
- Major policy decisions, such as the use of BOT roads and the decentralization of the network, were taken outside of PW/DOH;
- Road vehicles and user charges are under the Ministry of Transport and Communications (MOTC);
- PW/DOH does not seem involved in road industry development—which is managed by the Ministry of Commerce;
- Procurement for large works and BOT concessions has reportedly often been directly negotiated by the political management;
- We could not identify how PW/DOH communicates with road users and learns about their expectations;
- The Public Works was not involved in road safety matters, even for engineering design; DOH created a unit in charge of safety.

New Context, Reform Directions, and Uncertainties

The sector and political context for MOC's action in the road sector has changed deeply.

The private sector has become increasingly capable at delivering large works, managing road assets, and even mobilizing resources. At the local level, small companies are able to carry out small-scale works. A few large real estate development companies have developed road branches (some even with basic design capacity) and diversified into toll road management. As our review later shows, results are mixed. However, as a result, PW/DOH is no longer the only entity in Myanmar able to deliver road works and even to manage roads.

The nationwide move toward increasing decentralization has questioned the very existence of PW/DOH as a unified entity. The regime established since 2012 has enabled PW/DOH to make only minimal changes to its organization, but has led to a complex situation on the ground where (i) PW/DOH local staff is appointed by the central government and under its hierarchical control, but paid by the state and/or regional governments; (ii) local road network upgrade and maintenance plans are prepared by PW/DOH local staff, under the control of PW/DOH headquarters, but reviewed by local governments (which have little capacity in most cases), and approved by local parliaments; (iii) the regional and state road network is owned

by the central government, but management responsibility lies with local governments; and (iv) budgets are mixed for national roads and are determined on an ad-hoc basis, while resources for maintenance are pooled by PW/DOH staff on the ground. This arrangement has functioned so far, but seems difficult to maintain in the long run.

Should the country further decentralize or even become a federal state, this status quo would no longer function. For instance, political discussions could very possibly lead to the transfer of local PW/DOH offices to local governments, in which case only the headquarters of PW/DOH and its special units would remain with MOC.

Potential Objectives and Priorities for a Restructuring Agenda

Restructuring PW/DOH remains a necessity in 2015. The legacy organization of the Public Works was no longer adapted to delivering its missions in the new environment. It is important to consider what objectives long-term restructuring efforts should have. This policy note believes that restructuring efforts should support the broader agenda of the modernization of the road network within the next 10–15 years. This will require the following:

- **Creating an organization of which the structure and culture is aligned with the modernization mission**, and that basically "delivers" at the required quality, in time, within budgets, etc. This requires ample autonomy, tight decision-making lines, able managers, and accountability on results at all levels.[28]
- **Putting technical planning at the heart of decision making**. To deliver a long-term plan and optimize the use of resources, technical planning needs to receive a much higher status in the organization, and staff with adequate skills and culture need to be put in charge of new planning processes, and the quantity and quality of management information and statistical data need to be enhanced.
- **Creating the basis for sound private sector industry growth**. To meet a rapidly growing demand, the road industry needs to be balanced (mix of small, medium-sized, and large companies), markets need to be competitive and transparent (to minimize corruption risks, which are frequent in the road industry worldwide), and there should be a strong interaction with foreign expertise to improve the technologies being used.
- **Mobilizing larger resources**. The new organization should be able to command a broader range of resources (central and local government funds, earmarked fees, private sector investments, donor resources, and debt) and use them in support of its defined plans.

PW/DOH restructuring will also face threats, such as losing its skilled staff and managers to a growing private sector, becoming more politicized, becoming fragmented through decentralization—losing much of its capacity to act, and losing its technical control in the sector as it contracts outs more work. These threats are common to many road agencies.

The next paragraphs discuss in more detail three restructuring agendas—corporatization of the delivery units, devolution and deconcentration, and a new institutional structure at the central level.

[28] The National Highway Authority of India provides an example of a "mission" agency. It was established with the explicit purpose to implement the National Highway Development Project.

3.3 Corporatization of Delivery Units

Review of the Draft Corporatization Plan

As part of its reform, MOC plans to corporatize its construction units responsible for construction and improvement works. Apart from reducing the number of government staff, this will introduce a clear division between regulation and management of the trunk road network on one side, and implementation of road construction works on the other side. It will also allow efficiency to be improved through the introduction of competition.

Units concerned. The corporatization includes 5 road and/or bridge project units, 5 road and/or bridge subproject units, 16 road construction units, 16 bridge construction units, 8 airfield construction units, and 8 building construction units. These 58 special units (as of 2014) formed part of Public Works in its form as an SEE. Together, these units have an estimated asset value of approximately $165 million (MK210 billion) including land, buildings, and equipment. The estimated asset value of the different units varies from just $24,000 (MK30 million) to $61 million (MK78 billion). The largest special building construction unit and the two largest special bridge construction units together have an estimated asset value of $107 million (MK136 billion), nearly two-thirds of the total asset value of all 58 construction units.

MOC has considered transforming the construction units into a single state-owned enterprise—the United Engineering Construction Corporation (UECC). The UECC would encompass all special units, which would be reorganized into 3 bridge units, 3 road units, 1 airfield unit, and 1 building unit. As such, UECC would essentially be a holding company, with subsidiary operating companies. MOC plans to form UECC as a government-linked company (GLC) for the first 2 years of operation, after which it would be gradually privatized into a public limited liability company (LLC).

MOC estimates that approximately 3,300 staff members of the construction units will participate in the corporatization (this is less than half the staff positions currently reported to form part of these units). As part of the privatization process, the shares of the GLC would be offered to the 3,300 staff members from the different units to be corporatized. These staff members are expected to buy 60% of the shares worth

Table 32: **Estimated Asset Values of Road and Bridge Construction Units, 2014**
(MK million)

Type of Units	Number of Units	Combined Asset Value	Maximum Asset Value	Minimum Asset Value
Road/bridge project units	5	4,118	1,295	491
Road/bridge project units	5	618	149	73
Road construction units	16	8,409	1,532	152
Bridge construction units	16	41,475	24	26,842
Airfield construction units	8	2,933	165	1,308
Building construction units	8	66,806	89	61,357
Other assets		40,641		
Total	**58**	**165,000**		

MK = Myanmar kyat.
Source: Data provided by the Ministry of Construction.

approximately MK99 billion, implying an average investment per staff member of MK30 million. The 40% of shares remaining with the government would also be offered to these staff members upon transforming the GLC into an LLC. Any shares remaining with the government would be offered to other MOC staff, and subsequently to the general public as part of the transformation into an LLC. MOC is also considering inviting a strategic investor (potentially an international financial institution) to facilitate the restructuring. During the first 2 years of operations, the company would receive part or all of its contracts through direct awards, but free competition would then become the norm.

Analysis and Suggestions

The size of the UECC would make it the largest in Myanmar and a sizeable company by international standards. The asset value alone of the UECC would be large. The road and bridge construction units have an annual turnover of $300 million from MOC and state and/or regional budgets, putting it at 183rd position of the 250 largest international contracting companies according to the *Engineering News Record*. Including the turnover from the building and airfield construction units, it would become even higher. This should be compared with Max Myanmar Contracting, one of Myanmar's largest private sector contractors, which has an annual turnover of approximately $100 million.

Creating such a large company is likely to result in a monopoly position and lead to a long-term imbalance in power between UECC and DOH–DOB. This situation occurred in Kazakhstan, where the state-owned company Kazakhavtodor was created in 1998 for the management and maintenance of the trunk road network. A resolution issued in 2000 separated the roles of client and contractor, creating the Committee of Roads under the Ministry of Transport and Communications, and making Kazakhavtodor the sole entity responsible for implementing all maintenance and repair works in the trunk road network (it is allowed to bid for other works, although it has not been very successful). The limited resources of the Committee of Roads together with the monopoly position of Kazakhavtodor result in a situation where Kazakhavtodor is very much involved in determining the work program and budget needs.[29]

The creation of 3–5 companies would result in more competition with existing private sector companies, while still ensuring the viability of the corporatized entities. These companies would likely be of the same magnitude as the largest private sector contracting companies operating in Myanmar.

The division of the units between companies would be best done on the basis of specialty, separating buildings from roads and airfields. Due to the specialized nature of the two larger bridge construction units, these may form a separate company, while the smaller units may be combined with roads and bridges. Such a division by roles would also allow a greater degree of specialization in terms of staff capacities, equipment, and marketing. A further division may be introduced on the basis of geography. The resulting companies should have the financial capacity to address the size of project likely to be offered to them, and should have the staff available to fill the roles in a large corporation. Attention should also be given to ensuring that each company has access to land, quarries, workshops, etc. As part of the corporatization process, the burden of debts and pension obligations should be reviewed, and if found excessive (as seen in other transport sector SEEs), the government should assume them rather than load the new companies with it.

With the history of internal conflicts in Myanmar, MOC has expressed its concern that the creation of multiple companies would limit its ability to carry out works in conflict or postconflict areas. This is because a single

[29] ADB. 2012. *"Western Europe–Western China" Investment Program—Road Maintenance System Improvement Project*. Manila.

company would be easier to instruct to work in these areas and because of the imbalance that could be created if some companies work more in these areas than in others. Other countries have experienced similar concerns, and have resorted to free competition for procurement, offering premiums to companies willing to work in difficult areas and where the market is unwilling or unable to go to certain areas, rely on army engineering branches (e.g., Brazil), or army-owned companies. Also, it is important to understand that in a competitive market, MOC should lose the hierarchical or managerial capacity to order UECC to carry out works. The government may keep this power as long as the company is public, but should lose it once it is privatized.

Opening up competition to the private sector seems more important than privatization itself. By gradually opening up the market, the existing private sector companies will be able to compete with the corporatized units. Whether the private sector companies are competing with state-owned companies or privatized companies is less relevant, as long as there is a level playing field and the state-owned companies abide by the same rules. Opening up of the market to competition can start approximately 2 years after corporatization, gradually increasing the percentage of contracts that is openly tendered over a period of approximately 3 years, depending on the performance of the corporatized units.

The companies should become autonomous from MOC sooner, rather than later. One of the conditions will likely be that the "state-owned companies are legally and financially autonomous, operating under commercial law, and not dependent agencies of the Employer."[30] Typically, this would mean that (i) MOC should lose its right to appoint the management of the company, and decide upon its staff; (ii) the oversight of the company while it remains state-owned should lie with the Ministry of Finance (MOF), and MOC should not have the majority of seats (if any at all) at the company's board; (iii) the companies should not receive direct transfers from MOC; and (iv) the companies should be incorporated under commercial law, not under a special purpose law.

The privatization of the corporatized construction units should not be rushed as time is required to build the necessary skills and capabilities. MOC currently considers privatizing the construction units within 2 years after corporatization. This is a very short timescale to create the financial systems and mentality needed to manage a fully private company. Generally, a longer time frame is applied with gradual privatization to allow the staff and the company structure to become more market focused and able to compete in the market economy (e.g., 5 years in Canada and New Zealand). The corporatized units will need to build their capacities and experience in terms of costing and bidding for works and general business management. This process may also involve the hiring of people from outside who have experience working in the private sector. Sufficient time should be given to developing these capacities before the corporatized units are required to privatize.

A duration of about 5 years for the corporatization process is recommended, with the gradual public tendering of contracts starting about 2 years after corporatization. By this time, the corporatized companies will have acquired experience in managing the companies, bidding for contracts, and competing with the private sector, and will be in a better position to transition through the privatization process successfully. In any case, the status of the GLC should be reviewed before deciding to proceed with privatization. This should determine whether management systems, organizational structure, and sufficient operational and financial capacity are in place to allow a smooth transition to a limited liability company. Based on such a review, the timetable can be brought forward or delayed as considered appropriate.

The purchase of shares by staff of the new companies should also be delayed. It is not expected that staff members will be willing or even able to purchase the number of shares indicated above, especially considering that the company has yet to prove itself in the open market. Thus, delay in the sale of shares is proposed

[30] Wording of standard bidding documents used by international financial institutions.

till a later stage, after the market has been (partly) opened up to competition. Apart from allowing the new companies to focus on competing with the private sector without having to deal with a privatization process, it will also allow potential buyers of the shares to better judge the potential of the company. Although it is considered appropriate to first offer the shares to the staff of the companies, it is likely that the purchase of shares by staff will be much lower than expected.

Other Corporatization Opportunities

The maintenance units may also be corporatized. There are currently around 8,000 staff members involved in road maintenance implementation. The corporatization of these maintenance units will allow the division between regulation and implementation to be extended to maintenance, and allow efficiencies to be improved through competition. Given the type of experience and skills of these staff members and the equipment available to them, it is recommended that the government creates medium-sized companies capable of, and interested in, carrying out routine maintenance and minor special maintenance. Such maintenance companies may be based on the current district offices, as equipment and works tend to be managed at this level. This would result in approximately 60 companies, whereby some may be joined together and others may be split according to specific circumstances in the different districts. As such, the corporatization would result in companies with some 100–150 staff members each. Staff from the Mechanical Section responsible for the management of maintenance equipment may also be involved in the corporatization of the maintenance units.

The corporatization of the maintenance units should take place after the corporatization of the construction units. The corporatization process should use a similar approach to that of the construction units, where contracts are initially allocated directly to the new companies and gradually opened up to competition over time. Each company should also be provided with the equipment, land, and capital required to operate effectively as a business. Any debts and pension obligations would likely need to be taken over by the government. Each company should furthermore be provided with training and capacity building regarding business management and general bidding and organization skills. As the maintenance companies gain experience, the more successful ones may even start to compete for larger maintenance contracts. It is recommended, however, that the reform of the maintenance units be postponed for a possible second phase of reform. Although the current reform process should already look at possible reform strategies for the maintenance units, the actual reform implementation should be carried out later in order to take into account the lessons learned from the reform of the construction units.

Corporatization of the Yangon–Mandalay Expressway Maintenance Group should also be considered, and given the capacities of this unit, could be combined with the corporatization of the construction units. Only with the corporatization of these maintenance units would there be a real division in responsibilities for regulation and/or management and implementation.

The Design Branch and the Road Research Laboratory (RRL) could also be corporatized. In the current setup, MOC's ability to scale up its in-house designs and quality control capacity is limited by fixed allocations of staff and budgets to its design branch and to RRL. These units function very much on a service basis, however, and it would be easy to transform the model into a fee-for-service model. To overcome the status limitations, the units could be transformed into a design institute—remaining under MOC at least in the medium term—and allowed to scale up as the need arises, or to contract out to the private sector.

3.4 Devolution and Deconcentration

Framework Considerations

This section presents options and considerations regarding the organization of the road sector at the state and regional level. There is a great deal of interplay among the division of roles and responsibilities, the administrative setup, and the financing instruments, all partly determined by broader considerations of financial capability and state structure.[31] Should the country choose a federal or quasi-federal structure in the future, many of the options discussed below would become predetermined. Classic principles of fiscal decentralization will nevertheless continue to apply to the issue: subsidiarity (who should decide?), economies of scale (is it less costly to manage the roads at the central level?), spillovers (will a state and/or region be affected by the condition of the roads in a different state and/or region?), equity, local accountability, and costs of administration and monitoring.

- **National and/or local interest**. Trunk roads, by their nature, serve a combination of national, state and/or regional and local travel needs, with higher road classes serving generally a larger proportion of interregional movements. It is a common international practice that the central government defines needs on roads with (inter)national connectivity function, and provides a share of financing for their construction and sometimes maintenance. What varies among countries is the share of financing, which can be small, or up to 100% for both construction and maintenance.
- **Changing needs**. As the road network matures, needs change from construction to maintenance. National governments tend to take a more direct role in construction, and a more indirect role in maintenance.
- **Influence or control**. The national government may directly manage the roads at all levels (or at least the national roads), approve plans made by lower levels of government, forcing them to comply with national plans and prioritize projects with national interest, or simply give financial incentives to comply with national plans, such as through cost sharing or conditionality in budget allocations. The capacity of the central government to enforce its plans and require reporting is strong in a unified state, but is legally restrained in federal states. Financial incentives can then be powerful tools for bringing coherence.
- **Local capacity**. The share of costs borne by the central government should depend on the capacity of local governments to raise revenues. The extent to which the central government leaves local governments in charge of national interests (e.g., management of national roads) should depend on their capacity to manage them effectively. Conversely, there can be a role for the government to deliver local services *on behalf* of local governments if it is likely to have the best capacity to do so.
- **Costs of change**. Any reorganization plan should be mindful of the risks involved with breaking long-lasting structures.

Policy Options

Network ownership. It would make sense if ownership of trunk roads that have regional interest (i.e., being almost entirely within state and/or regional boundaries) be transferred to the states and regions. A formal transfer of the regional and/or state network would be an opportunity to assess the size of the resources that

[31] This section draws from ADB. 2012. *Financing Road Construction and Maintenance after the Fuel Tax Reform*. Manila, and Myanmar Development Resource Institute–Center for Economic and Social Development and The Asia Foundation. 2014. *Fiscal Decentralization in Myanmar: Towards a Roadmap for Reform*. Yangon.

should be transferred for proper management of these roads. In most countries, ownership of the national network lies with the central government,[32] and we see no reason to change the current status of this network in Myanmar.

