MYANMAR TRANSPORT SECTOR POLICY NOTE

RURAL ROADS AND ACCESS

ASIAN DEVELOPMENT BANK

50 YEARS

ADB

MYANMAR TRANSPORT SECTOR POLICY NOTE

RURAL ROADS AND ACCESS

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. Toward 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 policy making, 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.

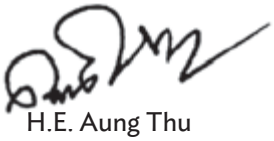
The research was organized by ADB and the then Ministry of Transport, with the active participation of the Ministry of Construction and the then Ministry of Railway Transportation. A working group comprising senior staff from these government ministries guided preparation. The work stretched over the 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 policy makers and other key stakeholders in the transport sector.

H.E. Thant Sin Maung
Union Minister
Ministry of Transport
and Communications



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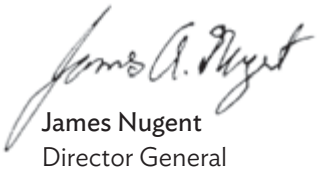

James Nugent
Director General
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Acknowledgments

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.

The notes benefited from advice and suggestions from ADB peer reviewers and colleagues including James Leather, Steve Lewis-Workman, Masahiro Nishimura, Markus Roesner, David Salter, Nana Soetantri, and Fergal Trace. Angelica Luz Fernando coordinated the publication of the reports. The editing and typesetting team, comprising Hammed Bolotaolo, Corazon Desuasido, Joanne Gerber, Joseph Manglicmot, Larson Moth, Principe Nicdao, Kate Tighe-Pigott, Maricris Tobias, and Alvin Tubio greatly enhanced the reports.

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

ADB	–	Asian Development Bank
ARAMP	–	Annual Road Asset Management Plan (Nepal)
CDC	–	city development committee
DDA	–	Department of Development Affairs
DPBANRD	–	Department of Progress of Border Areas and National Races Development
DRCN	–	District Road Core Network (Nepal)
DRD	–	Department of Rural Development
MLFRD	–	Ministry of Livestock, Fisheries and Rural Development
MOALI	–	Ministry of Agriculture, Livestock and Irrigation
MOBA	–	Ministry of Border Affairs
MOC	–	Ministry of Construction
NCDP	–	National Comprehensive Development Plan
PMGSY	–	Pradhan Mantri Gram Sadak Yojana (India)
RAI	–	Rural Access Index
SAD	–	self-administered division
SAZ	–	self-administered zone
TDC	–	township development committee
VDC	–	village development committee

Weights and Measures

ft	–	foot
kg	–	kilogram
km	–	kilometer (1 km ≈ 0.62 mile; 1 mile ≈ 1.61 km)
kph	–	kilometers per hour
m	–	meter
viss	–	local unit of weight, equivalent to 1.63 kg

Currency Equivalents

(as of December 2014)

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

Executive Summary

Overview

This note presents an initial review of rural access and mobility in Myanmar. Myanmar's rural poverty has been often characterized in terms of income, vulnerability, and empowerment. The causal links between poverty, agricultural development, conflict, and social outcomes have received much attention. The poor households' limited access to basic services is now well documented. However, physical access quality—e.g., whether there is a motorable road to connect a village and the nearest market, whether a pregnant woman will have access to a vehicle to take her to a health center for a checkup—has received much less attention, being largely an "invisible" issue to decision makers.

Because there is surprisingly little information available, this note has relied on a limited number of field visits, inferences from existing data, and discussions in the field and with decision makers. This note starts with a brief portrait of how poverty and rural access relate in Myanmar, and then attempts to characterize access conditions in a quantitative manner, seeking to answer three questions: **How many people have access to a motorable road? How many people have access to an all-season road? What would it take to connect all villages?** The note then reviews the type of vehicles and transport services available, and the quality of the road network to identify the most critical bottlenecks to better access (transport infrastructure and/or transport services) and the best way to tackle them. Finally, the note analyzes the way the government has been managing village roads, and the efficiency of its programs for improving and maintaining village road infrastructure. Throughout the note are proposals on what could be done and how to do so. This executive summary attempts to pull these messages together in a comprehensive proposal to improve rural access in Myanmar.

Main Findings

How Severe Are Myanmar's Rural Access and Mobility Issues?

About two-thirds of rural people in Myanmar are physically isolated during part or all of the year. There is only partial data available on how many people in Myanmar consider road access an issue, and the periodic release of household surveys do not inform on access conditions. However, it is striking that Myanmar has about 64,000 villages and only 75,000 km of all-season roads. That is barely 1 kilometer (km) of road per village, far below what would be needed to achieve universal access. This note builds a network model to estimate access levels from secondary data at the region and/or state level: road network length and type, land area, population, and number of villages. Two indicators were determined: the share of people living in villages without road access, and the share of people living more than 2 km away from an all-season road.

It was estimated that 20 million people live in villages without access to an all-season road. That is 40% of Myanmar's population, and over half of the rural population. Within this portion of the population of villages without all-season road access, about 25,000 villages and 9.2 million people were estimated to be living in villages that are not connected by any road. That translates to 40% of villages and 25% of the rural population. Without a road, people have to walk; they carry goods themselves, or on the backs of animals. Another 20,000 villages and 11.3 million people are connected by a road that is not all-season. These people may be able to use vehicles to reach the nearest township, but the link is likely to become impassable during the rainy season. That is an additional 30% of the villages and 30% of the rural population.

Seen differently, 24 million people are likely to live more than 2 km away from an all-season road. The Rural Access Index (RAI) is an internationally used indicator that shows the portion of the rural population that lives less than 2 km away from an all-season road. Myanmar's RAI is estimated at 36%, implying that 64% of the rural population has to travel more than 2 km to reach an all-season road. This indicator is stricter than simple village access levels, as it also looks at differences in access levels within the villages (taking into consideration that not all people live in the village center). There are major disparities in access between different states and regions. The RAI for Mandalay and Yangon regions is 60%, and up to 73% in Mon State, indicating relatively high levels of access. The RAI for Chin State is only 11%; for Kachin, Kayin, and Rakhine states it is 15%–18%; for Ayeyarwaddy region, Sagaing region, and Shan State it is 23%–28%; and 35%–40% in other areas. Myanmar's average RAI is the second lowest in Asia, after Afghanistan (34%). The levels of access in Chin, Kachin, and Rakhine states seem exceptionally low, lower than in any other countries, except Chad and Mali.

Links between Rural Access and Poverty in Myanmar

Isolation and poverty form a vicious cycle in Myanmar as in other countries. There is much international evidence that physically isolated people are poorer and have worse social outcomes. Isolation means limited access to basic services, to markets, and to employment opportunities. Physical isolation also limits inclusion of ethnic and other minority groups. It is telling that the worst access results are found in some of the peripheral states of Myanmar. Isolation forms a vicious cycle with poverty, as lack of access constrains economic development (because of difficult access to markets and education), which in turn keeps transport demand low (because of lack of economic reasons to travel and high transport costs). Isolation also limits the visibility of remote communities and makes them harder to reach for government programs. Because of this, such communities tend to receive less attention and funding from the government and from private investors, reducing the chances that they may break out of poverty.

Typical relationships between access and poverty are the following:

- **Agriculture.** In the absence of a road, agricultural productivity remains low, and use of fertilizers is limited. Agriculture is aimed more at subsistence, as inputs and products have to be carried on foot or by animals. There is some evidence in Myanmar that road access has led to increased use of fertilizers and higher agricultural productivity.
- **Health.** In areas visited, people requiring routine or emergency treatments had to travel 10 km or more on foot or in the back of an oxcart. Worldwide, an estimated 75% of perinatal mortality may be associated with inadequate transport. Effectiveness of medical outreach also strongly depends on rural transport.
- **Education.** People living in unconnected villages visited by the team generally had access to primary schools (located in the villages), but more than 90% of children dropped out of education after

primary school. Parents explained that daily attendance at middle school was impossible because of the time needed to walk to the township and because boarding was prohibitively expensive for them.
- **Gender.** Without road access, household members have to spend a large part of their time on transport. In areas visited by the team, this task fell disproportionately on women.

Improving rural access is necessary to reduce Myanmar's rural poverty. A broad set of conditions need to be met to foster rural development, as agricultural productivity, health, and education outcomes are not solely dependent on transport. However, minimum rural access seems to be a requirement for poverty reduction, and an enabling factor for the effectiveness of other government programs. There is a broad correlation between social outcomes and rural access, and evidence from the People's Republic of China and Viet Nam shows that in areas where rural access was improved, poverty was also significantly reduced.

What Are the Main Limiting Factors?

Myanmar has a great diversity of means of transport and transport services. The review identifies a wide array of rural transport means. Where there are no roads, particularly in hilly areas, walking, porters, mules, and horses are common. Even when there is a road, oxcarts are very important for field-to-village transport and for the "first mile" of agricultural transport. Horse-drawn carts provide valuable services in flat and dry areas, for peri-urban transport services, and to and from small markets. Motorcycles are the most numerous vehicles on village roads as soon as basic motorable tracks are established. They are able to reach villages isolated from the main roads, and are frequently hired to carry people and small freight. Bicycles and three-wheelers are used commonly for personal mobility in flat zones—Ayeyarwaddy delta and much of the dry zone. The Ayeyarwaddy delta area is very distinctive, as small boats complement road transport and provide essential rural.

Once roads are available that are motorable by four-wheel vehicles, passenger trucks (Dyna) and heavy-duty pickups (Hilux) become the most important form of rural transport. Operators are flexible and strongly demand-oriented, and the vehicles are robust, versatile, and popular. They carry up to 25–30 passengers and can also be used for freight. Formal rural buses (or minibuses) are rare or nonexistent on village-to-town routes. Services are regulated lightly by the Road Transport Administration Department: while an operating license is required, operational requirements are few for informal sector vehicles. Regulatory authorities generally do not intervene in price setting, route licensing, overloading control, or safety management on village roads. This light touch is allowing rural transport operators to respond quickly to demand, and is currently not resulting in significant safety or quality concerns.

Where villages are not connected by motorable roads, transport costs are generally extremely high. Often, there is no passenger transport at all, so people have to walk or be carried in case of emergencies. Animal power or tractors are otherwise used. Cost of freight transport is high ($2–$10 per ton-km); passenger transport costs are moderately high (¢5 per passenger-km) but travel is very slow. Motorcycles offer a fast but expensive solution to rural transport ($6 per ton-km and ¢30 per passenger-km). Three-wheelers in flat areas offer similarly fast services at a cheaper price ($1.3 per ton-km and ¢6 per passenger-km), but the highest efficiency requires high loading levels only available with high population density (20 passengers on average per trip).

Where there are motorable roads, a diverse range of rural transport services operate at what appear to be fair prices. Where passenger trucks operate, freight costs are generally ¢25–¢80 per ton-km, and passenger rates are ¢2–¢4 per km. These prices are low by international standards (e.g., rural passenger transport costs

are five times higher in nearby Yunnan Province in the People's Republic of China). Passenger transport costs are actually very similar to what is charged for long-distance transport (¢1.5–¢2.5). Freight transport costs are in line with economic costs. They are much lower than they would be in absence of a road, but remain 3–10 times higher than what is charged for long-distance freight on trunk roads (¢5–¢15 per ton-km), showing the benefits of further road improvement and economies of scale.

Village road infrastructure is the main limiting factor. Myanmar has 157,000 km of roads, giving a road density of 0.23 km/square kilometer (km^2), which is comparable with the Lao People's Democratic Republic (0.17) and Cambodia (0.21), but much lower than nearby Thailand (0.77). Half of that network (about 75,000 km) has standards sufficient to provide all-season access. There are 97,000 km of registered village-to-town roads or tracks in Myanmar. About 40% of these registered village roads (36,000 km) are only tracks. Village road densities are the lowest in Kachin and Kayin states. Only 5% of the village roads are paved, the majority (70%) being earthen—the share reaches 97% in Chin State. Many earthen roads or tracks become impassable during the rainy season. There are many timber bridges, which have to be replaced every few years. People without road access rely on informal footpaths, natural fords, or where available, footbridges.

This study estimates that Myanmar would need a minimum road network of 250,000 km to connect all its villages. The estimate draws from the same model discussed above. This compares with the present road network size of 157,000 km, less than 75,000 km of which provide all-season access. Put differently, **Myanmar needs to upgrade about 75,000 km of roads to all-season standard and build an additional 100,000 km of roads**. This is much more than estimates presented in Myanmar's ongoing National Development Plan (10,000 km of construction and 19,000 km of improvement).

How Efficiently Is the Village Road Infrastructure Managed?

The institutional organization is fragmented. Three actors are designated by law as responsible for construction and maintenance of village road infrastructure:

- The **Department of Rural Development** (DRD) under the Ministry of Agriculture, Livestock and Irrigation is currently the main government agency responsible for village roads. Established only in 2012, it had 2,000 staff at the time of report writing, and was recruiting to fill a target 10,000 positions. In just 3 years, DRD has successfully established a model of bottom-up planning and decentralized delivery of all type of rural infrastructure (roads, water supply, sanitation, housing, electrification) and economic development activities (microfinance, livelihoods).
- The **Department of Progress of Border Areas and National Races Development** (DPBANRD) under the Ministry of Border Affairs carries similar activities in designated townships, accounting for 32% of Myanmar's territory. Occasions of duplication of activities between DPBANRD and DRD were observed.
- The **town development committees** (TDCs) are placed under the General Administration Department of the Ministry of Home Affairs. The 285 TDCs are local executive bodies with power to raise tax, and spend on infrastructure and other rural development activities.

The allocation of responsibility at the local level is unclear. While all three actors share similar responsibilities, this study could not identify who was the actual owner of the village road network. The study team identified cases of duplicated works. Interviewed village leaders indicated that they were making requests to improve the same road to each actor, to increase the chances to receive financing. In the absence of a proper owner of the network and a single entity in charge of managing it, there are high chances that the roads built will not be cared for, and that resources to improve them will be poorly allocated, at times duplicated, and often wasted.

There are also overlaps between DRD and the Ministry of Construction (MOC). Public Works under MOC oversees highways and has the largest capacity for road management, but is not formally involved in village roads. Road classifications overlap: both Public Works and DRD claim to manage village-to-town roads. Areas of work also overlap. A large share of DRD budget has been spent on the construction of three "inter-district" roads, which are long gravel or paved roads with a total length of 2,300 km, crossing various states and running parallel to or complementing the Public Works' highway network. Such roads have a dubious function as they do not provide village-to-town access, nor do they have proper standards for long distance travel; their length and function should anyway put them under the Public Works' responsibility. Both DRD and DPBANRD maintain their own different set of standards that do not comply with Public Works standards.

DRD has been playing a very positive role, which should not be questioned by decentralization in the foreseeable future. DRD's operational model and impacts appear to be very positive. In the first 5 years of operation, DRD is expected to build more roads and bridges than what had been achieved in the previous 20 years. Its impact is only limited by the number of staff on the ground, which is due to increase rapidly. It is however clear that the centralized decision making and delivery applied by DRD does not follow the general political imperative to decentralize. Should decentralization proceed further, then the responsibility for managing local roads should at some point be transferred to local governments (state and/or region or lower). However, the form and timing of this decentralization should be considered in a pragmatic manner. Region and state governments currently prioritize urban infrastructure and the trunk road network, and would likely give a lower priority to village roads. DRD also has the highest capacity at the local level. Despite it being a national government department, its operational model emphasizes local decision making. Altogether, there seems to be no urgency to devolve the responsibility for local roads to local governments, and in the short term there are clear benefits in not doing so.

Broad targets and bottom-up prioritization do not add up to efficient planning. Under the current planning framework used by DRD, the 20-year plan defines the overall goal (connect all villages by 2030), while the task of identifying and prioritizing works is given to the village and township development committees. Funding requests are subsequently compiled by DRD staff, approved by the state and/or regional *hluttaws*, and withdrawn from DRD budget allocations to the different states and/or regions. National funding allocation is done proportionally to the number of townships and/or villages in the state or region. This framework ensures that funds are spent in function of local needs—the presence of DRD staff at all stages ensures some political neutrality and technical objectivity. However, there is no comprehensive overview of the needs for the country as a whole and for each state and/or region, and as a consequence resources and needs are not properly matched. In practice, influential villages are better able to get their project placed at the top of the list than less influential ones; this goes largely unnoticed by DRD staff, who only scrutinize lists that have already been compiled by the village development committees. Because funds are not allocated in function of needs, some villages may receive multiple road connections, while others cannot even get funding for basic access. In addition, a large share of DRD's road spending has been for interdistrict roads, which were not identified through this bottom-up process. Altogether, current planning procedures delay the achievement of DRD's stated goal, while a lack of data and monitoring procedures limit DRD's capacity to assess the degree to which the goal is being achieved.

Resources have increased but remain well below needs, particularly for maintenance. DRD in 2014/15 received about $200 million from the central government for village road construction and improvement and $5.8 million for maintenance. Altogether, DRD's resources increased fourfold from 2013/14 ($63 million). This study estimates that **the minimal cost to provide all villages with all-season road access is around $13 billion**. At the current rate of construction and investment, it would take Myanmar 65 years to complete its village road network, even if it focuses resources exclusively on access improvement. To complete the task

by 2030, resources need to increase fourfold. Annual maintenance needs are already estimated at $75 million, which is six times the current maintenance budget allocation.

Construction and maintenance are of low quality, being insufficiently professionalized. The quality of village road construction and maintenance is below standard. Cases of pavement or structure failure were observed soon after construction. To a large extent, this appears to be due to a lack of proper engineering design of the roads and proper supervision during implementation. DRD's current limited staff numbers at the local level, and the fact that its staff has to cover multiple sectors (road, electricity, sanitation, etc.) are also part of the problem. Since 2012, DRD contracts out construction works, which will be positive in the long run, but faces capacity bottlenecks of the private sector construction industry. Routine maintenance of village roads is currently carried out through voluntary labor contributions from people who lack the required skills, experience, and tools, and does not follow required schedules.

Recommendations

The exceptionally low levels of rural access in Myanmar, and the consequences these have on rural poverty, should make rural accessibility a nationwide priority. To meet the challenge to provide universal access within 15 years, this review's main recommendations are the following.

- **Resources for village road upgrading and/or improvement need to be scaled up.** A medium-term target could be to double the rate of investment (to $400 million per year), and then let it grow in line with gross domestic product. This would bring it close to the identified investment needs if spent on high priority needs.
- **New financial resources for road maintenance are required.** Village road maintenance needs to be supported financially to avoid the accelerated deterioration of village road assets.
- **Resources should be focused on the provision of basic access.** To keep costs down and spread benefits widely, low standards (e.g., footbridges, motorcycle paths, spot improvements, earth, gravel, or low-cost pavements) should be emphasized. Roads forming part of a core village road network—to be defined—should be prioritized over roads providing additional access to villages that are already connected. This will require increasing the information available regarding village roads and rural transport.
- **Roadwork implementation should be professionalized.** Design and supervision should become systematic for all significant construction works. Routine maintenance should be carried out by designated people or teams who are remunerated and whose performance is evaluated.
- **Responsibility for ownership and management of the village road infrastructure should be clearly allocated.** Overlaps and gaps between agencies should be eliminated.
- **Meanwhile, regulations of rural transport services should remain light.** Restrictions justified by improved safety or quality of services would, for the moment, cause disproportionate cost increases to users, and their introduction should be postponed.

A Possible Way Ahead

The government could launch a Nationwide Rural Access Improvement Program. India's Pradhan Mantri Gram Sadak Yojana (PMGSY) is a good example of such a program as shown in the box below. In the case of Myanmar, the program's main features could be as follows:

- **Objective-driven.** The program would aim to achieve universal all-season road access in rural areas, by gradually achieving higher levels of access, as measured in the share of communities connected and the quality of their connection (or the share of rural people living less than 2 km from an all-season road).
- **Centralized management and funding.** Such a program could be 100% financed by the central government. It would be managed by DRD, which would allocate resources based on needs, assist in local planning and prioritization efforts, and manage works execution. Resources could come from central government resources, from earmarked taxes, and from donors.
- **Scope and priorities.** The program could focus on establishing a **core village road network**, which would include the key roads needed to provide minimum road access to connect all villages to the trunk road network. The identification of the core village road network should be carried out at the township level, but could be compiled at the district and state and/or regional level. Operational priorities and standards would be required. For instance, the program could initially focus on basic access (spot improvements, footpaths) for unconnected communities of a given size, and all-season road access for larger ones. Targets could be periodically revised.
- **Operational planning.** At the township level, DRD could assist the township and village development committees in establishing maps of the core village road network, identifying the importance of the improvements based on national priorities (e.g., first priority: establishing core network access for large communities), and prioritizing all improvements needed in the medium term. This identification and screening should be done with local participation, but the choice of standards (and hence budgets) should follow nationwide guidelines. At the village tract level, DRD could help identify village-based road infrastructure needs using a form of integrated rural accessibility planning, specifically the participatory mapping methodology. DRD would then allocate resources to townships and villages based on needs (e.g., funding x% of needs within 5 years), potentially differentiating by subprograms and priority levels, and following priority lists.
- **Delivery.** Works delivery would still be contracted out by DRD. Design would likely be contracted out. Supervision could be done by DRD, by contracted teams, or with support from Public Works.
- **Monitoring.** DRD would need to set up a database of village roads, needs, and works.
- **Knowledge base.** Some resources should be dedicated to research and innovation to identify the most cost-effective planning strategies, operational priorities, standards, and technologies. Different pavement techniques could be piloted. An observatory or research team could carry out surveys and studies with regard to rural travel patterns and rural transport services, and maintain a link with nongovernment organizations.

