Design of a Master Plan for Regional Waterborne Transport in the Mekong River Basin

Cambodia • Lao PDR • Thailand • Viet Nam

VOLUME I

Baseline Conditions, Forecasts,
Development Scenarios and Action Plan



Mekong River Commission

Navigation Programme

Cambodia • Lao PDR • Thailand • Viet Nam
For sustainable development

MEKONG RIVER COMMISSION

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FINAL REPORT

VOLUME I

(Baseline Conditions, Forecasts, Development Scenarios and Action Plan)

December 2015

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ABBREVIATIONS

ADB	Asian Development Bank
ADN	Accord Européen relative au transport international des marchandises dangereuses par voie de navigation intérieure (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways)
AEC	ASEAN Economic Community
AFAMT	ASEAN Framework Agreement on Multimodal Transport
AIS	Automatic Identification System
AM	Ante Meridiem (before noon)
ASEAN	Association of Southeast Asian Nations
APSC	ASEAN Political Security Community
ASCC	ASEAN Socio Cultural Community
AtN	Aids to Navigation
AusAID	Australian Agency for International Development
BDP	(MRC) Basin Development Plan
CBTA	Cross-border Transport Facilitation Agreement
CCNR	Central Commission for the Navigation on the Rhine
CCTV	Closed Circuit Television
CFS	Container Freight Station
CMI	Cambodian Maritime Institute
CMIT	Cai Mep International Terminal
CNMC	Cambodian National Mekong Committee
CNTR	Container
CSCP	Chiang Saen Commercial Port
C-TPAT	Customs-Trade Partnership against Terrorism
CV	Cheval Vapeur
DEMP	Dredging Environmental Management Procedure
DG	Dangerous Goods
DLVN	Vietnamese Text Measurement Techniques
DWT	Deadweight Ton
ECDIS	Electronic Chart Display and Information System
EDI	Electronic Data Interchange
EHIA	Environmental Health Impact Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan

ENC	Electronic Navigational Charts
EP	Environmental Programme
EPC	Environmental Protection Commitment
ERM	Emergency Response Management
ERP	Emergency Response Plan
ESCAP	Economic and Social Commission for Asia and the Pacific
ESIA	Environmental and Social Impact Assessment
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
EU	European Union
FCL	Full Container Load
Ft	Foot (1 foot = 0,3048 m)
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GMS	Greater Mekong Sub-region
GMT	Greenwich Mean Time
GPS	Global Positioning System
GRT	Gross Register Tonnage
GT	Gross Tonnage
Ha	Hectare
HCCP	Hachiang Commercial Port
HCMC	Ho Chi Minh City
HP	Horse Power
Hr	Hour
IC	International Consultant
IC - FS	International Consultant Fleet and Waterway Safety
IC - PD	International Consultant Port Development
IC - RD	International Consultant River Design
IC - SE	International Consultant Socio-Environmental
IC – TE	International Consultant Transport Economy
IC - TL	International Consultant Transport Planner / Team Leader
ICD	Inland Clearance Depot
ICDPR	International Commission for the Protection of the Danube
IEE	Initial Environmental Examination
IEIA	Initial Environmental Impact Assessment
ILA	International Legal Advisor to the Navigation Programme
IMDG	International Maritime Dangerous Goods

IRWT	Inland Rural Waterway Transport
ISPS	International Ship and Port Facility Security
ITA	International Technical Advisor to the Navigation Programme
IWRM	Integrated Water Resources Management
IWT	Inland Waterway Transport
IWTD	Inland Waterway Transport Department (Cambodia)
JCCCN	Joint Committee on Coordination of Commercial Navigation (on the Lancang – Mekong River)
JICA	Japan International Cooperation Agency
KAMSAB	Kampuchea Shipping Agency and Brokers
KOICA	Korean International Cooperation Agency
LAD	Least Available Depth
Lao PDR	Lao People's Democratic Republic
LCL	Less Container Load
LCP	Laem Chabang Port
LMB	Lower part of the Mekong Basin
LMRB	Lancang – Mekong River Basin (from the source to the sea)
LOA	Length over All
LoLo	Lift-On / Lift-Off
LPG	Liquefied Petrol Gas
LRD	Least Required Depth (Required Draft + Keel clearance)
MC	(MRC) Member Country
MD	Marine Department
MEA	Millennium Ecosystem Assessment
MI	Mekong Institute, Khon Kaen, Thailand
MIME	Ministry of Industry, Mines and Energy (Cambodia)
MMMAP	Multi-Media Monitoring and Assessment Programme
MNFC	Mekong Navigation Facilitation Committee (Cambodia – Viet Nam)
MOE	Ministry of Environment
MONRE	Ministry of Natural Resources and Environment (Lao PDR, Viet Nam)
MOST	Ministry of Science and Technology
MOT	Ministry of Transport (Thailand and Viet Nam)
MOU	Memorandum of Understanding
MOWRAM	Ministry of Water Resources and Meteorology (Cambodia)
MP	Master Plan
MPWT	Ministry of Public Works and Transport (Lao PDR and Cambodia)
MRB	Mekong River Basin (from the China-Lao border to the Sea)

MRC	Mekong River Commission
MRCS	Mekong River Commission Secretariat
MSDS	Material Safe Data Sheet
MT	Metric Ton
MTO	Multimodal Transport Operator
MOU	Memorandum of Understanding
MV	Motor Vessel
MVIC	Mekong Vessel Inspection Checklist
MVIG	Mekong Vessel Inspection Guidebook
MVIS	Mekong Vessel Inspection System
NAB	Navigation Advisory Board
NAP	Navigation Programme (MRC)
NAPC	Navigation Programme Coordinator (at MRCS)
NCC	National Navigation Coordinator (at the NMCs)
NCDM	National Committee for Disaster Management (Cambodia)
NCT-LM17	New Container Terminal LM17 (Cambodia)
NE	National Expert
NE-FS-C/L/T/V	National Experts Fleet and Navigation Safety–Cambodia/Lao PDR/Thailand/Viet Nam
NE-PD-C/L/T/V	National Experts Port Development–Cambodia/Lao PDR/Thailand/Viet Nam
NE-RS-C/L/T/V	National Experts River Design–Cambodia/Lao PDR/Thailand/Viet Nam
NE-SE-C/L/T/V	National Experts Socio-Environmental–Cambodia/Lao PDR/Thailand/Viet Nam
NE-TE-C/L/T/V	National Experts Transport Economy–Cambodia/Lao PDR/Thailand/Viet Nam
NEQA	National Environmental Quality Act
NGO	Non-Governmental Organisation
NM	Nautical Mile
NMC	National Mekong Committee
NRT	Net Register Tonnage
NSCP	Navigation Spill Contingency Plan
NSDP	National Strategic Development Plan
NSEC	North-South Economic Corridor
NT	Net Tonnage
NTSP	Non Timber Forest Products
NVOCC	Non Vessel Operating Common Carrier
O&G	Oil and Gas
ONEP	Office of Natural Resources and Environmental Policy and Planning
OSP	Office of the Secretariat in Phnom Penh
OSRP	Oil Spill Response Plan

OSV	Office of the Secreatariat in Vientiane
PAS	Sihanoukville Autonomous Port
PAT	Port Authority of Thailand
PCD	Pollution Control Department
PIANC	World Association for Waterborne Transport Infrastructure
PM	Post Meridiem (after noon)
PPAP	Phnom Penh Autonomous Port
PPE	Personal Protective Equipment
PSHEM	Port Safety, Health and Environmental Management
PVC	Polyvinylchloride
QCDP	Vietnamese Local Technical Regulation
QCVN	Vietnamese National Technical Regulation
RAP	Regional Action Plan
RIS	River Information Services
RNCU	Regional Navigation Coordination unit
RTG	Rubber Tired Gantry Crane
SE	Socio-Environmental
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SIA	Social Impact Assessment
SOPEP	Shipboard Oil Pollution Emergency Plan
STAMEQ	Directorate for Standards, Metrology and Quality of Viet Nam
Sq	Square
SRT	State Railway of Thailand
STS	Ship-to-Shore
SWL	Safe Working Load
TAC	Terminal Audit Checklist
TbEIA	Trans-boundary Environmental Impact Assessment
TCCS	Organisation's Standard (Viet Nam)
TCVN	Vietnamese National Standard
TEU	Twenty foot Equivalent Unit
TMD	Thailand Marine Department
TOS	Terminal Operating System
TWSE	Thanaleng Warehouse State Enterprise
UN	United Nations
UNEP	United Nations Environmental Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific

USA	United States of America
VAT	Value Added Tax
VER	Vessel Emergency Response
VGS	Vessel Guidance System
VHF	Very High Frequency
VIC	Vessel Inspection Checklist
VIG	Vessel Inspection Guidebook
VIWA	Viet Nam Inland Waterway Administration
VLP	Vientiane logistics Park
VND	Vietnamese Dong
VR	Viet Nam Register
VTS	Vessel Traffic Services
WWF	World Wildlife Fund
WQE	Water Quality Emergency
WQMN	Water Quality Monitoring Network

DEFINITIONS

GREATER LANCANG-MEKONG RIVER BASIN

Refers to the area drained by the Lancang-Mekong River, from its source in PR China to its Vietnamese deltaic mouth in the Sea.

MEKONG RIVER BASIN (MRB)

Refers to the area drained by the Mekong River, including all tributaries, between the PR China-Myanmar-Lao PDR border and the Sea.

UPPER PART OF THE MEKONG RIVER BASIN

Refers to the part of the MRB between the PR China-Myanmar-Lao PDR border and the Khone Falls (Lao PDR-Cambodia border).

LOWER PART OF THE MEKONG RIVER BASIN

Refers to the part of the MRB between the Khone Falls and the Sea.

GREATER MEKONG SUB REGION (GMS)

A development project formed by the Asian Development Bank (ADB) in 1992 that brought together the six states of the Mekong River basin, namely Cambodia, Lao PDR, Myanmar, Thailand, Viet Nam, and Yunnan Province, China. The GMS is a natural economic area bound together by the Mekong River, covering 2.6 million square kilometres and a combined population of around 326 million.

FLEET

A number of vessels having a shared origin, purpose, or area of operation. A large group of ships under the same management, a number of ships belonging to a company. Number of inland waterway vessels registered at a given date in a country and authorized to use inland waterways open for public navigation.

VESSEL DESIGN

This refers to designing a vessel for an intended service such as oil transport (tanker), general cargo transport or passenger transport (ferry) by a naval architect according to safety rules and standards laid down by government agencies and classification societies.

A ship, boat or offshore structure must be stable, seaworthy and have adequate strength in all weathers as well as the hydrodynamic performance to give economic propulsion and safe and comfortable motion in all sea states.

Typical design issues are technical requirements, functions, analyses, materials, production processes, quality, reliability, appearance and costs, hazard identification and risk assessment techniques.

DEADWEIGHT

The weight (in tonnes) of all the cargo, fuel, dry provisions, supplies, etc. carried on board the ship. In other words, it is the “displacement” of the vessel minus the “lightweight” (see lightweight below).

Deadweight is a good indication for ship owners and clients of how much revenue the vessel is capable of generating.

DISPLACEMENT

The total weight of the volume of water a ship “displaces” when it floats in the water.

LIGHTWEIGHT

The weight of the ship when it was built in the shipyard including all framing, machinery, decking, etc. However, lightweight tonnage does not include the weight of any consumable such as fuel, water, oil, or supplies.

GROSS TONNAGE

Gross Tonnage (often abbreviated as GT, G.T. or gt) is a unitless index related to a ship's overall internal volume. Gross Tonnage and Net Tonnage are terms normally used for sea-going vessels only. Gross Tonnage, along with Net Tonnage, was defined by *The International Convention on Tonnage Measurement of Ships, 1969*, adopted by the International Maritime Organization in 1969, and came into force on 18 July, 1982. These two measurements replaced Gross Register Tonnage (GRT) and Net Register Tonnage (NRT) in 1994. Gross Tonnage is calculated based on the volume of all enclosed spaces of the ship in cubic meters and is used to determine things such as a ship's manning regulations, safety rules, registration fees, and port dues, whereas the older Gross Register Tonnage is a measure of the volume of certain enclosed spaces.

NET TONNAGE

Net Tonnage (NT) is a dimensionless index calculated from the total moulded volume of the ship's cargo spaces by using a mathematical formula. Defined in *The International Convention on Tonnage Measurement of Ships* that was adopted by the International Maritime Organization in 1969, the Net Tonnage replaced the earlier Net Register Tonnage (NRT) which denoted the volume of the ship's revenue-earning spaces in "register tonnes", units of volume equal to 100 cubic feet (2.83 m^3). Net Tonnage is used to calculate the port duties and should not be taken as less than 30 per cent of the ship's Gross Tonnage.

Net tonnage is not a measure of the weight of the ship or its cargo, and should not be confused with terms such as deadweight tonnage or displacement. Also, unlike the net register tonnage, the net tonnage has no unit and thus cannot be defined as "tonnes" or "net tonnes".

NAVIGATION SAFETY

Means the safety, efficiency and sustainability of inland waterway transport, including rules, regulations and guidelines for inland waterway vessels and the crew, best known working-practices for operations and recommendations, management of vessels and navigation conditions and restrictions of the waterway and the infrastructure.

SAFETY OF WATERWAYS

Means safety on the waterway provided by waterway infrastructure (locks, bridges, buoys and beacons, leading lights, etc.), Search and Rescue Organization, Aids to Navigation (AtN), Automatic Identification System (AIS), Vessel Traffic Services (VTS) and River Information Services (RIS), Navigation Rules and other regulations.

DANGEROUS GOODS

Those substances and articles that are prohibited for carriage by applicable legislation or authorized only under the conditions prescribed therein.

EMERGENCY RESPONSE MANAGEMENT BY VESSEL OPERATORS

Procedures to identify, describe and respond to potential emergency situations. The shipmaster and crew shall be aware of such operating procedures in the event of various types of emergencies, such as fire or explosion in cargo tanks or pump room, fire in the engine room, fire in the accommodation, the collapse of a person in a tank, the tanker breaking adrift from her berth, emergency release of a tanker from her berth, oil spill, man overboard, abandon ship or collision and grounding.

EMERGENCY PREPAREDNESS ON BOARD

Emergency preparedness includes a cargo stowage plan, a general arrangement plan and a firefighting equipment plan and the necessary life-saving and firefighting equipment. Extensive training shall be carried out in order to have the necessary experience and knowledge on board on how to handle a certain emergency. In case of an oil spill, the Shipboard Oil Pollution Emergency Plan (SOPEP) should be used.

EMERGENCY RESPONSE MANAGEMENT BY AUTHORITIES

To assist relevant authorities in managing the inland waterways (its ports, terminals and the traffic) a legal framework is needed. Normally government agencies such as inland waterway authorities, coast guards and port authorities can promulgate and enforce regulations. Such government agencies can enforce and control transport on the Mekong River including emergency response management. The liaison, coordination and cooperation between existing relevant authorities-- such as the coast guard, Vessel Traffic Center, national and local rescue teams and fire brigades-- regarding their respective areas of responsibility is vital.

STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

An assessment of environmental impacts and risks associated with policies, programs and plans. An SEA may assess multiple policies, programs and plans within one study area such as a river basin.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Analyses in an integrated manner all potential project impacts on physical, biological, socio-economic and physical cultural resources, and identifies and addresses risks in terms of institutional capacity and commitment to managing environmental impacts.

SOCIAL IMPACT ASSESSMENT (SIA)

Analyses the social impacts of infrastructure projects and other development interventions.

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A plan that guides the implementation of environmental management and mitigation measures. It contains the following key elements: mitigation measures, implementation and monitoring program, cost estimates, resource requirements, budget, and institutional arrangements.

ENVIRONMENTAL MONITORING PLAN

A plan that details environmental monitoring and reporting requirements, including parameters to be measured, methods, sampling locations, frequency of measurements, detection limits and definition of thresholds that will signal the need for corrective actions; typically a part of an EMP.

ENVIRONMENTAL PROTECTION COMMITMENT (EPC)

Where an EIA is not required, the operator shall prepare an EPC outlining the commitment to environmental protection.

SOCIAL AND NATURAL IMPACT ASSESSMENT (SNIA)

Lao PDR's Environmental Protection Law (2013) used a SNIA, which is similar to an EIA (see definition).

PORT

For the purposes of this document, a Port refers to any place on a waterway with loading, discharging, transfer or storage facilities for goods in bulk or packaged inside containers.

DRY PORT

A Dry Port is an intermodal terminal situated in the hinterland, servicing a region connected with one or several ports by rail and/or road transport and offering specialised services between the Dry Port and the overseas destinations. Normally the Dry Port is container-oriented and supplies all logistics facilities, which are needed for shipping and forwarding agents in a port.

DEADWEIGHT TONNAGE

Deadweight Tonnage is a measure of how much weight a vessel is carrying or can safely carry. It is the sum of the weights of the cargo, fuel, fresh water, ballast water, provisions, passengers, and crew.

FULL CONTAINER LOAD (FCL)

If an exporter has goods to accommodate in one full container load, he books an FCL to stuff his cargo. In an FCL cargo, all the goods in a container are owned by one shipper. In an FCL owned by one shipper, the cargo in the container does not need to be fully loaded. If the cargo in the container is half loaded or quarter loaded and is booked by one shipper under one shipment, the said shipment is called FCL shipment.

HEALTH AND SAFETY

Conditions and factors that affect the wellbeing of employees, temporary workers, contractor's personnel, visitors and any other person in the workplace.

LESS CONTAINER LOAD (LCL)

Under an LCL cargo, wherein a shipper does not have enough goods to accommodate in one full container, he books cargo with a consolidator to consolidate his goods along with goods of other shippers. This type of shipment is called LCL shipment. The said consolidator arranges a fully loaded container (FCL), and consolidates the shipments of other shippers and delivers each shipment to the final destination by separating each shipment at the final destination.

MULTIMODAL TRANSPORT

Multimodal transport is a method of transportation of goods from Point A to Point B using multiple modes of transportation, covered under one bill of lading. This Point A and Point B are in different countries. Multiple modes of transport include road, rail, air and sea.

NON VESSEL OPERATING COMMON CARRIER (NVOCC)

A NVOCC is a cargo consolidator who does not own any vessel, but acts as a carrier legally by accepting required responsibilities of a carrier who issues his own bill of lading (or airway bill), which is called House Bill of lading under sea shipment and House Airway Bill under air shipment.

STANDARD

A Standard is a document that sets out requirements, specifications, guidelines and characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.

TECHNICAL STANDARD

A Technical Standard is an established norm or requirement in regard to technical systems. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes and practices.

TWENTY FOOT EQUIVALENT UNIT (TEU)

TEU or “twenty foot equivalent unit” is a standard container size that can be loaded and sealed onto ships, railroad cars, trucks, and planes. The dimensions of a TEU are 20 ft (length) × 8 ft (width) × 9 ft (height). TEU is used as a standard unit to describe carrying capacity of a cargo ship or the terminal's handling capacity.

EXECUTIVE SUMMARY

The Mekong River is a source of valuable natural resources and has extensive natural navigation potential. Waterborne transport along the Mekong River has served as one of the main modes of transportation between communities in the riparian countries since they first settled along its embankments, many centuries ago. As river traffic is comparatively cheap, reliable and an ideal natural facility, navigation along the Mekong River has been significant for travelling, trading and gaining access to natural resources and social facilities such as schooling and health.

The Mekong River Commission (MRC) continues to stress the importance of investing in the waterborne transport sector to create a better livelihood for future generations and the formulation of a "Master Plan for Regional Waterborne Transport in the Mekong River Basin" is crucial at this stage in order to attract investments and realize additional regional trade potential.

The **main objective** of the project is *"To design a short-term and long-term development programme which will rehabilitate and improve the national and international transport network using the Mekong River Basin in the MRC Member Countries"*. In view of the multi-modal transport situations, opportunities and prospects, and the importance of including the whole transport network into the strategy, the essential transport corridors in the Mekong Region also need to be taken into account, even if they are located outside of the Basin.

The overall approach for the design of the Master Plan consists of six parts:

(1) **Problem definition,** including the assessment of the approach and methodology for the design of a "Master Plan for Regional Navigation on the Mekong River Basin" with all stakeholders in order to draft the "Inception Report".

(2) **Data collection,** including data and information on the current economic situation with planned and ongoing projects, but also for vessels and fleet, waterway design, waterway safety, port development, socio-environmental aspects and legal aspects in order to draft the "Current Situation and Baseline Conditions Report".

(3) **Economic forecast,** describing the current situation and a short-term and long-term multimodal economic forecast in order to draft an "Economic Assessment Report".

(4) **Development Scenarios,** where a future situation assessment for waterborne transport activities should lead to a short-term (5 years) and long-term (20 years) development scenario for fleet, waterway design, port development and waterway safety.

(5) **Action Portfolio,** where, next to initiatives for regional cooperation, legal and socio-environmental actions, projects and actions have to be identified for fleet, waterway design, port development and navigation safety in order to achieve the proposed short-term and long-term development scenario(s).

(6) **Action Plan,** where for all actions their feasibility (economic cost-benefit and socio-environmental assessment) has to be considered and stakeholders' involvement should lead to a prioritised action plan and investment programme.

This "Final Report" describes the data gathered and information on the actual situation of Waterborne Transport on the Mekong River, the Economic Assessment and Forecasts, the Development Scenarios and the Action Plan, including the ongoing and planned projects for the near and further future.

In November 2015, the draft final reports for the "Master Plan for Regional Waterborne Transport on the Mekong river Basin" have been submitted to the MRC Member Countries for review and comments. These final reports also formed the basis for regional discussions that took place at the

"Regional Final Navigation Master Plan Workshop" held in Bangkok, Thailand on 18 and 19 November 2015.

The Delegations represented at this Workshop reached a common agreement on the following conclusions, summarizing the workshop outcome as follows:

(1) The Meeting has reviewed and agreed with the Final Draft Master Plan technically. The Final Document will be submitted to the MRC Joint Committee for final approval after the Meeting comments and suggestions are incorporated;

(2) A "Regional Mekong Navigation Centre (RMNC)" will be established in 2016 under the umbrella of the MRC as a mechanism for the coordination and implementation of the Master Plan;

(3) The RMNC will assist the MRC Member Countries in the search for funding opportunities;

(4) The RMNC will assist the MRC Member Countries in the coordination and implementation of the Master Plan, including the Regional Action plan (RAP) for carriage and handling of dangerous goods and the Training Plan to implement the activities under the MRC Navigation Programme;

(5) The countries concerned will conduct the actions needed for the progressive removal of physical obstacles to navigation duly taking into account environmental and social aspects;

(6) The RMNC will assist the Lao PDR and Thailand in the setup, and Cambodia and Viet Nam in the implementation of bilateral waterborne transport agreements;

(7) The RMNC will assist the MRC Member Countries in the harmonization of Inland Waterway Transport, Port and Navigation Safety rules and regulations;

(8) The MRC Member Countries take the initiative to implement the National Actions under the Master Plan;

(9) The RMNC will assist the MRC Member Countries in the development of Climate Change adaptation measures, necessary to protect port and navigation infrastructures along the Mekong River;

(10) The RMNC will assist the MRC Member Countries in the collection and management of data and information to support planning and policy formulation and to provide daily services for safe and efficient navigation on the Mekong River System via a harmonised "River Information Service";

(11) The RMNC will assist the MRC Member Countries in the development of promotional activities and close co-operation with potential users, investors and other stakeholders in the field of navigation on the Mekong River System.

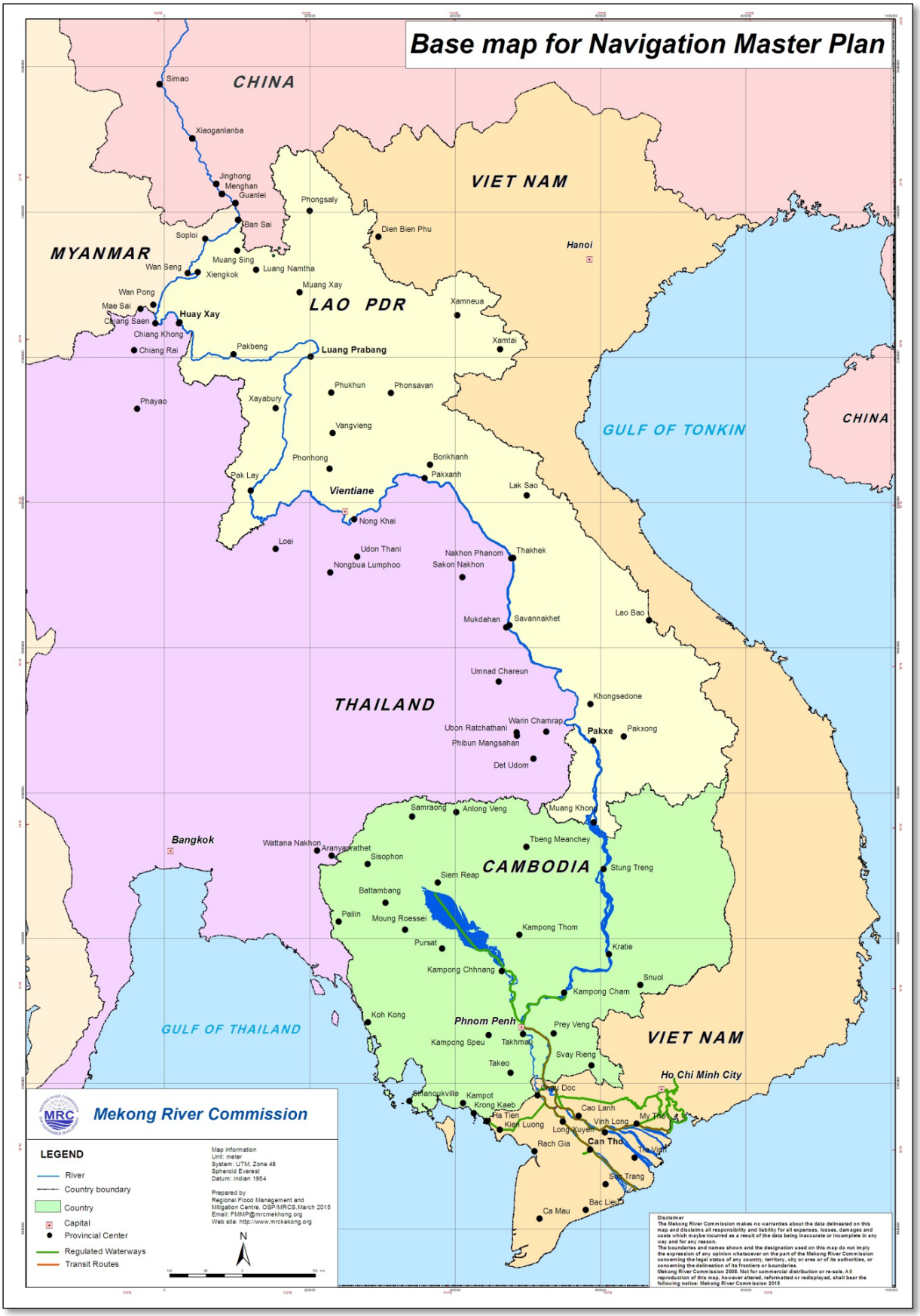
The regional consultation workshop mainly aimed at improving and approving the draft Master Plan documents. Throughout the workshop there was a common understanding that the navigation sector holds great potential for socio-economic development in the Mekong basin. All participants recognised that, in order to realise such potential, it will be crucial to reduce the physical and non-physical barriers to cross-border navigation.

To ensure the implementation and the sustainability of the Master Plan, following criteria should be followed:

- All infrastructure development projects such as ports and waterway development must include Work Plan and Budget available for riverbank protection in the vulnerable areas of the Mekong River in respective countries once data-information is acquired from relevant studies.
- All infrastructure development project planning and designs must be consistent with the capacity of operation and maintenance to ensure its sustainability and orderliness.

- Port development surveys and designs and navigation channel improvement projects should pay high attention to the opportunity cost of the people who relies on the Mekong River for their daily life. Those projects must fairly compensate opportunity cost of the people affected by the projects, in accordance with the rules and regulations of respective national Socio-environmental Law, including the Environmental and Social Impact Assessment (ESIA) and other appropriate requirements; and the application of the Procedures for Notification, Prior Consultation and Agreement (PNPCA) process where it is required as in the Mekong River Commission procedures.
- Waterway improvement projects and activities that may have impact on the common borders in the Mekong River between Lao PDR and Thailand shall be studied by joint working groups and received approvals from the existing Joint Boundary Committees between Lao PDR and Thailand.
- It is clearly understood that apart from the Member Countries' agreed financial contribution to the MRC, the Member Countries are not obliged, in any circumstances, to contribute any additional financial resources for implementing this Master Plan, either in regular or ad hoc basis. The MRC Secretariat, instead, as the main coordinating body, is encouraged to seek funding and mobilize financial resources for the implementation. Nevertheless, any Member Country who has financial resources capacity shall reserve its right to invest on navigation infrastructures including river protection where it is required within its territories.

Once the Final Master Plan is approved by the MRC Joint Committee, the Master Plan and all Actions can then be used by all relevant counterparts, including Member Countries, Developments Partners, Dialogue partners, investment banks, etc. to plan and implement national and regional navigation-related initiatives. As envisaged from the onset of its design, the Master Plan Actions would be incorporated into the National Plans and Legislation, or can be used as Guideline for waterborne transport projects.


Base map for Navigation Master Plan
CHINA
VIET NAM
MYANMAR
LAO PDR
THAILAND
CAMBODIA
GULF OF TONKIN
GULF OF THAILAND
Simao
Xiaoganlanba
Jinghong
Menghan
Guanlei
Phongsaly
Ban Sai
Soploi
Dien Bien Phu
Hanoi
Wan Seng
Muang Sing
Luang Namtha
Xiengkok
Wan Pong
Muang Xay
Mae Sai
Huay Xay
Chiang Saen
Xamneua
Chiang Khong
Chiang Rai
Pakbeng
Luang Prabang
Xamtai
Phukhun
Phonsavan
Phayao
Xayabury
Vangvieng
Phonhong
Borikhanh
Pak Lay
Pakxanh
Vientiane
Lak Sao
Nong Khai
Loei
Udon Thani
Nakhon Phanom
Thakhek
Nongbua Lumphoo
Sakon Nakhon
Mukdahan
Savannakhet
Lao Bao
Umnad Chareun
Khongsedone
Warin Chamrap
Ubon Ratchathani
Pakxe
Pakxong
Phibun Mangsahan
Det Udom
Samraong
Anlong Veng
Muang Khong
Bangkok
Wattana Nakhon
Aranyaprathet
Tbeng Meanchey
Sisophon
Siem Reap
Stung Treng
Battambang
Pailin
Moung Roessei
Kampong Thom
Pursat
Kratie
Kampong Chhnang
Snuol
Kampong Cham
Koh Kong
Phnom Penh
Prey Veng
Kampong Speu
Takhmao
Svay Rieng
Takeo
Ho Chi Minh City
Sihanoukville
Kampot
Chau Doc
Krong Kaeb
Cao Lanh
Ha Tien
My Tho
Kien Luong
Vinh Long
Long Xuyen
Can Tho
Rach Gia
Tra Vinh
Soc Trang
Bac Lieu
Ca Mau
Mekong River Commission
LEGEND
River
Country boundary
Country
Capital
Provincial Center
Regulated Waterways
Transit Routes
Map information
Unit: meter
System: UTM, Zone 48
Spheroid Everest
Datum: Indian 1954
Prepared by
Regional Flood Management and
Mitigation Centre, OSP/MRCS, March 2015
Email: FMMP@mrcmekong.org
Web site: http://www.mrckekong.org
N
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1 INTRODUCTION

The formulation of a "**Regional Master Plan for Waterborne Transport on the Mekong River Basin**" is part of the MRC Navigation Programme 2013-2015, as described in its Output 1.1.

Approach and methodology were described in the "**Inception Report**", discussed with the national representatives from the four MRC Member Countries at two workshops on 9 and 11 February 2015 in MRCS OSV Vientiane (one with the Lao and Thai representatives, one with the Cambodian and Vietnamese representatives).

During these same workshops, questionnaires on the current situation and baseline conditions were discussed between the international consultants and the national experts.

After the collection of information, completed by the study of websites, documents and reports, the "**Current Situation and Baseline Conditions Report**", the "**Economic Assessment and Forecasts Report**" and the Preliminary Short-Term (2020) and Long-Term (2040) Development Scenarios for Waterborne Transport on the Mekong River Basin were discussed during a three-day workshop on 25-27 May 2015 in MRCS OSP Phnom Penh.

From these Development Scenarios a list of short-term and long-term Actions was discussed during two workshops on 23 and 25 June 2015 in Phnom Penh (one with the Lao and Thai representatives, one with the Cambodian and Vietnamese representatives), to prepare a balanced Action Plan with Timing and Investment Programme.

A summary of the collected information on the Current Situation and Baseline Conditions is given in Chapter 2 of this report. A summary of the Economic Assessment and Forecasts is described in Chapter 3 and the Short-Term and Long-Term Development Scenarios are given in Chapter 4 of this report. And finally, the Action Plan and Investment Programme are described in Chapter 5 of this "**Final Report – Volume I**".

A full portfolio of the elaborated Action Files is given in the "**Final Report – Volume II**".

2 CURRENT SITUATION AND BASELINE CONDITIONS[1]

2.1 SOCIO-ECONOMIC SITUATION IN THE FOUR MRC MEMBER COUNTRIES

2.1.1 Physical Aspects of the Mekong River Basin

Reference: "Planning Atlas of the Lower Mekong River Basin", MRCS, 2011 - **"Overview of the Hydrology of the Mekong Basin"**, MRCS, 2005

The Mekong is one of the world's largest rivers, ranking 12th in terms of length at 4,880 km and 8th in terms of mean annual discharge (flow) at the mouth, which is about 14,500 m³/s.

The Mekong has a catchment area of 795,000 km² within the six countries of PR China, Myanmar, Lao PDR, Thailand, Cambodia and Viet Nam.

In China, the River is known as the Lancang and the Lancang River Basin makes up 24 percent of the total Basin area and contributes 15 – 20 percent of the water that flows into the Mekong.

The Mekong River Basin (MRB) downstream of the Chinese border with Lao PDR includes the majority of the total land area of Lao PDR and Cambodia, the northern and northeast regions of Thailand and the Mekong Delta and Central Highland regions of Viet Nam.



[1] This chapter is a brief summary of the information and data concerning the current situation and baseline conditions that were gathered during the design of the Regional Master Plan for Waterborne Transport on the Mekong River Basin. More information can be found in the "Current Situation and Baseline Conditions Report" and even more information can be found in the different Discipline Reports.

Countries included	Area of country in the LMRB (km²)	% of total area of the LMRB	% of total country area	Flow as % of total LMR basin
China	165,000	21	2	16
Myanmar	24,000	3	4	2
Thailand	184,000	23	36	18
Lao PDR	202,000	25	85	35
Cambodia	155,000	20	86	18
Viet Nam	65,000	8	20	11

At its mouth, the Mekong River discharges 457 km^3 of water annually. The Mekong River receives water from 6 countries. According to MRCS 1998, their contribution is as follows: PR China 16 percent, Myanmar 2 percent, Lao PDR 35 percent, Thailand 18 percent, Cambodia 18 percent and Viet Nam 11 percent.

The Mekong River has one flood pulse a year. During the wet season (May-November) the discharge is 30 times greater than in the dry season (December-April) in Pakxe (southern Lao PDR) and 53 times greater in Kratie (Cambodia). Floodplains cover some 70.000 km^2. The degree of inundation depends on the strength of the monsoon, as 85-90 percent of the discharge is generated during wet season.

The Tonle Sap River in Phnom Penh connects the lake to the Mekong. During most of the wet season the Mekong pushes the Tonle Sap River flow towards the lake. This expands it 3 to 6 times from 2,700 km^2 to 9,000-16,000 km^2 and stores 50-80 km^3 of water. In the dry season the flow direction is reversed. Then the lake supplies water to the Mekong and thereby raises the dry season water levels in the delta for some 5-6 months.

2.1.2 Socio-Economic Indicators in the four MRC Member Countries

The Lancang-Mekong River Basin has a population of approximately 75 million, of whom about 64 million live in the MRB. About one third of the MRB's population is living in urban areas. This proportion is likely to increase significantly due to rapid urbanization over the next decades.

The great majority of the MRB's inhabitants are farmers and fishermen and about two third of the MRB's population live in rural areas. The average population density is generally low, around 90 person/km² and is the highest (280 person/km²) in the Vietnamese part and the lowest in Lao PDR (around 30 person/km²). In 2013, life expectancy, at 68-72 years, was lowest in the Lao PDR and Cambodian areas, but higher, at 74-76 years, in the Thai and Vietnamese areas.

In its country reports, the World Bank gives, amongst others, the following socio-economic information:

	Thailand			Lao PDR		
	2007	2010	2013	2007	2010	2013
Population, total (million people)	66,1	66,4	67,0	6,0	6,4	6,8
Population Growth (annual %)	0	0	0	2	2	2
Population density (people per km²)	129	130	131	27	28	29
Poverty ratio (% of population)	23	17	12	28	-	23
GDP (billion current US$)	247,0	318,9	367,3	4,2	7,2	11,2
GDP Growth (annual %)	5	8	2	8	9	9
Inflation (annual %)	3	4	1	7	10	8
Agriculture, value added (% of GDP)	11	12	12	36	33	27
Industry, value added (% of GDP)	45	45	43	27	32	33
Services, value added (% of GDP)	45	43	45	37	35	40
Exports of goods and services (% of GDP)	73	71	74	34	36	37
Imports of goods and services (% of GDP)	65	64	70	45	38	46

	Cambodia			Viet Nam		
	2007	2010	2013	2007	2010	2013
Population, total (million people)	13,7	14,4	15,1	84,2	86,9	88,7
Population Growth (annual %)	1	2	2	1	1	1
Population density (people per sq. km)	78	81	86	272	280	289
Poverty ratio (% of population)	45	22	13	21	21	15
GDP (billion current US$)	8,6	11,2	15,2	77,4	115,9	171,4
GDP Growth (annual %)	10	6	7	7	6	5
Inflation (annual %)	7	3	1	10	12	5
Agriculture, value added (% of GDP)	32	36	34	19	19	18
Industry, value added (% of GDP)	27	23	26	39	38	38
Services, value added (% of GDP)	41	41	41	43	43	43
Exports of goods and services (% of GDP)	65	54	66	71	72	84
Imports of goods and services (% of GDP)	73	60	74	84	80	80

http://databank.worldbank.org/data/views/reports/tableview.aspx

2.1.3 Demand for Transport to trade Agricultural, Commercial, Industrial and Tourism Resources in the four MRC Member Countries

Agriculture and Forestry

In 2013, agriculture contributed 12 percent of Thailand's national GDP, 27 percent of Lao PDR's national GDP, 34 percent of Cambodia's national GDP and 18 percent of Viet Nam's national GDP.

