5. INFRASTRUCTURE

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Due to the scale and physiography of its major geographical regions, all of Myanmar’s large roads and waterways run to this day on a north-south axis. Until well into the 20th century, the Ayeyarwady River – the ‘Road to Mandalay’, as the poem calls it – and its tributaries formed the only unbroken corridor linking north and south. By comparison, the west-east axes are less developed: due to the topography of Myanmar’s mountain ranges, most of which run north to south, the west-east route poses much greater problems for construction and, for that reason, was hardly developed until comparatively late.

In the pre-colonial era, the road system consisted of local tracks for oxcarts and horse-drawn vehicles, but there was already a network of long-distance overland routes well-developed for its time – for the transportation of goods across present-day Myanmar and into neighbouring regions. They included the roads connecting China and India with the amber and ruby mines in Mogaung and Mogok, the jade deposits in Kachin and the tin-tungsten mines in Kayah (KTAM Report 1953: 361, Hla Tun Aung 2003: 513-514). A well-developed, good-quality cart track between Mandalay and Taungoo existed in the late 19th century.

**EXPANSION IN COLONIAL TIMES**

After the country’s progressive annexation by the British, modern roads and railway lines were constructed, mainly to support the extraction and transportation of natural resources. In 1881, the country had around 1,421 km of roads, just 499 km of them metalled, but road-building progressed rapidly thereafter: by 1891, there were more than 4,614 km in Lower and 4,672 km in Upper Burma, of which 1,540 km and 320 km, respectively, were metalled (Hla Tun Aung 2003: 515). However, it was not the roads but the railways which were crucial for the transportation of goods and people in the British colonial period: ‘Prior to the war, Burma Railways carried from 80 to 90% of the freight and practically all passengers’ (KTAM Report 1953: 256). The 260 km railroad from Rangoon to Prome opened in 1877, followed by a 620 km rail link from Rangoon to Mandalay in 1889. By 1903, the rail network had been extended to 2,113 km, with connections to Myingyan, Myitkyina, Alon, Lashio and Bassein-Letpadan, and by the Second World War, it had increased to 3,312 km. The Ava Bridge near Sagaing, built in 1934, was the first to span the Irrawaddy (KTAM Report 1953: 256, Storz 1967: 149). The British also drove the large-scale development of the Irrawaddy Delta as the ‘rice bowl’ for British India. Although this relied in part on the construction of roads and a railway line from Rangoon to Henzada and onward to Bassein, the country’s dense network of small ports and docks played a key role, increasing the volume of shipping along the rivers, channels and canals.

By the beginning of the Second World War, the British had built 10,961 km of paved roads suitable for year-round use and a further 9,030 km of earth and gravel roads which were passable only in the dry season (Hla Tun Aung 2003: 515). As the Second World War wore on, the US Army constructed the strategically important Ledo (later Stilwell) Road from Myitkyina via Mogaung to the Pangsau Pass. The route to India was also upgraded and extended with the construction of the Kalewa-Tamu Road. The Burma Road from Mandalay via Hsipaw and Lashio to Muse improved the transport link to China, and the highway from Kengtung to Tachileik was extended as far as
RECONSTRUCTION AND A NEW START DURING THE EARLY YEARS OF INDEPENDENCE

The legacy of war, along with unrest and insurgency during the post-war years, brought rail transport to a virtual standstill and inflicted serious damage on the road network. This began when numerous road and rail bridges and much of the rolling stock were destroyed by the British Army as it retreated from the advancing Japanese; in subsequent years, all the warring parties engaged in defensive and aggressive action and thus had a hand at various times in systematically destroying the country’s transport systems, which were seen as targets for ground operations and aerial bombardments (Storz 1967: 139, 149; Allen 1984, McCormack/Nelson 1993, Nesbit 2009). In 1940, the country had 3,314 km of rail track; by 1945, only 1,190 km were still functioning (Storz 1967: 149). Moreover, much of the pre-colonial network of inland waterways that had proved its worth over so many centuries – extending for around 6,500 km, with 3,200 km navigable in the Ayeyarwady Delta alone (Storz 1967: 154) – was unusable as almost all the ports, harbours and ships had been destroyed. Some of the vessels which had been deliberately scuttled in order to block the shipping routes were not raised until well into the 1960s. Making matters worse, there was also a lack of skilled workers for the reconstruction effort (KTAM Report 1953: 283, 336; Storz 1967: 155-157).