In parallel, to clarify allocation of responsibilities, the government could take the following steps: (i) gradually make DRD the only national entity managing village roads, (ii) formally make the Ministry of Construction the only entity responsible for classifying and establishing standards for Myanmar's roads, and identifying which ones it is directly responsible for; the responsibility for classification may be *delegated* to region and/or state governments in the case of lower-level roads, and DRD could receive a delegation for setting standards for village roads, (iii) make region and/or state governments the formal *owners* of lower-level roads holding ultimate responsibility (which could be further decentralized to township development committees in the case of village roads); DRD would then manage village roads *on their behalf*. This setup would clearly allocate responsibility to maintain village roads to DRD, but facilitates further decentralization.

Nationwide Rural Access Program, the Pradhan Mantri Gram Sadak Yojana Approach in India

The Pradhan Mantri Gram Sadak Yojana (PMGSY) is a nationwide program to provide all-weather access to all unconnected villages. The plan is fully funded by the central government and 50% of the national diesel levy is earmarked for this purpose. The original targets were to connect all villages with populations above 1,000 by 2009–2010, to connect all villages with more than 500 people by 2014–2015, and all villages with more than 250 people by 2021–2022. Targets are periodically revised. The program also finances improvement of roads that already have an "all-weather" standard but with lower priority. The Ministry of Rural Development has set up the National Rural Roads Development Agency to provide operational and management support, including the preparation of guidelines and manuals. For a district to have a road investment included in the PMGSY, the following steps need to be taken:

1. The state executing agency sets up a program implementation unit (PIU) in each district.
2. The PIU prepares a **district rural roads plan**. The district rural roads plan is prepared first at subdistrict level and then integrated into the district plan, following steps defined in the manual. These include
    - Preparing a database by collecting maps, road inventory, and road condition and census data. Pavement condition data is entered into an online management and monitoring system. All states are required to carry out a pavement condition survey every other year.
    - Preparing detailed maps showing the road network, habitation centers, and key facilities. All settlements of 100 people or more that are further apart than 500 meters (m) are identified on the map. Only settlements with more than 250 or 500 people depending on the area are eligible for connection.
    - Preparing two lists of all settlements that are either unconnected or only connected by a dry-season road. From these lists, road links are selected that connect the settlements with all-season roads. The most efficient and economic link should be selected, which connects with key facilities such as markets, health, education, and administrative centers.
3. Having established a district rural roads plan, a **core network** is identified that provides a single all-weather road to connect to each eligible settlement. This avoids unnecessary duplicate links. If a settlement is less than 500 m from a road, it is deemed to be connected and not eligible under the PMGSY. Each road link is identified by a code.
4. To be part of the PMGSY, the **priority** of each link must be determined. First, a new connectivity priority list is established. Three levels of priority are defined, based on the population size to be connected. Annual proposals are made and agreed on by district authorities. If no new road connection is required, a comprehensive upgrading priority list is submitted. The priorities are (i) water-bound macadam roads; (ii) gravel or "fair-weather" roads (only fordable during dry season), or through-routes with missing links or lacking cross-drainage; and (iii) existing through-routes in poor or very poor condition. The rural roads plans are reviewed by local authorities, and priority lists need to be approved at the district level. The PIU finally enters the core network priorities into the online management and monitoring system.
5. The PIU prepares **detailed project reports**. These include technical designs following specifications in the Rural Road Manual or Hill Roads Manual. The PIU holds consultations with the local community to determine the most suitable alignment, sort out issues of land availability, and deal with any adverse social and environmental impacts. A "transect walk" is arranged and digital photographs are attached to the submission.

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6. The choice of **design surface** is determined by traffic, soil type, and rainfall—following criteria specified in the manuals. Where populations are below 1,000 and traffic very low (fewer than 15 commercial vehicles per day), the road is designed for a gravel or other unsealed surface (subject to rainfall). With populations below 500, the carriageway width may be restricted to 3.0 m. Minor single-lane bridges less than 25 m may be included in the project. Based on the design, the PIUs will prepare cost estimates for each proposal.
7. Under PMGSY, state governments **allocate resources** to each district to finance at least 80% of the total road length needed to connect unconnected villages and up to 20% of the total road length requiring improvement (upgrading). Special allocations are provided to certain districts (border areas, ethnic minority, or deprived districts). Staff costs of the PIU are covered by state governments; the program finances administrative, travel, and independent supervision costs (up to 2.25% of total costs) and investigation, survey, and testing costs.
8. After approval by the district authorities, state technical agencies vet core network plans and annual proposals. Within each district, PMGSY funds are allocated annually to each project based on the priority lists for new connectivity and improvement (upgrading). Following technical approval, the state executing agency invites competitive tenders. Contracts include construction and 5 years routine and periodic maintenance.

Sources: Pradhan Mantri Gram Sadak Yojana, http://pmgsy.nic.in; Hine, J. 2014. Good Policies and Practices on Rural Transport in Africa: Planning Infrastructure and Services. Sub-Saharan Africa Transport Policy Program. *Working Paper 100*. Washington, DC: World Bank.

Ensuring the sustainability of village road infrastructure. To ensure sufficient resources are allocated to village road maintenance, the central government should target a minimum level of resources per kilometer. However, village road maintenance is likely to remain low on the agenda of most local governments. Because of this, a **preferred way to finance maintenance is to use a fuel tax**. Another report under the *Transport Sector Policy Note*[1] recommends setting up a fuel tax to cover maintenance and rehabilitation needs for all roads. Part of the proceeds of this fuel tax could be transferred to DRD, and allocated to each district or township for maintenance, in function of village road maintenance needs. In parallel, to professionalize village road maintenance, DRD could draw inspiration from other developing countries and set up permanent road maintenance groups. If properly trained, paid, and evaluated, these groups could significantly raise maintenance quality. These small businesses would also become formal job opportunities for the poor.

[1] ADB. 2016. *Myanmar: Transport Sector Policy Note. How to Improve Road User Charges*. Manila.

1 Rural Access, Mobility, and Poverty in Myanmar

Key Findings

Rural mobility, poverty alleviation, and economic development

Rural roads and rural transport services are fundamental to reducing rural poverty and enabling social and economic development. Evidence from Myanmar, and from around the world, makes it clear that access to markets and services is crucial for stimulating rural productivity and development. International examples show how lack of access leads to unsatisfactory medical care (and mortality), poor educational attainment, low agricultural production with little marketing, and insufficient economic activity. Replacing footpaths and seasonal tracks with properly maintained all-season roads greatly increases rural mobility, productivity, and economic activity and improves educational attainment and health care. Despite the clear problems and the available solutions, the issues of poor rural access tend to be "invisible" to urban-based decision makers, so that connecting isolated villages may not receive adequate attention or resources.

Measuring rural access

The need to end rural isolation is generally recognized and the National Development Plan envisages providing road access to all villages by 2030. However, the extent of the problem is not yet well documented, nor are there reliable estimates of the length of road construction and upgrading required to connect all villages with all-season roads.

This study has developed a spreadsheet model to estimate the scale of the problem. It was estimated that 70% of all villages in Myanmar do not have all-season road access and this affects a population of around 20 million people. There are about 20,000 villages without road access (30% of all villages). The Rural Access Index (RAI) is an international measurement of access based on the percentage of the rural population living within 2 kilometers (km) of an all-season road. The RAI for Myanmar is estimated at 36% (64% of the rural population are more than 2 km from an all-season road). The RAI is highest in Mon, Yangon, and Mandalay (60%–73%) and lowest in Chin, Kachin, Kayin, and Rakhine states (11%–18%). Providing all-season access to all villages would involve constructing about 100,000 km of roads and upgrading 75,000 km of existing roads.

1.1 Rural Mobility, Poverty Alleviation, and Economic Development

The Key Issues of Rural Transport

Rural transport involves moving people, produce, and goods between villages and small towns with markets and services. The small towns act as transport hubs, with small transport services and personal means of transport from many villages converging, particularly on special market days. The small towns have larger capacity transport services that link to the larger towns and cities that act as hubs for district, state and/or regional, and national transport services. While rural people may use these interurban services, the fundamental element of rural transport is the link between the villages and the small towns. Since individual villages have relatively small demand in terms of passenger and freight transport, rural transport services mainly involve vehicles of low capacity, unless some form of load consolidation is possible. Villages located on interurban roads benefit from the load consolidation and accumulation made possible by the interurban services. For more isolated villages, load consolidation may be possible on market days, holidays, and at harvest times when transport demand is high enough to justify higher capacity vehicles.

The "first miles" are often on foot, carrying loads. As will be discussed in section 5.2 (p. 45), it is estimated that nearly 25,000 villages (40% of all villages in Myanmar) do not have road access. This affects a population of over 9 million people (a quarter of the rural population). In addition to these villages without any road access, there are an estimated 20,000 villages (30% of all villages) that only have dry-season access provided by earthen roads that often become impassable during the rainy season. This affects another 11 million people (another 30% or more of the rural population). Where villages are not connected to the nearest town by a road, people may have to walk several kilometers (km) to reach the nearest motorable track or road. When they do reach a road, they may still have to walk some way, or wait a long time, as rural transport services are seldom frequent. An example of how poor rural transport affects rural communities in Shan State is provided in Box 1. In the example villages, most people have to travel on foot to markets and shops, and for access to health, education, and government services.

Figure 1: Carrying Goods from Market

These people have had to invest much time walking 10 kilometers each way to and from a market, making produce, goods, and construction materials expensive.
Photo credit: Paul Starkey.

Poverty Reduction and Economic Growth

Poor rural transport and poverty can form a vicious circle that must be broken.[1] Infrequent and high-cost transport services lead to low mobility rates and poor interaction with markets and services. There is low movement of goods and little development of resources. With lack of affordable alternatives, people spend

[1] See, for example, Starkey and Hine 2014; Hine 2014; Cook, Duncan, Jitsuchon, Sharma, and Guobao 2005.

a huge personal effort on carrying goods and/or obtaining transport, and women often have the biggest transport burden. These factors, in turn, lead to poor health, low education outcomes, and poverty.

Evidence from many countries has illustrated the social and economic benefits of connecting villages to the road network. Upgrading paths to motorable tracks greatly reduces transport costs, with high benefit-to-cost ratios.[2] Providing basic access increases economic growth and reduces rural isolation and poverty. However, villages are not homogenous and people with resources are able to benefit more from improved access. Transport interventions cannot solve all the chronic problems of poverty and so they need to be combined with other interventions to eliminate poverty and/or reduce inequalities.[3]

Figure 2: Carrying Produce to Market

Without access to roads and trucks, agriculture is constrained by transport costs for inputs and outputs.
Photo credit: Paul Starkey.

Agriculture

Connecting villages and improving rural roads has been shown to lead to enhanced agricultural production and marketing in many countries in the world. Most rural communities depend on agriculture (including crops, livestock, fisheries, and forestry) for subsistence and income generation. Surveys, analyses, modeling, and reviews show that providing access through small rural roads leads to improved market access, greater use of fertilizers and agro-inputs, enhanced agricultural production, higher employment and living standards, and reduced poverty.[4]

Examples from Shan State illustrate how agriculture and marketing can be constrained by poor transport and how improved roads can lead to higher agricultural inputs and outputs. An example of how poor rural transport appears to affect agriculture in Shan State is provided in Box 1. In the example villages, farmers did not have reliable transport to get goods to market. As a consequence, many women walked to market two or three times a week, each time carrying 15 kilograms (kg)–25 kg of produce (including cauliflowers and cabbages). Agricultural inputs also had to be carried. Elsewhere in Shan State where there were improved village roads, evidence showed trucks transporting organic fertilizer (chicken manure) into rural areas to increase agricultural production. With better transport and marketing, agricultural production and income generation could be increased in many villages in Myanmar.

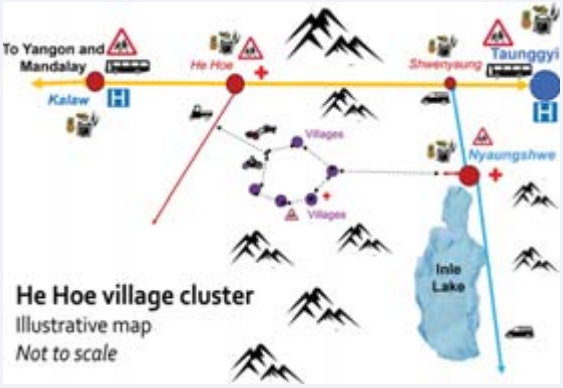
2 For example, see Hine and Riverson 1982; Gibson and Rozelle 2003; Fan, Zhang, and Rao 2004; Fan and Chan-Kang 2005; Shrestha and Starkey 2013.

3 For example, see Cook et al. 2005; Duncan 2007; Dercon and Hoddinott 2005; Dercon, Gilligan, Hoddinott, and Tassew 2009; Essakali 2005; Mu and van de Walle 2011; Khandker, Bakht, and Koolwal 2009; Gannon and Liu 1997; Jacoby 2000; Khandker and Koolwal 2011; Starkey, Tumbahangfe, and Sharma 2013; Ahmed 2010; Hettige 2006.

4 For example, see Knox, Daccache, and Hess 2013; Lebo and Schelling 2001; Orbicon and Gilroy 2010; Escobal and Ponce 2002; Binswanger, Khandker, and Rosenzweig 1993; Bell and van Dillen 2012; Aggarwal 2014; Stifel and Minten 2008; Jacoby and Minten 2008; Dorosh, Wang, You, and Schmidt 2010.

Box 1: Example of Poor Village Transport Affecting Livelihoods and Poverty in Shan State

A cluster of five villages were visited in the hills above Inle Lake in Shan State. The villages (Kyaung Shae Ywa, Kyaung Tang, Pantin, Thayet Pin, and Zeyar) lie between He Hoe and Nyaungshwe townships. There is no formal road access to these villages but there are tracks that connect these villages with He Hoe (about 10 kilometers to the northwest). These tracks are usable by motorcycles, tractors, and four-wheel drive vehicles when the road is dry. Footpaths lead to Nyaungshwe and a rough motorcycle track has been constructed but is not yet stable enough to use. There are no public transport services, but people can travel with motorcycles and tractors to He Hoe when the weather allows.



Source: Developed by ADB during consultations with local stakeholders.

Many women farmers walk to both He Hoe and Nyaungshwe markets each week (about 3 hours each way carrying loads) as they cannot earn enough income from what they can carry to a single market. If there were reliable transport services they would not need to visit markets so often and they would have more time for productive activities and for their families.

There are primary schools in the villages and most children attend primary school. However, there is no middle school or secondary school and over 90% of children drop out after primary school. Parents explained that without affordable transport services, daily attendance at middle school in He Hoe or Nyaungshwe was not possible for the children. The cost of boarding in the townships was also considered prohibitively expensive. Thus, poor educational achievement due to poverty could be counteracted relatively easily if there were an all-season road with an affordable informal transport service or school transport.

At present, people requiring routine or emergency medical treatment have to travel to He Hoe or Nyaungshwe—by walking, being carried, or riding on some private motorcycle, tractor, or oxcart. A health center is being built, but its construction progress has been very slow, due to the problems of obtaining building materials and skilled labor where there is no reliable road access and no conventional transport services.

continued next page

Box 1 *Continued*

Improved road access and transport services would reduce transport time and costs and should lead to increases in agricultural marketing, educational attainment and access to health and other services. However, while improved rural transport is vital to reduce poverty in these villages, there are also other crucial development issues such as water supplies, erosion, and deforestation.

These examples illustrate the problems of poor rural transport that are found in very many villages in Myanmar. The villages described here are actually relatively close to services and economic opportunities. There are many villages that have to cope with much greater problems of isolation.

Source: Data from interviews during project field visits, August 2014. Photos by Paul Starkey.

Health

Evidence from many countries demonstrates that poor rural transport infrastructure and lack of means of transport lead to unnecessary mortality.[5] An estimated 75% of perinatal mortality may be associated with inadequate transport.[6] The effectiveness of medical outreach teams and vaccination programs often depends on rural transport, associated with staff willingness to travel to villages and the timely delivery of supplies.[7] While road access can have some negative health consequences (such as the spread of HIV/AIDS and increased road accidents) the benefits to rural health can be great.[8] The example from Shan State, given in Box 1, highlights the problems of accessing health care (including for perinatal health problems) and of providing medical services in villages that are not connected to the road network.

Education

Education is enhanced by better rural roads and transport. There is evidence from many countries in the world that building and maintaining rural roads lead to better primary and secondary school attendance for boys and girls, better staffing and teacher attendance, and better teaching facilities due to easier transport of educational materials and infrastructure requirements.[9] Poor transport is often a gender issue, with girls more likely to suffer from poor education if travel and transport are a problem. An example of how poor rural transport appears to affect education in Shan State is provided in Box 1, where in some villages without reliable access, there is a dropout rate of 94% after primary school, with only 6% of children traveling to attend middle school.

5 See Babinard and Roberts 2006, Brenneman and Kerf 2002, Bell and van Dillen 2012.
6 See Babinard and Roberts 2006.
7 See Shrestha and Workman 2008, Transaid 2013, Bell and van Dillen 2012.
8 See Molesworth 2006, Downing and Sethi 2001, Bell and van Dillen 2012.
9 See Bell and van Dillen 2012, Levy 2004, McSweeney and Remy 2008, Mukherjee 2012, Aggarwal 2014, Starkey et al. 2013.

Invisibility of Rural Access Issues

The extent of rural access problems in Myanmar are insufficiently documented and understood, partly because decision makers, researchers, and consultants seldom have the time needed to visit isolated villages. In Myanmar, as in the rest of the world, urban issues often dominate national life, partly because most decision makers live in large towns. They do not have time to visit rural villages, particularly villages not on the road network and that require several hours of walking to reach. Even the present consultants, who were studying rural transport, found it difficult to find the time and resources to visit remote villages and remote areas. The examples provided in Box 1 are of poorly connected villages, but many villages have much less access than this.

Figure 3: Eroded Trail Restricting Access

If roads are impassable, transport costs are high and urban-based officials seldom visit villages. Photo credit: Paul Starkey.

Village roads (connecting villages to towns) are very different from the main roads that pass through rural areas. When talking to national and state or regional stakeholders about rural transport, most appear to think in terms of relatively accessible villages, because these are the ones that the stakeholders are familiar with. People discussing rural roads and rural transport services often think in terms of the main roads (national, state and/or regional interurban roads) that pass through rural areas and pass by some small villages, on and just off the road. The transport types and traffic volumes they recall relate to the interurban transport along such roads. Urban-based decision makers seldom imagine small village-to-town tracks with very little transport because they have limited exposure to these. They may be lobbied or petitioned by village leaders from isolated villagers without any road access, but they are much more likely to respond to the needs of those living in villages close to the towns where farmers and village leaders campaign for better quality roads (as was reported and observed in Shan State).

1.2 Measuring Rural Access

It is clear there are both economic and social reasons for ensuring that all villages in Myanmar are connected to the road network. In recognition of these, the 20-year National Comprehensive Development Plan (NCDP) for the period 2011–2030 has an outcome objective of connecting all villages by 2030. However, there are no reliable data available concerning the construction challenge required to connect all villages in Myanmar. It is not even clear what length of village road improvement is required to provide villages that have existing road connections with all-season access. Data is being collected by the Department of Rural Development (DRD) regarding the existing road network, but this does not provide any insight on the number of villages not connected or whether villages with existing connections have all-season or only dry-season access. Reliable information about the number of unconnected villages and the all-season status of connected villages is essential to determine appropriate output targets and calculate the investment needs for different areas. This will allow better targeting of interventions to provide essential all-season road access to those villages and village tracts that do not yet have it. Furthermore, such access data need to be disaggregated by state and/or region, township, village tract, and village.

In the absence of such data, a spreadsheet model has been prepared as part of the current Asian Development Bank (ADB) study. This estimates the number of villages without road access and the length of additional roads required to connect them. The model assumes a more or less uniform distribution of the villages throughout the country, but also assumes that villages in sparsely populated townships are concentrated (these townships generally coincide with mountainous areas). Based on an estimation of the average distance between the villages in each state and/or region, the road length required to connect all villages is subsequently calculated. This is compared to the existing road network, including both trunk roads and village roads (but not urban roads as these do not provide access to villages). This allows an estimation of the number of unconnected villages and the calculation of the additional length of road required to connect them. The population of these unconnected villages is subsequently estimated based on the total rural population, but with the assumption that the unconnected villages have slightly lower population densities and villages with all-season access have slightly higher population densities.

The results of this model are presented in Table 1. The total road network necessary to connect all villages is estimated to be nearly 250,000 km compared to an existing road network of just over 150,000 km, less than 75,000 km of which are considered to provide all-season access (the remaining earthen roads are often impassable in the rainy season). It is estimated that nearly 25,000 villages (40% of all villages) do not have road access. This affects a population of over 9 million people (a quarter of the rural population). In addition to these villages without any road access, there are an estimated 20,000 villages (30% of all villages) that only have dry-season access provided by earthen roads that often become impassable during the rainy season. This affects another 11 million people (another 30% or more of the rural population). Providing all villages in Myanmar with all-season road access by 2030 in line with the 20-year plan would involve upgrading 75,000 km of existing dry-season roads and the construction of 100,000 km of new roads to an all-season standard. This is significantly more than the 10,000 km of construction and 19,000 km of improvement planned in the 20-year plan.

For the country as a whole, approximately 40% of villages (with 25% of the rural population) have no road access. Road access is highest in Yangon, Mandalay, and then Magway where only about 5% of villages with 3% of the rural population are not connected by road. Road access is lowest in Kayin and Rakhine where nearly 69% of villages (with 59% of the rural population) are not connected by road.