According to the US Department of Agriculture (USDA) Foreign Agricultural Service Production Supply and Distribution Database, rice production and export are projected as follows:

1000 metric tonnes, milled basis		1999-2001 Average (ton)	Annual growth	2009-2011 Average (ton)	Annual growth	2019-2021 Estimation (ton)
Thailand	Production	17,019	1.8%	20,327	1.5%	23,545
	Export	6,916	3.1%	9,105	4.3%	13,012
Lao PDR	Production	1,170	1.8%	1,395		NA
	Export	NA		NA		NA
Cambodia	Production	2,555	5.1%	4,186	3.8%	6,089
	Export	0		805	6.5%	1,329
Viet Nam*	Production	20,812	2.2%	25,940	0.8%	27,964
	Export	3,771	6.2%	6,094	1.5%	7,033

** About half of the Viet Nam rice production is produced in the Mekong Delta*

An effort to diversify agro-forestry products has just started. Expected industrial crops for future development include cassava, maize and soybeans, and expected forestry products include rubber, palm and woodchips.

Fisheries

Estimates of total fisheries catch in the MRB have increased dramatically in recent years and are presently topping more than 2,5 million tonnes annually with a value exceeding US$ 2 billion (excluding aquaculture and reservoir production). This means that there is considerable trade in fish within the Mekong Basin (for instance in Cambodia, at least 70,000 tonnes of freshwater fish are exported to Thailand annually) while exports out of the region are limited, but increasing.

Industry

According to the CIA World Fact Book, in **Thailand** industry represents 45 percent of the GDP and textiles and garments, food processing, beverages, cement, computers, furniture and plastics represent the largest portion of Thailand's industry. In **Lao PDR**, industry represents one third of the GDP and is mainly composed of agricultural processing, garments and cement. In **Cambodia**, the garment industry represents the largest portion of Cambodia's manufacturing sector, accounting for 80 percent of the country's exports. Meanwhile in **Viet Nam**, the Mekong Delta is not strongly industrialised, and most of the industry is agricultural-based.

Minerals and energy

The region has a large potential for hydropower development, with several dams already in operation, in commission or in the planning phase. In addition to hydropower, energy resources include fuel, wood, oil, natural gas, coal and lignite. Oil, natural gas and coal occur in Myanmar, Cambodia and the Yunnan province but all MRC Member Countries still need to import oil products. There are high geological and economic potentials for the development of mineral commodities in the region (ADB/UNEP 2004). Mineral resources include gemstones, alluvial gold, alluvial cassiterite, silica, bauxite, cupper, calcite and construction materials.

Tourism

Tourism makes a strong contribution to the GDP of all MRB countries, dominating their exports of goods and services. In 2010 they attracted 27 million international visitors and riverine environments figure prominently in much of the sub-region's tourism.

In **Thailand**, popular destinations such as Chiang Mai and Chiang Rai are located either on or adjacent to the Mekong River or its tributaries. In **Lao PDR**, where backpackers predominate, the most

popular destinations are along the Vientiane/Luang Prabang/Huay Xay Corridor and the Siphandon region known as the 'Four Thousand Islands'. In **Cambodia**, most tourism is centered on the capital Phnom Penh, Siem Reap's ancient Angkor Complex and the Tonle Sap Great Lake. And finally in **Viet Nam,** the Mekong Delta, an area of great natural beauty, is an attractive and developing tourist destination.

2.2 TRANSPORT ECONOMICS

2.2.1 Annual Cargo Traffic Volumes

LAO PDR

Inland Waterway Transport (IWT) vessels cross the river border between Lao PDR and China near the Lao port of Ban Sai (294 km from Simao), while trucks cross the land border with China at Boten. Waterborne cargo volumes were provided for 7 ports or landings between Ban Sai and Vientiane and a border crossing volume of about 216,000 tonnes was identified in 2014, down from 218,000 tonnes in 2010.

Data on trade volumes collected from customs checkpoints at Boten and Huay Xay indicate that of the majority of cargo hauled by road through this checkpoint, approximately 65 percent moves along Route 13N, with the balance of 35 percent moving along Route 3A.

It is estimated that, within the corridor comprising the river route and Highway 13N, the road share of the cargo volume in 2014 was approximately 58 percent and the IWT share 42 percent Moreover, while the road volume has recently been increasing at a rate averaging about 6 percent per annum, the IWT volume appears to have been declining, albeit slightly.

Statistics relating to the total volume of cargo moving by road and water nationwide are published in the Statistical Yearbook of Lao PDR for 2013. Overall cargo volume data for the 10-year period 2002-2012 was regressed against real GDP, in order to determine the "fit" between these series. This was done both for total cargo and for the volume of cargo reported as moving by road.

The regression of overall cargo volume against real GDP (Lao PDR) leads to $y = 0.2394x^{0.9615}$ with $R^2 = 0.8374$ while the regression of road-hauled cargo volume against real GDP leads to $y = 0.0598x^{1.0738}$ with $R^2 = 0.8497$ both showing an acceptable correlation between the two series.

THAILAND

The principal transport routes linking Thailand with China and the Lao PDR are:

- The waterway route linking the ports of Chiang Saen and Chiang Khong with ports in Yunnan Province of China and ports in Lao PDR; and
- National Route 3A which links Chiang Khong with the Boten checkpoint on the China/Lao border and with other intermediate destinations in Lao PDR.

An estimate of road hauled cargo through the Chiang Khong/Huay Xay checkpoint is given in the table above. It is estimated that in 2014 nearly 700,000 tonnes of cargo passed through this checkpoint. Of this volume, it is estimated that about 380,000 tonnes was transported to and from China along Route 3A, with the balance (320,000 tonnes) being transported to and from locations in Lao PDR. When combined with the volume transported by IWT (about 600,000 tonnes), a total cargo volume in the corridor of 980,000 tonnes in 2014 is indicated, with the IWT and road shares standing at 61 percent and 39 percent respectively.

Future cargo flows in the corridor were estimated in relation to the forecast growth of total waterway traffic in Thailand. Statistics of the latter are available from the website of the Ministry of Transport Thailand. Total IWT cargo volumes for the period 2005-2013 were then regressed against

real GDP and reveal an acceptable correlation of cargo volume with GDP ($y = 0.1606x^{1.447}$ with $R^2 = 0.7354$).

Refined **petroleum products** (diesel and benzene) are transported from Bangkok and the Eastern Seaboard of Thailand by road to Haciang Port near Chiang Saen, where they are loaded onto barges for transport to China. In 2014, this volume was 21,761 tonnes. Approximately 32 percent of all petroleum transported to China from Thailand in 2014 moved by barge from Chiang Saen, and the balance (68%) is estimated to be moved by road tanker along Route 3A.

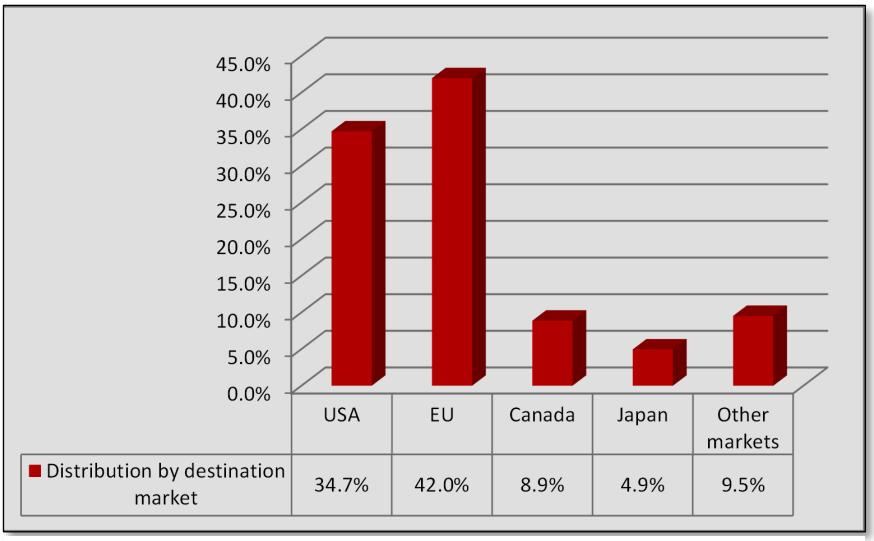
Regression of IWT petroleum transport volume against real GDP for Thailand indicated an acceptable correlation between these two variables ($y = 8.7501x – 30,755$ with $R^2 = 0.7483$)

CAMBODIA-VIET NAM

In Cambodia, in 2014 total **container throughput** in Sihanoukville Port was 333,904 TEU and in Phnom Penh Port 133,666 TEUs. Data showed that the national container throughput has been growing rapidly. Indeed over the 12-year period 2002-2014 it grew at a rate averaging nearly 9 percent per annum, about one percentage point faster than the growth of GDP over the same period. Moreover, the share of Phnom Penh Port in the total flow of containers in and out of Cambodia has been increasing rapidly and in 2014 accounted for nearly 30 percent of the total container throughput of Cambodia. Between 2013 and 2014, there was a 17.8 percent year on year increase in the national container volume, with the throughput of Sihanoukville increased by 16.6 percent and that of Phnom Penh by an impressive 21 percent.

Finished garments are estimated to account for about 70 percent of Sihanoukville's export container volume and probably for a similar proportion of Phnom Penh's export container volume. Owing to the demand for import of textiles and yarn (inputs for the garment industry), loaded import and export container volumes have been reasonably well balanced at both ports.

Data published on the website of the Cambodian Garment Manufacturer's Association indicates the following distribution of garment exports, based on *value*.



Distribution of Cambodian garment exports in 2014

If it can be assumed that the physical distribution of exports follows the same pattern as export values, then it appears that Phnom Penh Port would have an advantage to serve at least 48 percent of garment export volume, comprising exports to USA, Canada and Japan. Yet, it appears that two-thirds of loaded export containers are shipped through the Port of Sihanoukville. This would suggest that, despite Phnom Penh's distance advantage to serve North American export markets, a substantial volume of garment exports to those markets is being shipped through Sihanoukville and Singapore.

The throughput of Phnom Penh Port between 2002 and 2014 was regressed against real GDP for Cambodia. The results of this analysis reveal a high correlation between the port container throughput and GDP, $y = 0.0053x – 93.76$ with $R^2 = 0.954$.

Cambodia imports its total requirement of **petroleum products.** There are two main sources of supply: Viet Nam and Singapore, but a new source is developing in Thailand. The major movement of petroleum on the inland waterway is from Nha Be on the Saigon River near Ho Chi Minh City to bulk petroleum depots in Phnom Penh. Petroleum is carried in specialized tanker barges with a capacity of 1,000 DWT. Petroleum is shipped from Singapore in 7,000 - 8,000 DWT feeder tanker vessels, which are discharged at Tomnop Rolork jetty, about 12 km north of Sihanoukville. Petroleum from Thailand, transported in 2,000T - 3,000 DWT vessels, is unloaded at Stoeung Hav jetty, about 25km north of Sihanoukville.

Between 2002 and 2014, the tonnage of petroleum imported into Cambodia grew from 691,300 to 1,684,000 tonnes, representing an average annual increase of 7.7 percent, which was only marginally short of the growth of GDP during this period. By contrast, over the same period, the tonnage of petroleum moved into Cambodia on the waterway grew from 369,000 to 605,000 tonnes, at an average annual rate of 4.2 percent and the tonnage moved through Sihanoukville grew from 323,000 to 987,000 tonnes, or just short of 10 percent per year, meaning that the Phnom Penh Autonomous Port (PPAP) share declined to 36 percent from 53 percent and the Sihanoukville share grew to 59 percent from 47 percent. Regression of petroleum imports against real GDP indicated a close correlation between the two variables, $y = 4.0077x^{1.2388}$ with an R^2 value of 0.9463.

Concerning bulked and bagged cargo or **general cargo**, this category (agricultural products, steel, cement, fertilizer, etc.) sustained strong volume growth in PPAP within the past three years and in particular in 2014 when volume jumped by more than 60 percent up to 266,922 tonnes.

In 2014 the volume of Thai **cement** entering Cambodia is estimated to have amounted to more than 1.5 million tonnes in 2014 of which 925,155 tonnes was handled through the port system (Phnom Penh Port, Oknha Mong Port, Srei Ambel Port, Koh Kong Port).

Similarly, it is estimated that a substantial volume of **steel** is imported across land borders. In 2014, nearly 132,000 tonnes of steel entered Cambodia across the national boundary, about 50 percent each from Viet Nam via NR 1 and 50 percent from Thailand via NR 5.

Phnom Penh Port handles a substantial volume of **fertilizer**, most of it coming from Viet Nam, but also some from China. In 2014, fertilizer imports through Phnom Penh port jumped significantly, by more than 60 percent in a single year up to 87,540 tonnes (total volume of fertilizer import = 112,540 tonnes).

About 134,000 tonnes of **coal** is imported annually, all of it through the two major ports (91,000 tonnes by Sihanoukville and 43,000 tonnes by Phnom Penh Port).

And finally, the possibilities for the export of agricultural commodities from Kompong Cham have recently been raised by trade shipments of cassava from that province. It is estimated that during the period 2007-2014, the total production of cassava in Cambodia grew at an average annual rate of 20 percent, from 2.2 million tonnes in 2007 to 7.9 million tonnes in 2014. On the basis that two return voyages per month can be achieved per vessel during the 5 month navigation period, the total tonnage of cassava which can be shipped in a year may be calculated at 36,000 tonnes per year.

2.2.2 Annual Passenger Traffic

LAO PDR

Regional passenger traffic on the 596 km stretch of the Mekong from the Lao/China border near the port of Ban Sai, to Luang Prabang comprises:

- Passengers crossing the river and land borders between Lao PDR and China and between Lao PDR and Thailand. Somewhat data should be further improved to be used to estimate the major regional passenger volumes.

- Tourists travelling on slow tourist boats and speedboats between Huay Xay, Pak Beng and Luang Prabang, a distance of 300 km. Data obtained is of questionable quality, although it is estimated that approximately 50,000 tourists per year use these services.
- Tourists travelling on slow tourist boats or speedboats between Luang Prabang and Thame Tin Cave, a popular tourist site about 28 km upstream from Luang Prabang. Data relating to this traffic were not clear, but the volume of tourists using these services appears to be around 30,000 persons per year.

IWT cross border passenger traffic from China and Thailand to the Lao PDR

It is estimated that the majority of waterborne cross-border passenger traffic between Lao PDR and China and between Lao PDR and Thailand is now handled through the new International Immigration post in Ban Khouane. Lao immigration authorities have reported that 49,483 tourists passed through this post in 2013, increasing to 79,403 tourists in 2014.

For the purpose of forecasts, tourist arrivals through the Huay Xay checkpoint were regressed against actual GDP data for the period 2002-2013, giving a regression equation $y=0.0496x^{1.4124}$ (which expresses tourist arrivals (y) as a function of real GDP (x)). The results of this analysis reveal an acceptable correlation between these two variables with an R^2 value of 0.7795.

IWT tourist traffic, Huay Xay-Luang Prabang

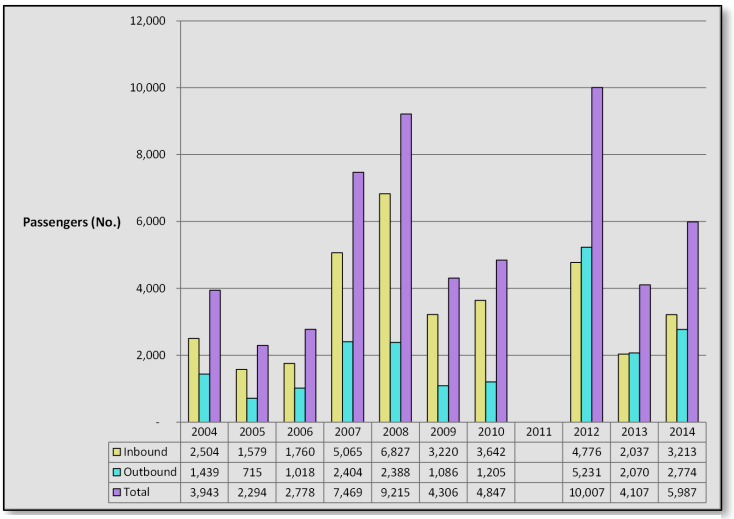
The forecast of tourist numbers travelling by slow tour boat between Huay Xay and Luang Prabang is based on the projected growth in overall tourist arrivals in the Lao PDR as well as the projected growth in real GDP. Regression of the overall tourist arrivals against real GDP for the period 2002-2013 leads to $y = 4E\text{-}07x^{2.1811}$ with a high correlation $R^2 = 0.9829$.

The baseline traffic data obtained by questionnaire are somewhat unreliable, but they do suggest that IWT tourists on the Huay Xay – Luang Prabang stretch make up just over 1 percent of all tourists arriving in Lao PDR and that this number has been declining slightly over the past seven years.

THAILAND

Cross border transport occurs between Thailand and China and Thailand and the Lao PDR via the Upper Mekong and the land border at the bridge between Chiang Khong (Thailand) and Huay Xay (Lao PDR).

Waterway cargo and passenger movements are concentrated at the port facilities in Chiang Saen, comprising the existing Chiang Saen port, the new Chiang Saen Commercial Port and the privately owned and operated Haciang Petroleum Terminal which transfers petroleum from road for shipment by barge to China. From Chiang Kong, cargo and passenger vehicles may proceed to the China/Lao border at Boten via Route 3A.



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Inbound	2,504	1,579	1,760	5,065	6,827	3,220	3,642		4,776	2,037	3,213
Outbound	1,439	715	1,018	2,404	2,388	1,086	1,205		5,231	2,070	2,774
Total	3,943	2,294	2,778	7,469	9,215	4,306	4,847		10,007	4,107	5,987

Inbound and outbound passenger volumes for Chiang Saen Port

Only limited data on IWT passenger traffic was made available for Thailand. The following chart provides a 10 year history of inbound and outbound passenger volumes for Chiang Saen Port, for the years 2004-2014.

An attempt was made to regress the passenger data for Chiang Saen Port against real GDP, but the analysis revealed a poor correlation between these two variables.

CAMBODIA-VIET NAM

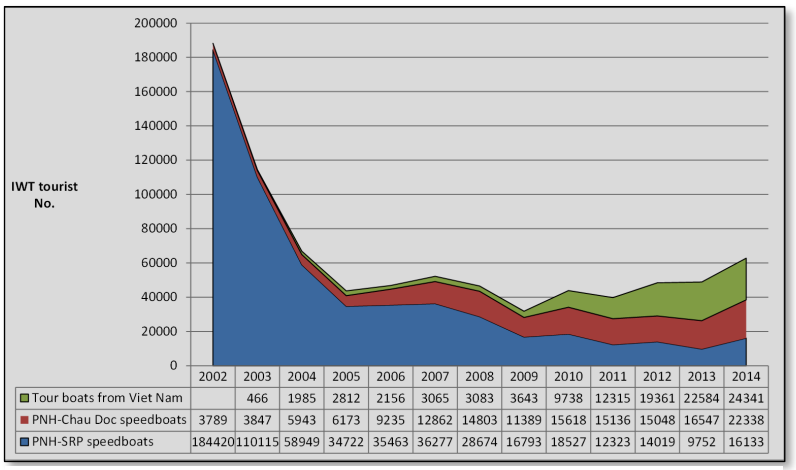
Passenger traffic on the Lower Mekong is of three types:

- Tourist passengers travelling from Phnom Penh to Siem Reap (Chong Kneas Port) on speedboats;
- Tourist passengers travelling by speedboat between Phnom Penh and Chau Doc Port, Viet Nam; and
- Tourists travelling on slow accommodation boats between Ho Chi Minh City and Phnom Penh, some of which extend their voyages to Siem Reap during the high water season.

Statistics of passenger volumes and passenger boat movements are maintained by the Phnom Penh Autonomous Port Authority. The trend in passenger volumes is given in the Figure below:

The average annual rate of growth for Chau Doc speedboat passengers between 2002 and 2014 was 15.9 percent, while that for Tour Boat Passengers from Viet Nam was 43.3 percent. During the same period, speedboat passengers to Siem Reap *declined* by an average of 18.4 percent per annum.

During the same period (2002-2014), international tourist arrivals into Cambodia increased at a rate averaging 16.5 percent per annum.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Tour boats from Viet Nam		466	1985	2812	2156	3065	3083	3643	9738	12315	19361	22584	24341
PNH-Chau Doc speedboats	3789	3847	5943	6173	9235	12862	14803	11389	15618	15136	15048	16547	22338
PNH-SRP speedboats	184420	110115	58949	34722	35463	36277	28674	16793	18527	12323	14019	9752	16133

Passenger volumes Cambodia-Viet Nam

Tourist arrivals were regressed against real GDP for Cambodia over the 12-year period reviewed and the results of this regression analysis revealed a very strong correlation between the two series, $y = 0.0014x^{2.0653}$ with an R^2 value of 0.9816.

2.2.3 Major Traffic Flow Directions

UPPER PART OF THE MEKONG RIVER BASIN

The Upper part of the Mekong Basin encompasses the stretch of the Mekong between the Lao PDR / PR China border and the Khone Falls.

Transport linkages to Kunming

Existing and future transport linkages to Kunming are shown in this Figure. They may be grouped together in five corridors:

(1) indicates existing linkages (high speed highways and double tracked railways) to the seaports of south-eastern China (Guangzhou, Hong Kong, Shanghai and Shenzhen).

(2) indicates an existing linkage by road and rail to the Port of Haiphong in Viet Nam. At a distance of 855 rail kilometers from Kunming, Haiphong is the closest outlet to the sea, but suffers the disadvantage of being a shallow draft river port.

(3) represents the existing 1,367 km road link from Kunming to Tanaleng/Nong Khai at the border between Lao PDR and Thailand, providing access to Bangkok and Laem Chabang.

(4) represents the existing 910 km road link from Kunming to Huay Xay/Chiang Khong at the border between Lao PDR and Thailand and the 590 km stretch of the Mekong (Lancang) River between Chiang Khong Port in Thailand and Simao Port in China.

(5) indicates a possible transport corridor linking Kunming with an outlet to the sea on the Bay of Bengal in Myanmar.



Transport linkages to Kunming

Detailed description of transport corridors related to the upper part of the Mekong Basin

Three corridors comprising existing road and waterway transport routes have been identified as being relevant for the analysis of current and future transport flows in the upper part of the Mekong Basin. These are as illustrated in the Figure below:

(i) **Corridor 1A:** Simao-Huay Xay/Chiang Khong, comprising:

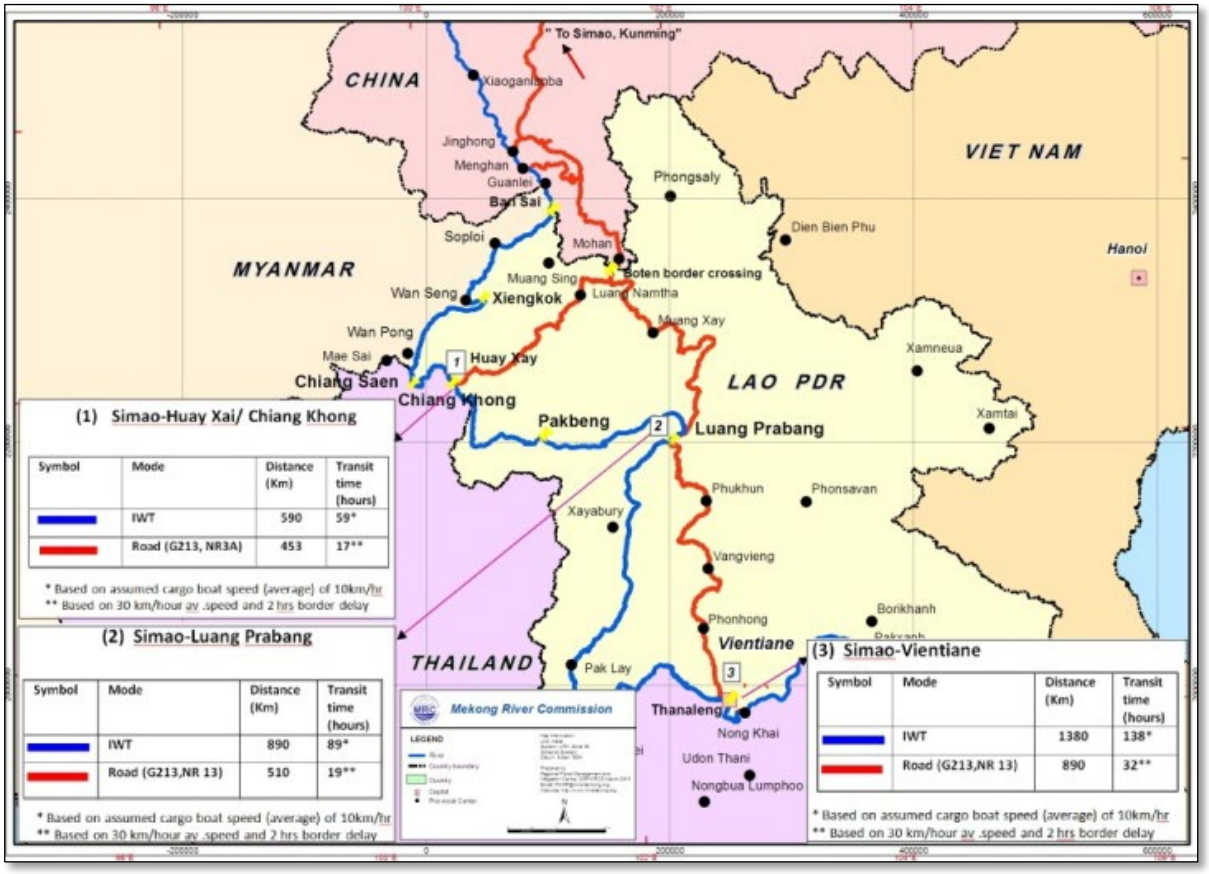
- The 590 km stretch of the Mekong between Simao Port in Yunnan Province of China and the opposed border posts of Huay Xay (Lao PDR) and Chiang Khong (Thailand); and
- A highway link of 450 km between Simao and the abovementioned Lao/Thai border crossing point.

(ii) **Corridor 1B:** Simao-Luang Prabang, comprising:

- An 890 km stretch of the Mekong between the two cities; and
- A highway link of 510 km between Simao and Luang Prabang, made up of 250 km on Highway G213 in China, 18 km on Route 3A in Lao PDR and 242 km on Route 13N in Lao PDR.

(iii) **Corridor 1C:** Simao-Vientiane, comprising:

- A 1,316 km stretch of the Mekong between the Phou Oeu City and Vientiane Capital; and
- A highway link of 890 km between Simao and Luang Prabang, made up of 250 km on Highway G213 in China, 18 km on Route 3A in Lao PDR and 622 km on Route 13N in Lao PDR.



Transport corridors, upper part of the Mekong Basin

LOWER PART OF THE MEKONG RIVER BASIN

The lower part of the Mekong Basin encompasses the stretch of the Mekong between the Khone Falls and its exits to the Sea.

Three corridors comprising existing road, waterway and, where relevant, railway transport routes have been identified as being relevant for the analysis of current and future transport flows in the lower region of the Mekong Basin. These are as illustrated in the Figure below:

(i) **Corridor 2A:** *Phnom Penh-Cai Mep International Port* - This is the principal transport corridor in the region which comprises a 368 km stretch of the Mekong mainstream linking Phnom Penh with the Cai Mep International container Port in Viet Nam; and an inter-capital highway route (NR1) linking Phnom Penh with Ho Chi Minh City, with onward highway connections to Cai Mep International Port which is 320 km by road from Phnom Penh.

(ii) **Corridor 2B:** *Phnom Penh-Sihanoukville Port* - This corridor comprises National Route 4, a tolled highway of some 226 km, which is in generally good condition and allows container transit times between Phnom Penh and Sihanoukville of about 5 hours and the Southern Line of the Cambodian Railway (now Toll Royal Railway) with a length of 269 km.

(iii) **Corridor 2C:** *Phnom Penh-Bangkok and the Port of Laem Chabang* - This corridor comprises a 648 km highway route (NR 5 in Cambodia and Highways 33, 304, and 331 in Thailand) linking Phnom Penh with Bangkok and the Port of Laem Chabang and a 675 km potential railway connection between Phnom Penh and Laem Chabang which would involve joining up of the Northern Line in Cambodia and the Eastern Line in Thailand.

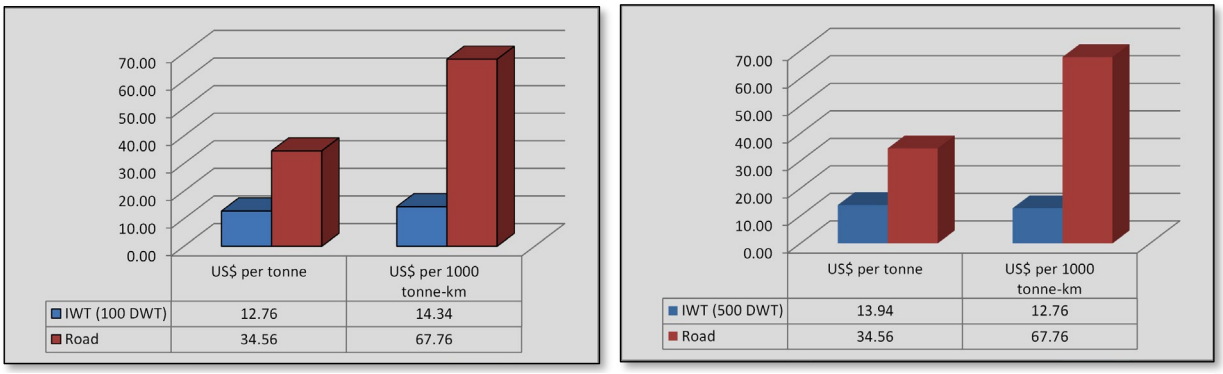


Transport corridors, lower part of the Mekong Basin

2.2.4 Commercial Aspects, Freight Rates and Passenger Charges versus Competition of other Modes

LAO PDR

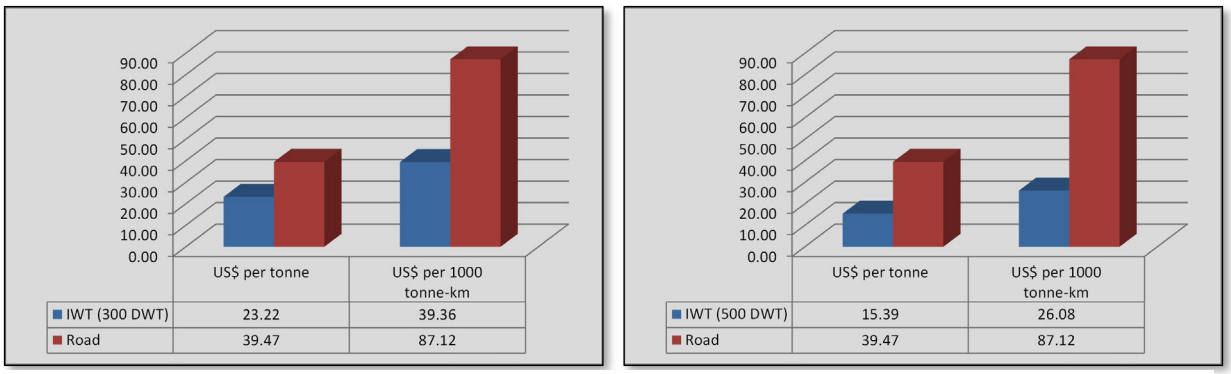
The figures below show the comparative costs of road transport and IWT in the case of current vessels of limited size (about 100 DWT) and in the case of 500 DWT vessels.



IWT and road transport operating costs: Simao-Luang Prabang

THAILAND

The effect on IWT market share of increasing average vessel size was assessed by estimating the change in vessel operating costs through a progressive change to 500 DWT from 300 DWT vessels.

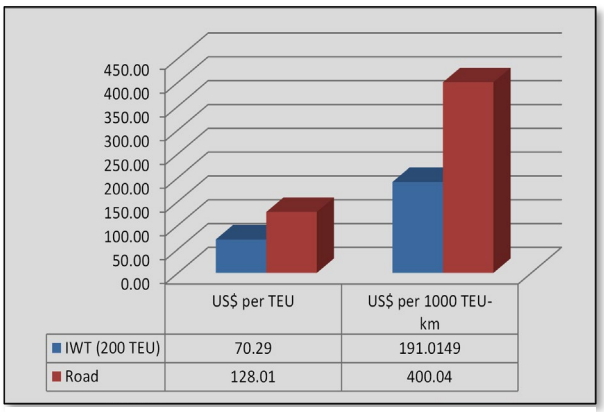


Comparative road and IWT operating costs, Simao – Chiang Kong

CAMBODIA-VIET NAM

Containers

Up until the present, 100 percent of the Phnom Penh Port's container throughput has been transported by barge to Viet Nam. However, with the opening of the new bridge over the Mekong at Neak Loeung 06 April 2015, it is now possible for truck operators to carry containers directly to Cai Mep (a distance of 320 km from Phnom Penh) in an elapsed time of about 9 hours. This compares with a transit time for barges of 36-38 hours depending upon the route used for navigation (Mekong mainstream or Cho Gao Canal in Viet Nam).



Comparative road and IWT operating costs, Phnom Penh-Cai Mep

For the estimation of IWT operating cost it was assumed that vessels with a capacity of 200 TEU would navigate via either the Mekong mainstream or the Cho Gao Canal.

Petroleum

Two sets of costs were calculated in the IWT case, one assuming a vessel of current size (1,000 DWT) and the other assuming a gradual doubling of vessel size to 2,000 DWT. The results of this cost assessment were that a feeder ship plus truck option (Singapore-Sihanoukville-Phnom Penh) would have a weighted average cost of US$ 27.66 per '000 tonne-km, while the comparable costs for 1,000 DWT and 2,000 DWT tanker barges (Nha Be-Phnom Penh) were respectively US$ 68.93 and US$ 36.30 per '000 tonne-km.

2.3 FLEET AND CREW

2.3.1 Legal Framework on the Mekong Inland Waterway Fleet

(See also paragraph 2.8 of this report)

LAO PDR-THAILAND

The Quadrangle Agreement on Commercial Navigation on the Lancang-Mekong River and the related MOU has the following annexes related to vessels:

Annex II: Rules on Water Transport Administration on the Lancang- Mekong River.

Annex VI: Technical Regulations on Surveys of Commercial Ships on the Lancang-Mekong River.

LAO PDR

Legal instruments in the Lao PDR that address management of passenger transport, cargo transport and cargo operations are very limited.

THAILAND

- The Act on Navigation in Thai Waters B.E. 2456 provides, among others, miscellaneous regulations for all kind of vessels
- The Thai Vessel Act B.E. 2481 requires Thai vessels, in order to be registered as such, to comply with the survey requirements under the Act on Navigation in Thai Waters.
- The Regulation on Ship Survey (No. 19) B.E. 2534, designed for passenger vessels and ferries, provide among others, regulations on construction, crew requirements, provisions for passengers, requirements when carrying dangerous cargo and firefighting and life-saving equipment.

CAMBODIA-VIET NAM

The Agreement on Waterway Transportation between Cambodia and Viet Nam is creating favorable conditions for transit and cross-border navigation within regulated waterways (Art. 1).

CAMBODIA

- *Circular 003/MPWT on the Management of Means of Water Transport* (27th June 2000) aims to ensure proper management of all kinds of vessels and/or boats navigating the inland waterways of Cambodia.
- *The **Draft** Inland Waterway Transport Law* provides, among others, several articles on the safety and security of crew, ships, passengers and cargo.

VIET NAM

In Viet Nam, legislation that concerns inland waterways and transport is extensive and covers emergency preparedness, ship construction, life-saving and firefighting equipment, crew standards and waste management.

2.3.2 Fleet composition of registered public and private owned/operated vessels

LAO PDR

In 2014, 2,912 vessels were registered in the Lao PDR, of which 1,809 were passenger vessels without accommodation with a total capacity of 68,970 people.

Five local ports in the north have been promoted to international tourism ports with reduction of visa fees, following the Quadrangle Agreement on Commercial Navigation on the Lancang-Mekong River. These ports are Xiengkok, Ban Mom, Huay Xay, Pak Beng and Luang Prabang.

The stretch from Huay Xay to Louang Prabang is still famous for boat passenger and tourists transport. Meanwhile boat tourism is still limited from the section of Luang Prabang to Vientiane Capital. Downstream, tourists come from Ubon province in Thailand via the Mekong bridge to Pakxe district, where they take a cruise down from Pakxe to Champassak (about 50 km) by a local long tail riverboat.

THAILAND

The number of barges registered in Thailand for the Mekong River is very limited; only 11 vessels have to be considered. Thailand does make significant use of the Mekong River and its associated waterways for domestic transport or passenger services. Attention should be paid to the state of the numerous local ferries and the different ferry sites.