It was the first Eight-Year Plan (1952) which finally enabled the country to begin investing in rebuilding its infrastructure, the aim being to re-establish domestic and international trade links, cut transport costs, consolidate national cohesion by facilitating the transport of people and goods and create a more integrated transport system (Storz 1967: 139). By 1962, as part of the plans for an Asian Highway System, the development of two major west-east axes was already under discussion, the first being the route from Tehran via Delhi and Calcutta to Kalewa, via Mandalay, Taunggyi, Kengtung and Tachileik to Lampang and Bangkok and then to Battambang and Phnom Penh and on to Saigon, and the second running from Chittagong via Prome to Rangoon, Thaton and Hpa-an and onward to Bangkok, Kuala Lumpur and Singapore (Storz 1969: 143-144).

As the first step, several key bridges (notably those spanning the Pazundaung, Bago and Sittaung Rivers) and major overland routes were rebuilt, foremost among them the highway from Rangoon to Mandalay and onward to Myitkyina, and the Tavoy-Mergui axis. Several west-east routes were also developed or proposed for expansion, e.g. from Prome to Taungoo, from Meiktila to Taunggyi, and from Prome to Taungup (KTAM Report 1953: 378-379, Storz 1967: 146-148). It also took comparatively little time – from 1956 to 1960 – to restore the rail network to a length of 3,100 km. In 1950, repairs were carried out to the Gokteik viaduct, constructed in 1900; the Inwa Bridge near Sagaing was renovated in 1953 (Hla Tu Aung 2003: 534). The expansion of aviation also played an important role. By the late 1960s, the country had 33 airfields, including seven which were accessible even during the monsoon season (Storz 1967: 163-165). During the period of nationalisation after 1962 until the transition to a market-oriented policy of openness in 1988, the transport networks were further upgraded, not least through the expansion of the road system from 17,194 km (1961) to 23,462 km (1988) (Hla Tun Aung 2003: 519).

DEVELOPMENTS AFTER THE TRANSITION TO A MARKET-ORIENTED ECONOMY

During the transition to a market-oriented economy, national development was given a boost by a large number of new infrastructural projects which extended into hitherto largely inaccessible peripheral regions. In the process, the road network was extended from 27,840 km (1995) to 40,575 km (2015); more
importantly, however, major improvements were achieved in the quality of road-building (almost 23,000 km were tarred, compared with only 10,000 km in 1995). Road network expansion focused mainly on the Ayeyarwady, Magway, Mandalay and Sagaing Regions and on Chin, Kachin, Rakhine and Shan States. The number of registered vehicles also increased more than tenfold during this period, from 302,833 to 5,077,699, rising from 174,379 to 679,485 in Yangon alone. The rail network was extended from 3,977 km (1995) to 6,107 km (2015), and the number of railway stations rose from 612 to 960. Although the provision of state aviation services decreased between 1995 and 2015 – measured in terms of the number of flights (down from 5,090 to 4,474), distance flown (down from 4,501,000 to 3,885,000 km) and number of aircraft in service (down from 13 to just 10) – the volume of private civil aviation increased substantially, with a sharp rise from 2011 onwards: the number of flights per year increased almost tenfold from 2,360 (1995) to 21,361 (2015), and from just two aircraft in 1995, there were 64 in service in 2015 (all the comparative data for 1995 and 2015 are taken from MNPED 2015: 407-439).

