Cambodia's Regional Connectivity: Unlocking the Full Potential of Transport Corridors

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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
ACTS	ASEAN Customs Transit System
AFAFGIT	ASEAN Framework Agreement on the Facilitation of Goods in Transit
AH	Asian Highway
ASEAN	Association of Southeast Asian Nations
ASYCUDA	Automated Systems for Customs Data
CBTA	Cross-Border Transport Agreement (GMS)
CITLS	Comprehensive Intermodal Transport and Logistics System Master Plan for 2023–2033
CIQ	Customs, Immigration and Quarantine
CLA	Cambodia Logistic Association
CLV	Cambodia-Lao PDR-Viet Nam
DWT	Deadweight (metric) tons
ERIA	Economic Research Institute for ASEAN and East Asia
FACBRTC	Framework Agreement for Cross-Border Railway Transport Connectivity (GMS)
GDP	Gross Domestic Product
GMS	Greater Mekong Subregion
GPS	Global positioning system
Kg	Kilogram
Km	Kilometer
Kph	Kilometer per hour
LPG	Liquid petroleum gas
LPI	Logistics Performance Index
MT	Master Plan for ASEAN Connectivity
MPWT	Ministry of Public Works and Transport
NR	National Road
PPAP	Phnom Penh Autonomous Port
RGC	Royal Government of Cambodia
PAS	Sihanoukville Autonomous Port
SEZ	Special Economic Zone
SRT	State Railway of Thailand
ton	Metric ton or 1,000 kg
TEU	Twenty-foot equivalent

EXECUTIVE SUMMARY

A Report Objectives and Structure

Cambodia's export-driven growth has resulted in increased freight demand. Containerized import and export cargo movement has increased more than five-fold over the past 12 years. By 2030, it is expected that trade volumes moving along highways and through ports, airports, and warehouses will double. However, high transport and logistics costs are major bottlenecks to Cambodia's economic competitiveness and diversification.

The Royal Government of Cambodia (RGC) developed the *Comprehensive Intermodal Transport and Logistics System (CITLS) Master Plan for 2023–2033*[1] to support improving the performance and efficiency of the transport sector and supporting the achievement of the national development objectives as defined in the RGC's *Pentagonal Strategy Phase 1*[2]. However, many of the projects put forward in the CITLS are in the conceptual phase requiring further technical studies and prioritization prior to securing financing from the public and private sectors.

This report prepared by the World Bank team aims to complement the RGC's efforts by focusing on immediate investments and policy actions *to unlock opportunities along the existing transport corridors* in Cambodia. The analysis and proposals described in this report focus on the short to medium-term priorities. By providing alternative insights on the role and performance of the existing roads, waterways and maritime transport, railways, and cross-border trade facilitation the report is designed to complement the CITLS. Throughout the course of this study, stakeholder consultations were conducted with involved public sector institutions and major private sector players in freight transportation and logistics[3].

The report is structured as follows:

- Chapter 1 – discussion of trade, transport, and logistics efficiency; trends in demand and modal competitiveness; and the current cross-border trade.
- Chapter 2–analysis of the transport sub-sectors covering roads, inland waterways, and maritime transport, and railways.
- Chapter 3 – analysis of the three prioritized transport corridors by the study.
- Chapter 4 – propose priority improvement directions.

1 *Comprehensive Intermodal Transport and System Master Plan 2023-2033* (Royal Government of Cambodia, August 2023). The Master Plan aims to improve domestic and international connectivity and promote continued sustainable, and equitable, economic growth. It has four major objectives. The Master Plan identifies 174 priority projects, including 94 road projects, 8 railway projects, 23 inland waterway transport projects, 20 maritime transport projects, 10 air transport projects, 15 logistics projects, and 4 additional projects. These projects, including better interconnections among modes and logistics centers, are divided into 90 short-term and medium-term projects and 91 long-term projects. The total cost of these investments is estimated at over $30 billion. Most of these investments are anticipated by the Master Plan to be implemented by private investors.

2 *Pentangle Strategy–Phase 1 for Growth, Employment, Equity, Efficiency, and Sustainability: Building the Foundation Towards Realizing the Cambodia Vision 2050* (Royal Government of Cambodia. August 2023).

3 Consultations with the private sector were conducted with (i) shipping companies operating barges along the Mekong River between Viet Nam and Cambodia; (ii) international shipping and logistics company that utilizes rail, road, and barges to transport cargoes to maritime ports; (iii) local companies mainly utilizing trucks between Cambodia and Viet Nam; (iv) several companies involved in rice production and trading; (v) Cambodian Logistics Association; (vi) Royal Railway (Cambodian railway concessionaire); and (vii) operators of boutique passenger cruise services between Viet Nam and Siem Reap.

B Country Context

Economic growth averaged 7.1 percent over the period 1995–2021, enabling Cambodia to become a lower middle-income economy by 2015. Growth has been driven by a few export-oriented sectors, including the tourism, agriculture, garments, and construction sector. However, the COVID-19 pandemic led to a 3.1 percent contraction in 2020, followed by a relatively subdued recovery with 3 percent growth in 2021. By 2023, GDP grew by 5 percent, and in 2024, it is estimated to have increased to 5.34 percent. The deteriorating global economy continues to pose challenges to Cambodia's export-driven economy.

Almost all of Cambodia's export growth over the past five years has come from North America, which overtook the European Union in 2019 to become Cambodia's largest export market.[4] The United States of America's share of exports rose from 24 percent in 2018 to 41 percent in 2021, while the European Union's share fell from 30 percent to 18 percent over the same period. Asia's share dropped from 46 percent to 41 percent over the same period. These markets increasingly require efficient and sustainable transport and logistics solutions.

Recent trade measured by the use of twenty-ton equivalent (TEU) containers grew from 317,200 TEUs in 2010 to 1,600,000 TEUs in 2022 an increase of over 400%. The main container gateways are Sihanoukville Port for maritime transport, and Phnom Penh Autonomous Port (container terminal LM17 located 28 kilometers downstream of Phnom Penh) using the Mekong River to Viet Nam, and using road transport to Viet Nam via Bavet. Despite the continued investment in all transport modes in recent years, inland waterways that cater to North American and Asian markets via transit in Viet Nam have slightly outperformed road transport to Viet Nam since 2015. Waterways are suited to bulk and containerized transport and have significantly lower transport costs per ton-kilometer than roads.

The World Bank's Logistics Performance Index 2023 (LPI) points to significant logistics challenges in Cambodia, which is ranked 115th out of 138 countries. Furthermore, the time it takes to comply with border and export formalities (for both imports and exports) is much higher in Cambodia than in neighboring countries. These inefficiencies in transportation and logistics are major bottlenecks constraining the diversification of the economy and its integration into higher value-added regional and global value chains.

Trade has been and will continue to be an important growth engine and determinant of Cambodia's ability to meet its goals of becoming a high-income country by 2050. To accommodate increased future trade flows, all modes must perform a larger and more efficient transport task. As in the recent past, significant new investment is planned in waterways, roads, and ports that can underpin a sharp growth in trade demand. In particular, an 80 percent increase in the container handling capacity of PPAP LM17 container terminal is planned by 2029. There is a significant opportunity to increase the share of exports by inland waterways and by rail transport that have untapped potential. However, there are several challenges, as listed below, that increase the costs of trade and reduce efficiency, speed, and reliability. As a result, the RGC is prioritizing the development of regional connectivity and improved efficiency logistics, as one of its strategic pillars in the Pentagonal Strategy Phase 1.

4 Cambodia Systematic Country Diagnostic (World Bank, 2023).

C Key Challenges

Transport and logistics constraints are increasing the costs of domestic and cross-border trade, creating inefficiencies in supply chains, and reducing Cambodia's international competitiveness. These constraints are summarized below:

- ***Logistics and transportation costs are high.*** National logistics costs in Cambodia (2020) are estimated at 26 percent of GDP, which is higher than most ASEAN countries, including Thailand (14 percent) and Viet Nam (20 percent). Transportation costs are particularly high, representing more than 40 percent of total logistics costs (alongside warehousing), pointing to significant inefficiencies in the transport sector[5].

- ***There are inefficiencies in border clearance and trade procedures.*** Border clearance is slow and costly due to poorly synchronized procedures among countries and inadequate cross-border facilities. Implementation of the national single window and ASYCUDA (Automated System for Customs Data) has been slow. The introduction of the single-stop inspection and common control area with Thailand and Viet Nam has been delayed.

- ***The infrastructure investment gap in Cambodia remains large.*** Public investment in infrastructure accounted for only 3.2 percent of GDP during 2019–2022, while estimated annual investment needs are about 10 percent of GDP. The transport sector accounts for a substantial portion of these investment needs. About 85 percent of national roads are paved, but only 38 percent of provincial roads and 10 percent of rural roads have pavement, indicating a major gap in climate-resilient last-mile connectivity. Maintenance spending is also inadequate; because of this, the current value of road assets is estimated to be more than one-third below their potential maximum net present value.

- ***Bottlenecks exist along regional road corridors.*** Good progress has been made in improving most national roads, including connecting Phnom Penh with major trade gateways such as the Sihanoukville port. But a major gap exists along the regional East-West corridor (the section running from Siem Reap to the Oyadav checkpoint at the Cambodia-Viet Nam border). This corridor connects Cambodia with Viet Nam, Thailand, and Lao PDR, and is part of the Greater Mekong Subregion (GMS) corridors and the Master Plan for ASEAN Connectivity (MPAC 2025).[6] The lack of development of this corridor is a major constraint to economic growth and job creation in the less-developed northeastern part of the country.

- ***Waterway connectivity between Cambodia and Viet Nam is a vital asset but is underutilized due to capacity constraints and administrative barriers such as the inspection of transit containers.*** Maritime ports in Viet Nam (such as Cai Mep and Cat Lai) accommodate liner container vessels bound for the United States and East Asia respectively and play an important role for transit of Cambodian exports. Today, there are two river port hubs and six inland-waterway sub-feeder general purpose terminals in Cambodia; but their capacity is limited, constraining access and preventing optimal consolidation of freight movements. This limited capacity inhibits barge connections of over 2,000 deadweight tons (DWT), which is more cost-efficient for freight transport. The current inefficiencies in cross-border transit procedures have time and cost implications for Cambodia's exports and imports requiring collaboration between the neighboring countries such as Cambodia and Viet Nam to find mutually beneficial solutions.

- ***The full potential of railways in facilitating trade with Thailand has not been realized, despite their capacity to play a more significant role.*** The role of the railways in

5 These figures represent data for 2018.

6 MPAC 2025 has been adopted by ASEAN member countries to "achieve a seamlessly and comprehensively connected and integrated ASEAN that will promote competitiveness, inclusiveness, and a greater sense of community." MPAC 2025 focuses on five key areas: sustainable infrastructure, digital innovation, seamless logistics, regulatory excellence, and people mobility.

regional trade is limited – estimated at less than one percent of total domestic freight movements. A shortage of existing rolling stock and dilapidated infrastructure have been the main constraints for the railway in attracting new businesses, including along the rail link between Phnom Penh to Poipet.

- ***The trucking fleet is old and inefficient.*** The average age of trucks in Cambodia is typically 20 years or older, many of which are imported secondhand. Compared to new trucks, secondhand purchases have resulted in slower travel speeds, significantly reduced fuel efficiency, increased maintenance costs, and generated higher emissions. Moreover, the absence of harmonized technical standards for cross-border trucking operations for factors such as axle load, vehicle length and width, imposes constraints on efficient regional trucking operations.

- ***Climate-related natural disasters disrupt logistics supply chains.*** Cambodia is highly exposed to climate change impacts, including heavy rainfall and floods. Nine out of ten provinces analyzed face more than 15 percent loss of access to employment bases such as factories and agriculture when roads are flooded. Furthermore, it is estimated that a seven-day closure of key road corridors by a 50-year flood event would result in a five percent indirect cost increase for trade partners for each day of disruption from freight rerouting or blockage.[7]

D

Proposed Investments to Improve Cambodia's Regional Connectivity

The conclusions of the analysis of trade corridors (Chapter 3) show the importance of improving regional connectivity along the following transport corridors (Figure ES1):

- ***Corridor A:*** *The East-West regional road corridor connecting Laem Chabang – Poipet – Siem Reap – Oyadav – Quy Nhon (Thailand–Cambodia–Viet Nam, and Cambodia–Lao PDR)*. The gap in international road connectivity is due to the poor condition of the section in Cambodia between Siem Reap and the border with Viet Nam (about 400km). Currently, due to poor condition this corridor is lightly trafficked but it is directly connected to Lao PDR and Viet Nam and has significant development and international trade potential.

- ***Corridor B:*** *The existing Inland Waterway corridor from Phnom Penh – Vipassana Kamsomnor – Cai Mep (Cambodia–Viet Nam)*. This is a key current trade corridor. Greater use of waterway transport on the Mekong River is an alternative to road to Viet Nam with significantly lower transport costs although at the expense of longer travel times that are unlikely to be a significant driver of freight mode choice as long as travel times are reliable.

- ***Corridor C:*** *The Existing Rail corridor from Poipet – Phnom Penh – Sihanoukville Port (Cambodia-Thailand).* For connection to Thailand, upgraded existing rail is an alternative to road transport with lower transport costs.

These prioritized corridors comprise part of the existing backbone corridors for the three modes – road, rail, and inland waterway – which can be improved with relatively lower costs and in the short-to-medium term (compared to new greenfield corridors). They do not compete, but complement each other, by serving different geographic areas, regional markets, and destinations. However, it is noted that well-designed inland waterway and railway measures that cater to shipper preferences would have important decarbonization benefits in addition to economic benefits. The following investments are proposed to enhance Cambodia's regional connectivity:

7 Cambodia Climate Change Development Report. (World Bank, 2023).

FIGURE ES.1 Three Prioritized Trade Corridors Showing Short– and Medium–Term Development Opportunities

Source: Study team.

- ***Corridor A:*** *Improve Siem Reap-Oyadav Road as part of the East–West corridor between Thailand, Cambodia, and Viet Nam (and the only road corridor connecting Cambodia with Lao PDR).* Under MPAC 2025, this road link is prioritized for improvement and designation as Asian Highway 21, which connects Cambodia to Quy Nhon, an important domestic and regional shipping port in Viet Nam. Investment in the main road infrastructure should be complemented by improvements to the condition and resilience of feeder roads linking to agriculture and production areas, modernization of the border-crossing facility, and the promotion of private investments to develop value-added services and consolidation facilities along the corridor. To take full advantage of road investments, rationalizing duties, and special taxes on imports of new trucks and vigorously pursuing harmonization of vehicle technical standards would help incentivize the replacement of the outdated fleet with larger, cleaner, and efficient vehicles.

- ***Corridor B:*** *Improve the inland waterway connection with Viet Nam and farm hinterland in Cambodia.* The Phnom Penh Autonomous Port (PPAP) plays an important role in the movement of freight, especially for exports to the United States and East Asia through the Mekong River and maritime ports in Viet Nam. Priority investments to expand capacity and improve efficiency of the inland waterway include (i) supporting PPAP investment plan for its phase 4 expansion of its main container terminal (LM17) to double its container-handling capacity; (ii) developing sub-river feeder ports and access roads for additional freight consolidation (for example in Kampong Cham, Siem Reap, Kampong Chhnang, and Prek Kdam); (iii) capital dredging of the navigation channels to accommodate larger vessels; (iv) expanding the river barging; (v) improving navigation safety and efficiency; and (vi) streamlining cross-border waterway transit procedures.

- ***Corridor C:*** *Improve the existing railway operations and infrastructure links with Thailand.* Priorities include (i) renovation of the existing one meter gauge track along the 386 kilometers northern line (infrastructure/track is owned by the public sector); (ii) acquisition and deployment of new rolling stock by Royal Railways, the railway concessionaire; (iii) enhancement and digitalization

of the signaling system; (iv) development of an improved legal and regulatory framework for railways operation; and (v) preparation of a forward business plan, including required public and private sector actions to improve railway operations. There is scope for detailed value-engineering to identify a first phase of upgraded railways that maximizes the benefits to be achieved for each dollar of investment. The feasibility of extending the rail connection to PPAP's LM17 container terminal should also be explored.

E

Proposed Actions to Address Logistic and Cross-Border Transit Inefficiencies

The study recommends a two-pronged approach to address current inefficiencies in trade, logistics and cross-border freight transit and trade:

- ***Improved cross border trade facilitation and more efficient transport movement*** focusing on relatively low-cost infrastructure, operational and management measures;
  - Implementing measures to reduce trade costs and promote smart logistics.
  - Synchronizing and streamlining border crossing procedures with those of neighboring countries.
  - Modernizing the truck fleet with harmonized truck axle load limits and other technical features among the GMS countries.

Connected transport networks focusing on completing the road network and improving its safety, further developing waterways, maritime transport, and expanding the role of rail, as follows:

- Develop primary, secondary, and tertiary road networks by focusing on current gaps in links between the key economic zones and international gateways. Ensure such networks have sufficient established alternatives at times of severe weather events. Improve traffic management and safety along highways and rural roads.
- Maintain and develop further the current trunk and feeder waterways that have demonstrated efficiency and sustainability advantages over the other modes and are well-oriented to the main international markets.
- Take advantage of the immediate opportunity to achieve enhanced utilization of the current railway with modest investment and to expand its role in cross-border movements (with Thailand and with other markets via Sihanoukville Port).
- Inter-link waterways, roads, and railways and multi-modal terminals thus developing multi-modal network that is inherently more resilient than individual networks working alone.
- Deploying weigh-in-motion technology along key international corridors (e.g., NR1, AH21) to monitor the incidence of truck overloading to preserve road assets and facilitate more freight usage by rail and waterways.

A summary of the proposed actions that are set out in Chapter 4 is presented below (Table ES.1). The proposed actions are described as having short-term and medium-term priority – with short-term actions generally occurring within a period of three years and medium-term actions after that.

TABLE ES.1

Proposed Actions to Address Logistic and Cross-Border Transit Inefficiencies

Short-term	Medium-term
Enhancing cross-border transport and trade facilitation	
Continue to enhance cross-border trade movement efficiency through further automation and implementation of single-stop inspection and a common control area.	Complete the negotiations on the GMS Framework Agreement for Cross-Border Railway Transport Connectivity and, in parallel, finalize key annexes and technical arrangements.
Complete the renewal of the early harvest arrangements for the GMS Cross-Border Trade Agreement, further harmonizing national requirements and enhancing CIQ capacity.	Provide effective bilateral and tri-lateral coordination to facilitate efficient regional, trade, and economic corridors involving updating and maintaining trade facilitation and associated agreements for all modes.
Activate the Mekong Navigation Facilitation Committee to overcome constraints in smooth and safe navigation along the waterways between Cambodia and Viet Nam.	Facilitate efficient multi-modal transport through an effective regulatory framework to ensure appropriate investment and domestic capacity development.
Facilitate better data access for investment and policy making.	
Improving road connectivity	
Improve Corridor from Siem Reap to Oyadav, at the border with Viet Nam (Corridor A), including cross-border facilities and linked tertiary roads.	Prioritize investment in climate resilience of critical rural roads.
Investigate and provide additional traffic management and safety measures along NR4, NR1, and NR5.	Facilitate developing a modern, safer, more energy-efficient, and lower-emission truck fleet with technical standards that are better harmonized with GMS neighbors.
Assess the implications for new axle load limits and impact on overloading and infrastructure deterioration.	
Developing inland waterways and maritime facilities	
Ensure the navigability and efficiency of the Mekong River and key ports for domestic and international waterborne trade (Corridor B).	Develop an adequate end-to-end management system along the main waterways. Enhance consolidation from agricultural and production areas.
Improve the capacity, safety, and quality of river navigation.	Equip the Department of Waterways to efficiently manage inland waterways and enhance the marketing capacity of inland waterways.
Strategically improving the current railway	
Develop a 3-year rolling business plan to improve the railway sector.	Improve the current meter gauge railway infrastructure and rollingstock (Corridor C), focusing on the Northern Line and facilities to develop new markets.
Undertake a value-engineering and feasibility study to determine the optimal level of investment in upgrading the railway, including infrastructure and rollingstock.	Complete a new feasibility study for a dual gauge track to PPAP LM17 container port.
Progressively strengthen the capacity of the Department of Railways for management of capital works and maintenance.	Draft a new Railway Law that sets out the legal framework to bring to fruition a modern domestic railway network with high-quality regional connections.

Source: Study team, refer to Chapter 4.

Delayed actions to address the critical identified challenges may ultimately undermine Cambodia's international trade competitiveness versus its regional peer countries. However, vigorous and coordinated efforts can overcome the challenges in transportation and logistics faced currently by Cambodia that are complex but not uncommon across the world. The complexity is related to the nature of the sector, which requires coordinated efforts by multiple public sector agencies s closer engagement with private sector stakeholders (such as freight forwarders, logistics companies, trucking associations, traders, and businesses). Institutional coordination can be strengthened through active facilitation by the National Logistics Council and regular government and private sector interaction. With the development of a common vision and improved coordination among stakeholders, success can be achieved through selective investments to close the gap in infrastructure. In this light, the investment program included in the *Comprehensive Intermodal Transport and System Master Plan 2023–2033* would benefit from further prioritization. Priority investments should be complemented by policy actions to unlock trade and export potential through seamless cross-border transit, improved logistics and value chains, and the develoment of productive sectors.

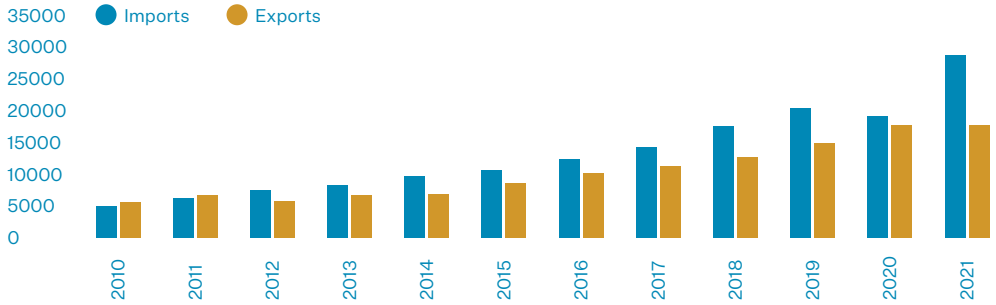
CHAPTER 1 IMPORTANCE OF REGIONAL TRANSPORT CONNECTIVITY

1.1 Overview of Transport and Logistics Efficiency

Trade continues to be an important growth engine for Cambodia. Exports and imports by value grew by 340 percent or at a rate of 14.4 percent per annum from 2010–2021. The value of imports grew at 17.4 percent per annum, 60 percent faster than exports that grew at 10.9 percent per annum (Figure 1.1). In real terms, the total value of exports and imports by value grew by 110 percent or at a rate of 7 percent per annum from 2010–2021 about the same rate as real GDP growth over the period. Containerized import and export cargo movements increased by 400 percent from 2010–2022 (Figure 1.2).[8] From 2015–2022, these containerized cargo movements grew by 130 percent or at an annualized compound growth rate of 12.5 percent. By comparison, growth in total exports and imports in containers and bulk cargo in terms of volume (i.e., tons) was slower at 7.8 percent over the same period. Based on these trends, it is expected that Cambodian firms will approximately double the volume of goods moving along highways and through ports, airports, and warehouses by 2030 compared to 2022.

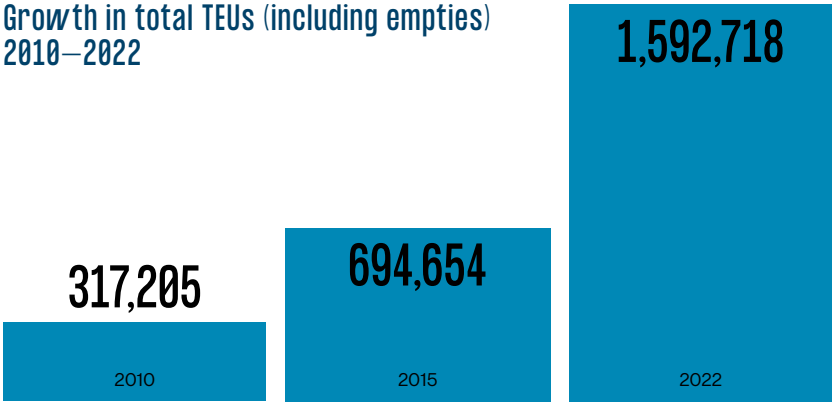
Two-thirds of Cambodia's exports by value are sent to highly competitive markets such as the United States of America, the European Union, and Singapore (Figure 1.3). Of the total value of exports, textiles and footwear represented just over 50 percent; stone, glass, and minerals represented 21 percent; and agricultural products and foodstuffs represented 11 percent.[9] The sources of imports by value show that China has the dominant role (40 percent) with Thailand (15 percent) and Viet Nam

FIGURE 1.1 Trends in External Trade Values 2010–2021 (US$ million)



Source: Cambodia Trade Summary | WITS Data (worldbank.org) accessed March 7, 2023; UNCommtrade for 2021 data (accessed March 8, 2023).