The main traffic lines are Chiang Saen-Tonpuang, Chiang Kong-Huay Xay, Palchum-Bolikunsai, Bungkarn-Bolikunsai, Nakon Phanom-Kummun and Mukdahan-Savannaket. Ferry crossings between Thailand and Lao PDR are situated at Chiang Khong, Bungkham and Mukdahan.

The different kinds of dangerous goods transported by inland waterway barges on the Mekong River are petroleum products, gasoline, diesel and asphalt. The cargo is traded for consumption in Thailand and Lao PDR.

CAMBODIA

In Cambodia, the Mekong River receives both kinds of vessels up to Phnom Penh: inland vessels and seagoing vessels up to 5,000 DWT. The main traffic is dedicated to inland shipping for the domestic market and cross-border trade with Viet Nam. The Ministry of Public Works and Transport registered some 250 inland vessels in April 2015. The average dimensions of inland waterway vessels operating in Cambodia are LOA = 53.1 m to 120.0 m, B = 8.8 m to 19.5 m, D = 3.3 m to 5.2 m, Capacity = 500 to 2,000 tonnes and container capacity = 72 to 120 TEU.

VIET NAM

About 755,000 inland waterway vessels are sailing on the inland navigation system in Viet Nam of which more than 3,000 are involved in shipping dangerous goods.

Inland waterway transport services are provided by public operators, several cooperatives in transport and handling services and numerous small and independent private operators.

In the Mekong Delta provinces, some 55,000 inland vessels are registered with a total capacity of about 1,100,000 DWT for cargo ships and 160,000 seats for passenger ships. Still part of the vessels are old, dating back to the 1960's and 1970's or earlier, and insufficiently renovated.

2.3.3 Vessel, Crew and Cargo Certification and Documents

LAO PDR-THAILAND

Vessel documents: According to the Quadripartite agreement and related MOU, some 10 certificates and documents that concern the vessel should be on board (Certificate of Registration, Load Line Certificate, Tonnage Certificate, Tanker Safety Certificate, Ship Survey Certificate, Oil Pollution Prevention Certificate, Vessel's License and Water Transport License, among others).

Crew documents: According to the same Quadrangle Agreement, all crewmembers should have valid identity documents, a number of crew on board should hold a valid certificate of navigation and at least one crewmember should hold a dangerous goods certificate.

Cargo documents: Under the Quadrangle Agreement and the MOU, the documents used for the transport of dangerous goods should meet the requirements stipulated in the International Maritime Dangerous Goods (IMDG) code. The Material Safety Data Sheet (MSDS) should be available and posted. When fireworks or other packaged dangerous goods are carried/handled, written instructions to handle these cargoes should be available.

CAMBODIA-VIET NAM

Inland waterway vessels registered in Cambodia or in Viet Nam have certificates on board which are normally used for sea-going vessels. Inland waterway vessels registered in Cambodia or Viet Nam carry the following certificates: Ship Registration Form, International Tonnage Certificate, Cargo Ship Safety Equipment Certificate, Cargo Ship Safety Construction Certificate, Cargo Ship Safety Radio Certificate, Passenger Ship Safety Certificate and Oil Pollution Prevention Certificate.

Cambodian or Vietnamese inland waterway vessels engaged in cross-border transportation need, according to the Agreement between the Government of the Socialist Republic of Viet Nam and the Royal Government of Cambodia on Waterway Transportation, the following documents: Registration Certificate, Technical Safety and Environment Protection certificates issued by national authorities or classification societies, Cross-Border Transportation Permit issued by the competent authority of the respective country, Cargo Manifest and/or list of passengers with passport details, Insurance Certificate covering the civil liabilities of the ship owner towards third parties, as far as required by applicable law, and Crew member list mentioning titles as well as the professional certificates, passports and, if required, vaccination certificates of each of the crew members.

2.3.4 Vessel Classification

LAO PDR-THAILAND

Lao PDR and Thailand have no vessel classification standard for inland waterway vessels. China has a vessel classification standard from class VII to class I corresponding to inland barges and freighter vessels of 50 DWT up to 3,000 DWT.

CAMBODIA

In Cambodia, in May 2009 the Navigation Coordination Committee prepared: "Calibrating the Navigable Waterways of the Mekong River System into a Classification Standard", and proposed a Mekong Vessel Classification. This vessel classification standard is used for the Ship Registration Form.

Class	Standard Vessel Dimensions				
	Length Ls (m)	Height Hs (m)	Width Bs (m)	Draft Ts (m)	DWT (ton)
0a (a)	140 - 160	29,0 - 33,4	19,0 - 22,0	7,3 - 8,0	7000 - 10000
0b	125 - 140	24,0 - 29,0	16,0 - 19,0	6,4 - 7,3	5000 - 7000
0c	110 - 125	19,0 - 24,0	14,0 - 16,0	5,6 - 6,4	3000 - 5000
0d	100 - 110	14,0 - 19,0	12,0 - 14,0	4,1 - 5,6	1000 - 3000
Ia	90 - 100	12,5 - 14,0	11,0 - 12,0	3,6 - 4,1	800 - 1000(b)
Ib	80 - 90	11,0 - 12,5	10,0 - 11,0	3,1 - 3,6	600 - 800
Ic	70 - 80	9,5 - 11,0	9,0 - 10,0	2,6 - 3,1	400 - 600
II	28 - 70	3,5 - 9,5 (c)	6,5 - 9,0	1,7 - 2,6	100 - 400
III	15 - 28	2,5 - 3,5	3,5 - 6,5	1,3 - 1,7	70 - 100
IV	13 - 15	1,5 - 2,5	2,5 - 3,5	1,0 - 1,3	30 - 70
V	11 - 13	1,2 - 1,5	2,0 - 2,5	0,8 - 1,0	10 - 30
VI	< 11	< 1,2	< 2,0	< 0,8	< 10

[a] *class 0 for river navigating seagoing vessels*

[b] *Container feeder barges up to 2000 ton*

[c] *Especially cruise vessels can be high for a relative low tonnage*

VIET NAM

Viet Nam has issued a classification "Standards of Technical Class of Inland Waterways in" (Code TCVN 5664 – 1992). This classification, which makes a distinction between natural rivers and canals, identifies 6 categories, class I being the biggest category. For modest inland navigation systems which biggest ships are self-propelled barges of not more than 200 DWT, this classification is satisfactory. However this classification does not mention anything about pushed convoys (3,000 to 9,000 DWT), self-propelled barges of 1,500 to 2,000 DWT or river navigating seagoing vessels (1,000 to 7,000 DWT).

In the report "Facilitating Trade through Competitive Low-Carbon Transport: The Case for Viet Nam's Inland and Coastal Waterways", World Bank (2014) the following is provided:

River Fleet by Waterway Class for 50 and 90 percent Load Factors, World Bank (2014)

	Self-propelled vessel				Pushed barge			
Class	Weight (tons)	Length (m) 50%/90%	Width (m) 50%/90%	Draft (m) 50%/90%	Weight (tons)	Length (m) 50%/90%	Width (m) 50%/90%	Draft (m) 50%/90%
I - North	601 - 1,050	49/52	8.8/9.5	2.5/3.1	4 x 400/600	121/132	20.0/22.0	1.85/2.70
I - South		44/50	9.0/10.0	2.85/3.1		87/92	20.6/22.0	2.55/2.80
II - North	301 - 600	44/47	7.50/8.50	2.10/2.60	4 x 400/600	121/132	20.0/22.0	1.85/2.70
II - South		39/42	7.70/8.80	2.50/2.75		87/92	20.6/22.0	2.55/2.80
III - North	101 - 300	34/40	6.00/7.30	1.70/2.00	2 x 200/250/400	104/108	7.0/8.5	1.50/2.70
III - South		25/36	6.50/7.50	2.15/2.55		80/87	8.5/9.4	2.30/2.80
IV - North	51 - 100	27/30	4.80/6.00	1.35/1.60	2 x 100	71/79	6.0/9.0	1.10/1.20
IV - South		18/22	5.10/5.80	1.80/2.10		54/68	6.10/8.00	1.20/1.60
V - North	10 - 50	19/24	4.00/5.20	1.20/1.40	NA	NA	NA	NA
V - South		14/16	3.40/4.40	1.05/1.50			NA	NA
VI - North	<10	12/18	1.90/3.00	0.55/0.85	NA	NA	NA	NA
VI - South		11/13	2.30/2.70	0.65/0.85			NA	NA

Source: VIWA 2007

Note: NA = not applicable

2.3.5 General Description of Vessels' Equipment

LAO PDR

The following navigation equipment are required by law:

Navigation Equipment	Required by law
Radar	No
Automatic Identification System (AIS)	No
Global Positioning System (GPS)	No
Communication equipment (VHF)	from 50GRT or >12 pax.
Electronic Navigational Charts (ENC)	No
Electronic Chart Display and Information System (ECDIS)	No
Fog horn	Yes
Search lights	Yes
Echo sounder	No
Navigation lights	Yes
Anchor	Yes
Mooring lines/steel cables	Yes

Vessel emergency response equipment

Requirements for emergency response equipment for inland waterway vessels, including passenger vessels, ferries and cargo vessels are prescribed in Chapter V of the Quadrangle Agreement: Firefighting equipment and Life-saving appliances.

Pollution prevention equipment

To dispose waste in the port and to avoid water pollution by throwing garbage overboard and pumping bilges in the river, the following provisions on board the vessel should be in place:

- a drum to collect the garbage, a drum to collect oily rags and a drum or slop tank to collect the bilges from the engine.

THAILAND

The following navigation equipment are required by law:

Navigation Equipment	Required by law
Radar	No
Automatic Identification System (AIS)	No
Global Positioning System (GPS)	No
Communication equipment (VHF)	from 50GRT or >12 pax.
Electronic Navigational Charts (ENC)	No
Electronic Chart Display and Information System (ECDIS)	No
Fog horn	Yes
Search lights	Yes
Echo sounder	No
Navigation lights	Yes
Anchor	Yes
Mooring lines/steel cables	Yes

Vessel emergency response equipment

Requirements for emergency response equipment for inland waterway vessels, including passenger vessels, ferries and cargo vessels are prescribed in Chapter V of the Quadrangle Agreement: Firefighting equipment and Life-saving appliances.

Pollution prevention equipment

- To dispose waste in the port and to avoid water pollution by throwing garbage overboard and pumping bilges in the river, the following provisions on board the vessel should be in place: a drum to collect the garbage, a drum to collect oily rags and a drum or slop tank to collect the bilges from the engine.
- The Regulation on Ship Survey No.19, Section 18, deals with provisions for toilets on passenger vessels and capacity of sewage tanks.
- The Public Health Act B.E. 2535 (1992), is the fundamental law to handle waste management and consists of 16 Chapters. Chapter 3 deals with the disposal of sewage and solid waste.

CAMBODIA

The following navigation equipment required by the Circular 003 of the Ministry of Public Works and Transport (MPWT) and the Technical Inspection Book:

Navigation Equipment	Required by law (as above)
Radar	Yes
Automatic Identification System (AIS)	Yes
Global Positioning System (GPS)	Yes
Communication equipment (VHF)	Yes
Electronic Navigational Charts (ENC)	No
Electronic Chart Display and Information System (ECDIS)	No
Fog horn	Yes
Search lights	Yes
Echo sounder	No
Navigation lights	Yes
Anchor	Yes
Mooring lines/steel cables	Yes

Inland waterway vessel emergency response equipment

Requirements for emergency response equipment for inland waterway vessels are only prescribed in the Technical Inspection Book and are according to the size and type of the vessel, passenger vessel/ ferry/cargo:

Firefighting equipment	Number required by law
Fire extinguisher	3/4/6
Fire pump	1/1/1
Fire hose, fire hydrant	5/1/4
Life-saving appliances	
Lifejackets	Total number of passengers and crew allowed/10
Lifebuoys	5/4/8
Life raft	2/2/2
Life boat	1/2/2

Emergency response equipment required by national regulations

Inland waterway vessel pollution prevention equipment

Article 8 of the Sub-Decree on Water Pollution Control of 1999, reads: "*The disposal of solid waste or any garbage or hazardous substances into public water areas or into public drainage systems shall be strictly prohibited. The storage or disposal of solid waste or any garbage and hazardous substances that lead to the pollution of water in public areas shall be strictly prohibited.*"

There are no specific regulations concerning vessel pollution prevention equipment on board.

VIET NAM

Navigation equipment

Apart from the required navigation equipment (Circular 44/2013 / TT-BGTVT November 15, 2013 amending Circular 14/2012 / TT-BGTVT April 27, 2012 by the Minister of Transport) for passenger transport by speedboat between inland ports in Viet Nam, there are no requirements for navigation equipment of inland waterway vessels.

Navigation equipment required by law:

Navigation Equipment	Required by law
Radar	No
Automatic Identification System (AIS)	No
Global Positioning System (GPS)	No
Communication equipment (VHF)	No
Electronic Navigational Charts (ENC)	No
Electronic Chart Display and Information System (ECDIS)	No
Fog horn	Yes
Search lights	Yes
Echo sounder	No
Navigation lights	Yes
Anchor	Yes
Mooring lines/steel cables	Yes

Vessel emergency response equipment

Requirements for emergency response equipment for inland waterway vessels, including passenger vessels, ferries and cargo vessels:

Firefighting equipment	*Number required by law*
Fire extinguisher	11/13/7
Fire pump	2/0/2
Fire hose, fire hydrant	3/3/2
Life-saving appliances	
Lifejackets	105%/105%/100%
Lifebuoys	10/10/6
Life raft	
Life boat	1/2/1

Pollution prevention equipment

Pollution prevention by inland waterway vessels is regulated by the National Technical Regulation on the Rule of Inland Waterway Ships Classification and Construction No.72: 2013/BGTVT compiled by the Viet Nam Register. This regulation specifies the requirements for test operations and classifications in design, building, conversion, restoration, repair and exploitation of the inland waterway transport activities on rivers, canals, lakes, marshes, breaks, bays and inland waterways transport routes along the coast.

2.3.6 Ship Design, Construction and Repair

(See also paragraph 2.8.5 of this report)

LAO PDR-THAILAND

The annex to the Memorandum of Understanding (MOU) on the *Quadrangle Agreement on Commercial Navigation on Lancang – Mekong River* with "*Technical Regulations on Surveys of Commercial Ships on the Lancang-Mekong River*" contains detailed requirements regarding vessel design, construction and equipment.

LAO PDR

Legal instruments in the Lao PDR that address design, construction and equipment of inland waterway vessels are very limited.

THAILAND

National standards, requirements and guidelines for vessel design, construction and equipment and ship survey are limited and regulated by:

- The Act on Navigation in Thai Waters B.E. 2456 providing miscellaneous regulations for all kinds of vessels;
- The Thai Vessel Act B.E. 2481 requires Thai vessels, in order to be registered as such, to comply with the survey requirements under the Act on Navigation in Thai Waters;
- The Marine Department Safety Measures for Transportation of Petroleum Products on Mekong River (Thailand) has prescribed safety measures for tankers and LPG carriers; and
- The Regulation on Ship Survey (No. 19) B.E. 2534, was designed for passenger vessels and ferries and provides, among other regulations, regulations on construction, provisions for

passengers, requirements when carrying dangerous cargo and firefighting and life-saving equipment requirements.

CAMBODIA

- The Circular 003/MPWT on the Management of Means of Water Transport (27th June 2000) addresses design, construction, equipment and inspection of inland waterway vessels. The requirements described in this Circular that concern vessel design, construction and equipment are limited.

A number of other applicable legislations are presently being drafted:

- *Draft Law on Inland Waterway Transport* **Chapter 11:** Ship Yard, Ship Building and/or Repair;
- *Draft Declaration (Prakas) for Carriage of Dangerous Goods* by Inland Waterways in the Kingdom of Cambodia;
- *Draft Sub-Decree on the positioning and technical details of lights*, shapes, light signals, sound signals and distress signals for ships;
- *Draft Declaration on Ship Technical Inspection*; *and*
- *Draft Sub-Decree on the format and procedures for the issuance of a permit* for the establishment of a shipyard.

In Cambodia standards and guidelines for design, construction and equipment for inland waterway vessels are not available. Phnom Penh has a military dock used for repair of inland waterway vessels. Most shipyards are private owned and used for new-building and vessel repair.

VIET NAM

In Viet Nam, the standards applicable for vessels regarding construction, life-saving and firefighting equipment, crew standards and waste management are regulated by the norms for classification and registration of inland waterborne transport, particularly “The National Technical Regulation on the Rule of Inland Waterway Ships Classification and Construction compiled by the Viet Nam Register (QCVN 72/2013/BGTVT)”, issued by the Ministry of Science and Technology and the Minister of Transport with Circular No. 61/2013/TT- BGTVT December 31, 2013. This regulation specifies the requirements for test operations and classifications in the design, building, conversion, restoration, repair and exploitation of the inland waterway transport activities on rivers, canals, lakes, marshes, breaks, bays and inland waterways transport routes along the coast, which were announced by the Socialist Republic of Viet Nam.

There are many shipyards; most of them are situated in Ho Chi Minh and Can Tho City.

2.3.7 Implementation of Ship Inspection and Registration, Crew Certification and River Traffic Permits

LAO PDR

The Department of Waterways (DoW) under the Ministry of Public Works and Transport (MPWT) is responsible for policy, planning, and managing all inland waterways in the country, including waterway transport. The Department of Waterways prepares the national legislation on the carriage of dangerous cargoes on board inland waterway vessels and the registering of inland waterways vessels, yearly inspection of the vessels and implementation. Ensuring compliance with the rules and regulations is also the responsibility of the Department of Waterways.

Registration offices

Registration is carried out by the Department of Waterways (DoW), the Provincial Departments of Public Works and Transport and the District Offices of Public Works and Transport depending on the size of the vessel. Registration offices are located in Oudomxay, Bokeo, Luang Prabang, Bolikhamsay, Khammouane, Savannakhet and Champassak Provinces.

Registration procedures

In order to register, the required documents must be submitted, which depend on the vessel's size. All inland waterway vessels need to be registered, except government owned vessels used for security and environment protection. Upon receipt of the necessary documents, the District Office of Public Works and Transport inspects the vessel, and if the vessel is in accordance with the registration requirements, the registration documents are issued and a vessel registration number is provided. The registered vessel has a "Navigation Booklet", issued by the Department of Waterways, providing the registry number and vessel particulars.

Required documents

Petition, Certificate, copy of ID card for Lao citizen or copy of passport for foreigner, Technical Inspection Certificate, import, invoice and receipt sheet, tax certificate or exempt tax in case of a foreign vessel, former registration documents in case the vessel was registered before in a foreign country, certificate relating to the actual present vessel owner, Technical Safety and Environment sheet and picture of the vessel (10 X 15cm).

Vessel inspection

A checklist and guidebook is presently not used in Lao PDR for conducting vessel inspections. However, there are checklists available at MRCS that can be used for this purpose.

THAILAND

The Marine Department (MD) is a governmental department under the Ministry of Transport (MOT), controlling and supervising the safety of transport by inland waterways, as well as the surveys and certification of vessels in Thailand.

The Marine Safety and Environment Bureau and the Ship Standard Bureau are the key responsible bureaus under the MD.

Besides the officials from the Ship Standard Bureau and the Marine Safety and Environment Bureau, the Marine Department has its Marine Office Branches throughout the provinces along the Mekong River. These branches include Marine Office Branch 1, which covers Chiang Rai Province and Marine Office Branch 7, which covers other Mekong River provinces.

In Thailand, the Marine Office Branch and the Ship Registration Bureau carry out the registration of inland waterway vessels.

The vessels sailing under the Thai flag are inspected at least once a year by the Ship Surveyor of the Marine Office Branch and the Ship Standard Bureau, the Marine Police (MP) under the Prime Ministry (Chiang Saen, Nong Kai, Mukdaharn) and the Navy Riverine Unit (NRU) under the Ministry of Defense (Chiang Saen, Nong Kai, Nakhon Phanom, Unon Rachathani)

Vessel Inspection Checklist and Guidebook

Vessel Inspection Checklist and Guidebook was prepared for Chiang Saen Commercial Port in Thailand, MRCS-NAP in 2012.

The Guidebook and the Checklist for the inspection of vessels outline the relevant and minimum requirements for inland waterway vessels and their crew. In order to carry out inspections of inland waterway vessels, a checklist has been made to provide a consistent basis for vessel inspections. The Vessel Inspection Guidebook (VIG) provides explanations on the items mentioned in the Vessel Inspection Checklist (VIC) and guidance on implementation.

CAMBODIA

The national legislation that addresses the Inland Waterway Transport sector is prepared by the Cambodian Inland Waterway Transport Department (IWTD) under the Ministry of Public Works and Transport (MPWT). The responsibilities of the IWTD, described in Sub Decree 14/ANKr/BK on the organization and functions of the Ministry of Public Works and Transport (03 March 1998), include preparation of national legislation for the safety of waterways, vessel construction and technical requirements, cargo and dangerous goods transport and transport and safety of passengers.

The IWTD, the Provincial Departments of Public Works and Transport, the Port Authority of Phnom Penh Autonomous Port (PPAP) under the Ministry of MPWT and the Waterway Traffic Police (Ministry of Interior) carry out the implementation and enforcement of the legislation, inspection of vessels, their equipment and documents.

Vessels crossing Cambodia-Viet Nam border

To cross the Cambodia- Viet Nam border, the MPWT prepared Declaration No.537 MPWT dated 12 December 2012 on the Procedures of issuance of cross-border transportation permits for inland waterway vessels as described in the Agreement between the Royal Government of the Kingdom of Cambodia and the Government of the Socialist Republic of Viet Nam on Waterway Transport.

Apart from registration of vessels, there is currently no national legislation in Cambodia on inland waterway vessels or the transport of passengers, dangerous and other goods by inland waterway vessels. Registration of inland waterway vessels is carried out by the Inland Waterway Transport Department under the Ministry of Public Works and Transport (MPWT) and Municipal City or Provincial Offices of Public Works and Transport. The same departments are responsible for inspecting vessels and are responsible for implementing and ensuring compliance with rules, regulations, standards and laws.

Registration procedure

Circular 003/MPWT on the Management of Means of Water Transport (27th June 2000): **Chapter 1**: Vessel/Boat Identity Card notes that: “All kinds of boats navigating on the waterways and loading capacity of 500 kilograms or more shall have a vessel/boat identity card issued by the Ministry of Public Work and Transport”.

Vessel inspection

- Circular 003/MPWT on the Management of Means of Water Transport (27th June 2000), **Chapter V:** Technical Inspection of Vessels/Boats:
- Draft law on Inland Waterway Transport, **Chapter 3:** Management and Registration of Ships.
- Draft law on Inland Waterway Transport, **Chapter 14:** Ship Inspection.
- The Draft Declaration on the format and procedures of issuing a ship’s technical inspection book by the Ministry of Public Works and Transport is especially important as it addresses the inspection of inland waterway vessels. The *Prakas* include an annexed checklist according to which all inland waterway vessels (minimum 5T or 15hp) should comply with the order to get the Ship Technical Inspection Book and regular (12 or 18 months) inspections for renewal of the Ship Technical Inspection Book.

Surveyors of IWTD using the Vessel Inspection Checklist and Guidebook prepared for Cambodia and Viet Nam, MRC, NAP October 2014, conduct the vessel inspection.

VIET NAM

The Ministry of Transport, Viet Nam Inland Waterway Administration (VIWA), the Viet Nam Register (VR), the Ministry of Public Security (MPS) and the Public Security Departments of cities and province prepare the national legislation for the IWT sector.

Inspection, implementation, and compliance is carried out by the Waterway Public Security Administration, the Inland Waterway Public Security Department, the Ministry of Public Security, the Inland Waterway Inspection Department, VIWA and the local port authorities. There are well-equipped units with rescue-boats as part of the Waterway Public Security Stations and the Inland Waterway Inspection Team. The Viet Nam Register (VR) conducts professional state management of technical safety for inland waterway vessels and organizes a unified survey network and a registration system throughout the country.

Registration Offices

- The VR technical supervision system of inland waterway vessels consists of 27 Offices and Branches and 37 watercraft Registration Offices under the Provincial Authorities. Registration Units are carrying out functions of management, technical supervision and quality certification for inland waterway vessels in accordance with the Decision No 2059/QĐ/PC of the Ministry of Transport.
- Water-craft Registration Offices under the Provincial Authorities are subject to the professional instruction of VR.

Registration procedure

Registering of inland waterway barges is the responsibility of the Departments of Transport (DOT) of cities and provinces (excluding police, navy and fishing vessels).

Vessel inspection

Viet Nam Registry is a specialist support unit that acts as a classification society; it classifies and issues technical certificates of seagoing vessels. Inspection, implementation and ensuring compliance of the law is carried out by the Waterway Public Security Administration, the Inland Waterway Public Security Department, the Ministry of Public Security, the Inland Waterway Inspection Department, VIWA and the local port authorities.

According to the Law No. 23/2004/QH11 of 15 June 2004 on Inland Waterway Navigation, Article 72, the Port Authorities have amongst others the responsibility to "*Check the implementation of the law on safety, security and protection of the environment of the vehicle, the ship; inspection certificate qualifications, professional certificates of crew and vehicle drivers; licensed vehicles, marine vessels entering and leaving ports and inland waterways".*

Location

- **Port authority area III:** inspection of all waterway vehicles in port. Main Office in Ho Chi Minh City.
- **Port authority area IV:** inspection of all waterway vehicles in port. Main Office in Can Tho City.
- Provinces in the Mekong delta have departments of the waterway traffic police for the inspection of waterway vehicles and inland waterway ports.

2.4 WATERWAY CHARACTERISTICS, BOTTLENECKS AND OPPORTUNITIES

2.4.1 The Mekong River System, River Stretches and Canals considered in this Master Plan

The Mekong River Basin has been split up in stretches that are suitable for navigation and have common hydrographic and topographic characteristics. Twenty-five stretches have been identified in the entire Mekong system.

They are mentioned in the table below with an indication of the length.

Stretches Suitable for Navigation in the Mekong River Basin

Stretch	From	Km	To	Km	Length
1	Green Triangle (mark 244)[2]	2,606	Golden Triangle[3]	2,373	233 km
2	Golden Triangle	2,373	Chiang Saen (passenger)	2,363	10 km
3	Chiang Saen (passenger)	2,363	Huay Xay	2,313	50 km
4	Huay Xay	2,313	Luang Prabang	2,007	306 km
5	Luang Prabang	2,007	Planned Sanakham Dam[4]	1,728	279 km
6	Planned Sanakham Dam	1,728	Vientiane (Laksi Port)	1,580	148 km
7	Vientiane (Laksi Port)	1,580	Savannakhet	1,125	455 km
8	Savannakhet	1,125	Pakxe	869	256 km
9	Pakxe	869	Khone Falls[5]	735	134 km
10	Khone Falls	735	Planned Sambor Dam	593	142 km
11	Planned Sambor Dam	593	Kratie	561	32 km
12	Kratie	561	Kompong Cham	447	114 km
13	Kompong Cham	447	Phnom Penh Chaktomuk	347	100 km
14	Phnom Penh Chaktomuk		Kompong Chhnang		122 km
15	Kompong Chhnang		Chong Kneas		122 km

[2] The three-land point PR China – Myanmar – Lao PDR is called the "Green Triangle"

[3] The three-land point Myanmar – Thailand – Lao PDR is called the "Golden Triangle"

[4] It has been informed that the Pak Chom dam will not be built. Instead, the Sanakham dam will probably be moved upstream to the Lao "only" river (following concerns from the Thai side), upstream the Loei river mouth somewhere around Km 1,728 although this has not been officially confirmed. Awaiting further detailed information, this report will assume the presumed location of the Sanakham dam is the Luang Prabang stretch ending at Km 1,728.

[5] The Khone Falls are spread over a distance of about 9 to 10 km. There is no distinctive "main channel" which may be presumed to be the Sahong channel, where most of the discharge comes through. For the use of this report the Km distance of the Khone Falls has been taken at Km 735.

Stretch	From	Km	To	Km	Length
16	Phnom Penh Chaktomuk	347	PPAP NCT LM17	322	25 km
17	PPAP NCT LM17	322	Cambodia-Viet Nam border	251	71 km
18	Cambodia Viet Nam border	251	Entrance Vam Nao River	218	33 km
19	Entrance Vam Nao River	218	Entrance Cho Gao Canal	66	152 km
20	Entrance Cho Gao Canal		Cai Mep		116 km
21	Entrance Cho Gao Canal	66	Cua Tieu (Mekong mouth)	0	66 km
22	Entrance Vam Nao River	218	Bassac River Vam Nao Pass	B188	24 km
23	Bassac River Vam Nao Pass	B188	Can Tho	B106	82 km
24	Can Tho	B106	Entrance Quang Chanh Bo	B 33	73 km
25	Entrance Quang Chanh Bo		Quang Chanh Bo seaside		32 km
For information					
	Cua Tieu		Cai Mep		44 km
	Quang Chanh Bo seaside		Cai Mep		118 km
	Cua Tieu		Hong Kong		1663km
	Quang Chanh Bo seaside		Hong kong		1741km
	Quang Chanh Bo seaside		Singapore		1013km

This means that the distance to be sailed from PPAP NCT LM17 to Cai Mep:

- via the Mekong and the Cho Gao Canal is 372 km;
- via the Mekong Mainstream to the mouth and then over the sea is 366 km; and
- via the Vam Nao Pass, the Bassac, the Quang Chanh Bo Canal and the sea is 433 km.

Moreover, the Agreement on Waterway Transportation between Cambodia and Viet Nam, signed in Phnom Penh on 17 December 2009, Chapter 3, article 26 says: *"Each Contracting Party shall maintain in good order the regulated waterways within its territory, and provide and maintain adequate aids to navigation so as to enable vessels, at least over the entire stretch of the transit routes, to sail permanently by day and by night."*

The canals that are considered as regulated waterways in the agreement between Viet Nam and Cambodia on cross border navigation are also taken up in this Navigation Master Plan.

2.4.2 Waterway Classification

In the upper part of the Mekong River Basin, neither Lao PDR nor Thailand has a waterway classification. Only PR China has a waterway classification, which is used on all PR China Rivers and which reaches from class VII to class I corresponding to Least Available Depths of 0.7 m up to 4.0 m.

In Cambodia, the Cambodian Navigation Coordination Committee prepared a waterway classification which has not yet been officially approved.

Cambodia Waterway Classification (not yet officially approved)

Class	Minimum navigation channel dimensions						
	Tonnage DWT (T)	Depth T (m) (a)	Width B (m)	Bent Radius R (m)	Bridge span (m)	Bridge Height H (m)	Electric wires height
0a (b)	7,000 - 10,000	8,8	66 - 88 (c)	960	88 - 132 (d)	37,00	39,00
0b	5,000 - 7,000	8,0	57 - 76	840	76 - 114	32,00	34,00
0c	3,000 - 5,000	7,0	48 - 64	750	64 - 96	26,50	28,50
0d	1,000 - 3,000	6,2	42 - 56	660	56 - 84	21,00	23,00
Ia	(e) 800 - 1,000	4,5	36 - 48	600	48 - 72	15,50	17,50
Ib	600 - 800	4,0	33 - 44	540	44 - 66	14,00	16,00
Ic	400 - 600	3,4	30 - 40	480	40 - 60	12,50	14,50
II	100 - 400	2,9	27 - 36	420	36 - 54	10,50	12,50
III	70 - 100	1,9	20 - 26	168	26 - 39	4,00	6,00
IV	30 - 70	1,4	11 - 14	90	14 - 21	3,00	5,00
V	10 - 30	1,1	8 - 10	78	10 - 15	2,00	5,00
VI	< 10	< 0,9	6 - 8	66	8 - 12	1,50	5,00

(a) T (m) = Ts (m) + DT (m) with DT (m) = 10% Ts (m)

(b) Class 0 for river navigating sea-going vessels

(c) Narrow (3 x Bs)-normal (4 x Bs)

(d) One way traffic (4 x Bs)-two way traffic (6 x Bs)

(e) Container feeder barges up to 2000 DWT

Viet Nam has issued a classification "Standards of Technical Class of Inland Waterways in Viet Nam" (Code TCVN 5664 – 1992). This classification, which differentiates between the natural rivers and the canals, identifies 6 categories, class I being the biggest category.

For modest inland navigation systems that have as their biggest ships self-propelled barges of not more than 500 DWT, this classification is satisfactory. However this classification does not mention anything about pushed convoys (3,000 to 9,000 DWT), self-propelled barges of 1,500 to 2,000 DWT or River navigating seagoing vessels (1,000 to 10,000 DWT).

Viet Nam Waterway Classification

Class	Minimum navigation channel dimensions						
	Tonnage DWT (T)	Depth T (m) (a)	Width B (m)	Radius R (m)	Bridge span (m)	Bridge Height H (m)	Electric wires height
I	500	> 3,0 (f)	> 90	> 700	80	10,00	12,00
II	300	2,0 - 3,0	70 - 90	500 - 700	60	9,00	11,00
III	100	1,5 - 2,0	50 - 70	300 - 500	50	7,00	9,00
IV	50	1,2 - 1,5	30 - 50	200 - 300	40	5,50	8,00
V	20	1,0 - 1,2	20 - 30	100 - 200	25	3,50	8,00
VI	< 10	< 1,0	< 20	60 - 150	15	2,50	8,00

2.4.3 Waterway Characteristics

Stretch 1: *Green Triangle to Golden Triangle (233 km)*

The information available on the actual situation of this stretch is provided by the "Development Plan on International Navigation on the Lancang-Mekong River (2014-2025), August 2014", submitted by the Department of Transport of Yunnan Province, Tianjin Research Institute for Water Transport Engineering, Ministry of Transport, China.

Some 50 rapids and dangerous areas are described in this report, where it is also mentioned that in 2006, PR China cleared 11 rapids and 10 shoals between the "Green Triangle" (the China-Myanmar-Lao PDR boundary marker Km 244) and the Golden Triangle (the Myanmar-Thailand-Lao PDR border).

Stretch 2: *Golden Triangle (km 2,373) to Chiang Saen - passenger pontoon (km 2,363) (10 km)*

The river is on average 500 metres wide and water depths easily reach 22 to 30 meters, except where the channel shifts from the right bank to the left bank or vice versa.

Stretch 3: *Chiang Saen - passenger pontoon to Huay Xay (50 km)*

The new commercial port of Chiang Saen is 6.5 km downstream of the former pontoon port and adjacent to the Mae Nam Kok river mouth, which has a high water outlet through the port harbor basin. The sharp river bend downstream of the port (Km 2,356) has a radius of R = 1,100 m. Water depths are in the order of 2.0-2.5 m with even a scour hole of 9.5 meters deep.

For this stretch, some nine rapids, shoals and dangerous areas are described in the "Waterway Design Report".

Stretch 4: *Huay Xay to Luang Prabang (306 km)*

The condition of most of the dangerous areas in this stretch has been surveyed and a proposal for a channel design (ships of 2,000 tonnes) has been made for eventual improvement for every dangerous area.

The channel is a continuation of the Chiang Saen – Chiang Khong/Huay Xay stretch, with many rapids and dangerous areas. The river in average is 500 to 600 m wide with many sand banks or rocky islands, whilst the navigation channel width varies between 180 and 220 m (average).

The river just downstream Chiang Khong/Huay Xay, is shallow (Hat Kham) where the channel shifts between riverbanks and/or between two sandy islands. Water depths are poor (at locations only 0.3 m) but the scarcity of the soundings renders them unreliable. In a narrow section of the river (73 m at Km 2,302.5) the river is more than 44 meters deep.

Some 30 rapids and dangerous areas have been identified between Huay Xay and Pak Beng. In addition some 30 rapids and dangerous areas have been identified between Pak Beng and Luang Prabang on the UHA maps and GPS Navigation Guidance System Base Charts and/or during boat travel between Huay Xay and Luang Prabang in March 2015.

Some of these rapids are real challenges to navigation and a few of them are famous for their accidents: Keng Phouang (two channels from which one is dangerously narrow and not recommended by the navigational aids) and Keng Leuk, known for its sharp bends, multiple islands and strong side currents. Many boats have perished in these rapids.

Stretch 5: *Luang Prabang to planned Sanakham Dam[6] (279 km)*

This stretch is not different from the upstream one, except for one big feature: the on-going construction of the Xayabury hydropower dam at Km 1,931. The dam, which at the time of writing this report was almost 65 percent completed, will create an impounded section upstream of about 80 km long with a highest operational water level (HOL) at +275 m, reaching the tail water level of the planned Luang Prabang hydropower dam. This means that under these highest operational water levels there will be no more section of free flow in the Mekong between the Luang Prabang hydropower dam and the Xayabury dam.

A number of dangerous rapids will also be submerged, amongst others the notorious Keng Luang rapid.

Some 15 rapids and dangerous areas amongst others were identified for condition survey and still exist at the time of reporting. Some features of 8 dangerous areas have already been surveyed under the previous MRC-study called *"Conditions Survey of Dangerous Areas for Navigation between Luang Prabang and Pakxe in the Lao PDR and Thailand"* (October 2009).

The river downstream of the dam site of Xayabury is characterized by a relatively straight and small channel (during low water level conditions) with multiple islands and rock outcrops and vast rocky areas (platforms, terraces) adjacent to the channel which all are flooded during the rainy season. Channel widths during the dry season (between rocky river banks) are often no more than 70 meters.

Other areas (e.g. Keng Sao: Km 1,791 – 1,792) are extremely complex channels and rocky islands, which all get flooded during the monsoon season. Six kilometers downstream (Don Sang at Km 1,786), the navigation channel contains an abundance of rock outcrops from which the majority gets submerged during the monsoon season.

Stretch 6: *Planned Sanakham Dam to Vientiane - Laksi Port (148 km)*

This stretch is characterized by narrow channels forming a braided Mekong River during the dry season. Every channel is wedged between rocky riverbanks about 4 to 5 meters high during the low water season and submerged during the monsoon season. Mid-water levels are extremely difficult and dangerous and ships often get stuck on top of the rocks of the riverbank, having to wait for the next monsoon season to get afloat again.

A huge number of scattered rock outcrops are making navigation extremely tricky during most of the time of the year and only extensive and durable navigational aids can be helpful.