THE TRANSPORT INFRASTRUCTURE: CURRENT STATUS

A glance at the current scale of the transport infrastructure shows the dominance of the north-south axis across all modes of transport, albeit with a small number of roads running in a west-to-east direction, e.g. from Pathein to Yangon, from Chauk via Meiktila to Taunggyi, and from Mandalay via Lashio to Muse, with various less significant routes leading into the mountains and towards the international borders. The backbone of Myanmar’s transport system is the 587 km Yangon-Mandalay Expressway, constructed from 2005 onwards and opened in late 2010, which connects its three major political and economic centres, i.e. Nay Pyi Taw, Yangon and Mandalay. The idea for the project goes back to the Pyidawtha Plan, conceived in 1952 during the period of post-war renewal (Government of Burma 1952, Lockwood 1958) but not implemented at first. The Expressway is open to cross-country buses and private vehicles but not to heavy goods vehicles and trucks. The rail network follows broadly similar routes but also fills the gaps in the road system, e.g. between Pakkoku and Kalay, between Monywa and Myitkyina, and in central Myanmar. Numerous airports and airfields have improved access to the peripheral regions, e.g. Kalay, Homalin, Puta-O, Kengtung, Tachileik, Myeik and Kawthaung. Alongside the major ports of Yangon, Sittwe, Thandwe, Pathein, Myeik and Kawthaung and the new major terminal at Thilawa, Myanmar has a number of smaller harbours. Deep-sea ports are currently planned in Kyaukpyu, Mawlamyine and Dawai.

LOOKING TO THE FUTURE: LARGE-SCALE PROJECTS

With an eye to the future, Myanmar is planning a number of large-scale projects whose purpose is to improve infrastructural connectivity within Asia. Several of these major projects aim to strengthen Myanmar’s links to neighbouring countries by establishing new transport corridors. As a member of the Association of Southeast Asian Nations (ASEAN), the Greater Mekong Subregion (GMS) and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIM-STEC), Myanmar is involved in numerous long-term infrastructure projects. As the volume of trade with neighbouring countries increases (Kyaw Min Htun et al. 2011, Florento/Corpuz 2014), Myanmar is likely to become a key regional centre due to its outstanding geostrategic location, with the potential to become a major transportation hub and gateway within Asia.

The Asian Land Transport Infrastructure Development (ALTID) project (established by UN-ESCAP in 1992) aims to expand the existing pan-Asian infrastructure initiatives. Its major components are the Asian Highway Network, the Trans-Asian Railway (TAR) and the upgrading of the intermodal transport terminals, including port infrastructures.
Expansion of the infrastructure and development corridor from Mandalay to Muse has been under way for some years (Fan 2011, Zhao/Yang 2012). The first priority for the new schemes is to develop the border sections of Asian Highway 1 (from Kalay via Kalewa to Monywa in the west and from Myawaddy via Kawkaraik in the east) and Asian Highway 2 (specifically, from Kengtung to Taunggyi) as part of the India-Myanmar-Thailand trilateral highway project, which will ultimately result in a two-lane rapid transit route from Manipur (India) to central Thailand (Kyaw Min Htun et al. 2011). And for northern Myanmar, long-term development plans are in place for roads which faded into oblivion after independence, including the Zawkhawdar-Rhi and Nampong-Pangsau routes (the former Ledo/Stilwell Road; Kyaw Min Htun et al. 2011: 186, Florento/Corpuz 2014: 10-12, Yhome 2015a). Other bilateral and large-scale projects are being implemented as part of the Asian Highway schemes, including the Asian Development Bank’s GMS corridor (Duvall 2008, ADB 2012b). Plans are also in place to establish a Myanmar–Lao PDR–Viet Nam Trilateral East-West Corridor.

Currently, road transportation, as compared to other modes such as rail and inland waterways, is the most important public service for logistics; this applies to both passenger and cargo transport. The Ministry of Construction (MoC) has responsibility and has proposed a long-term strategy for road transportation involving a network of seven plus five expressways. Strategy formulation is supported by Korean experts from KOICA. This envisages five expressways for the South-North axis and seven for the East-West axis. MoC further recommends 6 packages of road network development which are prioritised for mid-term planning in accordance with national development policy. They are Mandalay-Myitkyina, Pathein-Monywa-Shwebo, Minbu-Ann-Kyaunkphyu Deep Seaport, Yangon-Mandalay, Thilawa SEZ-Thanatpin-Kyeikhto, and Yangon-Pathein-Ngayokkaung.
Myanmar’s energy sector continues to develop. The installed energy capacities available have increased from 980 MW (2000) to 3,735 MW (2013); of these 2,780 MW (66.9%) are produced using hydropower, 996 MW (29.5%) from natural gas and 120 MW (3.2%) from coal (Hennig 2016: 1234-1235). However, despite expanding production in the natural gas sector, mostly based on foreign investment, only a very small proportion is used for domestic energy supplies due to existing export obligations. From 2000 to 2013 electricity consumption in Myanmar increased threefold to 10,112 GWh, but the country remains nonetheless among those with the lowest per-capita energy consumption in the world: 165 kWh (Hennig 2016: 1235).