Table 1: Estimated Village Access Levels

Area	Existing Network		Required Total Length (km)	Villages without Road			Villages with Dry-Season Road			Rural Access Index (RAI) (%)
	Total Length (km)	All-Season Length (km)		No. of Villages	Population	Required Construction	No. of Villages	Population	Required Improvement (km)	
Kachin	8,558	3,632	17,311	1,304	427,326	8,754	734	352,797	4,926	18
Kayah	1,948	977	2,869	164	45,846	921	173	71,633	971	35
Kayin	3,771	2,057	11,013	1,357	671,192	7,242	321	251,110	1,714	16
Chin	7,879	1,350	9,686	251	47,086	1,807	907	261,180	6,529	11
Sagaing	21,271	7,955	26,289	1,146	561,243	5,018	3,041	2,069,759	13,316	28
Tanintharyi	3,959	2,664	6,871	521	334,203	2,912	232	201,523	1,295	34
Bago	12,879	6,233	18,309	1,947	749,996	5,430	2,383	1,330,581	6,646	37
Magway	18,023	6,438	16,859	0	0	0	2,964	1,684,227	10,421	39
Mandalay	13,878	8,172	15,222	422	235,841	1,344	1,792	1,174,815	5,706	61
Mon	4,679	3,540	5,719	215	179,479	1,040	235	220,057	1,139	73
Rakhine	5,131	2,989	17,872	2,752	1,599,732	12,741	463	414,154	2,142	15
Yangon	4,616	2,395	4,903	125	86,005	288	964	794,891	2,221	60
Shan	29,213	16,257	68,420	8,228	2,041,539	39,206	2,719	977,991	12,957	23
Ayeyarwaddy	11,053	5,251	23,550	6,334	2,225,603	12,498	2,940	1,501,878	5,802	24
Myanmar	**151,266**	**73,503**	**247,622**	**24,765**	**9,205,092**	**99,200**	**19,868**	**11,306,596**	**75,785**	**36**

km = kilometer, No. = number.
Source: ADB estimates based on the Department of Rural Development and Public Works data.

Looking at all-season access, the situation is a little different. Due to its high percentage of all-season roads, Mon has the highest level of all-season access, with 62% of villages (73% of the rural population) having all-season road access. This is followed by Yangon and Mandalay with approximately half the villages (nearly two-thirds of the rural population) having all-season road access. The lowest levels of all-season road access are in Kayin, Rakhine, and Chin where only 17% of all villages (23% of the rural population) have all-season road access. This means that more than three-quarters of the rural population in these states are not connected by an all-season road.

The Rural Access Index (RAI) is an international indicator developed by the World Bank. It is defined as the percentage of the rural population that is within 2 km of an all-season road. The RAI is generally over 90% in high-income countries and drops to less than 20% in a small number of poor countries in Africa and Asia. RAI scores can be estimated using geographical information system (GIS) technologies, provided there are GIS map layers with rural roads (and their condition) and high-resolution population data (village-level information). The spreadsheet model used to estimate village access can also be used to provide some estimates of the RAI. It is assumed that all the people in villages not connected by all-season roads are further than 2 km from an all-season road. It is also assumed that where there is an all-season road, some of the population will live more than 2 km from that road (a proportion estimated from data on road lengths and population densities). Using this model, the RAI for Myanmar is estimated at 36% (so that 64% of the

Table 2: Estimated Village Tract Access Levels

Area	Existing Network		Required	Village Tracts without Road		Village Tracts with Dry-Season Road	
	Total Length (km)	All-Season Length (km)	Total Length (km)	Number of Village Tracts	Required Construction	Number of Village Tracts	Required Improvement (km)
Kachin	8,558	3,632	8,322	0	0	336	4,690
Kayah	1,948	977	1,092	0	0	8	115
Kayin	3,771	2,057	4,689	73	918	137	2,632
Chin	7,879	1,350	5,723	0	0	359	4,373
Sagaing	21,271	7,955	14,235	0	0	776	6,279
Tanintharyi	3,959	2,664	3,183	0	0	43	519
Bago	12,879	6,233	8,525	0	0	383	2,292
Magway	18,023	6,438	9,551	0	0	502	3,113
Mandalay	13,878	8,172	8,285	0	0	19	113
Mon	4,679	3,540	3,230	0	0	0	0
Rakhine	5,131	2,989	9,277	465	4,146	240	6,288
Yangon	4,616	2,395	2,645	0	0	59	250
Shan	29,213	16,257	22,595	0	0	439	6,339
Ayeyarwaddy	11,053	5,251	9,429	0	0	848	4,178
Myanmar	**151,266**	**73,503**	**112,100**	**538**	**5,064**	**4,148**	**41,181**

km = kilometer.

Source: ADB estimates, based on Department of Rural Development and Public Works data.

rural population are more than 2 km from an all-season road). The RAI is highest in Mon (73%), Mandalay (61%), and Yangon (60%) regions. The RAI is lowest in Chin (11%), Kachin (18%), Kayin (16%), and Rakhine (15%) states. In these states, five out of six rural people need to travel more than 2 km in order to reach an all-season road.

This model was primarily prepared to determine the access levels of villages. However, it can also be used to estimate the number of village tracts that are connected by road. Although most village tracts have road access, this does not appear to be the case in Rakhine and Kayin states, where respectively 45% and 20% of village tracts are estimated to still be without road access. When looking at all-season road access, it can be seen that an average of 6% of village tracts have only dry-season road access, reaching a maximum of 27% in Chin State and 13% in both Kayin and Sagaing. Providing all village tracts with all-season access would involve upgrading 40,000 km of existing roads and the construction of 5,000 km of new roads to an all-season standard. It should be clear that the provision of all-season access to village tracts should be the main priority in any village road strategy.

2 Rural Transport Services

Key Findings

Operation and function of different rural transport types. Most rural transport services are operated by individual transport entrepreneurs using "Dyna" or "Hilux" type passenger trucks, and smaller numbers of three-wheelers, horse carriages, or mules. These are complemented by motorcycles, tractor-trailers, oxcarts, and bicycles, which are mainly owned for personal use, although income from informal transport hire can be important. Some rural people benefit from the buses and minibuses that operate on interurban routes. Dyna and Hilux passenger trucks carry flexible loads of passengers and freight, and are popular with both operators and villagers. Motorcycles are the most common vehicle on rural roads and may be the main transporters of people and small freight.

Rural transport costs and prices. Where there are no roads, transport is very expensive in terms of walking time and freight charges. Dyna and Hilux operators charge a very reasonable $0.02 per passenger-kilometer, comparable to interurban buses. Motorcycles and three-wheelers charge more, as do interurban minibuses and taxis. Rural freight costs are always highly variable, due to different distances, capacities, and charging systems. Dyna and Hilux operators generally charge $0.25–$0.80 per ton-kilometer while motorcycles and smaller vehicles charge much more.

Safety and security. While overloading of passengers is common, there appears to be no evidence that rural transport is particularly dangerous or that safety and security are major issues for passengers or operators.

Appropriateness of transport services. Where there are roads, there are generally diverse and appropriate rural transport services for freight and passengers. The services of Dyna and Hilux passenger trucks operated by individual entrepreneurs are generally suitable and affordable. The limiting factor appears to be the availability of all-season roads to connect villages to markets and services.

Regulation of transport services. The Road Transport Administration Department licenses all passenger and freight vehicles, with high fiscal compliance achieved at state and/or regional levels. There are few operational requirements for rural transport vehicles apart from freight and passenger load limits. Despite some overloading of passengers, most rural transport services seem to be appropriate, affordable, and popular. Stricter regulatory enforcement does not seem required at present, as such regulation could have unintended negative consequences. Regular reviews sensitive to local transport needs are proposed. Safety measures are required on interurban roads to allow reasonable usage and/or crossing by rural communities.

Investing in transport services. Baseline data on rural access and transport services are required to ensure informed planning and prioritization of rural roads and transport services (section 5.2, p. 45). This, together with relevant capacity building, could be supported by ADB and donor agencies. While villagers want rural roads, access provided by motorcycle trails and/or trail bridges provide many benefits and could form part of local investment plans.

2.1 Operation and Function of Different Rural Transport Types

Myanmar has a great diversity of transport services and means of transport, including intermediate means of transport. The transport types are closely related to the topography, ecological zone, available transport infrastructure (notably road quality), and the economic activities of the area. Since individual villages have relatively small demand in terms of passengers and freight, most rural transport services are provided by vehicles of low-carrying capacity.

Rural bus services are very rare or nonexistent. Conventional buses generally have capacities of 35–65 passengers, and so are seldom used on village-to-town routes. "Midi-buses" have capacities of 18–35 passengers. While passenger demand may justify this size of vehicle, these too are seldom used for village-to-town transport. While midi-buses can have a "comparative advantage" for medium-scale passenger transport on good roads, the conditions of most village-to-town transport (rough roads and mixed passenger and freight transport demand) make passenger trucks ("Dyna") more flexible and robust vehicles for providing village-to-town transport services.

Figure 4: Interurban "Midi-Buses" that Pass through Rural Areas

Most 20–35-seat midi-buses that pass through rural areas are interurban services on major roads. While some rural people are able to use these services to access towns, these are not operated as village-to-town rural transport services.
Photo credit: Paul Starkey.

Some rural people living near main roads may benefit from interurban or commuter bus services. Bus services in Myanmar generally start and end in towns. Rural people may occasionally use these services for long-distance travel, having travelled to their nearby town. Some villages are located on, or close to, main roads and their villagers may use bus services regularly. Some other villages are located close to major towns or cities, and buses or minibuses may be used for commuter services to and from the conurbation. However, buses only play a minor role in rural transport in Myanmar.

Figure 5: Interurban Buses that Pass through Rural Areas

Most large buses passing through rural areas are interurban services on major roads. While some rural people are able to use these services to access towns, these are not operated as village-to-town rural transport services.
Photo credit: Paul Starkey.

Rural minibus services are rare and minibuses are mainly used for express interurban services and commuter transport. In Myanmar, minibuses, with passenger capacities of 10–16 seats, are mainly used for express interurban transport and commuter services. Their comparative advantages include their acceleration and speed (so they are faster than large buses) and their flexibility in departures (with about 16 seats, they can be filled more quickly than buses with 40+ seats). However, they have relatively little space for freight (unless there is a roof rack). In some countries minibuses are widely used for rural transport. This is generally where village roads are quite good and the requirement to carry freight is modest. Minibuses are able to compete with timetabled buses by creaming off waiting passengers for whom speed is important. As with buses, some rural people in Myanmar are able to benefit from interurban and commuting minibus services (e.g., on roads around Yangon in the Ayeyarwaddy Delta), but most rural people rely on other forms of transport. Very small minibuses or "microbuses" (often 7-seater) may be used in urban and peri-urban areas, sometimes as taxis. These have low clearance and little capacity or power and are seldom seen away from good roads and peri-urban areas.

Figure 6: Interurban Minibuses that Pass through Rural Areas

Most minibuses operate as express services on interurban roads. While some rural people are able to use these services to access towns, these are not operated as village-to-town rural transport services.
Photo credit: Paul Starkey.

Passenger trucks and pickups are the most important forms of rural transport in Myanmar. The most common forms of public transport in rural areas are the passenger trucks (Dyna) and heavy-duty pickups ("Hilux"). These are named after the common Toyota models that are frequently used. Other makes of vehicle are also used, including the Mitsubishi "Canter", so that a Dyna passenger truck may not be a Toyota Dyna vehicle—although many of them are. Such vehicles are also used for urban and peri-urban transport, notably in Mandalay and around Yangon.

Figure 7: "Dyna" Passenger Trucks Providing Rural Transport Services

These vehicles provide a wide range of passenger and freight transport in rural areas (including peri-urban services).
Photo credit: Paul Starkey.

Passenger trucks (Dynas) and heavy-duty pickups (Hilux) are operated in similar ways. They have side-facing passenger benches and a cargo platform that can be used for freight and/or passengers (possibly with additional bench seating). Almost invariably there is a strong roof rack that is used to carry freight and often passengers as well. Most operators are flexible and demand-oriented, with some running mixed passenger and freight public transport along established routes, some as contracted freight transport, and some contracted as "pagoda" trips, taking particular groups of passengers to temples and religious events.

Figure 8: "Hilux" Passenger and/or Freight Pickups Providing Rural Transport Services

These vehicles provide a wide range of passenger and freight transport in rural areas (including peri-urban services). Photo credit: Paul Starkey.

Passenger trucks and pickups may be licensed as public transport vehicles. Dynas may be licensed to carry 20 passengers. Hilux may be licensed to carry 15 passengers. These limits are commonly exceeded, particularly when passengers are carried on the roof. Operators reported regularly carrying 25–30 passengers in and on a Dyna and similar numbers in and on a Hilux. Overloading with passengers was not considered a big problem by operators or passengers, and regulatory authorities (e.g., police) generally did not intervene on passenger loading levels. Operators without passenger licenses were more fearful of the regulatory authorities and avoided possible police checkpoints (that are often located along the main roads within towns).

Passenger trucks and pickups are a robust, versatile, and popular means of public transport, despite their limitations. Passenger trucks and pickups have good clearance for poor roads and relatively modest purchase prices and operating costs, allowing affordable fares and freight tariffs. They are very durable: 20 years of active life is not unusual. Their simple load platforms offer great flexibility for carrying a variety of loads, and different ratios of passengers and freight. The same vehicle can perform a market run, with some passengers and much farm produce on one day and then the following day a pagoda run carrying many passengers and very little freight. If the weather is wet, or the road dusty, passengers can be adversely affected. While passengers on the roof may be particularly uncomfortable, weather-protecting materials can be claustrophobic for those passengers inside. The seats are much less comfortable than those in a bus or minibus, and access through the rear step is not easy for older persons or people with disability. On the other hand, despite the indignity of boarding and disembarking, it may be possible to travel with a wheelchair in a Dyna or Hilux (although few rural people use wheelchairs). More importantly for older persons and people with disability, these vehicles are often able to reach villages on village roads that would be difficult or impossible to access by more comfortable buses or minibuses. Despite their relative lack of comfort, Dyna and Hilux vehicles appear to be popular with passengers because of their availability, affordability, reliability, and versatility. As long as village roads remain rough and passengers want to travel with freight, these forms of public transport are likely to remain important and popular with both operators and users.

Motorized three-wheelers have a growing role in small-scale freight transport and some passenger transport. Most three-wheelers in Myanmar are based on a motorcycle front (usually not enclosed but often with an awning) and an integral box body, usually with a roof, and often a roof rack. They are driven by both rear wheels. Their clearance is high (compared to the Bajaj urban auto rickshaws of India), making them suitable for relatively rough village roads. Most are licensed as freight vehicles and most are based in small towns, providing small-scale freight services in urban and peri-urban areas. Some regularly provide public transport services between villages and small towns. They are mainly used in the relatively flat areas, as they may have insufficient power to make steep ascents when heavily laden. In some areas, they may be complementing or displacing peri-urban horse carriages that may offer comparable peri-urban passenger and freight services.

Figure 9: Three-Wheelers Providing Village-to-Town Rural Transport Services

Photo credit: Paul Starkey.

The comparative advantage of the three-wheelers is that they are relatively cheap with low operating costs (compared to Hilux pickups) but have much greater carrying capacity than motorcycles. They do not last many years, but operators can often recoup their capital costs in 1 or 2 years. Their low fuel consumption and relatively high fare tariffs mean that they only need a small amount of freight and/or a small number of passengers to offset their running costs, and so they can be used on routes where passenger and freight demand is modest. They are cumbersome relative to motorcycles, and this discourages some of the types of dangerous driving that are associated with motorcycle taxis (rapid acceleration and swerving movements). In some countries, three-wheelers (and two-wheel tractors) can be involved in nighttime crashes, when other drivers mistake the single headlamp for a motorcycle, and do not allow sufficient clearance. While this could be a problem in Myanmar, the authors are not aware of evidence relating to this.

Two-wheel tractors provide small-scale, short-distance freight and passenger transport around villages and small towns. The use of two-wheel tractors is increasing in Myanmar, although they are not as widespread as in some other Asian countries. Oxen and oxcarts are still very common, although they are gradually being replaced, particularly in the delta area. The two-wheel tractors (power tillers or iron oxen) are used for tillage, mainly in rice fields, and for transport. Some two-wheel tractors are used for small-scale, commercial freight services, in and around small towns. Many two-wheel tractors are used for a wide variety of agricultural and domestic transport purposes, with the owners gaining some income from informally transporting other villagers and/or their goods. In a few places, such as Heho (Taunggyi District, Shan State), there are regular public transport services to and from markets provided by two-wheel tractors with trailers specially adapted for carrying side-facing passengers and light freight on their roofs. The comparative advantage of two-wheel tractors is that they have multiple functions to justify ownership and they have good traction, allowing them to operate on very muddy or eroded tracks and roads. Their main disadvantage is that they are slow and noisy and exhaust fumes may blow over the driver and passengers.

Motorcycles are the most numerous vehicles on village roads and provide extremely important personal transport and transport services. Motorcycles have increased greatly in Myanmar in recent years and, with the exception of Yangon and the Yangon–Mandalay expressway, they are generally the most numerous of vehicles on most interurban, peri-urban, urban, and rural roads. They are particularly important on village roads, where there may be little other traffic. On many village roads, the narrow, smooth tracks worn by motorcycles are clearly apparent and little disturbed by the wheel tracks of the small numbers of other vehicles. Motorcycles carry people and small quantities of freight (up to 100 kilograms [kg] or more). They are mainly owned for personal mobility, but frequently carry other people and their goods, as favors or as informal motorcycle taxi services. In rural villages, people without motorcycles know the standard fares and tariffs they are charged by motorcycle owners to reach common destinations (market, medical center, school, bus stop). Such informal motorcycle services are extremely important for rural mobility, providing access for those without vehicles and providing income and cost-offsetting for motorcycle owners. In some cases, motorcycle transport services provide the main livelihood income, offering important employment and income-generating opportunities, notably for young men.

Figure 10: Tractor Transport Service

Photo credit: Paul Starkey.

Motorcycles are often able to reach villages isolated from the main road network. There are many comparative advantages of motorcycles, including their relatively low price and running costs, which make them affordable to many people. They are extremely flexible and maneuverable, allowing them to negotiate poor roads and avoid mud holes, landslides, and broken bridge sections that are impassable to larger vehicles. They can be used on some trails and footpaths, and in some regions, including Mandalay and Ayeyarwaddy, there are specially constructed narrow concrete trails that allow small, light traffic, such as motorcycles. In many villages that are not yet connected to the road network by an all-season road, motorcycles offer a vital means of transport for passengers, freight, and emergency access. While operating costs are low compared to larger vehicles, their low capacity means that these cannot be shared by many passengers or heavy loads. This makes their cost per passenger-kilometer (km) and per ton-km very high compared to conventional public transport vehicles and so villagers invariably want other transport services that should be much cheaper, particularly for freight transport. Nevertheless, until such services are available, rural people greatly appreciate the timely access provided by motorcycles and motorcycle taxis.

Figure 11: Photographs Illustrating the Importance of Motorcycles for Rural Transport

Photo credit: Paul Starkey.

Motorcycles can be risky and uncomfortable and drivers may exhibit dangerous behavior. While motorcycles have many advantages for rural transport, they also have some important disadvantages. There is little protection for the driver and passenger(s), so crashes can result in serious injuries, particularly if the riders do not wear crash helmets. Motorcycles can be unstable, particularly when overloaded, and this can increase crashes on rough, bendy village roads. Some motorcycle drivers, particularly young men, appear to enjoy the thrill and danger of driving, and indulge in risky behaviors that can cause crashes, affecting themselves, passengers, pedestrians, and other road users. Motorcycles have no protection from dust or weather, and traveling on rough roads is tiring. In general, motorcycles may have a comparative advantage for short, timely journeys (e.g., 1 km–10 km), but larger means of transport are generally preferred for longer journeys. While older persons and people with disability may find it challenging being a passenger on a motorcycle, in isolated areas such means of transport can offer important access to such vulnerable people.

Figure 12: Photographs Illustrating the Importance of Bicycles for Rural Transport

Photo credit: Paul Starkey.

Bicycles can be important for rural mobility and bicycle taxis may offer some short-distance services where infrastructure allows. Bicycles are commonly used for personal mobility, including small freight transport. These are mainly used in relatively flat areas, such as the Ayeyarwaddy Delta and the central dry zone. These can help men and women access employment and income generation, thus, assisting rural livelihoods. These can help pupils to commute daily to school, particularly to secondary schools that may be far from some villages. In some towns, and larger villages, bicycle taxis operate as recognized point-to-point transport services with specially manufactured sidecars. These vehicles require good road infrastructure and cannot operate effectively in hilly areas or very rough surfaces. Bicycle taxis are likely to decline, with the increase in motorcycle taxis and motorized three-wheelers. However, the importance of bicycles for short distance (<7 km) rural transport is likely to remain and may well increase.

In some areas that are relatively dry and flat, horse-drawn carts provide valuable peri-urban transport services to and from small markets. Horse-drawn carts operate in and around many small towns, particularly in the dry zone. Horse-drawn carts generally operate on a point-to-point basis (like a taxi) to and from the transport hubs of a small market town. These carry people and loads to and from markets, and often operate between the market towns and peri-urban villages. Unlike oxcarts (that are mainly for personal, village-to-farm use), horse-drawn carts are operated as public transport services, and may be locally regulated by the town authorities. The niche of horse-drawn carts is quite similar to that of the motorized three-wheelers that are increasing in numbers. Horse-drawn carts may become less important, although, as in many parts of the world, there may be an enduring niche market for tourist and/or ceremonial transport.

Figure 13: Horse Carriage

Photo credit: Paul Starkey.

Figure 14: Photographs Illustrating the Importance of Oxcarts for Rural Transport

Photo credit: Paul Starkey.