FIGURE 1.2 Growth in total TEUs (including empties) 2010–2022



Source: Study team estimates using PPAP, PAS, and Customs data. Thailand's Aranyaprathet Customs House data used for Poipet.

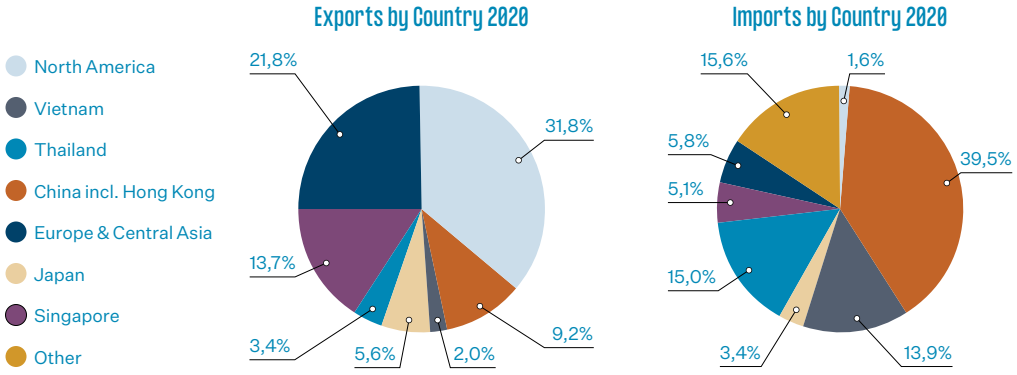
8 Containerized cargo movements in twenty-foot equivalent units (TEU).

9 Cambodia Trade Summary | WITS Data (worldbank.org) accessed March 7, 2023; UNCommtrade for 2021 data

(14 percent) having a lesser though significant role. A wide variety of product types were imported in 2020, including textiles and clothing (33 percent); stone, glass, and metals (11 percent); agricultural products (11 percent); fuels (11 percent); and food products (7 percent).

Cambodia's high logistics costs, gaps in infrastructure, and weak supply chains have hindered the country's economic diversification.[10] The World Bank's Logistics Performance Index (LPI) 2023 points to significant logistics challenges in Cambodia, which is ranked 115 out of 138 countries (Figure 1.4). Of Cambodia's neighbors, Viet Nam and Thailand have outperformed Cambodia and Lao PDR from 2018 to 2023 in terms of their global LPI ranking. While all four countries slipped in their global rankings the effect was most pronounced for Lao PDR and quite marked for Cambodia (Figure 1.5). Despite Cambodia's overall slip in global ranking mainly due to a drop in timeliness and international shipments, the logistics quality and customs clearance and the efficiency in the quality of transport and trade infrastructure showed a small improvement while tracking and tracing showed significant improvement.

FIGURE 1.3 Trends in External Trade Values 2010–2020 (US$ million)



Source: Cambodia Trade Summary | WITS Data (worldbank.org) (accessed March 7, 2023).

FIGURE 1.4 Logistic Performance Index

Source: Logistic Performance Index (World Bank 2023).

10 *Special Focus. Supply Chain Disruptions in the Wake of Covid-19: Strategies to Reduce Logistics Costs* (World Bank, 2022, p.2).

FIGURE 1.5 LPI Ranking 2023 versus 2018

Note: A smaller number indicates a better ranking.
Source: World Bank Logistics Performance Index, 2018 and 2023. (https://lpi.worldbank.org/).

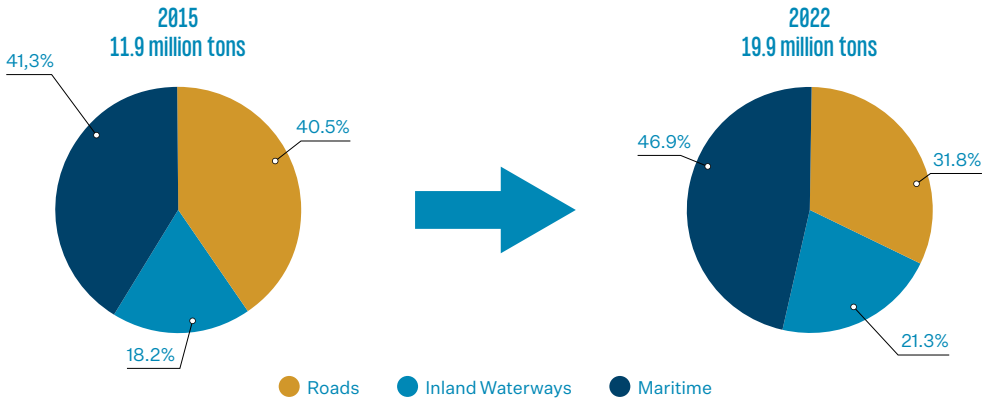
1.2 Trends in Trade, Freight Demand and Modal Share

Both sea and inland waterways increased their share of all international cargo movements by volume from 2015-2022 at the expense of road transport. Both sea and inland waterways rely on private investment and operations by private firms whereas road transport is operated by private trucking firms that operate on highways provided by the public sector or new private expressways that are facilitated by the public sector. It is estimated that for total international trade (imports plus exports) of 19.0 million tons in 2022,[11] the estimated share by modes was 32 percent carried by roads, 47 percent by sea, and the balance of 21 percent by inland waterways (Figure 1.6). In contrast, road transport dominates domestic freight movements with a share of over 90 percent of domestic freight movements, including between agricultural and industrial production areas and markets.

11 *All cargo inclusive of containers, bulk, general cargo, and fuels.*

FIGURE 1.6

Modal Shares of all Export/ Import Cargo Movements 2015–2022

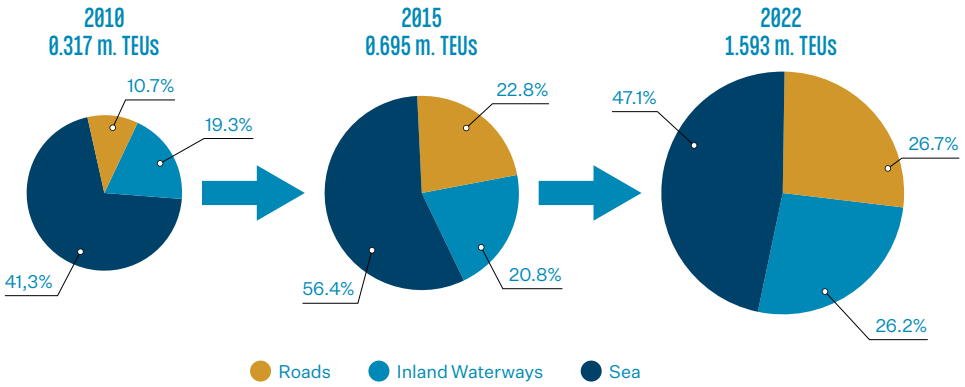


Source: Study team estimates using PPAP, PAS, and the road border crossings at Bavet and Poipet. Thailand's Aranyaprathet Customs House data used for Poipet.

Note: All cargo totaling the sum of exports and imports in containers, bulk, general cargo and fuels.

FIGURE 1.7

Modal Shares 2010–2022 based on all Export/Import TEUs (including empties)



Source: Data for 2015 and 2022 from study team estimates using PPAP, PAS, and Customs data. Data for 2010 from Cambodia Trade Corridor Performance Assessment (World Bank, July 2014).

The modal split is similar in terms of total international TEU movements. Overall, estimated total TEU movements have increased by 400 percent from 2010 when it was 317,200 TEUs to 1,592,700 TEUs in 2022 (Figure 1.7). From 2015-2022, inland waterway transport increased its share of TEU movements at a faster rate than roads and at the expense of sea transport. As a result, it is estimated that of all TEUs in 2022, 27 percent were carried by roads, 47 percent were carried by sea, and the balance of 26 percent by inland waterways. By comparison, in 2010 the shares of TEUs (including empties) were estimated to be 10 percent carried by roads, 70 percent by sea, and 19 percent by inland waterways.[12]

Facilitating the 190 percent expansion of the inland role for container transport from 2015-2022 was a corresponding 270 percent expansion of TEU handling capacity by PPAP. Actual TEUs transported by inland waterways grew from 145,000 to 417,000 TEUs per annum (growth of 190 percent over the period) over the period 2015 to 2022. TEU handling capacity grew from 134,000 TEUs to 500,000 TEUs per year, respectively, over the same period.[13]

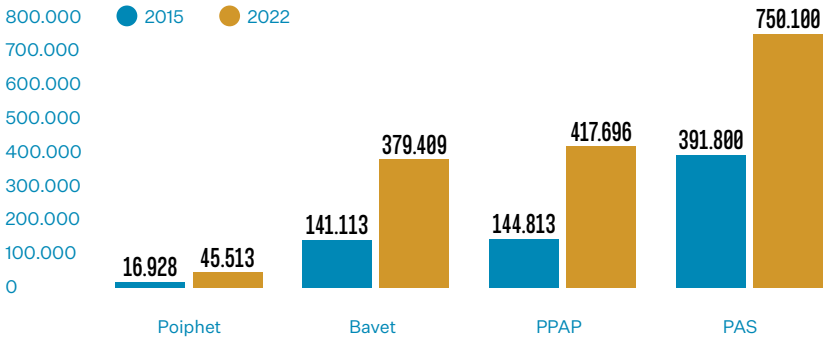
12 *Cambodia Trade Corridor Performance Assessment (World Bank, July 2014). Figure 1.*

13 *PPAP Presentation, 2022, Slide 11.*

The main container gateways are Sihanoukville Port, PPAP's container terminal LM17 (located 28 kilometers downstream of Phnom Penh) using the Mekong River to Viet Nam, and Bavet using road transport to Viet Nam (Figure 1.8).[14] Like inland waterways, road transport and port capacity have greatly increased. However, the relative share of export and import demand by these modes has declined to that carried by inland waterways. While rail transport has a negligible direct role in transporting goods across the main land borders with Thailand (Poipet) and Viet Nam (Bavet without a current railway), in 2022 rail transport represented 6.6 percent of all Cambodia's international container movements generated by Sihanoukville Port or 3.1 percent of all Cambodia's international container movements.

Poipet, recently replaced by the nearby Stueng Bot border date in 2023, is primarily a bulk cargo facility and so its importance is underrepresented in Figure 1.8 which presents TEU movements. Viewed in terms of overall cargo movements, Poipet was the most important land-based border crossing (Table 1.1). Overall, total exports in containers of general and bulk cargoes are estimated to have been 6.2 million tons. Total imports in containers of general and bulk and fuel are estimated to have been 12.8 million tons.

FIGURE 1.8 Main Container Gateways 2015 and 2022 (all TEUs, including empties)



Source: Study team estimates using PPAP, PAS, and Customs data. Thailand's Aranyaprathet Customs House data used for Poipet.

TABLE 1.1 Trade Volumes at International Gateways 2022

Border Crossing/ Gateway	*Export (tons)*	*Import (tons)*
Road		
Poipet	1,530,000	2,060,000
Bavet	979,000	1,292,000
Bavet (LPG)	0	171,000
Inland Waterways - Mekong		
Phnom Penh Autonomous Port	1,899,000	1,328,000
Fuel (other private companies)	0	817,000
Sea		
Sihanoukville port	1,778,000	5,225,000
Sihanoukville port (fuel)	0	1,890,000
Total (above)	**6,186,000**	**12,783,000**

Note: Excludes estimates of trade across smaller road borders such as Trapaeng Sre (Snoul), minor seaports (e.g., Kampot currently), and Kaom Samnor on the Mekong River at the border with Viet Nam. Total import and export tons in 2022 at Trapaeng Sre are estimated to be about 570,000 tons and at Kaom Samnor to be about 400,000 tons that are not accounted for in the table. Source: Study team estimates using PPAP, PAS, and Customs data. Thailand's Aranyaprathet Customs House data used for Poipet.

14 The new Prey Vor border crossing for container traffic near Bavet is relatively lightly used; data not available to the study team.

The composition of goods by type using each gateway can vary significantly from year to year. However, the following characteristics have been observed:

- ***Data for Poipet (main border gate with Thailand) shows that exports in years 2016 and 2022 were dominated by agricultural produce (Figure 1.9).*** Imports were dominated by cement and various consumer products.[15]

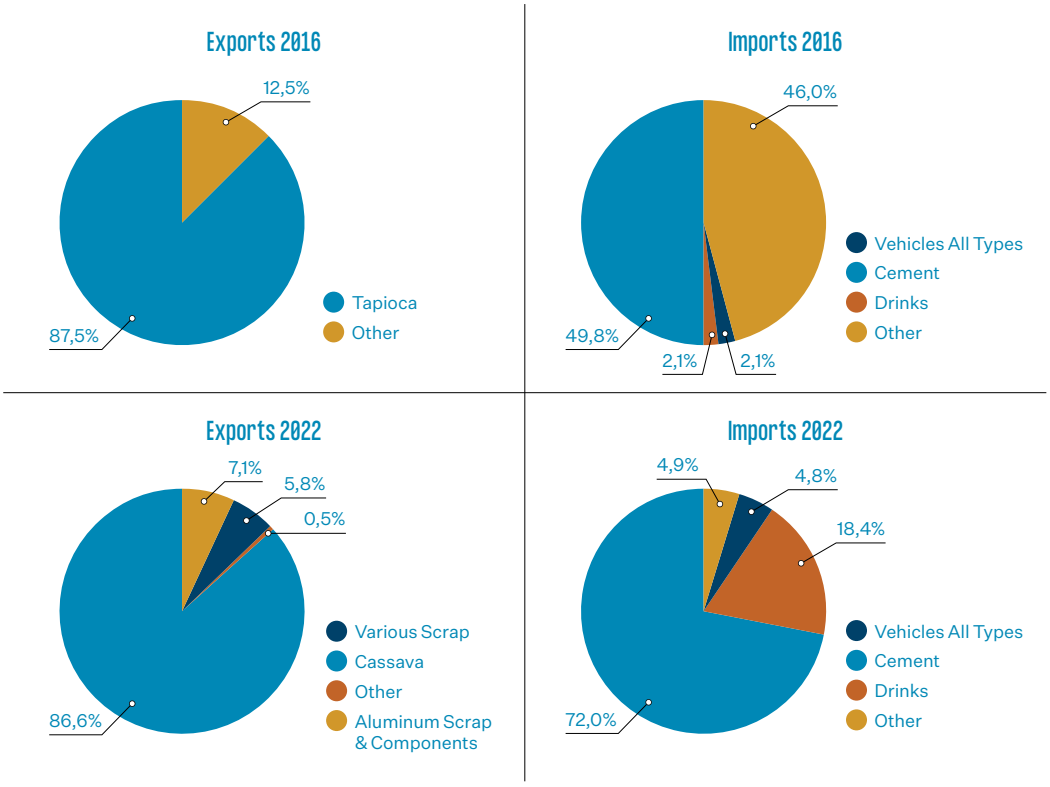
- ***Detailed data on goods using Bavet (main border gate with Viet Nam) are not available but in 2022 about 80 percent were in containers and the rest were in bulk.*** In addition, an estimated 171,000 tons of liquified petroleum gas (LPG) were imported in LPG trucks.

- ***Data currently available on total trade volumes using PPAP shows the dominant role of garments in exports in terms of TEUs is apparent from construction materials for imports (Figure 1.10).*** As for roads, there can be considerable variation in the composition of exports and imports from year to year; – while rice only represented 2 percent of exported TEUs in 2021, it was more significant in 2018 when it represented 7 percent of TEUs. Fuel imports via inland waterway are handled by private companies and in 2022 represented 1.7 million tons (Table 1.1).

- ***Detailed data for exports and imports for Sihanoukville Port in 2022 (Figure 1.11) indicate that rice and garments represent just over half of exports and general cargoes (33 percent).*** For imports, general cargoes represented 52 percent and fuels and gas 35 percent.

FIGURE 1.9

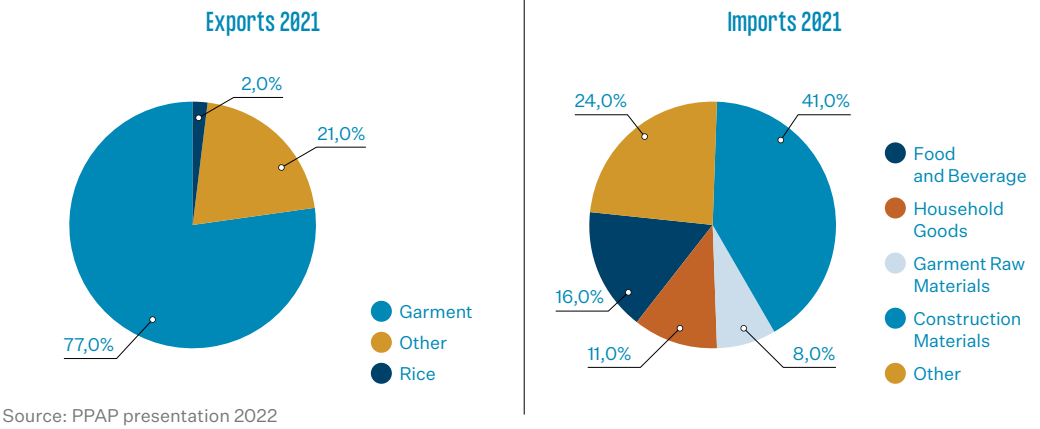
Distribution of Main Export and Import Products, Poipet 2016 and 2022 (Tons)



Source: Data for Poipet obtained from Thailand's Aranyaprathet Customs House on the other side of the border.

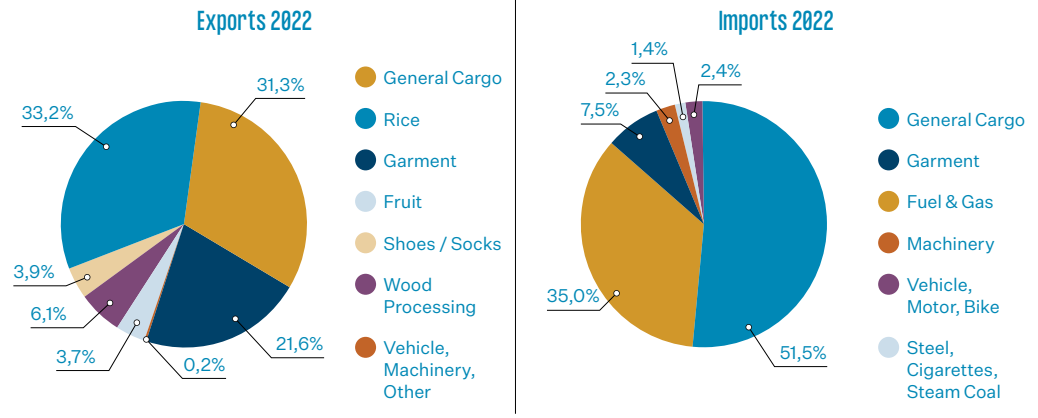
15 Data are sourced from the Ayanprathet Custom House in Thailand which is more detailed than that from Cambodian Customs.

FIGURE 1.10 **Distribution of Main Exports & Imports by Commodity, PPAP 2021**



Source: PPAP presentation 2022
Note: all export/ import cargoes, i.e., in containers and bulk but excluding fuel.

FIGURE 1.11 **Distribution of Main Exports and Imports by Commodity, PAS 2022**



Source: Annual Report (PAS 2022). Unofficial Translation.
Note: all export/import cargoes (i.e., in containers and bulk).

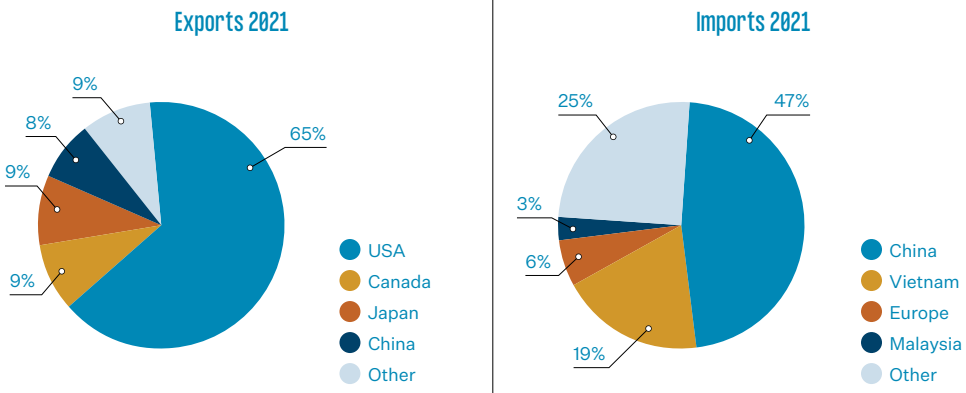
The destinations of exports by volumes through Phnom Penh's ports (Figure 1.12) and Sihanoukville Port (Figure 1.13) are heavily oriented to North America as are overall exports (Figure 1.3). Due to the convenient location of PPAP's container terminal (LM17) and their nearby bulk terminals, there is a direct connection to Viet Nam's Cai Mep deep seaport. PPAP's traffic has a stronger orientation to North America (United States and Canada) than Sihanoukville Port. Sihanoukville Port has a relatively strong orientation to Europe (32 percent of total export containers) whereas PPAP's ports do not. China is an important export market for both ports but more so for Sihanoukville Port (11 percent) compared to Phnom Penh's ports (8 percent). In terms of imports, China dominates the cargo movements for both Phnom Penh's ports and Sihanoukville Port with it being more important for the latter (64 percent).

Transit trade is currently limited but with future potential for growth. Transit trade, almost all from Thailand to Viet Nam, rose from 41,000 tons in 2018 to 102,000 tons in 2021 with a spike in 2020 where transit movements of 144,000 tons was recorded. The number of containerized transactions averaged 70% of transit trade from 2018–2021 but in 2021 reached 90 percent. With improvements in infrastructure and trade facilitation among the GMS countries the potential for growth in transit trade is significant.

Detailed data on the origins and destinations of import and export goods by road are not available. However, they are likely to have a stronger orientation to markets in Thailand (via Poipet/ Stueng Bot) and Viet Nam (via Bavet) than trade using Phnom Penh and Sihanoukville Port.

FIGURE 1.12

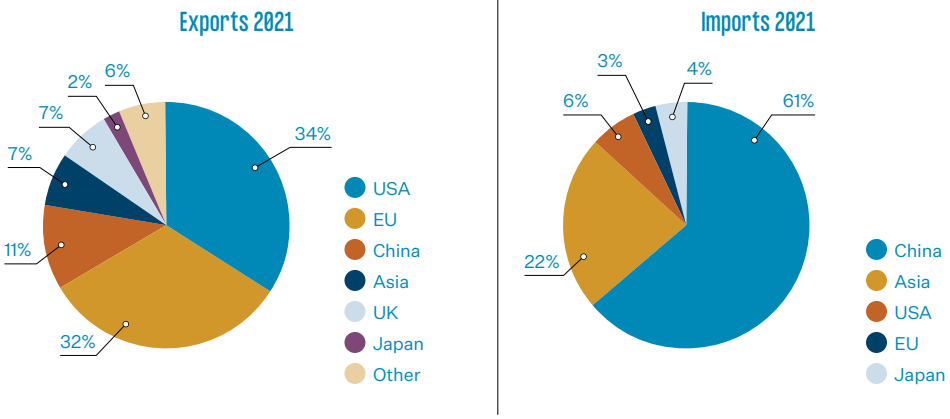
Distribution of Main Exports and Imports by Country, Phnom Penh Port 2021



Source: PPAP presentation 2022.