Funding responsibility. Costs can be shared between different levels of government. For instance, the Japanese government funds 75% of the costs of national expressways, 66% of national roads, and 50% or less of local roads.[33] In the US, the federal government is responsible for 80% of the financing of the national roads, but does not take responsibility in maintenance financing (it only transfers resources from the fuel tax to local governments). Most countries seem to rely on predefined cost-sharing ratios, rather than leave it to negotiation on a case by case basis. This is likely the way Myanmar should go. A starting point may be to allocate responsibility for funding maintenance of national networks with the central government, and that of local networks with local governments, and to share the responsibility for financing improvement works, with the cost-sharing ratio varying based on the national importance of the road, and according to the states' poverty level.

The legal feasibility of such solution would have to be studied. For instance, what if a state refuses to finance its mandated share for a national road? Under which conditions could the national government refuse to finance an excessive local investment? Shares could be interpreted as target shares, be expressed as an amount of investment per km, or be based on dividing a pool of funding by a number of projects. Also, the central government could put conditions on cofinancing local projects: buy providing funding only if the project meets national standards, if local road network plans are prepared in line with central government guidelines, etc. Cofinancing arrangements for large projects would likely take a contractual form (or memorandum of understanding).

Administrative Models

Three models of organization appear feasible as follows:

Option 1: Separating management of national and regional and/or state roads. This would involve creating two separate administrations in each state: a branch of the national PW/DOH, and a state and/or regional road management office. These would have separate staff and management. The branch of the national PW/DOH would be under the hierarchical authority of MOC and rely on national funding to manage the national network. The local road management office would be under the state and/or regional government, and use its budgets.

This model has the advantage of clearly delineating responsibilities, with each set of staff responsible for a different set of roads. It does not require cost sharing. In a federal state, it provides the central government with a high degree of control over the national network. This model is used in countries such as Brazil, Germany, Japan, and the United Kingdom. It allows each level to focus on its own network, and with the reduced size of the highway network managed by PW/DOH, could result in a very efficient structure. At the state and/or regional level this option would provide greater autonomy.

A major drawback is that it creates 16 separate regional road management offices in parallel to the PW/DOH offices, spreading capacity, introducing a risk that these offices will be too small to work efficiently (in Brazil some states function very well, while others do not perform as well), and limiting the flow of knowledge and processes (in Brazil state road departments meet once a year to share experiences).

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[32] An exception is the US, where states own national facilities.

[33] ADB. 2012. *Financing Road Construction and Maintenance after the Fuel Tax Reform*. Manila.

During a transition phase, PW/DOH could identify the staff strictly involved in local network management, and create separate divisions of its regional offices. These local divisions could then be put under the functional control of the state and/or regional governments, while administratively remaining deconcentrated parts of PW/DOH.

Option 2: Fully devolving management responsibility to the states and/or regions. Under this model, all staff and offices are transferred to the states and regions, and remain responsible for the entire trunk road network. PW/DOH would provide the plans and funding for the highway network, but delegate the management of the national highways to the states and/or regions. States and/or regions would be responsible for all roads or road sections within their area, but would have to abide by plans approved by central level for the national highway network. For the lower level roads the funding and plans would be decided by the states and regions.

This model has been applied successfully in much larger countries, such as Canada, the People's Republic of China, and the US. The main drawback is that it requires a powerful mechanism for the central government to ensure compliance with its plans and standards of quality. The model again has the disadvantage that it does not allow any management capacities to be centralized. The weakness of the former option is expanded to the national highway network.

Option 3: Transforming PW/DOH into a service provider. Under this model, PW/DOH local offices manage road networks on behalf of clients, which are the central government for national highways and the state and/or regional governments for local highways.

This model formalizes the current situation where the local PW/DOH offices have dual reporting and funding sources. This model has the advantage of avoiding duplicate structures and preserving PW/DOH as a unified entity. In its purest form, this system would require an agency or corporate status, fee-for-service and managerial independence. This is, for instance, the model of Vicroads in Australia. This model can be used during a transition phase to another form of organization. It was also used in France between 1982 and 2006 until the management of local road networks was fully transferred to local governments. Advantages of sharing staff would, however, be less evident after the corporatization process. This is especially relevant in the current context where there are large numbers of staff involved in maintenance implementation.

However, where these maintenance units are corporatized as discussed earlier, the remaining staff would be mainly responsible for preparing plans, procuring works, supervising contractors, and monitoring road conditions. For the national highways there would no longer be a need for staff at township level, and even at district level staff requirements would be minimal. The staff at district and township level would be mainly involved with the lower level trunk roads under the responsibility of the states and/or regions. The sharing of staff also has the risk of resulting in conflicting interests. Although salary and office costs may be shared, staff will always need to split their time between roads managed by PW/DOH and those managed by the states and/or regions in preparing plans and managing works.

Considerations

While Myanmar is embarking on a major effort to develop and modernize its trunk network, sector institutions currently lack capacity. In this context, any solution that would spread capacity and weaken central decision-making seems to carry more disadvantages than advantages for the foreseeable future. There is scope for experimentation. In particular, the management of all roads in Yangon metropolitan area could be put under a single authority. For the time being, the current organization of PW/DOH at the local level could be modified to a minimal extent: either combining all staff strictly involved in regional and/or state networks under

a separate division under the administrative control of the local government (toward option 1), or formalizing through fee-for-service the services that local PW/DOH give to local governments (toward option 3).

Further research into the feasibility and implications of each of these options would be useful. Follow-on research and next steps could include (i) assessing what cost share would be appropriate for the central and local governments, (ii) determining how a cost sharing approach could be implemented in the legal context, (iii) studying in more detail (e.g., with a case study) the implications of each of the three administrative organization options, and (iv) consulting with stakeholders. The ADB technical assistance for transport sector reform and modernization will assist PW/DOH in this process.

3.5 Reorganization of Department of Highways Headquarters

A Long-Term Structure

The following paragraphs and organizational structure show one possible form that a full-fledged Department of Highways (DOH) could take in the long term.

A Construction Division (or Network Development Division) could include all activities directly related to managing construction and improvement. This division would be directly in charge of the delivery of large-scale projects. Small-scale projects would be fully handled at the local level, with only coordination support from the construction division. A Project Development Section is included to manage the development of new, large-scale projects during preliminary and detailed designs, as well as to ensure consistency of smaller-scale projects with corridor requirements. Design itself may be handled by the technical services or contracted out. A road section would directly manage all ongoing large-scale road projects financed from the national budget. Airfield projects are limited and can be dealt with by the Roads Section, which would also deal with small bridges. For project supervision and inspection, the Construction Division would work through the offices at state and/or regional level and below; it may also contract out supervision. Large bridges would be dealt with separately by the Bridge Section. A BOT/PPP Section could be introduced to manage build–operate–transfer (BOT) contracts and other public–private partnerships (PPPs) that may be introduced in the future. It would develop specific legal and financial skills, and would be directly involved in negotiations of investment requirements by concessionaires. A specific Donor Projects Section could also be created to implement donor-funded projects, with staff that is familiar with the requirements of donor projects.

The Maintenance and Operation Division would include both maintenance planning and management. A single Maintenance Management Section would give oversight to the maintenance of both roads and small bridges (maintenance management for large bridges could be carried out by the Bridge Section under the Construction Division), as well as coordinate answers to emergencies. A Planning Section or Road Asset Management System (RAMS) section is introduced to prepare annual and multiannual maintenance plans using RAMS (or the strategy and 5-year plan derived from it). Road Safety could also be a new division under the Maintenance Division. The maintenance units at local level as well as the Yangon–Mandalay Expressway Maintenance Group would be corporatized, leaving only small offices at state and/or regional level and possibly district level for managing maintenance and other small projects, supporting larger projects, coordinating with local governments, and collecting data in support of planning.[34]

[34] The Mechanical Section that manages the equipment for maintenance would be corporatized together with the maintenance units.

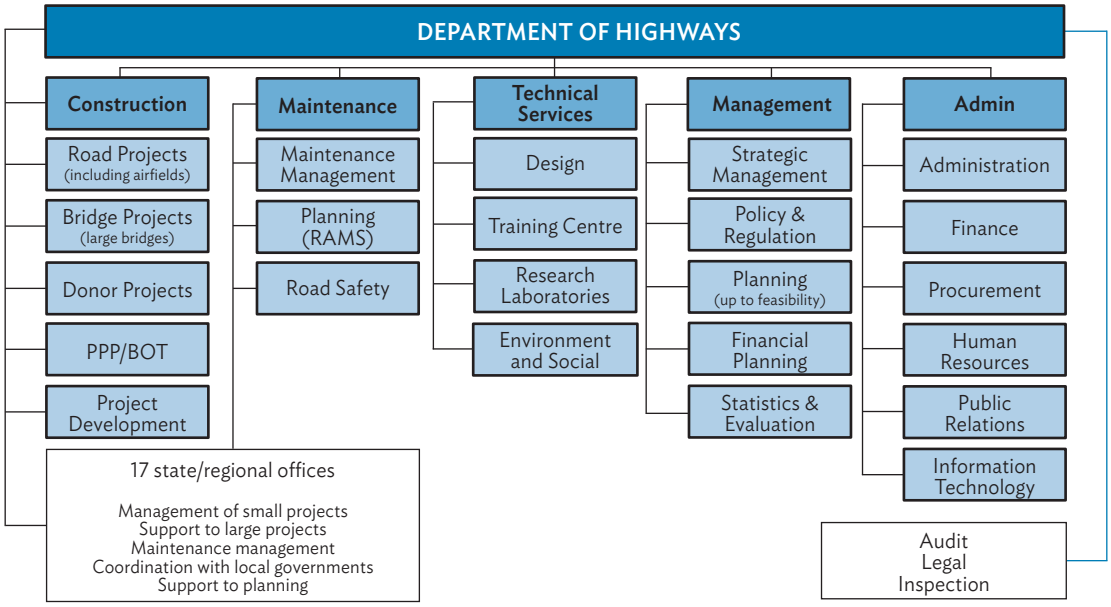
The Technical Services Division would provide support to all the different divisions of the DOH. This includes the Design Section incorporating all the different design units formerly under the Road and Bridge sections. It also includes the existing training center and the road and bridge research laboratories. The new Environmental and Social Safeguards Section also supports the different divisions. Part of these technical services may be contracted out to the private sector, especially if demand exceeds the capacity of the existing sections. At some point, a decision may be made to corporatize or sell off certain sections, tendering out all the related work.

The Management Division (or Strategic Management and Policy Division) would be aimed at strategic management. A Strategic Management Section would manage the department's corporate reporting, develop internal policies, processes, and tools to ensure the delivery of the department's objective and create needed management information. A Policy and Regulation Section would be responsible for preparing road-related policies, regulating the trunk road sector and setting standards. A Strategic Planning Section would be responsible for preparing medium- and long-term plans and developing projects up to the feasibility stage. The Financial Planning Section would be responsible for mobilizing funding to carry out the plans, including setting toll rates and other tariff policies, and maintaining relations with donors. The Statistics and Evaluation Section would be responsible for collecting data and preparing a Road Statistics Yearbook in support of planning and for monitoring and evaluation.

The Administration Division would be responsible for the general administration of the DOH. This includes a general Administration Section, a Finance Section, and a Human Resources Section. A Procurement Section is introduced to take care of contracting in light of the planned corporatization of the construction and maintenance units. A Public Relations Section is introduced together with an Information Technology Section to facilitate computerization.

An auditor, a legal office, and an inspection office would be reporting to management.

Figure 19: **Possible Long-Term Organization Structure for the Department of Highways**



BOT = build–operate–transfer, PPP = public–private partnership, RAMS = Road Asset Management System.
Source: Author.

Status

The creation of a road agency would have certain benefits. A full-fledged road agency refers to a (semi-) autonomous agency responsible for the day-to-day road management. It usually takes the form of an executive agency under a ministry (e.g., UK Highways Agency). Road agencies normally have more autonomy, and subsequently less political interference, increasing the likeliness it will comply with agreed (medium-term) plans. Their special status allows them to also offer commercial remunerations, and therefore to recruit better qualified staff. Road agencies are also often financially autonomous, giving them a capacity to receive earmarked funds and sometimes emit debt. They also tend to have higher standards of governance, facilitate user involvement (which can participate into their board), and have greater accountability for outputs and outcomes as a result of a performance agreement between government and the road agency. In the context of Myanmar, the greater autonomy would also allow it to serve both central government (highways) and the states and/or regions (lower-level trunk roads) without the current conflicting interests, as each would supply specific funding and related plans to be complied with (option 3).

However, attempting at this stage to develop a full-fledge road agency seems excessively risky. With the planned corporatization and other reforms in Myanmar, there is a lot of ongoing change, complicating the introduction of a road agency and putting its success at risk. For the potential benefits of a road agency to be achieved, the government needs to have a strategic plan in place and develop clear targets and cost estimates to form the basis of the performance agreement. This is not currently the case.

Nevertheless, it is possible to gradually introduce several features of a road agency, such as performance monitoring, performance targets linked to the funding allocations, and earmarking of funding. Performance monitoring consists of the collection of data regarding specific performance indicators related to output and outcome (e.g., length of roads constructed, improved, maintained; percentage of paved roads; percentage of roads in good or fair condition; average cost per km of routine maintenance, etc.). Initially, the focus may lie only on collecting the data each year, and subsequently targets may be set for future years, linking these to funding allocations or staff bonuses. A similar system was introduced by ADB in neighboring Yunnan Province in the PRC, for the Highway Administration Bureau.[35]

DOH may also want to consider returning to a corporate status. In the medium term, this status could enable it to become financially autonomous, thus, enabling it to invest directly into toll road projects on a cost-recovery basis, and emit debt or bonds. Possible long-term models would then be the National Highways Authority of India or of Pakistan or SANRAL, a state-owned company in charge of road network management in South Africa.

Review of the April 2015 Reorganization of the Public Works

Original plan. In 2014, MOC started considering a restructuring plan for the Public Works. MOC's plan considered the transition from the Public Works' previous form of a state economic enterprise (SEE)[36] into a DOH, corporatizing the construction units currently under the Public Works, and introducing a clear division in responsibilities for management and implementation. Besides the corporatization of the special units, the Public Works would have to consolidate the existing divisions and sections under the Public Works that are

[35] ADB. 2013. *Report and Recommendation of the President for the People's Republic of China: Yunnan Sustainable Road Maintenance (Sector) Project*. Manila.

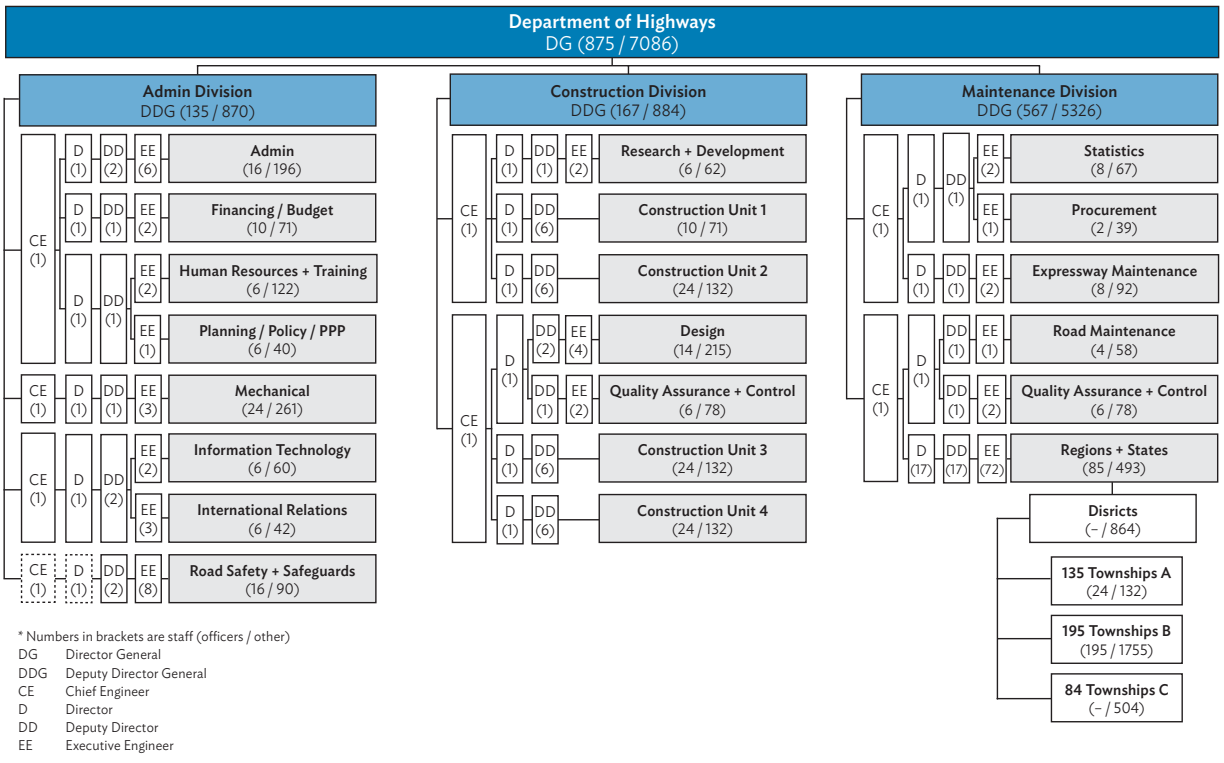
[36] State-Owned Economic Enterprises Law, March 1989, and the Law Amending the State-Owned Economic Enterprises Law, March 1997.

related to roads, bridges, and airfields into a DOH that would be responsible only for regulation. A Department of Building and Construction Administration would be created to regulate the building construction industry in Myanmar, incorporating the Public Works divisions and sections related to the building sector. In this process, the SEE form of the Public Works would be abolished, leaving the two departments responsible for regulation and management, and the corporatized companies responsible for implementation. The number of staff positions in the two new departments would be reduced to 13,500 from the current 25,000 under the Public Works. The Department of Human Settlement and Housing Development under MOC would be renamed as the Department of Urban and Housing Development.