Oxcarts remain extremely important for field-to-village transport and for the "first mile" of agricultural transport. There are very large numbers of oxcarts in use throughout rural Myanmar, particularly in the central dry zone and in areas of relatively level ground in the hilly zones (such as South Shan State). While most are pulled by oxen (castrated male cattle), some are pulled by cows or buffaloes. While oxcarts are sometimes used to transport people to and from markets or agricultural fields and to transport water and building materials, their main importance is transporting agricultural inputs and outputs. They carry manure and fertilizers to fields and bring harvested produce to villages or collection points. They complement motorized transport by helping to consolidate many small loads into consignments that can justify transport by trucks. The viability of agricultural freight transport by large trucks frequently depends on many oxcarts transporting loads of up to 1 ton to collection points or markets. While some oxcarts are being replaced by two-wheel tractors with trailers or pickup trucks, evidence from many countries suggests that oxcarts will remain important for many years to come. This is because owning livestock provides many economic benefits (including manure production) and because animal-drawn carts can be very cost-effective when it comes to the timely loading and short-distance transport of farm produce. The tall, wooden cartwheels, with steel rims, are robust and long lasting and provide high clearance and make it easy for oxcarts to reach fields and pass through potholes or deep mud. Smaller, pneumatic tires are generally much more problematic for farmers and so traditional wheels will remain important. Since oxcarts move slowly and narrow cart wheels can create ruts in roads, it may be appropriate to provide oxcart lanes by the side of main roads (such lanes are already evident along many roads in Myanmar, including along the expressway).

Pack animals (mules and horses) remain important in hilly areas that lack road access. Where there are no roads, horses and mules can be used for riding and pack transport along paths and trails. Mules are quite expensive (about $500) but are particularly strong and robust, being hybrids created by crossing a female horse with a male donkey. One person can control several pack animals, each carrying 70 kg–150 kg (depending on the steepness, the quality of the mule trails, and the type of animals—with mules carrying more than horses). While horses may be owned in rural areas for personal mobility, mules are generally owned by professional transporters, who earn their livelihoods transporting agricultural inputs (fertilizers) and outputs (harvested produce), timber, building materials, and retail goods for village stores. After roads are constructed, the main comparative advantage of pack animals is greatly reduced, and pack mules mainly operate in hilly and mountainous areas at extreme periphery of the road network.

Figure 15: Pack Horses and Pack Mules

Photo credit: Paul Starkey.

Figure 16: Photographs Illustrating the Importance of Small Boats for Rural Transport

Photo credit: Paul Starkey.

Small boats complement road transport and provide essential rural access in the Ayeyarwaddy Delta and in coastal, riparian, and riverine communities. While this policy note covers road transport, the importance of water-based transport must be stressed. The interchanges between water and land transport (ranging from ports to small jetties and landing stages) invariably act as small transport hubs. The facilities and transport services (land and water) available at such intermodal interchanges can have a huge impact on the efficiency of rural transport for both passengers and freight.

2.2 Rural Transport Costs and Prices

Interviews with transport operators, passengers, and people living in villages provided illustrative rural transport costs and prices. Time and resources did not allow a full survey of rural transport costs, and so the data obtained represent "order of magnitude" information. The information provided was triangulated with other users and transport operators, as far as practicable. The figures presented in the following tables and boxes are not accurate statistics but are believed to provide a realistic picture of the types of costs being incurred by transport users and operators.

Where villages are not connected by all-season roads, transport costs are generally extremely high with freight at least $2 per ton-km. Often there is no passenger transport at all, so people have to walk (or be carried in emergencies). In some areas there may be transport by horses, and where there are suitable tracks, motorcycles and two-wheel tractors and trailers can carry people and freight. Freight may be carried by porters, pack animals, motorcycles, two-wheel tractors, or oxcarts. Some illustrative costs of such informal village transport services are provided in Table 3.

Porters, animal power, and motorcycle taxis are generally much more expensive per ton-km than larger motorized transport services, such as passenger-freight trucks (e.g., Dyna, Hilux). This is partly due to the relatively low capacity of informal village-based systems and the relatively short-distances traveled: larger motorized transport systems benefit greatly from economies of scale, in terms of both load and distance. The high cost of informal village-based transport is one reason why connecting villages to all-season roads provides major economic benefits for rural communities.

Where passenger trucks operate, freight costs are generally $0.25–$0.80 per ton-km. Examples of small freight costs for villages connected to the road network are provided in Table 4. These vary from $0.25 per ton-km for a Dyna truck hired to carry a 3-ton load to $0.80 to $1.00 per ton-km for a consigned partial load. Small farmers and traders traveling with their loads may pay $0.40 per ton-km. These tariffs do not appear excessive

Table 3: Illustrative Costs of Rural Transport Where No Conventional Transport Services Are Available

Transport Mode	Distance (km)	Weight (kg)	Time (h)	Tariff (MK)	Cost per Ton-Km ($)	Data Source (Village)[a]
Freight						
Porter	10	50	2.0	5,000	10.00	Kyaung Gyi
Horse or mule	10	70	2.0	3,500	5.00	Phayam Gyi
Oxcart	10	400	2.5	5,000	2.00	Kyaung Gyi
Tractor-trailer	10	1,500	1.0	36,000	2.40	Kyaung Gyi
Motorcycle	10	50	0.5	3,000	6.00	Kyaung Gyi
Passengers					**Cost per Passenger-Km ($)**	
Motorcycle	10	0	0.5	3,000	0.30	Kyaung Gyi
Tractor-trailer	10	0	1.0	500	0.05	Kyaung Gyi

h = hour, kg = kilogram, km = kilometer, MK = Myanmar kyat.

[a] All villages in South Shan State. Data from project interviews, August 2014.

Source: ADB estimates.

Table 4: Illustrative Costs of Small Freight from Villages to Taunggyi, Shan State

Transport Mode	Origin Village	Distance (km)	Weight	Tariff (MK)	Tariff per Ton-Km ($)
Dyna, full load	Tamg Ni	40	3000 kg	30,000	0.25
Dyna, consigned partial load	Tamg Ni	40	1 viss	25	1.00
Dyna, passengers' small freight[a]	Tamg Ni	40	1 viss	10	0.40
Dyna, passengers' small freight[a]	Tamg Ni	40	1 viss	20	0.80
Hilux, full load	Kyaut Ni	44	1500 kg	35,000	0.53
Hilux, passengers' small freight	Kyaut Ni	44	30 viss	500	0.62

kg = kilogram, km = kilometer, MK = Myanmar kyat.

[a] Passengers' small freight costs may vary from MK10–MK20 ($0.008–$0.016) per viss depending on type of load and vehicle loading. Viss is a local unit of weight, equivalent to 1.63 kg. A Dyna is a passenger truck commonly used in rural Myanmar while a Hilux is a heavy duty pick-up.

Source: Data from project field visits, August 2014.

when seen in an international context. All these tariffs are much lower than the freight charges incurred by villagers who are not connected to roads. With load consolidation and use of larger trucks, freight costs can be even lower for larger-scale farmers, traders, or groups of farmers able to share transport.

Freight tariffs paid by rural people vary greatly with distance and vehicle type. The illustrations of freight costs must be viewed with caution as the freight costs paid by rural people are much more variable than passenger fares. Freight charges may vary by two orders of magnitude (a one-hundred-fold difference). This is due to different pricing systems, different distances, and different vehicles, which in combination can cause huge variations in the cost per ton-km. Most freight operators consider both volume and weight when they charge. A light, bulky package (e.g., a rolled roofing sheet) may cost the same as a small, dense package (e.g., a sack of cement), but the cost per ton-km may differ by a factor of five. It is quite common for passenger-truck

Box 2: Example of "Dyna"-Type Passenger-Freight Truck Operating Costs

Permit: Licensed to 20 carry passengers	$60/year including insurance
Typical loading	20 passengers
Typical operating days per month[a]	10
Value of vehicle (manufactured 2004)	$17,000
Annual capital cost (depreciation)[b]	$1,500
Annual servicing and tire replacement	$1,200
Vehicle overhead cost per working day	$19
Fuel per working day	$23
Passengers needed to cover fuel costs	10
Daily perceived profit or income	$30
Passenger fares (good rural roads and/or main roads)	¢2.3/km
Small freight (MK10–MK20 per viss, 40 km journey)[c]	$0.40–$0.80 per ton-km
Freight income from passengers	Equivalent to 3–7 passengers

km = kilometer, MK = Myanmar kyat.

[a] This low level of operation was associated with competition with other Dyna operators.

[b] This depreciation excludes interest (few owners take loans) or opportunity costs of the capital.

[c] Passengers may travel with some goods, depending on the driver. This is the indicative cost of an extra basket of freight.

Source: Data from project field visits, August 2014.

operators to charge a flat rate for freight (e.g., MK10 [$0.008] per viss), irrespective of the destination along that particular route. This makes the cost per ton-km of a journey of 5 km, 10 times more expensive than a 50 km trip. The operators of smaller vehicles generally charge more—one sack is significant for a small vehicle, but negligible for larger ones. Motorcycles generally carry only one or two sacks, while a Dyna can carry 20 sacks in addition to 20 passengers. Differences due to vehicle type can be five-fold or more. Finally, there is a great deal of flexibility and discretion in charging for freight, particularly when operators make most of their money from passenger fares. Some loads are carried free-of-charge, and the charges for others may depend on the driver's mood and social factors, such as status, relationships, and even ethnicity. Combining all these factors can lead to huge differences in freight costs to the end-user, when expressed as standardized units.

Operating cost and tariff examples are provided for Dyna, Hilux, and three-wheelers. Interviews with operators of transport services working on village-to-town routes provided illustrative costs of more conventional rural transport services. The figures provided in the tables and boxes below are based on the perceptions of informal sector operators who are generally unfamiliar with the types of record keeping, data, and statistics associated with "conventional" vehicle operating costs. It must be stressed that these are illustrative and have not been verified as representing typical operating costs or tariffs.

Box 3: Example of "Hilux" Passenger-Freight Pickup Operating Costs

Permit: Surveyed vehicle not licensed to passengers[a]	
Typical loading	25 passengers (16 back, 2 front, 7 roof)
Typical operating days per month	16
Value of vehicle (manufactured 1982)	$6,000
Annual capital cost (depreciation)[b]	$400
Annual servicing and tire replacement	$700
Vehicle overhead cost per working day	$5
Fuel per working day	$15
Passengers needed to cover fuel costs	10
Daily profit or income	$10–$20
Passenger fares (rough rural roads)	¢2.0 /km
Small freight (MK10 per viss, 40 km journey)[c]	$0.40 per ton-km
Freight income from passengers	Equivalent to 6–7 passenger fares

km = kilometer, MK = Myanmar kyat.

[a] Operator avoids towns due to police checks.

[b] This depreciation excludes interest (few owners take loans) or opportunity costs of the capital.

[c] Passengers may travel with some goods, depending on the driver; this is the indicative cost of an extra basket of freight.

Source: Data from project field visits, August 2014.

Table 5: Illustrative Costs of Interurban Transport on Narrow Paved Highways

Transport Mode	Origin	Destination	Distance (km)	Time (h)	Tariff (MK)	Tariff per Passenger-Km ($)
Bus	Namsang	Taunggyi	128	6.0	3,000	0.02
Minibus (rear seat)	Namsang	Taunggyi	128	3.0	6,000	0.05
Minibus (front seat)	Namsang	Taunggyi	128	3.0	8,000	0.06
Car (rear seat)	Namsang	Taunggyi	128	2.0	7,000	0.06
Car (front seat)	Namsang	Taunggyi	128	2.0	10,000	0.08
Passenger transport, Ayeyarwaddy						
Bus (49 seats)	Hlaingthaya	Mawtjun	160	0	2,500	0.016
Midi-bus (25 seats)	Hlaingthaya	Wakhama	190	0	2,500	0.013
Minibus (12 seats)	Hlaingthaya	Mawtjun	160	0	4,000	0.025
Minibus (8 seats)	Hlaingthaya	Maubin	60	0	2,000	0.033

h = hour, km = kilometer, MK = Myanmar kyat.

Source: Data from project field visits, August 2014.

Box 4: Example of Passenger-Freight Three-Wheeler Operating Costs

Permit	$40/year
Typical loading	20 passengers
Typical operating days per month	25 (most mornings)
Value of vehicle (manufactured 2013)	$2,300
Annual capital cost (depreciation)[a]	$500
Annual servicing and tire replacement	$400
Vehicle overhead cost per working day	$4
Fuel per working day	$3
Passengers needed to cover fuel costs	2
Daily profit or income	$25
Passenger fares (good rural roads)	¢5.9 /km
Small freight (MK10 per viss, 12 km journey)[b]	$1.35 per ton-km

km = kilometer, MK = Myanmar kyat.

[a] This depreciation excludes interest (few owners take loans) or opportunity costs of the capital.

[b] Passengers may travel with some goods, depending on the driver; this is the indicative cost of an extra basket of freight.

Source: Data from project field visits, August 2014.

Rural passenger trucks charge $0.02 per passenger-km, which is similar to interurban buses. Motorcycles and three-wheelers charge more, as do faster interurban services. Examples of fares of transport services in estate cars, minibuses, and buses are shown in Table 5, although these are typical of interurban services, not rural services. Interurban fares along paved roads by relatively slow buses are $0.02 per passenger-km. Minibuses and cars charge more, as these tend to be premium services for people prepared to pay extra for greater speed (less waiting and quicker journeys) and comfort (front seats cost more).

2.3 Safety and Security

Passengers and operators appear to consider vehicle overloading is acceptable if it allows the operation of a suitable and affordable transport service. The safety and security of transport services can be extremely important issues for individuals, transport operators, local authorities, and national authorities. These can be absolute (measured by incidents occurring or injuries sustained) or relative (the comparative safety and security of two different means of traveling). The safety and security attributes of transport services also have to be assessed in relation to other parameters, including convenience, timeliness, cost, comfort, and well-being. While people may not travel in or on a vehicle that they believe to be in imminent danger of a safety

or security incident, they are often willing to accept discomfort and reduced safety if these improve their timeliness or reduce their costs. (This behavior is seen worldwide in rural and urban contexts).

Transport safety and security are gender issues. Women are (in general) more risk-averse and vulnerable than men. They are less likely to travel if they are worried about accidents or their personal well-being.

Safety and security do not appear to be priority concerns, but they should be reviewed regularly at the local level. During discussions with rural transport users and operators, safety and security did not appear to be priority concerns. There were very few reports of crashes or assaults. Issues of greater concern were the availability, frequency, and timeliness of services. While the regulatory authorities must continue to regulate for good safety and security, they must also try to regulate for and/or facilitate appropriate availability, frequency, timeliness, and affordability of rural transport. This is discussed further in section 2.5 of this policy note.

Schoolchildren travel to and from schools on a wide range of transport services. Most primary schoolchildren walk to school, but some travel by bicycle or are passengers on bicycles, motorcycles, tricycles, carriages, Hilux, Dyna, minibuses, buses, cars, and small boats. Similarly, middle school and secondary school pupils make use of all forms of rural transport. Some of these appear to be overloaded, although this was not reported as a concern. Safe and affordable transport of schoolchildren is an important issue that needs to be reviewed regularly and sensitively, at the local level, taking into account the possible alternatives (including the dangers of other unsafe practices and the risk of non-attendance to school).

Figure 17: A "Dyna" Truck with Many Passengers and their Freight

Rural people want the Dyna to carry passengers and freight. Passengers offset safety and comfort with timeliness and affordability. Light-touch regulation is appropriate.

Photo credit: Paul Starkey.

Figure 18: A "Hilux" Transporting Pupils

Due to passenger numbers and sitting positions, safer but affordable transport options should be discussed sensitively.

Photo credit: Paul Starkey.

2.4 Appropriateness of Transport Services

In general, where there are motorable roads, a diverse range of rural transport services operate and provide valuable transport for goods and passengers at what appear to be fair prices. The main limiting factors appear to be the provision of roads and the quality of existing roads. Where the transport demand is small, low-capacity vehicles are used, including motorcycles and two-wheel tractors. With greater demand (which may be consolidated by agreed timetables), Hilux- and Dyna-type passenger trucks may start to operate, particularly on market days. Competition, people's ability to pay, and/or high loading levels appear to ensure prices are deemed "reasonable" by users and operators. Other forms of transport, including hired cars, minibuses, midi-buses, and buses seldom operate on village-to-town roads, but provide important services along interurban routes, and some rural people are able to access these. Larger buses offer lower fares and are often used by farmers traveling to towns. Cars and buses are quicker and more expensive, offering premium services to those prepared to pay, such as traders, entrepreneurs, and professional workers.

Most rural transport services appear appropriate to local needs, carrying both passengers and small volumes of freight. These generally operate to and from the transport hubs of local towns, periodic markets, and/or small river ports or jetties that link water and land transport. These also provide important occasional services for pagoda visits and local festivities.

Local small-scale entrepreneurs provide most rural transport services. This is appropriate given the very variable and localized transport demand. Most rural transport passenger and freight services are provided by informal sector entrepreneurs, who often own (or informally lease) a single vehicle. They may provide transport services on a part-time basis and combine these with other economic activities, including farming. Some rural transport providers hire drivers, and/or drivers' assistants ("spares") to operate their vehicle(s). Few, if any, rural transport passenger services are operated as fleets, although interurban services passing through rural areas may be operated by transport companies. Some small-to-medium freight entrepreneurs are based in rural areas and have small fleets of trucks for hire. The fact that rural transport entrepreneurs do not build up fleets of vehicles (as some urban and interurban operators do) suggests that the small, specialized market is well suited to small-scale local operations, but it is not sufficiently profitable to justify major investments. This is true in many countries. Rural transport entrepreneurs often aspire to become interurban or urban transport suppliers, as there is greater and more consistent transport demand in these markets and fewer problems of poor transport infrastructure. Even in the interurban transport sector, one of the biggest problems is market seasonality, with operators having to scale back their operations during the rainy season, when national transport demand is lower and operating conditions are more difficult.

Transport operator associations do not appear to act as anticompetitive cartels. Some operators form formal or informal associations, designed for mutual support and sharing the transport market without incurring excessive price competition. In some countries, such as Nepal, some such associations have become anticompetitive cartels that monopolize local transport markets and actively (perhaps violently) resist new entrants to the transport market. The consultants were not made aware of any anticompetitive transport cartels operating in Myanmar. Indeed, all stakeholders contacted implied that passenger and freight charges for rural transport services were to some extent negotiable, depending on the circumstances. There were few barriers to market entry for a transport owner wishing to provide some full-time or occasional services.

While there is clear evidence of passenger and freight loading levels that exceed national regulations and manufacturers' guidelines, these do not appear to be a major source of concern. Most rural transport involve low-capacity vehicles and relatively slow speeds. There is evidence of some rural passenger transport on vehicle roof racks (as is true with interurban, peri-urban, and commuter services, including in and around

Mandalay). As noted below, this issue does not, at present, appear to signify a major problem. Naturally, the issue of loading levels and safety should be reviewed regularly, preferably at local level, with appropriate education, training, and enforcement solutions, if required.

2.5 Regulation of Transport Services

The Road Transport Administration Department of the Ministry of Rail Transportation regulates passenger and freight transport. National regulations are implemented at state and/or region and district levels, with the issuing of operating licenses and the testing of vehicles. The regulating department concentrates on fiscal compliance for all vehicles. Enforcement is carried out by police and small numbers of ministry staff, mainly at checkpoints on urban access roads. Operators require driving licenses and operational licenses. In 2014, there were about a quarter of a million licensed public transport vehicles, as shown in Tables 6 and 7. The figures are not disaggregated by urban, interurban, peri-urban, and rural transport, and most transport vehicles fall under the first three of these categories, where the transport market is more concentrated and developed. Comparing the categories of vehicles and licenses in Tables 6 and 7 suggests that urban and interurban buses, minibuses, and the Dyna are considered passenger transport vehicles that operate specific routes. The informal transport services that operate in rural areas are considered "taxis," without any route obligations. While there are operational guidelines for bus transport services (with service obligations and requirements to form coordinating nongovernment organizations) there are no such requirements for taxis or rural transport services. There is no proactive planning for the provision of rural transport services. While there are regulations concerning maximum freight and passenger loads, overall regulation is generally "light touch," leaving local officials to determine appropriate enforcement.

Table 6: National Fleet of Licensed Transport Service Vehicles, 2014

Vehicle Type	Number
Passenger vehicles	
Bus	8,183
Minibus and/or microbus	16,320
"Dyna" light truck	5,433
Light truck	6,550
"Hilux" pickup	5,093
Pick up	3,949
Station wagon (van)	7,112
Saloon car (taxi)	49,855
Tricycle	32,243
Others	102
Total passenger vehicles	**134,840**
Goods vehicles	
Two-wheel tractor trailers	21,005
1–3 tons light trucks	41,004
4–5 tons	16,073
6–7 tons	18,721
8+ tons	37,037
Total goods vehicles	**133,840**
Total passenger and freight fleet	**268,680**

Source: Created by ADB for the purposes of this report, using data provided by Road Transport Administration Department and the Ministry of Rail Transport.

Passenger trucks are appropriate for rural transport services, but safe loading levels needs to be enforced appropriately in consideration of local situations. Mixed passenger and freight services are generally required for village-to-town transport and multipurpose vehicles with side-facing seats, such as tractor-trailers, three-wheelers, Hilux, and the Dyna should be permitted to transport freight and passengers, provided they do this safely. Loading levels affect the stability and the responsiveness of the vehicles. Overloaded vehicles are generally less easy to steer and to brake, and loads with a high center of gravity (e.g., loads on roof racks) are more likely to roll over. Therefore, regulations concerning safe loading levels are generally appropriate.

Enforcement should be related to the context, including vehicle speeds, road quality, and other traffic. Travel speeds on village roads are generally low, reducing the danger of crashes.