FIGURE 1.13

Distribution of Main Exports and Imports by Country, Sihanoukville Port 2022



Source: Annual Report (PAS 2022). Unofficial Translation.

To meet the desired growth in future trade flows, all modes must perform a larger and more efficient transport task. As in the recent past, significant new investment is planned in waterways, roads, and ports that can underpin a sharp growth in trade demand. In particular, an 80 percent increase in the container handling capacity of PPAP LM17 container terminal is planned by 2029. There is a significant opportunity to increase the share of exports by inland waterways and by rail transport that have untapped potential.

CHAPTER 2 OVERVIEW OF THE TRANSPORT SECTOR AND CROSS-BORDER TRANSPORT FACILITATION

2.1 Cross–Border Transport Facilitation

Under the various bilateral and regional agreements quotas for vehicle passage across land borders between Cambodia and its neighbours vary by country. Under the Bilateral agreements these quotas are currently as follows: (i) with Thailand, 150 trucks each way; (ii) Lao PDR, 40 trucks for each country; and (iv) Viet Nam, 800 trucks for each country. Under the tri-lateral agreement between Cambodia–Viet Nam–Lao PDR (CLV), 150 trucks from each country are authorized to travel among the three countries. Under the GMS Cross-Border Trade Agreement (CBTA), 500 trucks from each country are permitted to travel. During the Covid-19 pandemic, the permits issued to Cambodian truck operators under the ASEAN agreement lapsed. Under the ASEAN Framework Agreement on the Facilitation of Goods in Transit (AFAFGIT), a quota of up to 500 vehicles from each country are permitted to travel. This Agreement was launched following the operationalization of the ASEAN Customs Transit System (ACTS) in November 2020 between Singapore, Malaysia, Thailand, Cambodia, Laos PDR and Viet Nam.

During the Covid-19 pandemic, most of the cross-border points between Cambodia with neighboring countries were closed. The CBTA operation under the early harvest arrangements also expired but during 2024 are being renewed. They cover the following road corridors:

Thailand–Viet Nam. Laem Chabang and Bangkok to Ayanyaprathet, Thailand, connecting to Poipet and Phnom Penh; and to Bavet and then to Moc Bai, Ho Chi Minh City and Vung Tau, Viet Nam.

- ***The Southern Coastal Corridor* as follows:** (i) Laem Chabang to Hat Lek (border), Thailand connecting to Cham Yeam (border) and Sihanoukville Autonomous Port, Cambodia; and (ii) Sihanoukville Port to Prek Chak (border) in Cambodia and Ha Tien (border) in Viet Nam connecting to Rach Gia and Cau Mau in Viet Nam's Mekong Delta. However, the Southern Coastal Corridor is not considered a trade corridor other than at the western end along the Thai seaboard.

- ***The north-south corridor*** from Sihanoukville port to Phnom Penh connecting to Trapeang Kriel at the border with Lao PDR (opposite Nong Nok Khean, in Lao PDR).

Inland waterways using the Mekong Route are open for trade through legal processes. With their common interest in increasing international trade, the Mekong River Commission's member states (Cambodia, Lao PDR, Thailand, and Viet Nam) included Freedom of Navigation in the 1995 Agreement on Co-operation for the Sustainable Development of the Mekong Basin. This action provided a high-profile base for the Mekong River Commission to start facilitating the negotiations toward the 2009 Waterway Transport Agreement between Cambodia and Viet Nam. The Agreement also permits access to the river system by foreign vessels (transit routes are shown in Figure 2.1). The move was a historic change that facilitated increased regional and international trade. From that moment on, if there was full implementation of the Agreement, investors could be confident that cross-border shipping was based on a sound legal structure.

FIGURE 2.1

2009 Waterway Transport Agreement between Cambodia and Viet Nam

Source: Navigation Program, the Mekong River Commission, 2009.

The green-colored Regulated Waterways on the Mekong, Tonle Sap, Bassac and Vam Nao rivers, and selected canals can be used by Cambodian and Vietnamese vessels under the Agreement.
The orange-colored Transit Routes are destined for maritime traffic and can be used by all sea-going ships under foreign flag under the Agreement.

One of the cornerstones of the 2009 Waterway Transport Agreement was to establish a Mekong Navigation Facilitation Committee which could implement and monitor the stipulations and responsibilities under the Agreement. Unfortunately, the Committee was never established and only a few ad hoc meetings between Cambodia and Viet Nam were organized. The lack of such an institutionalized committee means that: (i) there is a room to improve joint efforts for deepening the river transportation, improving the accessibility, and conducting maintenance; (ii) the countries are still using different regulations for navigation, pilotage, tariffs, and aids to navigation; (iii) the implementing regulations do not conform to international standards; and (iv) border efficiency is not monitored closely for all cargo.

Cambodia established a bilateral agreement with Thailand on cross-border rail transport in 2017. Cross-border transport between Cambodia and Thailand by rail commenced at the end of 2023. A draft Framework Agreement for Cross-Border Railway Transport Connectivity (FACBRTC) for the Greater Mekong Subregion (GMS) was prepared in 2023 with the support of the Asian Development Bank (ADB). Further negotiations are needed after which ratification by each country would occur in parallel with finalization of key annexes and technical arrangements (for example, on freight, passenger, technical standards, and phytosanitary requirements).[16] It can therefore be expected that the ratified FACBRTC with annexes and technical arrangements would not be finalized until after 2025.

The architecture of the FACBRTC mirrors the CBTA for road transport in terms of scope. However, the design of FACBRTC is also attempting to address several weaknesses and shortcomings of CBTA. Improvements focus on the legal structure, the greater flexibility to adapt FACBRTC when necessary, in light of future transport, technological or regulatory needs, the different institutional framework, and the progressive nature of its coverage and level of ambition.

16 Connecting the Railways of the Greater Mekong Subregion (Phase 2), financed by the People's Republic of China Regional Cooperation and Poverty Reduction Fund, Final report, TA 9918 (ADB, 2023).

Cross-border transport facilitation efficiency improved from 2019 to 2021. The 2021 and 2019 time-release studies measured the customs clearance time from the arrival of the goods to the removal of the goods as well as the pre-arrival process procedure by measuring time taken to request for licenses, certificates, or permits conducted by other relevant government agencies and Customs.[17] On average, the 2021 Time-Release Study shows that the overall clearance process for imports takes 2 days, 17 hours, and 13 minutes, which is almost 20 hours shorter than was recorded in the 2019 Study (Table 2.1). The pre-Customs clearance time in 2021 dropped on average by almost 21 hours from 3 days, 6 hours, and 27 minutes in 2019 to 2 days, 9 hours, and 40 minutes whereas the post-customs clearance time in 2021 increased by about one hour compared to 2019 result. In the area of Customs processing, the average time for 2021 was similar to 2019. For export clearance efficiency, that was only measured at Sihanoukville Port, the overall clearance time declined by about one hour to 3 hours and 44 minutes down from nearly 5 hours in 2019 (Table 2.1). The major reason for the improvement in 2021 compared to 2019 was the reduction in time taken from temporary storage to the lodgment of the single administrative document. Other factors that prevented further improvement have been the high growth of export-import traffic, complicated procedures, and incomplete use of technology, and institutional inefficiency.

TABLE 2.1 Border Recent Clearance Times

Imports	***2021***	***2019***	***2015***
Poipet border point	0d 3h 30m	3h 48m	n.a.
Bavet border point	0d 4h 16m	1d 7h 51m	n.a.
Phnom Penh Autonomous Port	4d 18h 24m	5d 18h 24m	n.a.
Sihanoukville Autonomous Port	2d 7h 18m	4d 2h 9 m	n.a.
Teng Lay Dry Port	1d 1h 55m	5d 16h 42m	n.a.
Phnom Penh SEZ	8d 12h 33m	2d 2h 1m	n.a.
Exports	***2021***	***2019***	***2015***
Sihanoukville Autonomous Port	0d 3h 44m	0d 4h 55m	n.a.
Poipet border point	n.a.	n.a.	0d 2h 30m
Bavet border point	n.a.	n.a.	0d 1h 40m

Source: Data for 2021 and 2019 from JICA, World Customs Organization, Japan Customs Organization. 2021; and Time-Release Study 2021. Data for 2015 from JICA, Presentation of Cambodia Logistics Master Plan 2018.

Note: Data for 2015 is assumed to be export times. Opposite Poipet at Aranyaprathet in Thailand the Thai export time in 2015 was 30m. Opposite Bavet at Moc Bai in Viet Nam the Vietnamese export time in 2015 was 3h 30m.

The World Bank is supporting the General Department of Customs and Excise to develop a Single Stop Inspection and Common Customs protocol at Stueng Bot that has taken over this function from the previous facility at Poipet. The facilities are being developed by Thailand's Neighboring Countries Economic Development Cooperation Agency (NEDA). In addition, the Cambodian Government intends to pilot the Cambodian Single-Window system at least one location in the near future.

17 The reported clearance times mainly cover imports to Cambodia with information on export clearance times restricted to Sihanoukville Port. There is no up-to-date information available on clearance times at Aranyaprathet, Thailand, or Moc Bai, Viet Nam along the major land-based trade corridors. Time-Release Study 2021 (JICA, World Customs Organization, and Japan Customs Organization, 2021).

2.2 Road Transport

Road Network

Of the total length of national, provincial and rural roads of about 66,700 kilometers in 2022, the MPWT and the Ministry for Rural Development (MRD) are responsible for about 18,800 kilometers of national and provincial roads, and 47,900 kilometers of rural roads, respectively (Table 2.2). Across national roads managed by the MPWT, the pavement coverage is 100 percent of the one-digit national roads (connecting between national borders) and 73 percent of the two-digit national roads. While the length of paved provincial roads has nearly doubled between 2017 and 2022, the condition and pavement coverage of provincial roads remain poor. Only 10 percent of rural roads are paved. While average speeds have increased due to these improvements, border clearance times though improving remain an obstacle to efficient cross-border trade movement.

TABLE 2.2 Cambodia's Road Network Pavement Coverage (2017–2022)

Road types	Total length (km)		Paved length (km)		Paved rate (%)	
	2017	2022	2017	2022	2017	2022
National (1-digit)	2,254	2,254	2,254	2,254	100	100
National (2-digit)	5,007	5,178	3,525	3,764	70	73
Provincial	9,031	11,371	2,745	4,265	30	38
Rural	45,087	47,920	2,111	4,396	5	10
Total	61,379	66,723	10,635	14,679	17	22

Source: World Bank staff estimates based on data from MPWT and MRD, 2023.

Among the improved highways are National Road 5 (NR5) connecting Poipet (major border gate with Thailand), and NR1 to Bavet (major border gate with Viet Nam), both connecting with Phnom Penh. A new expressway connecting Phnom Penh with Sihanoukville Port was opened to traffic in 2022 and a new expressway between Phnom Penh and Bavet commenced construction in June 2023. Among the regional corridors, gaps remain along the highway connecting Siem Reap and Oyadav, which has potential to become an economic corridor (part of the GMS Southern Economic Corridor) in the northeastern region linking Cambodia with Thailand, Lao PDR, and Viet Nam.

Although the new 4-lane expressway between Phnom Penh and Sihanoukville Port has been in operation for more than one year, most heavy trucks continue to use the existing highway NR4. NR4 is not tolled and in practice overloading is not effectively monitored. The current toll[18] for use of the 175 kilometers expressway by a heavy truck is about US$60, adding 27 percent to the tariff of about US$220 to ship a container (TEU equivalent) one-way between Phnom Penh and the port. Without this added expense, the NR4 therefore remains congested. Tariffs per TEU-kilometer are up to one-half of what they are in other corridors (for example, Bavet and Poipet) likely due to an ample supply of available trucks and more intense competition.

Keeping road assets in good condition and resilient to natural hazards such as floods requires adequate management and maintenance. From 2018 to 2022, the MPWT annual budget of US$70 million remained the same for maintaining on average 10,291 kilometers of national and provincial roads or 55

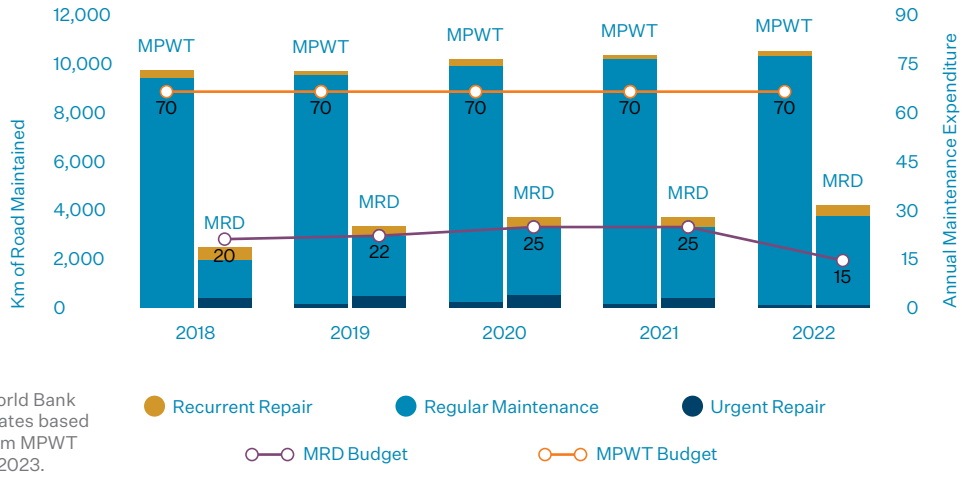
18 With 20 percent discount in the first year of operation.

percent of the national network. By contrast, the MRD spent on average US$21.4 million to maintain about 3,529 kilometers of rural roads (7 percent of the network) each year (Figure 2.2). With the current maintenance level, the share of roads in good condition is 40 percent for national roads (including both one- and two-digit national roads), 33 percent for provincial roads, and 23 percent for rural roads (Figure 2.3). Due to insufficient maintenance, the current value of the road asset in Cambodia has reduced to about 36 percent compared to its potential maximum net present value. Improvements are also needed in maintenance practices, including a full roll-out of the road asset management systems by MRD, and increased participation of the private sector.

Overloading of trucks can cause premature structural failure of road pavement and bridges, significantly shortening the economic life of the road assets. Despite recognition of the significance of overloading, local-level control may be thwarted by non-functioning weigh stations due to poor implementation and weak control on approval of illegal heavy vehicle modifications that increase vehicle mass and axle loads. Overloading also contributes to unsafe travel conditions and undue traffic injury. Road safety has therefore been identified as an important public health issue in Cambodia.

FIGURE 2.2

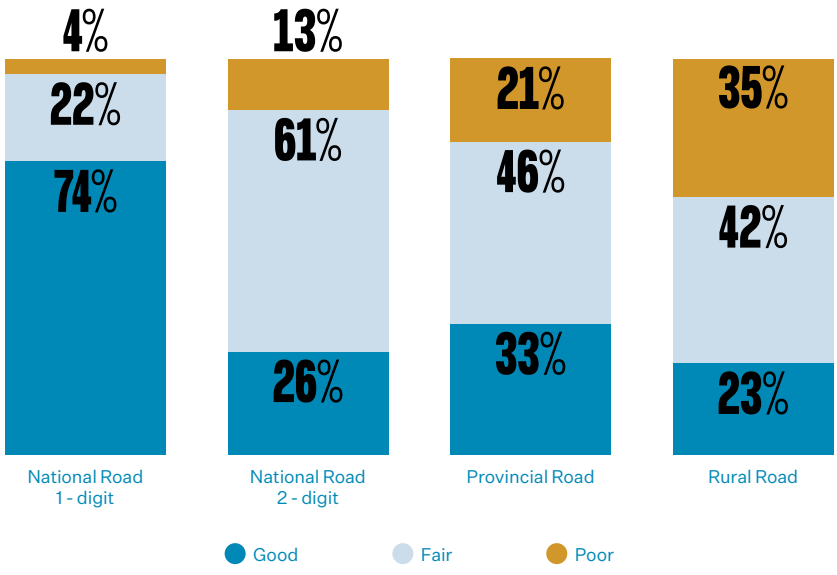
Road Maintenance by MPWT and MRD (km)



Source: World Bank staff estimates based on data from MPWT and MRD, 2023.

FIGURE 2.3

Road Pavement Condition 2022



Source: World Bank staff estimates based on data from MPWT and MRD, 2023.

Among 172 countries for 1999–2018, the 2020 Global Climate Risk Index ranks Cambodia 12th among most disaster prone with the infrastructure sector being particularly vulnerable to the impacts of disasters.[19] With only about 10 percent of rural roads currently paved, Cambodia's rural road network is extremely vulnerable to flooding-caused disruptions. Rural households rely on rural roads for accessing key services such as schools, hospitals, markets, and employment in factories and agriculture plantations. The indirect impact of flood disruptions on Cambodia's rural road network was assessed for 10 most populated provinces (Table 2.3). With a 1-in-50-year flood, rural households in Battambang and Prey Veng would suffer 48 percent and 34 percent, respectively, of access to hospitals. Smaller but substantial losses of access (greater than 15 percent) would occur for rural households in Banteay Meanchey, Kampong Cham, and Kandal. When measured by access to high schools, rural students in Battambang, Kampong Cham, and Prey Veng are impacted most during floods with about 20 percent loss of access.

TABLE 2.3 Impact of Flood Disruptions on Road Accessibility to Hospitals, Schools, and Jobs

Province	Population	Baseline accessibility			Accessibility loss in 50-year flood events		
		Hospitals (%)	Schools (%)	Jobs (No.)	Hospitals (%)	Schools (%)	Jobs (%)
1. Phnom Penh	2,281,377	96	95	526,852	-7.00	-2.80	-18.80
2. Kandal	1,201,581	87	79	342,707	-16.80	-8.50	-48.80
3. Prey Veng	1,057,720	60	47	25,648	-33.90	-19.60	-59.50
4. Siem Reap	1,014,234	75	64	43,485	-7.30	-4.70	-9.40
5. Battambang	997,169	73	65	38,781	-47.90	-21.30	-43.60
6. Takéo	900,914	76	70	71,009	-13.20	-5.40	-20.00
7. Kampong Cham	899,791	70	63	35,407	-18.30	-19.90	-71.20
8. Kampong Speu	877,523	64	51	110,554	-1.20	0.00	-19.10
9. Banteay Meanchey	861,883	76	63	23,856	-24.90	-11.30	-41.20
10. Tboung Khmum	776,841	64	50	23,167	-3	-1	-28.70

Note:
Accessibility to schools: Percentage of people with access to high schools within 30 minutes.
Accessibility to hospitals: Percentage of people with access to referral hospitals within 60 minutes.
Source: World Bank staff estimates based on geospatial analysis, 2023.

Road Transport Industry

The road transport industry in Cambodia is fragmented. Consisting of 20 large companies that own about 2,400 trucks, the Cambodian Logistics Association (CLA) focuses on international container freight that can be classified as follows: (i) Level 1, the large-scale international freight forwarding companies with a total of 800 to 1,000 heavy vehicles nationwide, of which each company has more than 10 vehicles; and (ii) Level 2, the small- and medium-sized registered companies mostly providing logistics services for agriculture and construction sectors, with a total of 1,100 to 1,400 trucks nationwide. There are also the Level 3 operators who are unregistered small carriers mostly providing services for domestic trade, with 2,300 to 3,000 trucks nationwide. In recent years, several international companies such as APL Logistics, DSV, Panalpina, Yusen Logistics, Evergreen Marine Corporation, Sinotrans Limited, China COSCO Shipping Corporation Limited, and Maersk have contributed to the promotion of modern, professional logistics services in Cambodia.[20]

19 2020 Global Climate Risk Index (Germanwatch, 2020).

20 Comprehensive Intermodal Transport and System Master Plan 2023-2033 (Royal Government of Cambodia, December 2023).

Trucks averaging 20 years or older imply less energy-efficiency and more polluting than modern trucks. The industry's preference for imported secondhand trucks is due to the 70 percent import tax applied to trucks of any age.[21] One consequence of the aged fleet is that trucks are relatively underutilized with heavy trucks typically traveling less than 60,000 kilometers per year.

A World Bank study identifies the following key issues constraining the development of a modern, safe, and professional road transport industry:[22]

- ***There is a need to improve and effectively enforce existing regulations.*** Operator licensing and overloading of trucks is regulated in order to harmonize with legislation of neighboring countries. However, meeting the requirements to become an operator or driver is not stringent. Increasing the standards of operators and drivers is necessary to professionalize the industry.

- ***Legislative harmonization among the ASEAN countries remains a challenge***. Although there are two important agreements governing cross-border movements (ASEAN and GMS CBTA) each country continues to apply its own but differing technical standards. For example: (i) the permissible length of an articulated vehicle in Cambodia is 16 meters, but in Viet Nam it is 20 meters; and (ii) the gross weight allowed on an 18-wheel truck it is 40 tons in Cambodia and 45 tons in Thailand. Different technical standards for vehicle weight and dimensions leads to additional delays at borders. At the 19th Government-Private sector forum (November 2023), among several key reforms suggested, MPWT proposed to increase the weight allowance for trucks from 40 to 45 tons with the rationale to reduce logistics and transportation costs. Higher load limits would need strengthened roads and bridges if with the new limits truck operators continue to overload trucks. A full assessment of the implications for new axle load limits should be undertaken by MPWT possibly with technical assistance.

- ***A targeted approach to enforcement for overloading and safety is needed.*** Cambodia would benefit from a more coordinated and efficient risk-based approach to assessing regulatory compliance inspection thus reducing the extent of weighbridges and other inspection facilities that tend not to be effective. The deployment of weigh-in-motion technologies possibly as a pilot project in addition to traffic management and safety measures) would be beneficial along selected international corridors (e.g., NR1, and the east-west road corridor section of Asian Highway 21 when upgraded). This measure would improve compliance and, as result, enhance safety, reduce overloading and delays to the benefit of the road transport industry and the nation. Strengthening MWPT's monitoring of the freight logistics industry (all modes) would be beneficial and could include variables such as: (i) empty running; (ii) weight-based–lading factor (ratio of ton-kms moved to the available m3-km carrying capacity); and (iii) overloading (proportion of vehicle-kms travelled with a load in excess of legal weight limits).

Constraints

Inadequate harmonization and efficiency of cross-border procedures exists along the major international highway corridors. Problems identified just prior to Covid-19 include inadequate cross-border facilities, poorly synchronized cross-border procedures, slow implementation of single-window and ASYCUDA. Also, there was only partial linking of ASYCUDA between border posts and the Customs Department head office in Phnom Penh and quarantine. Electronic Data Interchange was not available at ports and import licenses are not linked to ASYCUDA. There is less than 24 hours per day operation at some border posts. Improvements in procedures were observed in 2021 compared to 2019. Factors that have prevented further improvement have been the high growth of export-import traffic, complicated procedures, and incomplete use of technology, and institutional inefficiency.[23]

21 Special Focus. Supply Chain Disruptions in the Wake of Covid-19: Strategies to Reduce Logistics Costs (World Bank, 2022, p.2).

22 Investing in Logistics for Sustainable Economic Growth Background Studies for The Preparation of Cambodia Logistics Master Plan (World Bank Group, 2018).

23 Time-Release Study 2021, World Customs Organization and Japan Customs Organization (JICA 2021).

Post-Covid-19 there has been a slow take-up of the ASEAN Agreement and CBTA cross-border traffic rights. Cross-border trade facilitation at road checkpoints relies on bilateral agreements and the ASEAN Agreement on exchange of traffic rights. Legislative harmonization among ASEAN countries on technical standards for trucks remains challenging. Even with the two important agreements governing cross-border movements (ASEAN and GMS CBTA), each country continues to apply its own but differing technical standards. Previous permits issued by MPWT to Cambodian truck operators lapsed during the Covid-19 period. Information from the Cambodian Trucking Association and from discussions with Customs officials at border posts indicates that few Cambodian truck operators have applied to renew these permits. The main reason appears to be that Cambodian truck operators prefer to transfer goods at the border (for example, to Vietnamese trucks) rather than carry the goods to the destination within Viet Nam as their vehicles are subject to Vietnamese regulatory requirements that Cambodian truck operators may find difficult to meet.

There is rapidly growing demand for improved highway management. Extensive highway improvements have been made along the main trade corridors to Poipet (NR5) and Bavet (NR1), but these are merely keeping pace with growing traffic and trade demand. There is scope to improve traffic management along these and other highways to improve efficiency and traffic safety particularly to better separate roadside development and pedestrian and local motorcycle activity from through traffic.