In this stretch between the planned Sanakham Hydropower Dam and Vientiane Laksi Port (km 4), some 8 rapids and dangerous areas were identified, from which some characteristic features of 4 dangerous areas have been surveyed under the previous MRC-study from 2009.

Stretch 7: *Vientiane - Laksi Port to Savannakhet (455 km)*

This stretch in the upper Mekong (upstream of the Khone Falls) is probably the best natural navigation stretch of the entire Mekong. The waters are deep, the channel is straight with a steady flow and no strong currents or turbulences. The channel is between 350 and 500 m wide with gentle curves of more than R = 1,800 m. A number of bank protection works or simple river training works have been spotted at the Lao side between Km 1,338 and 1,335 and more substantial groynes (river training works) on the Thai side between Km 1,320 and Km 1,316. The river, which is between 600 m and 900 m wide looks stable and has a few sand banks and sand deposits, on the left and right banks and even sometimes in the middle of the river. The banks are all submersed during the monsoon

[6] According to the latest information obtained from the hydropower consultant POYRY in Laos, the Pak Chom dam will not be constructed but merged with the Sanakham dam upstream in the border with Thailand.

season. It is observed that many of these sandbanks have moved or shifted from the middle of the river towards one of the riverbanks by several tens of meters. Comparing the UHA-maps with the more recent Google earth aerial pictures reveals that the UHA-maps are outdated and need thorough revision. A typical example is in front of Tha Uthen (river mouth of Nam Hinboun).

Some 34 shoals (less than 4.0 m) and dangerous areas between Vientiane and Savannakhet have been identified of which only 4 rapids or dangerous areas for navigation have been selected for condition survey and channel design.

Keng Ka Bao at Km 1,151 is the only (condition surveyed) "dangerous area" between Vientiane and Savannakhet which is raising some navigation channel concern. Keng Ka Phouang at Km 1,157 is another example where a difficult channel has to be beaconed between rocks and islands.

However, here again the actual situation on navigational aids mainly relies on the old French markers, which are still functional and valuable although during mid- and high water levels some of them become an obstacle on their own.

Stretch 8: *Savannakhet to Pakxe (256 km)*

The stretch is characterized by a wide river (monsoon riverbed) but narrow navigation channel, hindered by many scattered rocks, islands and reefs that are creating a very difficult stretch for navigation. Most of these rapids and dangerous areas are, both in the dry season and in the monsoon season, a real problem for navigation. They are dispersed in average every 3 to 4 km. The longitudinal profile shows the Km location of the numerous dangerous areas and rapids, mostly concentrated between Km 908,0 and 1,100.0. In some places the river is very deep: often more than 40.0 to 50.0 m. These places are concentrated around the section Km 910.0 to Km 1,070.0 where the bottom gradient is greater than the up- or downstream sections.

The complete list of rapids and dangerous areas between Savannakhet and Pakxe shows some 80 locations of which only 10 rapids, shoals and dangerous areas have been identified for condition survey, indicated as being the most dangerous.

Stretch 9: *Pakxe (km 869) to the Khone Falls (km 735) (134 km)*

Close to the Khone Falls, the river splits in tens of branches, separated by islands and reefs where navigation is almost random between the hundreds of islands. The area is called "Siphandon" (translated into 4,000 islands).

The biggest of these islands is called Don Khong (Khong island) measuring 7 Km North-South and 7 Km East-West.

The navigation channel is situated in the left channel. Just downstream of Km 740.0 there is a bridge over the Mekong, connecting the mainland on the left bank with the Don Khong Island. The bridge has a main span of 6 x 90.0 m and the air clearance and navigation quadrangle = 60.0 m x 10.0 m.

This stretch has little or no commercial navigation, except for tourist passenger boats or local transport. Not a single rapid or dangerous area has been condition surveyed and little is known about the navigation condition in this area, except that it is often shallow, complex, intricate and purely domestic.

THE KHONE FALLS

There is no navigation at the Mekong Khone falls. The total drop is approximately 60 meters and the river splits into several branches, amongst others: Khone Lipy, Don Sahong branch, Khon Papaeng, and a number of smaller river arms all falling the same level down. Not a single of these river branches is navigable or shows any potential of being made navigable.



Khone Falls

The French, during the Indochina period, constructed a multi-modal transport system consisting of two river ports (one downstream and one upstream) linked by a small decauville railroad between the two river ports. The railroad crossed a bridge between the islands of Don Khon and Don Det and has now become a tourist attraction, as it has not been used in over 30 years!

Stretch 10: *Khone Falls (km 735) to planned Sambor Dam (km 593) (142 km)*

Downstream of the Khone Falls, the river remains divided into several branches, from which only a few are navigable but shallow and braiding through a 2.0 a 3.5 km wide monsoon river bed. There are, however, a few exceptions (e.g. Km 710.0 to Km 714.0) where the river is narrow, shallow, with sharp bends and quiet waters. It is the habitat of many exotic bird species, the extinguished/threatened Irrawaddy dolphins and other aquatic life.

The navigation channel is hopelessly complex, often even confused and only small domestic boats are plying on the river.

During the flood season, the waterway system becomes fully submerged and with little or no adequate navigational aids. The river system is about 4.0 km wide. The narrow channels are usually deep (more than 8.0 m and sometimes >30.0 m) but other places do not have more than 1.0 m water depth.

Further downstream in Stung Treng, the river is wide and navigable but requires a lot of skills from the pilot/captain in passing the rapids and often the narrow gaps are not more than 70.0 m (Km 660.5) in a 2,350 m wide waterway (monsoon river bed). The river is obstructed with scattered rocks and islands, most of them with vegetation (bushes) bended from being pushed during long months of flooding. A great number of parallel-aligned reefs (directed North-South) are crossing the channel and hindering navigation.

However, the navigation channel remains deep (20.0 to 40.0 m) but obstructions from reefs and rock outcrops, sometimes across the waterway, makes navigation without the French markers a difficult undertaking.

At some places there are two channels, both marked by French markers. One of the channels is usually very narrow but both are deep enough. However, this situation only occurs during low water.

There is an even more confusing channel marking (French markers) at Km 600.0, but the multitude of French markers is absolutely necessary due to submerged and scattered rock outcrops just under the water line which are totally invisible even during the low water season. The river is very wide (1,730 m) at this place and the water is flowing gently without ripples so that the pilots cannot "read" the water.

Stretch 11: *Planned Sambor Dam (km 593) to Kratie (km 561) (32 km)*

This is no doubt the most vulnerable ecological place on the entire river. It is also the habitat of the Irrawaddy dolphins and home to many other soft fresh water species and a multitude of colorful birds.

The river is very wide (2,300 m) and in some places shallow. The braiding river width is 4.0 km wide. The numerous islands are covered with white sand and low vegetation grows abundantly. The navigation channel leans close to the right bank where water depths are over 3.0 m and in some places even 24.0 m.

Stretch 12: *Kratie to Kompong Cham (114 km)*

Downstream from Kratie up to Kompong Cham, the river is wide, has a gentle flow, and is relatively deep. Kratie port is at Km 560.7 on the left bank (steel floating pontoon port connected with concrete stairs up the slope). Some 12 sandy shallow areas (water depth less than 2.0 m) are making navigation difficult during the dry season.

However, a lot of precaution has to be taken in the interpretation of the thalweg and hence the Least Available Depth (LAD). It sounds very suspicious that the LAD between Kratie and Kampong Cham should be - 0.5 m or - 0.6 m. In any case, more soundings are needed in such areas, not only for defining the LAD but also for designing a waterway channel either by dredging or by river training works.

The stretch Kratie-Kompong Cham, apart from these shallows, does not show any particular obstacle to the design of a commercial navigation channel. From Kratie on and further downstream in Kompong Cham towards the sea, the riverbed is moveable (non-cohesive material) and consists of silt, sand, coarse sand or gravel.

Stretch 13: *Kompong Cham to Phnom Penh Chaktomuk (100 km)*

Sea going vessels used to sail on the river up to Kompong Cham - Tonlé Bet. The Kizuna bridge over the Mekong at Kompong Cham - Tonlé Bet has a middle span of 200.0 m and a navigation clearance rectangle above the HHW level of 120.0 x 15.0 m. Sea going vessels cannot go further.

When the wooden port collapsed in 1992, no more sea-going cargo vessels sailed up the river but recently, on 14 April 2015, a Vietnamese vessel An Trung (3,075 DWT) sailed to Tonlé Bet and



Sea-going vessel called at Tonle Bet port

loaded 1,594 Tonnes of Cassava. On 1 May 2015 another ship, the G. Lucky (4,600 DWT and Togo-flagged), arrived at Tonlé Bet and loaded 2,000 Tonnes of cassava. Both vessels managed to pass the "shallow" Sdao channel at Km 385.0.

There are some 5 places where the water depths are less than 8.00m (with the view of considering the possibility of a future reinstatement of the sea going vessels up to Kompong Cham).

A number of hydrographic surveys have been carried out in the Sdao canal since 2010. Many proposals for dredging the Sdao canal have been made, all with a length of about 2,800 m to 3,500 m and a width of 100.0 m (suitable for sea-going vessels of 3,000 DWT).

All suggested solutions for improving this Sdao canal so far have been by dredging only. Almost every year a substantial quantity of sand/silt has to be dredged from this canal. After every flood season the channel is almost completely silted up and the dredging work has to start again. River training works have never been seriously considered, although they were suggested in previous studies (Cambodian Navigation Master Plan).

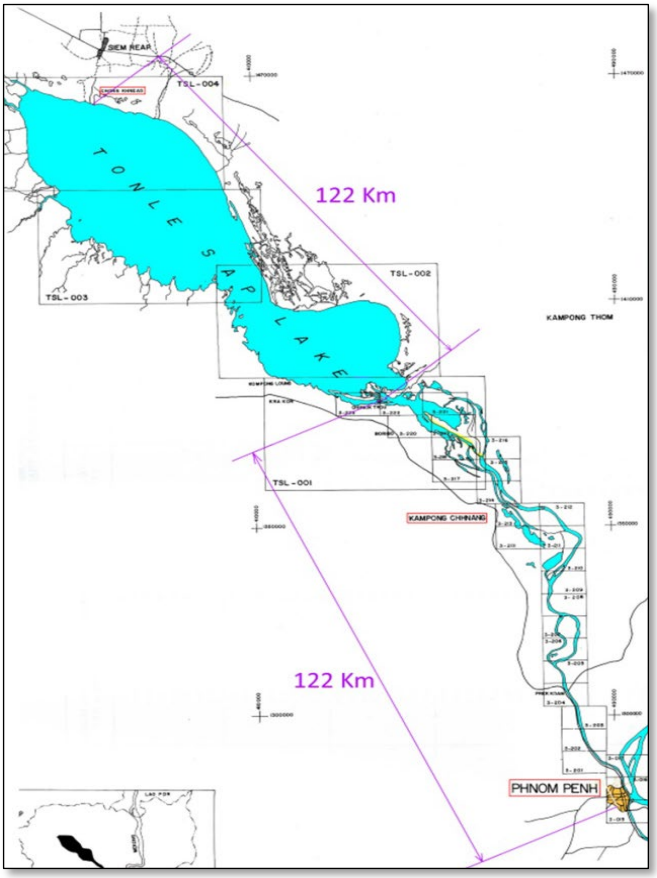
Further downstream (Km 365.0), the River splits again in two branches from which the western branch (right bank) is the main channel. However, boats with less draught can use the Eastern channel as well. The LAD is 1.5 m according to the UHA atlas. This is confirmed by the latest hydrographic survey from 9 and 10 November 2008.

A dredging proposal was established to allow small ships to take the channel. However, it was clear that the dredging solution was more intended to obtain quality sand from the river for construction or for reclamation, rather than to create a secondary navigation channel.

Stretch 14: *Phnom Penh Chaktomuk (km 347) to Kompong Chhnang (122 km) and Stretch 15: Kompong Chhnang to Chong Kneas (122 km)*

The Tonlé Sap waterway and the Great Lake are a particularity in the Mekong River System. The flow in the Tonlé Sap changes twice its direction per year. The Great Lake is the largest freshwater body in Southeast Asia and a vital part of the Mekong hydrological system. It is furthermore called "the nursery of all migrating fish species in the Mekong".

The Tonle Sap's mean water-surface area changes from 2,500 Km² to 3,500 Km² during the dry season (January to April-May) to a maximum of up to 14,500 Km² during the wet season (**4-5 times bigger**). Water depths up to 9.0 m can be reached (in the dry season not more than 0.7 to 1.0 m[7]) from late September to early October. However, the seasonal storage of water stored in the Great Lake goes from as low



Schematic map of the Tonle Sap and the Great lake, with length of the navigation channel

[7] Reference: MRC study named: "Technical Feasibility study of Dredging the Tonlé Sap Lake for Navigation", September 2008

as 1 to 2 km³ (= 1 to 2 million m³) to 50 or 80 km³ (= 50 to 80 million m³), or in average **50 times more** in the flood season. The differences between the water level in the Great Lake and the water level at Chaktomuk cause the unique flow reversal in the Tonlé Sap River.

The Tonlé Sap navigation branch starts from a width of 420.0 m at the river mouth at Chaktomuk to barely 80.0 m midway (because the main Tonlé Sap river branch is used by the fishermen over the entire width of the channel for their fishing activities). The small western river arm is also the only channel that passes the port of Kompong Chhnang.

Chhnock Trou is the last river port before the Great Lake. The river is extremely wide and very shallow. The UHA atlas gives negative water depths for the channel entrances (above chart datum), whilst the earlier referenced feasibility study on dredging in the Tonlé Sap mentions that the average water depth of the Great Lake is not more than 0.7 m during the low water season.

Stretch 16: *Phnom Penh Chaktomuk (km 347) to Phnom Penh NCT LM17 (km 322) (25 km)*

The Chaktomuk area is a four-river water distribution system. All water comes from the upper Mekong and, during a certain period of the year, from the Tonlé Sap, which is returning the water it had caught (and stored in the Great Lake) a few months before. The river bottom of the Chaktomuk is unstable and sand banks are moving back and forth according to the period of the year and the flow patterns. Nevertheless, this stretch of the Mekong River upstream of the Phnom Penh Autonomous Port (PPAP) keeps its importance due to its accessibility for sea going vessels (3,000 DWT) going up the Mekong until Tonlé Bet.

There used to be extensive maintenance dredging in the Chaktomuk area to create access to the former Phnom Penh port in the Tonlé Sap and to activate a better inflow in the Tonlé Sap for filling the Great Lake. However, nowadays the dredging has shifted downstream to guarantee continuous accessibility for the new Container Terminal of the PPAP for sea-going vessels (up to 5,000 DWT) and self-propelled barges sailing to Ho Chi Minh City and the Cai Mep - Thi Vai ports. The Ksom channel in front of the new Container Terminal of the PPAP is therefore a priority.

Yearly maintenance is now a fact. Ships and barges can reach the new Container Terminal of the PPAP without any problem. However, upstream of the Container Terminal there are a few shoals around Km 341.0 to Km 343.0. The natural Mekong at this place only has 4.5 m water depth below chart datum. Towards the left riverbank of the Mekong at Chaktomuk there are water depths of 8.2 to 8.5 m which are not a problem for shipping.

Stretch 17: *Phnom Penh NCT LM17 (km 322) to Cambodia - Viet Nam border (km 251) (71 km)*

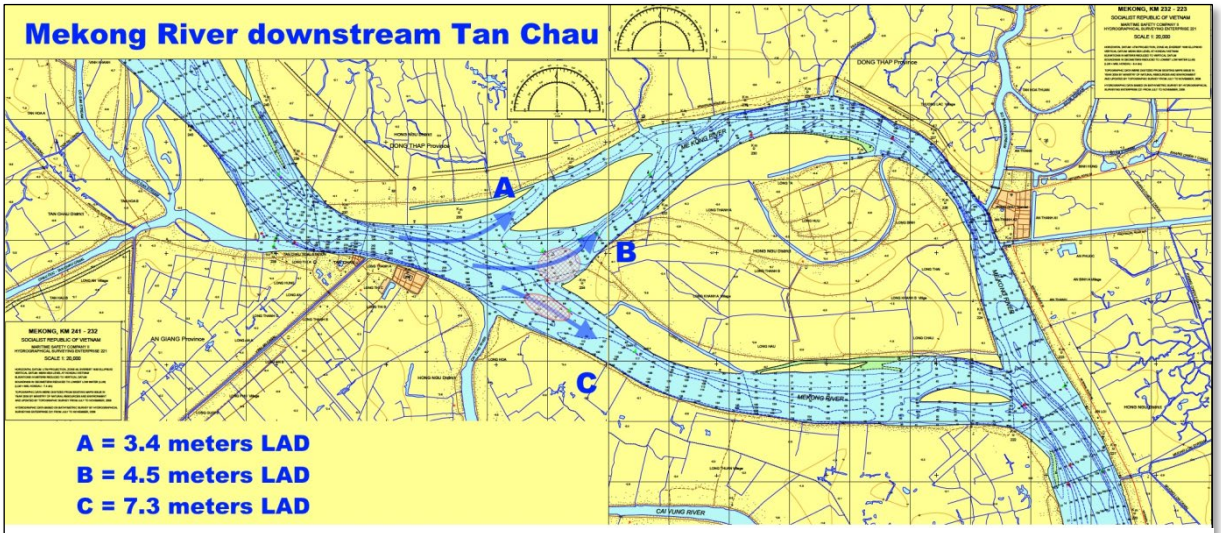
The river is generally deep, straight and shows only a few shallows in this area. There is heavy erosion of the right bank between km 307.0 and Km 314.0 and many bank protections in front of industrial land and LPG-tank farms have failed. The channel leans close to the right bank, which consists of over-saturated, unconsolidated fine sand to silt with little to no resistance to erosion.

A shoal is quickly growing just upstream the right river arm of the Kaoh Kandal island where a sandbank is emerging, obstructing the navigation channel (Km 316.0). The water used to be deep enough but is now silting up to water depths of merely 0.3 to 0.5 m. A dredging authorization has been issued by the Ministry of Mines and Energy for the PPAP to dredge the Koh Keo channel (estimated volume = 7.4 million m^3 sand). There are no other difficulties worth mentioning for shipping, even for sea going vessels with a draught of 7.0 m, between the border and the new Container Terminal of the PPAP.

Stretch 18: *Cambodia – Viet Nam border (km 251) to Junction Vam Nao River (km 218) (33 km)*

The Mekong mainstream is generally deep, with large bend radii for sea going vessels and few shallows. The entire stretch is well equipped with aids to navigation: buoys, shore marks and leading lines. The "physical" barriers or navigation problems are mainly related to shallows and sometimes short bend radii with poor visibility.

The next drawing shows the river just downstream Tan Chau. Starting from a narrow section in front of the city of Tan Chau, the Mekong river splits into three branches, named A, B and C. Branch A is only navigable for smaller boats and vessels: LAD = 3.4 m. In Branch B, which was the recommended navigation channel, LAD = 4.5 m. Branch C is now the actual channel with depths of over 7.3 m below chart datum.



Mekong River downstream Tan Chau where the river splits into 3 branches each with their own LAD form the shoal which is at there entrance

Further downstream there is a split between the [Northern] Vam Nao pass access (Western branch) and the Mekong mainstream (Eastern branch). Seagoing vessels and big barges taking the Western branch have to go to the Vam Nao pass and further to the Bassac (Hau). Seagoing vessels and barges taking the Eastern branch will have to stay in the Mekong mainstream in order to reach Ho Chi Min City and Cai Mep.

Stretch 19: *Junction Vam Nao River (km 218) to Entrance to Cho Gao Canal (km 66) (152 km)*

The Mekong Mainstream here has water depths of minimum 7.0 m deep below chart datum except in a few sections. Downstream of the My Thuan bridge (km 125.0), the river splits in two arms: the Northern branch being the Mekong mainstream (830.0 m wide) and the Southern branch being the Co Chien river (900.0 m wide). The main navigation channel (Northern River branch) becomes less deep (from over 20.0 m deep to less than 9.0 m deep at Km 120.0). At Km 115.0 there is a sharp bend to the right ending in a narrow section of not more than 310.0 m wide but 30.0 m deep. At Km 112.0, there is another split of the mainstream leading to the busy Cai Be River in Cai Be town. The mainstream channel is the Southern channel, which has water depths of over 8.0 m.

Where the Northern branch meets the Mekong mainstream again (Km 99.5) the river is remarkably narrow (355.0 m) and very deep (45.0 m). At Km 95.0 the Mekong splits again in two branches: a Norhern and a Southern Branch, the latter called Ham Luong River. Just before the split, the river is

2.0 km wide, but the Northern branch remains 8.0 m deep. The Ham Luong River (Southern river arm) is one of the nine river mouths of the Mekong delta estuary.

Navigation continues along the Northern river arm, relatively straight and deep. However, between Km 88.5 and Km 90.5, the navigation channel is only 7.1 to 7.5 m deep. Until the city of My Tho (Km 70.0) the river keeps its water depth of 8.0 m. However, navigation in this area is very dense and sea going vessels have been allocated their own channel, which is properly marked by buoys.

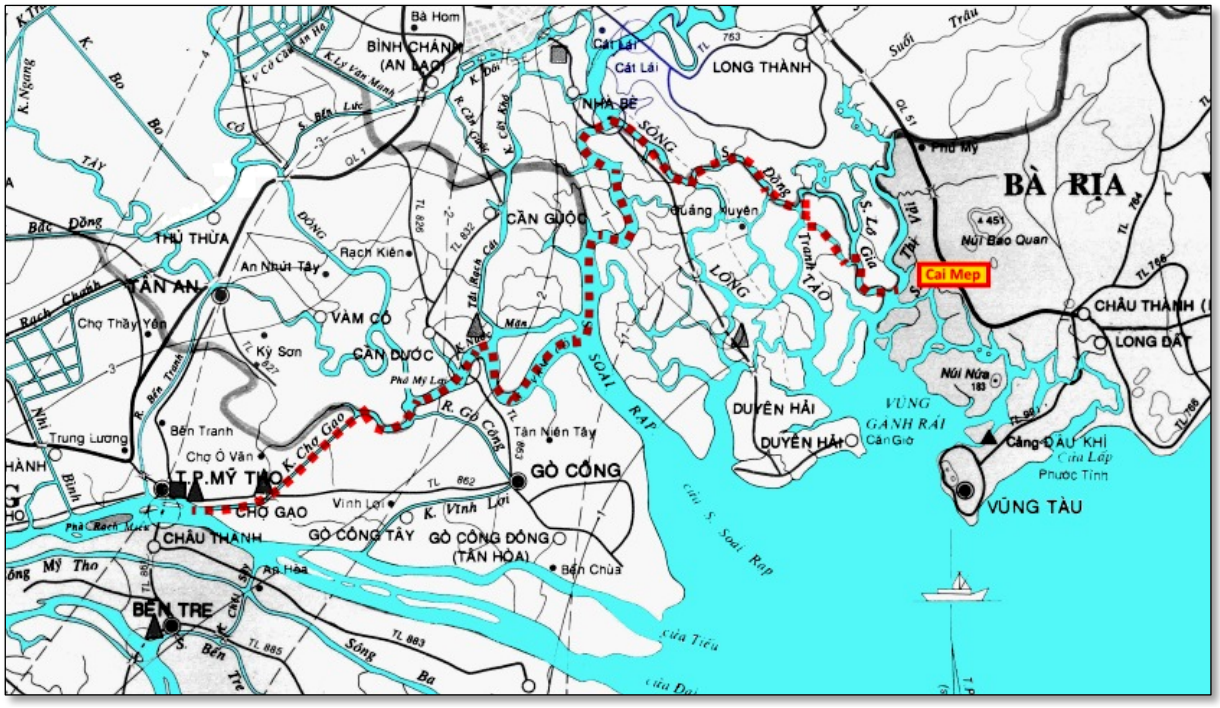
The entrance of the Cho Gao canal is at Km 66.0 and the last 5 km have only a water depth of 7.2 to 7.5 below chart datum.

Stretch 20: *Cho Gao Canal to Ho Chi Minh and Cai Mep (116 km)*

This shipping route is a labyrinth of canals and rivers (belonging to the Saigon River Delta) to reach the ports of Cai Map by barge. All of them are extremely busy and a great number of small domestic vessels and local passenger boats are all over the place, making it even more difficult for bigger vessels and barges to proceed through the canals. Therefore, bigger vessels and barges are requested to reduce their speed and use extreme precaution, especially in the bends.

Statistics show that, per day, 1,400 boats between 200 DWT and 1,000 DWT circulate on the canal. In peak days, this can even reach 1,800 boats per day. Traffic congestion and accidents are therefore frequent. The canal is actually being upgraded in different phases. The canal is being dredged, deepened and widened side by side, including bank protections, with the first half competed in 2014. The second half will start at end of 2015. The intention is to connect the port of Can To with Ho Chi Minh City and Cai Mep through the Ho Chi Minh - Chanh canal – Nuyen Van Tiep canal – Tien River (= Mekong mainstream) – Hau River (= Bassac) – Tri Ton – Tam Ngan Canal.

As long as the upgrading works are ongoing, no vessels bigger than 200 DWT and self-propelled barges of 70-80 TEU can use these canals which has the ultimate advantage of avoiding the open sea in order to reach Cai Mep.



Shipping route via Chao Gao canal to Cai Mep

Stretch 21: *Entrance to Cho Gao Canal (km 66) to Cua Tieu - Mekong Mainstream Mouth (km 0) (66 km)*

The Mekong Mainstream mouth in the Sea (Cua Tieu) is only navigable for commercial navigation at high tide. Water depth at low tide over the bar of Cua Tieu, which extends 11 miles from the entrance, can be less than 1.2. Due to the tidal currents and corresponding sediment transport, it is impossible to maintain a sufficiently deep navigation channel.

Therefore, the allowable draft of a vessels crossing the Cua Tieu depends on the depth of water on the bar plus the tide at Mui Vung Tau (tidal LLW = – 0.3 m, tidal HHW = + 4.0 m at spring tide).

Stretch 22: *Junction Mekong - Vam Nao River (km 218) to Entrance Vam Nao Pass in Bassac River (km B188) (24 km)*

The Western channel (towards the Vam Nao and the Bassac) has water depths of 8.0 m or higher until the entrance of the Vam Nao pass.

The Vam Nao pass is a natural connection between the Mekong mainstream (Tien) and the Bassac River (Hau) being 6.0 Km long and about 490.0 m wide. It is the only natural connection between these two important waterways; the others are man-made canals from which a few are to be/will be upgraded to have access for vessels and barges of up to 2,000 DWT.

The Vam Nao pass connects to the Hau (Bassac) with a sharp curve of approximately 1,500 m radius. Sea going vessels of 5,000 DWT and 10,000 DWT have problems as they need about 2,500 m radius (PIANC recommendations). During the flood season the current may be another additional problem, especially for downstream vessels. The Cambodian Master Plan recommended the dredging of the inner circle of the curve, which was estimated at 7 million m^3.

The entire Vam Nao pass is over its entire length deeper than 11.0 m, making it a suitable navigation channel for sea-going vessels over the Bassac (Hau) river.



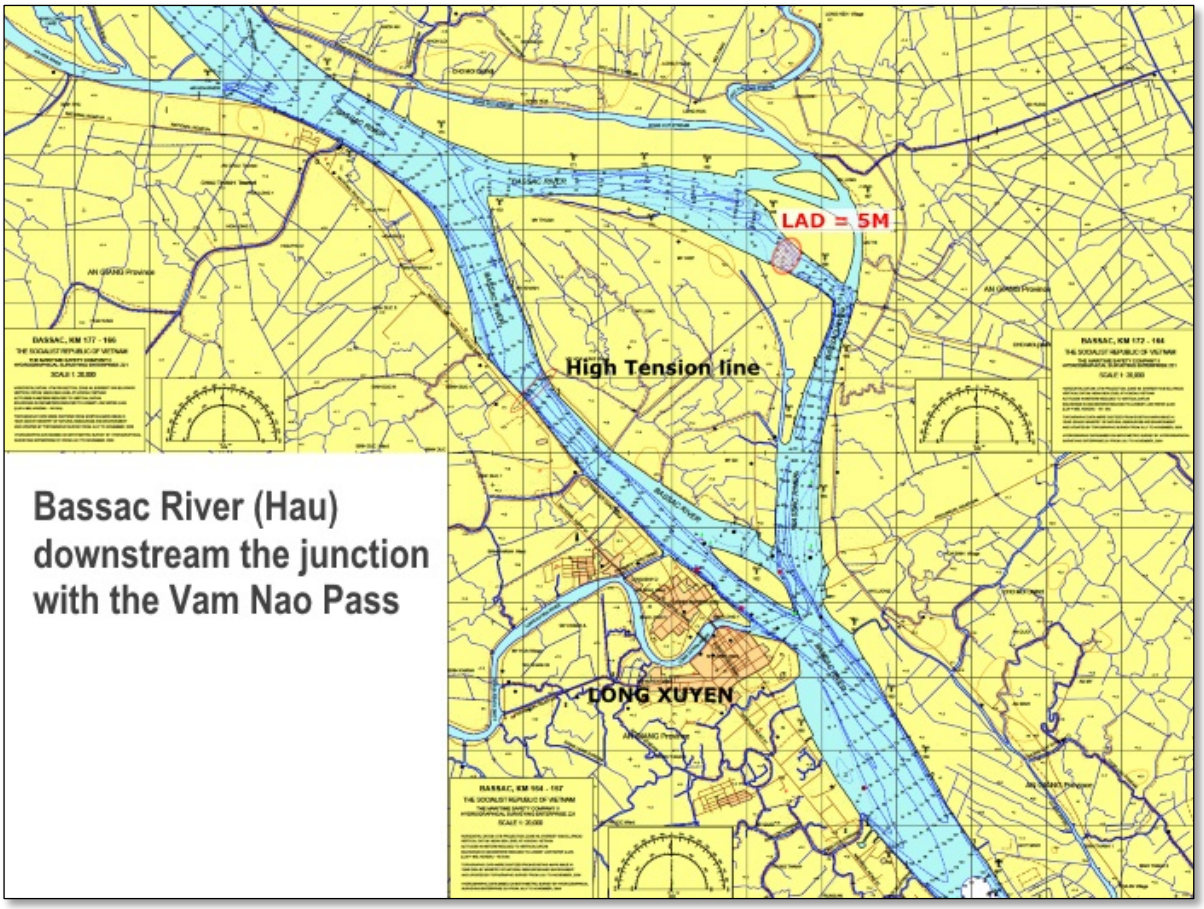
Stretch 23: *Entrance Vam Nao Pass in Bassac River (km B188) to Can Tho (km B106) (82 km)*

A few kilometers downstream of the junction with the Bassac, the Bassac splits into two river branches. The northern river branch is suitable for vessels of not more than 5.0 m draught (km B166.0) whilst the southern branch has water depths of minimum 12.0 m deep. However, 2.6 Km downstream of the split, there is a bundle of high-tension cable lines crossing the river from which the air clearance reportedly is only 15.0 m.

Where the two branches join again at the southern tip of the island, there is the city of Long Xuyen and the river mouth of the Long Xuyen River. The river remains deep (17.0 m) but only 340.0 m wide. There follows a long straight and deep stretch with lots of industrial settlements at the right river bank and numerous jetties.

At Km B149.0, the Bassac splits again in two branches, of which the northern branch is the deepest and the navigation channel. The river is straight, deep (14.0 m) and wide (1,150 m).

The Bassac continues to be straight, deep (avg. 14.0 m) and wide (avg. 750 - 800 m).



Stretch 24: *Can Tho (km B106) to Entrance Quan Chanh Bo Canal (km B33) (73 km)*

Downstream of Can Tho, the Bassac River splits into a number of braiding branches parallel to each other, each taking the share of "Bassac" discharge towards the sea (Sông Trà Ôn and Sông Hau). At Km B77.0, the total width of the river arms is 3.2 km. Nevertheless, the water depths remain between 20.0 and 9.0 m.

However, at Km B71.0 there is a shallow that requires almost yearly dredging, where water depths in the navigation channel are only 5.7 m.

Further downstream until the entrance of the Quan Chanh Bo canal (Km B33.0), the river remains straight and deep (never less than 8.0 meters).

The entrance to the Quan Chanh Bo canal is at the left river bank but the navigation channel follows the right river bank. Hence, a shoal has to be crossed, about 4 km and 100 m wide, in order to enter the shortcut canal. It is believed that this channel to the entrance of the Quan Chanh Bo canal will be part of the project of Quan Chanh Bo canal, but maintenance dredging is likely to be done on a regular basis.

Stretch 25: *Entrance Quan Chanh Bo Canal to Quan Chanh Bo Canal mouth in the sea (32 km)*

The Quan Chanh Bo canal was approved by a Decree of the Ministry of Transport nr. 3744/QD-BGTVT of 30 November 2007, wwhile adjustments to the project of Quan Chanh Bo canal were approved by Ministerial Decree nr. 2368/QD-BGTVT of 09 August 2013. The major works consist of a navigation channel 44.0 km long (12.0 km in the Hau River, 19.0 km in the Quan Chanh Bo Canal, 8.0 km in the Tat Channel and 5 km sea channel), a South breakwater 2.4 km long, bank revetments along the Tat channel, 5 km of road construction for the local residents, one new ferry, a barge berth (500 t), a channel management station and an Aids to Navigation system over the entire project of Quan Chanh Bo canal.

Total cost of the works of Quan Chanh Bo canal is estimated at 9,781 billion VNDong (450 million US$). These works have been financed by Ministerial budget. They are scheduled to be completed in 2017.

The project of Quan Chanh Bo canal will allow ships of 10,000 DWT fully laden and 20,000 DWT with reduced load to enter the Bassac.

2.4.4 Physical limitations and bottlenecks

In total, there seem to be some 40 places between the Golden Triangle and Kompong Cham, where the Least Available Depth (LAD) during the dry season is less than 2.0 m. Between Kompong Cham and Phnom Penh, there are some 4 places where the LAD is less than 6.0 m and downstream Phnom Penh to Cai Mep, there are some 6 places where the LAD is less than 8.0 m.

From the condition survey of the various dangerous areas between Huay Xay and Pakxe, some 15 narrow places (width of the navigation channel less than 40.0 m) have been identified in this stretch. These widths occur during the dry season.

Another obstacle could come from the bridge air clearance and the navigation quadrangle. The bridge air clearance is defined as being the vertical height of the quadrangle (defining the width of the navigation channel) that can be drawn under the bridge without touching the bridge beams.

The following table gives the navigation quadrangles of the bridges over the Mekong mainstream between the Green Triangle and the sea.

Navigation Quadrangles

Km	Name of the Bridge	Width (m)	Height (m)
NA	Friendship Bridge NR 5 in Louangnamtha: Lao PDR-Myanmar	60.0	12.22
2306.9	Friendship bridge NR 4 in Bokeo: Huay Xay – Chiang Khong	60.0	15.70
2173.0	Pak Beng (under construction)	60.0	17.14
1955.0	Tha Deua-Phakkone in Xayabury	60.0	17.96
1550.7	Friendship bridge NR 1: Vientiane (Thanaleng) - Nongkhai	60.0	10.00
1229.0	Friendship bridge NR 3: Khammouane - Nakhon Phanom	60.0	10.00
1130.0	Friendship bridge NR 2: Mukdahan - Savannakhet	60.0	14.48
866.6	Friendship bridge Lao PDR-Japan (Champassak - Pakxe)	60.0	11.00
740	Bridge between the left river bank and island of Khong	70.0	10.00
682	Stung Treng bridge over the Mekong	133,43	15.00
NA	Stung Treng bridge over the Sekong	99.553	10.00
370.5	Kizuna bridge in Kompong Cham	120.00	15.00
360.7	Prek Tameak bridge	120.00	14.00
2.7	Chrui Changvar bridge over the Tonlé Sap	135.00	10.00
13.4	Prek Phnov	95.00	10.00
32.5	Prek Kdam	120.00	10.00
NA	Monivong bridge over the Bassac River	50.00	5.00
NA	Prek Samroung or Takhmao bridge over the Bassac River	60.00	6.00
NA	Koh Thom over Bassac River	45.00	8.00
292.4	Tsubasa or Neak Lueng bridge	180.0	37.50
125.3	My Thuan bridge	110.0	37.50
72.3	Rach Mieu (My Tho) bridge	270.0	37.50
162.6	Cao Lanh (under construction)	200.0	37.50
105.0	Can Tho bridge over the Bassac	200.0	39.00
151.8	Vam Cong bridge over the Bassac	200.0	37.50

2.4.5 Overview of (Inter) national plans

LAO PDR-THAILAND

Plans to improve the navigation channel between the Green Triangle and Luang Prabang are proposed in the "Development Plan on International Navigation on the Lancang-Mekong River (2015-2025)", Department of Transport of Yunnan Province - Tianjin Research Institute for Water Transport Engineering, Ministry of Transport, PR China (see paragraph 2.13.5 of this report).

CAMBODIA

Plans to improve the navigation channel between Kratie and Phnom Penh are proposed in the "Feasibility Study on Waterway Improvement for Port Logistics Development in Cambodia, February 2015", KOICA (see paragraph 2.13.4 of this report).

VIET NAM

Plans to improve navigation in the Mekong Delta are proposed in the "Master Plan for Viet Nam Inland Waterway Sector to 2020 and Orientation to 2030" and in the "Decision No. 1071/QD-BGTVT dated 24/4/2013 of Ministry of Transport with Amendment on the Inland Waterway Development

Master Plan to 2020 and Vision to 2030". Unfortunately, these plans only exist in Vietnamese language.