Regulation of rural transport must be sensitive, taking into consideration local needs and the unintended consequences of regulatory enforcement. In many countries, safety legislation and/or enforcement has been enacted in response to unfortunate incidents. A more proactive approach is to assess risks and the costs and benefits of any regulatory enforcement and the overall consequences of action and inaction. Enforcing safety regulation has costs to the transport operators, transport users, and regulatory authorities. There can be unintended consequences, including increased corruption, higher transport costs, and reduced traveling. The example of Pu'er in Yunnan, People's Republic of China, which shares a border with Myanmar, shows that enacting and enforcing high standards in rural transport can lead, unintentionally, to lower transport provision and poorer safety outcomes (Box 5).

Table 7: Licenses Issued to Transport Service Vehicles, 2014

License Type	Number
"A" Freight transport	115,984
"B" Passenger transport	26,952
"C" Taxis	89,502
"D" Contract transport	1,398
"E" Freight transport for own business	34,844
Total passenger and freight fleet	**268,680**

Source: Created by ADB for the purposes of this report, using data provided by the Road Transport Administration Department and the Ministry of Rail Transport.

Box 5: Rural Transport Regulation in Pu'er, Yunnan, People's Republic of China

Just over the border from Myanmar, in Pu'er Prefecture (Yunnan Province), authorities in the People's Republic of China have regulated for high standards of the rural transport services. Informal transport services and the use of passenger trucks and three-wheelers have been banned. Only large bus companies are allowed to operate transport services. The only public transport vehicles allowed are buses, midi-buses or minibuses, which must be scrapped after 7 years of operation. While traveling, people must be seated (one person per seat). The objective of this legislation is to have only good quality bus services that are safe. Unfortunately, the end result has been very disappointing. The companies are based in city hubs and make most of their money from interurban routes. Unlike transport entrepreneurs based in small market towns, the bus companies are not familiar with the specific needs of village-to-small-town transport. The requirement to use buses makes it difficult for bus companies to provide affordable yet profitable services on rough rural roads. Regulated bus fares are based on relatively expensive vehicles and low occupation levels, making them very high ($0.10 per kilometer compared to $0.02 per kilometer in Myanmar). The end result is that most rural roads in Pu'er have no legal transport services at all. This is difficult for all rural residents, particularly schoolchildren as all secondary schools and most primary school are now located in towns. The only option for rural people (including schoolchildren) is to travel on the back of motorcycles (a relatively dangerous means of transport) or on illegal transport services, which are unregulated. The objective was good, safe transport, but the regulation actually led to very high fares (where there were services) and most people traveling on dangerous and unregulated means of transport.

Source: MMM Group. 2014. Final Report for ADB. 2012. *Technical Assistance to the People's Republic of China for Preparing the Yunnan Pu'er Regional Integrated Road Network Development Project.* Manila.

While it is envisaged that better safety practices for rural transport will be gradually adopted in the coming years, there appears no need to take immediate regulatory action or additional enforcement. In general, where roads are available, rural transport services are meeting an important need and are mainly appropriate and affordable. Improved regulatory enforcement is not a major priority. That said, dangerous practices should be reduced over time, bearing in mind the local context and the transport needs of rural people.

When addressing regulatory enforcement of overloading, it will be necessary to understand why operators and users appear to accept this, and ways in which their concerns (such as prices and profitability) can be addressed within a better safety context. The aim should be for locally appropriate practices that contribute to safer, affordable outcomes for transport operators, users, and regulatory authorities.

Special road safety solutions may be required to prevent slow-moving rural transport from causing problems on major roads. Many rural transport vehicles, including animal-drawn carts and two-wheel tractors and trailers, move at slow speeds. This presents a problem where village roads merge with main roads that have high traffic volumes and fast-moving vehicles, especially around towns. This creates potential hazards for both the slow-moving rural transport and the higher-speed traffic. Various road safety solutions are available, depending on the local situation and the extent of the problem. There can be additional road lanes or wider shoulders to allow the higher-speed traffic to safely pass the slow-moving vehicles. There can be separate tracks parallel to the main road and there can be specially designated routes that keep slow vehicles away from the main roads. Other measures include traffic calming and speed restrictions for the longer-distance traffic.

Mechanisms must be provided to allow slow-speed rural transport vehicles to cross and/or use main roads. Interurban roads pass through rural areas and may sever rural communities and their farm lands. The needs of rural communities must be understood, and mechanisms planned that allow rural communities (pedestrians and those with intermediate means of transport and rural vehicles) to cross the roads and/or use the roads for short distances to access their local village roads. Solutions should ensure that the local communities can safely pursue their livelihoods despite the severance, while the safety of all road users is as high as practicable. Options include special lanes in or near villages, wide road shoulders, parallel tracks, designated crossing places, and traffic islands and/or traffic-calming measures where slow-moving traffic will be encountered. In all cases, decisions should be made based on the local situations, and in the knowledge that both through traffic and local rural transport are likely to have to compromise for the safety and well-being of all people.

2.6 Investing in Transport Services

Benchmarks for Rural Access and Rural Transport Services

There is relatively little information available in Myanmar concerning the existing rural transport services, their costs, their modes of operation, and their adequacy in meeting the needs of farmers; commercial enterprises; government services (health, education); and rural women, men, children, and people with special transport needs. This information is also needed for assessing the access provided by existing village roads and the requirement for new investments in road construction, rehabilitation, and maintenance. While this policy note provides some illustrative information, more rigorous and comprehensive information is required to plan investments relating to transport services.

National and local authorities, assisted where appropriate by ADB and donor agencies, should invest in detailed research to obtain relevant data on rural access and transport services that can be used to justify appropriate interventions and can be a baseline to measure their impact. Information is needed from surveys and participatory discussions relating to the following.

- **User information:** Travel needs and patterns. Transport options. Service availability, standards, costs (passengers and small freight). Special needs of women, children, old people, people with disability, etc. Problems and/or issues. Options for improvements.
- **Operator information:** Perceived demand. Operating costs. Regulatory issues (government and associations). Problems and/or issues. Options for improvements.
- **Regulator information:** Systems of regulation and charges. Regulatory compliance. Associations and/or cartels. Problems and/or issues. Options for improvements.
- **Development authority and nongovernment organization information:** Problems and/or issues relating to rural access. Options for improvements.

Potential for Motorcycle Trails and Trail Bridges

Given the great value of motorcycles for village-to-town transport, where there are no road connections to villages, efforts should be made to provide tracks and/or trail bridges usable by motorcycles. Rural people, local businesses, government service providers, and almost all stakeholders desire that all villages should be connected to the road network by all-season roads as soon as is practicable and affordable. (Those not wishing such connections are generally concerned by the potential negative environmental and/or cultural impact of new road connections). To provide full access, all-season roads should be passable by pickups and light trucks. In the short term, prior to this full connectivity, villages without all-season roads are likely to benefit if trails (and in some locations, trail bridges) can be constructed that allow motorcycles, bicycles, and other small vehicles to pass easily. While motorcycle transport is expensive per passenger-km and per ton-km, it is generally cheaper and much less time-consuming than walking and carrying. The timeliness of motorcycle transport can be very important for access to health care. It is therefore proposed that transport investment plans for village tracts, townships, districts, and states and/or regions include some consideration of the benefits of constructing and/or rehabilitating trails that could be used to access villages using motorcycles.

Figure 19: Concrete Trails for Motorcycles

Photo credit: Paul Starkey.

Figure 20: Simple Earth Trails for Motorcycles

Photo credit: Paul Starkey.

Figure 21: Trail Bridges in Nepal, Some of Which Can Be Used by Motorcycles

Photo credit: Paul Starkey.

3 Village Road Infrastructure

Key Findings

Pursue basic all-season access in village roads

A very large portion of the village road network is earthen, and becomes impassable during the rainy season. At the same time, funds are being invested to improve village roads to a bituminous standard where these already provide all-season access (without traffic volumes necessarily warranting such improvement). The use of more basic standards of improvement, consisting of the improvement of drainage systems, basic water crossings (causeways and drifts), and protective measures (retaining walls) complemented by low-cost surfacing where necessary, would allow a greater length of the village road network to be brought to an all-season standard using the same budget. Improvement to bituminous standard should only be carried out where traffic volumes justify such an investment.

Focus on village roads that have a clear rural development potential

Part of the investments in village roads has been allocated to interdistrict roads. These roads connect multiple states and/or regions and do not appear to serve a specific rural development function. While such long roads might have an impact on national economic development, the low standards used are not compatible with heavy vehicles or high traffic volumes, so they are unlikely to fulfil the role of long distance connectivity. The development of such roads should be left to the Ministry of Construction, with the Department of Rural Development focusing on providing access and mobility between villages and nearby towns.

3.1 Road Network

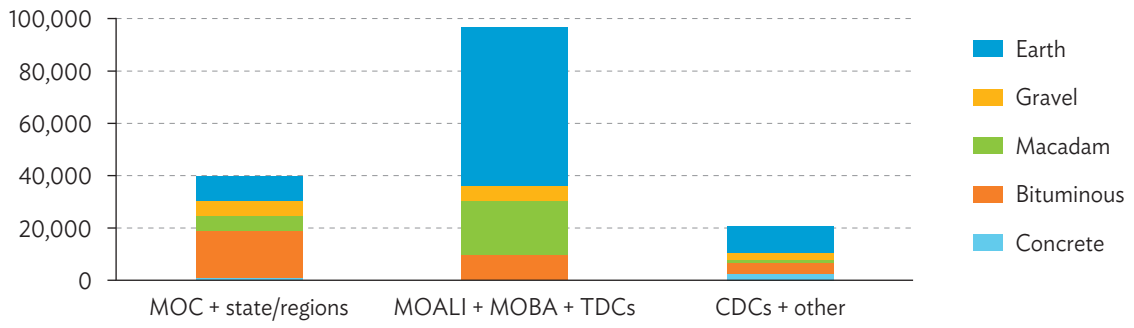
There are 157,000 kilometers (km) of roads in Myanmar, giving a road density of 0.23 km/square kilometers (km^2), comparable to neighboring Thailand (0.22 km/km^2) and the Lao People's Democratic Republic (0.17 km/km^2). Nearly 97,000 km are village roads and town roads managed by the Ministry of Agriculture, Livestock and Irrigation (MOALI), the Ministry of Border Affairs (MOBA), and the township development committees (TDCs). The remainder include 40,000 km of trunk roads managed by the Ministry of Construction (MOC), 9,500 km of urban roads managed by the city development committees (CDCs) in Yangon, Mandalay, and Naypyidaw, and 11,000 km of other roads managed primarily by the Army Corps of Engineers.

Table 8: Road Lengths by Road Type and Responsible Agency, 2013 (km)

Responsible Agency	Concrete	Bituminous	Macadam	Gravel	Earth	Total
MOC + state/regions	695	18,286	5,255	5,793	9,673	**39,702**
MOALI + MOBA + TDCs	193	9,294	20,807	5,638	60,848	**96,780**
Yangon CDC	1,108	1,766	0	551	1,032	**4,457**
Mandalay CDC	55	1,034	172	0	491	**1,752**
Naypyidaw CDC	795	276	67	1,652	476	**3,266**
Army Corps of Engineers	393	685	1,035	171	8,142	**10,426**
MEP	79	64	181	250	103	**676**
Total	**3,319**	**31,406**	**27,517**	**14,053**	**79,658**	**157,059**

CDC = city development committee; km = kilometer; MOALI = Ministry of Agriculture, Livestock and Irrigation; MEP = Ministry of Electrical Power; MOBA = Ministry of Border Affairs; MOC = Ministry of Construction; TDC = township development committee.
Source: Public Works.

Figure 22: Road Lengths by Road Type and Responsible Agency, 2013 (km)



CDC = city development committee; km = kilometer; MOALI = Ministry of Agriculture, Livestock and Irrigation; MOBA = Ministry of Border Affairs; MOC = Ministry of Construction; TDC = township development committee.
Source: Created by ADB for the purpose of this report, using data from the Department of Rural Development and Public Works.

Village Roads

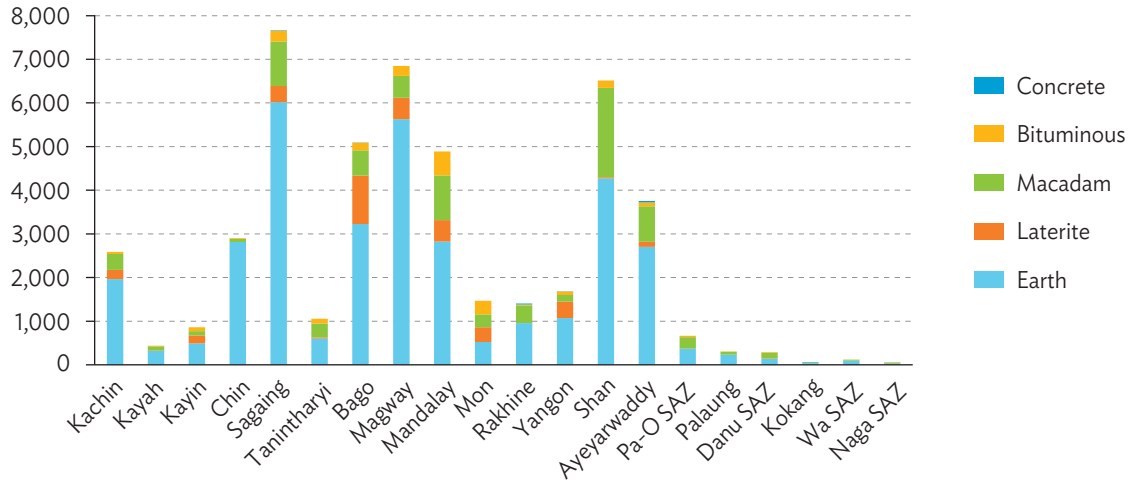
Of the 97,000 km of village and town roads, approximately 11,500 km are town roads managed by municipalities and TDCs. The remaining 85,000 km are low-volume rural roads and tracks, of which 48,700 km are classified as village roads by the Department of Rural Development (DRD) (leaving over 36,000 km of tracks). Village road densities (km/100 km^2) are highest in Yangon and lowest in Kachin and Kayin. Only 5% of the village road network is paved, with the highest percentage of paved roads in Mon State (21%), and the lowest in Chin and Kachin states (respectively, 1% and 2%). The majority of village roads (70%) remain earthen, reaching a maximum of 97% in Chin State and a minimum of 36% in Mon State. Many of these earthen roads become impassable during the rainy season.

Table 9: Village Road Lengths by Surface Type and State and/or Region, 2013 (km)

State/Region	Concrete	Bituminous	Macadam	Laterite	Earth	Total	Km/100 Km²	% Paved	% Earth
Kachin	0	44	365	209	1,967	**2,586**	2.9	2	76
Kayah	0	16	98	7	319	**440**	3.8	4	72
Kayin	0	91	97	182	492	**862**	2.8	11	57
Chin	0	16	73	0	2,816	**2,905**	8.1	1	97
Sagaing	14	249	1,015	371	6,018	**7,668**	8.1	3	78
Tanintharyi	0	113	315	26	603	**1,057**	3.1	11	57
Bago	9	175	579	1,110	3,224	**5,097**	12.9	4	63
Magway	0	229	501	492	5,627	**6,849**	15.3	3	82
Mandalay	0	549	1,026	491	2,824	**4,890**	13.2	11	58
Mon	0	313	296	337	525	**1,471**	12.0	21	36
Rakhine	24	22	404	0	957	**1,407**	3.8	3	68
Yangon	6	81	150	375	1,074	**1,686**	16.6	5	64
Shan	0	171	2,045	29	4,269	**6,514**	4.2	3	66
Ayeyarwaddy	36	87	813	117	2,703	**3,756**	10.7	3	72
Pa-O SAZ	0	28	264	0	372	**664**	n/a	4	56
Palaung SAZ	0	12	65	0	231	**307**	n/a	4	75
Danu SAZ	0	14	124	14	137	**288**	n/a	5	47
Kokang SAZ	7	0	16	0	40	**63**	n/a	11	63
Wa SAD	0	8	21	0	94	**122**	n/a	7	77
Naga SAZ	0	8	16	0	40	**64**	n/a	13	63
Total	**97**	**2,227**	**8,282**	**3,761**	**34,330**	**48,696**	**7.2**	**5**	**70**

km = kilometer, km² = square kilometer, n/a = not applicable, SAD = self-administered division, SAZ = self-administered zone.
Source: Created by ADB for the purpose of this report, using data from the Department of Rural Development.

Figure 23: Village Road Lengths by Surface Type and State and/or Region, 2013 (km)



km = kilometer, SAD = self-administered division, SAZ = self-administered zone.
Source: Created by ADB for the purpose of this report, using data from the Department of Rural Development.

Road Construction and Improvement

During the 20-year existence of the Department of Development Affairs (and later the Department of Progress of Border Areas and National Races Development), it has constructed 9,310 km of earthen roads and improved 7,220 km to gravel standard and 4,270 km to bituminous standard. It has furthermore carried out periodic and large maintenance in nearly 6,400 km.

Since its creation in 2011, the DRD has constructed 3,685 km of earthen roads, and improved 2,125 km of village roads to macadam standard and 940 km to bituminous standard. DRD does not appear to apply gravel surfaces anymore due to the high maintenance requirements of such roads. The annual average length of construction and improvement is significantly higher than MOBA, in line with the increased budgets DRD receives. The annual length of construction and improvement is still increasing, with nearly 3,700 km of construction and 3,450 km of improvement to bituminous and macadam standard planned for 2014–2015 (similar to the volumes carried out in the past 3 years).

Table 10: Road Construction and Improvement by the Department of Rural Development (km)

Surface Type	2011/12	2012/13	2013/14	Total
Bituminous	65	350	525	**940**
Macadam	413	441	1,271	**2,125**
Gravel	265	0	0	**265**
Earth	652	930	2,103	**3,685**
Total	**1,395**	**1,720**	**3,899**	**7,014**

km = kilometer.

Source: Department of Rural Development.

Interdistrict Roads

Apart from the village roads linking villages to each other and to village tracts and townships, the Department of Development Affairs (DDA), and subsequently DRD, have also been involved in the construction and improvement of three interdistrict roads with a total length of 2,300 km. These interdistrict roads have been formed by joining various sections of road that tend to run parallel to the main trunk roads so that together they form roads of 700 km–800 km running north–south from (#1) Mandalay to Yangon, from (#2) Mandalay to Mawlamyine (Mon State), and from (#3) Sagaing to Myitkyina (Kachin State). The roads were first upgraded to gravel standard (most work have been completed) and subsequently to bituminous standard (works on the Sagaing–Myitkyina road are ongoing as of 2015). These road alignments tend not to pass through towns (which are served by the trunk roads) but connect many villages and agricultural areas.

Figure 24: Interdistrict Road 2, Illustrating Bridge and Surface Problems

Photo credit: Paul Starkey.

Table 11: Interdistrict Roads (km)

	Mandalay	Magway	Bago	Yangon	Mon	Sagaing	Kachin	Total	Bridges
1. Mandalay–Yangon	134	214	211	85	0	0	0	**644**	792
2. Mandalay–Mawlamyine	343	0	231	0	169	0	0	**744**	813
3. Sagaing–Myitkyina	0	0	0	0	0	362	185	**547**	692

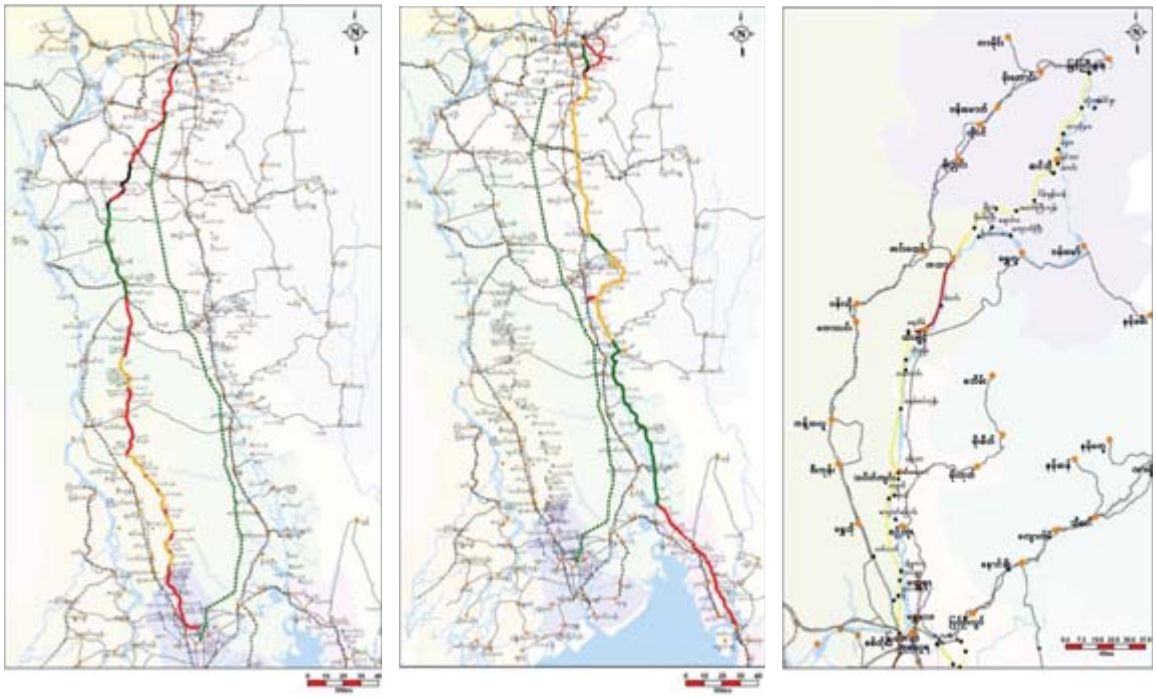
km = kilometer.
Source: Created by ADB for the purpose of this report, using data from the Department of Rural Development.