The areas with the best energy supplies are Nay Pyi Taw, Yangon and Mandalay, followed by a few regional centres. The supply to several regions on the border to China (in the north and east of Shan State and Kachin State) is also relatively good, as cross-border trade and concessions for the extraction of raw materials provide higher incomes and better infrastructure in the locality. However, in the majority of the country less than half and often only a quarter of households have access to electricity. The peripheral mountain areas of Rakhine State, Tanintharyi Region and parts of Kachin State are characterised by poor energy supplies with less than 5% of all households having access to electricity, for instance for lighting. Energy supplies in Chin State are not quite as poor, a situation that can be attributed to external support provided by charitable organisations, civil society initiatives and available remittances. Also, energy is at some locations delivered across the border from India.

Thirty hydropower plants are currently in existence, 29 of them with a capacity of less than 10 MW; 17 are multipurpose dams that store water for irrigation as well as for electricity production and also help control flooding (ADB 2013). Three of the 15 largest hydropower plants were erected before 2000. These include the Baluchaung-2-Project, built in 1960 and financed by post-war Japanese reparations, which supplies electricity primarily to Yangon and Mandalay. Other large-scale projects, including the Kinda Multipurpose Dam and Yeya wa, supply Mandalay and Nay Pyi Taw (Hennig 2016: 1237).

Estimates suggest that it would be possible to develop 302 potential hydropower locations with a total capacity of up to 46.3 GW in Myanmar (Hennig 2016: 1236). The controversial large-scale project of the Myitsone Dam at the confluence of N’Mai Hka and Mali Hka with the Ayeyarwady River was suspended by the Thein Sein government in 2011 due to strong public reservations (Sun 2012, Simpson 2013, Kirchherr/Charles/Walton 2016, Kirchherr et al. 2017). A number of other projects, proposed mostly by China but also by India and Thailand – for instance Nawchanka and Shweli or Tamanti, Shwsyay and Mawlight on the Chindwin – largely or wholly for the export of energy to China and India, were in 2013 also suspended (Hennig 2016: 1237-1238, Kirchherr/Charles/Walton 2016, Mizuno 2016, each with lists of possible future projects). There has to date been no comprehensive, independent re-evaluation of planned projects that assesses ecological, economic, social and political factors.

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Starting with the first post office in 1854, the first military telegraph office in 1861 and the establishment of a public telegraph service from 1895 (KTAM Report 1953: 495, Hla Tun Aung 2003: 552), the telegraph system had expanded to almost 50,000 km of wire by the Second World War, with 656 stations, 331 of them owned by the railway administration (Storz 1967: 166). The first telephones were installed in 1888; from 1904, wireless radio broadcasters were producing news bulletins for shipping and aviation. The first Burma broadcasting station was set up in 1937, telex was introduced in 1971 and telefax followed in 1987 (KTAM Report 1953: 495, Hla Tun Aung 2003: 556).

Reconstruction of the postal and telegraph network, which was badly damaged during the war, commenced in the 1950s, initially with an emphasis on the more secure airmail system and wireless telephony, which offered greater reliability during the campaign against insurgents. Wireless lines and landline facilities were then progressively improved during the 1960s. The international telephone and telegraph service, which before the war relied on a connection via Madras, became more international in focus after 1960 with connections via other Asian cities.

From the 1990s, the mobile services began to evolve: ‘MPT’ launched a variety of cellular systems in the major urban areas, such as Advanced Mobile Phone Service (AMPS), Digital Advanced Mobile Phone Service (D-AMPS), International Direct Dialling Service, Wireless in the Local Loop (WLL) automatic radio telephone systems (TDMA), Digital European Cordless Telecommunications (DECT) radio telephone system and CDMA ... MPT launched GSM in Yangon and Mandalay in 2002, and W-CDMA in 2008’ (Thaw Tar Min/Fife/Bohlin 2014: 5/6).