In late 2014, an ADB mission reviewed MOC's initial plan, and proposed the structure described in Figure 20. MOC then finalized its proposal and submitted it to the President's Office.

Actual changes. On 31 March 2015, Ministry Resolution #21/2015 was issued, which required the reform of the Public Works into three entities—a DOH, a DOB, and a Department of Buildings and Construction Management. The decision to create a separate DOB was a significant change from earlier discussions with MOC (where bridges were foreseen to fall under DOH) and was apparently a decision of the President's Office. The resulting departments come with a significant reduction in staff positions from 25,000 under the Public Works to just over 12,000 across the three departments.[37] However, the reduction is understood to involve

Figure 20: **Approved New Organization Structure of the Department of Highways**



Source: Ministry of Construction.

[37] DOH: 875 officers and 7,086 other staff, DOB: 286 officers and 2,000 other staff, Department of Buildings and Construction Management: 352 officers and 1,578 other staff.

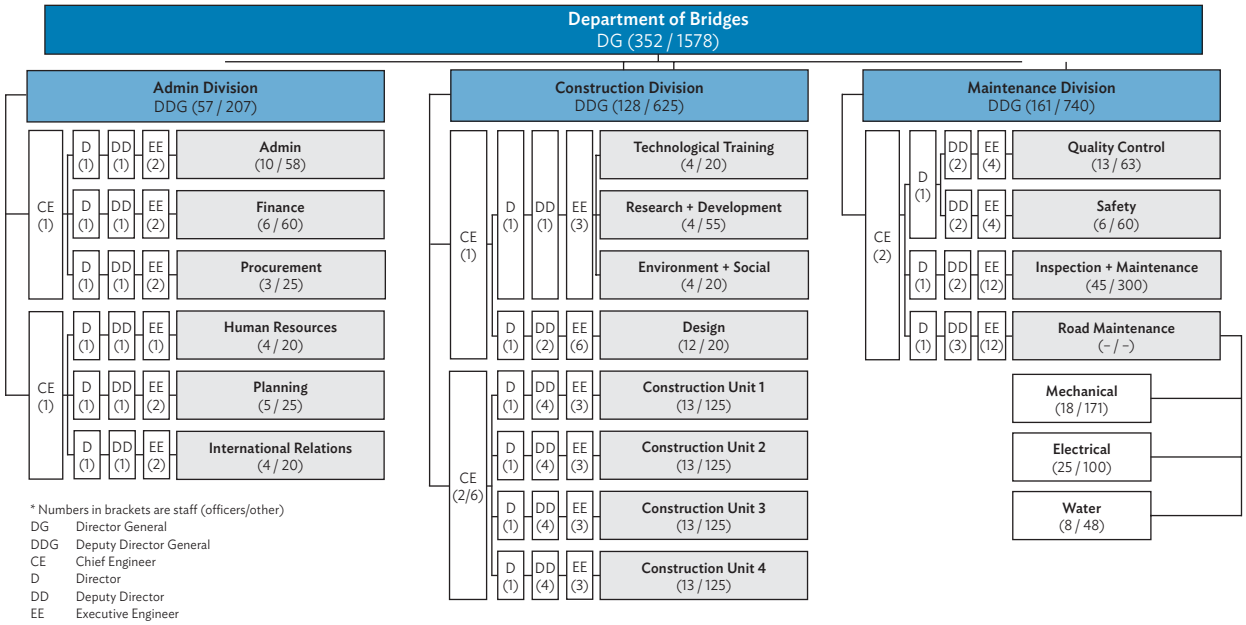
only positions that are currently vacant. Together with the reform of the Public Works, Ministry Resolution #20/2015 was issued, calling for the creation of a Permanent Secretary post under MOC, which the different departments would report to. The resolution calls for a unit to be created in support of the Permanent Secretary with 50 officers and 115 other staff.

The new organizational structures have been approved by the President's Office and are presented in Figure 20 for DOH and in Figure 21 for DOB. As the resolution was only recently issued, the reform was still ongoing at the time of report writing and many of the positions have not yet been allocated. In developing the new structure, recommendations made by ADB were reportedly applied. However, this has not been done in a very structured manner and there are still a number of issues that will need to be addressed.

In the reform, the 16 road construction units and 8 airfield construction units have been grouped together under 4 regional construction units so that each have 6 construction units (regional construction units 1 and 2 cover lower Myanmar and numbers 3 and 4 cover upper Myanmar). The staff from the 10 special road and/or bridge project units have reportedly been merged into the general structure of DOH. There is a tendency to transfer the best performing staff from the construction units to DOH. Although this improves capacities in DOH, it puts at risk the successful corporatization of the construction units. The steps to be taken in the corporatization of the construction units still need to be agreed upon.

With the planned corporatization and outsourcing of works, the creation of a procurement section had been strongly recommended by ADB. Such a unit has been created under the new structure, but it is currently just a renaming of the former Store Section from Public Works. It is furthermore placed under the Maintenance

Figure 21: Approved New Organization Structure of the Department of Bridges



Source: Ministry of Construction.

Division, while the unit will mainly focus on construction works (although maintenance works may be outsourced in the future). It is recommended that this unit be moved to the Admin Division. DOB also has a procurement section, which is placed under its Admin Division.

The ADB technical assistance (TA-8244) also recommended creating a strong management division, including a strategic management unit, a policy and regulation unit, a planning unit, a financial planning unit, and a statistics unit. These units have all been grouped together into a single unit, which also includes PPPs such as the build–operate–transfer (BOT) contracts (statistics is in a separate unit, but it is placed under the Maintenance Division). The Planning/Policy/PPP Unit shares a deputy director with the Human Resources and Training Unit, and is not considered to have sufficient authority for the strategic function that it should perform.

The new structure of DOH also continues to have significant numbers of staff under the Regions and States Section, the Expressway Maintenance Section, and the Mechanical Section that are directly involved in works implementation and service delivery. It is not yet clear to which extent these units may be corporatized in the future, or decentralized to the regions and states. Regarding the Expressway Maintenance Section, DOH has initiated the tendering process for a BOT contract to upgrade the expressway,[38] which would make the Expressway Maintenance Section redundant.

The division of DOH and DOB is causing some units to be split that would otherwise be kept together (under a unified department covering both roads and bridges). The most apparent of these is the Mechanical Section that provides equipment to both road and bridge works according to needs. Splitting up of this section will limit the flexibility and reduce the capacity as staff is also spread over two units. A major problem is the division of the two workshops and two equipment maintenance and logistics groups between the different departments. A similar situation exists for several other units, such as the Admin, Finance, Human Resources, International Relations, Procurement, and Safeguards sections. For the Planning sections, an added problem will be to ensure coordination between the two departments to avoid roads being planned without bridges or vice versa. There is a need to see how to better coordinate between the two departments and use available staff and resources more efficiently and effectively. In some cases, it may be desirable to have only one single unit under DOH, which serves both DOH and DOB. This provides greater flexibility and allows resources and skills to be concentrated (although this is not suitable for all sections).

Next Steps

The 2015 creation of DOH and DOB is an improvement over the previous structure but the split has created new issues. In the short term, the following are priorities:

- **Units that fulfill "new" functions of MOC should receive quickly guidance and training on how to operate the following**: safety, IT, safeguards, procurement, quality assurance, planning, policy, PPPs, and statistics.
- **The corporatization of construction units, just initiated, should be actively pursued**. The new DOH will then need to change its role from that of issuing work orders to one of tendering out contracts and supervising works. This change in the role of the Public Works will require significantly more skilled staff for procurement, contract management, and supervision, and the reform process should include a proper assessment of the numbers and types of staff required after the reform.

[38] The contract would involve widening to 2x4 lanes and an asphalt concrete overlay. A total of 26 companies have reportedly expressed interest.

The change will also require amended regulatory procedures and systems (procurement legislation, tender documents, contract management systems, etc.).

- **Operational arrangements between DOB and DOH should be identified** to (i) avoid unnecessary duplication of structures (e.g., for administration), and (ii) clearly allocate responsibilities at the local level and for project preparation and/or execution.

The ADB technical assistance on Transport Sector Reform and Modernization includes a specific output to support the restructuring and modernization of MOC. This technical assistance is a follow up to this study and aims to provide support to MOC in determining a new organizational structure and developing its key business systems related to investment planning and budgeting; procurement; contract management; design and supervision; information systems; and the planning, management, and delivery of maintenance.

4 Modern Business Processes for Construction and Maintenance

Key Findings and Suggestions

Findings

The spending efficiency of the Public Works/Department of Highways (PW/DOH) is limited by the way it selects designs and carries out works.

PW/DOH does not have a planning tradition. In practice, plans have followed budgets. Planning has been either left to politicians (for large investments), or been understood as a budgeting process (cutting down wish lists defined at local level to fit the available budget).

PW/DOH has three investment plans and a new set of design standards. The plans are well articulated and generally sound, but PW/DOH lacks a process for prioritizing investments. The design standards are better than what existed before, but they seem to confuse administrative and technical classes, which could lead to poor investment choices.

PW/DOH has until now, delivered all works in-house. Its staff designs, constructs, and maintains the roads. This system shows limited efficiency and quality. It comes with an excessive reliance on labor-based techniques. It also cannot be easily scaled up to match modernization needs.

Suggestions

PW/DOH and the Ministry of Construction (MOC) should give planning a much stronger role and institutional status. Technical and economic planning processes, such as feasibility studies and prioritization based on economic returns, could be formalized and become legal requirements. Separate technical and administrative classifications should be introduced.

Asset management should become a central process in PW/DOH. Building on a first technical assistance, PW/DOH needs to approve a maintenance strategy, regularly update road condition information, and use them as a way to allocate spending and assess results.

MOC has been considering contracting out construction works through open bidding, which is a priority reform that should receive full attention. It will bring large benefits, but is also challenging, requiring PW/DOH to fully change its business processes. PW/DOH needs to develop a new practice of contractual relations and independent supervision. It needs new bidding documents, procurement and supervision guidelines, and much staff training.

PW/DOH could also gradually outsource part of design and supervision, opening up to consultants. Maintenance could also be outsourced, but the priority is to corporatize existing units, increase mechanization, and create the basis for performance management.

4.1 Planning

Investment Planning and Budgeting

The Ministry of Construction (MOC) has until recently, only moderately relied on long-term planning to select investments. The main guiding documents used have been 30- and 5-year plans. The existing *30-Year Road Development Plan* (2001–2031) given in Table 33 consists of a simple list of road projects. It gives long-term objectives, foreseeing 4,200 kilometers (km) of new construction and repeated improvement and widening of almost all international communication and union roads (IC/UR). Despite making up more than 70% of the trunk road network, state and/or region roads, district roads, and township roads are not included in the plan. The plan is structured around road corridors, leading to some duplication of road sections under different corridors, including apparent duplication of budget allocations.[39] The plan has become obsolete due to the significant changes in Myanmar over the past decade. The estimated budget is $5.3 billion (MK5,371 billion), but due to the significant changes in the exchange rate with the dollar since 2001, the budget estimations are no longer relevant.

Shorter-term plans have been largely disconnected from long-term plans. For shorter-term planning, PW/DOH has been using 5-year plans and lists of priority projects. There is a weak connection between long-term and short-term plans—some short-term priorities do not form part of the long-term plan while others are of low priority on the list. Selection of priority construction works is a political decision (Cabinet, Parliament), to which PW/DOH seems only remotely associated (the Ministry of National Planning and Economic Development translates these decisions into plans). Smaller investments are identified using a bottom–up approach, from priorities identified by PW/DOH field offices, and compiled by the head office. Consideration by the Parliament has so far not led to changes in the list of projects, but often results in a reduction in proposed individual budgets to make room for nonroad expenditures.

Budget "as you go." Budgets are given on a yearly basis, so that investment starts as soon as the budget is made available and continues until funds are exhausted. Only major investments are the object of detailed design (200 km in 2013 out of 2,000 km+ of works), so that the budget needed is not precisely known until

Table 33: **30-Year Road Development Plan, 2001–2031**

5-Year Plan	Period	Length (km)				Budget (MK million)			
		IC	UR	New	Total	IC	UR	New	Total
1st	2001–2006	5,676	4,324	1,423	**11,427**	28,804	24,082	2,382	**55,267**
2nd	2006–2011	12,073	8,696	1,101	**21,870**	98,074	44,620	1,901	**144,595**
3rd	2011–2016	5,765	7,214	1,694	**14,674**	375,334	1,108,794	350,765	**1,834,893**
4th	2016–2021	0	4,461	0	4,461	0	401,662	0	401,662
5th	2021–2026	6,256	0	0	6,256	1,821,154	0	0	1,821,154
6th	2026–2031	0	5,349	0	5,349	0	1,113,802	0	1,113,802
Total		**29,770**	**30,044**	**4,218**	**64,037**	**2,323,366**	**2,692,960**	**355,047**	**5,371,373**

IC = international communication roads, km = kilometer, UR = union roads, MK = Myanmar kyat, New = new construction.
Source: ADB estimates based on data from the Ministry of Construction's 30-Year Road Development Plan.

[39] An example is the road section between Yargyi and Kalewa that forms part of the Tripartite Highway and is also included under the Union Highways (finance is provided under both budgets).

works are completed. Individual allocations are also generally small. Large projects are carried out over several years, with progress depending on each year's budget availability. A commonly heard saying is that "planning follows the budget," not the other way around.

The planning and budgeting process seems excessively politicized and insufficiently integrates technical and/or economic considerations. Even a basic feasibility study before decision making to assess the costs and verify that a planned project is economically feasible is missing. In practice, investments have been focused on extending the network under objectives of national connectivity or for widening works. Such investments have low economic benefits, while real needs on the core network have been left unaddressed. A more technically oriented planning and budgeting process would significantly raise the economic returns Myanmar gets on road sector investments.

Maintenance Planning

Maintenance plans are prepared using a bottom–up approach. Plans are prepared on an annual basis—one for the national highways and one for each of the state and/or regional road networks. Based on regular visual condition surveys of the roads, PW/DOH staff at the township level prepares a list of required maintenance works for the trunk roads in the township, including rough cost estimates. These township level plans are subsequently consolidated at district level and again at state and/or regional level. Apart from the cost of road works, the plans also include the staff salary costs and costs of buildings and equipment. The consolidated plan for states and/or regions roads is sent to the state and/or regional government for approval by the state and/or regional parliament (*Hluttaw*), while the consolidated plan for national highways is sent to PW/DOH (Finance Branch under the Road Section) for approval. The approved budget is often less than requested (it was reported that in general, only some 10% of the requested budget may be received), and when this happens, the plans are returned to the lower levels where the low-priority activities are removed.

This maintenance planning procedure is generally sound, but (i) does not integrate mechanisms to orient resources where they are most cost-efficient, (ii) leads to dispersion of budgets over high- and low-priority roads, (iii) is susceptible to nontechnical interference at all levels, and (iv) does not take into account the life cycle costs of the roads. In practice, solutions chosen are often only short-term fixes, while longer-lasting solutions would be cheaper in the long run (and would significantly reduce user costs). Again, improving this planning and budget allocation process could significantly raise the efficiency of expenditures in the road sector.

New Planning Documents

MOC owns three recent plans listing priority investments, and needs to create new management processes to implement them. All three plans have been prepared with international donor support.

The National Transport Development Plan (NTDP) shown in Table 34, was prepared under the coordination of the former Ministry of Transport (MOT) with the involvement of the former Ministry of Rail Transportation (MRT) and MOC, and with technical assistance from the Japan International Cooperation Agency (JICA). The NTDP covers road, rail, air, and inland waterway transport, and identifies 11 transport corridors. The priority interventions in the road sector are estimated to require $11.3 billion (MK11,313 billion) up to 2030, for an average of $700 million (MK700 billion) per year. A total of 27 road sections with a combined length of

Table 34: National Transport Development Plan in the Road Sector

Intervention Type	Length		Cost (MK billion)				Unit Cost (MK million)	
	Road (km)	Bridge (m)	Up to 2015	2016–2020	2021–2030	Total	Road (per km)	Bridge (per m)
Road improvement	6,887	0	369	1,558	4,740	6,667	968	n/a
Road widening	1,706	0	0	0	2,496	2,496	1,463	n/a
Expressway construction	200	0	0	243	728	971	4,855	n/a
Expressway improvement	50	0	193	483	0	676	13,520	n/a
Bridge replacement	0	7,653	0	239	68	307	n/a	40
Bridge construction	0	4,780	0	0	196	196	n/a	41
Total	**8,843**	**12,433**	**562**	**2,523**	**8,228**	**11,313**		

km = kilometer, m = meter, MK = Myanmar kyat, n/a = not applicable.

Source: Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar*. Naypyitaw.

8,593 km are identified for improvement, including 1,706 km for widening to four lanes.[40] A further four road sections totaling 250 km are identified for expressway construction and improvement, as well as 17 bridges to be replaced or constructed, with a combined length of 12,433 meters. A full list of the road works planned under the NTDP can be found in Annex 3. Compared with the *30-Year Road Development Plan*, the NTDP shows a move away from construction and toward increasing the capacity of existing roads.