New expressways are being developed, but appropriate pricing and traffic management are critical to optimizing expressway use and benefits to the economy. A new expressway developed as a private concession to Sihanoukville was recently opened. Construction of a new four-lane expressway to connect from Ring Road 3 in Phnom Penh to Bavet, passing Phnom Penh Port's main container terminal LM17, started in June 2023. Due to the anticipated trade growth, these facilities would also be expected to merely keep pace with growing demand. Despite new expressways being largely used by passenger vehicles, the current pricing of the expressway to Sihanoukville is not attractive to truck operators or shippers who prefer to use NR4. Expressway toll pricing needs to be reviewed for future expressway concessions are structured. This would also help ensure that new public-private partnerships are affordable, including from a government fiscal risk perspective and the end users' perspective regarding the levels of tolls and tariffs levied.

The highways connecting between Siem Reap and Oyadav are in need of upgrading. This corridor has the potential to become an economic corridor in the northeastern region linking Cambodia with Thailand, Lao PDR, and Viet Nam. The road forms part of the GMS Southern Economic Corridor. Proposed for upgrading as part of the new Intermodal Transport Master Plan and the Master Plan for ASEAN Connectivity (MPAC) 2025, the road is to be known as Asian Highway 21.[24] Connecting highways 19/19B in Viet Nam are being upgraded under the Central Highlands Connectivity Improvement Project financed by the World Bank.[25]

Gaps also remain in the secondary network connecting between provincial centers and the highway network (1-digit highways). Improved, more resilient connections are needed in the tertiary road network linking villages and farming areas to towns and to agricultural processing facilities and transport terminals. The gaps will continue to need attention even with extensive expressway development. Strengthening of secondary roads and small bridges would enhance supply chain resilience; so even if they are inundated, they can be open to traffic sooner without sustaining serious damage. Multi-modal solutions also have an important role to play in minimizing disruptions and enhancing resilience.

Low utilization by truck fleet limits the potential improvement in logistics cost due to new transport infrastructure. The Cambodi-

24 MPAC 2025 is adopted by ASEAN member countries to "achieve a seamlessly and comprehensively connected and integrated ASEAN that will promote competitiveness, inclusiveness, and a greater sense of Community." MPAC 2025 focuses on five key areas: sustainable infrastructure, digital innovation, seamless logistics, regulatory excellence, and people mobility.

25 *Viet Nam: Central Highlands Connectivity Improvement Project* (World Bank, approved June 2017).

an Logistics Association in discussion confirm that transport cost is a key factor driving the choice of routes and not small savings in travel time. In part the high sensitivity to cost is due to the Cambodian truck fleet bring aged (about 20 years old) with high operating costs, and its relatively low utilization, that reduces the potential to cover fixed costs.

2.3 Inland Waterways and Maritime Transport

Waterborne transportation in Cambodia is divided into three categories for this report:

- ***Maritime transport.*** Transport by sea-going and coastal ships between overseas ports and the ports of Sihanoukville and Kampot, and ports on the Mekong River System.
- ***Regional cross-border waterborne transport.*** Transport by inland waterway river boats crossing the border between Cambodia and Viet Nam (Corridor B as described in Chapter 3). This inland waterway transport offers a direct link between Phnom Penh and the Cai Mep port, a mother port,[26] south of Ho Chi Minh City, Viet Nam, and is a vital transport connection between Cambodia and overseas ports beyond Cambodia/ Viet Nam.
- ***Domestic commercial waterborne transport.*** Inter-provincial commercial feeder transport by inland waterways on the Mekong River System within Cambodia.

An overview of the typical dimensions of container carriers in terms of DWT, draft (depth of water to float a ship), and TEU capacity referred to in this report is provided in Table 2.4.

TABLE 2.4 Important Dimensions of Container Vessels

Type	*DWT*	*Draft in meters*	*TEU capacity*
A. Barges	1,000	2.2-2.6	80
	1,500	2.5-3.0	120
	2,000	3.5-3.8	160
	3,000	3.6-4.0	240
	4,000	3.8-4.2	350
B. Sea-River Vessels	2,000	3.5-4.5	120-180
	3,000	4.5-5.5	160-220
	4,000	5.8-6.2	280-360
	5,000	6.0-6.4	380-500
C. Sea-Going Vessels	10,000	8.2-8.8	700-1,000
	20,000	9.4-10.0	1,500-1,800
	30,000	10.5-11.2	2,500-3,000
	50,000	11.0-12.0	4,000-4,400
	70,000	12.3-13.0	5,800-6,200
	90,000	13.2-14.0	7,800-8,200
	140,000	14.0-14.8	11,500-12,000

Notes:
- The deadweight tonnage (DWT) of a vessel measures the total maximum weight of cargo that the vessel can carry, including the weight of fuel, stores, water ballast, fresh water, crew, and passengers.
- Barges differ from sea-going vessels in that they generally do not transport ballast water. This distinction contributes to the usual scenario where the DWT for barges surpasses that of sea-going ships with equivalent cargo capacities.
- TEU capacity: number of twenty-foot equivalent unit containers a carrier can take.

Source: World Bank staff estimates.

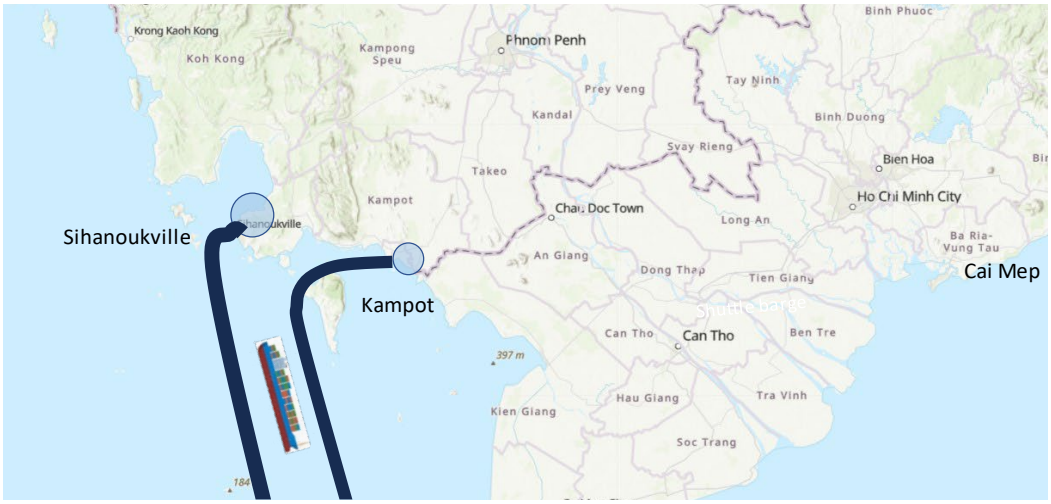
26 Mother vessels serve major ports that can be described as mother ports. While the average capacity of a mother vessel is about 10,000 TEUs, the largest mother vessels today have a capacity of up to 24,000 TEUs. By comparison, the largest vessels that can use the Sihanoukville Port today are about 1,800 TEUs. In October 2020, Cai Mep received Maersk Line's EEE vessel Margrethe Maersk with close to 20,000 TEU (APM Terminals. https://www.apmterminals.com/en/news/news-releases/2020/201027-cmit-receives-largest-container-vessel-in-Viet Nam-s-history) accessed September 25, 2023).

Direct Maritime Traffic

Sihanoukville Port, a listed company that operates the nation's primary maritime port, has been growing rapidly. The Sihanoukville Port has registered a 9.7 percent annual growth rate in container traffic from 392,000 TEUs in 2015 to 750,000 TEUs in 2022, with the latter carrying about 5 million tons of cargo. In addition, Sihanoukville Port handled 115,000 tons of general cargo and 1.9 million tons of fuel imports in 2022. With a current draft of 9.2 meters, Sihanoukville Port is undergoing an expansion with an increase in draft to 14.5 meters and construction of a new container terminal of 350 meters in length by 2025. The railway connects directly to the Sihanoukville Port dock although the railway loading and unloading length is limited to 100 meters.

Because of the limited draft along the Cambodian coast and Sihanoukville's absence from the global maritime routes, there are no mother container vessels servicing Cambodian seaports. There are however liner services that offer direct shipments between Sihanoukville Port and Europe, but these are carried by smaller than mother vessels. The number of TEUs being handled per calling vessel reached a record level of 1,071 TEU per call in 2021.[27] As shown in Table 2.4, the equivalent maximum container vessel capacity for a fully laden vessel for the current draft of 9.5 meters would be 1,500–1,800 TEUs.[28] In an international context, these vessels are small thus requiring transshipment in Singapore, Port Klang, or other Asian hub ports (Figure 2.4).

FIGURE 2.4 Direct Maritime Links



Source: Study team based on consultations with shipping companies in Cambodia.
Map base – Google Maps, September 21, 2023.

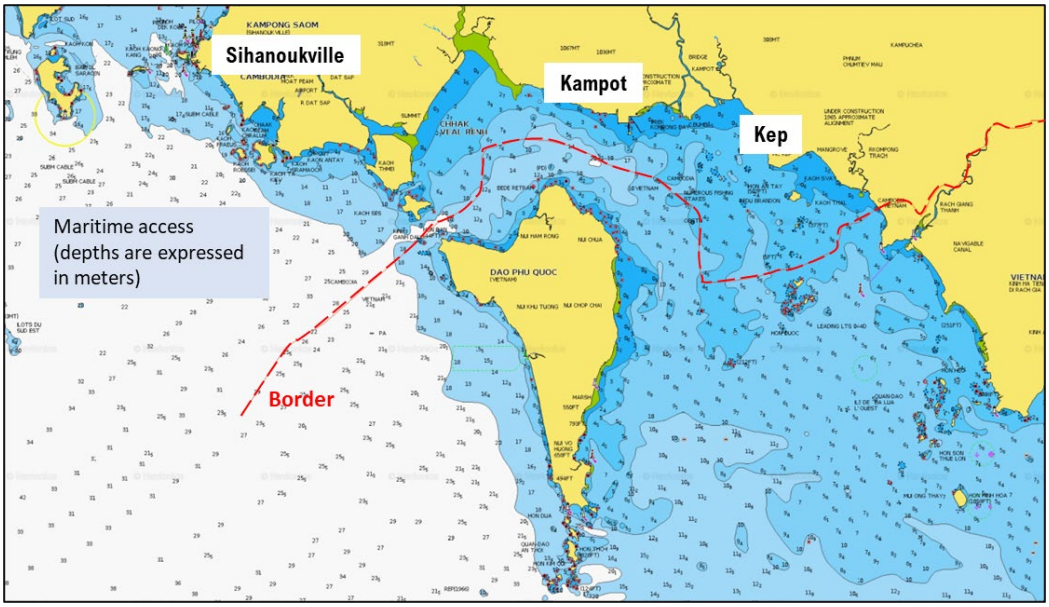
A second maritime port, Kampot Multipurpose Port, is under development. It is the first private port in Cambodia with an estimated cost of US$1.5 billion. The port's multi-purpose design envisions a water depth of 14-15 meters and the ability to accommodate ships of up to 100,000 DWTs. The feasibility of these plans is contingent upon addressing important offshore shoals. During the second phase of the project, the port's container capacity is set to double to 600,000 TEUs by 2030. This new port could offer similar advantages and limitations with regards to overseas maritime links as does the current Sihanoukville Port. Ships could sail directly to Asian ports but for other international shipments transit in Malaysia, Singapore, or Thailand would be required.

27 Preparatory Survey for Sihanoukville Port New Container Terminal Expansion Project (Nippon Koei Co., Ltd. for JICA, 2022). Page 4-3.

28 While it is said Sihanoukville Port can accommodate container vessels of up to 50,000 DWT, the vessels must be partially laden because of the constraints of its 9.2 meters depth.

FIGURE 2.5

Nautical Access to Kampot Port



Source: Navionics Maps 2023, with authors' additions.

While there are a few direct connections via sea-going vessels operating between PPAP container terminal (LM17) and Singapore and on occasion to Thai ports, such routes remain somewhat limited. These vessels follow the Transit Route, navigating through the Mekong River, Vam Nao River, and then the Lower Bassac River, ultimately reaching regional ports (Figure 2.6). In this context, the Can Tho Port in Viet Nam could serve as an additional option for cargo topping up or unloading, given that the stretch between Can Tho and the estuary offers greater depth and can accommodate vessels of up to 10,000 DWT.

FIGURE 2.6

Coastal Shipments using the Bassac River

Source: Study team based on consultations with shipping companies in Cambodia.

Map base – Google Maps, September 21, 2023.

Cross-border Inland Waterway Transportation

Currently, Cambodia's options are to either: (i) transport containers via seagoing vessels to nearby mother ports like Singapore, Laem Chabang, Port Kelang; or (ii) barge containers directly from Phnom Penh to Cai Mep Port in Viet Nam, both of which occur today (Figure 2.7). Cai Mep Port – a deep seaport located right on the global east-west trunk shipping line connecting Europe, the Middle East, South Asia, South-East Asia, and East Asia – attracts larger vessels than Laem Chabang Port, one of the largest ports in the region.[29]

Transit cargo moving between Phnom Penh and Cai Mep, situated on the global maritime route to international markets, is facilitated by shuttle barges. With a draft of 15 meters, Cai Mep's deep seaport is capable of accommodating Post-Panamax[30] container vessels of up to 120,000 DWT and is a mother port for global traffic, both eastbound and westbound. Mother ports accommodate liner vessels bound for the United States and Europe without the need for transshipments. The newly built 24,188 TEU container ship, the *m/v OOCL Spain*, one of the world's largest vessels, is now calling at Cai Mep Port in its Asia-Europe service.[31]

FIGURE 2.7 Connections between Cambodia and the US Market

Source: Study team based on consultations with shipping companies in Cambodia.

Map base – Google Maps, September 21, 2023.

29 *Preparatory Survey for Sihanoukville Port New Container Terminal Expansion* Project (Nippon Koei Co., Ltd. for JICA, 2022).

30 Post-Panamax ships are a class of vessels that exceed the maximum size parameters set by the Panama Canal's original locks. Post-Panamax ships typically have a length of over 294.13 meters (965 feet), a beam exceeding 32.31 meters (106 feet), and a draft beyond 12.04 meters (39.5 feet). They can carry 5,000 to 14,000 TEUs of cargo. (Source: www.inboundlogistics.com)

31 OOCL Service routes. [https://www.oocl.com/eng/ourservices/serviceroutes/aet4/Pages/default.aspx] accessed September 21, 2023.

Maintaining a secure and efficient direct connection to the Cai Mep mother port in Viet Nam is of importance, supported by a robust transport network whether by road or inland waterways. With the establishment of an appropriate institutional framework, a mutual commitment to enhance regional and international trade, and diligent implementation of the 2009 Waterway Transport Agreement, usual concerns about cross border customs arrangements can be addressed, fostering productive collaboration between the two countries in the future.

Since the signing of the Waterway Transport Agreement in 2009, the inland waterway transport industry has experienced remarkable growth. Containerized traffic along the Mekong River has surged from 62,000 TEUs in 2010 to an impressive 418,000 TEUs in 2022, a 570 percent increase[32]. The public listing of Phnom Penh Autonomous Port in December 2015 also appears to have further bolstered containerized inland waterway transport traffic. From 2015 to 2022, container movements between Viet Nam and Cambodia via inland waterway transport exceeded the growth of containerized road transport via Bavet over the same period (Figure 1.7). Importantly, the trade volumes passing through Viet Nam's main ports offer significant benefits to the host country. Notably, 74 percent of the export goods destined for the United States and Canada pass through Cai Mep Port, amounting to approximately 1.4 million tons. The remaining 26 percent utilize other ports like Cat Lai, Vung Tau and Saigon ports. In terms of imports, about 0.66 million tons bound for Phnom Penh pass through Cai Mep Port. In total, about 2.07 million tons (exports and imports) of PPAP traffic use Cai Mep Port, which is just over half of PPAP total imports and exports in 2022 of 4 million tons.

Another crucial component of cross-border inland waterway transport is the cruise boat industry. Although still in the early stage, cruise vessels plying between the Mekong Delta in Viet Nam and Siem Reap (Chhong Kneas) will increase in numbers and in size. The main obstacle is the restricted river depth along the Great Lake during the low water season. The cruise vessels therefore halt their activities on the Lake in February but restart in June each year.

32 PPAP and the barge operators face challenges with the availability of containers for individual vessel movements, but these are common operational issues and are manageable.

Domestic Waterway Transport between Phnom Penh and the Provinces

Domestic inland waterway transport plays an essential role for the transport of goods to and from Cambodia. Cambodia has a well-connected waterway network with a total navigable length of 1,750 kilometers along the Mekong, Tonle Sap, and Bassac Rivers (Figure 2.8). This importance of this domestic network is its river connections of many agricultural centers with the PPAP container port LM17 and other facilities through feeder ports. To facilitate such domestic feed trade, Phnom Penh has expanded the capacity of LM17 and other facilities. Phnom Penh is well advanced to undertake its Phase 4 expansion of LM17 to increase its container-handling capacity to 900,000 TEUs per year by 2030 (from 500,000 TEUs in 2023). Planned as part of Phase 4 is a new rice processing facility. However, upstream of Phnom Penh, there are substantial navigational restrictions along both the Mekong and Tonle Sap rivers.

FIGURE 2.8 Waterways in Cambodia

Source: MPWT Navigation Coordination Committee. 2009. Calibrating the Navigable Waterways of the Mekong River System into a Classification Standard. Prepared by Eng. Freddy Wens.

In addition, Phnom Penh is also planning to expand its network of sub-feeder general purpose terminals from six to 11 in the near future. These sub-terminals are important for the growth of sustainable waterborne transport in Cambodia (compared to heavy trucking) and connect the agricultural hinterland to Phnom Penh and overseas. The six sub-feeder general purpose terminals today include the new downstream terminal LM26 that is under development at the Viet Nam border. Planned for the future are five new sub-feeder general purpose terminals with two located upstream along the Tonle Sap River, one on Tonle Sap at Siem Reap, and two upstream along the Mekong River (Figure 2.9).

FIGURE 2.9

Current and Planned Sub–Feeder General Purpose Waterway Terminals

Note: LM = Lower Mekong, UM = Upper Mekong, TS = Tonle Sap;
Brown color terminals are in operation or under development, blue color terminals are planned.
Map base – Google Maps, September 21, 2023.
Source: Information provided to the study team by PPAP.

The four planned, new sub-feeder general purpose terminals are all in the design phase but three only have nearby road access. Of the planned sub-feeder terminals, the most important are:

- ***UM1, multimodal feeder terminal*** just north of Phnom Penh has deep river access and road connections.

- ***TS30, Chong Kneas (Siem Reap Port) has limited access in the dry season to boats of only about 20 DWTs.*** Even cruise boats cannot venture to Siem Reap during the dry season. There is road access. To open up the full potential of Chong Kneas as cargo port and cruise boat harbor, a deep navigation channel will need to be dredged all along the Great Lake. This will require detailed economic, environmental, and hydromorphological studies.

- ***TS24, Kampong Chhnang Port*** is located between Siem Reap and Phnom Penh and about 100 kilometers from the capital, and along the deep and navigable Tonle Sap River. The Phnom Penh has done extensive hydrographic surveys to determine accessibility; there are three minor shallow spots to be dredged between Phnom Penh and TS24. Consultants to the World Bank Team who visited TS24 in November 2023 found that the planned port is strategically situated, boasting a prime location and considerable potential. Most of the rice is grown close to Kampong Thom – Kampong Chhnang. The location of TS24 would be on the left bank of the Tonle Sap without access to the current road network. There is a new private port located in close proximity to TS24 but it is primarily targeting the iron-ore products of the mines in the north of the country. TS24 will focus more on agricultural products.

- **TS20, Prek Kdam Port.** The Tonle Sap is a deep and navigable river up to Prek Kdam. However, there is no current road access available.

To enhance the competitiveness and sustainability of Cambodia's exports in general, it is critical to continue use of the Mekong (and Bassac) rivers to access Cat Lai and other Viet Nam ports, for the main Asian and North American markets the route is currently serving. Dependent on the destination markets, this key inland waterway corridor should carry over half of all formal rice exports and other exports particularly to Asia while Sihanoukville and the new Kampot port may be better placed for European and some South-East Asian markets. Further, the upper and lower Mekong Rivers should be maintained to ensure all-year-round navigability for larger vessels. The development of a domestic vessel design and shipbuilding industry offers potential to develop modern, low emission, and efficient vessels appropriate for Cambodia. In addition, the sub-feeder terminals described above offer the potential for securing new customers for barge transport, and meeting their needs and those of existing customers, efficiently, as amplified in Box 2.1.

BOX 2.1

Analysis of Recent and Potential Rice Exports along the Mekong

Cambodia's rice exports totaled 637,000 tons per year in 2022 with about 60 percent destined to China. Prior to 2018, about half of exported rice used barges shipped from PPAP terminals to access Cat Lai Port in Viet Nam prior to being loaded on to ships to China and other Asian markets.

More recently, Cambodian rice exporters are required by cross-border authorities to apply for a transit license and a phytosanitary transit certificate. This leaves many exporters with the attendant risks of inspections and unpredictable delays and having to divert their rice export shipments to Sihanoukville Port. As a result, in 2022 Phnom Penh estimated that 16 percent of total rice exports used barges to access Vietnamese ports, about one-third of the value in 2018.

Use of Sihanoukville Port, while a short-term solution to address the risk of delay in Viet Nam, the export route via Sihanoukville Port affects the competitiveness of Cambodia's rice exports compared to the route using the Mekong to Viet Nam. The transport cost to Cat Lai Port by barge from Phnom Penh, for example, is about US$4 per ton (without profit, handling, administration, storage and feeder transport costs added) and about US$7 per ton by rail to Sihanoukville Port and double the price by road. Moreover, sailing distances from Sihanoukville Port are longer and/or ship departures less frequent to China, Japan, or potential new markets such as the Philippines and Indonesia.

Source: Study team with some information provided by Columbia University's Capstone Project 2023, Improving the Competitiveness of Cambodia's Rice Exports.

Constraints

Among several constraints identified that affect more efficient trade facilitation, intermodal transport, and logistics along the Mekong River System, the inadequate implementation of the 2009 Waterway Transport Agreement is significant. For an international river system to be effectively maintained and improved, the presence of a common institutional body is essential. Under the bilateral agreement between Cambodia and Viet Nam, the Mekong Navigation Facilitation Committee should consist of high-level Executive Council that is responsible for navigation, a Board, Working Groups, and a Waterway Transportation Consultative Group. The detailed terms of reference for the structure and functioning of the Committee were formulated and agreed to by both countries in 2010.

The process of clearing the goods at the border is only limited to daytime operations. In fact, Article 17 of the 2009 Waterway Transport Agreement does not include a stop at the border but rather a single stop at entry and a single stop at destination. An uninterrupted voyage between LM17 and Cai Mep should take no more than 21 hours. But due to inadequate implementation of the Agreement, voyages can take 26 hours or longer due to nighttime closure.

Long and uncertain transit times are experienced by container shipments by road and inland waterways travelling between Cambodia and Viet Nam ports despite the bilateral Agreement on Goods in Transit. Shipping companies and freight forwarders have indi-

cated their concerns about the time it takes for the cross-border processing of cargo entry permits and lengthy phyto-sanitary controls of agricultural products.

To ensure the integrity of containers in transit which cross border authorities could be concerned about, emerging technologies like Smart Seals offer promising solutions (Box 2.2). These Smart Seals can be seamlessly integrated into containers during their loading at the port. Equipped with advanced features, including GPS, radio frequency identification, and sensors, these advanced monitoring devices are fitted with sensors that collect data such as temperature, humidity, vibration, and location. With precise tracking of container locations, the sensors promptly detect unauthorized opening of containers or tampering. Containers fitted with Smart Seals could potentially be afforded preferential treatment, expediting their passage through designated Green Lines to minimize delays and enhance security.[33]

BOX 2.2

Use of Smart Seals in Transit Containers

Europe has successfully tested Smart Seals (Eye-Seal being the most advanced) as a track and trace technology. Transit containers with a Smart Seal installed do not have to be checked by Customs because the device offers a breach detection solution. That means the device is installed inside the container upon loading, and its sensors will alarm and monitor if the doors are unlawfully opened. With the use of GMS and GPS, the device can identify location and time of any container breach and inform the authorities.