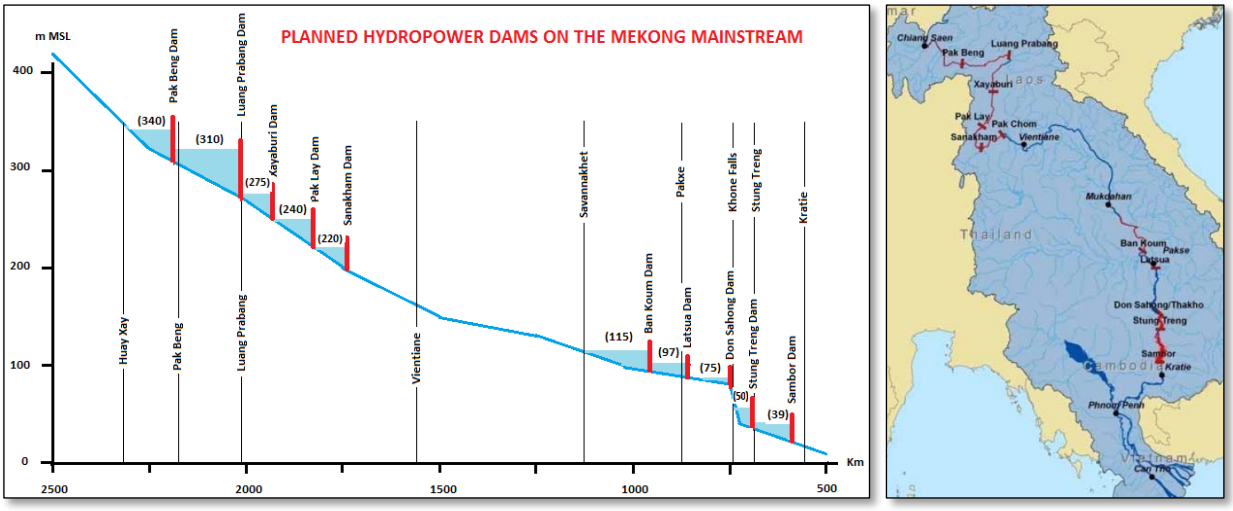
As mentioned before, the Quan Chanh Bo canal was approved by a Decree of the Ministry of Transport nr. 3744/QD-BGTVT of 30 November 2007, while adjustments to the project of Quan Chanh Bo canal were approved by Ministerial Decree nr. 2368/QD-BGTVT of 09 August 2013.

Finally, a major World Bank project consists of upgrading the canals between Can Tho, via the Mang Thi canal, to the Ham Luong River, with connection to the Tien Giang (Mekong Mainstream) via the Cho Lach canal, including the upgrading of the Cho Gao canal.

The upgrading of the Cho Gao canal to an inland waterway channel of class II is taking place in two phases: dredging one side of the canal was finished in 2014, while dredging the other side of the canal will start at end of 2015.

2.4.6 Hydropower Dam Projects

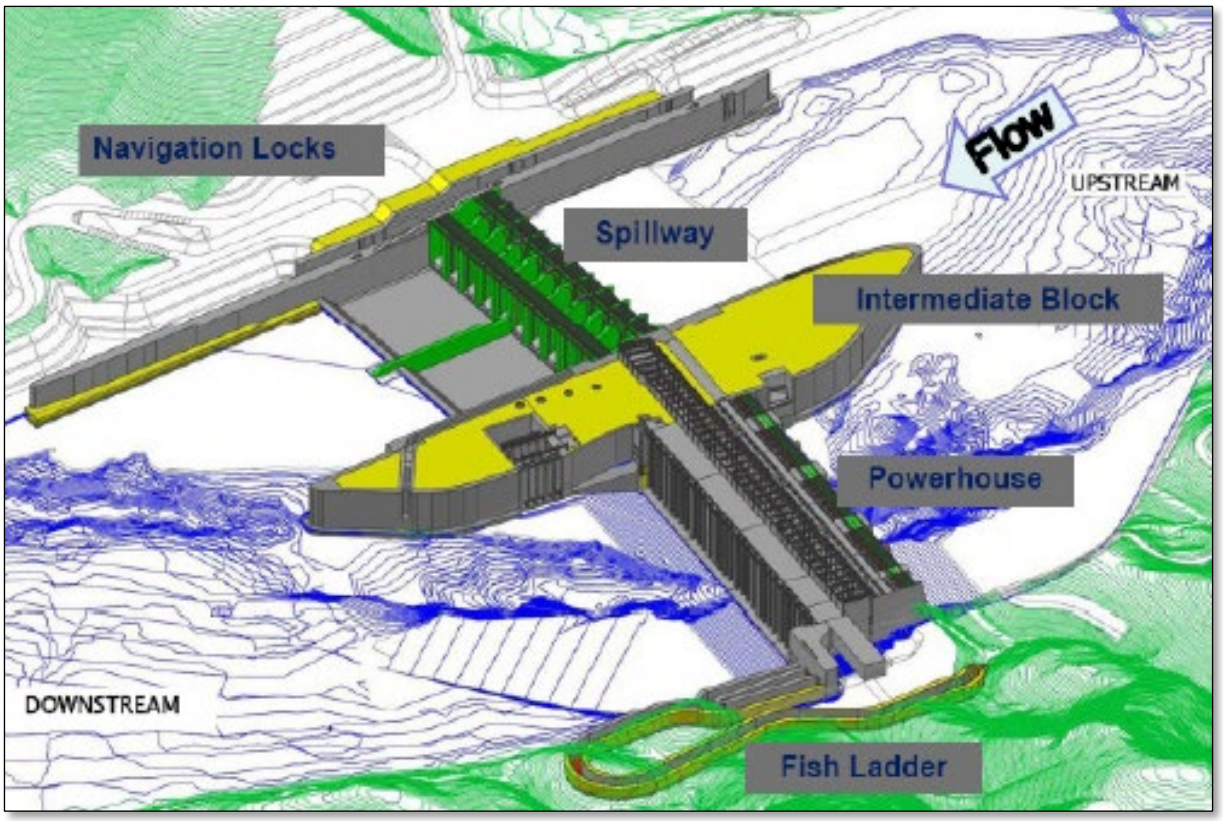
In the October 2010 final report on the "Strategic Environmental Assessment of Hydropower on the Mekong Mainstream", prepared for the Mekong River Commission by ICEM – International Centre for Environmental Management, eleven planned hydropower dams on the Mekong Mainstream have been considered with a total capacity of 12,418 MW: six in the Chiang Saen – Vientiane stretch (Pak Beng Dam, Luang Prabang Dam, Xayabury Dam, Pak Lay Dam, Sanakham Dam and Pak Chom Dam) and five in the Savannakhet – Kratie stretch (Ban Koum Dam, Latsua Dam, Don Sahong Dam, Stung Treng Dam and Sambor Dam).



Pak Beng is the northern-most of the Mekong Mainstream dams, located upstream of the town of Pak Beng, in Lao PDR. It has an installed capacity of 1,230 MW with a dam 943 m long, 76 m high and a water head of 31 m. It has a reservoir area of 87 km^2 and live storage of 442 million m^3. As originally designed with a Full Supply level at 345 m MSL, it would have inundated land back into Thailand, but under the Lao Government Optimization Study for the cascade, the FSL was lowered to 340 m MSL.

Luang Prabang is the second dam in the cascade, located above Luang Prabang town, about 3 km above the confluence with the Nam Ou, and the Pak Ou caves. It has an installed capacity of 1,410 MW and a dam 1,106 m long and 68 m high with a rated head of 40 m and a FSL of 320 m MSL. It has a reservoir area of 90 km² and live storage of 734 million m³.

Xayabury, the third dam in the cascade, is located about 150 km downstream of Luang Prabang town and is under construction now. It has an installed capacity of 1,260 MW with a dam 810 m long and 32 m high with a water head of 24 m and a FSL of 275 m MSL. It has a reservoir area of 49 km² and live storage of 225 million m³.



Artistic view of the Xayabury dam

Pak Lay, the fourth dam in the cascade, is located just above the district town of Pak Lay in Lao PDR.

It has an installed capacity of 1,320 MW and a dam 630 m long and 35 m high with a water head of 26 m and a FSL of 240 m MSL. It has a reservoir area of 108 km² and live storage of 384 million m³.

Sanakham, the final dam of the cascade to be located fully in Lao PDR, is situated just upstream of the Thai-Lao border, between Loei and Vientiane provinces. It has an installed capacity of 700 MW and a dam 1,144 m long and 38 m high with a water head of 25 m and a FSL of 220 m MSL. It has a reservoir area of 81 km² and live storage of 106 million m³.

The exact location of the **Pak Chom** dam site, at the time of drafting this report, was not known yet. The international hydropower consultants Pöyry have even said that the Pak Chom dam would not be built. There are reports that this dam would be merged with the planned Sanakham dam in the upstream direction at Km 1,743, some 7 km upstream of the Nam Heung River (which is the borderline with Thailand) in order to have the entire construction and reservoir on full Lao territory instead of building the dam and the reservoir on the shared river stretch with Thailand.

With these Full Supply Levels, the air clearance of the Huay Xay Bridge should be 19.8 m, of the Pak Beng Bridge 20.0 m, of the Luang Prabang Bridge 20.0 m, of the Tcheua Pachon Bridge 12.0 m and of the Pak Lay Bridge only 7.3 m.

Ban Koum is located about 10 km above the confluence of the Mun/Chi River with the Mekong, in a narrow valley with sandstone hills on each side. It has an installed capacity of 1,872 MW and a dam 780 m long and 53 m high with a water head of 19 m and a FSL of 115 m MSL. It has a reservoir area of 133 km² and little live storage.

Lat Sua has been relocated to a site 10 km downstream of Pakxe. The original site was between Pakxe and the Mun/Chi confluence, but since the reservoir would have flooded back to the Mun/Chi River, it was decided to relocate it and reduce the height, so that Pakxe would not be affected. It has an installed capacity of 686 MW and dam 1,300 m long and 27 m high with a water head of 10.6 m and a FSL of 97,5 m MSL. It has a small reservoir area of 13 km² and very little live storage.

Don Sahong dam blocks off the Hou Sahong channel, one of more than ten channels that flow over the Khone falls at the southern end of Siphandone. It has an installed capacity of 240 MW and a dam 720 m long and 8.2 m high with a water head of 17 m and a FSL of 7 m MSL. It has a small reservoir area of 290 ha and a live storage capacity of 115 million m³.



Stung Treng is the uppermost of the two Cambodian dams, and is located about 10 km upstream of Stung Treng town and the confluence with the Sekong/Sesan/Sre Pok Rivers. It has an installed capacity of 980 MW with an 11 km long and 22 m high dam with a water head of 15 m and a FSL of 55 m MSL. The reservoir would extend up to the Cambodia/Lao border covering 211 km² with an active storage of 70 million m³. The dam site lies within the Stung Treng Ramsar Site which effectively obliges the Royal Cambodian Government to 'actively support' the Ramsar Convention.

Sambor is the lowest of the Mekong Mainstream dams and largest one in Cambodia. It is located near the village of Sambor, upstream of Kratie and would inundate the river channel to just south of Stung Treng town. It would have an installed capacity of 2,600 MW and a dam over 18 km long and 56 m high with a water head of 33 m and a FSL of 40 m MSL. It would create a reservoir of 620 km² with an active storage of 465 million m³.

	Developer	Location	Water Head	Height	Design Discharge	Installed Capacity	Full Supply Level	Reservoir Area	Navigation Locks
		Km	m	m	m^3/s	MW	m MSL	Km^2	L (m) x B (m) x D (m)
Pak Beng	Datang International Power Generation (China)	2,188	31	76	7,250	1,230	340	87	Two locks 120 x 12 x 4
Luang Prabang	Petro Viet Nam Power Corporation (Viet Nam)	2,010	40	68	3,812	1,410	310	90	Two locks 120 x 12 x 3
Xayabury	SAEN & Ch. Karnchang Public Co Ltd (Thailand)	1,930	24	32	6,018	1,260	275	49	Two locks 120 x 12 x 4
Pak Lay	CEIEC and Sino Hydro (China)	1,810	26	35	4,500	1,320	240	108	
Sanakham	Datang International Power Generation (China)	1,730	25	38	5,918	700	220	81	
Pakchom*	NA	1,650	22	55	5,720	1,079	192	74	
Ban Koum	Italian Thai Asia Corp Holdings (Thailand)	950	19	53	11,700	1,872	115	133	
Lat Sua	Charoun Energy and Water Asia Co Ltd (Thailand)	860	11	27	10,000	686	97,5	13	
Don Sahong	Mega First (Malaysia)	735	17	11	2,400	240	75	290 ha	
Stung Treng	Song Da Construction Co (Viet Nam)	680	15	22	18,493	591	55	211	
Sambor	China Southern Power Grid (China)	593	33	56	17,668	2,030	40	620	

Overview of the Mekong Mainstream (planned) hydropower dams.

** will probably not be built and the Sanakham dam will be replaced to Km 1746*

Although navigation locks should be provided at all dams (except the Don Sahong dam), almost no information is available concerning the planned dimensions of the locks, but MRC insisted firmly that all dams should have locks with the dimensions 120 x 12 x 4 m.

2.5 NAVIGATION SAFETY

2.5.1 Legal Framework for Navigation Safety along the Mekong River

(See also paragraph 2.8.4 of this report)

LAO PDR-THAILAND

Several annexes to the MOU on the Quadrangle Agreement on Commercial Navigation on the Lancang-Mekong River are related to navigation safety:

Annex I: Regulations on Safe Navigation of Vessels on the Lancang- Mekong River;

Annex IV: Regulations on the Investigation and Handling of Waterborne Traffic Accidents;

Annex V: Regulations on Management of Search & Rescue, Salvage and Wreck Removal; and

Annex VI: Technical Regulations on Surveys of Commercial Ships on the Lancang-Mekong River.

LAO PDR

Legal instruments in Lao PDR that address safety management on board inland waterway vessels on the Mekong River are limited to the Draft Rule on Safety of the Port, the Draft Rule on Dry Port, the Draft Regulation on Handling and Storage of Dangerous Goods and the Draft Rule on Inland Waterway Transportation of Dangerous Goods.

In addition, reference can be made to some 10 regulations, guidelines, technical standards and notifications that currently apply to inland waterway transportation in Lao PDR.

THAILAND

- **Marine Department:** Safety Measures for Transportation of Petroleum Products on the Mekong River.
- **Notification of Marine Department No. 412/2543:** Guidelines for the Action Plan for Combating Marine Pollution at Ports where Dangerous Goods are loaded/discharged.

CAMBODIA

- The "Waterway Safety Report" prepared by the Cambodian Navigation Coordination Committee (Executive Office), December 2009 (www.ciwn.mpwt.gov.kh) is mainly focused on safety of navigation, ships, crew, waterway environment, cargo and passengers.
- The Agreement on Waterway Transportation between Cambodia and Viet Nam, Chapter 3. Technical Management of Waterways notes that: *"Each Contracting Party shall … provide and maintain adequate aids to navigation so as to enable vessels, at least over the entire stretch of the transit routes, to sail permanently by day and by night."*
- Draft Inland Waterway Transport Law, Chapter 4.
- Inland Waterways and Aids to Navigation, Chapter 5 notes that: "Skipper or navigator and shipping company shall be obliged to comply with the ship navigation rules, in order to prevent hazards or distress, resulting in personal injuries or loss of life, damages to or loss of properties."

VIET NAM

Some four Vietnamese laws, decrees and regulations contain provisions relevant to the carriage of goods by inland navigation and the management of safety on board inland waterway vessels. In addition, some eight circulars and decisions also regulate inland waterway transportation.

Some six decrees and circulars contain standards for vessels carrying dangerous goods and some eight decrees and circulars concern transport and safety of passengers.

2.5.2 Information Technology

LAO PDR

Automatic Identification System

The Automatic Identification System (AIS) is used on board inland waterway vessels on a voluntary basis. There is no plan to implement the use of AIS equipment on board inland waterway vessels.

Vessel Guidance System

In Lao PDR, the installation and use of a Vessel Guidance System and/or Global Positioning System (GPS) on board inland waterway vessels is voluntary. There is an on-going GPS project executed by NAP of MRC on the Mekong River from Huay Xay downstream to Luang Prabang Port.

Vessel Traffic Services

Vessel Traffic Services (VTS) are not available in Lao PDR on the Mekong River.

River Information Services

River Information Services are not available in Lao PDR on the Mekong River.

Electronic Chart Display and Information System

Electronic Chart Display and Information System (ECDIS) and Electronic Navigational Charts (ENC), see Vessel Guidance System.

THAILAND

Automatic Identification System (AIS)

The Automatic Identification System (AIS) is used on board inland waterway vessels on a voluntary basis.

Vessel Guidance System (GPS)

In Thailand, the installation and use of a Vessel Guidance System and/or Global Positioning System (GPS) on board inland waterway vessels is voluntary. Only three vessels are presently equipped with GPS equipment.

Vessel Traffic Services (VTS)

Vessel Traffic Services (VTS) are not available in Thailand on the Mekong River.

River Information Services (RIS)

River Information Services are presently not available in Thailand on the Mekong River.

Electronic Chart Display and Information System (ECDIS – ENC)

Electronic Chart Display and Information System (ECDIS) and Electronic Navigational Charts (ENC).

CAMBODIA

Automatic Identification System

The Automatic Identification System (AIS) is used on board inland waterway vessels on a voluntary basis. The MRC developed a strategy for the use of AIS in 2009 in Phnom Penh Autonomous Port, which called for implementing AIS coverage along the Mekong River between Phnom Penh and the Viet Nam border. Presently about 21 barges, mainly containerships sailing between Phnom Penh and Viet Nam, are equipped with AIS transponders.

Vessel Guidance System

In Cambodia, the installation and use of a Vessel Guidance System and/or Global Positioning System (GPS) on board inland waterway vessels is voluntary.

Vessel Traffic Services

Vessel Traffic Services (VTS) are not available in Cambodia.

River Information Services are presently not available in Cambodia. In 2009, the Navigation Coordination Committee started a website www.ciwn.mpwt. gov.kh but this website has not been actualized since.

Electronic Chart Display and Information System

The Republic of Korea is funding a project to develop electronic navigational charts to facilitate navigation between Phnom Penh and Kratie (215 km). Research and study is done by Korean experts together with local experts of the Waterway Department of the Ministry of Public Works and Transport.

VIET NAM

AUTOMATIC IDENTIFICATION SYSTEM

AIS equipment is compulsory according to Circular 44/2013 / TT-BGTVT of 15 November 2013 of the Ministry of Transport, regarding the regulations of passenger transport with speedboats between inland ports in Viet Nam. Speed boats, hydrofoils and hovercraft intended for passenger transport need to be equipped with AIS equipment.

For inland waterway vessels of 1,000 tonnes and more this will be made compulsory from 2017 – 2020 (according to the Master Plan for the Mekong Delta).

Vessel Guidance System

Circular 44/2013 / TT-BGTVT November 15, 2013 by the Minister of Transport concerning regulations for passenger transport with speedboats between inland ports in Viet Nam, require these vessels to have GPS equipment on board. For inland waterway vessels of 1,000 tonnes and more, this will be made compulsory from 2017 – 2020 (according to the Master Plan for the Mekong Delta).

Vessel Traffic Services

The Ministry of Transport and the Viet Nam Inland Waterway Administration are responsible for establishing a VTS system. The VTS system is used only for the river stretch between Saigon and Vung Tau (length 100 km). The system is set up and operated by the Viet Nam Maritime Administration.

River Information Services

Not available in Viet Nam.

Electronic Chart Display and Information System

NAP, with financial contribution from Belgium, has installed channel markers between Phnom Penh Port and the Cambodia-Viet Nam border.

The Hydrographical Surveying Enterprise (HSE) 221 of Viet Nam won the tender for the Condition Survey for navigation on the Mekong, Bassac and Vam Nao Rivers and started the project in June 2008. HSE221 will also prepare Electronic Navigation Charts for Monitoring Purposes of the Mekong, Bassac and Vam Nao Rivers in preparation of the installation of an Automatic Identification System.

2.5.3 Emergency Response and Search and Rescue

LAO PDR

The **legal framework** concerning emergencies on waterways is limited to the Environmental Protection Law, 17 January, 2013.

Emergency response stations along the Mekong River in Lao PDR are not available.

There are no **emergency response procedures** for explosions, fire, grounding, collision or spills.

EMERGENCY RESPONSE AUTHORITY

Depending on the extent of the emergency, the Office of Public Works and Transport of the Waterway Management of the river section will be the responsible agency, or, in case of major emergencies, the Department of Waterways will be responsible.

THAILAND

The **legal framework** consists of "The Regulation of the Prime Ministers' Office on the Prevention and Combating of Oil Pollution B.E. 2547 (2004)", the Notification of Marine Department no. 411/2543 – Safety measures for the loading/discharging of oil and chemicals, the Notification of Marine Department No. 412/2543 – Guidelines for the action plan for combating marine pollution at ports where dangerous goods are loaded/discharged, and "The National Oil Spill Response Plan", developed by the Committee on the Prevention and Combating of Oil Pollution.

Emergency Response stations along the Mekong River in Thailand are available in Chiang Saen, Chiang Khong, Nong Kai, Bungkan, Nakhon Phanom, Mukdaharn, and Ubon Rachathani.

There are no **emergency response procedures** for explosions, fire, and grounding but there are procedures for collision or spills.

Emergency Response Authorities

- **Marine Department (MD) under the Ministry of Transport:** Marine Office 1 Chiang Rai, and Marine Office 7 (Nong Kai, Nakhon Phanom, Ubon Ratchathani).
- **Marine Police (MP) under the Prime Ministry:** Chiang Saen, Nong Kai, Mukdaharn.
- **Navy Riverine Unit (NRU) under the Ministry of Defense:** Chiang Saen, Nong Kai, Nakhon Phanom, Unon Rachathani.

CAMBODIA

In January 2008, the Executive Office of the Navigation Coordination Committee, which operated under the MPWT, adopted a draft proposal of the Contingency Plan for Oil Spill Response in Cambodia for the Mekong River, its Tributaries and Lakes. This draft has not been approved yet.

There are no specialized **emergency response** stations along the Mekong River. Assistance is given by the port, under the responsibility of the Port Authority, with limited emergency response equipment, often in bad state and no or insufficient trained personnel.

A number of petroleum terminals have the necessary equipment and trained personnel for handling emergencies on the terminal and on board the vessel. However, no specialized teams are available.

Emergency response procedures are available for explosions, fire and spills but there are no procedures for grounding or collision.

Emergency Response Authority

Emergency response on the river and in the port is the responsibility of the National Committee for Disaster Management, the Port Authority within port limits and the Municipal and Provincial Governors for emergencies on the river outside port limits.

VIET NAM

Responses to oil spill incidents and other emergencies are implemented by the Viet Nam Search and Rescue Committee and in particular for oil spills through the National Response Oil Spill Plan under the Ministry of Science, Technology and Environment.

The Viet Nam Inland Waterway Administration (VIWA) under the Ministry of Transport (MOT), and the Dyke Management and Flood and Storm Administration under the Ministry of Natural Resources and Environment are among the partners of the Viet Nam National Committee for Search and Rescue. It is, however, unclear how the oil spill response plan is applied to the Mekong River system and if central rescue units in Ho Chi Minh City and coastal areas extend to the Mekong Delta.

Emergency Response Agencies

The responsible agencies ashore for search and rescue and emergency response in case of collision, explosion, fire, spill and grounding are the Port Authorities, Waterway Police, Fire Safety Police, pilots, rescue vessels, medical facilities and companies responding to oil spills, according to the Circular 37/2010 / TT-BGTVT (December 2010) on the rule for prevention and remedying the consequences of floods and storms, disaster emergency response and rescue on inland waterways.

The Committee for Storm and Flood Search and Rescue, Department Inland Waterways Viet Nam, has the responsibility to carry out flood prevention and search and rescue in the area of national inland waterways and is subject to the direct guidance of the Committee for Flood Prevention and Search and Rescue of the Ministry of Transport.

The Mekong Delta currently does not have any central search and rescue and oil spill response. Each provincial Committee for Flood and Storm Prevention and search and rescue, needs to deal with issues with simple equipment. In the near future, three centers for emergency rescue in case of collision, explosion, fire, oil spill, and grounding will be established:

(a) **Tien Giang Province:** responsible inland waterways stream Tien River area;

(b) **Can Tho City:** responsible inland waterways stream Hau river area; and

(c) **Chau Doc City:** responsible inland waterway Cambodia border areas.

Emergency response procedures

There are currently no procedures or scenarios to respond to different kind of emergencies on inland waterways in Viet Nam.

2.5.4 Ongoing and planned Studies and Projects

LAO PDR

Cfr. Development Plan on International Navigation on the Lancang-Mekong River (2014-2025), Department of Transport of Yunnan Province, Tianjin Research Institute for Water Transport Engineering, Ministry of Transport, China, August 2014 (see paragraph 2.13 of this report).

THAILAND

Vessel monitoring system from the Golden Triangle to Chiang Saen port (19.5 Km) with VHF, AIS, CCTV, water level gauge.

CAMBODIA

In the "Master Plan for Waterborne Transport on the Mekong River System in Cambodia, MPWT, 2006", some sixteen actions are related to and need to be considered under the present "Fleet and Waterway Safety" discipline.

VIET NAM

- **Mekong River Commission, NAP:** Carriage, handling and storage of dangerous goods along the Mekong River (2011-2014) (see paragraph 2.13).
- Report on the trial voyage on motor vessel Tay Nam 19 along the Mekong River between Cambodia and Viet Nam, January 2015 (see paragraph 2.13).
- Study on the Vessel Navigation and Security Management Network Reinforcement Project in the Socialist Republic of Viet Nam, prepared for the Ministry of Economy, Trade and Industry by Japan Radio Co., Ltd. Toyota Tsusho Corporation in February 2012.
- Facilitating Trade through Competitive, Low-Carbon Transport. The Case for Viet Nam's Inland and Coastal Waterways, prepared by the East Asia and Pacific Region of the World Bank in collaboration with Ecorys Research and Consulting.

2.6 AIDS TO NAVIGATION

2.6.1 Lao PDR and Thailand

Between the Green Triangle and Huay Xay 300 km), the Chinese authorities have installed 57 aids to navigation, including large beacons on the shore and on some rocks. In addition, signs indicating the name of villages and sound signals (warning horn) have been installed.

From Bokeo to the Khone Falls, between 1910 and 1930 some 600 concrete beacons were built



by the French. Some of them disappeared but there are still 541 unlighted concrete beacons left in the Lao PDR, although many of them are damaged.

Between Huay Xay and Luang Prabang, in 2014 the MRC installed a GPS Navigation Guided System with a navigation map on some 15 vessels. The system is fully functional here.

2.6.2 Cambodia

In 2007, 56 lighted buoys and eight leading markers were inaugurated between Phnom Penh and the Cambodia-Viet Nam border.

Today, some 34 buoys are still in place and installed with lantern and GSM locator modules to prevent theft.

In 2009, between Kompong Cham and Phnom Penh, 45 lighted buoys were inaugurated but today only 8 medium sized buoys remain. Many of the installed buoys have been swept away by debris or through theft.

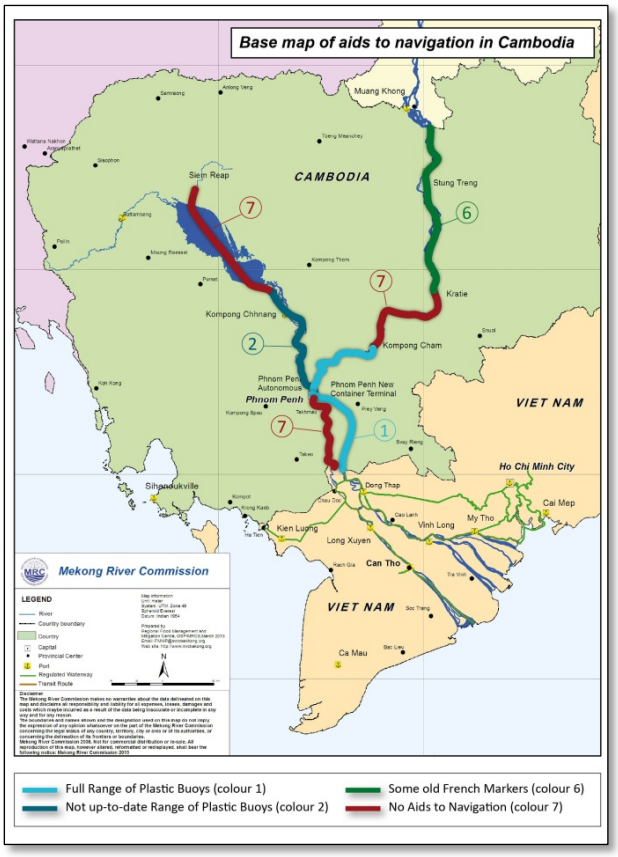
In 2012, 18 lighted buoys were installed between Phnom Penh and Chhnok Trou but today only 8 medium sized buoys remain and some of the lanterns are dysfunctional.

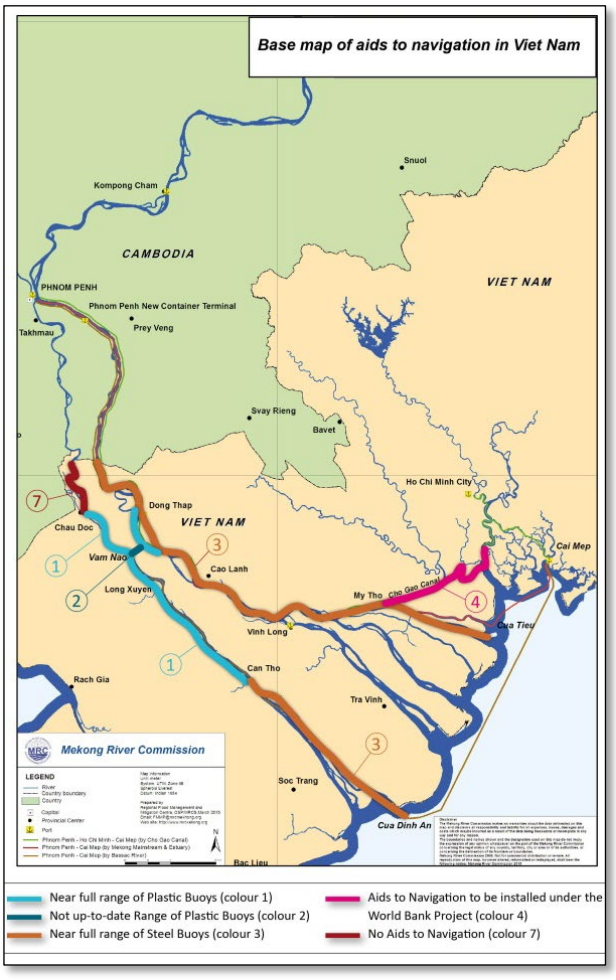
2.6.3 Viet Nam

On the Mekong Mainstream, from My Thuan to the Cambodia – Viet Nam border, 24 red steel buoys and 30 green steel buoys. Downstream of My Thuan, a nearly full range of steel buoys is also installed.

In the Vam Nao Pass, two red and two green large plastic buoys are installed. From the Vam Nao Pass to the Vàm Cái Săn on the Bassac River, 15 red large plastic buoys and 15 green large plastic buoys have been installed. Moreover, from the Vam Nao Pass to Cần Thơ, 57 steel red buoys and 32 steel green buoys are still present. Meanwhile downstream of Cần Thơ, a nearly full range of steel buoys is installed.

In the Cho Gao Canal from the Mekong mainstream to Ho Chi Minh – Cai Mep, there is no Aids to Navigation available, but it should be installed under the World Bank Project.





2.7 PORT DEVELOPMENT AND MANAGEMENT

2.7.1 The Mekong River Port System

LAO PDR

There are 21 river port facilities on the Lao PDR side of the river. All river ports and facilities are under the responsibility of the provincial government. Most of these river ports are small and still in their natural condition or consist of a reinforced concrete ramp parallel to the riverbank. These berthing facilities make it difficult for vessels to berth. Most ports have none, or limited, landing facilities and no maintenance nor a management system in place.

THAILAND

In Thailand, there are four main ports located on the Mekong River: Haciang Commercial Port (HCCP), Chiang Sean Passenger Port, Chiang Sean Commercial Port (CSCP) and Chiang Khong Port. Chiang Sean Commercial Port, Chiang Port and Chiang Khong port are owned and operated by the Port Authority of Thailand (PAT). Haciang Commercial Port is a private-owned and operated port.

As a result of the low water level at CSCP and in the navigation channel, HCCP started exporting petroleum products (diesel and gasoline) in 2012. The petroleum products are mainly exported to mainland PR China and the Union of Myanmar. The export of fuel products through Haciang Commercial port reached 27 million liters in 2014.

CAMBODIA

The cities and provinces where all international and domestic ports are located are Phnom Penh, Kompong Cham, Kratie, Stung Treng, Kandal, Kompong Chhnang, Siem Reap, Kompong Thom, Po Sat and Prey Veng. However, it should be noted that, apart from Phnom Penh, all the inland waterway ports are mainly just ramps or simply riverbanks used by domestic boats for landing to discharge and load various kinds of food stuffs, groceries, construction materials and passengers.

To sum up, for Cambodia as a whole, the ports handling domestic cargoes and passengers are located in Phnom Penh, Kampong Cham, Kratie and Stung Treng on the Mekong River, and in Kampong Chhnang, Chhnok Trou and Siem Reap on the Tonle Sap River and Lake.

VIET NAM

Most containers that are shipped from the NCT LM-17 in Phnom Penh, Cambodia are part of an intermodal transport chain. The containers come from the manufacturer in Cambodia and are transported by road to NCT LM 17, where they are loaded on barges to Cai Mep seaport in Viet Nam. From there, the goods are transferred on ocean-going vessel with different destinations such as the US and Europe or on feeder vessels going to Singapore where cargoes are consolidated and then go on ocean vessels to their destination in the US or Europe. In Cai Mep there are several (about seven) big container terminals. As most of the containers shipped from Cambodia are intended for Cai Mep International Terminal, only this terminal will be discussed.

2.7.2 Port Facilities

LAO PDR

Ban Sai Port

The port is located 3.7 km away from the China-Lao PDR-Myanmar border. At the port, a public security inspection station has been established to undertake exit and entry inspections for border inhabitants and ferry boats. The port is located at the natural river bank and has no facilities.

Xiengkok Port

The port is located 238 km away from Jinghong Port (PR China) and 107 km away from Chiang Sean port (Thailand). A joint inspection organization inspects people, vessels and cargo passing the port from four countries (China, Myanmar, Lao PDR and Thailand). The port has a sloped berth but no cargo handling facilities.

Muongmom (Ban Mom) Port

The port is located in Bokeo Province, 327 km away from Jinghong Port and 18 km from Chiang Sean Port. At the port there is almost no cargo handled. The port serves as a checkpoint, all vessels passing this port need to stop in order to sign the necessary documents.

The total area of the port is 4.3 hectares. The port has open storage area and one office building. The total length of the berth is 248 meters. The access road to the port, the roads in the port, the parking area for trucks and the sloped ramp (average slope 9%) are all made of concrete. The maximum permissible draft at the port is 5.0 meters during the wet season and 1.8 meters during the dry season.

Ban Khouane Port

Ban Khouane Port is located within the territory of Bokeo Province, 334 km away from Jinghong Port and 11 km away from Chiang Sean Port.

Currently, Ban Khouane port called “Golden Triangle of International border checkpoint where is opposite to the Golden Triangle of Thailand in Chiang Saen district of Chiang Lay province, is improving and upgrading to be passenger port and cargo port.”

Huay Xay Port

The port is a national-level checkpoint and is located 402 km away from Jinghong Port and 57 km away from Chiang Saen Port. The port started commercial operations in 1990 and is used both as a passenger and cargo port. The port is already more than 25 years old and maintenance has only been done when equipment/infrastructure has broken down.

The port is an embarking/disembarking point for boat trips or “cruises” going to Pak Beng and Luang Prabang. The port has no parking space available and all trucks, cars and taxis need to park on the sloped wharf, sometimes leading to chaotic traffic situations. The port has no proper landing facilities for passengers. Embarking and disembarking from the passenger boats is often an “adventure” and not always easy even for people in good health.

Pak Beng Port

Pak Beng port is located at km marker 172 in Oudomxay province. The port has a 5 ton lifting truck but most cargo operations are done using manual labor. The maximum permissible draft at the port is 2.5 meters during the wet season and 0.4 meters during the dry season.

Pak Beng port is however mainly used as a passenger port. The port is an intermediate stopping place as there is no navigation during the night for tourists going from Huay Xay to Luang Prabang and makes it more comfortable than the rocky embankment but it is unstable for the number of people.

Luang Prabang Port

Luang Prabang has two ports, one used for cargo and one for passengers. The port is located 702 km away from Jinghong port (PRC) and 357 km away from Chiang Saen Port (Thailand).

The Trade port has done a new harbour, down ports are paved with concrete, with the association with one boat handling. The product portfolio through these ports is construction material, timber, lumber, agriculture produce and consumer goods with parking place. The port is linked to the town with the concrete slope and road.

The Luang Prabang passenger port is located near the city center. The landing facility has a steep slope in earth and partly in concrete.

Vientiane – Km 4 State Port (Laksi Port)

Km 4 State port is located in Vientiane Capital. Cargo exports have, however, decreased as transport companies have opted for improved roads as a more viable and reliable transport link. The main types of cargo handled are construction materials, agricultural products and timber.

Km 4 Port has two underground storage tanks on the premises, each having a storage capacity of 10,000 litres but was not use for long time ago (since 1989).

Savannakhet Port and Pakxe Port

No information received.

Ferry Ports

There are many ferry ports in Lao PDR. In the past, ferries were the only connection between Thailand and Lao PDR. However, some ferries have ended operations since the completion of the Lao-Thai friendship bridges (road transport).

Ferry ports are for example located in Pakxe, in Paksan Port in Bolikhamxay Province, New Thakhek Port in Khammoun Province, Pakxebangfai Village Port in Savannakhet Province, Thaphin Port in Champassak Province and Barn Vang Port in Vientiane Province, among others.

Dry Ports

According the intergovernmental agreement on dry ports adopted by resolution 69/7 by the member States of UNESCAP, Lao PDR has currently one dry port: Thanaleng Dry Port located in Vientiane. The agreement also mentions eight other potential dry ports.