NTDP relies largely on technical considerations and a very extensive data-gathering exercise. Based on a multicriteria analysis, the NTDP gives priority to the corridors connecting Yangon to Mandalay, Yangon to Myawaddy (border with Thailand), Mandalay to Muse (border with the PRC), Yangon to Pathein, and Yangon to Pyay/Magway. The criteria are simple but introduce objectivity in the prioritization of road investments (Table 35). Limited departures to the criteria have been observed.[41] It also remains to be seen whether traffic will justify all planned 4-laning and 8-laning of the expressway in the latter part of the plan. This is because minimum traffic levels justifying major widening would only be reached in the later years of the plan (2025–2030), which creates uncertainty as to the timing. However, these minor deviations do not question the overall strength of the plan, which should anyway be regularly updated. The NTPD only focuses on key road corridors and on improvement works; it does not consider needs on other trunk or rural roads and does not include rehabilitation needs. These are covered by two other plans under preparation.

Table 35: Multicriteria Analysis Used in the National Transport Development Plan

Criteria	Description
Connectivity	A corridor connecting to a larger growth center is given a high score.
Economic contribution	A corridor running through a region with a high contribution to the gross domestic product is given a higher score.
Investment impact	A corridor with higher traffic demand is given a higher score.
Investment efficiency	A corridor with a high volume and/or capacity ratio[a] is given a higher score.

[a] The existing volume of traffic divided by the existing capacity of the road.

Source: Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar*. Naypyitaw.

[40] The remaining 6,887 km of improvement includes partial widening to at least 18 feet (ft).

[41] In particular, the improvement of the Mandalay–Muse road is only considered after 2021, even though the road is already considered congested and has a high priority ranking. Also, AH112 has the lowest priority category, but is receiving 30% of the funding up to 2016.

The Master Plan for Arterial Road Network Development was prepared by PW/DOH, with technical assistance from the Korea International Cooperation Agency. The plan includes a complete description of target long-term expressway, national, and regional and/or state road networks. The plan takes a long-term perspective. It introduces a logical classification of the network based on functionality, including a road numbering and coding system. The plan considers the construction of 12 expressways (7 running east–west and 5 running north–south) together with expressway ring roads around the major cities, totaling 10,000 km. It also identifies 19 main arterial highways (12 running east–west and 7 running north–south), complemented by an extensive subarterial highway network. The plan seems very ambitious, but will surely provide a very useful framework for conceiving future road sector improvement works.

A Road Asset Management Program was prepared by PW/DOH, with technical assistance from ADB.[42] This technical assistance is carrying out road condition surveys to create a road database, define a strategy for maintaining and upgrading pavements, and identify a 3- to 5-year priority list of periodic maintenance and rehabilitation investments on the basis of their economic returns[43] and long-term costs. It is also helping PW/DOH set up a Road Asset Management Unit, and is training PW/DOH staff in data collection and database management to enable them to periodically repeat the exercise.

The Road Asset Management Program will require maintenance and rehabilitation plans to be prepared centrally rather than in a bottom–up manner. Budget allocation should be largely determined at central level based on the road and condition data provided by the local level. The role of PW/DOH head office would therefore change from approving plans, to preparing plans and discussing these with local staff and state and/or regional governments. This requires the creation of a strong road asset management unit or maintenance planning unit within PW/DOH to prepare clear plans and discuss these with the local levels. For the planning of state and regional roads, the plan based on the Road Asset Management System (RAMS) may be provided to the state and/or regional government as an input for preparing a state and/or regional level plan. The creation of state and/or regional level road asset management units is not considered a viable option at this stage.

Suggestions

Technical and economic planning processes could be formalized and become legal requirements. The need for rational economic planning has been expressed in various studies over the past 20 years, but has still not gained obvious acceptance, and related processes are lacking. With the reforms in Myanmar and the return of donor agencies, the use of rational economic planning is expected to increase in relation to donor-funded projects that will require plans and feasibility studies to be based on economic costs and benefits. This will allow the government to become more acquainted with the concept. Further, the government could

- Give a legal status to long-term and medium-term plans, making it a requirement for the government to propose budgets in line with plans, and imposing specific processes to introducing investments departing from plans;
- Make feasibility studies (including cost–benefit analyses) and have detailed designs as a legal requirement, at least for large-scale works.[44] The same law could also enshrine the principle that investments should be chosen to serve their likely economic and social benefits.

[42] ADB. 2014. *Technical Assistance to Myanmar for Preparing a Road Asset Management Program for Myanmar Roads.* Manila.
[43] Using the Highway Development and Management–IV model.
[44] Feasibility studies can be a requirement for project approval, and detailed designs a requirement for procurement.

- Create an administrative review process of feasibility studies. During the process, the ministries should formulate a judgment on the technical and economic feasibility of the investment. The process should not preclude a political decision, but come ahead of it to inform it. This process could be carried out by a joint team of the three ministries in charge of transport (MOC, MOT, MRT), and in case a unified ministry is created, by its planning department. The process could involve the Ministry of National Planning and Economic Development, and the Ministry of Finance (MOF).
- Maintain a rolling 3-year or 5-year investment plan. This would help (i) define the budget needs for the preparation of feasibility studies and design works ahead of project approval, (ii) determine required multiyear commitments to large investments, and (iii) in the coordination with donors and other financiers.

It is also suggested that PW/DOH makes road asset management one of its business process, and dedicates a team to this process. This will require limited internal resources and further technical assistance. It will clearly take time before PW/DOH has the capacity to operate a full-fledged RAMS, and subsequent technical support will be required. Computers are hardly used by PW/DOH staff, and the capacity required to run the prioritization system (both in terms of hardware and/or software and human resources) is currently lacking. During the transition process, it is expected that PW/DOH staff can rely on an optimized asset management strategy, describing the type of intervention to be carried out (patching, sealing, penetration macadam or asphalt concrete overlay, reconstruction, etc.) based on traffic volumes and road conditions (roughness and surface distress) in the context of the expected budget levels for maintenance. PW/DOH will need to regularly repeat the road condition surveys and keep the database updated. After 5 years or so, the asset management strategy should be updated with external assistance, gradually increasing the involvement of PW/DOH staff and its RAMS unit in the modelling itself, as well as gradually improving the level of detail of the plan.

PW/DOH and the transport ministries will also need assistance to build the teams needed to manage the preparation and review of the feasibility studies.

Separate state and/or regional road development plans should also be drawn up. Drawing from the NTDP and the Master Plan for Arterial Road Network Development, local PW/DOH offices could draw up local road plans. These plans would need to be reviewed by the local *Hluttaws*. Before this, they could be reviewed by PW/DOH for consistency with the national plan. Such review and consistency could become another legal requirement, or a condition for receiving national funds transfers, subject to legal feasibility (local roads being under local parliament responsibility).

4.2 Trunk Road Classification and Standards

Historical and New Systems

Myanmar has long had a classification system based on technical standards, which have been used to assign administrative responsibilities between central government and the states and/or regions. Until 2014, the trunk road classification was based on technical standards (traffic levels, design speed, number of lanes, etc.). It distinguished six technical classes (DI to DVI) as well as expressways (Table 36). Based on these technical classes, administrative classes were superimposed: Super Highways or Expressways, International Communication Roads and Union Roads (DI+DII), Regional and/or State Roads (DIII+DIV), and District and Township Roads (DV+DVI). Implicitly, all roads of a given administrative class were identified for future

Table 36: **Trunk Road Classification** (until 2014)

Technical Class	Administrative Class	Length (km)	Number of Roads
	Expressway (EW)	590	1
DI + DII	International Communication Road (IC)	5,918	43
	Union Road (UR)	4,837	20
DIII+DIV	State/Region Road (SR)	4,595	59
DV + DVI	District Road (DR)	11,824	215
	Township Road (TR)	12,309	401
Total		**40,074**	**739**

Source: Ministry of Construction.

improvement to meet their corresponding technical class. This was not the case in practice, with most roads remaining below their designated class, which led to multiple arrangements and deviations from the standards.

Myanmar has ratified several systems of international highways, with overlapping and parallel road sections. This includes the Asian and Association of Southeast Asian Nations (ASEAN) Highway networks that connect Myanmar to the PRC, India, and Thailand. These Asian/ASEAN Highway (AH) sections tend to carry the most traffic (especially AH1 and AH14), although some sections currently still have low traffic levels (notably AH3 and AH111). According to the 2010–2015 Brunei Action Plan, Myanmar still had 201 km of missing links that needed to be constructed and 2,791 km of existing links that needed to be improved to Class III (22 feet [ft], two-lane pavement and HS20-44 structure loading). Besides the AH network, there are also three sections of the Greater Mekong Subregion (GMS) Highway Network in Myanmar (these fully overlap with the AH sections). The Tripartite Highway connects India, Myanmar, and Thailand and partly overlaps with AH1, although it uses an alignment that runs parallel to AH1 for several sections. An additional corridor from Tamu (India) to Tachileik (Thailand) was ratified as part of the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation. This corridor roughly overlaps with AH1/AH2, but follows a slightly different route from Gangaw to Mandalay. The different international highway systems within the country are listed in Table 37, Table 38, and Table 39 and are indicated in the map in Executive Summary.

In 2014, MOC approved a new classification for trunk roads based on the function of the road (Table 40). The classification was revised as part of the preparation of the Master Plan for Arterial Road Network Development.[45] It includes the classes of Expressway, National Highway, Regional/State Road, District Road, and Township Road. Although the names of the classes are similar, the basis for classification is formally different. The new classification looks at the function of the road—whether a road runs within a township, a district, a state and/or region, or connects multiple states and regions. The new classification system introduces a strong link between functional, technical, and administrative classes. According to the new standard, a road connecting multiple states (function) is a national highway (administrative), which needs to have two or four lanes and an asphalt concrete surfacing (technical design standard). It is not known to the team how this classification applies to international highways.

[45] This analysis is based on the documents shared by the Public Works and the team preparing the plan. The final version of the standards may differ from the one reviewed.

Table 37: Asian and ASEAN Highway Networks in Myanmar
(km)

Asian Highway	ASEAN	Route	Length	Below Class III	Missing Link
AH1	AH1	Myawaddy (Thailand)–Thaton–Yangon–Meiktila–Mandalay–Tamu (India)	1,656	448	
AH2	AH2	Tachileik (Thailand)–Kengtong–Loilen–Meiktila	807	457	
AH3	AH3	Kengtong–Mongla (PRC)	93		
AH14	AH14	Muse (PRC)–Lashio–Hsipaw–Mandalay	453		
	AH 111	Loilen–Hsipaw	239	239	
	AH 112	Thaton–Mawlamyine–Dawei–Lenya–Kawthoung/Mawtaung	1,145	981	60
	AH 123	Dawei–Maesamee Pass (Thailand)	141	141	
Total			**4,534**	**2,266**	**60**

AH = Asian/ASEAN Highway, ASEAN = Association of Southeast Asian Nations, km = kilometer, PRC = People's Republic of China.

Source: Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar*. Naypyitaw.

Table 38: Greater Mekong Subregion Highway Network in Myanmar
(km)

GMS	Route	Length
R3	Tachileik (Thailand)–Kengtong–Mongla (PRC) (overlap AH2+AH3)	257
R4	Muse (PRC)–Lashio (overlap AH14)	176
R7	Kengtong–Loilen–Hsipaw–Lashio (overlap AH2+AH14+AH111)	666
Total		**1,099**

AH = Asian/ASEAN Highway, GMS = Greater Mekong Subregion, km = kilometer, PRC = People's Republic of China.

Source: Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar*. Naypyitaw.

Table 39: Tripartite Highway Network in Myanmar
(km)

Tripartite	Route	Length
Tripartite Highway	Tamu–Kalaywa–Chaungma–Lingadaw–Pakokku–Theegone–Nay Pyi Taw–Payagyi–Thaton–Hpa An–Myawaddy (partial overlap AH1)	1,285
Total		**1,285**

AH = Asian/ASEAN Highway, km = kilometer.

Source: Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar*. Naypyitaw.

Table 40: New Trunk Road Classification System

Administrative Class	Description	Pavement
Expressway	High-speed road with access control	AC
National Highway	Road connecting multiple states and regions	AC
Regional/State Road	Road within a state or region	AC
District Road	Road within a district	DBST / Penetration Macadam
Township Road	Road within a township	DBST / WBM / Gravel

AC = asphalt concrete, DBST = double bitumen surface treatment, WBM = water-bound macadam.

Source: Korea International Cooperation Agency. 2014. *Master Plan for Arterial Road Network Development in Myanmar*. Naypyitaw.

Table 41: **Previous and New Design Standards**

	Previous Standard		New Standard	
	Lanes	Lane Width (m)	Lane Width (m)	Pavement Type
Expressway (EW)	6	3.66 (12 ft)	3.60	AC/CC
International Communication Road (IC)	4	3.66 (12 ft)	3.50	AC/CC
Union Road (UR)	4	3.66 (12 ft)	3.50	AC/CC
State/Regional Road (SR)	2	2.74 (9 ft)	3.50	AC/CC
District Road (DR)	1	4.88 (16 ft)	3.25	DBST/PM
Township Roads (TR)	1	3.66 (12 ft)	3.00	DBST/WBM/GR

AC = asphalt concrete, CC = cement concrete, DBST = double bitumen surface treatment, ft = feet, GR = gravel, m = meter, PM = [bituminous] penetration macadam, WBM = water-bound macadam.

Source: ADB estimates based on Ministry of Construction information regarding historic design standards, and Korea International Cooperation Agency. 2014. *Master Plan for Arterial Road Network Development in Myanmar*. Naypyitaw.

The new classification also links road design standards to the administrative class. The established design practice in PW/DOH has been based on MOC geometric design standards (1969) and on Overseas Road Note 29[46] for rigid pavement and Overseas Road Note 31 for bituminous pavement design.[47] New design standards were prepared in 2015 with assistance from the Korea International Cooperation Agency based on the American Association of State Highway and Transportation Officials and Republic of Korea standards. Under the new design standards, the lane width and the surface type are determined by the administrative class of a road. Asphat concrete is prescribed for all international connectivity roads, union roads, and state and/or regional roads (Table 41). This standard implies a move away from penetration macadam, the predominant pavement type in the trunk road network.

Analysis and Suggestions

The new classification and standards may lead to overinvestment and reduce the scope for efficient planning. Under the new classification system, some technical characteristics such as lane width depend on the administrative class, while others such as the number of lanes depend on the traffic volumes. This results in a mix of technical and administrative classification principles (including the classification of expressways as an administrative class). It may cause inappropriate technical standards to be applied in certain cases (e.g., asphalt concrete for state and/or regional roads with low traffic volumes, or penetration macadam for district roads with high traffic volumes). It may also make planning more difficult because of the link between functional, administrative, and technical class, it seems most roads should be considered underclass, requiring immediate upgrade.

Preferably, technical and administrative standards should be made independent. The administrative classification should remain linked to the function of the road. The purpose is to allocate the responsibility for funding and management of the road to those having the most interest. The technical classification system should depend on traffic volumes, and determines necessary width, surface type, number of lanes, etc. In such a system, the Yangon–Mandalay expressway would administratively be classified as a National Highway under the responsibility of the central government, but technically be classified as an Expressway with high

[46] Overseas Centre. Transport Research Laboratory. 1970. *Overseas Road Note 29 (3rd ed.). A Guide to the Structural Design of Pavements for New Roads*. Crowthorne, Berkshire.

[47] Footnote 23.

speeds and access control. At the early stages of network development, planning should attempt to make all roads meet their necessary technical classifications. This is the most cost-efficient way to allocate resources, and can remain the leading planning strategy. At some point, planning can target to bring all roads of a given functional and/or administrative class to similar technical standards (e.g., targeting to connect all townships with a Class III road), but this is less economically efficient and is based more on equity considerations. Such dual classification systems and planning strategies have been extensively used in the PRC. However, technical and administrative standards can never be fully aligned, even in a developed country.[48]

PW/DOH should take the lead in establishing a single road classification system applicable to other ministries (rural) and committees and/or councils (urban). The new classification system appears to create some overlap in responsibilities with the Ministry of Agriculture, Livestock and Irrigation (MOALI), which is responsible for rural roads linking villages to the township capitals. Under the new classification, such roads would be classified as township roads and form part of the trunk road network under the responsibility of the region and/or states, and would be managed by PW/DOH. A national road classification system classifying all roads would be preferable, avoiding such overlap and clarifying responsibilities between different ministries and councils.

PW/DOH could also attempt using a unified definition of the international highway network. The various international highways signed up to by Myanmar largely overlap, but follow slightly different alignments in some cases. The improvement of these parallel highway networks is putting an unnecessary burden on the trunk road budget, limiting the funding available for other trunk roads. A coordinated approach would allow the selection of a single international highway network complemented by additional links to nearby cities, facilitating planning and freeing up funds for other trunk roads. MOC would have to propose the changes to the international bodies.

For instance, Myanmar could propose revising the alignment of the Northern and East–West GMS corridors. In 2012, a review of the corridors[49] proposed that the Myanmar section of the Northern corridor could run from Muse to Mandalay and then South to Yangon (instead of heading to Tamu), and that the Myanmar section of the East–West corridor could run from Myawaddy to Payagyi where it would connect with the Northern Corridor[50] (instead of heading to Mawlamyine). These changes would make the GMS corridors run along Asian Highways (AH1 and AH14), align GMS corridors with Myanmar's most important international transport corridors, and eliminate duplicate alignments. A similar review of the Tripartite Highway would be useful, particularly to eliminate the duplicate sections south of Tamu and along the expressway South of Taungoo.