Shippers that place a Smart Seal inside their containers offer registered and full security against opening their containers. Such a transit container would not be required to be opened, would be given a priority Green Lane, and would avoid delays along the route. The Smart Seals are purchased and installed by cargo owners. If this system allows better and faster passage, the cargo owners and freight forwarders have no problems with covering the costs.

Source: Study team based on best practices in Europe (Source: https://mag.wcoomd.org/magazine/wco-news-103/developing-an-ecosystem-of-trust-at-the-uk-border/).

Navigation restrictions along the Mekong River pose challenges for larger and more cost-efficient barges (exceeding DWT 3,000). The Mekong Estuary is a hydrodynamically complex environment, necessitating comprehensive morphological studies to evaluate sustainable dredging needs and the associated long-term maintenance cost. However, such analysis should be coordinated between both Cambodia and Viet Nam. Depth limitations along the Upper Mekong and Tonle Sap rivers, coupled with a shortage of cargo terminals, hinder convenient feeder barge connections, which represent the most cost-efficient mode for bulk and containerized freight transport. To address the issue of sedimentation and navigational hindrances, specialized dredging vessels and equipment are required.

Until now, PPAP has performed most of the operational needs within Cambodia such as deepening the river, installing aids to navigation, and hydrographic surveys and charting. PPAP needs to keep waterways deep and safe to have 24/7 access to their ports and terminals. However, their focus should be on port-related businesses. International best practice dictates that the services of maintaining the waterways deep and safe should be the responsibility of the Waterways Department under MPWT for which it would receive sufficient annual budget to provide these services through contracting specialized companies. Moreover, the Department should have the boats, vehicles, equipment, and instruments before starting. Alternatively, initiating a system of performance dredging by the private sector is another option. In any case, clear legal and financial responsibilities must be established beforehand. The operational and financial requirements for such services are substantial.

33 Belgium introduces smart seals on shipping containers to fight drug trade (Brussel Times, September 8, 2023). https://www.brusselstimes.com/681077/belgium-introduces-smart-seals-on-shipping-containers-to-fight-drug-trade.

There is a need to improve institutional capacity on management of modern waterway and maritime transport. Hitherto, Sihanoukville and Phnom Penh Autonomous Ports have been the main port authorities in the country. They are autonomous and publicly listed but remain state-owned corporations. It is understood that the government intends to open the coastal and riverine waterways to allow more private ports. It is essential that a competent authority exists for the maritime and river sectors to ensure that technical, safety, security, and operational standards are maintained, with adequate commercial viability and cargo consolidation.

The absence of adequate road connections to all PPAP terminals and lack of rail access to LM17, despite the completion of Ring Road 3, are among key constraints. Adequate consolidation facilities such as warehousing and inland container depots are necessary for certain cargo like rice. The pressing need for modern container gantry cranes is evident as the current outdated shore cranes at PPAP (LM17) contribute to slow loading and discharging operations. Upgrading terminal equipment is essential for improved efficiency.

Cambodia lacks a fleet of commercial barges or coastal vessels. The absence of shipyards, slipways, facilities, equipment, and skilled personnel for building new barges or conducting repairs is a challenge. However, establishing a national shipbuilding industry in the long term, even on a small scale, is key to support a motivated and capable shipping industry. The development of a shipbuilding and ship repair sector would significantly enhance domestic and regional shipping capabilities.

The inland waterway transport sub-sector lacks an independent agency to promote and market inland waterway transport and consolidate fragmented cargo, reflecting existing established models worldwide. There are competing public interests in waterways for navigation, sand mining, water supply, fishing, and ecology that should be harmonized. Inland waterway transport infrastructure managers must actively manage relationships among the public sector agencies and private sector firms.

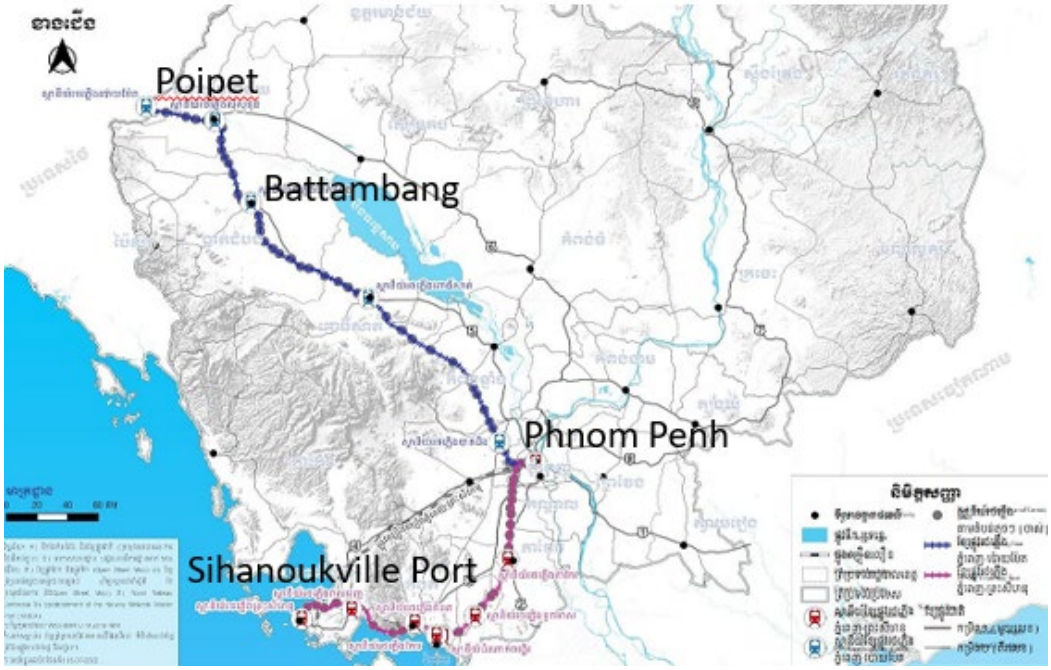
2.4 Rail Transport

Rail Infrastructure and Operations

Cambodia has two railway lines with a total length of 652 kilometers that operate as a single railway system. The 386-kilometers Northern Line and the 266-kilometers Southern Line were built in the 1930s and 1965-1969, respectively (Figure 2.10). In addition, a 6.5-kilometers branch line linking the Phnom Penh railway station with petroleum depot facilities along the Tonle Sap River was recently constructed. In the early 2000s, the railway was in a dilapidated condition due to the civil war 20 years earlier. Following an ADB technical assistance initiated in 2006, 420 kilometers of the then existing railway infrastructure was rehabilitated.[34] Further, the state-owned Royal Railway of Cambodia was dissolved in 2009 and its assets conceded to a private operator. Under a public-private partnership, a private concessionaire (sold in 2014 and renamed Royal Railway Cambodia) was granted exclusive rights to run commercial railway services under a 30-year agreement. In turn, the concessionaire assumed the end-user risk posed by uncertain traffic development and infrastructure conditions. A new Railway Department within MPWT was established to supervise and regulate the concessionaire with respect to safety and the use of the infrastructure assets.

34 *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Loan to the Kingdom of Cambodia for the Greater Mekong Subregion: Rehabilitation of the Railway in Cambodia Project.* Manila (Loan 2288-CAM) (ADB, 2006).

FIGURE 2.10 Current Railway Lines



Source: Comprehensive Intermodal Transport and System Master Plan 2023-2033 (Royal Government of Cambodia, December 2023).

Cambodian rail tracks are meter gauge[35]. This gauge is common with the existing railways in Thailand and Viet Nam, whereas the new Lao PDR–China Railway is standard gauge (1,435 millimeters). Standard gauge railway technology is superior to meter gauge and is used by 75 percent of the world's railways. The Northern Line has not been upgraded to the same technical standard as the Southern Line. The Southern Line has concrete sleepers that support 20-ton axle loads whereas the Northern Line permits only 15 tons on steel sleepers between Phnom Penh and Sisophon. Trains must operate at slower speeds along the Northern Line, which reduces interoperability and train performance. The Royal Railway operates a dry-port near Phnom Penh where containers are picked-up or delivered. It also has sidings to private dry ports in the Phnom Penh area. The average age of Royal Railway's 199 wagons (for containers and fuel), passenger coaches, and locomotives are all over 25 years.

Despite many years of planning and studies, there are no direct rail connections to neighboring Lao PDR and Viet Nam. There is no rail link to PPAP container terminal LM17 nor to Siem Reap. The northeast of the country is not connected to rail.

Royal Railway's freight train operations are currently focused on the Southern Line linking Phnom-Penh with Sihanoukville Port. Unlike most other ports in South-East Asia, rail has on-dock access to Sihanoukville Port (though short at 100 meters) and a container terminal within the PAS boundary. Train operations on the Northern Line linking Phnom Penh to the bridge at the border began in 2019 and were governed by a bi-lateral agreement between Thailand and Cambodia on cross-border operations. Due to the outbreak of Covid-19 in February 2020, cross-border trade by rail was interrupted. The line became operational in 2022 after completion of upgrading and repair works by 2019 and following the Covid-19 pandemic. Some freight trains are operating along the Northern Line to transport milled rice for export via Sihanoukville Port by using a specially developed siding within a privately owned rice and agricultural processing facility. Commercial, cross-border rail freight

35 1,000 millimeters distance between the rails.

operations commenced in the second half of 2023. However, the main cargo pattern in 2023 is intermodal, by road in Thailand and by rail in Cambodia.

Royal Railway operates daily passenger trains services to and from Battambang and three times weekly services between Phnom Penh and Sihanoukville. Passenger trains are old and slow. The journey from Phnom Penh to Sihanoukville takes about eight hours at an average operational speed of just over 30 kilometers per hour. A strategy for developing the passenger train business is needed. Trains are controlled by a communications-based train control system that uses telecommunications between the train and track equipment for traffic management and infrastructure control.

Current Rail Traffic

Royal Railway's current main business segments are the transport of fuel from Sihanoukville Port to Phnom Penh and container transport between Phnom Penh and Sihanoukville, mainly in the direction to Phnom Penh. In 2017, the railway carried 39,000 passengers and 760,000 tons of freight with three-quarters generated by the Southern Line connecting to Sihanoukville Port. For comparison purposes, total rail freight in 2008 was 194,000 tons indicating a growth of 290 percent over 2008–2017.[36] In 2022, the railway carried 912,00 tons of freight (Table 2.5) having dropped from 1.1 million and 1.0 million tons in 2020 and 2021, respectively.

TABLE 2.5 Rail Freight Movements by Type 2022

Type	*Tons*
Containers	**508,000 (55.6%)**
Fuels	
Diesel (Sokimex, SL and Battambang)	183,085
Gasoline (Sokimex, SL)	39,624
Diesel (Tela, Bat Doeung)	13,159
Gasoline (Tela, Bat Doeung)	725
Diesel (Tela, NL)	77,424
Gasoline (Tela, Boeung Pring)	57,135
Sub-total (fuel freights)	**371,000 (40.7%)**
Non-fuels	
Cement (Chip Mong Insee Cement, Kampot)	19,052
Motorcars	<1,000
Fertilizer	2,100
Ballast	11,403
Sub-total (non-fuel freight)	**33,000 (3.7%)**
Total	**912,000 (100.0%)**

Source: Royal Railway.

36 Masterplan for Railway Network Development in Cambodia (Koica, 2014). Table 6.5.4

Overall, the rail freight and passenger mode shares of the domestic transport task are low and negligible for direct cross-border trade. For 2017, an analysis for the Intermodal Master Plan estimates that total domestic passenger movements were 184 million passengers (of which 39,000 rail passengers represented 0.02 percent of the total). The situation for rail freight movements in 2017 was more promising. Rail's 760,000 tons of freight in 2017, compared to the domestic total of 82.51 million tons indicates rail's freight mode share was 0.9 percent. In 2022, with growth in rail traffic but also rapid growth of the economy (nearly 7 percent per annum real GDP growth) and growth in freight movements, it is likely that in 2022 the railway represented about 1 percent of total domestic freight demand.

The railway performs better in the transport of fuel and containers between Sihanoukville Port to Phnom Penh where it had an estimated 20 percent and 7 percent, respectively, of these markets in 2022 (Table 2.6). Due to competition from trucks, rail's share of container traffic declined from a peak of 9 percent in 2017 (Figure 2.11). Having cut freight train running times between the 260-kilometers rail distance between Phnom Penh and Sihanoukville from eight hours prior to track rehabilitation and use of communications-based train control to four hours, Royal Railway currently runs 13 freight trains a day in each direction along the Southern Line, including trains used to reposition fuel and flatbed wagons. At present, due to the shortage of rollingstock, the Southern Line is operating at about 40 percent of capacity.[37] Additional rollingstock, new passing loops, and innovation such as double stacking of containers would increase the operating capacity. There is also similar or greater spare capacity on the Northern Line.

TABLE 2.6

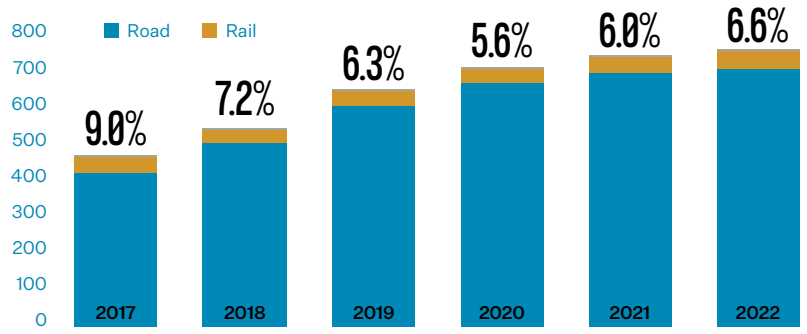
Fuel and Container Modal Split at Sihanoukville Port, 2022

Modes	*TEU containers*	*Fuel Imports in tons*
Road	700,100 (93.4%)	1,457,226 (79.7%)
Rail	49,589 (6.6%)	371,000 (20.3%)
Total	750,100 (100.0%)	1,828,226 (100.0%)

Source: PAS Annual Report (2022). Unofficial translation, page 22 for containers and total fuel imports, Table 1 for 2022 fuel movements by rail.

FIGURE 2.11

Rail Share of Container Transport from/to Phnom Penh to SAP (% of total TEUs)



Source: PAS Annual Reports (2021 & 2022). Unofficial Translation, Table 1 for 2022 rail fuel movements

37 Estimate of World Bank team.

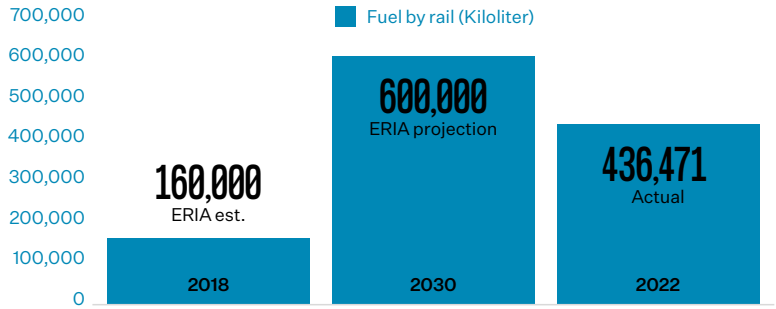
Market Potential

There are several reasons for the low market share of railways in domestic freight and passenger traffic markets despite a 400 percent growth in Cambodia's imports and exports from 2010 to 2021. Rail transport only restarted in 2010 after a long absence. Freight hauls and passenger trips are short which is a difficult market for railway transport. It is challenging for any rail carrier to achieve high margin returns from hauling containers on railway wagons, and especially so on short hauls where trucking is most competitive. The shortage of rollingstock is a key constraint to attracting new business. Infrastructure condition on the Northern Line limits operating performance.

Container business shows growth potential for railways. Since Sihanoukville Port handled 47 percent of all international container (TEU) movements for Cambodia in 2022, rail's share represented 3.1 percent of all Cambodia's international container movements. Rail is competitive with trucking in the Phnom Penh to Sihanoukville corridor; but until recently, it did not have the capacity to increase the frequency of trains due mainly to shortage of rollingstock. There are also infrastructure constraints mainly along the Northern Line. There appears to be potential to increase rail container and other freight traffic by 150 percent given the current reserve track capacity assuming sufficient rollingstock and adequate latent demand.

Fuel transport has continuing growth potential. A study by the Economic Research Institute for ASEAN and East Asia (ERIA) examined alternative fuel supply options for Cambodia. ERIA projected that the volume of fuel transported by rail from Sihanoukville could grow from 160 million liters in 2018 to 600 million liters by 2030.[38] While the forecast by rail from 2018 to 2030 represents a projected 275 percent increase from 2018, in 2022 the volume of fuel transported by rail was 436 million liters indicating that the ERIA projection is likely to be achieved earlier than 2030 if additional locomotives and rail fuel tankers are acquired (Figure 2.12).

FIGURE 2.12 Fuel by Rail to PAS (kiloliters) 2018 estimate, 2030 projection, and 2022 Actual



Source: Study team's calculation.

Royal Railway is increasing train operations on the Northern Line to gain a share of the significant volumes of imports that are currently transported by truck. In 2022, 1.5 million tons of freight were exported to Thailand via Poipet, and another 2.1 million tons were imported almost all by truck. Most of these goods were in the form of bulk traffic (87 percent of exports were cassava and 72 percent of imports were cement in 2022). There is immediate potential for expanded cross-border rail operations between Cambodia and Thailand as evidenced by Royal Railway's new agreement with Thailand's PTT Public Limited Company to commence fuel imports from Thailand's Eastern Seaboard by rail. As

38 "Optimal Future Petroleum Supply Chain" in *Cambodia Petroleum Master Plan 2022-2040*, ERIA and General Department of Petroleum, Ministry of Mines and Energy of Cambodia (eds.), ERIA Research Project Report FY2021 No. 21, (Jakarta: ERIA, pp.96-116).

of mid-2023, the rail connection to Thailand was not open for commercial operations. Fuel imports from Thailand by land transport used Thailand's State Railways of Thailand (SRT) or trucks to transport to the border where transfer was made to truck or rail. Under the new agreement, Royal Railway will utilize 134 special purpose fuel or LNG wagons provided by PTT to transport these products from PTT terminals in Thailand to Cambodia. Royal Railway has commenced to carry car imports from Thailand along the Northern Line. The RMA Automotive and Ford opened a car assembly plant with a production capability of 9,000 vehicles per year at Pursat between Phnom Penh and Battambang offering the potential for carriage by rail to end markets.

Royal Railway is also looking at the possibility of cooperation with the State Railways of Thailand to connect to China. Royal Railway could use SRT wagons to transport goods by rail from Cambodia via SRT network between Aranyaprathet, Thailand, and Vientiane, Lao PDR. In Vientiane, goods could be transshipped to the Lao China Railway and then to southern China, a 10–13-days journey, comparable in time by sea to China's Eastern Seaboard.

Toward the end of 2022, Royal Railway was listed on the Cambodian Stock Market as a publicly listed company (shares are not traded) and successfully finalized a US$34 million bond issue. This money is being used for improving tracks on the Northern Line (concrete sleepers, new and wider track base), building new sidings into silos and warehouses of new customers, and buying 340 secondhand wagons (initially from South Africa) plus some secondhand locomotives. Royal Railway is attempting to obtain increased business from agricultural producers. For example, Royal Railway has built a new rail siding along the Northern Line in the vicinity of Battambang to serve the major rice producers in the area. Rice had mainly been shipped by truck to PPAP LM17 container terminal then transported by inland waterways to Viet Nam ports. With the new rail siding, rice is now transported by rail to Sihanoukville Port.

Planned Railway Investments

The upgrading of Northern and Southern rail lines and a new rail line to Bavet is proposed by the *Comprehensive Master Plan on Cambodia Intermodal Transport and Logistics System 2023–2033.* The estimated investment for all three projects is US$1.425 billion. These investments would apply to rail fixed infrastructure and exclude rollingstock both of which are the responsibility of the private railway concessionaire for the existing railway lines. The proposed Phnom Penh–Bavet line is envisaged to extend to Ho Chi Minh City and nearby Vietnamese ports, a total distance of about 300 kilometers. A cross-border rail connection has been discussed by Cambodia and Viet Nam over the last two decades. Cambodia's preference is to build a line from Phnom Penh to Ho Chi Minh City via Bavet/Moc Bai (in Viet Nam) but the rail master plan for Viet Nam prioritizes a longer line via Snoul and does not mention a line via Bavet. A feasibility study of the line via Bavet has not yet been undertaken. Because the proposed project involves building and operating an international railway, new (and complex) institutional structures would be needed to oversee coordinated project development and implementation.

In the future, by 2050, the *Comprehensive Master Plan* proposes a network of electrified, high-speed, standard gauge railways. The lines would include a new northern railway (with capability of 160 kilometers per hour) connecting to Poipet and Thailand, rail links to the Cambodia-Lao PDR border, and a rail link to the Cambodia-Viet Nam border. The preliminary results of an initial assessment by the project proponent to develop the proposed, new high-speed railway (standard gauge, electrified) between Phnom Penh and Poipet (382 kilometers) indicates the project could cost more than US$4 billion. While feasibility study is ongoing, financing of this rail development is not yet confirmed.

Constraints

The existing railway is under-utilized due to a shortage of rolling stock and poor infrastructure condition. The Northern Line between Sisophon and Phnom Penh is the most constrained with low operating speeds (34-30 kilometers per hour), constrained axle loads (15 tons), and an absence of continuous welded track. Improvement of the existing Northern and Southern rail lines is urgently needed to facilitate an increased role for the railway in domestic and international transport movements.

The proposed new high-speed railway lines (standard gauge and electrified) could transform surface transport in Cambodia, but these investments are very costly and require a long implementation period, and prior to a decision to proceed require robust technical and economic studies. The railway would be the starting point for shifting some of the transport of cargo and passengers from road. However, a decision on implementation should not be made in haste because there are several matters that need careful consideration.

- ***Rail gauge.*** The proposed new railways are standard gauge (1,435 millimeters between rail tracks) as opposed to 1,000 millimeters on the existing railway. The new railway would not be interoperable with the existing (concessioned) railway. The new railway would likely attract business from the Northern Line, making it redundant; and the Southern Line would become isolated. The viability of the concession would be affected.

- ***Electrification.*** The railway will require a secure and reliable power supply. Cambodia's power transmission system has gaps and is unreliable especially during dry season. The potential for improving existing power supply or using alternate sources for powering the new railways such as batteries or hydrogen should be examined.

- ***Financing.*** From preliminary information on the Poipet project, it seems likely that it would be built and operated similar to the Lao PDR-China Railway, that is with significant investment and financing provided by China. However, considering the estimated cost (US$4.5 billion), it is likely the tariffs would be relatively expensive making it less competitive compared to road transport. It will be important for the RGC to decide carefully on commercial structure and concession scheme of the proposed public-private partnerships to ensure efficiency gains and manage potential fiscal and contingent liabilities from the investment.

- ***Construction.*** Some of the key parameters for the proposed investment are not yet available but require careful consideration.

- ***Training.*** Training needs will be significant with a change from diesel power and meter gauge operations to standard gauge and electric technology.

The potential of the Phnom Penh–Poipet high-speed rail project's potential performance would be seriously degraded unless Thailand's railway between the Cambodian border and Chachoengsao (major railway junction south-east of Bangkok) is upgraded to a similar standard. Interchange facilities would otherwise be needed at the border because the railway system in Thailand is presently entirely meter gauge. It might be best to consider a regional high-speed rail project to develop a continuous double track and electrified railway from Bangkok through Phnom Penh to Ho Chi Minh City. Such a regional high-speed rail connection would then connect to the planned high-speed rail line between Bangkok and Vientiane (by 2030), thus eventually connecting to the Lao PDR–China Railway.[39]

The distance of 150 kilometers to Bavet is short so an onward connection to Viet Nam is important. Despite the potential of a high-speed railway connecting to Ho Chi Minh City and nearby ports, the rail line would still be only about 260 kilometers long or well below the minimum length of about 400 kilometers at which high-speed rail can be competitive

39 Capital-Poipet express rail project making headway (The Phhnom Penh Post, January 24, 2023)

timewise with air and road transit. However, there are several challenges including: (i) the new railway is proposed as standard gauge while existing railways are meter gauge; (ii) a high-level railway bridge (37.5 meters clearance) over the Mekong River downstream of PPAP LM17 container terminal may be required with engineering challenges and investment impact if the most direct route to Bavet is to be followed; (iii) there are likely to be difficulties in synchronizing railway development on the Viet Nam side with Cambodia's rail development to Bavet; and (iv) even if a railway on the Viet Nam side can be quickly developed to Ho Chi Minh City, onward connections to Vietnamese ports are dependent on development of Viet Nam's national railway network. The implication of these challenges taken together is that the development of the new railway as an effective transport option will likely take longer than planned. Hence, it would appear to make more sense in the long term to connect a new railway between Phnom Penh and Ho Chi Minh City to Sihanoukville Port and to Bangkok via Poipet.