The rationale may have been to allow trucks to pass through agricultural areas, and so bring economies of scale to rural freight transport to the many villages along the alignments. There is evidence that on some rural roads (not necessarily interdistrict roads) lower freight costs for agricultural inputs and outputs have been achieved once the roads have been made suitable for larger trucks.

The concept of these interdistrict roads appears to have two fundamental flaws, as follows:

- They do not pass through the nearby destinations that rural people want to travel to.
- The design standards are those of low-volume rural roads, which are inadequate for heavy, long-distance vehicles.

Figure 25: Alignment of Interdistrict Roads 1–3



Source: Department of Rural Development.

Villagers mainly wish to travel to the nearest towns to sell produce, buy goods, and access various services including health, education, financial transactions, civic responsibilities, and recreation. Sometimes (but infrequently) they will connect to long-distance transport services along the trunk roads. They do not have routine needs to travel to other villages along the alignment of the interdistrict roads. Therefore, there are few (if any) transport services traveling up and down the interdistrict roads. Those private vehicles and passenger and freight services that do use the interdistrict roads generally travel to and from villages along the interdistrict road until they reach a radial spoke road that goes to a nearby town located on a trunk road. Local demand is for more and better radial connections that link villages to the town hubs. This is true for agricultural inputs and outputs and also for other road users (river sand enterprises, rock quarries, and even pagoda complexes). This is part of the classic "hub and spoke" concept of transport requirements that encourages the development of village spokes to market towns that are situated along trunk roads (national spokes). Rural residents are likely to benefit most from roads that link them to nearby towns and from the long-distance transport services that can operate effectively on national roads.

If the interdistrict roads were of a higher standard, these would attract traffic from the trunk roads, particularly where these "cut corners" or bypass toll stations or places of inspection and/or regulation. These roads would also be very heavily used if there were problems (flooding, repairs, or disturbances) along the trunk roads to which these more or less run parallel. There is evidence that when interdistrict road #2 was first opened, a number of long-distance trucks used the road as an alternative to the trunk roads. However, due to the failure of bridges (failed timbers and failed earthworks), the road stopped being a dependable alternative route, and traffic declined to the current very low levels. If the roads did become viable as long-distance routes, these would attract heavy trucks and traffic requiring higher-standard roads. Over time, such long-distance transport routes (if technically viable) would almost certainly stimulate economic development along their length, with some larger villages developing into small towns. However, such an investment should be part of a national roads plan. The level of economic planning and infrastructure construction required for long-distance, interdistrict roads does not seem to fit into the present role of DRD.

Serious consideration should be given to the option of reclassifying the three existing interdistrict roads that connect several states and/or regions as union roads or state and/or region roads. Their management would then be taken over by MOC. DRD should concentrate on low-volume roads that link villages to towns and to the national road network.

3.2 Bridges

A lot of attention is being paid to the construction of bridges in the village road network to provide all-season access. Most of these bridges are made of timber, and have to be replaced every few years. This is a serious problem as replacement is generally not carried out in a timely fashion. The timber bridges are gradually being replaced by concrete bridges with support from both DRD and MOBA, although timber bridges also continue to be constructed. Although most bridges are small (less than 30 meters [m]), there is also a relatively high number of large bridges (more than 30 m in length), including bailey and suspension bridges. In the past 3 years alone, DRD has constructed a total length of 20,800 m of bridges, causeways, and culverts.

In addition to the bridges constructed by DRD that are listed below, MOBA reports having constructed a total of 1,664 small bridges, 212 large bridges (more than 30 m), and 86 suspension bridges since 1994.

Table 12: Number of Bridges by Type and State and/or Region, 2013 (m)

State and/or Region	Concrete	Timber	Culvert	Bailey	Suspension	Total
Kachin State	34	304	13	0	0	**351**
Kayah State	23	10	8	0	0	**41**
Kayin State	114	79	0	0	0	**193**
Chin State	0	18	41	0	0	**59**
Sagaing Region	173	800	45	2	31	**1,051**
Tanintharyi Region	269	91	30	0	0	**390**
Bago Region	544	634	0	7	2	**1,187**
Magway Region	80	176	92	0	0	**348**
Mandalay Region	185	337	146	0	0	**668**
Mon State	410	439	140	2	0	**991**
Rakhine State	149	456	107	0	0	**712**
Yangon Region	63	149	219	0	0	**431**
Shan State	129	616	198	0	2	**945**
Ayeyarwaddy Region	248	475	181	5	0	**909**
Total	**2,421**	**4,584**	**1,220**	**16**	**35**	**8,276**

m = meter, SAD = self-administered division, SAZ = self-administered zone.
Source: Department of Rural Development.

Table 13: Bridge Construction by the Department of Rural Development (m)

Surface type	2011/12	2012/13	2013/14	Total
Concrete	858	0	0	**858**
Timber	2,068	2,791	8,284	**13,143**
Culvert	169	1,430	4,171	**5,771**
Causeway and/or other	363	0	671	**1,033**
Total	**3,458**	**4,221**	**13,126**	**20,805**

m = meter.
Source: Department of Rural Development.

Footbridges

Although roads and bridges are very important for rural access, many of the rural transport and mobility needs are fulfilled using footpaths and footbridges. Improvement of such basic infrastructure can often greatly improve access, including access to roads, at a minimal cost. Especially in the case of footbridges, access improvements can be significant in terms of linking villages isolated by water courses and avoiding the need for costly road bridges. This has been very evident in Nepal, where the Department for Local Infrastructure Development and Agricultural Roads has a special unit responsible for footbridges. DRD does not currently have any activities aimed at footbridges, however, and focuses its activities on providing road access to all villages.

4 Village Road Management

Key Findings

Improve institutional coordination and integration of activities in village roads

Responsibility for village roads and bridges is shared between the Department of Rural Development (DRD) under the Ministry of Livestock, Fisheries and Rural Development and the Department of Progress of Border Areas and National Races Development under the Ministry of Border Affairs. Township development committees also invest in village roads and bridges, and have increasingly larger budgets as a result of the government's focus on rural development. Better coordination and an integration of activities are needed to avoid the duplication of efforts and to increase the efficiency of rural development budgets. The Rural Development Law currently being drafted forms a good basis for introducing such an integrated approach and clearly defining the responsibilities of the different agencies.

Accelerate the recruitment of engineers

With only one-fifth of the positions in DRD local offices filled and the annual volume of works increasing rapidly, there are not enough engineers to ensure proper supervision of the works. This is likely to adversely affect the quality and sustainability of village road works. Recruitment of additional engineers should be accelerated to address this issue.

Improve the design and supervision of village road construction and improvement

The quality of village road construction and improvement is below standard. In large part this appears to be due to a lack of proper engineering design of the road and proper supervision during implementation. The recruitment of additional civil engineers and the development of clear design and supervision guidelines will help ensure the quality and sustainability of village road works. Further development of design standards and harmonization of standards between DRD and the Ministry of Border Affairs is also recommended.

Professionalize maintenance implementation

Routine maintenance of village roads is currently carried out through voluntary labor contributions. Necessary skills and experience, as well as proper tools, are lacking and maintenance is not carried out in a timely manner. The introduction of trained maintenance workers who are paid against clear performance targets will result in better road conditions and reduce the need for special maintenance.

4.1 Administrative Divisions

Myanmar is divided into seven states and seven regions[10] and the Union Territory of the capital Naypyidaw. Each of the seven states and seven regions has a state and/or regional government with a chief minister and Parliament (*Hluttaw*), and has the same status as a ministry. Naypyidaw Union Territory is under the direct administration of the President through the Naypyidaw Council. The states and regions are divided into 63 districts, which are subdivided into 330 townships. Within each township there are many villages (64,134 villages in total) that are grouped into village tracts (13,618 village tracts in total). There are on average five villages in a village tract, and an average of about 40 village tracts in a township. The average village tract comprises 3,771 individuals (and each village, 564 individuals). In addition, there are five self-administered zones (SAZ)[11] and one self-administered division (SAD)[12] managed by a leading body, covering a total of 18 townships.

4.2 Agencies Involved in the Road Sector

The road sector in Myanmar is characterized by a very fragmented institutional structure encompassing several ministries as well as local governments: Ministry of Electrical Power, Ministry of Home Affairs, Ministry of Agriculture, Livestock and Irrigation (MOALI), Ministry of Border Affairs (MOBA), Ministry of Construction (MOC), Ministry of Defense, Ministry of Transport, Ministry of Rail Transportation, state and regional governments, city development committees (CDCs), township development committees (TDCs), and village development committees (VDCs). In the case of village road management, the responsibility lies mainly with MOALI and MOBA, with complementary involvement of the TDCs and VDCs.

Ministry of Agriculture, Livestock and Irrigation

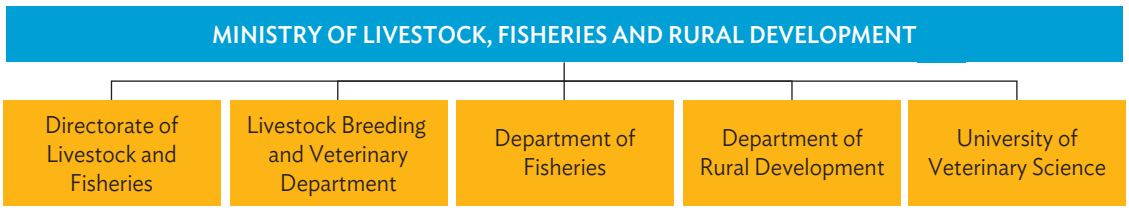
The Department of Rural Development (DRD) under the MOALI is currently the main government agency responsible for village roads. It was established in 2012 under the MOBA and transferred to the Ministry of Livestock, Fisheries and Rural Development (MLFRD) in August 2013. The MLFRD was merged with the Ministry of Agriculture and Forestry in April 2016 to form the 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).

[10] These are Chin State, Kachin State, Kayah State, Kayin State, Mon State, Rakhine State, Shan State, Ayeyarwaddy Region, Bago Region, Magway Region, Mandalay Region, Sagaing Region, Tanintharyi Region, and Yangon Region. States and regions have the same status, but the population of regions can be described as predominantly Burman (Bamar), while in the states, the population is mainly from ethnic minorities.

[11] Naga SAZ in Sagaing Region is comprised by Lahe, Leshi, and Namyun townships; and in Shan State, Danu SAZ by Pindaya and Ywangan townships, Kokang SAZ by Konkyan and Laukkai townships, Palaung SAZ by Manton and Namshan townships, and Pa-O SAZ by Hopong, Hshihseng, and Pinlaung townships.

[12] Wa SAD in Shan State is comprised by Hopang, Metman, Mongmao, Naphan, Panwai, and Pangsang townships.

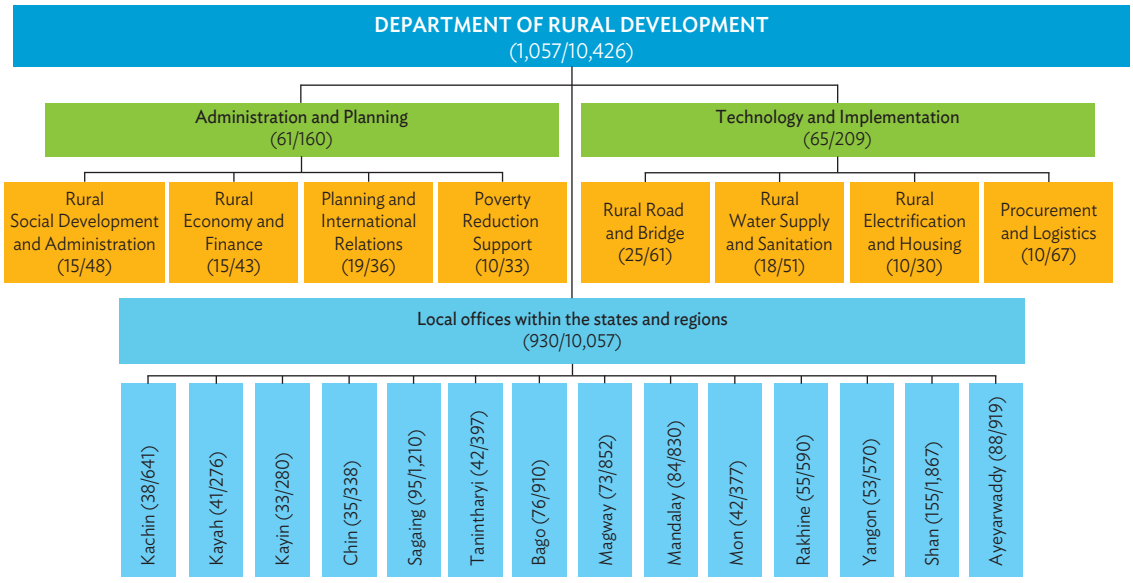
Figure 26: Ministry of Livestock, Fisheries and Rural Development Organization Chart (until April 2016)



Source: Ministry of Livestock, Fisheries and Rural Development.

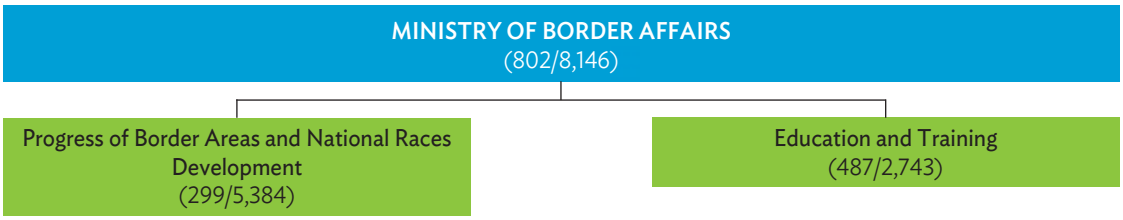
At headquarters in Naypyidaw, DRD has an Administration and Planning Division dealing with soft functions, and a Technology and Implementation Division taking care of infrastructure activities, including the Rural Road and Bridge Section that is responsible for village roads. Furthermore, DRD has offices 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 the VDCs are involved in planning and prioritizing works and where works are carried out by contractors or VDCs.

Figure 27: Department of Rural Development Organization Chart and Staff Numbers



Note: Numbers in brackets refer to officers/staff.
Source: Department of Rural Development.

Figure 28: Ministry of Border Affairs Organization Chart and Staff Numbers



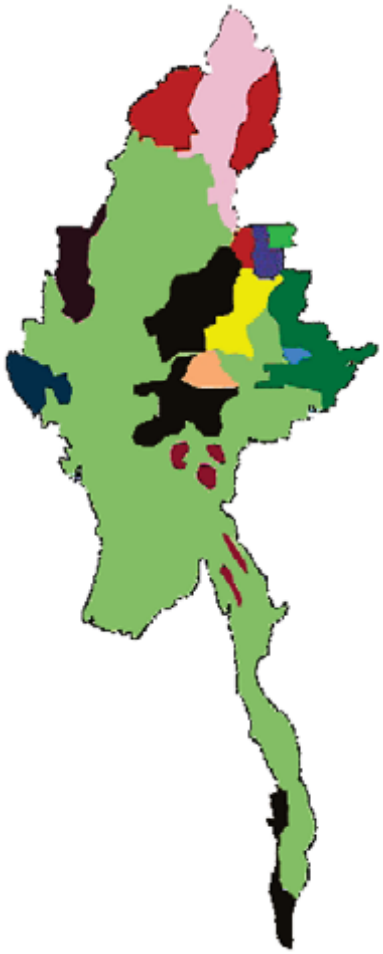
Note: Numbers in brackets refer to officers/staff.
Source: Ministry of Border Affairs.

Ministry of Border Affairs

In 1992, the Ministry of Progress of Border Areas and National Races was formed. In 1994, the Department of Development Affairs (DDA) was created, and the name of the ministry was changed to the Ministry of Progress of Border Areas, National Races, and Development Affairs. The DDA was made responsible for the township development committees (previously under the Ministry of Home and Religious Affairs). DDA was responsible for rural infrastructure development, including village roads, and worked through offices at state and/or regional level and township level (there were no district level offices). In 2011, the ministry was transformed into the MOBA. In 2012, the DDA was transformed into the DRD in a significantly compacted format, with most local staff transferred to the Department of Progress of Border Areas and National Races, and the TDCs and their staff transferred to the Ministry of Home Affairs. DRD was subsequently transferred to MLFRD in 2013.

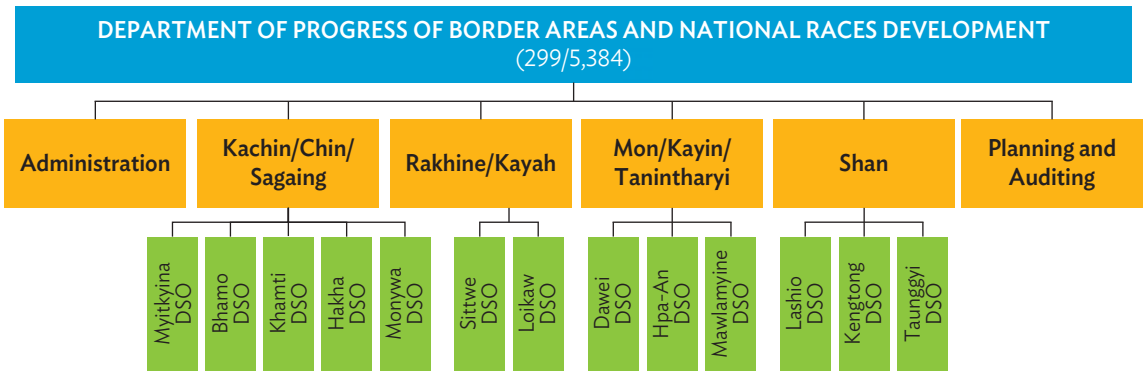
MOBA remains active in village roads through its Department of Progress of Border Areas and National Races, which was renamed as the Department of Progress of Border Areas and National Races Development (DPBANRD). The activities of MOBA and its DPBANRD are restricted to approximately one-third of the townships located in border areas or with large ethnic minority populations. These townships are spread over 7 states, 2 regions, and 6 self-administered zones and/or divisions. The total area covered is almost 220,000 km^2, 32% of the country.

Figure 29: Ministry of Border Affairs Activity Areas



Source: Ministry of Border Affairs.

Figure 30: Department of Progress of Border Areas and National Races Development Organization Chart



DSO = Development Supervisory Office.
Note: Number in bracket refers to officers/staff.
Source: Ministry of Border Affairs.

Part of the mandate of DPBANRD in these townships is to implement socioeconomic infrastructure for the border areas and infrastructural works for peace, including roads and bridges, agricultural water supply, drinking water supply, electricity, housing, education, and health. As such, it duplicates the responsibilities of DRD in these townships. Examples of duplication in planned projects have been mentioned by both DRD staff and villagers. Better coordination and integration of activities in these townships is required to avoid duplication and ensure a harmonized approach to rural development.

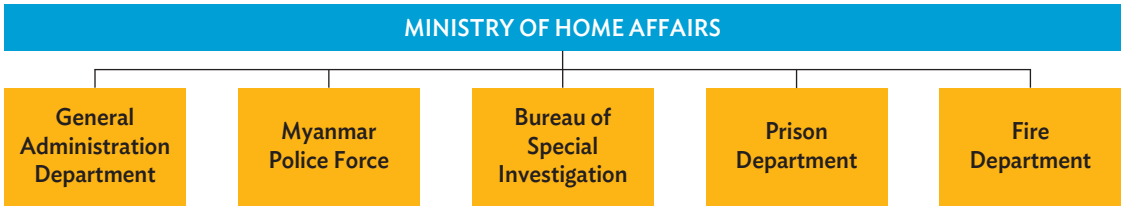
At its headquarters, DPBANRD has an Administration Division and a Planning and Auditing Division as well as four divisions that monitor the activities carried out in the nine states and regions covered by MOBA. In these states and regions, DPBANRD has 13 development supervisory offices. Under these offices, there are 22 regional development offices, with 61 subregional offices and 84 development supervisory suboffices at township level. The total staff of DPBANRD is 5,683 of whom 299 are officers.

Table 14: Ministry of Border Affairs Local Offices

Development Supervisory Office	Regional Development Office	Subregional Office	Development Supervisory Suboffice
Myitkyina	2	9	8
Bhamo	1	2	3
Lashio	3	11	10
Taunggyi	1	4	10
Kengtong	1	5	8
Loikaw	1	3	1
Pa-an	1	6	9
Mawlamyine	1	4	2
Dawei	1	2	6
Sittwe	1	4	3
Monywa	3	5	3
Hakha	3	3	4
Khamti	3	3	4
Supervisory Department	0	0	1
Upgrading to township level	0	0	2
To be opened	0	0	10
Total	**22**	**61**	**84**

Source: Ministry of Border Affairs.

Figure 31: Ministry of Home Affairs Organization Chart



Source: Ministry of Home Affairs.

Township Development Committees

In 1972, TDCs were introduced under the General Administration Department of the then Ministry of Home and Religious Affairs, as integrated organizations responsible for both urban and rural development works. In 1993, the Development Committees Law was promulgated, which stipulated that the Ministry of Home Affairs should form TDCs in all townships. As a result, there are currently 285 TDCs (the remaining townships fall under the city development committees in Mandalay, Naypyidaw, and Yangon). The law further stipulates that TDCs have the right to levy taxes, including building and land taxes, municipal service taxes, tax on vehicles registered in the town, and wheel tax. TDCs are required to spend 25% of their revenue on rural development, including the construction and maintenance of roads and bridges that is mentioned explicitly as one of the responsibilities in the Development Committees Law.