Maintenance Standards

Although maintenance standards exist, these are not properly harmonized and adapted to the context of Myanmar. PW/DOH has a *Road Maintenance Manual* that was prepared in 1982, describing the different steps in the maintenance of different road types and road elements. *Road Maintenance Standards* were also prepared for PW/DOH in 2012, but these are an almost exact copy of the *Maintenance Standards for Road and Bridge Works* prepared as part of the *Botswana Roads Maintenance Manual*. These two documents need to be reviewed and harmonized, properly adapting the standards to the Myanmar context, including the significant

[48] For instance, roads with local interest may have high traffic volumes, justifying a high technical standard.
[49] ADB. 2012. *Initial Review of the Greater Mekong Subregion Transport Sector Strategy, 2006–2015.* Manila.
[50] It could also end at Yangon, the Payagyi to Yangon section becoming common to the two corridors.

changes in the road sector in the past decade (new pavements, higher traffic volumes, use of equipment, etc.). Maintenance standards should identify the different maintenance activities and set standards for the required condition of the related road elements, possibly including different standards for different road classes. These performance standards would subsequently need to be achieved by PW/DOH staff and private sector contractors alike. The maintenance standards should also provide guidance on estimating maintenance needs and preparing maintenance plans. The maintenance manual would complement the standards and provide information on how to carry out the different maintenance activities, how to select and check materials, how to avoid damage to the road, and how to carry out complementary activities such as traffic control.

4.3 Implementation of Works

Design Phase

Geometric and pavement designs are generally carried out by PW/DOH, which has limited capacity to carry out the work. Geometric designs for roads are carried out by the Design Branch under the Roads Section of PW/DOH. Pavement designs for large works are carried out by the Road Research Laboratory (RRL) under the Roads Section of PW/DOH that has offices in Yangon and Mandalay, and road projects without geometric changes may be fully prepared by them. Simple pavement designs are sometimes carried out by the construction units under PW/DOH or build–operate–transfer (BOT) contractors. Bridge substructure designs are prepared by the Design Branch of the Bridge Section under PW/DOH, which has staff in Yangon and Naypyitaw. Design of the bridge superstructure is generally tendered out together with the provision of the necessary materials. The capacity of the design branches and laboratories is quite limited, especially since designs are carried out by hand.

PW/DOH could aim to generalize the use of designs for all major works, including periodic maintenance and rehabilitation, and tender out the larger ones. Initially, PW/DOH could seek to scale up its in-house capacity (RRL and the Design Branch) to carry out simple design works (e.g., all pavement rehabilitation). The volume of design work is expected to increase quickly. To alleviate the burden on the PW/DOH units, larger design works could be tendered out to consultancy firms, opening up to international competition. In time, a decision should be made to tender out most design activities, in line with international practices.

Construction Phase

Construction and improvement works for roads and bridges have been mostly carried out through force account by construction units under PW/DOH. There are five special project and subproject units and 32 special construction units (16 for roads and 16 for bridges) under the Road and Bridge Sections of the Works Division of PW/DOH. All construction and improvement works financed from the budgets of PW/DOH or the states and regions are carried out by these construction units. Private sector involvement in road construction and improvement is almost exclusively through BOT contracts (section V).

The construction units vary greatly in size and capacity, from small labor-based units to large specialized bridge construction units. The different construction units have differing capacities, with estimated asset values of most units varying from $0.1 million to $1 million, and two large bridge construction units with $12 million and $28 million each. As a result, the type of works they carry out and the quality levels they can achieve are very different. Many of the smaller units only carry out basic works, while the large bridge units are involved in complex bridge construction. Field observations suggest that even PW/DOH's larger road

construction units use little equipment, even for major construction works, and rely instead on large numbers of hired temporary workers.

Since most works have been carried out in-house, PW/DOH is not familiar with open procurement, contract management, and independent supervision. MOC has in the past developed its own set of procurement guidelines, but these have been mainly used for equipment and material procurement, rather than for works. PW/DOH staff is accustomed to directing workers to carry out small works, but is not accustomed to acting as the client in a contract, or as an independent engineer in charge of supervision. BOT contractors work without field supervision, and PW/DOH is only involved in works acceptance. PW/DOH lacks the basic processes for managing contracts with the private sector, and the local consulting industry has not yet developed the necessary supervision skills.

Contracting out and open procurement of construction works seems to be a much-needed and high-priority reform. Myanmar stands out with its practice of carrying out most construction works with in-house units of PW/DOH, whereas this practice was discontinued in other countries.[51] International experience suggests that the private sector is more able than the government to deliver construction works, having more flexibility to scale-up to meet needs, increased incentives to keep costs down and quality high, and greater ability to connect with international expertise and technology. MOC has indicated its desire to implement this reform, which is fully supported by this review.

This reform will significantly alter PW/DOH's established practices. The reform will result in the need for new procedures and systems, especially for procurement, contract management, and supervision. A detailed review of MOC procurement guidelines is necessary. Rather than slowly develop an efficient set of bidding documents, MOC could look into the ones used by international donors (e.g., the bidding documents for small works). Preferably, the government could prepare a national procurement law, rather than leave it to each ministry to define its practices. As the volume of procurement rapidly increases with the planned reforms, PW/DOH will need at least a simple contract management system. PW/DOH has the necessary staff to supervise works directly, but they will need training to become efficient in contract supervision. RRL does not have the capacity to carry out materials testing (or verification of contractors' laboratories) for all works. A network of testing laboratories is needed. These may be branches of RRL, but it may be more efficient to invite the private sector to carry out this function (this may attract international investment). Proper guidelines for contract management and supervision are also required, given that these are new activities for PW/DOH staff. Initially, PW/DOH will need to set up a procurement unit to manage procurement and contract management.

Through its technical assistance for Transport Sector Reform and Modernization, ADB is providing support in preparing an action plan for rolling out this reform. In parallel, donor-financed projects should be considered as opportunities to develop new practices and train staff. The staff involved in ADB and other donor projects could become the core of PW/DOH's future procurement team.

Maintenance

Maintenance of the trunk road network is largely carried out through force account. Distinction is made between routine maintenance, special maintenance (periodic maintenance), and special repairs (emergency maintenance). In case of smaller maintenance works, the work is carried out by the PW/DOH staff in district and township offices under the Repair and Maintenance Division of PW/DOH. These offices have basic

[51] For instance, the PRC corporatized all its road construction units in the 1990s and started open bidding.

equipment such as dump trucks, rollers, and excavators. Additional temporary workers are hired as needed, mainly for off-carriageway maintenance. Only material provision is tendered out. In case of larger works (including asphalt concrete repairs), the implementation is carried out by one of the construction units under the Works Division of PW/DOH. In case of bridges, maintenance works tend to be carried out by the bridge construction units. Private sector companies are only involved in cases of BOT contracts (section V).

The maintenance staff under PW/DOH could be corporatized into medium-sized maintenance companies. With approximately 8,000 staff positions under the Repair and Maintenance Division of PW/DOH involved in road maintenance implementation, as well as 2,900 staff under the Mechanical Section responsible for managing maintenance equipment, there is ample scope for corporatization. Corporatization and outsourcing of maintenance works is a very common practice internationally. It separates regulation and/management from execution and brings better value for money, and because of this, it has been a common step in road agency reforms.

Given the type of experience and skills of the staff members and the equipment available to them, the creation of medium-sized companies capable of carrying out routine maintenance and minor special maintenance is recommended. Such maintenance companies may be based on the current district offices, as equipment and works tend to be managed at this level. This would result in approximately 60 companies, whereby some may be joined together and others may be split according to specific circumstances in the different districts. The corporatization would only involve the staff from local offices involved in implementation (mainly those at township level), with some staff remaining to carry out the overall management on behalf of PW/DOH and the states and/or regions (mainly staff at district level and state and/or regional level). Staff from the Mechanical Section may also be involved in the corporatization to a certain extent. As such, the corporatization would involve around 8,000 staff of the total 10,000 staff under the Repair and Maintenance Division, resulting in companies with some 100–150 staff members. With the corporatization of maintenance equipment, some of the staff from the mechanical section may also be corporatized together with the maintenance units. An alternative approach in some cases may be to allow existing private sector companies to take over PW/DOH maintenance staff and equipment. Incorporation of some staff into the corporatized construction units may also be an option.

Maintenance of the Yangon–Mandalay expressway is carried out by PW/DOH staff. This staff cohort does not form part of the Repair and Maintenance Division but is organized into a separate Yangon–Mandalay Expressway Maintenance Group. Both toll collection and maintenance are carried out by the same unit. PW/DOH does not plan to corporatize the Yangon–Mandalay Expressway Maintenance Group, stating that the expressway tolls are not sufficient to allow contracting out of works. However, expressway maintenance contracts can be subsidized by PW/DOH, as is currently happening with the works carried out by the Yangon–Mandalay Expressway Maintenance Group. Given that the Yangon–Mandalay Expressway Maintenance Group has a much higher capacity than the regular PW/DOH maintenance units, combining its corporatization with that of the construction units is recommended.

Should PW/DOH corporatize its maintenance units, it would need to set up new contractual arrangements. Initially, contracts would likely be awarded directly to the same units of PW/DOH, but over time they would be tendered out. Options for contracting modalities include traditional volume-based maintenance contracts, performance-based maintenance contracts, or term-based maintenance contracts, and even maintenance concessions along the line of BOT contracts. The latter three options also lend themselves to multi-annual contracting, something that has yet to be introduced in Myanmar. A detailed review of options is required to allow PW/DOH to select the modalities that are considered most appropriate to the (changing) context in Myanmar.

4.4 Quality of Works

Construction and Improvements

Most construction and improvement works are carried out using labor-based methods. Most road improvement works carried out by PW/DOH and BOT contractors, consist of constructing a penetration macadam pavement, often involving widening of the existing pavement. This work is carried out by hand (hand-laid penetration macadam).[52] Crushed stone and other aggregates as well as drums with bitumen are often transported to the road by truck. Transport and spreading of the crushed stone aggregate from the roadside is done by hand. The bitumen is heated along the side of the road by lighting fires under the drums. Heated bitumen is then transported to the road and spread by hand. Compaction is done using steel drum rollers. Except for long-distance transport and compaction, almost all activities are carried out by hand.

The preparation of the subbase and base in the case of widening is often not carried out properly. The thickness and compaction of these layers is generally insufficient. Generally, only large steel drum rollers are used, complicating compaction of subbase and base in case of limited widening. This results in uneven settling between the existing pavement and the widened pavement, leading to premature failure. This type of failure is very common in Myanmar, both for roads constructed by PW/DOH and by BOT contractors.

Improper spreading of the aggregate material is causing an uneven surface (even after compaction), increasing the roughness of the road. Although standards recommend the use of level lines and hand packing of the aggregate to reduce unevenness and improve compaction and interlocking, this was only witnessed in one case. Issues were also found with the "keystone" layer placed both before and after the spreading of bitumen, reducing the mixing and interlocking of the macadam aggregates and the bitumen. The specifications furthermore stipulate the use of pneumatic rollers to improve kneading and interlocking, but these were not witnessed at any of the sites visited.

Although the research laboratories are involved in quality control in some larger projects, most projects appear to lack proper quality control and supervision. In the case of BOT contracts, it is not clear to which degree supervision and inspection of improvement works is carried out by PW/DOH. For works that it recommends, PW/DOH acts both as contractor and supervisor, undermining the concept of independent supervision. Supervision and quality control capacity is recommended, preferably through the hiring of independent supervision consultants. This will become even more important as more works are tendered out. The contract documents for BOT contracts and other contracted works will need to include proper quality indicators to facilitate inspections and ensure that a higher level of quality is attained.

The heating of bitumen over fires has serious environmental implications and negatively affects the quality. The heating of bitumen in drums over wood fires is practiced by both PW/DOH and BOT contractors. Apart from the burning of firewood (10–15 tons per mile), the spillage of bitumen can have a serious effect on the environment, especially where this is close to a water course. The heating of bitumen over fires also rapidly leads to overheating, causing the bitumen to evaporate faster and become brittle sooner. The use of bitumen tanker and/or sprayers with built-in heating elements (either truck or trailer mounted) could avoid such detrimental impact.

[52] Penetration macadam can also be laid by machines.

Figure 22: **Defects Observed in Widening Works**

Figure 23: **Spreading of Aggregate**

Maintenance

The quality of maintenance carried out by PW/DOH is quite good, but works tend to be small-scale and reactive rather than preventive in nature. Despite having had only limited funding, equipment, and materials in the past, the PW/DOH staff has been able to do a relatively good job in providing basic maintenance. Pavement patching is generally carried out a few times a year by a team of workers traveling in a vehicle with a premixed bitumen-crushed stone mix. Potholes are properly squared and excavated before patching. Additional temporary workers are hired to assist in vegetation control and drainage clearing. Although seals are applied, this does not appear to be frequent enough. Overlays are only applied in roads in poor condition. As such, the maintenance is mainly reactive, and little preventive maintenance takes place.

Figure 24: **Heating of Bitumen**

Figure 25: **Pothole Patching in Build–Operate–Transfer Contracts**

The quality of maintenance work under BOT contracts tends to be poor. In many BOT contracts, the maintenance is of very poor quality, with patching carried out by simply putting a bitumen-stone mix in the pothole (without squaring, and compacting by foot only). Crack sealing is not carried out, and drain cleaning and vegetation control is carried out infrequently. The condition of the Lashio–Muse road section, for instance, which forms part of the main route to the PRC, has one of the highest traffic levels in Myanmar, and one of the first BOT contracts, was found to be very poor. In part, the poor maintenance performance of BOT contracts is due to the low profitability of most BOT contracts and the lack of clear maintenance standards in the contract documents (see also section V).

Table 42: **Ministry of Construction Highway Maintenance Expenditure Composition**
(April–November 2014, $ million)

	Total Spent	Share of Total (%)
Widening	2.6	8
Overlay	8.3	26
Leveling and sealing	8.4	26
Patching	1.5	5
Timber bridge	1.1	3
R.C. bridge	1.7	5
Retaining wall	2.2	7
Others	6.3	20
Total	**32.2**	**100**

Source: ADB estimates based on Ministry of Construction data.

5 Increasing the Contribution of Toll Roads

Key Findings and Suggestions

Findings

Myanmar tolls 22,000 km of road, including 5,545 km that are privately managed build–operate–transfer (BOT) contracts. This is an exceptional achievement among developing countries.

While all key trunk roads are locked into 40-year BOT contracts, the BOT model is severely flawed. Contracts are not enforceable, investments that are viable for financing are minimal, and performance is generally poor. While user payments are large ($120 million a year), they are not getting value for money. As it stands, the BOT model would hamper the modernization of the road network where it matters most.

Of the trunk roads, 16,500 kilometers (km) are covered by toll gates where revenues are "auctioned" out. In practice, the system amounts more to a lottery and has high collection costs. There is no proper link between revenues and costs. Most toll gates barely generate any revenue.

Suggestions

The BOT model has much value. It should be preserved, but needs to undergo substantial improvement. Tolls should be raised, investment requirements should be made more realistic, contracts should be improved to provide good performance incentives, competition needs to be introduced, and supervision by the Public Works/Department of Highways (PW/DOH) needs to be strengthened. BOT contractors would then make reasonable profits, and have the resources to finance quality upgrading and maintenance. Potentially, BOT contractors could finance most of the needed modernization works on Myanmar's key corridors.

The most workable way to deliver this change is to propose to all contractors to transfer to a new regime, on the basis of an objective audit and financial model. A more radical approach would see the cancellation of all contracts and their bidding on new terms.

Some roads would still be unsuitable for tolling on a cost-recovery basis. We put the threshold at about 1,000 vehicles per day, a limit that only 4,000 km roads met in 2013. Other contracting modalities, such as performance-based contracts, could be considered for these roads.

When a fuel tax is implemented, we suggest canceling all auctioned toll gates. This is because as a tax collection mechanism, tolling is less efficient than a fuel tax (section 2). Until then, the "auction" model could be transformed into a proper auction system, whereby candidates bid on the basis of the highest payment to the government.

Myanmar is unique in respect to the extent to which it uses toll roads, particularly privately managed toll roads under build–operate–transfer (BOT) arrangements. The first BOT contracts were signed in 1996 for the Mandalay–Lashio–Muse road (AH14). There are currently 28 national BOT contractors covering 5,545 kilometers (km) of trunk roads, comprising 30% of the trunk road network managed by the Public Works/Department of Highways (PW/DOH). This is a significant achievement compared with other countries. Myanmar also routinely tolls the highways built with public funds. The Yangon–Mandalay expressway now generates more than $11 million in annual revenues for PW/DOH. Other publicly tolled roads—under a somewhat curious "auction" model—raise much lower revenues. Myanmar also tolls its main bridges.

Almost all of Myanmar's highways are tolled, and most of those with significant traffic are under BOT contracts. From toll gate data, we estimate that 90% of the roads with more than 1,000 vehicles a day, not including the expressway, are under BOT contracts. These roads are the ones that most urgently need upgrading and require the highest maintenance investments.