Cambodia does not have a modern railway policy nor a railway law. There is currently an unclear description of the roles of the government and private sector for railway investment, renewal and operations nor of the principles for setting of tariffs or for regulation of more than one railway operator. This has hindered the development of the existing railway and the development of new rail lines. The Concession Agreement between the RGC and Royal Railway is the only regulation governing rail transport. The Concession Agreement is administered by the Railway Department within MPWT. Royal Railway sets its own safety rules and standards. The Railway Department in theory conducts compliance audits on safety and infrastructure maintenance.

CHAPTER 3 | CORRIDOR ANALYSIS

3.1 Description of the Three Selected Corridors

The corridor analysis described in Chapter 3 focuses on three of Cambodia's transport corridors (Figure 3.1). These were prioritized from among Cambodia's three major transport corridors and three secondary transport corridors as identified by *the Comprehensive Master Plan on Cambodia Intermodal Transport and Logistics System 2023–2033*. Selection of these corridors was based on the following considerations:

- ***Complementarity with the Master Plan:*** A review of the corridors defined in the Comprehensive Intermodal Transport and Logistics System Master Plan for 2023–2033 identifies the key trade corridors that traverse the following main external gateways: (i) Poipet to Thailand; (ii) Bavet to Viet Nam; (iii) Phnom Penh to Viet Nam along the Mekong river; and (iv) Sihanoukville Port and other seaports (in future). Poipet has both rail and rail options while Sihanoukville and the other future seaports have existing road, new expressway, rail, and other proposed connections in the Master Plan. Where the RGC has already approved extensive improvement works focusing on particular modes along these corridors these locations would have been redundant for further analysis. For example, the analysis in this study did not focus on the road corridors to Poipet and Bavet. In the former, RGC has upgraded the highway NR5 to four-lane standard and is proposing a new expressway. Similarly, the road connection to Bavet is being upgraded as a new expressway to the border, and construction is imminent on a connecting expressway in Viet Nam.

- ***Potential for short-to-medium term improvement (3-5 years):*** **The selected existing corridors have potential for improvement in the short-to-medium term.** The new green field expressways and railways, which are being considered as part of the Master Plan and are passing parallel to the existing corridors, are not included in this study as their implementation requires major land acquisition, significantly higher investments, and longer implementation time. With the designation of the east-west highway corridor between Siem Reap and Oyadav connecting to Viet Nam as Asian Highway 21, this current secondary corridor was also considered due to its development potential.

Consequently, the corridors selected for further analysis are: (i) the east-west road corridor section of Asian Highway 21 (Thailand-Cambodia-Viet Nam, and Lao PDR); (ii) existing inland waterway connecting to ports in Viet Nam; and (iii) existing railway connecting to Poipet (border gate with Thailand) and Sihanoukville Port. These corridors are not competing and are not assessed against each other. Therefore, the study focuses on identifying critical gaps along each corridor to enhance their economic potential.

FIGURE 3.1

Three Identified Trade Corridors Showing Short– and Medium–Term Development Opportunities

Corridor A = East-West Road: Laem Chabang – Poipet – Siem Reap – Oyadav – Quy Nhon (1,204 km)
Corridor B = Inland Waterway: Phnom Penh –Komsomnor Border – Ho Chi Minh City – Cai Mep (370 km)
Corridor C = Improved Existing Rail: Laem Chabang – Poipet – Phnom Penh – Sihanoukville Port (880 km)

Source: Study team.

Corridor A – East–West Road

Connectivity: Laem Chabang – Poipet – Siem Reap – Oyadav – Quy Nhon (1,204 kilometers); through Thailand, Cambodia, Viet Nam; Cambodia and Lao PDR. From Laem Chabang (Thailand), this east-west road corridor crosses the border to Poipet, Cambodia, where it travels east-west through Siem Reap to the northeast border with Viet Nam at Te Le Tanh after which it continues to Quy Nhon Port of Viet Nam. The focus on the report analysis is the Cambodian section between Siem Reap and Oyadav given that highways in Thailand are generally in good condition and the Viet Nam section is being upgraded with World Bank financing with planned completion by end of 2024. This corridor is also proposed for upgrading as part of MPAC 2025 and to be known as Asian Highway 21. It forms part of the GMS Southern Economic Corridor.

Corridor B – Inland Waterways

Connectivity: Phnom Penh –Komsomnor Border – Ho Chi Minh City – Cai Mep (370 kilometers) through Cambodia and Viet Nam. Connecting from Phnom Penh (30 km downstream of Phnom Penh), this important trade route uses the Mekong River to connect to Cai Mep and nearby ports including Cat Lai Port, Ho Chi Minh City. Improvements to enable greater navigability, safety and facilitation of cross-border trade movements are needed. Greater use of the Lower Bassac river (the stretch downstream of the Vam Nao Pas in Viet Nam) is also a possibility in the future. This waterway corridor parallels the important road corridor connecting between Phnom Penh – Bavet – Ho Chi Minh City, Vung Tau and Cai Mep ports south of Ho Chi Minh City (295 km) that is under major upgrading at present and is therefore not considered in detail in this report. A new toll expressway is under construction between Phnom Penh and Bavet and a four-lane expressway is proposed to be constructed by 2028 between Moc Bai (opposite to Bavet)

and Ho Chi Minh City.[40] Cross-border capacity was recently doubled with the construction of the Prey Vor border facility located close to Bavet. Attached to this corridor is a network of upstream inland waterways that act as feeder routes with sub-feeder terminals linked to Phnom Penh.

Corridor C — Improved Existing Rail

Connectivity: Laem Chabang – Poipet – Phnom Penh – Sihanoukville Port (880 kilometers) through Cambodia and Thailand. The main focus is the existing meter gauge Northern Line railway that has been connected to the Thai meter gauge system since 2019. Operating between Poipet and Phnom Penh, the Northern Line is constrained by axle limits (15 tons) on old bridges, but a 30-40 kph operating speed is possible. The existing Southern Rail Line has a higher operating speed (50 kph) and a higher axle load (20 tons) so is not the first priority for improvement given the limited fiscal space. On the Thailand side, the meter gauge railway track between Bangkok and Aranyaprathet (opposite) Poipet is proposed to be double tracked by 2030. Within Cambodia, highway NR5 runs parallel to the Northern Line Railway to Phnom Penh and then on to Sihanoukville Port (NR4). The highway sections between Poipet and Phnom Penh are under major improvement, including expansion to four lanes. A new toll expressway was recently opened between Phnom Penh and Sihanoukville Port parallel to road NR4. Given the major recent and ongoing road upgrading, the road corridor is not considered in detail in this report.

The selected corridors link the Special Economic Zones (SEZs), which are major demand generators for transport and logistics services in the region. As of 2019, Cambodia had 54 SEZs located in four main areas: (i) Phnom Penh; (ii) Sihanoukville; (iii) Manhattan (Svay Rieng along NR1, about 40 kilometers from the border at Bavet); and (iv) Tai Seng/ Bavet. All SEZs operate under the authority of the Cambodia Special Economic Zone Board under the umbrella of the Council for the Development of Cambodia. Each SEZ offers a 'one-stop-shop' where all government services are offered in one building such as the General Department of Customs and Excise, the Ministry of Commerce, the Council on the Development of Cambodia, and the Labor Ministry. Export and import clearance for the SEZs is usually completed at the warehouse of the firm.

3.2 Corridor Analysis

Gaps and potential improvements for each selected corridor were analyzed from end to end.[41] The analysis examines the features of the individual discrete waterway, road, and railway sections, their standards and condition, and the influence of these factors to estimate travel time and adding the available information on cross-border trade clearance times at relevant border crossings. The time required for pre-departure customs clearance at the origin and post-arrival customs clearance at the destination are not included in the analysis. The results of analysis are presented in the following sections for the base case (current and likely future situation without specific interventions) and the various improvement scenarios (with specific interventions) as a time–distance diagram.

To facilitate the corridor analysis and the potential for travel time improvement required assumptions on current and potential, future, improved border crossing times. As shown in Section 2.1, there is no recent, published information available for export trade facilitation times at the main land borders and export/ import times at the border crossing on the Mekong River between Cambodia and Viet Nam despite there being

40 Three years, $255 million: Ho Chi Minh City-Moc Bai Expressway Overruns Original Cost Estimate (VnEXpress International, September 2022).

41 It is not however expected that all goods would travel from end to end such as from a port in one country to a port in another; rather, the corridors were defined to include relevant production zones and markets along the corridors and to illustrate the potential to make each corridor more efficient.

an assessed overall improvement in cross border trade facilitation from 2019 to 2021. For the corridor analysis set out below, estimates of current border crossing times were made based on field work, industry estimates and previous studies. The potential for an improvement in these facilitation times to both reduce them and make them more predictable is a significant driver of corridor improved corridor performance as shown below. The potential improvement was an estimate made by the study team taking into account the circumstances of each border crossing plus the range of measures available that are: (i) promoting measures to reduce trade costs smart logistics including; (a) full automation and transparency in customs clearance; (b) introducing Smart Seals for containers to avoid tampering; and (c) implementing advance cargo information and prearrival processing; (ii) synchronizing and streamlining border crossing procedures including acceleration of the single stop inspection/common control area protocol at major border crossings to facilitate streamlined and efficient transit of freight, (iii) improving domestic institutional between the government and the private sector facilitated by the National Logistics Council; and (iv) promoting vigorous bilateral and regional coordination including: (i) better implementation of the 2009 Waterway Transport Agreement between Cambodia and Viet Nam; (ii) reactivation of cross-border traffic rights for trucks under the ASEAN and GMS CBTA agreements; and (iii) similar for rail in the future.

Corridor A – East–West Road

The corridor begins in Laem Chabang port connecting to Poipet inside Cambodia where it continues to Siem Reap along the east-west section of the Southern Economic Corridor between Siem Reap to the Oyadav border post with Viet Nam. Under MPAC 2025, it is proposed to improve most of this east-west highway and to designate it as AH21. Within Viet Nam, highway QL19 connects between Te Le Tanh close to the border with Cambodia and Quy Nhon, an important domestic and regional shipping port. Corridor A will likely carry mainly domestic products to markets except in the vicinity of Viet Nam where there is likely to be relatively short-distance, cross-border trade, while in the long term it has potential to capture transit freight and generated cargo from other corridors. This corridor also links to NR13 in Lao PDR, which is the only transport connection between Cambodia and Lao PDR.

The road distance between Laem Chabang, Thailand to Quy Nhon Port in Viet Nam via Cambodia is 1,203 kilometers. Thailand highways 331/359 are generally in good condition over their 245 kilometers length between Laem Chabang Port, Thailand, and the Aranyaprathet border check point, Thailand/Cambodia. Of the total corridor distance, the roads between the Poipet on the Cambodian side of the border with Thailand via Siem Reap to Ratanakiri province near the border with Viet Nam, a distance of about 500 kilometers, is in the most need of improvement.

The Quy Nhon Port in Viet Nam's Bình Đinh Province is a secondary port in Viet Nam's Central Region connecting to the Mekong Delta, western Viet Nam, Cambodia, and Lao PDR. It has regular though infrequent maritime routes connecting to international ports, including in China, South Korea, Japan, Singapore, and Thailand. Quy Nhon and nearby Thi Nai Wharf have a general terminal and can handle container vessels up to 50,000 tons with specialized terminals for vessels from 5,000 to 10,000 tons. The port is planned to be expanded to handle a larger quantity of fuel shipments. Related ports in the province include Nhon Hoi Wharf serving the Nhon Hoi Economic Zone and local terminals servicing satellite development in Dong Da, De Gi and Tam Quan. Total tonnage in 2020, including domestic cargo and containers, was about 11 million tons.[42]

The 164-kilometer section connecting between Poipet and Siem Reap is not proposed for upgrading indicating the road is in fair-to-good condition. A southern bypass of the city is being considered by MPWT. Highways 64 and 78 connecting between Siem Reap and Ratanakiri over a distance of 498 kilometers consist of two 3.5-meter wide paved

42 *Quy Nhon port handles 11 million tons of cargo in 2020* (Viet Reader Viet Nam, December 31, 2020).

lanes with 1.5-meter paved shoulders on both sides. An assessment prepared for MPWT in 2018 indicates that the original double bituminous surface treatment on the existing pavement has cracked and created potholes, which would need to be fixed.[43] Overall, the road is in poor-to-fair condition with the road pavement deteriorated over the 170 kilometers length between Sam Ang and Ratanakiri. The pre-feasibility study for this Cambodian two-lane road section of the overall corridor was completed in 2019 and recommended extensive upgrading of the pavement primarily within the current right of way.[44] Based on the earlier study, a preliminary business case was completed in 2022 that investigated the financial business case for upgrading the route.[45]

Within Viet Nam, Highways QL19 and QL19B connect between Te Le Tanh close to the border with Cambodia and Quy Nhon Port. They are being upgraded from a Class IV to a Class III (11 meter-wide carriageway consisting of one lane for car and one lane for motorcycle each direction) under the Central Highlands Connectivity Improvement Project financed by the World Bank. These works are in progress with some road sections completed by end-June 2023 and the remaining by December 2024.

Analysis of Corridor Efficiency

Base Case – Current Highways

Speed Assumption. Average road speeds in Thailand were assumed to be 65 kilometers per hour, while in Cambodia the speed between Siem Reap and Ratanakiri was assumed to be 35 kilometers per hour based on the current road conditions, and in Viet Nam 45 kilometers per hour.[46]

Assessment of trade facilitation arrangements. At the border between Thailand and Cambodia, it is understood that single-window customs clearance arrangements may be in place on the Thai side of the border. Single-window arrangements do not exist at the border between Cambodia and Viet Nam. The entire sections of the corridor in Cambodia and Viet Nam between the border with Thailand to Quy Nhon Port were not included as agreed routes under the early harvest arrangements for the CBTA.

Base case performance. The results of the analysis of the base case scenario shows that to traverse the 1,203-kilometers route from Laem Chabang to Quy Nhon Port would take an estimated 37 hours (Figure 3.2). This estimate of total travel time along the corridor includes an assumed clearance time in total of 3 hours at the border with Thailand, that is 30 minutes at Aranyaprathet on the Thai side and 2.5 hours at Poipet on the Cambodian side (Table 2.1) and 6 hours at the border with Viet Nam (3 hours each side in line with the average of border crossings in the region).[47] Since permits to through-run generally lapsed during the Covid-19 period , transfer between trucks at the border is generally assumed to occur. It is likely that transhipment would take at least one hour, but this time has not been factored into the calculations as it is minor and common to the base and improvement cases. The total border clearance time is almost 25 percent of the total estimated journey time.

43 Initial Environmental and Social Impact Assessment: Siem Reap to Ratanakiri National Roads Upgrading Project (SRNRUP) (MPWT, October 2018)

44 *ASEAN Initial Priority Infrastructure Project Pipeline. Upgrading of Siem Reap to Ratanakiri National Road* (EY, December 2019). Financed by the Australian Foreign Affairs and Trade.

46 Cambodia. Higher Level Business Case for the Siem Reap – Ratanakiri Road Improvement (EY. October 2022). For MPWT, with funding of PPIAF.

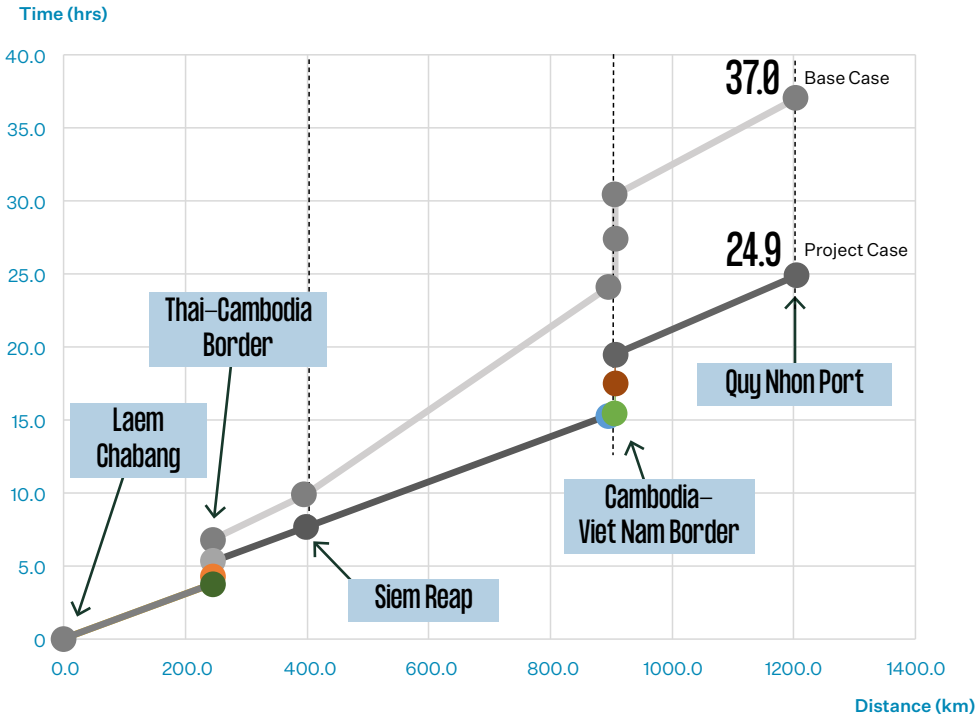
46 Estimates of road speed were derived from Google maps and study team assessments for Corridors A to C.

47 Referring to Table 2.1, the clearance times for 2015 for these border crossings appear to be for exports only, whereas in 2019 and 2021 they represent import times. Further there is no recent information on the clearance times on the Thai and Vietnamese sides of the border. Accordingly, the times referred to are assumed to be representative of the current average of import and export clearance times at these locations.

Project Case – Improved Highways + Reduction in Border Clearance Time

The improved highway scenario (shown in Figure 3.2) includes a 50 percent reduction overall in clearance times at Poipet, Oyadav and Te Le Tanh, offers a time saving of about 12 hours or 32 percent compared to the base case.[48] The corridor passes through several less-developed provinces of Cambodia and would have the potential to support the development of sustainable agriculture, ecotourism with improved 'last-mile' connectivity.

FIGURE 3.2 Estimate of Operating Costs



Source: Study team.

The travel time and transport component of logistics cost per ton over the entire corridor length was estimated. Assumptions of truck, train, and barge operating costs for future cross-border train operations are shown in Table 3.1. The potential for reducing the transport component of logistics cost per ton in the improvement scenario compared to the base case scenario is about 10 percent as shown in Figure 3.3.

48 2019 pre-FS indicates that the proposed upgrading has an estimated investment cost of US$450 million (2018 prices) and includes the following components: (i) road surface treatment with 100 percent asphalt concrete pavement within existing pavement widths; (ii) maintenance of 17 bridges; (iii) maintenance of existing drains; (iv) installation of some new drains along road edge; (v) installation of road signs and markings; (vi) selected climate change features such as slope protection and storm water dissipation; and (vii) past flooding in the areas that run through Lower Sesan II (hydropower dam) catchment suggests that major upgrading is needed in low-lying (flood prone) areas (both upstream for closed gates scenario and downstream for open-gate scenario.

TABLE 3.1

Estimate of Operating Costs

Indicator	*Parameter*
Rail operating cost (63% average loading at 40 kph)	**$0.035 per ton-km**
Inland Waterway barge (DWT 2,000 – 3,000 at 15 kph)	**$0.01 per ton-km**
Heavy Truck (31-ton payload – 75% average loading)**:**	
Distance driven per year (kilometers)	75,000
Hours driven per yar	2,200
Vehicle operating cost per ton-km (Average speed 50 kph and higher)	**$0.073**
Estimate of delay cost per hour of delay (based on truck)	
Depreciation ($/vehicle-km)	$0.064
Delay cost/ hour:	
Labor cost/ US$ per hour (1.8 crew per truck hour)	$5.0
50% depreciation ($/truck hour)	$1.1
Opportunity cost of freight in transit (per hour)	$16.5
Est. cost of delay per truck $ /hour	$22.6
Estimated cost of delay $ per ton hour (used for truck and train)	**$0.70**
Estimated transshipment cost per ton for road and rail	**$5.0**

Notes:

- Highway Design Model indicates speed at 40 kph would be 3% higher; and at 30 kph would be 14% higher.
- An opportunity cost of freight in transit of $0.50 per ton-hour was used. Although this value is higher than the Highway Design Model-4 default value for Asia of $0.15 per ton-hour, it is closer to what was found by a relevant 2006 feasibility study where values for ton-hour were: (i) bulk freight $0.2–$0.5 per ton-hour; and (ii) containers $0.2–2.0, the ranges for both types of freight dependent on the category of freight with the values expressed in circa 2005 prices. Kunming-Haiphong Corridor–Multimodal Transport Demand Model. TA-4050 (ADB, February 2006).
- Truck operating costs assume articulated 31 ton Payload Trucks.
- Freight train operating costs assume a 800 ton maximum payload. Based on World Bank analysis of State Railways of Thailand's data in 2016 and Study Team's own estimates of GMS railway operating costs.
- Inland waterway ferries cost per ton-km. Based on Study Team's own estimate for Mekong Delta.

Source: Study team calculations.

FIGURE 3.3

Corridor A: Estimated Transport Operating Cost per Ton for Selected Scenarios

Source: Study team.

The economic benefits from reduced transport cost and travel time were estimated with the Economic Internal Rate of Return of 25.1 percent. The 2019 Pre-Feasibility Study[49] was conducted in 2019 to assess the rehabilitation and upgrading of the existing northern road corridor between Siem Reap to Ratanakiri (approximately 390 kilometers), which is a part of a transport corridor stretching from the Stueong Bot cross-border facility (with Thailand) to Ratanakiri, near Viet Nam. The benefit-cost ratio was estimated to be 3.0 (assuming a discount rate of 9 percent) or 2.3 (with a discount rate of 12 percent). At the current low daily traffic volumes of a few hundred vehicles per day with few trucks the potential for generated traffic is high – across the whole route traffic generation of about the same as the inverse of that due to the overall reduction in travel time is likely (i.e., +30% assuming an elasticity of -1.0[50]).

Corridor B – Inland Waterway

Shuttle barges. The main transport modality along this important trade corridor is by DWT 2,000 (160 TEU) to DWT 3,000 (240 TEU) shuttle barge. The Mekong River connects directly to Cai Mep port and nearby ports (refer to Figure 3.1). The cross-border trade volume of 4.0 million tons (exports + imports) using the Mekong River between Cambodia and Viet Nam in 2022 (refer to Table 1.1) grew at 8.9 percent per annum from 2.2 million tons in 2015. Of the 4.0 million tons transported in 2022, 0.8 million was bulk cargo, 2.4 million was in containers, and 0.8 million was fuel imports.

Most of the cargo handled by the main terminal of PPAP LM17, arrives or leaves the terminal by truck, with most being containerized. The remaining cargo comes by barges from the feeder terminals. There is no rail connection to LM17. Custom clearance is done at LM17 and takes two to eight hours. Because LM17 still does not have specialized and high-speed gantry cranes, the containers are discharged and loaded by single-point swing cranes. Operations at LM17 are conducted 24-hours per day, ensuring continuous movement of goods.

Sea-going and sea-river vessels. An alternative to utilizing shuttle barges between Phnom Penh and Cai Mep is to opt for direct sailing using DWT 5,000 (380-500 TEU) coastal vessels or sea-river vessels between PPAP and Singapore or other regional seaports in Asia. Presently, maritime traffic along the Mekong River System is somewhat limited, but the prospects are promising, albeit necessitating additional dredging efforts. These vessels follow the transit route, traversing through the Mekong River, Vam Nao River, and then the Lower Bassac River, ultimately reaching regional ports (Figure 3.4). In this context, the Port of Can Tho could serve as an additional option for cargo loading or unloading, as the stretch between Can Tho and the estuary offers greater depth and can accommodate vessels of up to DWT 10,000.