Up until 1993, the TDCs were the only institutions responsible for village road works, using part of the revenue collected by the townships. In light of the limited revenues available, however, very few village road works were carried out. In 1994, the DDA was created under the Ministry of Progress of Border Areas and National Races and Development Affairs, and made responsible for the TDCs. With the introduction of DDA, funding came from the central government to complement the allocations to rural development from locally collected revenue.

With the creation of DRD in 2012, and its transfer to MLFRD, the TDCs were again placed under the General Administration Department of the Ministry of Home Affairs. The TDCs continue to carry out development works, including village roads, within the township boundaries as per the Development Committees Law, using part of the collected tax revenue. The TDCs work through the VDCs that play a similar role at village tract level.

In 2013, the central government set aside a poverty alleviation budget that is allocated by the General Administration Department under the Ministry of Home Affairs. As part of this budget, each township receives MK100 million ($78,000) per year for development projects, although only MK5 million ($3,900) may be used for any single project.

5 Planning and Prioritization

Key Findings

Review the long-term planning for village roads and bridges. Currently, planning of village roads and bridges is guided by a five-year (2011–2016) and a twenty-year (2011–2031) plan. Increased attention to rural development has led to larger budgets, resulting in the plan's targets being surpassed. The targets beyond the first 5-year plan need to be adjusted. In doing so, account should be taken of actual needs, in terms of new construction to connect remaining villages and populations and improvement to all-season access to all villages. Initial results of modeling suggest that approximately 100,000 kilometers of new construction and 75,000 kilometers of improvement of existing roads are required to provide all-season access to all villages, mostly involving village roads. The resulting village road sector plan should be further expanded to be more comprehensive than a list of target investment levels and work volumes, including a clear strategy consisting of objectives and selection and/or prioritization criteria.

Introduce a consolidated approach to annual planning of village road works. There is a lack of coordination in annual planning for village roads and bridges between the Ministry of Border Affairs and the Ministry of Livestock, Fisheries and Rural Development, leading to a duplication of planned investments. The selection and prioritization criteria applied by both agencies are also different. With the township development committee (TDC) funding for village roads and bridges also increasing, there is scope for further confusion. A consolidated, township-level, annual village-road sector plan, based on a single set of planning procedures and criteria, would allow greater coordination among the different agencies.

Collect basic access data and introduce objective planning procedures. Currently, project selection and prioritization for village roads is strongly influenced by village development committee and TDC officials and members of the Parliament. Monitoring of proposed priorities by the Department of Rural Development is limited due to a lack of data on overall construction and improvement needs. This is resulting in some poor villages that lack proper roads being excluded, and more developed villages already having all-season road access being prioritized. The introduction of clear and objective planning procedures and prioritization criteria complemented by a review of proposed priorities against identified access needs would ensure greater transparency and ensure greater effectiveness of village road investments in terms of rural access and development. The identification of a village road core network would allow further targeting of villages and populations with the lowest levels of access.

Introduce standards for village road surface selection. Currently, the surface type of village roads is largely decided by village development committees and TDCs. There are no standards regarding the type of all-season surface to be applied based on traffic volumes, terrain, and climate. The introduction of such standards would allow the objective selection of surface types, while optimizing the use of village road budgets in providing all-season access to all villages.

5.1 Planning Targets in Use

The Department of Rural Development (DRD) and the Ministry of Border Affairs (MOBA) rely on a five-year (2011–2016) and a twenty-year (2011–2031) plan, which sets targets for different sectors.

For the village road sector, the overall outcome objective of the 20-year plan is to provide road access to all villages by 2030. The 20-year plan includes output targets for 10,000 kilometers (km) of village road construction and 19,000 km of village road improvements to macadam or bituminous standard. Although graveling was included in the first year of the plan, it is not included in subsequent years due to the high maintenance costs for this surface type.

Table 15: Twenty-Year Plan for Roads (km)

	20-Year Plan (2011–2031)	5-Year Plan (2011–2016)	2011–2012 (Actual)	2012–2013 (Actual)	2013–2014 (Actual)	2014–2015 (Planned)	2015–2016 (Planned)	Total 2011–2016
Bituminous	6,693	2,022	65	350	525	672	493	2,105
Macadam	12,129	4,760	413	441	1,271	2,994	1,163	6,282
Gravel	265	265	265	0	0	0	0	265
Earth	9,904	8,499	652	930	2,103	3,681	1,969	9,335
Total	**28,991**	**15,546**	**1,395**	**1,720**	**3,899**	**7,347**	**3,625**	**17,987**

km = kilometer.

Source: Created by ADB for this report, using data provided by the Department of Rural Development.

A large part of the 20-year plan is to be implemented in the first 5 years (2011–2016), including 8,500 km of planned village road construction (85% of total) and 7,000 km of planned improvement (37% of total). Due to increased funding levels, DRD expects to exceed these targets, reaching approximately 9,500 km of construction and 8,750 km of improvement by 2016. This expected achievement in the first 5 years of DRD operation is more than what the Department of Development Affairs (DDA) and the Department of Progress of Border Areas and National Races Development (DPBANRD) achieved in the past 20 years. The ever-increasing funding levels for rural development make adjustment of the 20-year plan necessary, especially for the period beyond 2016.

In terms of bridges, the 20-year plan foresees nearly 117,000 meters (m) of bridge construction consisting mainly of timber bridges, and 77,500 m of culverts and causeways. Most of the concrete bridges and causeways are planned to be constructed in the first 5 years, with the length of planned causeways for the 5-year period already significantly increased compared to the original 20-year plan. Implementation by DRD is also exceeding planned volumes, with significant increases in the length of causeways as an inexpensive means of providing water crossings for roads with little traffic. This approach is considered very effective in terms of providing basic all-season access for village roads with very low traffic volumes.

Table 16: Twenty-Year Plan for Bridges (m)

	20-Year Plan (2011–2031)	5-Year Plan (2011–2016)	2011/12 (Actual)	2012/13 (Actual)	2013/14 (Actual)	2014/15 (Planned)	2015/16 (Planned)	Total 2011–2016
Concrete	4,790	3,495	858	0	0	4,458	794	6,110
Wooden	112,101	28,728	2,068	2,791	8,284	10,991	6,925	31,059
Culvert	77,192	14,522	169	1,430	4,171	4,624	4,243	14,638
Causeway and/or other	363	1,766	363	0	671	4,165	482	5,680
Total	**194,446**	**48,511**	**3,458**	**4,221**	**13,126**	**24,238**	**12,443**	**57,486**

m = meter.

Source: Department of Rural Development.

5.2 Access Needs

The model presented in section 1.2 (p. 7) serves to determine the approximate number of villages and village tracts without (all-season) road access, and the additional construction and improvement required to provide them with all-season road access. Its function is to show the scale of work still required, and how this work is likely to be distributed over the different states and regions. However, for proper planning purposes, actual data are required regarding the number of villages and village tracts that have road access, and whether this involves all-season or only dry-season road access. Such data would allow the preparation of a well-founded medium- to long-term plan for the village road sector as well as the development of a village road sector strategy aimed at achieving the outcome objective of (all-season) road access for all villages within a realistic time frame.

Initially, the data collection could concentrate on determining which villages and village tracts have all-season and dry-season road access. Such information could be quite easily obtained through the township development committees (TDCs) and the DRD offices at township level. Another important step would be to identify those village roads that provide only dry-season access to villages and village tracts and to determine their length from the existing road inventory. This would allow the calculation of the length of village roads for improvement to all-season standard.

A crucial planning exercise must be to estimate the length of construction required to connect those villages and village tracts that do not yet have any road access. This may be more complicated, but can be modeled using geographic information system (GIS) data for the unconnected villages and the points on the road network to which they could be connected. Obtaining such data on rural village access and rural road conditions should be a priority objective for DRD.

In line with this thinking, the introduction of a village road "core network" approach is recommended. The core network comprises those roads absolutely necessary to reach all villages, with one single designated road connection to the national network for each village. Where a village is connected to the national network by multiple roads, only one road is selected to form part of the core network. This approach allows funding to be focused on the core network, accelerating the speed with which different villages can be provided with road access and core roads can be improved to all-season standard. More importantly, it should avoid the situation where some villages have multiple access roads improved to all-season standard while others have no road access at all (as is currently happening in some situations in Myanmar). Improvement of additional roads outside the core road network would then become a second priority (perhaps with budget restrictions or funding from other sources).

Box 6: The District Road Core Network Approach in Nepal

In Nepal, rural roads are managed at district level. The past decade has seen a period of intense road construction in Nepal aimed at improving access to village development committees and villages. The limited funding available was spread over a large number of roads, resulting in poor quality construction that led to many of these roads becoming impassable. In 2012, a district road core network (DRCN) approach was introduced, whereby a network of roads was identified by the district development committees connecting each of the village development committees to the trunk road network. District road sector budgets are now focused on constructing any missing DRCN links, improving existing DRCN roads to all-season standard, and providing proper maintenance to the entire DRCN network.

Source: Asian Development Bank.

5.3 Annual Planning

The 20-year plan that currently provides guidance to investments in the village road sector is simply an investment plan with estimated volumes based on available budgets. The actual selection of specific roads and bridges for construction or improvement is carried out on an annual basis.

Department of Rural Development

In the case of DRD, priorities for different villages are decided at the village tract level by the village development committees (VDCs). The identified priorities are submitted to the TDCs, which decide on the priorities of the different village tracts. DRD township staff participate in the TDC meetings together with other government agencies.

The resulting project needs identified by the TDCs and DRD staff at the township level are forwarded to the district level DRD office and subsequently to the state and/or regional DRD office, with further selection and prioritization taking place at each level. Criteria used by DRD in preparing and prioritizing the plans at the different levels are development need and beneficiary coverage. Priority is further given to new construction, followed by maintenance and upgrading. For roads, the focus is on roads linking villages to village tracts and townships.

The state and/or regional plan is finally submitted to the state and/or regional government for approval by the state and/or regional parliament (*Hluttaw*). The state and/or regional government then send a request letter to the Ministry of Agriculture, Livestock and Irrigation (MOALI) in Naypyidaw for the required budget. Budget allocation by DRD to the different states and/or regions and self-administered zone (SAZ) and/or self-administered division (SAD) is according to the percentage of villages and townships in the area concerned, not according to the existing access levels. Where the available budget allocation is insufficient, the states and/or regions are requested to adjust their plans.

The annual plan for FY2014 is presented in Table 17. This includes 3,600 km of earth road construction and 3,500 km of road improvement works, as well as 17,300 m of bridges and causeways and 4,600 m of culverts.

Table 17: Planned Department of Rural Development Road and Bridge Works, 2014–2015

State and/or Region	Roads (km)				Bridges (m)				
	Bituminous	Macadam	Earth	Total	Concrete	Timber	Causeway	Culvert	Total
Kachin	32	88	123	**243**	61	532	0	194	**787**
Kayah	31	98	145	**274**	0	365	0	352	**717**
Kayin	15	63	213	**291**	0	533	0	230	**764**
Chin	14	39	432	**485**	0	256	0	152	**408**
Sagaing	36	280	257	**573**	0	1,045	536	178	**1,760**
Tanintharyi	116	251	188	**556**	2,089	195	25	181	**2,491**
Bago	34	245	436	**714**	18	1,605	262	268	**2,153**
Magway	21	348	335	**704**	0	386	1,500	306	**2,192**
Mandalay	68	488	393	**949**	124	873	640	226	**1,864**
Mon	22	37	82	**141**	0	383	0	152	**535**
Rakhine	34	170	162	**366**	148	746	0	283	**1,177**
Yangon	73	19	151	**242**	264	293	0	152	**709**
Shan	39	182	253	**474**	0	501	0	465	**967**
Ayeyarwaddy	37	430	229	**696**	668	2,610	0	871	**4,150**
Pa-O SAZ	8	31	53	**93**	0	183	0	96	**280**
Palaung SAZ	8	20	56	**85**	0	94	0	110	**204**
Danu SAZ	8	16	47	**71**	0	137	0	114	**251**
Kokang SAZ	6	10	26	**42**	0	122	0	91	**213**
Wa SAD	4	8	19	**32**	0	9	0	101	**110**
Naga SAZ	13	25	40	**78**	0	122	0	91	**213**
Total	**618**	**2,848**	**3,640**	**7,107**	**3,373**	**10,991**	**2,963**	**4,618**	**21,945**

km = kilometer, m = meter, SAD = self-administered division, SAZ = self-administered zone.
Source: Department of Rural Development.

Department of Progress of Border Areas and National Races Development

The planning process applied by DPBANRD under MOBA does not make use of the plans developed by DRD, and follows a separate selection and prioritization process. This resulted in a number of overlapping projects in FY2013 (the first year of operations of DRD under MLFRD). Where this was the case, DRD proceeded to select different projects. DRD reports that for FY2014, there is less overlap as there is better coordination.

Integrated Planning

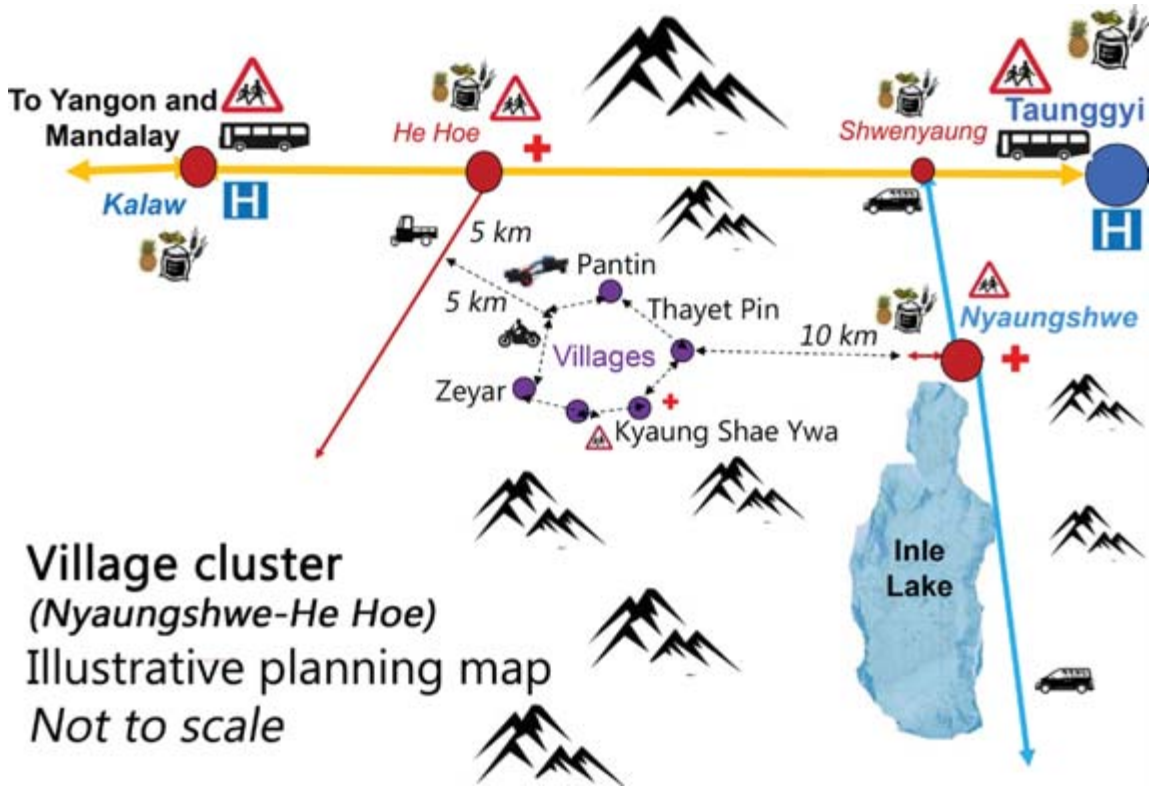
With multiple government agencies funding village road development, working on one single annual plan to be developed by the TDCs is recommended, with support and funding to be provided by DRD, DPBANRD, and the General Administration Department. The TDC would then be responsible for avoiding duplication of planned investments and ensuring that priority projects receive funding. Ideally, such an approach should make use of a common set of selection and prioritization criteria and procedures, based on an underlying strategy.

A clear strategy on the selection and prioritization of roads and bridges does not exist at present. As a result, the annual plan is very much influenced by VDC and TDC officials as well as members of Parliament, who prioritize certain projects and exclude others from the list. Anecdotal evidence suggests that in several cases, road improvements for more developed villages are being selected. While this may be in accordance with legitimate aspirations for such villages, the funding decisions may be at the expense of other villages that do not have any proper road access, and so should have priority.

To a certain extent, this is due to the fact that not all new construction needs are included in the project list. The project list prepared by the VDC only shows the prioritized projects instead of showing a complete list of projects and their related priorities. As a result, there appear to be many cases where influential villages are able to get their projects prioritized and included on the list that is presented to the TDCs. Less influential villages without road access may be unable to get their road needs included. As a result, these road needs go largely unnoticed by the TDCs and DRD as they are not included in the priorities of the VDCs. Although DRD may prioritize new construction over improvement, this is only possible if all new construction and improvement needs are included in the list of required road projects. This requires a comprehensive overview of all the needs.

The suggested collection of data on the current access levels of all villages (section 5.2, p. 45) could help solve this problem. It would provide DRD, MOBA, and the TDCs with an overview of all the road construction and improvement needs. Together with a village road core network approach, this would allow targeting of

Figure 32: Example of Rural Access Planning Diagram for a Village Cluster in Shan State



km = kilometer.
Source: Created by ADB, based on project field visits and discussions (August 2014).

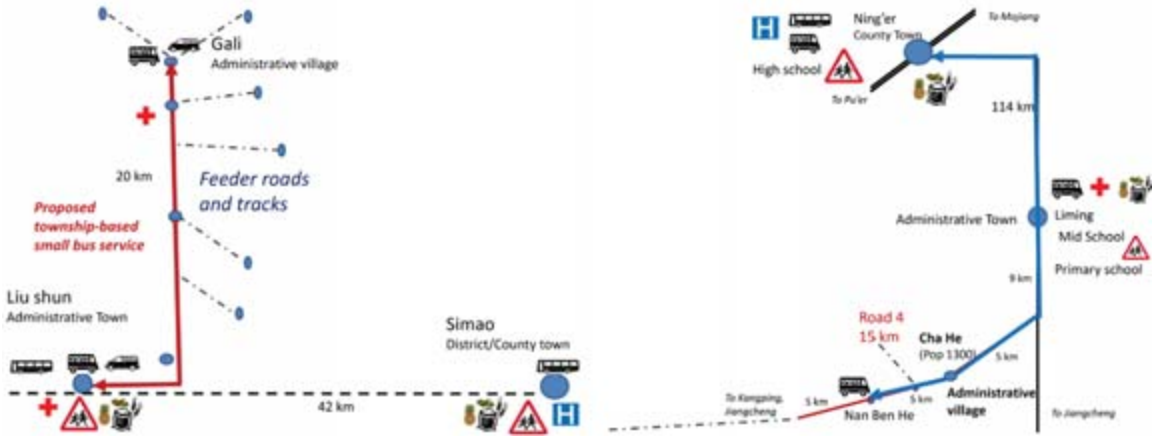
investments toward those villages that currently lack any road access and those lacking all-season road access. However, this would need to be complemented by a simple annual planning system at VDC and/or TDC level to determine the priority interventions in the village road sector. Such an annual planning system may consist of a simple spreadsheet to present the different construction, improvement, and maintenance needs, applying objective prioritization criteria to rank the investments in a transparent manner. The prioritization principles should be in line with the DRD objective of providing all-season road access to all villages by 2030, but could also include additional criteria, such as the cost per beneficiary, poverty levels of the beneficiary population, and distance from existing all-season roads. Such a system has recently been developed in Nepal, resulting in more targeted and cost-efficient use of available rural road sector funding.

5.4 Construction and Improvement

Under DRD, all works for village roads and bridges are tendered out. In Shan State, for instance, a total of 605 lots of different infrastructure works (including village roads and other sectors) have been identified for FY2014. These have been awarded to 131 companies. Most companies were awarded more than one lot, with 27 lots the maximum awarded to any single company. The process of awarding the lots is not very clear. Companies submit an expression of interest, after which DRD awards the contracts based on an assessment of the company performance and experience.

In some cases where VDCs are very strong, the VDC itself is authorized to carry out the project. In this case, materials are supplied by DRD (tendered from suppliers) or purchased directly by the VDC. Labor is hired through local contractors (labor-only contracts) and necessary equipment is hired locally. Technical support is provided by DRD (also where funding is from other sources).

Figure 33: Examples of Rural Access Planning Diagrams from Yunnan, People's Republic of China



km = kilometer.

Source: Created by ADB for this report, based on stakeholder discussions on options for village-to-township transport services.

Box 7: Annual Road Asset Management Planning in Nepal

In Nepal, district road sector planning is governed by the 5-year District Transport Master Plan that defines the investments to be carried out for maintenance, improvement, and construction of the district road core network (DRCN). It is based on an assessment of needs and the estimation of the available annual budgets from different funding sources. Currently, an Annual Road Asset Management Plan (ARAMP) is being piloted to complement the District Transport Master Plan. The ARAMP is an annual plan that looks at the actual budget amounts available each year and their allocation to maintenance, improvement, and new construction of the different roads that make up the DRCN. Improvement and new construction needs are copied from the District Transport Master Plan, while maintenance needs are assessed annually through a rapid condition survey. Funds are allocated from different funding sources according to specific criteria based on intervention type, traffic levels, and the cost per beneficiary. Any deviation from these criteria has to be properly justified in the ARAMP report. Districts are furthermore able to allocate a certain percentage of the annual budget to lower-ranked roads or to other roads outside the DRCN to address specific needs and priorities of certain population groups. The ARAMP is prepared as a simple spreadsheet, complemented by a short report to provide further explanation where necessary.