Thanaleng Dry Port is located near the Lao-Thai Friendship Bridge I, is 6 hectares and has an open space, a parking lot for 150 trucks/trailers, warehouses with closed doors, warehouse units for rent and a cool warehouse. With the completion of the rail link from Thanaleng to Bangkok and Leam Chabang, there are plans to establish another dry port at the Thanaleng Railway Station. Dry ports are also planned for Savannakhet, at the intersection of NR13 and NR9 highways, which will improve logistics facilities along the Greater Mekong Sub-region's East-West Economic Corridor and at Champassak on NR16, which will



facilitate transport on the Thailand-Lao PDR-Cambodia-Viet Nam route.

THAILAND

Chiang Saen Port

Chiang Saen Port is an open port and is situated on the bank of the Mekong River in Chiang Saen District. The total port area is about 14,400 m^2. The terminal at Chiang Saen Port consists of two floating pontoons provided with bridges linking to the quayside. This means that there are two berths of 12 by 50 m and an area for container storage. The port has one mobile crane with a capacity of 50 tonnes and a conveyor belt for loading/discharging cargo to and from ships. The designed cargo handling capacity is about 540,000 tonnes per year. Since the port is located in a designated historical site, the port is currently mainly used as a tourist port.

Chiang Saen Commercial Port

The port is located about 10 km south of the present Chiang Saen Port, with a total area of 640,000 m^2. The port has two 300 m two-level sloped berths (30% slope) for loading and discharging general cargoes and a 200 m vertical berth for general cargo and container handling. For loading/discharging cargo, the port is equipped with a 10 ton mobile crane, a 10 ton forklift and a 3.5 ton capacity forklift, all in good condition.

Chiang Saen Commercial Port has adopted a one-stop service system at the port office building including Chiang Saen and Chiang Khong Port Office, Marine Office of Chiang Rai Branch, Chiang Saen Customs House, Chiang Saen and Chiang Khong Food and Drug Checkpoint, International Health Control Office, Chiang Saen Immigration Checkpoint, Chiang Saen Plant Quarantine Station, Chiang Rai Animal Quarantine Station and Chiang Rai Provincial Fish inspection Office.

Chiang Kong Port

The port is a small river port adjacent to the Mekong River, facing Huay Xay in the Lao PDR. The port primarily serves small ships and ferries from Lao PDR. The port has a concrete quayside terminal with a width of 24 meters and length of 108 metres.

The port has a small 10 wheel truck parking area and is able to accommodate 5-10 ton wheel trucks at a time. The port has no facilities to load or discharges vessels. All cargo operations are carried out using manual labor. The highest import and export value is from two-way trade with China, followed by Lao PDR and Myanmar. The top three imported products through this port are vegetables, fruit and fresh flowers from China. The top three exported products are petrol (diesel), gasoline (benzene) and consumer products, mostly to China and Lao PDR.

Haciang Commercial Port

Petroleum products (diesel and gasoline) are mainly exported through Haciang Commercial Port (HCCP) to the mainland of PR China and Myanmar and partly used for bunkering vessels. The port has a sloped berth for trucks to reach the vessels for loading/discharging general cargoes. The berth is about 110 meters in length. The port also has one vertical berth where one vessel can berth for loading/discharging heavy loads and one dedicated berth for loading/discharging fuel (diesel and gasoline) from truck to vessel. Loading and discharging of vessels is mostly done by manual labor. For heavy loads the port has one Tandano crane available.

Dry Ports

According the intergovernmental agreement on dry ports adopted by resolution 69/7 by the member States of UNESCAP, Thailand has currently one dry port: Lat Krabang. The agreement also mentions two other potential dry ports in Thailand, such as Chiang Khong. The Lat Krabang Inland Clearance

Depot (ICD) is located about 27 km east of Bangkok and 118 km north of Laem Chabang Port and has a total area of about 104 ha. It is divided in six modules, each of which is leased over a 10 year period to tenants, mostly shipping companies. The dry port has a designed capacity of 1.5 million TEU/year.

CAMBODIA

Phnom Penh Autonomous Port

Phnom Penh Autonomous Port is located in the center of Phnom Penh with congested access from city streets. The main wharf was built in 2002 and is still in good condition. It comprises a concrete decked structure some 300 m long by approximately 20 m wide, built out into the stream with two broad concrete connecting bridges. In 2012, the port handled 95,333 TEUs but due to the location of the port (in the city center between the river and the street) the area cannot be expanded in any direction. Therefore, to minimize environmental impact and allow all-the-time truck transport in order to reduce traffic congestion and take advantage of Viet Nam's Cai Mep Port development, the PPAP has decided to construct a new container terminal (NCT LM 17), which will leave the old port abandoned.

Phnom Penh Passenger Port

In Phnom Penh, the Passenger and Tourist Terminal is situated at Sisowath Quay Boulevard, at the Riverfront. The passenger port is located walking distance from the town center and there is wide parking across the road where buses, taxis and tuk-tuks can park their vehicles. There are two floating pontoons of 15 m x 45 m. There is currently no separation between international and domestic passengers or between those embarking and disembarking.

Phnom Penh New Container Terminal LM17

The construction of the 10-hectare terminal began in March 2011 with financial assistance from the Chinese Government (a soft loan of 28.2 million US$). The terminal officially started operations in the beginning of 2013.

The construction works were planned following a phased approach:

- **Phase I:** A container yard for a total capacity of 150,000 TEUs/year with one 22 m x 300 m long berth for two vessels of about 5,000 DWT - Completed beginning 2013;
- **Phase II:** Expansion of the container yard to a capacity of 300,000 TEU/year, estimated to be completed in 2015;
- **Phase III:** Further expansion of the container yard to a capacity of 500,000 TEUs/year, estimated to be completed in 2017.

The actual container yard can be described as a classic open system with a quayside for loading and unloading of ships and a landside where containers are loaded and unloaded on/off trucks. The total ground slot capacity is 896 TEUs of which 488 are for 20-foot containers and 204 are reserved for 40-foot containers.

The container terminal is provided with a modern terminal operating system with:

- A Port management and community system with Harbour View *Plus;*
- A Cargo Terminal Management system to follow up the day-to-day operations in real-time; and
- An invoicing of port and terminal operations with BillSys for efficient invoicing of all operations.

The port has two (old) floating derricks owned by Sovereign, three single jib mobile cranes used for discharging/loading up to twenty-four 20-foot containers per hour or twenty 40-foot containers per hour, four 8-wheel Rubber-tire gantry (RTG) cranes, six reach stackers and three sky stackers.

NCT LM 17 also has a warehouse of 40,000 square meters and both general cargo and bagged cargo can be discharged at a rate of approximately 350 tonnes per day/per gang.

Stung Treng Port

Stung Treng port, located in Stung Treng Province, is an important regional center located where the Sekong river joins the Mekong and with road access both to Lao PDR (road 7) and Viet Nam (Road 78). There are no dedicated port facilities. Instead, the riverbanks have to be used or, during the low water season, a temporary jetty is provided for the ferry.

Kratie Port

Kratie port is 220 km upstream from Phnom Penh, ideal for travel and bulk product transportation. The port has a 35 m long pontoon, used only in the rainy season, and a 1,000 m^2 warehouse said to have a capacity up to 5,000 tonnes.

Kompong Cham Port (Tonlé Bet)

Kompong Cham Port (or Tonle Bet Port) is located in Kompong Cham province on a cross road of two main trading routes: north-south along the Mekong from Lao PDR to the sea, and east-west between Thailand and Viet Nam. There is passenger landing and a 10 m long pontoon for barges up to about 400 tonnes capacity. During the dry season, the pontoon is grounded and the riverbank is used. There is also a warehouse with a covered area of 550 m^2, said to have a capacity of about 600 tonnes. Across the river from the town, on the left bank, there is about 5,700 m^2 of open storage.

Chong Kneas Port

Chong Kneas port (or Siem Reap port) is located 5 km from the city and can only be used at high water. A temporary wooden port is constructed at the beginning of each dry season but is destroyed together with any improvements to the access road as the water rises. The port is mainly used for goods traffic to/from Phnom Penh, either directly via the Tonle Sap River or with transshipment in Chhnock Trou in the southern end of the lake. Meanwhile some 12 passenger boats ply the route. The present landing at Chong Kneas moves with the water level in the Tonle Sap. During the low-water period from mid-March to the end of May, goods and passengers are loaded and discharged at the lake edge just east of the existing channel mouth. As the water level rises, the landing is moved progressively up the embankment until, at high water, it is located at the foot of Phnom Kraom. As the water level recedes, the landing moves progressively down towards the lake. Cargo boats and tankers do not operate between mid-February and early July.

Oil & Gas Terminals

The current legislation related to oil terminals along the Mekong River in Cambodia is limited. Today, individual ports and terminals decide for themselves the specifications that will be used for design and construction. That means that, for example, the Total Cambodia Khsom Depot is a state of the art terminal and is driven by its commitment to safety and security, while a little further upstream, a gas terminal that has already been operating for about four years, still does not have any firefighting equipment, except some portable fire extinguishers.

Dry Ports

According the intergovernmental agreement on dry ports adopted by resolution 69/7 by the member States of UNESCAP, Cambodia has currently seven dry ports: CWT Dry Port (Phnom Penh), Olair

World Wide Dry Port (Phnom Penh), Phnom Penh International Port (Phnom Penh), Phnom Penh Special Economic Zone (Phnom Penh), So Nguon Dry Port (Bavet), Tech Srun Dry Port (Phnom Penh) and Teng Lay Dry Port (Phnom Penh). Dry port development and management of these dry ports is currently under the General Directorate of Customs and Excise of the Ministry of Economy and Finance. Aside from these dry ports, there are many privately-owned dry ports in Phnom Penh, Poipet and Sihanoukville.

VIET NAM

Cai Mep International Terminal (CMIT)

CMIT is a recently-built, modern and efficient container terminal facility with a total area of 48 ha. The terminal has about 600 m berth, a large container stacking area, a reefer area with 840 reefer plugs, an empty container area, separate gates for in- and outbound traffic, a maintenance building and an administration building. The access channel has a depth of 14 m (16.6 MSL) and a depth of 16.5 to 20 m alongside the terminal. The terminal can accept vessels up to 160,000 DWT. The maximum handling capacity of the terminal is 1.115 million TEUs.

CMIT has five super post Panamax STS cranes with an outreach of 63.5 meters, 15 rubber tire gantry cranes (RTGs), 28 terminal trucks, 3 empty handlers and 2 reach stackers. CMIT operates 24 hours per day and 7 days per week and is compliant with the International Ship and Port Facility Security (ISPS).

Ho Chi Minh Tan Cang - Cat Lai Terminal

The Port of Ho Chi Minh City's Tan Cang – Cat Lai Terminal is the biggest, most modern container facility in Viet Nam with a total area of more than 800,000 m^2. The terminal has about 1,500 m berth, a large container yard (almost 570,000 m^2), a container freight station warehouse (almost 17,500 m^2), and a reefer area with 1,000 reefer plugs. The available water depth at the terminal is 12 m, and the berths can handle six vessels with capacity for up to two thousand TEUs at one time. The terminal has currently the capacity to handle 2.5 million TEUs per year. Tan Cang – Cat Lai Terminal has 1 floating crane, 35 gantry cranes, 2 rail mounted mobile cranes for handling containers, 2 fixed cranes for handling containers, 103 Rubber tyred gantry cranes (RTG), 6 rail mounted gantry cranes (RMGC), 42 reach stackers, 65 forklifts, 24 forklifts for empty containers and 4 rubber tired mobile cranes.

Can Tho Port

The new port has been built downstream the city of Can Tho and is called “Cai cui port”. It has a quay wall 365 m long and is situated 6 km downstream of the new bridge of Can Tho, on the right bank. The port area is 400 x 300 m with two warehouses and an administration building.

Dry Ports

According the intergovernmental agreement on dry ports adopted by resolution 69/7 by the member States of UNESCAP, Viet Nam has currently seven dry ports: ICD Lao Cai (Lao Cai Province), ICD Song Than (Binh Duong Province), ICD Tan Cang-Long Binh (Dong Nai Province), ICD Tien Son (Bac Ninh Province). The agreement also mentions four other potential dry ports: Hanoi, ICD Gia Lai (Gia Lai Province), ICD Vinh Phuc (Vinh Phuc Province) and Lang Son. For the South development, three ICD developments are planned:

- North-east HCM City (2020: 150 ha ⇨ 400 ha / 6,000,000TEUs)
- South-west HCM City (2020: 70 ha ⇨ 150ha / 1,700,000TEUs)
- Mekong Delta Region (2020: 50ha ⇨ 100ha / 1,100,000TEUs).

Oil & Gas Terminals

In Viet Nam there are several oil and gas terminals. Some of them have been newly built and meet the current standards for oil terminals. There are, however, a lot of older terminals that urgently need to be rehabilitated. Sometimes the firefighting equipment is in very bad condition and there are holes in the bunding walls of the fuel tanks.

2.7.3 Port Statistics

LAO PDR

Pak Beng Port

The port is used for import and export of agriculture products in bulk. There are no dangerous goods handled at the port. In 2014, the cargo throughput was 725 tonnes for import and 1,350 tonnes for export on some 22 cargo vessels. About 34,000 tourists and passengers arrived and departed in the port on some 1,100 passenger boats (without accommodation).

THAILAND

Chiang Saen Port

Passenger throughput in Chiang Saen Port declined from 10,000 in 2012 to 4,000 in 2013 but went up to 6,000 in 2014.

Chiang Saen Commercial Port

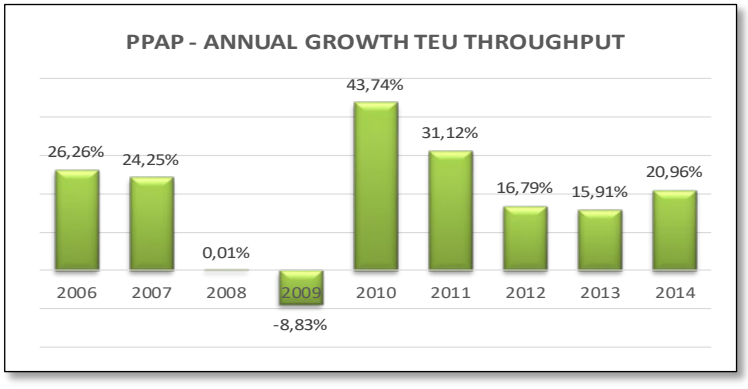
Cargo throughput has been growing from 2003 until 2007. However, due to the world economic recession that started in 2008, cargo throughput (like most of the world's traffic) has fallen back. Since 2010 the traffic has been steadily growing from 500,000 tonnes in 2010 to 780,000 tonnes in 2013.

Most products imported through Chiang Saen Commercial port are fruit from China, such as pomegranates and apples, and sunflower seeds, garlic, shiitake mushrooms, and cassava, while exported products include mostly frozen chicken and red meat, palm oil, and energy drinks.

CAMBODIA

PP New Container Terminal LM17

Since 2002, when the old port started with container operations with the support of only one logistic company (Sovereign Base Logistics Holdings Co., LTD), container throughput has expanded from 746 TEUs in 2002 to 95,333 TEUs in 2012. In 2012, operations have been transferred from the old port to NCT LM 17. Since then, throughput started to expand continuously up to 133,666 TEUs in 2014. If the container volumes keep growing as before, the full capacity of the terminal projected for phase I will be reached in 2015.



Looking at the annual growth of TEU throughput from 2006 till 2014 one can see that Cambodia was hit hard by the world economic recession in 2008-2009 (like the most of the world). In 2008, the growth was nearly nil (47,507 TEUs) and in 2009

the port had a negative growth of almost 9 percent (43,312 TEUs). However, the port's business has seen strong and economic growth has been bouncing back and continuing to grow since2009.

PPAP Passenger Port

The passenger throughput has increased in the last 4 years more than 150 percent, from about 10,000 in 2010 to about 25,000 in 2014. A growth of more than 100 percent took place in the first two years (between 2010-2012). The following years the growth was nearly 17 percent and only 5 percent between 2013 and 2014. This traffic is important for Phnom Penh and needs attention. The location of the passenger terminal is well situated and reasonable infrastructure is in place.

PPAP Ship Calls

In total, some 1,750 ships called PPAP in 2014. The number of calls of container vessels, general cargo vessels and tourist vessels is steadily increasing. For the LPG vessels, the number of ship calls increased from 2010 to 2012 and afterwards remained more or less stable, with a slight decrease in 2014. During the period 2010 – 2014 only the petroleum vessels calls at PPAP decreased.

VIET NAM

Cai Mep International Terminal (CMIT)

For CMIT, the expected cargo throughput for 2015 is about 75,000,000 tonnes.

2.7.4 Port Safety and Security Measures

LAO PDR

Muongmom (Ban Mom) Port

The port has a permanent fence with a height of 1.5 m. Access to the port is not controlled. The port has no emergency response plan and no firefighting equipment (in case of fire it takes about 1.5 hours for the fire brigade to reach the port).

Huay Xay Port

Although large amounts of fuel are stored in the port there are no safety/security measures in place and there are no proper emergency response procedures. There is also no firefighting equipment available. Passengers embarking or disembarking are not registered, which can lead to difficult rescue operations in case an accident happens during the boat trips.

Vientiane - Km 4 State Port (Laksi Port)

The tanks in the port were flooded by Mekong waters in 2008, when management opened the lids to check the condition of the tanks and their contents. The Km 4 port has two underground storage tanks on the premises, each having a storage capacity of 10,000 litres but was not use for long time ago (since 1989).

THAILAND

Chiang Saen Commercial Port

The port has several security measures in place. The installation of a closed-circuit television (CCTV) system covering the complete port area has been completed. Access to the port is controlled and there are measures in place to avoid unauthorized access. The port has a fence 2.5 meters high.

Chiang Khong Port

The port has no specific security measures in place.

Haciang Commercial Port

At the 10th Navigation Advisory Board Meeting, Thailand requested the MRC's assistance to implement a "Pilot Project for Sustainable Management of Dangerous Goods at Chiang Saen Commercial Port (CSCP)". In response to this, the MRC Navigation Programme travelled to CSCP in February 2012 to meet with representatives from the Thailand Marine Department and the Port Authority of Thailand (PAT).

Given that the owner/operator of HCCP was not fully familiar with the transfer of dangerous goods, the owner requested to participate in the pilot project that was set up for CSCP. The Terminal Audit Checklist (TAC) completed for HCCP was analyzed in order to determine the existing deficiencies and improvements needed at the port. Later that year the port workers and management from HCCP were invited to participate in a dangerous goods training course.

The port has several security measures in place. The port has a CCTV surveillance system in place, access to the port is controlled (security guard with logbook, registering equipment and handheld very-high frequency (VHF)) and the port has a fence.

CAMBODIA

PP New Container Terminal LM17

NCT LM 17 is ISPS code compliant. The port has several physical security measures in place: an access gate with a security office for identification procedures, a firm fence construction of a least 2.5 m in height, sufficient lighting to cover the entire port area and a CCTV video surveillance system, operated remotely from the security office.

2.7.5 Overview of Port Administrations and Management

See paragraph 2.12.4 of this report.

2.7.6 Overview of National Plans

LAO PDR

Vientiane Logistics Park Project

A logistics park on the north side of Thanaleng Station in Dong Phosy Forest will be developed with a public warehouse for import/export, a domestic delivery business, a private warehouse, a container yard, a tenancy business and a customs house.

THAILAND

ESCAP-Development of Dry Ports

This project concerns the development of two intermodal facilities in Thailand: the first one in *Chiang Khong* with a central administration building, operation building, Container Freight Station (CFS), stacking area, maintenance area, warehouse, control gate and a total area of 44.8 ha; and a second one in *Natha, Nong Khai*, 8.5 km from Lao PDR's Tanaleng Station, with a consolidation and

distribution center, intermodal facilities, one-stop service center, logistics and value added center, and a total area of 9.12 ha.

CAMBODIA

Master Plan for Waterborne Transport on the Mekong River System in Cambodia (2006)

This Master Plan has about 14 actions related to port development and management in Phnom Penh Autonomous Port, Kompong Cham Port, Chong Kneas Port and Kompong Chhnang Port.

2.8 LEGAL ASPECTS, AGREEMENTS, RULES AND REGULATIONS

2.8.1 International, Regional and Bilateral Legal Instruments, Conventions and Agreements

United Nations (UN)

- Final Act of the United Nations Conference on Transit Trade of Land-locked Countries (with annexed resolutions), New York, July 1965.
- Convention on Transit Trade of Land-locked States, New York, July 1965.
- United Nations Convention on the Law of the Sea, Montego Bay, December 1982.
- Intergovernmental Agreement on Dry Ports, Bangkok, April 2013: this agreement was finalized in October 2012, and adopted by resolution 69/7 by the member states at the United Nations Economic and Social Commission for Asia and the Pacific's (UNESCAP) annual legislative session held in Bangkok in April 20.

International Maritime Organization (IMO)

The International Maritime Organization (IMO), established in Geneva, Switzerland in 1948, is a specialized agency of the United Nations (UN) and is responsible for measures to improve the safety and security of international shipping and the prevention of marine pollution from shipping.

Most of the IMO conventions and protocols (approximately 60) fall into three main categories: Improvement of Safety at Sea, Liability and Compensation for Damage and Protection of the Maritime Environment.

The most important conventions are:

- The International Convention for the Safety of Live at Sea (SOLAS);
- The International Convention for the Prevention of Pollution form Ships (MARPOL);
- The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW);
- The International Convention on Load Lines; and
- The Convention on the International Regulations for Preventing Collisions at Sea (COLREG).

These IMO conventions generally only deal with ships on international voyages and only apply to ships from a certain tonnage, so that these ships can sail to any port in any country. Therefore the relevance of these conventions for navigation on inland waterways is limited to those waterways that are connected to the sea.

For non-convention sized ships, IMO also prepared a *"Safety and load line regulations for non-convention sized ships in the Asian region"* (Bombay 1995 and Tehran 1996, issued as SRNCSS regulations in March 2002), which can be adopted and implemented by the involved countries into their national legislation.

This possible model for harmonized rules and regulations for ship construction, equipment and safe operation of non-convention sized ships, sailing in local (inland), coastal and regional (inland and inter islands) waters, takes into account, as far as it is reasonable and practicable, the provisions specified in SOLAS, LL, STCW, MARPOL and COLREG.

Association of South East Asian Nations (ASEAN)

- ASEAN Framework Agreement on the Facilitation of Goods in Transit;
- ASEAN Framework on Multi Modal Transport;
- ASEAN Framework Agreement on the Facilitation of Inter-State Transport; and
- ASEAN Agreement on Customs.

Mekong River Commission Agreement

Agreement on cooperation for the sustainable development of the Mekong River Basin, Chiang Rai, 5 April 1995.

Greater Mekong Sub Region (GMS)

The Cross-Border Transport of Goods and People Agreement (CBTA) was originally a trilateral agreement between and among the governments of the Lao PDR, the Kingdom of Thailand and the Socialist Republic of Viet Nam signed on 26 November 1999 in Vientiane. The Kingdom of Cambodia acceded the CBTA in 2001, the People's Republic of China in 2002 and the Union of Myanmar in 2003.

The CBTA provides a practical approach to streamlining regulations and reducing non-physical barriers in the Greater Mekong Sub-region (GMS).

Agreement on Commercial Navigation on the Lancang-Mekong River among the Governments of the People's Republic of China (PRC), the Lao PDR, the Union of Myanmar and the Kingdom of Thailand:

- The aim of the agreement is to develop on the Lancang-Mekong River international passenger and cargo transportation among the contracting parties, to promote and facilitate trade and tourism, and to strengthen cooperation in commercial navigation on the basis of respect for sovereignty, equality, and mutual-benefit.

In accordance with Article 2 of the Agreement, the parties adopted six Rules, Regulations and Guidelines attached as annexes to the MOU:

Annex I: Regulations on Safe Navigation of Vessels on the Lancang-Mekong River;

Annex II: Rules on Water Transport Administration on the Lancang-Mekong River;

Annex III: Guidelines on the Maintenance and Improvement of the Navigability;

Annex IV: Regulations on the Investigation and Handling of Waterborne Traffic Accidents;

Annex V: Regulations on Management of Search & Rescue, Salvage and Wreck Removal; and

Annex VI: Technical Regulations of Surveys of Commercial Ships on the Lancang-Mekong River.

Agreement on Waterway Transportation between the Royal Government of Cambodia and the Socialist Republic of Viet Nam:

- Agreement between Cambodia and Viet Nam on transit of goods, Phnom Penh, 2000.

- Agreement between the Royal Government of Cambodia and the Government of the Socialist Republic of Viet Nam on Waterway Transportation, Phnom Penh, 17 December 2009.

The Agreement's purpose is to establish a legal framework that effectively implements freedom of navigation in the Mekong River system as well as to create favorable conditions for transit and cross-border navigation within regulated waterways.

Border Trade Agreements

- Memorandum between Cambodia and Lao PDR on Communication and Transportation Cooperation, Vientiane, April 1997.
- Protocol between the Government of the Lao PDR and the Government of the Union of Myanmar on border trade between the two countries, Vientiane, December 2000.

2.8.2 National inland Waterway Laws

LAO PDR

Lao PDR has no Inland Waterway Law, but Lao PDR has rules governing the waterway transport and the Inland Waterway Law is being prepared.

THAILAND

Act on Navigation in Thai Waters (B.E. 2456 or 1913), amended and consisting of three parts: Part 1: General Provisions, Part 2: Regulations on Issuing of License and Part 3: Special Regulations.

CAMBODIA

Law on River Navigation, 1991.

VIET NAM

Viet Nam Inland Waterway Navigation Law No 23/2004/QH11, June 2004 and Viet Nam Law on Inland Waterways Transport No 48/2014/QH13 dated June 2014, on amending and supplementing the Law of 2004.

2.8.3 National Rules and Regulations on Inland Waterway Transport of Goods and Passengers

LAO PDR

Aside from a Customs Law (No.05/NA, May 2005), Lao PDR has Regulations on Transport Business Establishment, Forwarders and Maintenance Services (No. 1423/CTPC, June 1996), on Truck and Transport Boat Associations (No. 1414/CTPC, July 1996) and on the Operation of Passenger Speed Boats (No. 1663/MCTPC, June 1997), and Guidelines on River Transport (No. 104/MCTPC, January 2000) and on River Traffic (No. 219/MCTPC, April 2000).

THAILAND

Thailand has a Customs Act B.E. 2469 (1926), a Merchant Marine Promotion Act, B.E. 2521 (1978) and Multimodal Transport Act, B.E. 2548 (October 2005).

CAMBODIA

Cambodia has the Sarachor No. 003 SRC/MPWT of October 1, 1999 on Means of Water Transport Management.

VIET NAM

Viet Nam has some 15 decrees and decisions and some 25 circulars on navigation orders and safety on inland waterways, on rules for the transport of goods on inland waterways, on rules for the management of passenger transport, on multimodal transport holding, several provisions concerning the liability of the consignor, on rules for business conditions in inland waterway transport and on the management of inland waterways, among others.

2.8.4 National Legal Instruments on Inland Waterway Safety

LAO PDR

See “Environmental Protection Law”, January 2013.

THAILAND

Thailand has a Hazardous Substance Act, B.E. 2535 and several regulations and Marine Department announcements regarding the classification of dangerous substances and articles, the safety of discharging and loading of petroleum and chemical products, on handling petroleum products on the Mekong River (issued under the Agreement on Commercial Navigation on the Lancang-Mekong River) and on the establishment of a Committee on the Prevention and Combating of Oil Pollution.

CAMBODIA

Cambodia has the Prakas for carriage of dangerous goods by inland waterway in the Kingdom of Cambodia, June 2011.

VIET NAM

Viet Nam has some 10 decrees, decisions and circulars on the carriage of dangerous goods by inland waterways, on contingency planning, incident response and search and rescue, on minimum safety standards on the means of inland waterway transport and on rules for the transport of dangerous goods and toxic and infectious substances, among others.

2.8.5 National Legal Instruments on Ship Construction and Registration, Crew Certification and Manning

LAO PDR

- Guidelines on Request for Ship Building Permission No. 1442/MCTPC, January 1996.
- Standard of Technical Inspection for Ship and Ferry No. 0030/DOT, January 1996.
- Regulation on Vessel Technical Inspection No. 0052/DOT.
- Regulation on Permission of Vessel Extension No. 1412/MCTPC.

THAILAND

Aside from the Act on Navigation in Thai Waters B.E.2456, providing miscellaneous regulations to obtain a license, and on the Survey of Vessels, Thailand has a Thai Vessel Act, B.E. 2481 and some 35 regulations on ship survey.

Thailand also has the Harbour Department’s Regulations on Training, Examination and Certification for Seafarers, B.E. 2541 (1998).

CAMBODIA

Cambodia has the Circular No 003 SRC/MPWT on the Management of Means of Water Transport, 1 October 1999, addressing design, construction, equipment and inspection of inland waterway vessels.

VIET NAM

Viet Nam has some 10 decrees, decisions and circulars on the registration of inland waterway vessels, on the rules for crewmembers on inland waterway vessels, on inland waterway vessel classification and construction and on technical supervision of inland waterway vessels, among others.

2.8.6 National Legal Instruments on Ports and Port State Control

LAO PDR

The Department of Waterways, MPWT prepared a Draft Rule on Safety of the Port, a Draft Rule on Dry Ports, a Draft Regulation on Handling and Storage of Dangerous Goods and a Draft Rule on Inland Waterway Transportation of Dangerous Goods. However, at this stage these documents are only available in Lao-language.

THAILAND

Thailand has a Port Authority of Thailand Act, B.E. 2494 (1951), as amended, an Occupational Safety, Health and Environment Act, B.E. 2554 (2011) and Ministerial regulations on Fuel Oil Storage Premises B.E.2551 (2008).

CAMBODIA

Cambodia has a Prakas on the Formation of Private Port Management Commission and a Circular N°070, December 2011, on Port Planning, Construction and Operation in the Kingdom of Cambodia with four Items: A: Port Establishment, B: Port Construction, C: Port Operation and D: Responsibilities of Official Staff.

VIET NAM

Viet Nam has some eight decisions and circulars on the organisation and operation of ports, on rules for inland waterway port authorities, on the implementation of inland waterway ports and landing stages, on the operation of port state control systems and on the technical classification of inland waterway ports and landing stages, among others.

Moreover, the standard system in Viet Nam consists of more than 7,000 standards, and many apply for ports, landing stages and terminals.

2.8.7 National Legal Instruments on Environmental Protection

LAO PDR

- Law on Water and Water Resources (No. 02-96, October 1996).
- Environmental Protection Law (No. 02-99/NA, April 1999).
- Decree on Environmental Impact Assessment (No. 112/PM, February 2010).
- Environmental Protection Law, January 2013.

- Decree No 7737/MPWT, dated 8/08/2010 and 467/MPWT.WD, dated 15/01/2013 on the responsibility for the dredging of the navigation channel and licensing for sand mining operators.

THAILAND

- Public Health Act, B.E. 2535 (1992).
- Conservation of the National Environmental Quality Act, B.E. 2535 (1992).
- Hazardous Substance Act B.E. 2535 (1992).
- Regulation of the Prime Minister B.E. 2547 (2004) on the Establishment of a Committee on the Prevention and Combating of Oil Pollution and Development of a National Oil Spill Response Plan.

CAMBODIA

- Law on Environmental Protection and Natural Resources Management, 1996.
- Law on Protected Area Management, 2008.
- Sub-Decrees on EIA Process, on Solid Waste Management, on Water Pollution Control, on Air Pollution and Noise Disturbance and on Chemicals Classification Labelling.
- Declaration on General Guidelines for Conducting IEIA/EIA Reports, 2009.

VIET NAM

Environmental Protection

Aside from the Law on Environmental Protection 2014, Viet Nam has some 10 decrees, decisions and circulars on SEA and EIA processes for transport projects, on environmental pollution control, on environmental protection in the transport sector and in IWT activities and on rules to prevent river pollution caused by vessels, among others.

Oil spill and contingency planning

Decision 02/2013/ND-CP, Jan 2013, requires all port operators (maritime, military and inland) to develop emergency and oil-spill response plans.

Dredging and sand mining

Aside from the Directive on the Survey, Transportation and Extraction of Gravel and Sand from the Riverbed (Directive No.29/2008/CT-TTg), the Circular No. 17/2013/TT-BGTVt states that VIWA or the Department of Transportation (DOT) should evaluate the maintenance of inland waterway plans for dredging and then submit them to MOT for approval.

Climate Change

Viet Nam has a National Program to Respond to Climate Change (*Decision No. 158/2008 / QD-TTg, February 2008*) and MOT has developed specific adaptation and mitigation plans (*Decision No 199/QĐ-BGTVT, Jan 2011*) for transport infrastructure.

2.8.8 Overview of National Plans

LAO PDR

The Department of Waterways, Ministry of Public Works and Transport prepared a Draft Rule on Safety of the Port, a Draft Rule on Dry Ports, a Draft Regulation on Handling and Storage of Dangerous Goods and a Draft Rule on Inland Waterway Transportation of Dangerous Goods.

CAMBODIA

- In January 2008, the Navigation Coordination Committee, which operates under the MPWT, adopted the draft proposal of the **Contingency Plan for Oil Spill Response** in Cambodia for the Mekong River, its Tributaries and Lakes. The Ministries, Council of Ministers and/or the National Assembly have not approved this proposal yet.
- A "Waterway Safety Report" was prepared by the Cambodian Navigation Coordination Committee, December 2009 (**www.ciwn.mpwt.gov.kh**) and focused mainly on safety of navigation, safety of ships, safety of crew, safety of waterway environment, safety of cargo and safety of passengers.
- In 2010, the Ministry of Public Works and Transport prepared a **Draft Inland Waterway Transport Law**, which concern mostly administrative applications and technical guidelines.
- Aside from the Draft Inland Waterway Transport Law, the MPWT prepared some 5 Sub-Decrees and some 10 Prakas on Aids to Navigation, Ship Inspection, Carriage of Dangerous Goods, Transport Licenses and Training of Crew, among others.
- In 2011, JICA prepared a Draft Port Act which has not been approved yet by the Minister, the Council of Ministers or the Assembly.

2.9 ENVIRONMENTAL ASPECTS

2.9.1 General Inland Waterway Transport Environmental Aspects

IWT is promoted as a safe and sustainable mode of transport due to lower CO_2 emissions per ton-km compared to road transport. To take advantage of more energy efficient transport, the environmental impacts of IWT must be effectively managed. Potential impacts are derived from the following activities:

(1) Construction of navigation infrastructure e.g. ports and landing facilities;

(2) Operational e.g. water pollution from oil spills, solid and liquid wastes, navigation accidents; and

(3) Maintenance of the navigation channel and waterway conditions and commercial extraction of sediment.

Sustainable Development

Integrated planning has been promoted in Europe to ensure that sustainable development is achieved in the IWT sector. During the planning and design stages, development alternatives should be identified that minimise the adverse impacts on river basins.

The assessment of master planning or projects (ecological, economic and social aspects) should be carried out as a whole, rather than individually, considering all alternatives and taking into account integrated water resources management (IWRM) objectives (ICDPR 2010). The integrated planning process should translate IWT and environment objectives into concrete projects measures.

Comprehensive environmental monitoring plans should be established during and after the project works to evaluate the success of implementation (ECMT 2006).

A Strategic Environment Assessment (SEA) ensures integrated planning by assessing environmental and sustainability opportunities and risks of strategic options (e.g. master plan or policy). A SEA or integrated planning process for the IWT sector should also incorporate:

- Environmental aspects such as water quality, environmental flow, sediment management, hydro morphology, biodiversity and climate change;
- Economic assessment of multi-modal transport i.e. road, rail and maritime shipping;
- Competing uses of the waterway (e.g. hydropower, flood protection, agriculture, industrial use, recreation, water supply); and
- Tranboundary management for IWT sector (e.g. shared maintenance of waterways, accident prevention, and emergency response).

The definition that SEA applies to policies and master plans and that EIA applies to specific projects is outdated. SEA is about the integration of environmental issues into development processes, while EIA is one of the instruments used to implement SEA guidelines or follow up actions.

Operational Aspects

Concerns of IWT operations include risks of water pollution from fuel and oil spillage, from accidents and from disposal of waste and wastewater from vessels, from activities such as vessel maintenance and from dangerous goods storage and handling in inland ports, terminals and landing facilities.

Air Emissions: IWT vessels can carry larger volumes of cargo relative to the extra fuel needed, resulting in lower emissions per ton-km compared to road transport. However, if improvements are not made for vessels to use more energy efficient engines and cleaner fuels, it is estimated that in 2020 ships will emit more SOx and NOx that all other land transport in the EU combined.

Air emissions in developing countries may be even higher with old technology and limited regulations or public awareness to reduce sulphur content of marine fuels. An inventory of air emissions in the IWT sector must consider a wide range of sources, including:

- IWT vessels (cargo, tankers, passenger, ferries, cruise ships, fishing vessels, tugboats);
- Ports and terminals (vehicles, cargo handling equipment, cranes, and infrastructure)
- Dredging (vessels, trucks); and
- Vehicles (on-road trucks or other port vehicles).

Oil Spills and Operational Discharges: Oil spills in inland waters are highly likely to contaminate water supplies, impacting aquatic ecosystems and riparian populations. Fixed facilities and vessels are the major sources of oil spills in inland waters. The impacts of oils spills are highest for heavy fuels, followed by crude oil, and lower for light oils and gasoline.

Another threat to the environment is caused by the operational discharges of bilge oil, heavy oils and lubricants, as well as organic substances, mainly polycyclic aromatic hydrocarbons (PAH) and wastes.