Corridor B can be extended upstream to incorporate inland waterway transport for the transshipment of goods between the feeder terminals such as Kampong Cham and Kampong Chhnang with PPAP LM17. Domestic inland waterway transport plays a pivotal role in the transportation of goods to and from Cambodia thanks to a well-connected waterway network spanning a total navigable length of 1,750 kilometers along the Mekong and Tonle Sap Rivers. The domestic waterway network, particularly the Tonle Sap and Upper Mekong Rivers, presents an opportunity for the connection of numerous agricultural centers along these rivers with PPAP LM17 that is being doubled in size, and other related facilities through the existing and planned sub-feeder ports (refer to Figure 2.9).

The main route used to transport goods by inland waterways between LM17 other PPAP terminals and private fuel terminals uses shuttle barges or vessels that operate along

49 ASEAN Initial Priority Infrastructure Project Pipeline, "Pre-feasibility report on Upgrading of Siem Reap to Ratanakiri National Road." 10 December 2019.

50 An elasticity of -1.0 for travel time implies a 10% increase in demand for a reduction in travel time of 10%.

the Mekong River within Cambodia and Viet Nam. There are two main routes that vary at the Viet Nam end in the last one-third of Corridor B. The first route (Route i in Figure 3.4) traveling between PPAP LM17 and Cai Mep port through the Chao Gao canal and passing via Cat Lai port is 428 kilometers. The second route (Route ii in Figure 3.4) traveling via the Mekong Estuary to Cai Mep port is shorter at 370 kilometers.

FIGURE 3.4 Corridor B, with Two Access Routes to Cai Mep

Source: Study team based on Consultations with Shipping Companies in Cambodia. Map base – Google Maps, September 21, 2023.

Larger shuttle barges take Route ii to avoid the limited capacity of Cho Gao Canal.[51] Importantly, this route does not provide the option for partial loading or discharging at Cat Lai. In terms of travel time, it can be slightly shorter if the vessels can navigate the estuary at the optimal time, specifically between medium and high tide. The estuary has a depth of only 2.8 meters during low tide but exceeds 5 meters during high tide. There is a potential risk of an approximately eight hour delay if the timing with the tidal window is not well-coordinated. There are plans to upgrade the Cho Gao Canal.

One drawback of opting for Route ii is the wave and wind conditions in the open sea. Since the segment between the Mekong Estuary and Vung Tau is in open water, smaller and lightly constructed barges may lack the necessary seaworthiness. It remains unclear what Vietnamese regulations govern the safe construction of vessels navigating these coastal waters, but it would be reasonable to assume there are restrictions in place. In Europe, analogous situations have led to the development of specialized sea-river vessels that use strengthened double-hull barges permitted to navigate at sea under predefined sea conditions and within a specified safe distance from shore.

The initial leg of this journey spans 73 kilometers and typically requires approximately 4 hours to reach the Cambodian border.

51 Cho Gao Canal's depth of 3.7–3.9 meters (low-tide) is sufficient for container barges of 2,000 DWT (160 TEUs); however the volume of barge traffic and constrained width (minimum 35 meters) of these larger vessels means that such vessels until must wait eight hours for a high tide or travel via the Mekong Estuary. Currently being upgraded, the work when completed will allow the canal to meet the standard of a Grade 2 inland waterway route, with over 3.5 meters in depth (low tide) and over 50 meters in width.

During this stretch, the Mekong River maintains a depth of over 5 meters with few obstructions. Illuminated polyethylene buoys assist with night navigation, although it is worth noting that these buoys have been in use since 2006 and their maximum lifespan is 20 years. Upon reaching the border on the Cambodian side, the barge drops anchor and awaits Customs and Immigration clearance. Once this process is completed, the barge proceeds slightly beyond the Vietnamese side of the border, where the clearance procedures are repeated. Normally, this entire process takes around 2 hours; however, it can extend to up to 9 hours if the barge arrives after the daytime operating hours of the border control. The current border control procedures and nighttime closures do not align with the stipulations of Article 17 in the 2009 Transport Agreement, which requires 24-hours operation.

Shuttle barges operating between the border to the entrance of the Vam Nao Pass in this area do not stop here but continue their journey along the Mekong River.[52] Navigating this 48-kilometer stretch typically takes approximately 2.7 hours. Downstream of the border, there are shallow patches that necessitate periodic dredging. Night navigation is permitted in this section, and there are no scheduled stops.

For shuttle barges destined for Cai Mep, the journey continues along the Mekong for another 150 kilometers, taking roughly just over eight hours to reach the entrance to the Cho Gao Canal. Nighttime navigation is also allowed in this part with no stops scheduled. Most of this stretch of the Mekong River maintains a depth exceeding 5 meters, even during low tide and the dry season. However, there are specific areas that require dredging maintenance.

The entrance to the Cho Gao Canal is situated at My Tho, just 5 kilometers downstream of the My Tho Bridge, the first bridge built over the Mekong River in the Mekong Delta. At this point, barges have the option to choose their route to Cai Mep: either Route i, which involves passing through the Cho Gao Canal, followed by the Saigon River, Vam Co, Cat Lai Port, and eventually reaching Cai Mep; or Route ii, which entails continuing downstream along the Mekong River to its estuary and then navigating coastal waters directly to Cai Mep in Vung Tay Bay. Sea-going vessels, coastal vessels, or sea river vessels are obliged to follow Route ii.

The Ministry of Transport of Viet Nam and the World Bank are implementing a new project for developing waterway corridors and logistics in the Southern region under financing by the World Bank. It will include renovating and upgrading the East-West transport corridor connecting the Mekong Delta region, from its main port of Can Tho to HCMC port to HCMC port, and improving the North-South transport corridor connecting the southeast region and industrial cities like Dong Nai with HCMC port and the Cai Mep Thi Vai deep seaport cluster. These developments will contribute to better passage of the barges.

The Cho Gao Canal is classified as a Waterway Category II South, with a depth ranging from 3.7 to 3.9 meters and a channel width varying between 35 to 80 meters. This is not accessible to sea-going vessels, coastal vessels, or sea river vessels. Furthermore, the limited bridge clearances prevent taller barges from passing through, resulting in reduced cargo capacity. Another significant challenge in this canal is the high traffic density, leading to congestion. Currently, approximately 2,000 vessels transport goods along this 29-kilometers canal daily. There are plans to upgrade the Cho Gao Canal.

Exiting the Cho Gao Canal, passage continues for 26 kilometers along the Vam Co River and 45 kilometers along the Saigon River in total about 4 hours sailing to Cat Lai Port. Night navigation is allowed so no stops here. Depths are more than 5 meters in the Saigon River. Most of the shuttle barges have combined Cat Lai and Cai Mep containerized cargo on board so first Cat Lai is done, then Cai Mep. The distance between Cat Lai and Cai Mep ports is 55 kilometers or a bit more than 3 hours traveling time.

52 However, certain sea-going vessels, such as those importing gas from Thailand, use the Vam Nao Pass to access the Bassac River, and enter the sea by the Bassac estuary.

FIGURE 3.5 PPAP to Cai Mep via the Bassac River, and PPAP to Singapore

Source: Study team based on Consultations with Shipping Companies in Cambodia.
Map base – Google Maps, September 21, 2023.

An additional existing route to Cai Mep and direct passage to Singapore could increase the utilization of the Lower Bassac River. Historically, most shipping companies have concentrated their transportation routes along the Mekong River. However, the Lower Bassac River, located downstream of the Vam Nao Pass, provides accessible, deeper, and safer access to the Viet Nam Delta. Enhanced value can be achieved by integrating voyages that involve partial loading and unloading at Can Tho Port and loading and unloading at Cai Mep Port. Passage times would be similar to the LM17–Cai Mep through the Mekong Estuary (Figure 3.5). Instead of continuing their route along the Mekong River, vessels would make a right turn at the five kilometer long Vam Nao Pass that connects the Mekong and Lower Bassac rivers. They then proceed on an 80-kilometers journey to Can Tho Port, where cargo can be conveniently topped up. Beyond Can Tho, the river depth accommodates vessels of up to 10,000 DWT. The use of the Lower Bassac River could also open opportunities for 5,000 DWT (feeder) seagoing vessels between Phnom Penh and Singapore. The journey time between PPAP LM17 and Singapore would be between 2.5 and 3.3 days.

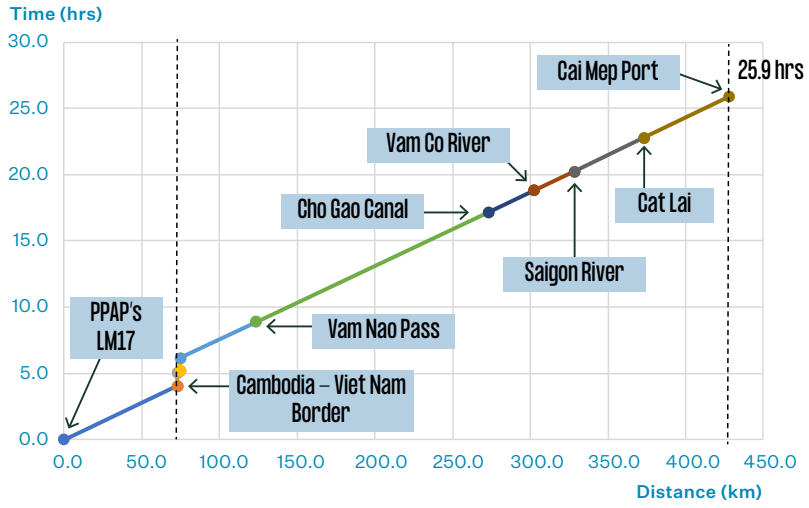
For travel to Cai Mep, the next 114 kilometers lead to the Bassac Entrance, passing through the Quan Chan Bo Channel, which has been fully excavated by Viet Nam. There are several advantages and disadvantages of using the Bassac Estuary for travel to Cai Mep port. The main advantages are: (i) no delay at the estuary waiting for high tide; (ii) the possibility of integrating cargo at Can Tho; and (iii) larger vessels up to 380 TEU can be used. The disadvantages are: (i) higher fuel consumption; (ii) specialized sea river vessels are needed to cross the open sea between the estuary and Vung Tau; and (iii) adverse sea conditions may potentially extend the passage time.

Analysis of Corridor Efficiency

The fastest passage time following Route i, currently used by barges, in connection with the Mekong Corridor between LM17 and Cai Mep, including custom clearance in Cai Mep, is about 26 hours, and the slowest passage time is 35 hours (Figure 3.6). These total journey times include a minimum border clearance time of 2 hours in total (one hour on each side

of the border) which can increase to by about 6 hours on average if vessels arrive at night when the border is closed (opening hours are 6 am to 6 pm). When the canal widening is completed, the largest barges that could use this Route i without waiting for the tide would be about DWT 3,000 (240 TEUs), corresponding to the largest barges currently in use.

FIGURE 3.6 Corridor B – Fastest Journey Time by Barge (Route i)



Source: Study team

River-sea vessels (DWT 4,000 up to 360 TEUs) could use Route ii via the Mekong Estuary during high tide taking a minimum journey time of 23 hours. Depending on the tide and whether the border is closed at night, the journey time could rise by about six hours, the same as for Route i. These river-sea vessels would be larger than the largest barges in use and would have shorter travel time to Cai Mep Port than barges using Route i, and they would be able to cope with the open conditions and normal range of wave heights in the Mekong Estuary.

The comparison road corridor is the parallel main road corridor from Phnom Penh to Ho Chi Minh City, and Vung Tau and Cai Mep Ports south of Ho Chi Minh City (295 kilometers). Of the total corridor distance, slightly more than half follows NR1, also known as AH1, between Phnom Penh and Bavet (166 kilometers) on the Cambodian side of the border with Viet Nam. The corridor is also identified by the Vietnamese Government as one of its most important economic corridors in the next 10–30 years.[53] New expressways will be completed between Phnom Penh and Ho Chi Minh City by 2030.

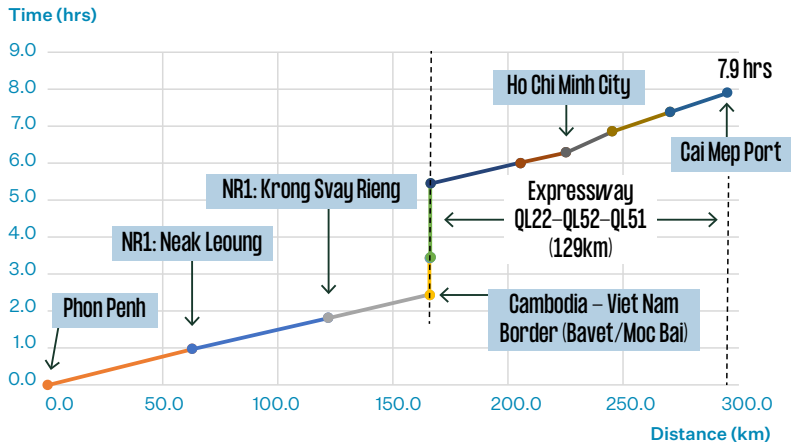
The road comparison case assumes that the expressways on both sides of the border are completed by 2030, and there is a 45 percent reduction in current cross-border clearance times. The results of the analysis of improved road scenario via Bavet shows that to traverse the 295-kilometers route from Phnom Penh to Cai Mep Port would take 7.9 hours when the new expressways are completed.[54] Compared to the use of waterway taking 27 hours between PPAP LM17 and Cai Mep, the road would be 70 percent faster although the bulk and container traffic using the waterway would not be sensitive to travel times of less than a day. More important is consignment reliability to meet scheduled ship departures from Viet Nam ports and the cost per ton of these consignments compared to road.

53 *The-most-important-economic-corridors-for-next-10-30-years* (VietNamnet, August 15, 2022).

54 Included in the total journey time is an assumption of a 0.7-hour reduction in clearance times at Bavet down to one hour, and a 1.5-hour reduction in clearance time at Moc Bai down to 2 hours. The reduced total border clearance time of 2.2 hours represents almost 60 percent of the improved journey time reduction of 3.8 hours, the rest being due to road improvements.

FIGURE 3.7

Comparison Road Corridor: Phnom Penh – Bavet – Ho Chi Minh City, Vung Tau and Cai Mep



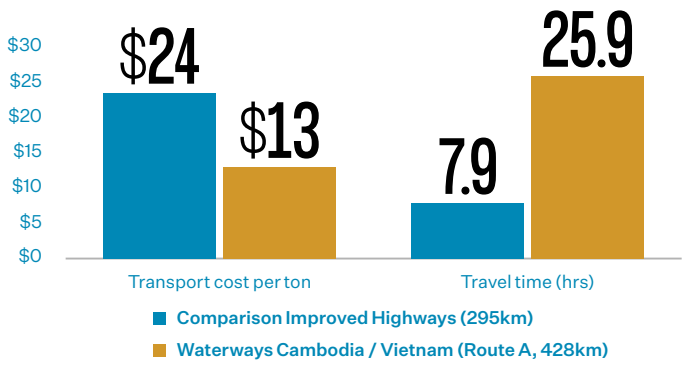
Source: Study team

The theoretical effect on transport costs of the use of the current inland waterway barges verses use of truck along the road corridor to Viet Nam via Bavet was examined. The largest vessels operating today are barges of about DWT 3,000 (240 TEUs). However, the main advantage is the potential cost advantage of barges using the Mekong River (Routes i or ii) compared to road transport via Bavet. Using barges, would give a US$12 per ton reduction or almost a 50 percent cut in transport costs including an allowance for feeder trucks compared to the use of road via Bavet (Figure 3.8) although the travel time would be about 17 hours longer than by NR1.

Road transport is also complementary to waterway transport. Despite the clear cost advantage of the use of inland waterway to transport goods to Vietnamese ports, some logistics companies based in Cambodia offer a back-up road service to transport goods by road to Cai Mep. The transport service is aimed at shipments that would normally use inland waterways but are at risk of missing their vessel departure from Cai Mep. Hence, this back-up road service is complementary to the use of inland waterways.

FIGURE 3.8

Corridor B: Waterway (Route i) vs Comparison Road – Estimated Transport Operating Cost per Ton and Journey Times



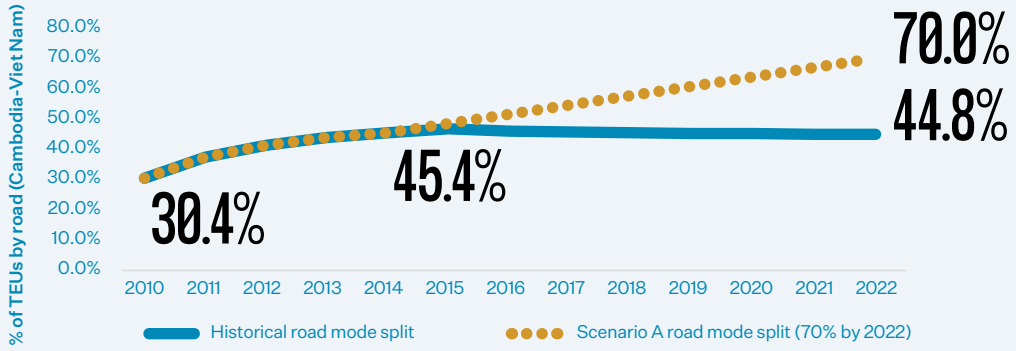
Source: Study team

Inland waterways have been effective at reducing Greenhouse Gas Emissions for containerized transport. Cambodia's National Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) identifies reductions from freight transport as an important area for mitigation but with the mitigation measure being proposed being to shift freight from road transport to rail transport[55]. Inland waterways play a far greater role for domestic and international freight transport today than rail transport and since 2015 has competed effectively with road transport between Cambodia and Vietnamese ports by attracting road freight to inland waterways. A cumulative GHG emission reduction of 135,000 tons over 2015–2022 is estimated due to the investment in inland waterways. Continued improvement in Inland waterways and railways in the future is expected to significantly reduce GHG emissions across the transport network since overall freight demand is growing rapidly.

BOX 3.1

Role of Inland Waterways in reducing GHG emissions

While road transport's share of the containerized freight task between Cambodia and Viet Nam was just over 30% in 2010 (with waterways carrying the balance) it had grown to 45% by 2015 due to extensive road investment (refer figure below). Due to PPAP's major expansion of the capacity of the LM17 container terminal from 150,000 TEUs to 500,000 TEUs[56] annually in 2022, inland waterways curtailed the growth in containerized road freight to Viet Nam, and slightly reduced road's mode share to below 45% by 2022 (refer figure below). Without the significant investment by PPAP in LM17 and other waterway improvements it is likely that road transport's share of the Cambodia–Viet Nam freight task would have continued to grow likely hitting about 70% by 2022 (still lower than road freight's 90% share of the total domestic freight task). Compared to this alternative 70% road mode share scenario, the actual historical growth trend where waterway transport curtained road transport's share to below 45% in 2022, is estimated to have reduced direct, cumulative Green House Gas emissions by 135,000 tons from 2015–2022.



Source: Study team.

55 *Cambodia's Updated Nationally Determined Contribution* (The Kingdom of Cambodia. 2020). Published by the General Secretariat of the National Council for Sustainable Development/Ministry of Environment.

56 A TEU or Twenty-foot Equivalent Container.

Corridor C – Improved Existing Rail

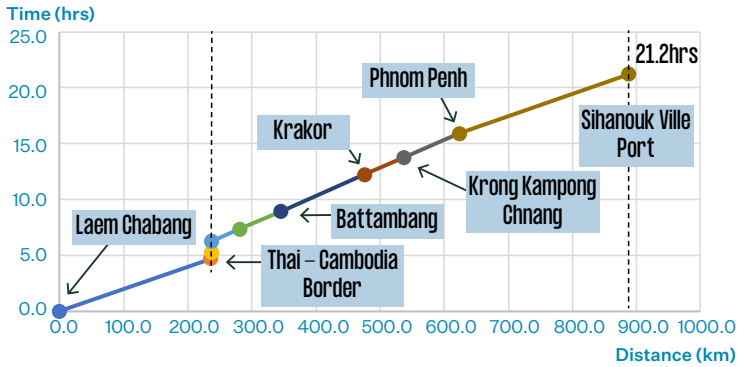
The entirety of Corridor C extends from Laem Chabang Port, Thailand, to Sihanoukville Port, Cambodia. It focuses on the current single-track, meter gauge railways in Thailand and within Cambodia with a total length of 888 kilometers. The focus of Corridor C is the existing meter gauge Northern Line railway that has been connected to the Thai meter gauge system since 2019. Operating between Poipet and Phnom Penh, the Northern Line is constrained by axle limits (15 tons) on old bridges, but a 30-40 kilometers per hour operating speed is possible. The existing Southern Rail Line has a higher operating speed (50-60 kilometers per hour and a higher axle load of 20 tons). Hence, it is not the first priority for improvement. On the Thailand side, the meter gauge railway track between the Chachoengsao railway junction, located 150 kilometers south-east of Bangkok, and Aranyaprathet (opposite) Poipet is proposed to be double tracked by 2030. There is potential for increased domestic and cross-border use of the railway with selected investments along the Northern Rail Line and new rollingstock.

Analysis of Corridor Efficiency

An analysis of movements along the current rail corridor without improvement was first undertaken. The analysis shows that the total journey time would be 25.5 hours; total border clearance time of 1.5 hours would match that for the comparison of improved road scenario that takes account of feasible measures to reduce the border clearance time. Most cross-border rail border freight would only travel over a portion of the entire corridor length, for example Phnom Penh to Bangkok. With the purchase of new rollingstock and minor investment in improved infrastructure cross-border rail traffic could be facilitated, possibly reaching around 500,000 tons per annum in the next five years or a little less than 10 percent of total cross-border movements at Poipet by that time.

The improved rail scenario assumes the existing meter gauge track would be upgraded, primarily focusing on overcoming the constraints along the Northern Line (Figure 3.9). The assumed improvements are consistent with proposals of the new *Comprehensive Master Plan on Cambodia Intermodal Transport and Logistics System 2023–2033*. The journey time along the entire corridor by rail would be 21.2 hours, including the same total border clearance time of 1.5 hours, a reduction of 4.3 hours or a 17 percent reduction compared to the existing rail scenario. More importantly, the reliability and capacity of the upgraded railway would be greatly improved. Use of either of these two railway scenarios would allow connection to the planned high-speed railway to be completed between Bangkok and Vientiane, Lao PDR, by 2030 that would also connect to the Lao China Railway.

FIGURE 3.9 Corridor C, Improved Existing Rail: Laem Chabang – Poipet – Phnom Penh – Sihanoukville Port (880 km)



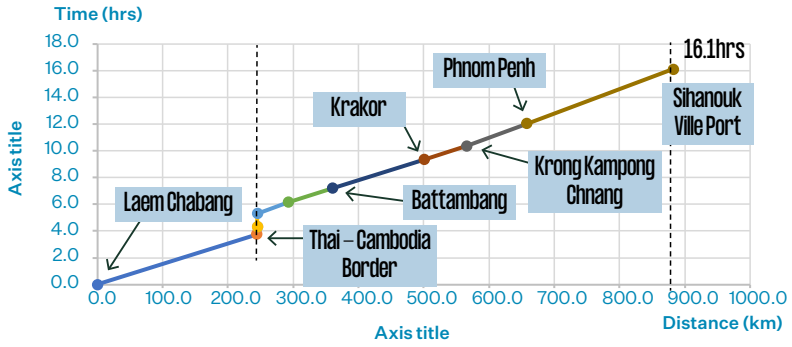
Source: Study team

The comparison road corridor includes highways in Thailand between Laem Chabang Port to the border with Cambodia that are generally in good condition. Within Cambodia from Poipet to Phnom Penh, the main highway is NR5 and is a key section of Asian Highway 1 which connects to Bavet. The entire length of NR5 (408 kilometers) has now been recently upgraded to four-lanes, generally with a median and paved shoulders. Although a new four-lane expressway between Phnom Penh and Sihanoukville Port has been in operation since October 2022, almost all heavy trucks continue to use the existing highway NR4 that remains congested.