Source: Asian Development Bank.

The quality of village road works was found to be lacking in certain aspects. Construction and compaction of the road surface was not always appropriate, with recently constructed roads already showing signs of deterioration due to water and traffic. Although most structures were found to be well constructed, there tended to be a lack of culverts, leading to water crossing the road at low points. Proper slope protection was also often missing, leading to slope collapse and erosion in several instances. Bridges were often made of timber, even in the case of bituminous roads carrying larger traffic volumes (although there does appear to be a move toward concrete bridges). All these examples of quality problems appear to be related to a lack of engineering design and supervision. To a certain degree, this is explained by the fact that many positions in DRD remain unfilled, with a small number of engineers looking after a large number of projects. In addition, the engineers in place are not necessarily road engineers or even civil engineers. To ensure that investments are effective and sustainable, more attention needs to be paid to proper engineering design and supervision.

5.5 Maintenance

Village road maintenance is mostly carried out through voluntary labor contributions, with every household contributing a certain number of person-days. Road users are often required to provide material transport services or cash contributions in support of the maintenance works. The maintenance is carried out once a year after the rainy season to make the road passable again. Additional maintenance is sometimes carried out during the rainy season if the road becomes totally impassable (including for two-wheel tractor-trailer and oxcart). This level of maintenance is insufficient, and the road is vulnerable to accelerated deterioration for most of the year. Earthen roads are especially vulnerable to damage by the combination of water and traffic, and many are in poor condition. Very little preventive maintenance is carried out to avoid damage during the rainy season (e.g., clearing drainage systems) or to improve the ability of the road to withstand the rains.

Box 8: Road Maintenance Groups in Yunnan Province, People's Republic of China

In Dehong Prefecture, just across the border from Muse in northern Shan State, road maintenance groups were introduced through an Asian Development Bank pilot project. The pilot project demonstrated the benefits of remunerated, year-round routine maintenance of rural roads. The initiative led to a reduction in the number of days that roads were closed during the rainy season, an improvement of road conditions, and a decrease in the costs of major repairs and emergency maintenance. The approach is now being replicated in approximately half of the township road network in the prefecture using government maintenance budgets.

Source: ADB. 2012. *Performance-Based Routine Maintenance of Rural Roads by Maintenance Groups: Manual for Maintenance Groups.* Manila.

In many developing countries, road maintenance groups have been introduced for rural road maintenance, providing more or less continuous year-round road maintenance. A small group of maintenance workers working half- or full-time, providing 50–100 person days per km of road per year, is generally able to carry out most routine and minor emergency maintenance works. The use of a small, permanent group allows skills to be developed and proper tools to be provided, making them more effective and efficient. Such maintenance groups are generally paid a fixed amount per month, and provided with clear performance standards that they have to achieve to receive their payment. These experiences have shown the benefits of preventive maintenance in terms of reduced overall maintenance costs and improved road conditions. A similar approach is recommended in Myanmar, with proper capacity building regarding maintenance implementation and the development of a clear structure for implementation and financing.

Larger maintenance repairs are contracted out to companies using the maintenance budget that has become available this fiscal year. Some maintenance work is reported to be carried out by DRD staff using hired equipment. DRD has expressed its desire to purchase more equipment to allow it to increase its capacity to carry out such maintenance works (DRD has already done this in other sectors, e.g., borehole drilling equipment). This move appears to have been made in response to the low level of maintenance funding, making it impossible to address the maintenance needs through contractors. A move toward a force account approach is not suggested, as most government agencies are moving away from force account toward tendering out. Rather, it is recommended that increased maintenance funding is made available to properly address maintenance needs through contractors. It is further recommended that more efficient contracting modalities are introduced, including performance-based contracts or term contracts that make it easier to involve contractors in the maintenance of a large road network.

5.6 Standards

DRD has prepared a set of standard designs that it uses for road construction and improvement. These designs build on those prepared by DDA, but with increased pavement strength in certain cases (e.g., increasing of macadam pavement thickness from 6 inches to 9 inches) in response to village roads being used by heavier vehicles (e.g., to collect local harvests). Road widths have also been increased from 9 feet (ft) to 12 ft compared to DDA designs. Narrower roads are generally not accepted, except in very mountainous areas where these standards would be excessively costly. In these areas, lower standards of 4–6 ft are accepted for short sections.

It is not clear if MOBA is still using the old DDA design standards, in which case different standards would be used for the same roads.

As mentioned earlier in this policy note, provision of basic access to villages has significant benefits. Such basic access may consist of simple motorcycle trails complemented by trail bridges. The costs of such trails are much lower than of roads that are accessible by four-wheeled vehicles, allowing the available budget to provide access to a larger number of villages. Such basic access may, at a later stage, be improved to (all-season) village road standard. Such an approach allows the accessibility of villages to be significantly improved within a relatively short time period, with the related benefits of economic development and improved education and health. This is considered preferable to the current approach where a limited number of villages receive (all-season) road access, and others are left without any access. However, such a staged improvement approach will need DRD to approve the use of lower standards under certain circumstances, as a temporary measure in providing basic access.

A similar staged approach may be used in upgrading the surface of existing village roads. This may focus initially on addressing problem areas through spot improvements to ensure basic access. A second stage may look at improving the drainage (especially cross drainage) to reduce future damage to the road. A final stage may look at appropriate surfacing for the road, based on the traffic levels, topography, and climate.

Standards for surface selection do not currently exist, and the surface is generally determined by the VDC in their project proposal. Gravel is not commonly used, and roads are generally upgraded from earth to macadam and then to bituminous standard. The introduction of surface standards linked to traffic volumes, climate, and terrain is recommended to properly guide investments in improvement, ensuring optimal usage of budgets to ensure all-season access and avoiding wastage in unnecessarily high surface standards or in surfacing options that are not appropriate to the context. The selection of surface type should also take into account the potential use of local materials and labor in the construction and maintenance of the road.

In selecting a suitable surface type, the results of extensive surface trials carried out in Cambodia, the Lao People's Democratic Republic, and Viet Nam under the South-East Asia Community Access Program and subsequent projects can be used, which give clear lessons learned regarding a wide variety of low-cost surfacing types and their suitability to different topographies, climates, and traffic levels, and which are likely to be very relevant to Myanmar.

6 Financing

Key Findings

Estimate actual budget requirements for construction and improvement

A proper estimate of the budget requirements for construction and improvement does not exist and this should be made to determine suitable budget levels and implementation time frames. Such an estimate requires data on the number of villages without all-season road access and the length of road construction and improvement required to provide such access. Identifying a limited village road core network (providing single road access to each village) is recommended. The investments should be determined based on what would be required to complete construction and improvement to an all-season standard for the entire village road core network, together with a time frame for implementation. Based on simple modeling of village road access levels, it is estimated that 100,000 kilometers of road construction is required to connect all villages, and 75,000 kilometers of improvement of existing roads. The costs involved are estimated to reach MK7 trillion ($5.5 billion) for construction and MK6 trillion ($4.6 billion) for improvement, resulting in a total cost of MK13 trillion ($10.1 billion). Based on current annual funding levels of MK200 billion ($156 million), it would take 65 years to provide all villages with all-season road access. Completing this task by 2030 would require quadrupling investment levels to MK850 billion ($662.8 million) per year.

Increase allocations to village road maintenance

FY2014 is the first year a maintenance budget has been approved for the Department of Rural Development. However, the size of this budget allows only for a limited amount of special maintenance. In addition, half the budget is allocated to interdistrict roads that should not be the responsibility of the department. Meanwhile, routine maintenance is dependent on voluntary labor contributions that do not reduce road deterioration effectively. A six-fold increase of the maintenance budget, together with a restriction of its use for village road maintenance only, would allow most special maintenance works to be carried out, while also providing a financial incentive for timely implementation of routine maintenance. Without a significant increase in funding for village road maintenance, the potential benefits of new construction and improvement will be significantly reduced, with many village roads becoming impassable during all or much of the year.

6.1 Construction and Improvement

Financing for village roads has come a long way since the early 1990s when the only funding was from the allocation of township development committee tax revenues. With the creation of the Department of Development Affairs (DDA) in 1994, budget allocations from the central government were introduced, allowing the village road network to be expanded and improved. With recent increased attention to rural development, central government budget allocations to rural development and village roads have increased significantly. The Department of Rural Development (DRD) allocation to village roads and bridges from the central government budget reached MK202 billion ($202 million) for FY2014, up from MK63 billion ($63 million) the year before, and many times the annual budget of its predecessor, DDA. This funding is provided to the states and/or regions and self-administered zones and/or division based on the number of villages and townships within their area. Apart from the funding of infrastructure works, central government allocations also fully finance the DRD staff at state and/or regional, district, and township levels.

Table 18: Department of Rural Development Budget Allocations for Roads and Bridges
(MK million)

State and/or Region	FY2013				FY2014				
	Roads	Bridges	Interdistrict	Total	Roads	Bridges	Interdistrict	Maintenance	Total
Kachin	2,487	440	0	2,927	5,877	881	1,526	372	8,655
Kayah	2,216	440	0	2,656	5,924	849	0	19	6,793
Kayin	2,422	443	0	2,865	4,789	1,371	0	161	6,320
Chin	2,370	440	0	2,810	5,653	606	0	167	6,426
Sagaing	4,607	1,687	36	6,329	8,845	2,939	3,735	660	16,180
Tanintharyi	2,943	440	0	3,383	17,906	3,497	0	38	21,441
Bago	5,247	705	117	6,069	16,988	2,138	1,871	1,456	22,453
Magway	2,235	444	184	2,863	11,980	1,914	104	765	14,764
Mandalay	1,637	456	207	2,300	14,632	1,634	407	2,007	18,680
Mon	2,294	440	96	2,830	3,044	706	2,834	1,989	8,573
Rakhine	2,847	733	0	3,580	9,770	2,073	0	364	12,206
Yangon	5,113	470	96	5,679	8,050	1,873	1,277	577	11,776
Shan	6,037	1,320	0	7,357	9,000	1,431	0	1,029	11,460
Ayeyarwaddy	2,629	550	0	3,179	18,284	5,066	0	990	24,340
Pa-O	1,065	220	0	1,285	2,044	474	0	44	2,562
Palaung	1,065	220	0	1,285	1,715	313	0	44	2,071
Danu	1,350	220	0	1,570	1,701	343	0	44	2,087
Kokang	1,065	220	0	1,285	937	313	0	44	1,293
Wa	1,065	220	0	1,285	816	138	0	44	998
Naga	889	220	0	1,109	1,284	313	0	44	1,640
Naypyidaw	0	0	0	0	0	0	0	966	966
Total	**51,582**	**10,328**	**736**	**62,646**	**149,240**	**28,868**	**11,754**	**11,823**	**201,685**

MK = Myanmar kyat.
Source: Department of Rural Development.

In addition to this funding from the Ministry of Livestock, Fisheries and Rural Development, DRD also receives special funding from the President's office. Complementary financing for village roads and bridges is further provided by the Ministry of Border Affairs and the General Administration Department (including annual allocations of MK100 million ($100,000) to each township for development works from the Poverty Alleviation Fund).

Due to the low traffic volumes on village roads, private sector investments are not common. However, village development committees in more developed areas have been investing in the construction and improvement of village roads with funds they collect from road users and voluntary contributions from villagers.

Investments from international donors and development organizations have been limited until 2012. With the reforms in Myanmar, these organizations are starting to increase investments. The Department of Progress of Border Areas and National Races Development currently has over $250 million in international funding from different international organizations (although most of this funding is not aimed at village roads and bridges). DRD is starting similar initiatives, and is currently negotiating some specific village road projects (e.g., a project in Taunggyi District, southern Shan State, with proposed funding from KfW for the improvement of nearly 160 kilometers [km] of village roads to bituminous standard, with a proposed budget of $10.5 million and $2.5 million for additional measures).

Funding Needs

Based on the results of the village road access modeling presented in Table 1 (section 1), the funding required for construction and improvement to all season-standard of village roads connecting all villages in Myanmar can be estimated. This has been done using the following unit costs provided by DRD or calculated from the planned works for 2014–2015. Adjustments have been made for mountainous and delta areas where unit costs are considered to be higher.

Table 19: Unit Costs for Construction and Improvement

Intervention Type	Cost (MK/km)	Cost ($/km)	Source
Construction and improvement			
Bituminous road	60,000,000	60,000	DRD
Gravel road	43,000,000	43,000	DRD
Macadam road	30,000,000	30,000	NCDP
Earth road	10,000,000	10,000	NCDP

DRD = Department of Rural Development, km = kilometers, NCDP = National Comprehensive Development Plan.
Source: Department of Rural Development.

The estimated costs for the 100,000 km of new construction to connect the remaining villages comes to MK7 trillion ($7 million), while the estimated cost of improving existing roads connecting villages to an all-season standard is estimated at MK6 trillion ($6 billion). The total cost for connecting all villages to an all-season standard therefore comes to approximately MK13 trillion ($13 billion). Based on the current allocation of MK200 billion ($200 million) from DRD, it would take 65 years to achieve all-season access for all villages in Myanmar. To achieve all-season access for all villages by 2030 in line with the National Development Plan objective would require a quadrupling of the annual investment to MK850 billion ($850 million).

Table 20: Estimated Village Access Levels

Area	Villages without Road				Villages with Dry-Season Road				Total costs (MK million)	% of cost	% of villages
	Number of villages	Required construction (km)	Construction cost/km (MK million)	Cost of construction (MK million)	Number of villages	Required improvement (km)	Improvement cost/km (MK million)	Cost of improvement (MK million)			
Kachin	1,304	8,754	65	615,581	734	4,926	45	568,984	**1,184,565**	9	4
Kayah	164	921	65	85,143	173	971	45	59,864	**145,008**	1	1
Kayin	1,357	7,242	45	268,658	321	1,714	30	325,874	**594,532**	5	3
Chin	251	1,807	65	375,096	907	6,529	45	117,434	**492,531**	4	2
Sagaing	1,146	5,018	45	550,015	3,041	13,316	30	225,808	**775,823**	6	9
Tanintharyi	521	2,912	45	126,216	232	1,295	30	131,030	**257,246**	2	2
Bago	1,947	5,430	45	362,283	2,383	6,646	30	244,337	**606,619**	5	10
Magway	0	0	45	312,624	2,964	10,421	30	0	**312,624**	2	7
Mandalay	422	1,344	45	211,509	1,792	5,706	30	60,476	**271,985**	2	7
Mon	215	1,040	45	65,367	235	1,139	30	46,802	**112,170**	1	2
Rakhine	2,752	12,741	65	669,743	463	2,142	45	828,185	**1,497,928**	12	6
Yangon	125	288	65	112,904	964	2,221	45	18,697	**131,601**	1	3
Shan	8,228	39,206	65	2,347,335	2,719	12,957	45	2,548,418	**4,895,753**	38	22
Ayeyarwaddy	6,334	12,498	65	823,474	2,940	5,802	45	812,359	**1,635,833**	13	19
Myanmar	**24,765**	**99,200**		**6,925,948**	**19,868**	**75,785**		**5,988,269**	**12,914,217**		

km = kilometer, m = meter, MK = Myanmar kyat.

Source: ADB estimates, using data compiled by the Department of Rural Development and Public Works.

A large part of the estimated cost for new construction and improvement is for Shan State (38%), followed by Ayeyarwaddy (13%), Rakhine (12%), and Kachin (9%). This distribution is not in line with the distribution of villages in the different states and regions, which currently forms the basis for the distribution of the DRD budget. It is clear that such an analysis based on access needs would form a more effective basis for distributing available DRD funding among states and regions.

6.2 Maintenance

Although DDA used to allocate a certain percentage of its budget to maintenance, this was not the case for DRD, and the Ministry of Finance did not approve requests for maintenance budgets until FY2014. Half the approved maintenance budget of MK11.8 billion ($11.8 million), however, is allocated to interdistrict roads, reducing the available budget for village road maintenance.

The remaining maintenance budget of MK5.9 billion ($5.9 million) is allocated to the different local offices (for FY2014 this includes an allocation of nearly MK1 billion [$1 million] or 17% of the remaining maintenance budget to roads in Naypyidaw Union Territory). This budget is mainly used to address periodic maintenance

including regraveling, seals, and overlays. The maintenance budget allocation to the local offices (excluding Naypyidaw) translates into an average allocation of MK100,000 per km ($100/km). This budget is clearly insufficient and only allows for some 250 km of maintenance sealing for the entire country (10% of the bituminous road length). This is insufficient to cover heavy patching and/or overlays and repairs to macadam and gravel roads.

A minimum intervention scenario could be based on bituminous roads needing sealing every 5 years with an overlay or heavy patching every 10 years. Gravel roads need regraveling every 5 years and macadam roads need repairs every 5 years. With these assumptions, the total special maintenance budget for existing village roads should be around MK65 billion ($65 million). This is 11 times the current maintenance budget for village roads and five times the total maintenance budget (including interdistrict roads).

Routine maintenance of the village roads is organized by villages. Generally, this is done through voluntary contributions from each household (one or more person-days per household each year, depending on the need) complemented by contributions from road users (e.g., two-wheel tractor-trailer loaned for transport of materials). These investments are insufficient and aim at making the road passable after the rainy season, rather than maintaining the road to a specific minimum standard.

Table 21: Department of Rural Development Budget Allocations for Village Roads and Bridges, FY2014 (MK million)

State and/or Region	Interdistrict Roads Budget	Village Roads Budget	Total Budget for Maintenance	% of Total DRD Budget	Village Road Length (km)	Average Investment (MK/km)
Kachin	170	202	372	4	2,586	78,205
Kayah	0	19	19	0	440	43,621
Kayin	0	161	161	3	862	186,897
Chin	0	167	167	3	2,905	57,489
Sagaing	131	530	660	4	7,668	69,087
Tanintharyi	0	38	38	0	1,057	35,777
Bago	951	505	1,456	6	5,097	99,084
Magway	390	375	765	5	6,849	54,822
Mandalay	1,865	142	2,007	11	4,890	29,122
Mon	1,895	94	1,989	23	1,471	63,903
Rakhine	0	364	364	3	1,407	258,524
Yangon	577	0	577	5	1,686	0
Shan	0	1,029	1,029	9	6,514	157,934
Ayeyarwaddy	0	990	990	4	3,756	263,706
Pa-O	0	44	44	2	664	65,713
Palaung	0	44	44	2	307	142,005
Danu	0	44	44	2	288	151,525
Kokang	0	44	44	3	63	688,836
Wa	0	44	44	4	122	356,881
Naga	0	44	44	3	64	679,626
Naypyidaw	0	966	966	100	n/a	n/a
Total	**5,978**	**5,845**	**11,823**	**6**	**48,696**	**100,190**

DRD = Department of Rural Development, km = kilometer, MK = Myanmar kyat, n/a = not applicable.
Source: Created by ADB using data compiled by the Department of Rural Development.

Table 22: Unit Costs for Special Maintenance

Intervention type	Cost (MK/km)	Cost ($/km)
Overlay for 12 ft road	45,000,000	45,000
Heavy patching for 12 ft road	33,000,000	33,000
Leveling and sealing for 12 ft road	23,000,000	23,000
Regraveling	15,000,000	15,000
Macadam repairs	15,000,000	15,000

ft = feet, km = kilometer, MK = Myanmar kyat.
Source: Department of Rural Development.

Experiences in other countries with road maintenance groups made up of local people have shown that in general 50–100 person-days per km are required each year to carry out routine maintenance (including minor emergency maintenance) and keep the road at a proper standard (complemented by additional inputs in case of severe damage). At a daily wage rate of MK3,000 ($3) per day, this translates into a minimum investment of approximately MK200,000 ($200) per km per year (including funds for tools and materials). It must be noted that this is a minimum investment, and does not include significant patching of bituminous roads. For the existing village road network, this translates into a minimum investment of MK9.7 billion ($9.7 million) per year. Although these inputs may be provided through voluntary labor contributions, experience has shown that maintenance performance improves if the maintenance workers are paid. The funding source may be the government or local cash contributions, although some government contribution is recommended to ensure the routine maintenance is carried out in a timely manner.

Total budget requirements for routine and special maintenance can thus be assumed to be MK75 billion ($75 million), which amounts to 13 times the current maintenance budget allocation to village roads (just over six times the current total maintenance budget including interdistrict roads). Large emergency maintenance is not included in this calculation, as DRD uses special funds from the President's office, made available at the request of the state and/or regional government. The calculations given above show a clear need to increase the maintenance budget and to avoid the allocation to roads (notably the interdistrict roads) that do not clearly fall within the main mandate of DRD. Where the required budget allocation cannot be achieved, it is recommended that a village road core network be identified as described in section 5.2 (p. 45). Such a core village road network would receive priority in maintenance funding allocations, ensuring that villages have at least one road in good condition.

Table 23: Unit Costs for Routine Maintenance

Intervention Type	Cost (MK/km)	Cost ($/km)
Bituminous road	310,000	310
Macadam road	280,000	280
Earthen road	240,000	240

km = kilometer, MK = Myanmar kyat.
Source: Created by ADB for the purpose of this report, based on ADB estimates and data from the Department of Rural Development and the Ministry of Construction.

Ensuring proper funding for the maintenance of the core village road network should be given a high priority to avoid investments in expansion and upgrading of village roads getting lost due to accelerated deterioration, causing villages to become inaccessible again. This occurred in Nepal, for instance, with rural roads built to low standards and without maintenance, resulting in approximately half the 60,000 km rural road network currently being impassable to four-wheeled vehicles. Nepal has recently prioritized the maintenance of existing rural roads, ensuring that motorable roads remain that way, and using remaining funds to improve standards and repair impassable roads.

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* ADB recognizes "Vietnam" as Viet Nam.

Myanmar Transport Sector Policy Note

Rural Roads and Access

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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