Transport of Dangerous Goods (DG): A possible incident involving the transportation of DG can have severe consequences for the environment and people, including, but not limited to, the following:

- Increased pollution from transportation of petroleum products (e.g. cargo residues, spills and leakages, solid and liquid wastes);
- Risk of spillages and pollution from shipping accidents as well as ports and terminal operations;
- Loss or damage to habitats and species due to reduced water quality and pollution; and

- Impacts on human health as a result of pollution, fire and explosion

Waste Management: The operations of ports, terminals and vessels have the potential to generate both domestic and hazardous wastes. Direct dumping of untreated wastes into rivers can alter the aquatic habitats and harm fisheries, other aquatic organisms and riparian vegetation. Uncontrolled disposal of wastes can cause contamination to groundwater, while direct dumping to rivers can impact both surface and groundwater aquifers.

Construction of Infrastructure

The construction of inland port and landing facilities development can cause significant direct and indirect impacts on the environment and socio-economic characteristics of a river basin. The social and environmental impacts need to be considered during siting, planning construction and operational phases of the port. The baseline report will determine the legal framework for Environmental Impact Assessment (EIA) for new ports and waterway developments and whether Environmental Management Plans (EMP) need to be developed by port operators to manage impacts during operations.

Maintenance and Modification of Navigation Channels

Maintenance dredging of navigation channels can have significant impacts on the environment including: biodiversity loss, loss of livelihoods for those dependent on natural resources from the river, conflict with other uses (e.g. drainage, flood protection, water supply and tourism), hydrological changes (e.g. alteration of surface flows and drainage), destruction of floodplains, increased erosion, flooding risk and drainage of wetlands.

Water Quality: Dredging Activities pose a threat to the aquatic environment not only through the disposal of dredged material, but also through the dispersal of pollutants into surface waters during dredging. If the sediments are contaminated with industrial discharges there can be severe impacts on water quality.

Hydromorphological Impacts: Hydromorphological changes can have far-reaching impacts upstream and downstream from dredging activities, significantly affecting river system dynamics and interfering with the exchange of water and sediments between the mainstream river and its tributaries and flood plains. Maintaining the waterway can result in a stabilised uniform channel, lacking both natural in-stream structures and connectivity with floodplains, leading to ecosystem degradation and loss of species. In-stream structures include shoals, deep pools, reefs, rocks, rapids and sandbars. These provide critical habitats for fish and other aquatic organisms.

Assessment and Planning: The impacts discussed above must be incorporated into an EIA and planning for the modification and maintenance of waterways for IWT. It is important that new projects are assessed with consideration for the main natural functions of river systems, including the morphological processes (e.g. erosion, sediment transport and sedimentation), the maintenance of the hydrological balance (e.g. flood pulse), the maintenance of the sediment balance, the provision of habitat (ecosystem connectivity) and the maintenance of biological and chemical processes (nutrient cycles).

Sandmining: Dredging and sand mining would usually be considered as two separate issues, as modern waterway dredging strategies prohibit commercial extraction and require refilling of dredged material in the system. To date, the issue of sediment mining in the Mekong River channel has been a politically sensitive issue. In-channel extractions are contributing to a reduced sediment load in the Mekong Delta causing large-scale erosion.

The MRC and World Wildlife Fund (WWF) conducted sand and gravel mining survey and found that in 2011, a total volume of 34.5 million m^3 or 55.2 million tonnes of sediment was extracted from the Mekong main stream in Lao PDR, Thailand, Cambodia and Viet Nam.

2.9.2 Specific Mekong River Environmental Aspects in the four MRC Member Countries

The degree of human impact on water quality in the 17 Mekong and 5 Bassac water quality monitoring stations from 2007 to 2011 were mostly rated as “impacted” or “severely impacted”.

Water Quality Monitoring

In 2011 MRC conducted a **Multi-Media Monitoring** and Assessment Program (MMMAP) to assess the levels of persistent micro-pollutants in water, sediment and biota in the Mekong Basin. A total of 28 stations were included in the field survey. The findings relevant to navigation include the detection of phenol, oil and great and heavy metals (lead and mercury).

Phenol: Most phenol values in water were low, but levels at the Chiang Saen Pier, Chiang Khong, Vientiane, Pakxe and Phnom Penh Port exceeded the MRC Water Quality Criteria for the Protection of Aquatic Life.

Oil and grease (O&G): Elevated levels of O&G were detected in Luang Prabang, Vientiane and Phnom Penh port.

Heavy metals: Urban areas such as Luang Prabang, Vientiane and Phnom Penh show trends of increasing levels of lead and mercury.

Risk analysis of the transport of DG: The ‘*MRC Risk Analysis of the Carriage Handling and Storage of Dangerous Goods’* identified pollution downstream due to high levels of petroleum and cargo transport. The table below describes these areas in relation to navigation activities.

Location of Monitoring Station	Potential pollution source
Lao PDR/China border	Commercial shipping between China and Thailand
Luang Prabang (Lao PDR)	Large volume of tourist-boat traffic
Vientiane (Lao PDR)	High population density
Kratie (Cambodia)	Medium volume of boat traffic for tourism and transport
Prek Kdam, Tonle Sap (Cambodia)	Boat traffic and some industrial activities
Neak Leang, Mekong (Cambodia)	Downstream of Phnom Penh
Tan Chau, Mekong (Viet Nam)	High population density in the Mekong Delta
Chau Doc, Bassac (Viet Nam)	High population density in the Mekong Delta

Contingency Planning: There are limited emergency response mechanisms along the waterways to respond to accidents or oil spills. In addition, solid and liquid waste management facilities along the Mekong River are limited. Emergency response plans do not involve consultation with local communities and several terminals are in densely populated areas.

The MRC Environment Programme (EP) is currently drafting ‘Chapter 4: Water Quality Emergency Response and Management’, developed to ensure timely and effective cooperation between Mekong Countries in response to water quality emergencies, and to minimise the extent and mitigate the negative effects on water quality in the Mekong River.

Climate Change

Regional: Analysis of daily data for historical and future climate data at six mainstream stations in the Mekong Basin indicates that the nature of change is consistent along the Mekong and can be summarized by four key changes:

(1) **Increase in flood magnitude and volume**: Climate change will increase the flow during the flood season and the size of the flood peak. In terms of the percentage change in volume, a

25 percent increase in flow in Chiang Saen, approximately 20 percent between Vientiane and Pakxe, and 15 percent from Paxse to Kratie.

(2) **Increase in flood duration**: Across all stations, climate change will increase the duration of the flood season.

(3) **Shortening of transition seasons and onset of flooding**: Climate change will shorten the transition seasons at all stations and increase the rate of increase of discharge.

(4) **Increase in dry season water levels:** Climate change will increase dry season flows in response to increases in dry season rainfall for most areas of the Mekong catchment.

Transport Sector in Viet Nam: The ADB undertook a climate change threat and vulnerability assessment of existing and future transport projects in Viet Nam due to concerns about the impacts of climate change on project bridges, approach roads and interconnecting roads. ADB (2014) reported that if mean sea level rises by one meter in the Mekong Delta, it is estimated that 11,000 km of roads could be submerged and that up to 695 km of national highways would be at risk of inundation.

To allow the future passage of 10,000 DWT vessels upstream to Phnom Penh port, the water levels for the navigation channel and floodplain will provide navigational clearance of 37.5m. However, climate change would increase the number of periods in the year when the full navigation clearance of 37.5 m would not be available at the Cao Lanh and Vam Cong bridges.

Hydropower Development: The changes in flow regime due to potential hydropower and climate change could result in higher flows in both wet and dry seasons, lower flow in the high-flow season and increased flow in the low-flow season (MRC 2011).

Moreover, the Mekong delta is vulnerable to projected reductions in sediment transport (of up to 75%) that could cause destabilisation of riverbanks from down cutting and bed erosion, potentially impacting port and waterway infrastructure.

Habitats, Species, Aquatic Life, Sensitive Areas

Ecosystem services: The Mekong Basin is one of the most productive and diverse river systems in the world and is particularly rich in migratory fish species. Ecosystem connectivity and natural flood pulses drive both its productivity and basin-wide fish migrations. The Mekong River aquatic and wetland ecosystems provide unique habitats for both aquatic and terrestrial plants and animals. Natural habitats provide distinct services to society. The connectivity that the river and its tributaries bring to the wetlands of the Mekong through the seasonal flooding caused by the flood pulse is critical for the productivity and diversity of the Mekong Basin fisheries.

Fisheries and natural resources: Maintaining and improving the natural productivity of the river basin is essential to both the local populations and the national economies of the countries within the basin. The people of the Mekong have the highest per capita consumption of fish in the world. Of the Mekong's fish species, nearly 200 are migratory "white" fish, some of them travelling long distances from the Tonle Sap or the Delta up the Khone Falls and further up the Mekong in Lao PDR and Thailand.

The rural poor are heavily dependent upon ecosystem services, as livelihoods are derived from activities relating to agriculture, fisheries, livestock and non-timber forest products. Threats to the provision of these ecosystem services, such as climate change and major infrastructure projects, can have large development impacts.

Ecoregions: Limited research exists on the impacts of modifications of waterway channels on ecosystems, fisheries and livelihoods in the Mekong River Basin. Planned developments for port construction, dredging and reef removal in the upper and lower part of the Mekong Basin need to be assessed against the significance of the ecological areas. There are more than 114 officially

designated protected areas in the Mekong Basin and also more than 100 important wetland sites, other sites including fish conservation zones, community managed forests and biosphere reserves.

The specific eco-regions, protected areas, important wetlands and critical habitats sites need to be incorporated into EIA and planning. In addition, it will be important to determine further ecologically sensitive areas, protected areas and ecotourism sites along the Mekong River.

Social Impact Monitoring and Vulnerability Assessment (SIMVA): *The* SIMVA was carried out to provide data on the number of people who rely on the Mekong's natural resources for livelihoods and their vulnerability to changes. More than 29.6 million people are estimated to live within 15km of the Mekong mainstream, defined as the Mekong corridor. The table below shows the number of people living in the Mekong corridor:

Population living within 15 km of the Mekong mainstream

Country	Corridor population	Percentage living in the corridor	Percentage of corridor population
Cambodia	9,895,525	70	33
Lao PDR	3,430,040	53	12
Thailand	2,499,395	4	8
Viet Nam	13,851,600	16	47
All Countries	29,676,560		100

Based on data from this study, it can be concluded that the most vulnerable populations due to declining resources are those living within 5 km of the Mekong particularly in the fishing zone of the Tonle Sap, Cambodia, where land is limited and alternative occupations are rare and in Siphandone, Lao PDR, where there is a high level of dependence on natural resources, especially fish, for food and income.

Conclusions

It is important that proposed IWT projects are assessed with consideration of the main natural functions of river systems in specific waterway sections as the environmental and socio-economic characteristics are unique throughout the Mekong Basin. The eco-regions are important to use as a first step in preliminary assessments (e.g. initial environmental impact assessment or examination) to determine the existing environmental degradation, biodiversity and protected areas in relation to the specific location of existing and planned IWT projects/activities in specific stretches. Further assessment would be required to consider the critical ecosystems, fisheries conservation zones, water quality, ecological status and socio-economic conditions. The eco-regions could also be used to determine zones or restrictions for port/vessel activities, transport of dangerous goods and dredging/sand mining activities.

The SIMVA provides baseline data on socio-economic conditions of people living in the Mekong corridor and their dependence on water resources. As identified in the SIMVA, the 29.6 million people living in the Mekong corridor are important to consider for navigation activities, to ensure that all rural communities have access to IWT.

Water quality pollution is increasing in the Lower Mekong Basin (LMB); high levels of phenol, oil and grease and heavy metals (lead and mercury) were detected by MMAP and WQMN.

Elevated values of phenol indicate possible leakage of petroleum products close to cities and navigation routes. The elevated levels of O&G detected in Luang Prabang, Vientiane and Phnom Penh port could be due to navigation/port activities and rubbish, or from the high-density communities living in these areas. The concentration of heavy metals in bottom sediment along the Mekong River may increase the significance of the environmental impacts of dredging. High levels of heavy metals

including copper, zinc, mercury and cadmium have been reported in the Mekong Delta, Viet Nam. Further water quality monitoring is required to ensure that the operational impacts of IWT are effectively monitored and effective pollution control plans are implemented.

Climate change threat and vulnerability assessments in the Mekong Delta have found that transport infrastructure is under threat from rising sea levels and increased flooding. In the future these assessments need to be applied to ports, terminal and IWT activities. The climate change predictions in the Mekong Basin suggest an increase in annual mean flow of 4-13 percent during the wet season and 10-30 percent during the dry season. The increased flow in the Mekong River would boost water availability in the dry season for navigation, but it would also increase the risk of flooding in the wet season.

Climate change could have positive impacts by improving navigability in the wet and dry season. Increases in frequency and duration of rainfall, sea level rise, and increasing river flow would result in elevation of river water levels. Therefore, climate change threat and vulnerability assessments should consider the impacts of flooding and rising sea levels on existing and planned IWT infrastructure (e.g. ports, landing facilities and terminals) and navigation clearance (e.g. bridges and power lines).

IWT should be incorporated in green/sustainable transport and climate mitigation plans to reduce carbon emissions in the transport sector. Vessels can reduce CO_2 and GHG emissions, but improvements need to be made in the energy efficiency of IWT vessels and port/terminal operations.

2.9.3 Overview of National plans

Environmental Protection and Environmental Impact Assessment

LAO PDR

The Environmental Protection Law 2013 in Lao PDR defines the principles, regulations and measures related to environmental management, including the monitoring protection, control, preservation and rehabilitation of the natural environment. This law includes two articles on the impact on social and natural environment with the assessment procedures for Initial Environment Examination (IEE), Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA) and Social and Natural Environment Impact Assessment (SNIA).

THAILAND

The Thailand National Environmental Quality Act (NEQA) 1992 outlines requirements to prepare an EIA report for different project types and sizes. For the IWT and shipping sectors EIAs are required and must be prepared for the construction of new ports and navigation infrastructure along the Mekong River. The Thailand Marine Department (MD) and Ministry of Transport (MOT) reported that an EIA is required before making a decision to build transport projects, including the construction of inland ports and terminals. Ports/terminals, shipping companies and dredging/sand mining operators are required to develop EMPs. The main environmental issues reported for the IWT sector on the Mekong River are water pollution and soil degradation.

CAMBODIA

The Ministry of Environment (MOE), MPWT and Ministry of Water Resources and Meteorology (MOWRAM) reported that an EIA study and report is required for the construction of new ports and landing facilities, channel dredging and bank protection works. All public and private investment/development projects must submit an IEIA and full EIA report to the MOE. Specific legislation, sub-decrees or prakas (guidelines) for the IWT sector have not been developed. However, existing environmental legislation can be applied to the operation of cargo ports, passenger ports, ferries and inland vessels.

The MOE reported that the main environmental impacts from IWT are the incorrect disposal of solid and liquid waste and water quality emergencies (e.g. oil spills and accidents).

The Cambodian government is currently advancing further discussion on a new EIA law, following public consultation in December 2014. The principles of the draft law promote public participation and integrating social impacts into the EIA process, including a health impact assessment for people living in or surrounding the project area.

Sub-Decree N°27 dated 6 April 1999 on water pollution control and for standard of releasing waste water from sources to public areas; standard of water quality at public areas for conservation of aquatic biodiversity (for river, reservoir and maritime) is adequate in controlling water pollution caused by waterborne transport.

VIET NAM

For the development of inland ports, the decision on SEA, EIA and environmental protection commitment (*Decree No. 29/2011/ND-CP*) outlines the projects that are subject to EIA:

- Inland port that can receive ships of more than 1000 DWT need to prepare EIA; and
- Inland ports that can receive ships of less than 1000 DWT need to register an environmental protection commitment (EPC).

The Ministry of Natural Resources and Environment (MONRE) and Ministry of Transport (MOT) are both responsible for monitoring IWT operations. The appraisal of an EIA is required by MONRE for projects that may have serious impacts or that are being undertaken in more than one province. MOT will undertake the appraisal of an EIA when the investment in the project is made by MOT. Local authorities shall assess EIAs of investments in their area if they are considered low risk and have only been undertaken in one province.

MONRE reported that EIA legislation requires private transport enterprises and port/terminal operators to develop EMPs, however, the inspection and supervision of environmental functions is not implemented or enforced. The capacity of port authorities, environmental and local authorities for inspecting, monitoring and handling violations related to environmental protection is limited due to a lack of technical equipment, operating funds and the awareness, skills and knowledge of port and vessel staff on environmental protection.

TRANSBOUNDARY EIA

The MRC, in consultation with Member Countries, has been preparing "Technical Guidance for Conducting and Considering Trans-boundary Environmental Impact Assessment (TbEIA)" process for proposed development projects/activities in connection with the national EIA process. The TbEIA guides when and how two or more Member Countries should conduct a joint TbEIA study in order reach a common understanding of any potential impacts of a development project/activity.

Water Quality Monitoring

LAO PDR

Chapter 2 of the Environment Protection Law 2013 relates to pollution control, air, soil, water and disturbance such as noise, light, odour, vibration and heat. Article 17 includes environmental prevention against chemical leakages due to accidents and limitation of impacts caused by construction. This can be applied to the construction of ports/landing facilities and also the operational impacts of IWT. The water quality parameters and guidelines are outlined in the National Environmental Quality Standard No: 2734/PMO-WREA, December 2009, which includes drinking water quality, groundwater quality and surface water quality standards.

In Lao PDR, monitoring of water quality is not undertaken for specific locations in relation to navigation activities and ports.

THAILAND

Under the NEQA, the National Environment Board prescribes the following environmental quality standards:

- Water quality standards for river, canal, swamp, marsh, lake, reservoir and other public inland water sources according to their use and classifications in each river basin or water catchment;
- Water quality standards for coastal and estuarine water areas;
- Groundwater quality standards;
- Atmospheric ambient air standards;
- Ambient standards for noise and vibration; and
- Environmental quality standards for other matters.

The Pollution Control Department (PCD) under MONRE is responsible for water quality and management, hazardous materials and pollution control.

CAMBODIA

MOWRAM reported that water quality monitoring is undertaken in surrounding ports/terminals and IWT operations. The water sampling stations include: Phnom Penh Port, Bak Prea, Kompong Luong, Neak Luong and Phnom Krom.

A specific water quality standard has not been developed to measure the potential impacts from IWT. However, several national standards from the Sub-Decree N°27 dated 6 April 1999 on Water Pollution Control can be applied. MOWRAM and MOE do not specifically monitor or report water quality in the navigation sector.

VIET NAM

The function and organisational structure of the Department of Water Resource Management (DWR) is issued by MONRE (*Decision No. 1686QD-BTNMT September 5, 2013*). The DWR is responsible for water quantity (flow) and does not undertake water quality monitoring for ports/terminals; this is done by the Environmental Management Agency. Water quality issues can be discussed with the Environmental Management Agency and the National Hydrometeorology Service. The implementation of environmental monitoring responsibilities and data management is detailed further under the 'Law on Environmental Protection 2014'. This new law will take effect from 2015 and the government is preparing regulations to support implementation. Port/ship operators must also comply with standards for environment and water quality.

Pollution Control and Waste Management

LAO PDR

Chapter 3 (toxic, chemical control and waste disposal) and Chapter 4 (environmental certification and permission) of the Environment Protection Law 2013 will ensure that investments comply with the national environmental quality standards and the national pollution control standards. There is

currently limited pollution control and contingency planning for the existing ports and IWT activities in Lao PDR.

THAILAND

The PCD is responsible for water quality and management, hazardous materials and pollution control. Section 78 of the NEQA 1992 relates to water pollution from the collection, transport and disposal of garbage/solid wastes and the discharge of oil and the dumping of wastes from sea-going vessels, tankers and other types of vessels. The main issue with establishing systems to monitor and respond to water pollution incidents is the implementation of water quality emergency plans at the regional and national level.

CAMBODIA

The MOE is responsible for monitoring the existing IWT operations for pollution control and the management of solid and liquid wastes, including ballast water discharge. There are no adequate waste reception facilities or systems to monitor and respond to water pollution incidents along the Mekong River.

It is the responsibility of the port and terminal operator to arrange for the collection of wastes.

VIET NAM

Small oil spills during IWT activities are reportedly common, but only a few ports have adequate equipment for collecting oil, diesel and other liquid wastes. The handling of oil spills is difficult as there is limited funding and investment, limited training, out of date technology and low effectiveness of treating oil spills in fast flowing rivers. There are no facilities to receive vessel wastes on shore and ships are not equipped with adequate waste collection systems.

According to 2009 statistics from a survey of 24 port companies operating in the southern region of Viet Nam, 66 per cent reported managing solid and hazardous waste in accordance with national regulations. However, only 30 per cent of those surveyed had invested in environmental protection and wastewater treatment systems.

Article 16 of 'Decision 02/2013/ND-CP dated Jan 14th 2013' requires all port operators (maritime, military and inland) to develop emergency and oil spill response plans. Port authorities are responsible for coordinating local monitoring and evaluating the effectiveness of the response plans.

The 'Law on Environmental Protection 2014' outlines actions against causing serious environmental pollution from activities such as discharges of wastewater, exhaust gases, dust, solid wastes, noise, vibration, and other pollutants. MONRE is responsible for enforcing these laws.

The same law requires ministries/departments to report environmental aspects to MONRE, including condition reports, environmental complaints, compliance with regulations, list of entities causing pollution, investigations and environmental protection plans and solutions.

Dredging and Sand Mining Operations

LAO PDR

The responsibility for dredging the navigation channel and licensing sand mining operators requires further investigation. It could not be determined from laws or guidelines if private and public operators are required to prepare an EIA or EMP for dredging or sand mining activities (Decree No 7737/MPWT, dated 8/08/2010 and 467/MPWT.WD, dated 15/01/2013 on the responsibility for the dredging of the navigation channel and licensing for sand mining operators only in Lao language).

THAILAND

Under the NEQA, activities that involve dredging of more than 100,000 m^3 are considered as serious impacts to the environment. It was reported that MONRE is responsible for monitoring dredging and sand mining operations in Thailand. The Thailand Marine Department (MD) is responsible for maintaining the navigation channel; there are no specific licensing or environmental requirements for dredging and sand mining in the Mekong River.

CAMBODIA

The processs for licensing and managing the environmental impacts of dredging the navigation channel and sand mining operations is complex. The MPWT is responsible for dredging the navigation channel and waterway conditions and the Ministry of Industry, Mines and Energy (MIME) for sand mining.

The MPWT is preparing a technical guideline on managing the environmental impacts of navigation dredging that will require private-sector dredging of more than 50,000 m^3 to submit an EIA to MOE and develop an EMP. Due to concerns around sand mining, the government recently established the Committee on Sand Resources Management with relevant ministries and institutions (dated 20th March 2015) and issued an Inter-Ministries Prakas (MIME-MOE) on EIAs for all kind of sand mining activities (dated 24th March 2015).

VIET NAM

The dredging extraction of sand and gravel is widespread along the waterways and is becoming increasingly complex, affecting the navigation channel and also the safety of IWT operations. The government requires dredging and sand mining operators to comply with an EIA (Decree No. 29/2011/ND-CP dated 18 April 2011) if the volume is higher than 50,000 m^3 or the area is higher than 10,000 m^2. If the volume is below 50,000 m^3 and the dredging area is less than 10,000 m^2, then an EPC is required.

To strengthen the management of sand mining, the government has issued specific instructions for the survey, transportation and extraction of gravel and sand from the riverbed (Directive No.29/2008/CT-TTg). Under this directive the Provincial People's Committee consult with other ministries to restrict illegal sand mining activities. Meanwhile MONRE coordinates with provincial People's Committees to raise local awareness on the relevant laws, and MOT reviews and approves the dredging plans and ensures that the operator registers the volume of sand and gravel to be extracted. VIWA or the Department of Transportation (DOT) evaluate the maintenance of inland waterway plans for dredging, and then submit them to MOT for approval (Circular No. 17/2013 /TT-BGTVt dated 05 Aug. 2013 of MOT).

Climate Change

LAO PDR

In 2010 the National Strategy on Climate Change of the Lao PDR was adopted. In June 2011, the Department of Disaster Management and Climate Change (DDMCC) under the MONRE was formed. The main duties of the DDMCC are:

- To research, disseminate, and implement directions, policies, resolutions, orders, strategies, laws and legislations of the government on national disaster and climate change; and
- To research and apply directions, policies, strategy plans, orders, agreements, notifications, and other legislation of MONRE to become work plans, detailed projects and implement these in an effective way.

In the meantime, the '*National Climate Change Adaptation Action Plan for 2013-2020*' is being implemented with the followings priority activities:

- Strengthening institutional and human resource capacity on climate change;
- Enhancement of adaptive capacity for coping with climate change;
- Climate change mitigation through reduction of GHG emissions; and
- Strengthening education and public awareness on climate change.

THAILAND

Thailand Climate Change Master Plan is a framework of integrated policies and action plans. Its purpose is to support climate change preparedness initiatives so that they are in line with Thailand's economic and socio-cultural contexts as well as economic development.

The Safety and Planning Bureau of the Transport and Traffic Policy and Planning Office has developed the "Master Plan for Sustainable Transport and Climate Change Mitigation". The master plans enable the integration of information among stakeholders, build up capacity and develop infrastructure. It could not be determined whether any IWT projects are under the Master Plan for Sustainable Transport and Climate Mitigation.

CAMBODIA

Cambodia has developed and documented action plans to respond to climate change, including:

- Cambodia Climate Change Strategic Plan 2014-2023;
- National Adaptation Programme of Action to Climate Change (NAPA);
- Sectoral action plans (e.g. MOWRAM, Ministry of Agriculture, Forestry and Fisheries, MPWT, National Committee of Disaster Management and other line agencies); and
- National Strategic Development Plan (NSDP) 2014 – 2018.

The climate change strategic and sector plans are being developed for transport infrastructure including roads, bridges, and maritime and inland ports.

VIET NAM

In recent years, the weather and hydrology in the Mekong Delta has been reported as more variable. Reduced rainfall, low flow during the dry season and sediment deposition in the waterway channel has reduced the depth available for navigation. Inland ports and navigation infrastructure in the Mekong Delta are extremely vulnerable to climate change.

According to the National Climate Change Scenarios 2012 the following is predicted for the low, medium and high emissions scenarios in Viet Nam: A sea level rise of 54 to 72 cm in the low emission scenario (B1), a rise of 62 to 82 cm in the medium emissions scenario (B2), and a sea level rise of 85 to 105 cm in the high emission scenario (A1).

Climate change is predicted to adversely affect transportation infrastructure in the Mekong Delta. Rising sea levels may impact on low lying inland ports and sea ports and, combined with increased water levels, affect navigation clearance under bridges and power lines crossing over the river. Predicted heavy rains and flooding may lead to increased erosion, damage to port infrastructure, road works and railway.

The government has implemented the National Program to Respond to Climate Change (Decision No. 158/2008/QD-TTg dated 12/02/2008) and MOT has developed specific adaptation and mitigation plans (Decision No 199/QĐ-BGTVT dated 26 Jan 2011) for transport infrastructure including roads, bridges, and maritime and inland ports.

Coordination

LAO PDR

Further analysis is required to determine the coordination mechanisms between MONRE and the Department of Waterways to ensure that the social and environmental impacts of future IWT development is effectively managed.

THAILAND

Coordination mechanisms exist between MD, MOT and ONEP to manage the environmental and social impacts of IWT.

CAMBODIA

The Department of Planning in the MPWT is responsible for managing social and environmental impacts and for coordinating with MOE. The MPWT reported that environmental and social issues are addressed in project planning and implementation through education/awareness programs and by establishing authority and teams for monitoring and assessing potential impacts.

VIET NAM

MOT is required to coordinate with MONRE and relevant ministries to implement and monitor laws on environmental protection for construction of traffic infrastructure and transport activities (Decree No. 107/2012/ND-CP). The MOT reported that good coordination exists between MONRE and the Ministry of Labor, Invalids and Social Affairs (MOLISA).

VIWA does not have any inspectors and relies on MONRE to inspect ports and terminals. More coordination between VIWA, MONRE and port authorities would improve this process.

Regional Plans

Waterway Improvement for Port Logistics Development in Cambodia (KOIKA):

The Korea International Cooperation Agency (KOICA) is developing a feasibility study for waterway improvement from Phnom Penh to Kratie including: electronic navigation chart, soil investigation report, environmental review system, waterway improvement plan and dredging and disposal plan. The KOICA 'environmental review system' should fully comply with Cambodia's Environmental Protection Law by ensuring that EIA and EMPs are completed for each individual port and waterway improvement.

The location of dredging and disposal of dredging wastes would need to consider the biodiversity, critical habitats (e.g. fish spawning and migration, floodplains, riparian zones), and livelihoods in specific sections between Phnom Penh and Kratie. The hydromorphological impacts of dredging would most likely have the most significant impact on the Mekong River and would need to be carefully assessed.

The 2nd phase of the project will see the port development plan for Tonle Bet port, Kilometer No. 6 port and Phnom Penh New Port (Phase 3). Grain ports are also planned in Kompong Chhnang and Kratie, up to 3,000 DWT capacity. Each of these ports would require a separate EIA to be conducted and approved prior to construction, in line with environmental protection laws in Cambodia.

The **"Master Plan for Waterborne Transport on the Mekong River System in Cambodia"**, 2006 had the following environmental actions:

Environmental actions	Progress
C3: Strategic Environmental Impact Assessment (SEIA) for the Master Plan for Waterborne Transport on the Mekong River in Cambodia	**MPWT- MOE:** If additional procedures are necessary, a project proposal should be prepared for C5 Implementation of an "Environmental

C4: Establishment of an Environment Focal Point (EFP) in the MPWT **C5**: Implementation of the environmental safeguarding methodology for the Master Plan	Safeguarding Methodology"

Environmental actions	Progress
A26: Adoption of Dredging Environmental Management Procedure (DEMP)	Start Task Force Prepare draft Prakas
B19: Implementation of a Waste Management Plan for ships	Final review of the draft Prakas + guidelines (MPWT, PPAP, MOE, KAMSAB)
B20: Approval of the Navigation Spill Contingency Plan for the Mekong and its tributaries **B21**: Designation of key personnel for the implementation of the Navigation Spill Contingency Plan **B22**: Arrangements with third parties for response to navigation spills **B23**: Specific actions for navigation spill response preparedness	Adaptation and actualisation existing draft NSCP (2005) to Mekong and tributaries Meeting with Cambodian National Committee for Disaster Management (NCDM) on responsibilities Draft project proposal

Development Plan on International Navigation on the Lancang-Mekong River 2014-2025 (Joint Committee on Coordination of Commercial Navigation - JCCCN):

The development plan proposed on the Lancang-Mekong will improve the navigation channel from China-Myanmar to Luang Prabang in Lao PDR to allow navigation for vessels up to 500 DWT. Ports will also be constructed and built in Guanlei, Xiengkok, Wan Pong, Pakbeng and Luang Prabang Ports.

The Lancang-Mekong Development Plan (2014-2025) is sure to draw criticism from civil society and potentially downstream countries due to the magnitude of environmental and social impacts. The development plan outlines the proposed 'Environmental Impact and Protective Measures'. However, these measures fail to adequately consider:

- The impacts and costs of dredging, reef trimming and maintaining the waterway channel;
- Assessment of eco-regions and critical habitats for fish and aquatic species;
- The hydromorphological impacts from reef trimming, dredging and other activities on the river and its flood plains;
- Environmental and social impacts of construction of ports and landing facilities and increased shipping and waterway use; and
- Future volumes of cargo and passenger transport.

An EIA will be conducted as part of Phase 1. However it could not be determined to what level the EIAs would be conducted, whether the EIA would cover the whole project or be separated for specific ports and waterway improvement sections. Specific EIAs should be undertaken for each of the ports constructed and for different sections of waterway improvement. The JCCCN should also consider TbEIAs to ensure that trans-boundary and cumulative impacts are considered.

Transportation Development Plan for the Mekong Delta in 2020:

Section V of the '*Transportation Development Plan for the Mekong Delta in Viet Nam 2020*' includes a detailed section on SEA. The following issues were reported in the current status of the environment in the Mekong Delta:

(1) Increasing trends in air pollution and noise pollution caused by transportation activities;

(2) Increasing trends of water pollution from port and shipping activities in the Mekong Delta;

(3) Port areas, channel, river and coastal areas are contaminated by oil and heavy metals; and

(4) Solid waste and hazardous waste generated from port activities is increasing.

Other environmental pressures in the Mekong Delta are from the overuse of fertilizers in agriculture, incorrect disposal of domestic wastes, flooding, rising sea levels, salinity and riverbank erosion. Twenty percent of the population in the Mekong Delta is living below the poverty line due to a lack of employment opportunities and income. The educational level is lower and unemployment rate higher in the Mekong Delta than the national average in Viet Nam. Therefore, investing in human resources and education is critical.

The development priorities of the 2020 plan are to:

- Balance economic development with social development, poverty alleviation, job creation and reducing disparities between regions and between ethnic minorities; and
- Balance economic development with environmental protection to achieve sustainable development.

The development planning for terminals, ports and shipping channels will consider the impacts of oil spills and dredging, and improving ambient air quality and reducing greenhouse gas emissions. Inland waterway ports must have water collection systems and adequate wastewater treatment to protect water quality. To manage dredging activities, control plans will be developed to manage sediment during construction activities and to consider longer-term impacts to bank instability and erosion.

Conclusions

There is an appropriate legal framework in all of the Member Countries to ensure that environmental and social assessment, management and monitoring is undertaken for existing and future IWT projects. The type of environmental and social assessment is determined by the size and type of the project and activities specified under environmental protection and EIA laws.

The environmental assessment framework can be applied to port developments, dredging, waterway improvements and increased waterway use. The main issues reported were the limited capacity of line agencies to monitor and enforce law and regulations for environmental protection in the inland navigation sector. The following measures are required to improve environmental and social assessment in the Mekong Basin:

- Enhance coordination between ministry/departments of transport, environment and water resources and the private sector to manage and monitor the impacts of IWT;
- Promote education and awareness campaigns for the private sector and local populations of the consequences of waste disposal in the river and the dangers of pollution for the environment;
- Develop environmental assessment guidelines for the IWT sector to improve understanding of assessing and managing social and environmental impacts. This would include developing technical guidance and capacity building for environmental assessment and monitoring of future IWT planning and project/activities in the Mekong Basin.

An SEA and integrated planning approach should be applied to both the 'Lancang-Mekong Development Plan (2014-2015)' and the 'Waterway Improvement for Port Logistics Development in Cambodia'. A SEA or CIA would allow a program of EIA, EMP and monitoring to be developed to ensure the cumulative impacts of both plans are fully considered. The KOICA 'environmental review system' should fully comply with Cambodian EIA environmental protection and ensure that EIAs are conducted for port construction and dredging. Specific EIAs should be undertaken for each of the ports constructed and for different sections of the waterway improvement in the Lancang-Mekong Plan, in order to comply with Thailand and Lao PDR environmental protection laws.

2.10 SOCIAL ASPECTS - OPPORTUNITIES FOR RURAL INLAND WATERWAY TRANSPORT

2.10.1 Overview

With such a large proportion of rural communities living within 15 km of the Mekong River and its tributaries, IWT is a popular mode of short and medium distance transport and has increased people's access to social services and markets, as well as created employment opportunities.

The future development of IWT in the Mekong region is essential to achieving the goals of poverty reduction and provides the following opportunities:

- Economic: agricultural and industrial production, markets and tourism; and
- Administrative: access to education, health, cultural and social services.

2.10.2 Approach

On-the-spot surveys of local waterway users at passenger ports in order to determine the current situation and how access to IWT can be improved. The local questionnaires were developed with Member Countries to identify and provide better understanding of waterway users in the Mekong River Basin.

2.10.3 Lao PDR

Survey of Local IWT Users

Participants were interviewed at the following small cargo and passenger ports in Lao PDR: Huay Xay port, Pak Tha port, Pak Beng port, Luang Prabang port, Watnong port, Ban Donmai port and Nakasang port (Pakxe province). A total of 91 participants were interviewed, including 54 passengers and 37 non-passengers.

The passengers all indicated that a 'passenger boat' was the type of boat they were travelling on. All 37 non-passengers surveyed were owner/operators of the boats, 23 percent of these were female. The types of boats owned were 21 small cargo boats, 10 river cruises and six private boats. Forty-six percent had been operating their boats for 6 - 10 years and 27 percent for 0 - 5 years. Only 8 percent had been operating their boats for more than 15 years.

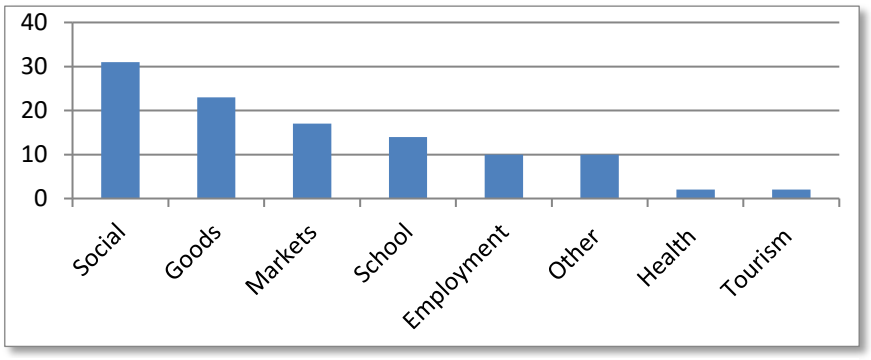
Frequency and Distance

Twenty percent of passengers used transport monthly and weekly, 18.5 percent daily and 16.7 percent used it 3-4 times per week. Participants were asked to indicate if they used IWT for short (0 - 30 minutes), medium (30 minute to three hours) or long (more than three hours) trips. Twenty-six passengers used it for long trips, 25 for medium and only 3 used it for short trips. All passengers reported that IWT is cheaper than other modes of transport.

With regards to the boat owners, 45.9 percent use their boats on a monthly basis and 29.7 percent on a daily basis. Fifty-four percent of owners use their boats for long trips (more than three hours), 29.7 percent for medium trips (30 minutes to three hours) and 16.2 percent for short trips (0 - 30 minutes). The boats undertaking short trips were involved in cross border transport from Huay Xay to Chiang Khong (Thailand), running multiple trips in a day.