This section reviews the BOT and "auction" road programs to answer the following questions:

- Can the current BOT contracts be implemented?
- Will the current BOT model deliver needed investments and quality at the expected level?
- If not, should it be kept? What could be done to improve it?
- How efficient is the "auction" model?
- Considering needs and revenues, what type of roads should be tolled? How?
- How can the change to a new model be managed?

This section does not deal with tolling policy—the structure and level of the charges—which is discussed in the section on road sector financing and analyzed in more depth in the separate Thematic Note on Review of Road User Charges.

5.1 Tolling Program Overview and Performance

PW/DOH's tolling program covers most of the trunk road network. There are currently 5,545 km of trunk roads under BOT contracts (14% of the total trunk road network, 31% of the national highway network (Table 43), and about 16,000 km of trunk roads under the "auction" toll road program. There are also 170 tolled bridges, of which 16 are BOT bridges and 154 are "auction" bridges.

Toll rates are fixed nationwide by the Production Section under the Admin Division of PW/DOH and are reviewed every 2–4 years. Toll rates are higher for BOT roads than for auctioned toll gates. BOT roads vary from $0.3 to $0.22 per km (MK5 to MK300 per mile) depending on the vehicle type. Auction gate tolls are 3–5 times lower (see Appendix 2 for a full list of toll rates).

Limited observations suggest that the performance of many BOT contracts is poor and enforcement of the contract is lacking. The main road leading to the PRC (AH14), for instance, was found to be largely in poor or bad condition,[53] despite being one of the first BOT contracts with one of the largest contractors in Myanmar.

[53] Road condition surveys carried out in 2014 revealed an average roughness index (IRI) of the section between Lashio and Muse higher than 10, reaching 15 near the border with the PRC. A level of 2–4 denotes generally good condition, 8 is poor, and at 12–15 the road is so degraded that vehicles have to slow down to about 20 kilometers per hour (kph).

Table 43: Road Lengths under Build–Operate–Transfer Contracts, 2014

State/Region	National Highways			State/Regional Highways			Total (km)
	DOH (km)	BOT (km)	Total (km)	DOH (km)	BOT (km)	Total (km)	
Kachin State	1,333.5	424.7	1,758.2	2,028.6	0.0	2,028.6	**3,786.8**
Kayah State	413.8	0.0	413.8	536.7	0.0	536.7	**950.5**
Kayin State	798.4	127.1	925.6	988.5	0.0	988.5	**1,914.1**
Chin State	687.0	0.0	687.0	1,285.1	0.0	1,285.1	**1,972.0**
Sagaing Region	1,285.9	391.9	1,677.7	2,747.1	0.0	2,747.1	**4,424.9**
Tanintharyi Region	788.6	23.9	812.5	403.1	140.8	544.0	**1,356.5**
Bago Region	614.0	684.2	1,298.1	914.4	0.0	914.4	**2,212.5**
Magway Region	708.1	616.2	1,324.3	2,195.5	0.0	2,195.5	**3,519.8**
Mandalay Region	544.4	1,075.2	1,619.6	565.3	0.0	565.3	**2,184.9**
Mon State	248.0	259.1	507.1	306.0	0.0	306.0	**813.1**
Rakhine State	691.4	137.0	828.4	1,036.6	0.0	1,036.6	**1,865.0**
Yangon Region	175.6	365.9	541.5	502.3	0.0	502.3	**1,043.9**
Shan State (East)	1,065.2	276.0	1,341.2	2,535.1	0.0	2,535.1	**3,876.3**
Shan State (South)	1,231.1	529.9	1,761.0	3,290.9	0.0	3,290.9	**5,051.9**
Shan State (North)	583.0	164.6	747.5	1,348.4	0.0	1,348.4	**2,096.0**
Ayeyarwady Region	777.1	235.6	1,012.7	1,587.7	0.0	1,587.7	**2,600.4**
Naypyitaw Union Territory	335.7	92.7	428.5	0.0	0.0	0.0	**428.5**
Total	**12,280.9**	**5,404.0**	**17,684.8**	**22,271.5**	**140.8**	**22,412.3**	**40,097.1**

BOT = build–operate–transfer, DOH = Department of Highways, km = kilometers.
Source: ADB estimates based on the Ministry of Construction data.

There have been some issues with delayed implementation and poor performance of the initial works, leading to extension approvals in some cases and contract termination in others (approximately 1,000 km of BOT contracts have been terminated). The poor performance during initial works appears to be largely caused by problems in obtaining financing for the works.

Despite initial works not having been completed, toll collection was observed in several cases. Widening of roads is not carried out as specified in the contracts. Instead, the pace and extent of widening is negotiated by DOH and the concessionaires, and depends on their financial capacity. In most cases, widening works happen later and to a lesser extent than specified.

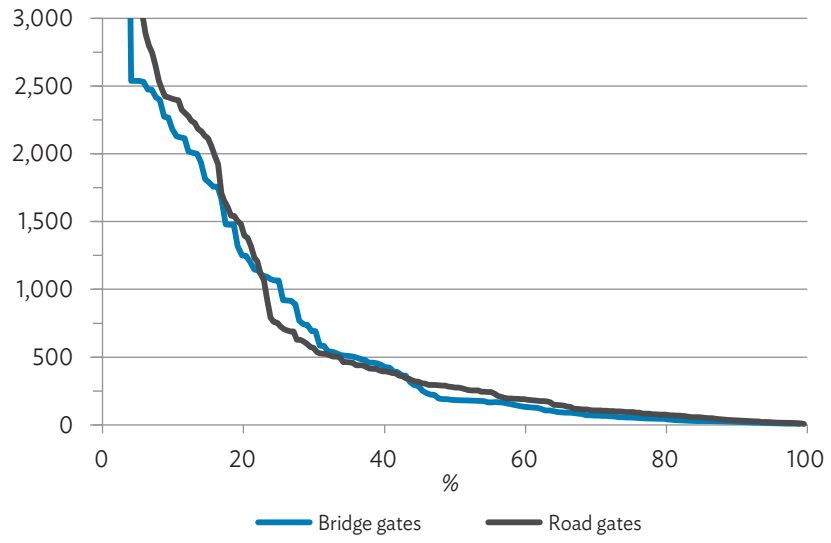
Maintenance performance in BOT contracts tends to be poor. Although patching appears to be carried out quite regularly, this cannot be said for sealing, drainage clearing, vegetation control, and landslide removal, with many instances encountered of pavement cracks, blocked drains, encroachment of vegetation, and partial blockage by landslides. Casual observations and road condition surveys carried out in 2015 suggested that maintenance may be better on roads maintained by PW/DOH than on many BOT roads.

5.2 Revenue Analysis

The tolling program generates large revenues. The tolling program generated $155 million in toll revenues in 2013. Based on available data, we estimate that the trunk road tolling program generates $125.5 million ($121.2 million collected under BOT scheme and $4.4 million under auction schemes). The bridge tolling program is estimated to generate $19.1 million ($2.8 million under auction scheme and $16.3 million under BOT scheme). The revenues associated with the Yangon to Mandalay expressway are about $10 million.[54]

However, revenues are concentrated on a small fraction of the road network with significant traffic. Only 20%–25% of toll gates register significant traffic of more than 1,000 vehicles per day (annual average daily traffic [AADT]), excluding motorcycles and bicycles that do not pay tolls. Half of the toll gates have traffic levels of less than 250 AADT, and 30% even have traffic levels below 100 AADT. Only 4% of bridge toll gates and 8% of road toll gates have a traffic level above 2,500 AADT (Figure 26). We received information on average traffic by vehicle category in 2013 for 214 road toll gates (128 managed under auction schemes, and 85 managed under BOT schemes), and 170 bridge toll gates (154 auction and 16 BOT). The road BOT program covers 5,575 km, an average length per toll gate of 66 km (41 miles). The auction road program covers 16,500 km, an average length per toll gate of 130 km (80 miles). This corresponds to a tolled network of 22,000 km.

Figure 26: **Distribution of Traffic at Toll Gates**
(AADT level in % of toll gates)



AADT = annual average daily traffic.
Source: ADB estimates using data provided by the Ministry of Construction for the study.

[54] Our calculations are based on the assumption that each road toll gate covers the same distance of 41 miles for BOT gates and 80 miles for auction gates. Large bridges (above 1,000 feet [ft]) receive higher tolls than medium-sized bridges (180–1,000 ft). These bridges were individually identified to accurately estimate revenues. These are calculations based on traffic data. No actual figure exists for BOT gates. Estimates are very close to actual figures for "auction" gates.

Road Toll Revenue Analysis

A large share of the network is covered by auction road toll gates, which generate negligible revenues. The average revenue of an auction road toll gate is $34,000. The AADT is 215 (excluding motorcycles). Almost all (96%) auction road toll gates have less than 1,000 AADT, and 94% have revenues below $100,000 a year. The 10 auction toll gates with the most traffic generate annual revenues of $175,000 to $500,000. Auction gates account for 60% of all road toll gates.

By contrast, BOT road toll gates generate significantly higher revenues. The average revenue of a BOT road toll gate is $1.4 million, and the average AADT is 1,600 vehicles per day (excluding motorcycles). Only 1% of BOT road toll gates generates less than $100,000 a year. Still, 42% of BOT road toll gates registers an AADT of less than 1,000. BOT gates account for 40% of all road gates.

Altogether, a large share of toll gates generates very little revenues. Of the tolled network, 75% has less than 1,000 AADT (Table 44). While the top 10% of the toll gates generates 77% of toll revenues, the last 50% of the network generates only 2% of toll revenue (Figure 27).

Bridge Toll Revenue Analysis

Auction bridge gates generally have little traffic, but their individual revenues are higher than those for road gates. The average revenue of an auction bridge toll gate is $106,000. The average AADT is 750. Only 20% of gates has traffic levels above 1,000 AADT and revenues above $100,000. A few have very high traffic (up to 16,000 AADT), but only four bridges generate annual revenues above $1 million, and the largest single revenue bridge generates only $2.6 million annually. All but one bridge with large span are auction bridges. Auction gates account for 90% of all bridge gates.

A few medium-sized bridges are managed under BOT agreements. The average revenue of a BOT bridge gate is $170,000. The average AADT is 2,000. Most BOT gates have traffic between 1,800 and 2,500 AADT, and annual revenues between $200,000 and 250,000. BOT gates account for 10% of all bridge gates.

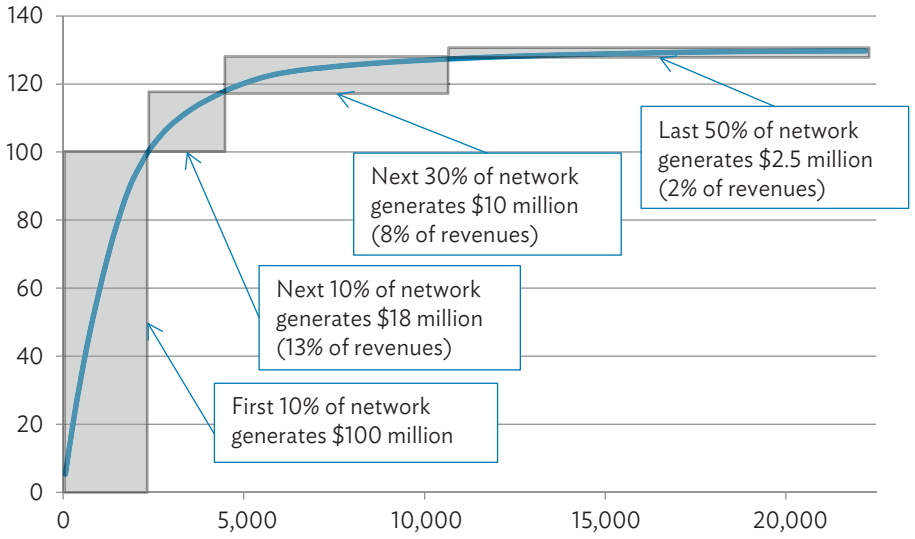
Table 44: **Analysis of Road Toll Gates Data**

	Auction	BOT	Total
Number of toll gates considered	128	85	214
Revenue estimates ($ million/year)	8.4	121.2	129.6
20% of gates with highest revenues generate... % of revenues			84%
50% of gates with lowest revenues generate... % of revenues			1.5%
Toll gates generating less than $100,000 annually in % (number)	94% (83)	1% (1)	39% (84)
Related revenues ($ million/year)	3.8	0.1	3.9
Toll gates with traffic below 1,000 AADT in % (number)	96% (123)	42% (36)	75% (159)
Related revenues ($ million/year)	6.8	14.0	20.8

AADT = annual average daily traffic, BOT = build–operate–transfer..

Source: ADB estimates using data provided by the Ministry of Construction for the study.

Figure 27: Toll Road Revenues by Network Extension
($ million, km)



km = kilometer.
Source: ADB estimates using data provided by the Ministry of Construction for the study.

Altogether, the distribution of bridge toll revenues appears similarly skewed as the road toll revenues. Large bridges contribute even more disproportionately to overall revenues: the seven largest bridges generate 50% of all revenues.

Table 45: Analysis of Bridge Toll Gates Data

	Auction	BOT	Total
Number of toll gates considered	154	16	170
Revenues estimates ($ million/year)	16.3	2.7	19.1
20% of gates with highest revenues generate... % of revenues	n/a	n/a	85%
50% of gates with lowest revenues generate... % of revenues	n/a	n/a	2%
Toll gates generating less than $100,000 annually in % (number)	82% (126)	25% (4)	76% (130)
Related revenues ($ million/year)	2.2	0.05	2.2
Toll gates with traffic less than 1,000 AADT in % (number)	80% (123)	25% (4)	75% (127)
Related revenues ($ million/year)	3.5	0.05	3.5

AADT = annual average daily traffic, BOT = build–operate–transfer, n/a = not available.
Source: ADB estimates using data provided by the Ministry of Construction for the study.

5.3 Build–Operate–Transfer Model

Under the BOT contracts, private sector contractors provide the investment funds required for improvement and widening of trunk roads, in exchange for which they are allowed to collect tolls.

Contractual template

The BOTs follow a common contractual template. This template has been revised periodically, and when doing so, existing contractors were *de facto* put under the new contract types. The version dated 2013 shared by the Public Works includes the following sections: definitions, procedure for road building (the scope of works), specifications for improvement works, a list of duties and responsibilities of the contractor and the authority that includes all the financial and risk clauses of the contract, performance guarantee, toll schedule (with rates), milestones, value of investments, supervision by PW/DOH, risk sharing, termination rules, and the procedure for amending or terminating. It includes more detailed technical specifications on investments in an annex. It does not specify the location of the toll gates, which is left to a "regional authority." The contract is between MOC and the contractor, and is not set under any specific law.

All contracts were directly awarded. Reportedly, in some cases, the government pushed contractors to accept contracts that may have seemed too risky or unprofitable, or provided unrelated compensations for taking the contracts.

Scope of Works

The BOT contracts all involve initial repair and widening works to be completed within a maximum of 3 years, followed by regular maintenance for the full contract period of 40 years, extendable to 55 years by 5-year increments. All investments are financed by the BOT contractor, who is able to collect toll revenue after completion of the initial works (in practice toll collection appears to start before the initial works are completed). Specifications relate to pavement type and width, shoulders, and embankments. These do not include safety features and do not define the road geometry, ruling out road realignments. The definition of the scope of works is generic to all contracts.

During the operational period, further widening and upgrading to asphalt concrete pavement is required if traffic volumes reach specified thresholds. These thresholds are given in Table 46.

Table 46: **Build–Operate–Transfer Contract Works Standards**

Traffic Level (AADT)	Width (feet)	Width (meter)	Lanes	Surfacing Type
200–500	18	5.4	1.5	Penetration macadam
500–1,000	22	6.6	2 (narrow)	Penetration macadam
1,000–2,500	24	7.2	2	Below 2,000 AADT: Penetration macadam Above 2,000 AADT: AC
2,500–5,000	48	14.4	4	AC
> 5,000	72	21.6	6	AC

AADT = annual average daily traffic, AC = asphalt concrete.

Source: Build–operate–transfer standard contract document provided by the Ministry of Construction.

The contractor is required to maintain the road for the full contract period. However, the contract does not include specifications regarding activities to be carried out or the standards to be achieved. The contractor is only responsible for "continuously maintaining the proper condition of the road and bridges," so that "transportation not to be cut off" and bears the "expenses of repairing."

Financial Regime

The toll rates for BOT contracts are defined in the contract document, requiring contract renegotiation in case of changes in the toll rates. In case of bridges that exceed 180 feet (ft) and that are constructed by the BOT contractor, specific toll rates are negotiated as part of the contract. Where such bridges are constructed by PW/DOH, auctioned toll gates are introduced and toll revenue goes directly to PW/DOH (after deduction of approximately 20% for toll collection).

The contractor is eligible for duty free import of equipment for the works, and can acquire materials from the government at government rates. The contractor is required to provide a performance guarantee of 1% of the estimated investment cost, which is returned upon completion of the initial works.

The contractor collects tolls after PW/DOH has accepted the initial road works. Part of the toll revenues are transferred to PW/DOH. A contractor who does not make any profit can request PW/DOH to examine the situation. Lack of profits is a legitimate reason to propose contract extension beyond 40 years.

Table 47: **Share of Build–Operate–Transfer Toll Revenue Collected by the Ministry of Construction**

Period (years)	**Percentage to MOC** (%)
1–3	0
4–13	5
14–23	10
24–33	15
34–40	20

MOC = Ministry of Construction.
Source: Ministry of Construction.