MODERNISATION

As part of the liberalisation from 2010, the telecommunications sector was restructured. Nonetheless, until 2014, Myanmar Post and Telecommunication (MPT) was the only nationwide provider of mobile services, mainly serving Yangon, Mandalay and Nay Pyi Taw. With the subsequent award of nationwide licences, first to two local providers (MPT and Yatanarpon Teleport YPT) and then to two foreign operators (Telenor and Ooredoo), the number of mobile phone and internet users has rapidly increased.

Due to restrictive controls and the impossibility of expanding the telecommunications sector for many years, Myanmar has been dubbed a ‘telecommunications greenfield’ or the ‘last frontier’ in the global context (Goeres/White/Tun 2013, Fife 2014). The few studies which exist describe the major expansion potential in detail (Ericsson 2012, Chhor et al. 2013, Goeres/White/Tun 2013, Fife 2014, Thaw Tar Min/Fife/Bohlin 2014).

In 2014, Myanmar was reported to have 0.98 telephone lines per 100 population and 54.04 cellular subscriptions per 100 population. The number of internet users was reported as 2.1 per 100 population (all figures: ADB 2016; also see Johnsson 2014). The official statistics for 2014/15 (MNPED 2015: 441) refer to 18,405,814 telephones nationwide, including 5,844,375 in Yangon. The number of MPT mobile phones rose from 13,480 (2000/01) to 1,637,629 (2011/12) and then 17,839,244 (including 5,590,071 in Yangon), with Telenor accounting for a further 6,400,000 and Ooredoo 3,329,000 (figures for 2014/15; MNEPD 2015: 441).

The greatly improved provision is concentrated on the urban areas, with rural regions still underserved. The highest number and density
of the MPT towers are found in urban areas and along the country’s main transport routes; provision is much poorer in the rural, mountain and peripheral regions. This is reflected in the low level of household mobile phone ownership, but it is also noticeable that the number of households with mobile phones in border regions (especially to China and Thailand) is very high along stretches with higher population densities. As regards the distribution of the towers owned by private providers (Telenor and Ooredoo), it is noticeable that preference was given first to urban and densely populated areas.

MOBILE COMMUNICATION

The use of mobile communications shows Myanmar-specific traits:

- The main user group is the young and educated population, particularly the 18-34 age group and university graduates (Thaw Tar Min/Fife/Bohlin 2014: 15).
- Many users share a mobile phone with family members and friends, largely on account of the high purchase costs of handsets and expensive phone tariffs.
- The main motive for having a mobile phone is for use in emergencies (96%), convenience (95%), communication (94%), time-saving (92%) and direct access to information (90%) (Thaw Tar Min/Fife/Bohlin 2014: 11).
- The predominant forms of use are voice calling (83%), texting (52%) and social networking (43%) (Thaw Tar Min/Fife/Bohlin 2014: 13) – a user preference which reflects and compensates for the difficult and expensive general transport situation in Myanmar.
- When asked about the most important functions and services that should be further expanded, community information is the first preference (40%); almost one third of respondents would like to see the expansion of healthcare services via mobile phone, a further 23% mention job opportunities and 6% want to see a rollout of mobile money transfer services (Thaw Tar Min/Fife/Bohlin 2014: 13).

As regards the further expansion of mobile communications services in particular, the providers are pursuing different strategies: due to the inadequate UMTS infrastructure, 3G is available only to a very limited extent and LTE (1800 MHz) is still in its infancy. In cooperation with France Telecom/Orange, MPT launched international roaming services for GSM and WCDMA in 2014 (Thaw Tar Min/Fife/Bohlin 2014: 5/6). ‘Telenor has intended to implement 2G network in rural areas and both 2G and 3G networks in urban centers. ... Ooredoo has decided to jump directly to 3G networks, providing both 3G and 4G networks in urban areas and 3G in rural areas’ (Thaw Tar Min/Fife/Bohlin 2014: 6).

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Internet communication (MoPF 2016: 477)