The comparison highway scenario assumes border clearance times are 1.5 hours in total reduced from the current 4.0 hours (Figure 3.10).[57] It is also assumed that the average road speed along the entire corridor, which is mainly due to the recent upgrade along NR5, is 55 kilometers per hour (increased from the previous 45 kilometers per hour) giving a total travel time of 16.1 hours. Further, trucks crossing the border are assumed to not have to transship goods due to the use of ASEAN or CBTA permits. For trucks that must transship goods, they would use one of several privately owned dryports in Cambodia that are located along NR5 in close proximity to the Thai-Cambodia border.

FIGURE 3.10

Comparison Road Scenario – Thailand to Sihanoukville Port



Source: Study team

The transport component of logistics cost per ton over the entire corridor length was estimated for the improved rail and the comparison road scenario.[58] Given that the trains can already operate along the Northern Line, the effect on transport costs of a transfer to rail at Poipet and of using rail the whole distance between Laem Chabang and Sihanoukville ports was examined. This third scenario assumed trucks use the improved NR5 and the new expressway between Poipet and Sihanoukville Port, but that goods are transferred to Thai trains at the border.

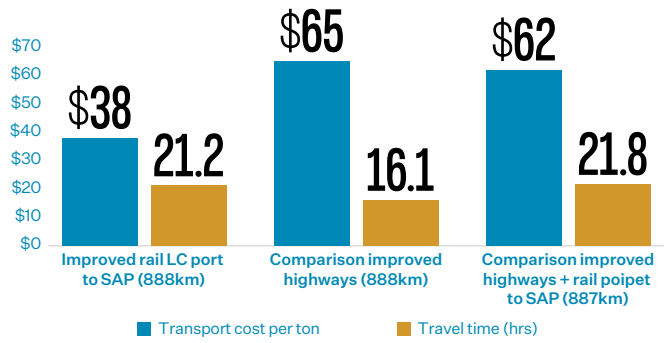
The improved rail scenario offers a 40 percent reduction in transport cost although a 40 percent longer travel time compared to road transport (Figure 3.11). Transshipping goods between truck and trains at the border offers little advantage compared to the highway scenario and performs poorly in terms of transport cost per ton with no speed advantage compared to the improved rail scenario.

57 The improved border clearance time assumes the Thailand clearance time of 0.5 hours remains while the Cambodian side's clearance time is assumed to be reduced from 2.5 hours to 1.0 hour giving a total clearance time of 1.5 hours. This improved time is considered to be quite feasible since the border crossing capacity for immigration and customs clearance has been significantly expanded recently. This same improved border clearance time is assumed to apply to the two railway scenarios.

58 Only accounts for transport operating costs and therefore excludes tolls, customs duties and other logistics charges (e.g., storage, port fees) and logistics company administrative charges and profit.

FIGURE 3.11

Corridor C: Estimated Transport Operating Cost per Ton and Journey Times for Selected Scenarios



Source: Study team

3.3 Summary of Corridor Performance

The main features of each of the three corridors and the potential to improve transport and trade efficiency are summarized in Table 3.2.

For East-West Road (Corridor A), the main improvements needed are along Cambodia's section of the corridor between Siem Reap and Oyadav at the border with Viet Nam. With a cut in border crossing times by 40 percent, the journey time can be reduced by one-third (from 37 to 25 hours). Corridor A also has strategic importance for Cambodia as the only corridor with a connection to Lao PDR in the north of the country. The investment in this corridor does not only fill the regional connectivity gap but also enables this economically underdeveloped part of the country to benefit from enhanced connectivity and link to the regional supply chains. Investment in the corridor can be complemented by improving the condition and resilience of feeder linking to agriculture and production areas, promoting private investment to develop value added and freight consolidation services along the corridor and improving efficiency of logistics and cross-border trade through targeted measures.

There is significant potential to reduce transport costs compared to road use where inland waterway (Corridor B) and railway (Corridor C) can be used. Greater use of inland waterways to connect to Vietnamese ports is estimated to cut transport costs by 50 percent compared to use of the nearby parallel road via Bavet, although travel times would be longer though reasonably reliable assuming customs inspection becomes more predictable. For Corridor C, improvement of the existing rail line, mainly between Poipet and Phnom Penh, would likely also facilitate greater use of this mode since it has the potential to cut freight transport costs by 40 percent.

The strategic advantages of continuing to develop the role of inland waterways along the Mekong and Bassac rivers are clear since they offer efficient and sustainable access to key ports in Viet Nam serving Cambodia's main international markets. Complementing the further expansion of Sihanoukville and Kampot seaports, Cambodia secures a strong logistics connectivity to external markets. Rail transport provides access to Sihanoukville Port for fuel and container transport; and this role can be greatly expanded. At the same time, the role of rail for cross-border transport is in its infancy and has great potential to grow. International road transport is important but is more expensive than waterway, sea, and rail transport although it is highly complementary to these other modes. Importantly, roads serve villages, production zones, and towns that are not served by waterways and railways.

TABLE 3.2

Summary of Corridor Performance

Corridor name and connectivity	*Features*	*Trade role*	*Performance*
Corridor A – East-West Road Laem Chabang – Poipet – Siem Reap – Oyadav – Quy Nhon (1,204 km) (Thailand–Cambodia–Viet Nam; Cambodia–Lao PDR)	Condition – 2 lanes in poor to fair condition between Siem Reap and Oyadav (northeast border with Viet Nam). Thailand section of the corridor is in good condition, and the Viet Nam section is being upgraded with World Bank financing with expected completion by December 2024.	Since the road passes through relatively poor provinces, when improved it has the potential to boost local economies. This corridor provides the only road connectivity between Cambodia and Lao PDR.	With road improvements between Siem Reap and Oyadav in Cambodia and a cut in border crossing time by 40%, the journey time can be reduced from 37 to 25 hours (for the entire corridor Thailand–Cambodia-Viet Nam).
Corridor B – Inland Waterway Phnom Penh – Vipassana Kamsomnor – Cai Mep (428 km) (Cambodia–Viet Nam)	Major trade corridor. Connecting from LM17, the route uses the Mekong River to connect to Cai Mep port in Viet Nam and nearby ports, including Cat Lai Port, Ho Chi Minh City. Improvements to enable greater connection to upstream sub-feeder ports, navigability, safety, and facilitation of cross-border trade movements is needed. Greater use of the Basaac river in future is also a possibility.	Significant corridor for container traffic, bulk cargo, and fuel imports. Since 2015, container traffic using the Mekong River has kept pace with TEU movements along the comparison road corridor via Bavet.	Improved inland waterway transport can cut transport costs by 50% compared to use of road via Bavet, but the travel time would be longer at about 18 hours. As long as efficient trade facilitation leads to reliable travel times shippers would still find waterways with low operating cost attractive for freight transport. Greater use of river-sea vessels (4,000 DWT and 350 TEUs) is possible by using the Mekong Estuary at high tide.
Corridor C – Improved Existing Rail Laem Chabang – Poipet – Phnom Penh – Sihanoukville Port (880 km) (Cambodia–Thailand)	The Northern Rail Line is constrained to an operating speed of 30-40 kph. The existing Southern Rail Line has a higher operating speed (50+ kph).	Most important land-based trade route between Thailand and Phnom Penh (northern section). Connects key agricultural and industrial areas within Cambodia to Sihanoukville Port (southern section).	Use of the improved meter gauge railway has the potential to cut transport costs by 40% compared to use of trucks but with slightly longer travel times.

Source: Study team.

CHAPTER 4 PROPOSED IMPROVEMENT DIRECTIONS

The results of the Sector Assessment (Chapter 2) and Corridor Analysis (Chapter 3) provide important information to assist the RGC to focus on investments that could be implemented in the short-to-medium term with relatively modest financing and yield high impact. This focus complements the priorities set out in the *Comprehensive Master Plan on Cambodia Intermodal Transport and Logistics System 2023–2033.* The prioritized corridors in this study comprise the existing backbone corridors for the three modes – road, rail, and inland waterway – which can be improved with relatively lower costs and in the short-to-medium term (compared to new greenfield corridors). They do not compete but complement each other serving different geographic areas, regional markets, and destinations.

The improvement directions are presented below. The proposed measures are described as having short-term and medium-term priority – with short-term measures generally occurring within a period of three years and medium-term measures after that.

Short-term	Medium-term
• **Enhancing cross-border transport and trade facilitation**	
• Continue to enhance cross-border trade movement efficiency through further automation and implementation of single-stop inspection and a common control area. • Complete the renewal of the early harvest arrangements for the GMS Cross-Border Trade Agreement, further harmonizing national requirements and enhancing CIQ capacity. • Activate the Mekong Navigation Facilitation Committee to overcome constraints in smooth and safe navigation along the waterways between Cambodia and Viet Nam. • Facilitate better data access for investment and policy making.	• Complete the negotiations on the GMS Framework Agreement for Cross-Border Railway Transport Connectivity and, in parallel, finalize key annexes and technical arrangements. • Provide effective bilateral and tri-lateral coordination to facilitate efficient regional, trade, and economic corridors involving updating and maintaining trade facilitation and associated agreements for all modes. • Facilitate efficient multi-modal transport through an effective regulatory framework to ensure appropriate investment and domestic capacity development.
Improving road connectivity	
• Improve Corridor from Siem Reap to Oyadav, at the border with Viet Nam (Corridor A), including cross-border facilities and linked tertiary roads. • Investigate and provide additional traffic management and safety measures along NR4, NR1, and NR5. • Assess the implications for new axle load limits and impact on overloading and infrastructure deterioration.	• Prioritize investment in climate resilience of critical rural roads. • Facilitate developing a modern, safer, more energy-efficient, and lower-emission truck fleet with technical standards that are better harmonized with GMS neighbors.
Developing inland waterways and maritime facilities	
• Ensure the navigability and efficiency of the Mekong River and key ports for domestic and international waterborne trade (Corridor B). • Improve the capacity, safety, and quality of river navigation.	• Develop an adequate end-to-end management system along the main waterways. Enhance consolidation from agricultural and production areas. • Equip the Department of Waterways to efficiently manage inland waterways and enhance the marketing capacity of inland waterways.
Strategically improving the current railway	
• Develop a 3-year rolling business plan to improve the railway sector. • Undertake a value-engineering and feasibility study to determine the optimal level of investment in upgrading the railway, including infrastructure and rollingstock. • Progressively strengthen the capacity of the Department of Railways for management of capital works and maintenance.	• Improve the current meter gauge railway infrastructure and rollingstock (Corridor C), focusing on the Northern Line and facilities to develop new markets. • Complete a new feasibility study for a dual gauge track to PPAP LM17 container port. • Draft a new Railway Law that sets out the legal framework to bring to fruition a modern domestic railway network with high-quality regional connections.

4.1 Cross-Border Transport and Trade Facilitation

Measures are needed to overcome the constraints to efficient cross-border movement along roads, waterways, and railways. The measures listed here are by nature relatively low cost and are mainly operational and management measures:

Short-term

- ***Continue to enhance cross-border trade movement efficiency across land borders*** through further automation, reinstatement of the green lanes, implementation of Cambodian single window, and implementation of single stop inspection and a common control area. Clearance times at borders can be time consuming due to various factors such as insufficient use of automation, residual inefficiencies in compliance processes, differences in operating times on each side of a border, and inadequate technical capacity.

- ***Complete the renewal of the early harvest arrangements for the GMS Cross-Border Trade Agreement*** along with further harmonization of national requirements and enhanced capacity building of Customs, Immigration and Quarantine Agencies at the border. These improvements would complement the ASEAN Agreement on exchange of traffic rights. However, Cambodian truck operators appear reluctant to renew their permits with MPWT under the ASEAN Agreement because of the difficulty of Cambodia's aged truck fleet meeting Viet Nam and Thailand's technical requirements for trucks.

- ***Through enhanced bilateral coordination, activate the Mekong Navigation Facilitation Committee*** defined in the 2009 Waterway Transport Agreement, to overcome constraints in coordinating smooth and safe navigation along the waterways between Cambodia and Viet Nam. Administrative and operational constraints, such as customs clearances and nighttime closures, call for collaborative assessments and solutions by both nations. Straightforward solutions are available to address transit container delays such as implementing Smart Seals on containers.

- ***Facilitate better data access for investment planning and policy making,*** for example: (i) better and more up-to-date data on trade volumes by type and on trade movements by mode at a national level; (ii) use of individual border crossings; (iii) features and improvement needs at border crossings related to causes of undue delay in facilitating border clearance; and (iv) traffic volumes, traffic composition and growth trends. It would also be beneficial for MPWT to strengthen its monitoring of the freight logistics industry (all modes) by improved collection of data on variables such as: (i) empty running; (ii) weight-based–lading factor (ratio of ton-kms moved to the available m^3-km carrying capacity); and (iii) overloading (proportion of vehicle-kms travelled with a load in excess of legal weight limits).

Medium-term

- ***Complete the negotiations on the Framework Agreement for Cross-Border Railway Transport Connectivity for the Greater Mekong Subregion.*** Work with other GMS countries, likely with continued support of the Asian Development Bank, to complete negotiations and ratifications of the draft FACBRTC and in parallel finalization of key annexes and technical arrangements.

- ***Facilitate efficient multi-modal transport through an effective regulatory framework to ensure appropriate investment and the development of domestic capacity to provide efficient and safe logistics services.*** Cambodia's liberal policy on allowing international logistics firms to establish operations in Cambodia has provided a boost to domestic logistics efficiency in recent years and should be continued. Further, an appropriate investment and regulatory framework would also foster the growth of the domestic logistics industry through technology and knowledge transfer.

- ***Provide effective bilateral and tri-lateral coordination to facilitate efficient regional, trade and economic corridors*** involving updating and maintaining trade facilitation and navigation agreements for all modes; and coordinating maintenance and new investment along regional corridors to ensure adequate connectivity and efficiency.

4.2 Develop Resilient and Connected Transport Network

The overall approach advocated is to develop connected transport networks focusing on completing the road network and improving its safety, further developing waterways, maritime transport, and expanding the role of rail, as follows:

- ***Develop primary, secondary, and tertiary road networks*** **by focusing on current gaps in links between the key economic zones and international gateways.** Ensure such networks have sufficient established alternatives at times of severe weather events. Improve traffic management and safety along highways and rural roads.
- ***Maintain and develop further the current trunk and feeder waterways*** **that have demonstrated efficiency and sustainability advantages over the other modes and are well-oriented to the main international markets.**
- ***Take advantage of the immediate opportunity to achieve enhanced utilization of the current railway*** **with modest investment and to expand its role in cross-border movements (with Thailand and with other markets via Sihanoukville Port).**
- ***Inter-link waterways, roads, and railways and new multi-modal terminals*** **thus developing multi-modal networks that are inherently more resilient than individual networks working alone.**

Road Connectivity

Short–term

Improve over 400 kilometers of NR64 and NR78 from Siem Reap to Oyadav, at the border with Viet Nam (Corridor A). The road is in poor-to-fair condition and is the key gap in the international road corridors. The aim is to improve the quality and resilience of the two-lane road plus shoulders within the existing 10 meter right of way. The 2022 feasibility study proposed that the road be conventionally procured but maintained using an Output- and Performance-Based Road Contract for an as yet to be determined period. Preparation of a final business case, safeguards assessment, design, and contract documents for both construction and the Output- and Performance-Based Road Contract is needed once a decision to implement the project is made. These highway improvements could be enhanced with complementary secondary road improvements connecting to agricultural production zones. It is equally important to investigate the feasibility of new logistics centers at Siem Reap and new dry ports closer to the border crossing (for example on Corridor A) near Oyadav at the border with Viet Nam or in other locations where demand for these services is unmet.

Investigate and provide additional traffic management and safety measures along NR4, NR1, and NR5. Identification and design of potential measures should be carried out:

- ***NR4 continues to experience significant recurrent congestion due to continued heavy truck use even with the new parallel expressway (Phnom Penh–Sihanoukville Port).*** There is potential for improved traf-

fic management and safety measures along NR4. Although extensive rehabilitation and expansion of NR5 to 4 lanes (Poipet – Phnom Penh) has been completed there is little segregation from roadside land use. Improved traffic management and safety measures are also likely to be needed on NR4.

- ***Traffic management and safety measures would be needed along NR1 to Bavet even when the new expressway is completed.*** Extensive rehabilitation and maintenance of NR4, and NH1 between Poipet and Bavet respectively, has been ongoing over the last decade, and new four-lane expressways between Phnom Penh and Ho Chi Minh City are underway. However, since high truck use of NR1 is likely even after the expressway is completed, and there is little segregation of adjacent land use, modest capacity expansion, traffic management, and safety measures would be required along NR1.

- **Assess the implications for new axle load limits and impact on overloading and infrastructure deterioration.** Harmonization of truck axle load limits among the GMS countries is worthwhile but it would be advisable for MPWT to assess the full implications on the truck industry, on road assets and other factors. Deployment of weigh-in-motion technology along key international corridors (e.g. NR1/ AH21) would be an important means of monitoring the incidence of overloading.

Medium–term

Prioritize strategic investment in climate resilience of critical rural roads. With a massive rural road network of 47,920 km, Cambodia must spend its rural road investment strategically by focusing on communes where the rural accessibility gap is most severe and where climate risks have the highest negative impacts. It is recommended that the RGC develop a strategy for the prioritization of investment and maintenance on critical part of its network focusing on climate resilient accessibility gains.

Inland Waterway and Maritime

Facilitate the development of a modern, safer, more energy-efficient and lower-emission truck fleet. In the medium term, a reduction in the punitive import taxes for trucks would reduce the price of modern, higher-payload trucks that are more likely to meet Thailand and Viet Nam's technical standards thus facilitating more seamless cross-border truck operations.

Short–term

Ensure the navigability and efficiency of the Mekong River (Corridor B) for domestic and international waterborne trade. These improvements would further expand the trade capacity between Phnom Penh and Cai Mep Port in Viet Nam that directly serves East Asian and North American markets. At the same time, greater use of these waterways would significantly reduce transport costs compared to use of road via Bavet.

Improve the capacity, safety and quality of river navigation. Within the framework of the joint work under the Mekong Navigation Facilitation Committee, start preparing:

- **Joint planning between Cambodia and Viet Nam for river-regulating works.**
- **Rules and procedures supporting the safe navigation of vessels on the Cambodian Mekong River System.**
- **A technical regime for approval of plans and construction of Cambodian cross-border vessels.**
- **Reporting of marine accidents on the Mekong River System.**
- **Prevention of oil pollution from ships along the Mekong River System.**
- **Joint work on facilitating border passages such as implementation of Smart Seals in containers (refer to Box 2.2).**

Medium–term

Develop an adequate end-to-end management system along the main waterways, with the backing of proper studies and bilateral cooperation, including link the cross-border Mekong Route/Phnom Penh with the upstream sections of the Mekong/Kampong Cham hinterland, and on the Tonle Sap/ Kampong Chhnang hinterland:

- Conduct studies and update the waterway classifications based on regular hydrodynamic modelling and engineering studies on the potential for river improvements.
- Dredge the navigation 'hot spots' (depending on the situation, either performance-based dredging or purchase of two-cutter suction dredgers 500 with ancillary equipment).
- Install, where appropriate, permanent river-regulating structures.
- Conduct studies on the sub-feeder terminals and their access (road and rail).
- Develop Kampong Chhnang sub-feeder terminal.

Equip the Department of Waterways to efficiently manage inland waterways:

- Develop the capacity of the Inland Waterways Department to manage waterway and maritime safety and to take the responsibility of ensuring adequate access of the waterways to the ports.
- Develop a River Information System to provide modern day/night aids to navigation, modern communication (VHF/radar), and vessel tracking systems (for example, Automatic Information System).
- Upgrade the hydrographic facilities and Inland Electronic Navigational Charts (IENC) with fast transit logistical support boats.
- Establish an environmental focal point to promote "clean" river transportation, focusing on strategic prevention of environmental damage from waterway infrastructures or from shipping or port accidents**.** Reducing emissions on the vessels and in ports and the introduction of green ships with low emissions would be useful. This environment focal point would also be able to prepare Dredging Environmental Management Procedures, and Waste Management Plans.

Enhance the marketing and capacity of inland waterways as a sub-sector:

- Create an independent agency to promote and market inland waterway transport (for example, inland waterway transport promotion center), reflecting existing established models worldwide.
- Develop an inter-university program in waterborne transport operations and management to develop high-skilled personnel.
- Re-instate the Cambodian ship-building industry (efficient low-emission barges). A useful pilot project could be the introduction of reinforced sea-river barges (with green ship technologies).

Railway Infrastructure and Operations

Short–term

Undertake value-engineering and feasibility study to determine the optimal level of investment to upgrade the railway. Of the total potential investment in fixed infrastructure identified by the *Comprehensive Master Plan on Cambodia Intermodal Transport and Logistics System 2023–2033*, up to US$250 million would likely be required to upgrade the Northern Line fully including upgrading the 48 passenger railway stations, strengthening track and replacing old railway bridges, that constrain the axle load to 15 tons compared to the Southern Line's 20 tons, and continuously welding the railway track as for the Southern Line. However, based on discussions with Royal Railway, a cheaper more targeted investment could be usefully carried out as a first phase toward the larger investment. In reaching this potential, Phase 1 works should be determined following an appropriate feasi-

bility study examining the full upgrading of the Northern Line. Following the feasibility study, proposed improvement works would need to be designed and project preparation (business case, safeguards assessment, procurement and governance options) carried out. These improvements would facilitate faster, more reliable freight transport movements. New freight train rollingstock would be needed to realize the potential provided by these improvements.[59]

Determine the share of the investment that should be borne by the Government and Royal Railway. The Government of Cambodia owns the railway fixed infrastructure, and the private Royal Railway is responsible for rollingstock and infrastructure rehabilitation, maintenance, and improvement. A potential proposed investment of about US$765 million for the upgrading of the entire railway has been identified by the new *Comprehensive Master Plan on Cambodia Intermodal Transport and Logistics System 2023–2033*. The potential investments include an estimate for new freight train rollingstock that is the responsibility of Royal Railway indicating a potential fixed infrastructure investment of about US$500 million.[60]

Develop a 3-year rolling business plan for the improvement of the railway sub-sector: (i) investment in infrastructure; (ii) investment in rollingstock; (iii) new policies to promote a sustainable shift to rail transport; (iv) legislation to underpin new policies, and (v) new institutional arrangements to govern sector development and standards.

Progressively strengthen the capacity of the Department of Railways for the management of:

- **Capital investment management for railway network development.**
- **Maintenance works and programs.**

Medium-term

Improve the current meter gauge railway infrastructure and rollingstock (Corridor C): *Improving the existing railway, focusing initially on the Northern Rail Line*, to increase domestic freight operations and to cross-border train operations between Thailand and Cambodia. More detailed value engineering will be required to determine priority works.

Complete a new feasibility study for a dual gauge track to PPAP LM17 container port. This line has already been designed. The design would need to be updated as well as carrying out sufficient due diligence (business case, procurement and safeguards assessment). The total length of the line would be about 42 kilometers allowing for integration with the existing railway.

Undertake technical and economic feasibility to prioritize new railway proposals:

- **Undertake detailed feasibility studies for important projects.**
- **Initiate bilateral agreements with neighboring countries to jointly study new cross-border lines.**
- **Identify multi-lateral or other development partners to assist the coordination of these bilateral efforts and to assist the financing of the feasibility studies.**

Draft a new Railway Law that sets out the legal framework to bring to fruition a modern domestic railway network with high-quality regional connections. Subjects that should be covered include the roles of the public and private sector, the principles for investment including in regional connections, renewal and operations, the framework for regulation of more than one operator and the approach to setting of technical standards. The subject matter is complex, and the potential contents would need to be discussed among the relevant government departments and stakeholders. Subject matter experts should also be desirably involved in this process and during the drafting of the law. Technical assistance from a development partner to provide this expertise and enhancement of the capacity of local staff would be valuable.

59 An additional 6 freight train sets each consisting of two locomotives and 54 wagons would cost about US$60–80 million, assuming second hand equipment is purchased, and a doubling of the rail freight task to about two million tons per year is permitted.

60 Phased-in according to demand, each freight train could carry about 125,000 to 150,000 tons per year indicating that the rail freight task could grow from today's 900,000 tons to over 4 million tons per year.