Risk Regime

Delays in achieving the contractual milestones lead to a penalty of 0.1% of the investment value per day. Failure to perform upgrading, construction, rehabilitation, and maintenance is a contractual default. Failure is determined by PW/DOH. It allows PW/DOH to terminate the contract without compensation. The contract includes a force majeure clause.

PW/DOH can order the contractor to carry out works or to remedy defects. In this case, the contractor will make a proposal, which will be accepted or corrected by PW/DOH. PW/DOH can then change the terms of the contract after reaching an agreement or by simple decision.

Conflicts are solved through a negotiation mediated by two judges chosen by the parties, and if this fails, by the arbitration of either the same judges, or by an umpire chosen by agreement of the parties.

Analysis

The BOT model in use in Myanmar as described above presents a number of unusual features by international standards, and is often far removed from best practice. Overall, the contracts in use leave excessive room for government discretion and open-ended renegotiations. This can lead to corruption, nontransparent arrangements, multiple contract renegotiations without any clear basis for renegotiating, frequent conflicts, and poor performance. Contracts in use in other countries are typically much more specific and clearly set rules when renegotiations are likely. This makes contract enforcement easier, and in the long-term significantly reduces the risks for the concessionaires, their financial costs, and ultimately the rates paid by users.[55]

Specific issues are as follows:

- **Legal basis**. Concession contracts are usually based on the government's procurement law or on a specific concession law, rather than being simple private contracts.
- **Duration**. Concession durations of 40 years or more are encountered in developed countries, but only for very large investments financed at low interest rates. Best practice sees the contract duration match with the lifetime of the investments being financed. Financing sources also matter: where interest rates are high and maturity short, such as in Myanmar, profits beyond 10 years or more are heavily discounted. Typical durations of 20–30 years are observed for new construction works in developing countries, down to 10–15 years for rehabilitation works.
- **Toll rates** are best left outside of the contract so that their change is not a contractual renegotiation. Toll rates for BOT contracts are fixed nationwide. Official posting of BOT toll rates in the contract is recommended, thus allowing toll rates to be changed without requiring all BOT contracts to be amended (although compensations may be needed).
- **Investment requirements**. Contracts rarely leave the timing and scope of works open.[56] Better definition allows concessionaires to appreciate their future costs. Many road concessions consist of only a single investment carried in the first years followed by maintenance. Long-term road management concessions, seen for instance in Brazil or in France, refer to an investment program. This investment program is then periodically updated.
- **Upgrading requirements**. The requirements for upgrading are excessive and increase risks. By comparison, engineering standards of the PRC put the minimum traffic level justifying a four-lane road at 15,000 AADT (passenger car unit equivalent) and for an eight-lane road at 60,000 AADT, rather than the thresholds of respectively 2,500 and 5,000 vehicles per day stipulated in Myanmar. The combination of the low traffic thresholds for widening and the long contract duration make it very difficult to estimate the required investments and toll revenues for the full contract period, especially in light of the significant changes taking place in Myanmar and the sudden rise in vehicle registration and traffic volumes.
- **Performance standards**. The absence of performance standards for maintenance and the lack of penalties that can be applied in case of poor performance (other than contract termination) make this part of the contract difficult to manage. Detailed performance standards and penalty rules defined within or referred to by the contract are usually the norm.
- **Termination rules**. Termination is normally done with some compensation to the concessionaire for past investments in the road, the amount of which can vary depending on the cause for termination.

[55] Consistent application of contractual rules in Brazil between 1995 and 2006 led to a major decrease in financing costs. World Bank. 2010. *Private Participation in the Road Sector in Brazil.* Washington, DC.

[56] As an exception, the *timing* of predefined capacity expansion works in some road concession contracts in Brazil is determined by a traffic trigger. Their scope is determined in advance.

- **Financial capacity**. Most contracts generally require the concessionaire to maintain minimum equity in the company that is large enough. This reduces the risk of nonperformance during the concession.
- **Supervision and reporting**. Concession contracts in Myanmar include preparing audited statements of toll revenues. In many countries, concessionaires also have to report on the condition of the road, and on their entire financial statements.
- **Financial equilibrium**. Concession contracts that leave the scope of works open, generally refer to a financial equilibrium clause. This clause typically states that the government can make contractual changes if the changes respect the financial equilibrium of the concessionaire. This concept facilitates renegotiations over additional investments or changes in tolling structure.

The contracts are not executable as they are written. Where technical standards and especially the traffic thresholds for widening are strictly enforced, none of the current BOT contracts would be financially viable. Based on the specific standards in BOT contracts, we estimate that BOT contracts would only become profitable for traffic volumes exceeding 16,500 AADT, even when future traffic growth over 40 years is taken into account (such traffic volumes do not exist in Myanmar). Low financial profitability gives incentives to shirk on investments, and is likely the main reason behind the poor quality of BOT roads. A complete change is required regarding the types of investments to be carried out through BOT contracts.

On the basis of the current toll rates, only maintenance and/or rehabilitation concessions are viable. No concession is viable for traffic levels below 750–1,000 AADT. For the lowest traffic volumes (750–1,750 vehicles per day), we find that only maintenance concessions (i.e., including periodic and routine maintenance) are financially viable. For roads with higher traffic volumes, the concessions may include rehabilitation (the threshold being about 2,000 vehicles per day) and even some limited widening (exceeding 3,500 vehicles per day).

Higher toll rates would be necessary to finance significant improvements on the basis of road tolls. Where higher toll rates and an improved toll rate structure are introduced in line with the "high rates" introduced in Table 28, more significant improvements can be carried out. Such toll rate increases are a prerequisite for the financial viability of BOT contracts, including the construction of additional lanes, and then only for traffic volumes exceeding 3,000 vehicles per day. Higher traffic volumes and toll rates also allow the duration of the BOT contract to be reduced for a particular type of investment, bringing it more in line with the expected life span of the investment concerned. Table 48 shows the minimum traffic levels needed to make concessions financially viable, depending on the scope of the works (maintenance and/or improvements), the duration of the concession ("short" durations better match the lifetime of assets and type of financing available), and the toll rates (the high toll rates match the recommendation of Table 28).

Table 48: Minimum Traffic Volumes (AADT) and Contract Durations by Investment Types

	Current Toll Rates		High Toll Rates	
Investment Type	Long Duration	Short Duration	Long Duration	Short Duration
Maintenance only	750 (20–40 years)	1,000 (10 years)		
Rehabilitation + maintenance	1,750 (40 years)	2,300 (20 years)	750 (40 years)	1,500 (10 years)
Reconstruction + limited widening	3,500 (40 years)	5,000 (20 years)	1,700 (40 years)	2,800 (15 years)
Major upgrade + widening	–	–	3,000 (40 years)	4,200 (20 years)

AADT = annual average daily traffic.

Source: ADB estimates based on model developed for the study.

The BOT regime also lacks a mechanism for matching the revenue potential of the road to the investments of the concessionaire. Concessionaires can make losses or make unjustified profits. Two mechanisms are used internationally. Open bidding equalizes in advance of costs with expected revenues. The successful bidder can be the one that (i) proposes the highest payment to the government, or the lowest subsidy (lump sum or periodical) from the government; or (ii) proposes the lowest tolls.[57] In the first option, tolls can be set nationwide, while they differ between roads in the second option. Both mechanisms ensure that the concessionaire's expected revenues are sufficient to recover the expected costs and make some profit. During the concession, the government and the contractor may have to make changes in investment requirements, toll levels, or concession duration. These changes are carried out by varying other parameters on the basis of a financial model, by applying a financial equilibrium clause.[58]

Suggestions

To solve the most critical flaws of the BOT model, it would be necessary to, at least, undertake the following:

- Shorten the concession duration;
- Increase the toll rates;
- Revise down the upgrading (widening) standards and potentially eliminate these entirely from the concession contracts (particularly if short concession durations are used);
- Introduce instead an investment plan for each contract stating the investments to be carried out in each year (or at least in the next 5–10 years) and their estimated costs;
- Include a maintenance standard and associated penalty regime;
- Make the percentage of revenue to be paid to PW/DOH variable, potentially even negative (a subsidy), so that it becomes a mechanism to equalize costs with revenues. Related regulatory practice would need to be created;
- Require the contractors to prepare audited financial statements following a common template; and
- Require minimum equity throughout the concession.

More long-lasting improvements would require the following:

- A new procurement, public–private partnership (PPP), or concession law;
- Open bidding—all contractors would have to bid for concession contracts, with the criteria for award being the payment to or required subsidy from the government; and
- Rewriting of most contractual clauses, particularly related to risk sharing.[59] In practice, it may be better to use a contract used in another country as a starting point.

Since the key trunk roads are already all locked into contracts of 40 years or more, it is crucial to consider how the transition to a better model could take place. Failure to change the existing contracts would mean that Myanmar's key trunk roads remain poorly managed for a very long time, with all the related negative effects

[57] Other mechanisms are possible, e.g., bidding on concession duration or total revenues expected (in which case, contract duration is variable).

[58] The details can be complex. The clause may seek minimum revenue for the concessionaire or a minimum rate of return on investments. The financial model can either be built on the basis of (i) the unit costs, traffic forecasts, and target rate of return as stated in the concessionaire's original bid; (ii) based on actual costs, traffic, and financial costs; or (iii) based on regulated costs and actual traffic.

[59] The previous review gives a starting point on which sections would need fixing. Many others could benefit from improvements, for instance (i) concession goods—better describe what they are and what the rights of the concessionaire are in their regard, and (ii) condition of assets before reversion—currently not specified.

on transport costs and economic growth. To enable better contracts to be introduced, PW/DOH could either renegotiate or cancel the existing contracts. Two paths are conceivable:

- **Gradual change**. PW/DOH would first launch a systematic audit of all BOTs. The review would consist of (i) an audit of the quality of the works and the maintenance, (ii) an audit of the investments carried out by the concessionaires, (iii) an analysis of their financial capacity, (iv) an analysis of investment requirements on the road, and (v) the preparation of a financial model enabling the evaluation of the past and future profitability of the contract. PW/DOH would then draft an improved version of the standard contract, including common performance standards and specific investment plans. It would require all contractors to meet the performance standard, and propose that they shift to the new contract. A transition period could be negotiated. Negotiations should be done on the basis of the financial model, using common parameters (e.g., unit costs, rate of return, traffic growth rate). Concessions with traffic levels that are too low to be financially viable could either be canceled or transformed into performance-based contracts (see below). Concessionaires who do not accept the new terms of contract would be required to meet the (tighter) performance standards and may be declared in default if they fail to do so.
- **Big bang**. PW/DOH would cancel all contracts and rebid them through open bidding, on the basis of the new contracts. Roads with the highest traffic levels would be under BOT contracts, while those with low traffic levels would be under performance-based contracts. This model has the advantage of providing a clean start for the industry, but its legality would have to be assessed. Feasibility studies for each would likely be required.

As discussed in section 2, the scope of the BOT program would likely be reduced initially from 5,500 km to about 4,000 km, as there simply are not enough roads with sufficient traffic to make BOT contracts viable.

In roads where traffic volumes do not allow for BOT contracts, alternative models to concessions could be considered. This may include output- and performance-based road contracts, where the contractor is contracted to carry out the initial works as well as all maintenance works for a certain period (generally 5–10 years, with maintenance payments according to an agreed lump sum). The contracts may be combined with toll collection to finance part of the costs involved. Such performance-based contracts have many of the same aspects as the current BOT contracts, including similar road lengths, but generally exclude investments by the private sector. Other contracting modalities, such as the traditional volume-based contracts and term-based contracts, may also be applied where conditions are appropriate. The suitability of the different contracting modalities will be strongly influenced by expected changes brought on by the corporatization of the construction and maintenance units under PW/DOH, the amendments to BOT contracts, and the changes to the financing of the trunk road sector. A detailed review is required to determine how such different modalities may fit into the changed context in Myanmar after the reform of PW/DOH.

5.4 'Auction' Toll Model

Auctioned toll gates cover almost half the trunk road network. There are currently 274 auctioned toll gates in operation in Myanmar (109 road toll gates and 165 bridge toll gates), covering 16,500 km of trunk roads (40% of the total trunk road network and almost half the trunk road network not covered by BOT contracts). We understand that tolling was initiated after some form of improvements works, as a way for PW/DOH to recoup some of the costs. In practice, most paved trunk roads are tolled, either through BOT or the auction system.

Under the model, the operation of auctioned toll gates is "auctioned" off to interested bidders. The price is fixed at 80% of the estimated traffic volume multiplied by the respective toll rates for the different vehicle types. The "auction" process consists of the selection of a maximum of 12 interested candidates through a lottery process. The performance of these 12 candidates is evaluated, and one of the candidates that pass this evaluation is selected through a second lottery process. The selected candidate pays the stipulated price to the government and if actual traffic volumes exceed 80% of the estimated traffic volume, this results in profit. The remaining 11 candidates serve as backups in case the selected candidate cannot provide the required payment or does not perform well. Seven-day traffic surveys are carried out three times a year to verify that traffic volumes are in line with estimates and to prepare the estimates for the following year. PW/DOH ensures road or bridge maintenance. Auction revenues are directly transferred to the treasury; they do not go through PW/DOH accounts.

Analysis

The award system is a lottery, not an auction; as a tax collection mechanism, its costs are high. Tax farming is used where revenues are uncertain, where the cost of monitoring and enforcement is high, and where it is necessary to give strong incentives to collectors to reduce evasion risks. Toll collection in a developing country can be a candidate for tax farming on the basis of the two last points. The first point (uncertainty) does not apply to toll roads (revenues are predictable) and especially at the national level (aggregate revenue risks are mitigated). However, a proper farming system should ensure that the government gets the best value. During an auction for tax farming, candidates usually bid on the basis of the amount they will provide to the government. This results in the highest possible revenue for the government, and minimizes collection costs. In contrast, the system currently used in Myanmar ensures that the collection costs will be on an average of 20%, which is high for a tax collection mechanism. The profits made by the toll collector could be qualified as unjust enrichment. In addition, the selection of a particular candidate is the result of pure luck, rather than on the basis of merit (best technical or financial proposal).

The system is very far from applying the user pays principle. There is no connection between the improvement or maintenance costs of PW/DOH and the revenues of the tolls, even in an aggregate manner. The revenue ($19 million) is equivalent to approximately 27% of the maintenance budget received by PW/DOH from the central government for 2014–2015 for the national highway network. It is just enough to cover routine maintenance costs of the roads concerned. The revenue is not used directly by PW/DOH, however, but is transferred to the Ministry of Finance and the national budget.

Most of the auction toll gates only have very marginal revenues. By comparison with BOT toll gates, road toll gates only generate marginal revenues. Within road toll gates, the 50% of auctioned toll gates with the lowest traffic volumes provide only 13% of total revenue. In the case of bridges, the situation is even more extreme, with the 50% of bridge toll gates with the highest traffic volumes providing 96% of the toll revenue. The very low revenue collected from the auction toll gates for the roads and bridges with the lowest traffic volumes raises the question whether toll gates are an efficient and effective means of collecting user charges in such roads, and whether it is not more appropriate to apply a different type of road user charge.

Suggestions

The "auction" system seems to result only in marginal revenues and its design is severely flawed; we see little value in keeping it. A marginal improvement would be to transform it into a proper auction system, e.g., with candidates bidding on the highest payment to the government. However, we see a greater advantage in simply terminating auctioned tolls for most of the road gates and for a large share of the bridge gates, as this would barely dent government revenues while providing very visible benefits to local users. Should the government introduce a fuel tax, the system would become redundant entirely.

This is not to say that tolling should remain limited to BOT contracts. There can be a role for publicly financed and managed investments fully repaid through tolls. The Yangon–Mandalay expressway is an example of such investment (even though revenues are still too low). In the future, PW/DOH could consider directly investing on a project basis into revenue-generating toll roads, and potentially emitting government-backed debt to finance it. This is the model commonly used in the PRC; it has enabled a great expansion of the expressway network, leveraging government equity with private debt.

6 Possible Next Steps

This policy note has identified important challenges that would need to be addressed to start modernizing Myanmar's road sector. This section gives suggestions on a medium-term approach to preparing and implementing a road network modernization program and a reform program. It also proposes ways ADB could support this agenda.

Conditions for Sector Reform and Modernization

To embark on an ambitious agenda of reform and modernization of the road sector, there must be some clarity and consensus on three points: on the need for change, on the objectives of such change, and on the elements and conditions that need to be changed. This policy note has sought to identify the limitations of the current sector financing system; institutional organization; and the business processes for choosing investments, delivering them, and maintaining assets. These limitations would need to be addressed to meet the objective of modernizing the road network. This policy note also formulated a number of suggestions on what could be changed. It is hoped that this can serve as a basis for the initial debates, despite acknowledged gaps in the analysis, e.g., on the ways to foster the development of the private sector industry or on the potential role of civil society.

While all government agencies demonstrate a clear drive to reform, it is clear that many stakeholders do not fully appreciate what corporatization, privatization, regulation, and public–private partnerships (PPPs) entail. Many have only a partial understanding of important concepts of a modern market economy, such as economic sustainability; value-for-money; the role of policy and planning; and the type of interaction between decision makers, managers, and users. For instance, initial attempts to deal with the private sector through build–operate–transfer (BOT) contracts or auctions seem more to reflect guesswork on what is "fair" than what is good value for the road agency and the users. Because of this, it will be important to be realistic regarding the pace of sector change, to devote sufficient time to awareness raising and consultations, and to consider a large capacity-building effort.

The chances of obtaining quick success would also be increased by the active participation of key sector stakeholders in designing reforms—the administration (the Ministry of Construction [MOC], planning, and finance), the state and/or regional governments, representatives of the Public Works/Department of Highways (PW/DOH) workers, the private sector industry, and very importantly, politicians from the highest level of the government and the Parliament.

Preparing a Reform Plan

Awareness raising. After the presentation of the first draft of this policy note, MOC and PW/DOH have set up a lead working group headed by the MOC permanent secretary to consider the findings and proposals. Assuming that there is interest in pursuing a number of them, the working group drafted a mandate letter. The letter

outlined the general rationale for reform, identified the broad elements that need to be changed, and required PW/DOH to prepare an action plan for Cabinet review within a given time frame. At the same time, the working group could initiate consultations with stakeholders, potentially using the report as a platform for discussions.

Reform preparation. Once there is a high-level support for the type of change proposed, two options seem possible:

- **Expert-driven**. The same working group would nominate a small team of internal experts and external consultants to propose action plans covering the main reform agendas. The experts would need to have the authority to call for support from PW/DOH's departments to prepare information, formulate proposals, or analyze them. They would also consult selected stakeholders individually or in small groups. Periodically, the experts would report to the leading group. By the end of their assigned time, they would make proposals on policy measures and action plans, which they think address the objectives, and appear reasonably consensual. Their report would then be disseminated officially, and after needed changes, be endorsed by the Cabinet (e.g., as a "white paper").
- **Consultative forum**. Under this option, a stakeholder forum would be used to form a broad consensus on reforms. A small team of experts and consultants would still be needed, but their role would be limited to (i) preparing background materials on issues and potential options, (ii) facilitating stakeholder meetings, and (iii) assisting in putting together proposals in a consistent plan. For instance, MOC could call upon a stakeholder forum, which would be a gathering of sector stakeholders, including a high-level committee (e.g., ministers, heads of private companies, head of university, governor of state, etc.). This forum would meet twice: once at the beginning of the process to set expectations, and once at the end to review and approve proposals. From the forum, MOC would create thematic working groups (e.g., institutional reform, user charges, toll roads, and the private sector) composed of representatives from each category of stakeholders. Each working group would include a rapporteur, which would likely be from DOH. The working groups would receive mandates from the high-level committee to make proposals. Working group members could be requested to make formal written contributions to the questions raised. Within a prescribed time, the working groups would convene to harmonize their draft reports, which would form the basis for the final meeting of the forum. The government would need to indicate from the beginning its willingness to generally respect the proposals of the forum. The events could receive high visibility (e.g., invitation of high-level members of the government, coverage in the media, etc.).

Both options have advantages. The first process is very manageable, but largely top–down. The second process is heavier, but can help create a very strong momentum for the reforms, which may later facilitate implementation. An intermediate form is also possible, for instance, with the expert-driven approach also including a stakeholder forum to present proposals and gather feedback.

Reform preparation could take about 6 months, from the first meetings to the approval of a draft plan. The output of the process would be a reengineering plan: a strategy document including a road map setting targets, supported by a set of action plans. To be operational, action plans should include objectives, short- or medium-term actions, milestones and schedules, and resources or inputs needed. Action plans could cover, among others, the following areas:

- Action plan for creating a Department of Highways (DOH) or Highway Authority;
- Action plan for the corporatization of delivery units;
- Action plan for decentralizing the management of lower-level trunk roads;
- Action plan for improving road sector financing;
- Action plan for restructuring toll road programs and related BOT contracts;

- Action plan for improving construction management, technology, and implementation;
- Action plan for strengthening investment planning and budgeting;
- Action plan for developing and contracting with the road industry;
- Action plan for improving maintenance management and delivery; and
- Action plan for performance-based management.

This process is supported by the ADB Transport Sector Reform and Modernization policy advisory technical assistance.

A Road Periodic Maintenance and Rehabilitation Program

MOC could also launch a nationwide Road Periodic Maintenance and Rehabilitation Program. This program would be one of the building blocks of a strategy for modernizing the trunk road network. Given Myanmar's situation, the program's main features could be as follows:

- **Objectives**. The program would aim to bring Myanmar's trunk road network up to a good condition in the most cost-effective manner. One of the main elements would be the gradual generalization of modern surfacing techniques, particularly asphalt concrete and equipment-laid surface dressing, as well as improved maintenance management. Key result indicators could include (i) the average roughness of the road network, (ii) the share of the network being resurfaced annually, and (iii) the share of estimated long-term periodic maintenance and rehabilitation needs being financed.
- **Scope**. The program would include the periodic maintenance (e.g., asphalt overlays) and the rehabilitation and/or strengthening of road pavements. To keep it manageable, works should be focused on pavements, but could include some limited improvement works, such as marginal widening, shoulder (re-)construction, safety improvements on blackspots, and short bridge rehabilitation or replacement (long bridges would not be included).
- **Financing**. Various sources of financing could be tapped. Initially, donor resources (e.g., ADB) and central government resources could be pooled to finance the program. Works for trunk roads under BOT contracts would be fully or partly financed by the concessionaires, with necessary improvements introduced to the toll program and concession contracts. In the medium term, a fuel tax could replace donor and government resources.
- **Planning and prioritizing**. MOC's road asset management strategy and system would underpin the program. Each year, MOC would select the highest priority road segments in its road database, based on traffic levels and pavement condition, following the operational priorities and broad treatment standards recommended by the strategy. Periodically (every 1 or 2 years), the Road Research Laboratory (RRL) would carry out surveys to update the road database pavement condition and traffic information. The strategy itself could be updated every 5 years. Separate planning procedures would be needed for the national and for the state and/or regional road network.
- **Technical preparation and oversight**. The task of identifying road works and scoping out needs (drawing from the priority lists) would likely fall on PW/DOH staff in local offices, while preparing designs would be under RRL. Pavement design would be easy to standardize, but RRL may need to outsource some of it and may require external technical assistance, to prepare asphalt concrete pavement design guidelines. Technical supervision could largely be done by PW/DOH staff, provided it receives sufficient training, but RRL would need to scale up its testing abilities.
- **Delivery mechanism**. When financed by the government and donors, the program would be a very good candidate for private sector delivery: works would not be technically complex to deliver or supervise, the size of the packages could likely be tailored to fit the capacity of Myanmar's

road sector industry, and because the market would be predictable, contractors would have good incentives to invest in modern equipment. PW/DOH would have to develop operational procedures for open-bidding works under the program.

In 2015, ADB agreed to consider preparing a technical assistance for DOH to prepare and build its capacity to implement such program. This technical assistance will start in 2016, and prepare for a project to be considered for approval by ADB in 2017.

Other Areas for Technical Assistance

Review of Bago–Myawaddy corridor and Mandalay–Muse corridor improvement options. A small-scale study could be launched to identify the best way to improve transport conditions on these corridors in the short term (3 years) and in the longer run. The study could cover a rapid road safety audit, a pavement rehabilitation study, and an alignment and standards improvement report. The two first components would aim to give proposals that could be immediately carried out by the government or the concessionaire. The last component would develop the scope for an improvement project, paving the way for a feasibility study. It would seek to scope out (i) the design standards for improvement works; (ii) the likely alignment; (iii) potential solutions to the main technical challenges, particularly the Nawnghkio–Gokteik section; and (iv) cost range, likely viability, and potential financing sources.

Review of Yangon–Mandalay expressway. DOH could commission an independent consultant to work with the design section and RRL to carry out a safety audit of the expressway, to identify any technical obstacles that would limit heavy trucks to use the expressway, and to recommend a program of emergency improvement works to address issues.

Capacity-building areas. Under the Maubin–Pyapon Road Rehabilitation Project, ADB is financing equipment for RRL and building improvement works for RRL and the training center, but this is expected to address only short-term needs. PW/DOH generally seems to be in need of information technology (IT) equipment. However, the limited skills of PW/DOH staff in this area (as in other government agencies), make the computerization of PW/DOH and the digitalization of its information systems a long-term objective. Because Myanmar has long been cut off from other countries' experience, the benefits of international trainings (whether delivered locally or overseas) is enormous. Road-related engineering education programs delivered in universities could benefit from a partnership with an established foreign university. The technical assistance for Preparing a Road Asset Management Program for Myanmar Roads identified the following priority training needs for PW/DOH staff:

- Creating new regular in-house training courses that include geotechnical engineering (soil and foundations), construction materials, basic highway engineering, road maintenance (management and operations), procurement and contracting, project management, and road asset management (surveying, operating the database, and management principles).
- Participation in international professional meetings and conferences. A preliminary review identified the following: participating in World Road Association's (PIARC) World Road Congress, financing postgraduate degrees in road management areas for selected staff (e.g., road asset management, road economics, and road safety), and each year sending a delegation of managers to the "Senior Road Executive Programme" that is delivered by the University of Birmingham.
- Translating (dubbing) the International Road Federation's maintenance video series and then disseminating them to PW/DOH's local staff.

APPENDIX 1
Toll Rates

Table A1: Toll Rates for Build–Operate–Transfer and Auctioned Toll Gates

Vehicle Type	Permissible Load (tons)	Road		Bridge			
		Auction (MK per mile)	BOT (MK per mile)	180–1,000 ft (MK)	1,000–5,000 ft (MK)	5,000–8,000 ft (MK)	>8,000 ft (MK)
Bicycle	n/a	0	0	0	10	15	20
Motorcycle, cart	n/a	0	0	10	50	75	100
Tricycle	0.35	2	5	20	100	150	200
Two-wheel tractor and trailer, saloon car, station wagon (under 2 tons)	2	2	5	50	150	200	300
Farm truck (2-stroke), double cab, Pajero, Prado, microbus, Super Custom	3	5	15	100	300	450	600
Pickup (passenger transport)	2.25	6	20	100	300	450	600
Light truck (4 wheels)	4	6	20	125	350	500	700
Farm truck (4-stroke)	4.5	10	30	200	500	700	900
Light truck (6 wheels, 2 axles, under 15 ft), minibus (up to 25 seats)	5.5	10	30	200	600	800	1,000
Light truck (6 wheels, 2 axles, over 15 ft)	5.5	15	75	225	1,000	1,500	2,000
Bus (26 to 35 seats)	12	10	30	200	700	1,000	1,400
Truck (6 wheels, 2 axles)—Hino, Nissan	15	20	100	250	1,500	2,000	3,000
Truck (6 wheels, 2 axles)—TE 11, TE 21, GMC, Fuso, UD Counter	15	20	100	250	1,500	2,000	3,000
Bus (36–45 seats)	16	10	50	200	700	1,000	1,400
Bus (over 46 seats)	17	12	55	210	800	1,100	1,500
Truck (6 wheels, 2 axles)	16	20	100	250	1,500	2,000	3,000
Truck (8 wheels, 3 axles)	19	25	115	275	1,800	2,500	3,500
Truck (10 wheels, 3 axles)	21	30	125	300	2,000	3,000	4,000
Truck (12 wheels, 4 axles)	25	35	150	350	3,500	5,000	7,000
Truck (14 wheels, 5 axles, all wheels must drop on the road while driving)	25	40	175	450	4,000	7,000	10,000
Truck (14 wheels, 4 axles, container with trailer)	33	45	200	550	6,000	9,000	12,000
Truck (18 wheels, 5 axles, container with trailer)	40	60	300	800	10,000	15,000	20,000
Truck (22 wheels, 6 axles, container with trailer)	48	65	350	900	11,000	16,500	22,000
Truck or express bus without cargo or passengers	n/a	20	100	250	1,500	2,000	3,000

ft = feet, MK = Myanmar kyat, n/a = not applicable.
Source: Ministry of Construction.

APPENDIX 2
National Transport Development Plan

Table A2.1: National Transport Development Plan (Roads)

Priority	ASEAN/GMS Highway	Location	Length (km)	Activity	Budget (MK billion)			
					Up to 2015	2016–2020	2021–2030	Total
1		Yangon–Mandalay Expressway	50	Expressway improvement	193	483	0	676
	AH1	Yangon–Bago	50	Road widening	0	0	84	84
	AH1+AH2	Bago–Mandalay	604	Road widening	0	0	880	880
		Yangon City–Thilawa Port	50	Expressway construction	0	243	0	243
		Yangon City–Hanthawaddy–existing expressway	80	Expressway construction	0	0	388	388
		Yangon–Pyay–Mandalay	782	Road widening	0	0	1,139	1,139
	AH1+AH112	Payagyi–Mawlamyine–Thanbuzayat	270	Road widening	0	0	393	393
	AH1	Thaton–Eindu–Kawkareik–Myawaddy (Thailand)	198	Road improvement	0	192	0	192
		Yangon–Pathein	128	Road improvement	0	0	124	124
	AH14/R4+R5	Mandalay–Lashio–Muse (PRC)	459	Road improvement	0	0	440	440
2		Mandalay Circular Expressway	70	Expressway construction	0	0	340	340
		Mandalay–Thabeikkyin–Tagaung–Bhamo[a]	282	Road improvement	0	0	274	274
		Shwebo–Myitkyina[a]	476	Road improvement	0	0	462	462
	Tripartite	Monywa–Yargyi–Kalewa[a]	186	Road improvement	0	0	181	181
	AH1+AH2	Monywa–Pale–Gangaw–Kale[a]	311	Road improvement	0	0	302	302
		Monywa–Pathein	721	Road improvement	0	0	700	700
	AH2/R5	Taunggyi–Loilen–Kengtong[a]	677	Road improvement	110	548	0	658
		Minbu (Magway)–Ann–Kyauktaw–Sittwe[a]	477	Road improvement	0	0	463	463
	AH3/R3	Kengtong–Mongla (PRC)	93	Road improvement	0	90	0	90

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Table A2.1 *continued*

Priority	ASEAN/GMS Highway	Location	Length (km)	Activity	Budget (MK billion) Up to 2015	2016–2020	2021–2030	Total
3		Loikaw–Magway	380	Road improvement	0	0	363	363
	AH123	Tanintharyi (Lenya)–Mawtaung	110	Road improvement	0	0	107	107
		Thanbyuzayat–Three Pagoda Pass	104	Road improvement	0	80	21	101
	AH112	Thanbyuzayat–Dawei–Myeik–Kawthoung[a]	934	Road improvement	259	648	0	907
	AH111/R5	Thibaw (Hsipaw)–Loilen	239	Road improvement	0	0	232	232
		Taunggyi–Loikaw–Hpapun–Pha An	680	Road improvement	0	0	660	660
	AH123	Dawei–Maesamee pass (Thailand)	132	Road improvement	0	0	128	128
		Hpasawng–Pyay	300	Road improvement	0	0	283	283
Total			**8,843**		**562**	**2,284**	**7,964**	**10,810**

AH = Asian/ASEAN Highway, ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, GMS = Greater Mekong Subregion, km = kilometer, MK = Myanmar kyat.

[a] Priorities that are also listed in the 30-Year Road Development Plan.

Source: Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar*. Naypyitaw.

Table A2.2: National Transport Development Plan (Bridges)

Priority	ASEAN/GMS Highway	Location	Length (m)	Activity	Budget (MK billion) Up to 2015	2016–2020	2021–2030	Total
1	AH1	2 bridges on Yangon–Mandalay	100+100	Bridge replacement	0	10	0	10
	AH1	Don Tha Mi and Naung Lon Bridge	200+120	Bridge replacement	0	16	0	16
	AH1	Gyaing (Kawkareik) Bridge	450	Bridge replacement	0	21	0	21
		Gyaing (Zarthapyin) Bridge	870	Bridge replacement	0	34	0	34
		Chaungnitkwa Bridge	360	Bridge construction	0	0	14	14
		Hlaing River Bridge	1,200	Bridge construction	0	0	58	58
	AH14/R4+R5	New Goat Twin Viaduct	910	Bridge construction	0	0	35	35
		Thetkal Thoung Bridge	760	Bridge construction	0	0	29	29
2		Yaw Chaung (Yepyar) Bridge	1,000	Bridge replacement	0	0	39	39
		Chindwin (Kalaywa) Bridge	600	Bridge construction	0	0	23	23
		Yaw Chaung (Ohn Taw) Bridge	760	Bridge replacement	0	0	29	29
		Hinthata Bridge	3,620	Bridge replacement	0	141	0	141
3		Tha Mouk Bridge	350	Bridge construction	0	0	14	14
		Atran Bridge	433	Bridge replacement	0	17	0	17
	AH112	Thanlwin (Chaungsone) Bridge	600	Bridge construction	0	0	23	23
Total			**12,433**		**0**	**239**	**264**	**503**

AH = Asian/ASEAN Highway, ASEAN = Association of Southeast Asian Nations, GMS = Greater Mekong Subregion, m = meter, MK = Myanmar kyat.

Source: Japan International Cooperation Agency. 2014. *The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar*. Naypyitaw.

Myanmar Transport Sector Policy Note

Trunk Roads

Better transport is essential to Myanmar's development. After decades of underinvestment, Myanmar's transport infrastructure lags behind other regional countries. Sixty percent of trunk highways and most of the railways need maintenance or rehabilitation. River infrastructure does not exist, while 20 million people lack basic road access. Can the transport sector deliver upon the master plan's objectives? What is needed to improve the quality of the infrastructure and services for the industry? How can basic transport services be provided to all? How can Myanmar reduce the economic and social cost of transport? This report is an attempt to answer these questions.

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