Use of IWT

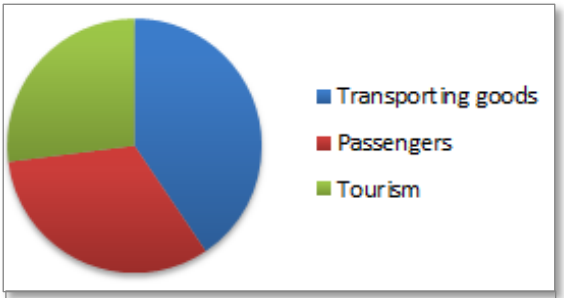
The passengers and boat owners were asked what they used IWT for. More than one answer could be provided for this question. The results for passengers is shown in the adjacent figure.



Passanger uses of IWT in Lao PDR

Fifty seven percent of passengers indicated that they used IWT for 'social' reasons, for example passengers reported travelling from Huay Xay and Pak Beng to visit family and friends in Luang Prabang. A number of passengers used IWT for economic reasons. Forty three percent used IWT to transport goods and 31.5 percent for accessing markets, while and 18.5 percent used it for employment. Nearly twenty-six percent used IWT to access schools.

Boat owners were asked to report what they use their boats for as shown in the adjacent figure.



Boat owner's use of IWT in Lao PDR

Nearly forty-one percent used their boats for transporting goods, 32.4 percent for passenger transport and 27 percent for tourism. A number of passengers use boats to go from village to village or from one province to another e.g. Huay Xay to Pak Beng to Luang Prabang.

Transport of Goods

Both passengers and boats owners reported using IWT for transporting goods. From the data it was evident that some passengers that selected 'markets' and 'social' also used IWT for transporting goods. Fruit/vegetables (53.7 percent) and rice (46.3 percent) were the main goods transported by passengers on local boats.

Boat owners were also asked to report what types of goods they carried. Based on the responses it is clear that passenger boats are also used to transport goods. Construction materials (e.g. cement, steel, wood) and agricultural products (e.g. rice, fruit/vegetables and livestock) were the most common materials transported. None of the boat operators in Lao PDR reported using boats for transporting fuel, chemicals or fertilisers. According to the Department of Public Works and Transport, in Luang Prabang province there were 49 boats registered to transport goods in 2014. A total of 63,709 tonnes of goods were transported in 2014, the main goods transported were rice, construction materials and livestock (e.g. buffalo, chicken, pig).

Passenger Transport

For the boats carrying passengers, 59.5 percent were used for local transport, 43.2 percent for international tourism (foreigners) and 16.2 percent for cross-border transport from Huay Xay to Chiang Khong. The questionnaires indicated that passenger boats are used to carry both local people and international tourists.

At Huay Xay port the passengers indicated that they were travelling along the Mekong downstream to Pak Beng and Luang Prabang. The Pak Beng Port Association recorded a total of 75,645 passengers in 2014. Most of these passengers were international tourists. The passenger boats in Pak Beng also provide access to markets in Luang Prabang to local passengers who own guesthouses in Pak Beng.

In the Southern province of Pakxe, the Nakasang port provides access to the main Don Khone and Don Det islands. The 4,000 islands (*Siphandon*) is a popular destination for international tourists. Local people living on Don Khone, Don Det or other islands use passenger boats to access Nakasang province for schools, health centers and markets. Cargo vessels are used to transport food, fuel and other items to guest houses and restaurants.

The Boat Association at Nakasang port reported that there are 148 boats registered, including 120 small boats with carrying capacity of less than 19 persons and 28 larger boats for carrying up to 50 persons. In 2014, 26,333 foreigners and 5,475 local passengers were transported.

Access to national and cross-border ports

Fifty percent of passengers indicated that local IWT provides them with access to other local ports, 42 percent to larger national passenger ports and 7.4 percent to cross-border transport. Nearly thirty-eight percent of the boat owners reported that IWT provides access to national cargo ports (e.g. Huay Xay, Pak Beng and Luang Prabang), 32.4 percent reported access to the cross border port at Chiang Khong, Thailand and 16.2 percent indicated that they only had access to local ports.

Pak Tha is a good example of a local passenger and cargo port linking to larger national/cross-border ports. Local passengers at Pak Tha port and local boat operators reported using IWT to access Huay Xay and then cross-border to Chiang Khong (Thailand). The Pak Tha boat association reported that in 2014 there were 6,586 round trips made from Pak Tha port to Huay Xay carrying a total of 29,421 local passengers and 32,002 foreigners.

The Huay Xay Port Association reported that there are 22 small cargo vessels registered to transport goods from Huay Xay port to Chiang Khong in Thailand. Lao people travel by boat from Huay Xay to the market in Chiang Khong to buy fruit/vegetables and construction materials. The type and amount of goods transported through Pak Tha port in 2014 is shown in the Table below:

Goods	Amount
Corn	32 tonnes
Rice	86 tonnes
Motorcycles	228
Construction materials	2,468 tonnes
Fruit/vegetables	54 tonnes
Beer	7,500 boxes

Source: Public Works and Transport Office in Pak Tha District

Issues and opportunities for improvement

The passenger and boat owners were asked to provide further details on why they use IWT, what the main issues are and how IWT can be improved. The participants reported that the main reasons they use IWT are:

- IWT is cheaper and more comfortable than transport by car;
- Passengers enjoy travelling by boat due to the environment; and
- Safer and less accidents than road transport.

The participants reported that IWT could be improved by:

- Providing more safety, emergency response and communications equipment for passenger vessels;
- Improving the legal system to ensure sustainable development of navigation activities;
- Promoting IWT and water-related tourism for international and local tourists;
- Enhancing the existing port and warehouse facilities;
- Building capacity of captains, crewmembers and port workers;
- Considering financial incentives and reducing tax to promote IWT to transport operators;
- Conducting safety inspections of boats e.g. enforcing the restrictions on number of passengers;
- Improving the navigation channel, installing more aids to navigation and providing more waterway information for boats and port operators; and
- Improving coordination between provincial Departments of Public Works and Transport, Boat Associations and Port Authorities.

2.10.4 Thailand

National

Thailand has been an active partner in GMS cooperation, particularly in transport, transport and trade facilitation, energy, agriculture, environment, human resource development, tourism, telecommunications, and trade and investment. Unfortunately, Thailand is mostly focusing on the regional integration of road and rail networks.

The GMS Core Environment Program and Biodiversity Conservation Corridor Initiative, which aims to promote environmentally sound and sustainable GMS development, is being implemented through the GMS Environment Operations Center, based in Bangkok.

Survey of Local IWT Users

IWT is really important for economic development and poverty alleviation in Thailand, as it stimulates domestic and international trade along the Mekong River. In Thailand, there are no studies that show the contribution of IWT or transport in terms of employment or economic benefits at the national level. There are also no studies that determine the significance of IWT for rural communities in terms of accessing services such as school and health, or accessing employment and markets.

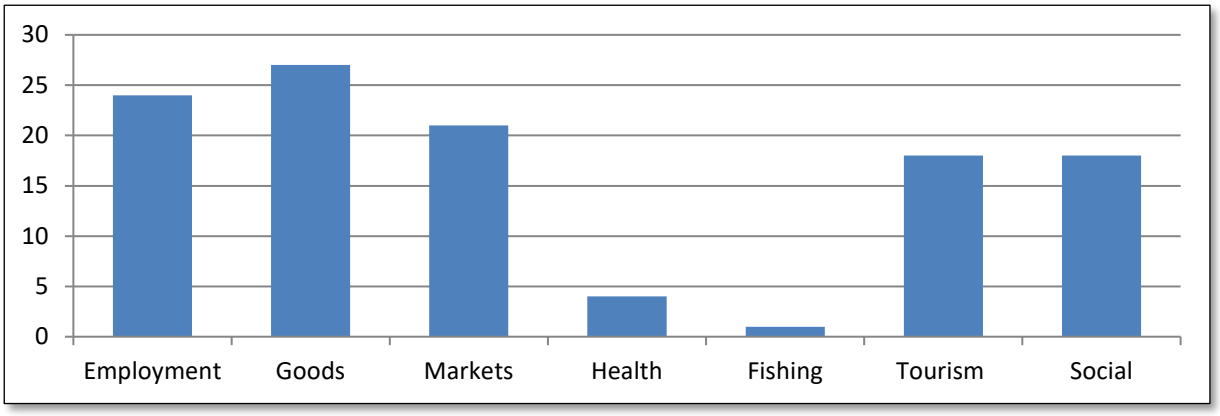
The Thai National Experts interviewed local passengers and boat owners at the following three ports along the Mekong River in Thailand: Chiang Kong port, Nakorn Phanom Municipality Port and Mukdahan Municipality Port. A total of 50 participants were interviewed: 42 passengers and 8 boat owners. From these eight boat owners, three were real owners, four were boat operators and one was a boat worker. The types of boats were: 48 percent small cargo and 36 percent used to transport local passengers. All participants were asked to indicate the type of transport assets that they own and 76 percent owned a boat (motorised), 22 percent a motorcycle and 18 percent a car.

Frequency and Distance

Eighteen participants used IWT weekly, 11 persons daily and five persons used the IWT 3-4 times per week. Fifty-sevent percent of participants indicated using IWT for long trips (more than three hours), 19.8 percent for medium trips (30 minutes to three hours) and 23.1 percent for short trips (less than 30 minutes). In terms of cost, 79.5 percent found IWT cheaper than other means of transport, 4.5 percent found that it was about the same and 15.9 percent found that it was more expensive.

Use of IWT

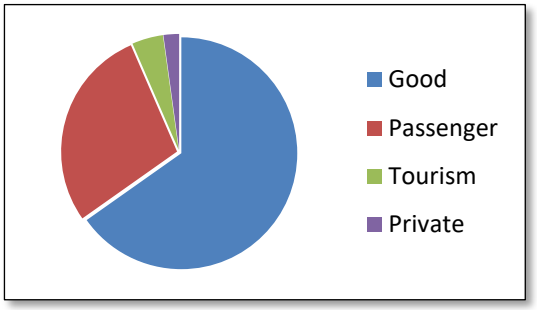
The passengers and boat owners were asked what they used IWT for and they could provide more than one answer. The results for passengers is shown below:



Uses of IWT

IWT was mainly used for economic activities: 54 percent used IWT for transporting goods, 48 percent for employment and 42 percent for acessing markets. Meanwhile, 36 percent used IWT for social reasons, such as visiting friends and family.

The boat owners were also asked to report what activites they use their boats for as shown in the graph below:



Uses of boats by boat owners

Sixty-five percent used their boats for the transport of goods (national and local) and 28.3 percent for the transport of passengers. Meanwhile 59 percent of the participants reported that IWT provided access to cross-border cargo ports with Lao PDR, 29.5 percent reported access to cross border passenger ports and 11.4 percent reported access to local ports only.

Transport of Goods and Passengers

IWT is mainly used for transporting agricultural products: 72.7 percent reported transporting fruit/vegetables, 50 percent transported rice and 40.9 percent livestock. Nearly forty-eight percent reported using IWT to transport construction materials and 25 percent transported fuel. In terms of passenger boats, 46.2 percent were used for cross border transport, 21.2 percent for international passengers and 17.3 percent for local transport

Issues and Opportunities for Improvement

The following issues were reported for IWT:

- The main problem is the authority of each country to manage the river; and
- Water transportation is difficult in the dry season due to low water levels.

The participants had the following suggestions for IWT improvement:

- Improve laws and regulations of both Thailand and Lao PDR;
- Apply the international standards for managing IWT;

- Increase boat capacity to respond to the increase of the demand for markets;
- Strict enforcement of safety rules for passengers;
- The transportation should be sustainable and not lead to environmental degradation; and
- Enhance the collaboration among China, Thailand, Lao PDR and Myanmar to manage hydropower projects and IWT.

2.10.5 Cambodia

National

There are currently no studies that show the contribution of IWT in terms of employment or economic benefits in Cambodia. The Ministry of Social Affairs and Veterans Youth Rehabilitation (MOSAVYR) could not provide specific information on socio-economic data or studies related to IWT.

Several ministries suggested focusing on the following key issues for the inland navigation sector and socio-economic development:

- There are limited laws and regulations to promote 'green' navigation and the implementation of an IWT master plan to ensure everyone benefits;
- Low flow during the dry season only provides rural communities transport from one area to another and limits access to larger or national ports;
- The management of solid and liquid wastes has not been fully applied at port/terminals and onboard vessels;
- Vessels sailing on the Mekong River are carrying dangerous goods that may have serious consequences on the environment; and
- Consideration of the positive and negative impacts of climate change on IWT is needed.

Rural IWT Users

There are no statistics related to the use, access to services (e.g. health and education) or significance of IWT to rural communities. The MPWT also reported that there are no existing studies that show the contribution of IWT in terms of employment and economic benefits for rural communities. On-the-spot surveys of local IWT users were conducted at three sites in Cambodia: Kompong Chhnang, Chong Kneas and Kompong Cham.

Survey of Local IWT Users

One hundred and five people were interviewed in total: 35 people at each site, with a total of 56 passengers and 49 non-passengers. Of the 49 non-passengers interviewed, 43 were boat owners, four were boat operators and two were workers.

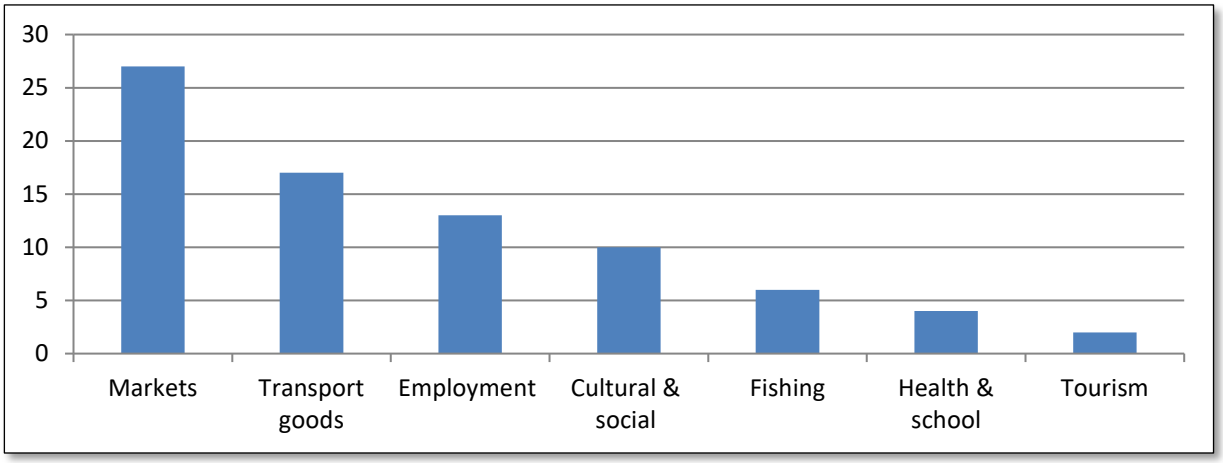
Frequency, Distance and Costs of IWT

The majority of passengers use IWT at least weekly: 37.5 percent daily, 23.2 percent 3-4 times per week and 10.7 percent weekly. Passengers were asked to indicate if they used IWT for short trips (0-30 minutes), medium trips (30 minute to three hours) or long trips (more than three hours). Forty passengers reported using IWT for medium trips, 10 for long trips (more than three hours) and six for short trips. Eight of the 17 passengers surveyed at Chong Kneas reported that they were taking a long journey. Passengers were asked to consider the costs of IWT compared to other modes of transport: 39.3 percent reported it to be cheaper, 30.4 percent said it was more expensive and 30.4 percent said it was about the same.

Fifty-three percent of owner/operators used their boats for daily trips and 24.5 percent made 3-4 trips per week. Only 6.1 percent of participants do multiple trips in a day and 6.1 percent do less than one trip per month. Fifty-nine percent of participants use their boats for medium trips (30 minutes to three hours), 28.6 percent for long trips (more than three hours) and 14.3 percent for short trips (0-30 minutes).

Use of IWT

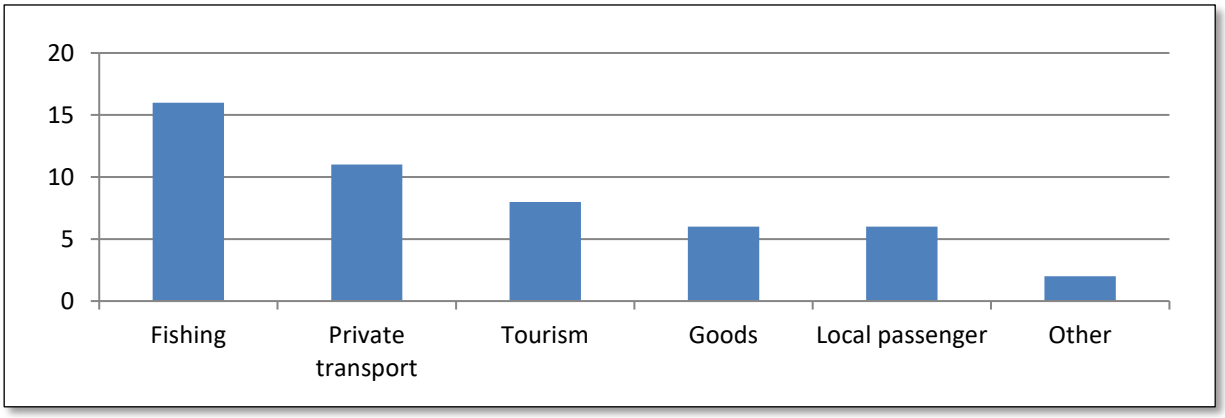
Participants were asked what they use IWT for, and could provide more than one answer. The results for passengers is shown below:



Passenger use of IWT

Passengers indicated acessing markets, transporting goods and employment as the main reasons they were using IWT. All these uses provided economic benefits to rural communities. From the data, it is evident that some participants that selected 'markets' also used IWT for transporting goods.

Boat owners/operators were asked to report what they use their boats for as shown in the chart below:



IWT uses for boat owners/operators

Nearly thirty-three percent used their boats for fishing and 22.4 percent for private transport. Eight of the 18 participants at Chong Kneas used their boats for tourism, the only site reporting tourist activities.

Owner/operators using boats for passengers were asked to indicate the type of passengers they were carrying; more than one type could be selected. Nearly eighty-four percent used passenger boats for local transport, 18.4 percent for tourists (foreigners) and 12.2 percent for tourists (locals).

Transport of Goods

Passenger reported that agricultural products such as fruit/vegetables (48.2 %), rice (37.5 %) and fertilizers (19.6 %) were the most commonly transported goods. Overall, participants at Kompong Chhnang indicated the highest number and range of goods transported.

The owners/operators/ were asked to report what types of goods are carried. Based on the responses it is clear that goods are carried on all types of boats (e.g. private or local transport boats are used to transport goods and passengers).

Owners/operators reported that agricultural products such as fruit/vegetables (38.8 %), rice (28.6 %) and livestock (14.3 %) were most commonly transported. Fourteen percent used boats to transport fuel, and 12.2 percent used it to transport timber/logs; the other goods carried included sand, wastes, scrap metals and fish products.

Ownership of Transport Assets

Passengers were asked to indicate the different types of transport assets that they own (more than one could be selected). Nearly seventy-seven percent of participants owned a motorized boat, 42.9 percent owner a bicycle and 32.1 percent owned a motorcycle. Boat ownership had the highest prevalence in Kompong Chhnang. Owners/operators were asked to indicate the different types of transport that they own (more than one could be selected). Nearly eighty-two percent of participants owned a motorized boat, 30.6 percent owned a motorcycle and 18.4 percent owned a bicycle. The non-passengers had a higher ownership of boats (motorized) and motorcycles than the passengers.

Issues and Opportunities for Improvement

The passenger and owner/operators were asked to provide further details on why they use IWT and to list the main issues and opportunities for improvement. The participants reported that the main reasons they use IWT are:

- Close to farming and employment opportunities along the river;
- No access to roads and bridges, especially during the wet season;
- Unsafe roads and long distance from housing; and
- High costs of other transport modes.

The participants reported that IWT could be improved by:

- Developing a safe, cheaper and more efficient ferry service;
- Considering the use of larger passenger and cargo vessels;
- Establishing better port/passenger facilities and waste management plans;
- Increasing participation from the private sector by raising awareness of IWT;
- Reviewing pricing of fuel and transport costs;
- Implementing a legal framework and improving cooperation among line agencies and between line agencies and local authorities;
- Promoting education to boat owners to maintain, control and inspect engines and equipment for safety; and
- Notifications for weather and navigation conditions to reduce accidents.

2.10.6 Viet Nam

National

The Mekong River delta has a dense network of rivers and canals as reported by VIWA. In 2014 there were 160,000 vessels and 2,500 inland ports/terminals operating, transporting up to 50 million tonnes of goods and 300,000 passengers. The proportion of goods carried in the Mekong Delta has increased from 30 percent in 2009 to 62 percent in 2012, with an average annual growth of about 10 percent.

IWT plays a vital role in cargo and passenger transport and creates millions of jobs, contributing to poverty alleviation and economic development. There are a number of studies that show the contribution of IWT in term of employment or economic benefits at the national level.

Moreover, the MOT reported that many projects, studies and workshops have been conducted to promote the development of IWT in the Mekong Delta and for rural areas, and that the following plans have been approved:

- Transport Development Planning of the Mekong Delta's Key Economic Zones to 2020 with the Outlook to 2030 (Decision No. 11/2012/QD-TTg by the Prime Minister dated 10/02/2012);
- Detailed Planning of Port Groups in the Mekong River Delta (group 6) to 2020 with the Outlook to 2030 (Decision No. 1746 /QD- BGTVT by the MOT dated 3/8/2011);
- Irrigation Planning in the Mekong River Delta Phase 2012 - 2020 with the Outlook to 2050 in the Context of Climate Change, Sea Level rRse (Decision No. 1397 /QD- TTg by the Prime Minister dated 25/9/2012);
- Development Planning of Inland Fleets by 2020 with the Outlook to 2030 (Decision No. 639 / QD-BGVT by the Ministry of Transport dated 14/3/2013); and
- A Master Plan for Development of Viet Nam Inland Waterway Transport by 2020 with the Outlook to 2030 (Decision No. 1071 / QD-BGTVT by Ministry of Transport dated 24/4/2013).

Survey of Local IWT Users

The questionnaires were conducted at three main passenger terminals on the Mekong and Bassac rivers in in Viet Nam: Ninh Kieu Cruise Terminal, Can Tho Maritime port (fishing village area) and Chau Doc Port of Tourism.

The national experts randomly selected people for the survey at all three sites. Generally the participants could be divided into three types: i) local residents living in the surrounding port area ii) tourists and iii) ship-owners, ship operators, ship workers and crew members.

A total of 104 participants were interviewed, including 68 passengers and 36 non-passengers.

The participants reported that they travelled on different types of boats; as a result more than one option was selected as shown in the table below:

Boat	Total
Passenger ship (inland transport)	54
Passenger ship (tourist)	21
Small sized cargo vessel	19
Private small sized cargo vessel	19
Cruise ship	7
Other	6

Nearly thirty-nine percent of participants indicated that they used passenger ships (tourist), 34.6 percent used passenger ship (inland transport) and 18.3 percent used small cargo and private vessels.

The non-passengers were asked whether they were a ship owner, operator, worker or other as shown in the table below:

Type	Total
Owner	16
Operator	19
Worker	12
Other	1

Participants indicated that in some cases they were both the owner and operator of the vessels. The owner and workers reported that they had merchant mariner licenses to work on the vessels. Forty-seven percent had been operating their boats for 6-10 years, 33.3 percent for 11 - 15 years and only 11.1 percent for 0 - 5 years. Nearly six percent had been operating their boats for more than 15 years.

Frequency and Distance

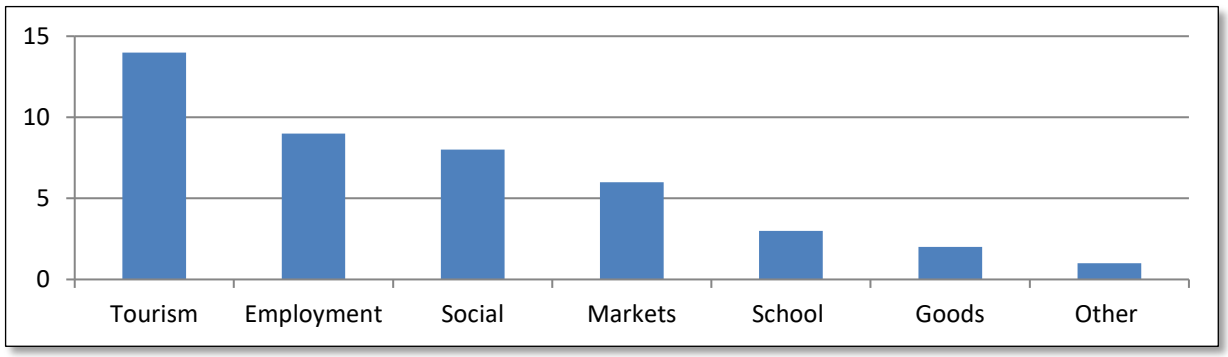
Nearly thirty-nine percent of passengers used transport on a weekly basis, 22.1 percent on a daily basis and 17.6 percent used it 2-3 times per week. Only 1.5 percent indicated that they used IWT monthly and 8.8 percent made multiple trips in day.

Participants were asked to indicate if they used IWT for short (0-30 minutes), medium (30 minute to three hours) or long (more than three hours) trips. Thirty-three passengers reported using IWT for short trips, 28 for medium trips and only 7 used IWT for long trips. In relation to costs, 70.6 percent found that IWT was cheaper than other modes of transport, 13.2 percent found that it was about the same and 7.4 percent found that it was more expensive.

Concerning the frequency of trips undertaken by the owners/operator, 50 percent of owner/operators indicated that they used their boat 'sometimes', 33.3 percent used it on a daily basis and 13.9 percent used it 4-5 times per week. Nearly forty-two percent of owners/operators use their boats for short trips (0 - 30 minutes), 33.3 percent use it for medium trips (30 minutes to three hours) and 11.1 percent use it for long trips (more than three hours).

Use of IWT

The participants were asked what they use IWT for and could provide more than one answer. The results for passengers is shown below:

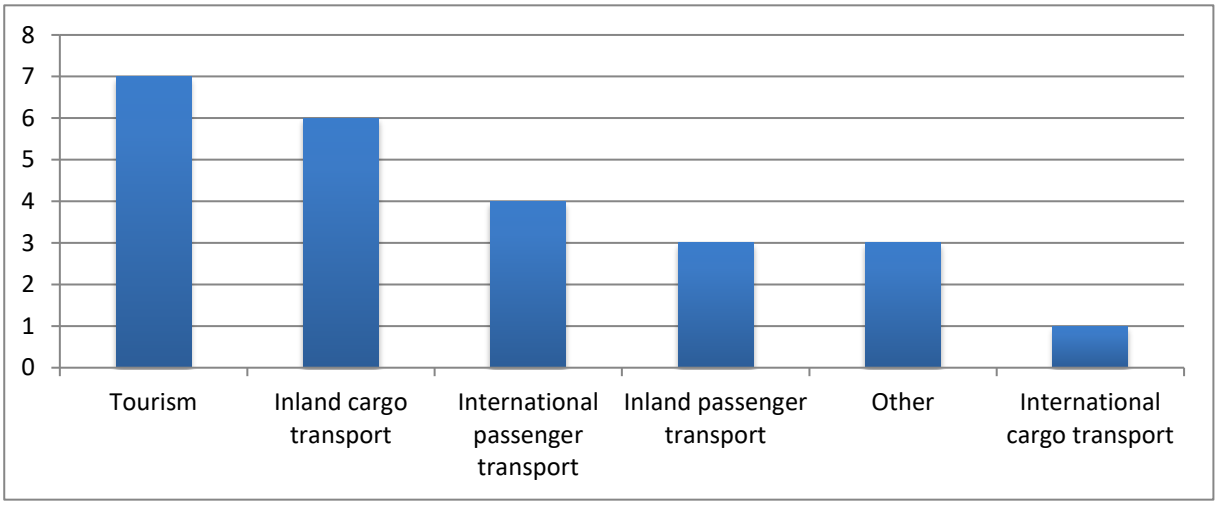


Passenger use of IWT

Nearly twenty-one percent of passengers reported that they used IWT for tourism, 13.2 percent used it for employment, 11.8 percent for social reasons (e.g. visiting family) and 8.8 percent used it for accessing markets.

The use of boats for owner/operators is shown in below. Nineteen percent of owner/operators indicated that they used their boats for tourism, 16.7 percent use it for inland cargo transport, 11.1 percent for international passenger transport and 8.3 percent for inland passenger transport.

International passenger transport referred to cross-border (i.e. Chau Doc to Phnom Penh) and inland passenger transport for local transport. This question had a low response rate with 23 passengers and 12 non-passengers not indicating what they used IWT for.

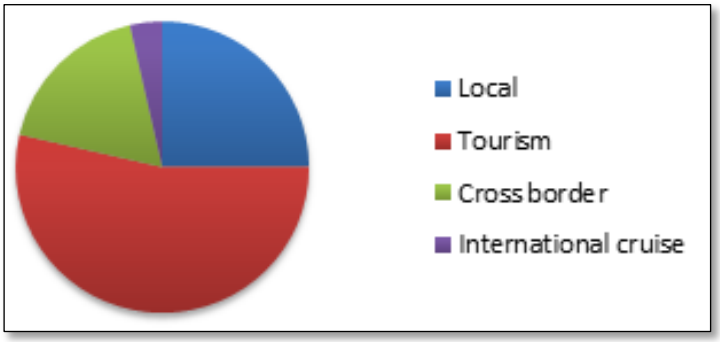


Transport of Goods

The main goods transported along the waterways in Viet Nam are fruit, vegetables, dried foods and other products for local residents and tourists. Specialized vessels are used to transport fuels (e.g. gasoline, diesel, gas), chemicals (e.g. fertilizer or pesticides) and livestock. Small cargo boats are also used to take people across the Bassac River to access markets. Generally these ships were reported to be poorly maintained, carrying limited safety, communications and emergency equipment and unable to transport long distances.

Passenger Transport

The different types of passenger services provided by the owner/operators are shown in the chart below:



Nearly forty-one percent of passenger ships are used for tourism, 18.9 percent are used for local passengers and 13.5 percent for cross border transport. Some passenger ships are used to transport both national and international tourists.

It was reported that there has been a significant decline in demand for waterborne transport due to improved roads in the Mekong Delta. However, for transporting large quantities of fruit/vegetables, IWT was still the preferred mode of transport. Tourist and visitor numbers have also been decreasing, with some ship owners/operators responding by converting their passenger ships into cargo vessels.

Chau Doc Passenger Port

A representative of the Chau Doc port reported that there has been a significant decline in tourist numbers for waterborne transport tours including the routes from Can Tho to Chau Doc and Chau Doc to Ha Tien. The demand for cross-border water transport route from Can Tho to Phnom Penh remains steady.

There are three types of passenger ships operating in the in Chau Doc area:

(1) **Small speedboats:** 15 to 30 passengers;

(2) **Speedboats:** 30 to 35 seats; and

(3) Large speedboat of 120 to 150 seats.

The number of ships and passengers for Chau Doc port from 2008-2014 is shown the table below:

Year	Ship			Passengers
	Cruise	Passenger	Total	Tourist
2008	-	58	-	3,217
2009	45	630	675	16,436
2010	153	400	553	20,216
2011	224	601	825	12,086
2012	214	743	957	20,450
2013 (8 months)	84	393	417	8,314
2014	209	689	898	14,352

Source: Inland Waterway Port Authority, Region IV

Ownership of Transport Assets

The participants were asked to indicate the type of transport assets that they own, as shown in the table below:

Asset	Passenger	Non-passenger
Boat (non-motorised)	0	5
Boat (motorised)	0	16
Car	3	2
Motorcycle	13	10
Bicycle	11	10

Nine of the participants owned no transport assets, and use ferries, private or passenger boats to take them to markets or across the river. The ship owner/operators and tourists own boats, motorcycles and bicycles. The data also indicates that non-passengers owned more than one asset. This answer had a low response rate, with 32 passengers not indicating what type of assets they owned.

Issues and Opportunities for Improvement

The passenger and owner/operators were asked to provide further details on why they use IWT, what the main issues are and how IWT can be improved. The participants reported that the main reasons they use IWT are:

- Convenient to get from home to work and to visit tourist attractions and entertainment;
- Visiting family, friends and enjoying the scenery on the river;
- Going to the floating markets in Viet Nam and tourist attractions in Cambodia; and
- Employment, access to markets and transporting goods.

The passengers reported that IWT can be improved by:

- Enhancing the awareness of the Law on Inland Waterway Transport as well as traffic safety for local boat operators;

- Ensuring that passenger boats are carrying the appropriate lifesaving and other equipment to improve safety; and
- Increasing the number of ferries and passenger services operating to reduce waiting times.

The ship owner/operators reported that IWT can be improved by:

- Reviewing the pricing structure of fares and monitoring tour operators/travel agencies to ensure consistency;
- Promoting awareness for local people and ship owners to reduce pollution and solid wastes in the Cai Rang and Phong Dien floating markets;
- Maintaining the navigation channel at Chau Doc port to ensure access for large passenger vessels during the dry season;
- Enhancing coordination between the Inland Waterborne Port Authority - Region IV and customs to reduce the burden of administrative procedures for cross-border transport;
- Simplifying the procedures and requirements for ship owners to transport passengers across the border to Cambodia; and
- Improving the connections between Can Tho/Chau Doc and Phnom Penh port for cross border transport.

2.10.7 Conclusions

People in the Mekong use IWT for local passenger transport, ecotourism and the transport of local products (agricultural, fisheries, garments) to markets, creating economic opportunities for rural communities. The reasons for use, issues and areas for improvement relating to IWT are summarised below for each of the Member Countries.

Summary of local survey results in Lao PDR

Lao PDR		
Survey areas: Huay Xay, Pak Tha, Pak Beng, Luang Prabang, Ban Donmai, Wat Nong and Nakasang passenger port		
Reasons for using IWT	**Issues**	**Improvements**
• Transporting goods (agricultural) to and from markets • IWT is cheaper and there is limited access to roads • Passengers enjoy travelling by boat due to the environment • Safer and less accidents than road transport • Access to cargo and national ports	• Boats do not have lifejackets, buoys or fire extinguishers onboard • No warning facilities for navigation accidents • Poor access to ports and/or no cargo facilities exist • Larger boats are required for passengers • Low water levels restricts navigation and rapids/reefs are hazardous • Water pollution from oily wastes and re-fuelling activities, solid wastes/garbage	• Providing safety, emergency response and communications equipment • Improving the legal system to ensure sustainable development • Promoting IWT and tourism • Enhancing the existing port facilities; • Improving the navigation channel and aids to navigation • Building capacity and improving coordination between line agencies

Summary of local survey results in Thailand

Thailand		
Survey areas: Chiang Saen, Chiang Khong, Nakhon Phanom and Mukdahan		
Issues	**Improvement**	**Cross-border**
• The main problem is the different standards in Lao PDR and Thailand for managing IWT • Water transportation is difficult in the dry season due to low water levels	• Improve laws and regulations of both Thailand and Lao PDR • Apply international standards for managing IWT • Increase boat capacity for cargo and passengers • Enforcement of safety rules for passengers • Sustainable and not lead to environmental degradation • Enhance the collaboration between China, Thailand, Lao PDR and Myanmar	• Simplifying procedures and regulations for cross-border transport between Lao PDR and Thailand • More staff are required to monitor the condition of vessels, passenger safety and customs • IWT could be expanded to relieve congestion on the friendship bridge • Identity more economic opportunities for local people

Summary of local survey results in Cambodia

Cambodia		
Survey areas: Kompong Cham, Kompong Chhnang, Chong Khneas		
Reasons for using IWT	**Issues**	**Improvements**
• Farming and employment along the river • No access to roads and bridges • Unsafe roads and long distance from housing • High costs of other transport modes	• High transport costs due to the price of fuel • Relatively low carrying capacity of the vessels • Low water levels in the dry season and storms/flooding impact on safety and efficiency • Legal instruments for IWT have not yet been fully implemented	• Developing safer, cheaper and more efficient services • Using larger passenger and cargo vessels • Establishing better port/passenger facilities and waste management plans • Increasing participation from the private sector • Reviewing pricing of fuel and transport costs • Implementing a legal framework and improving cooperation among line agencies

Summary of local survey results in Viet Nam

Viet Nam: Passengers		
Ninh Kieu Cruise Terminal, Can Tho port (fishing village area), Chau Doc port		
Reasons for using IWT	**Issues**	**Improvements**
• Employment, access to markets and transporting goods • Visiting family, friends and tourist attractions/entertainment • Going to the floating markets in Viet Nam and tourist attractions in Cambodia	• Delays for ferry and passenger services • Pollution at Cai Rang and Phong Dien floating markets and the waterway • Solicitation by tour operators/travel agencies • Prices vary between different travel agencies	• Enhancing awareness on Law on Inland Waterway Transport as well as vessel safety • Ensuring passenger boats are carrying lifesaving and other equipment • Increasing the number of ferries and passenger services operating in order to reduce wait time

Viet Nam: Boat owners and operators		
Survey areas		
Ninh Kieu Cruise Terminal, Can Tho port (fishing village area), Chau Doc port		
Issues	**National**	**Cross-border**
• Limited knowledge on traffic safety • Declining tourist number for IWT is affecting income • Current passenger fares are too low • Environmental issues along the waterway, especially at the floating markets • Procedures for passenger transport and Chau Doc border are still very complicated	• Reviewing pricing structure of fares and monitoring tour operators • Promoting awareness to reduce pollution and solid wastes • Maintaining the navigation channel at Chau Doc port to ensure access for large passenger vessels • Upgrading the Chau Doc passenger port	• Enhancing coordination between the Inland Waterborne Port Authority - Region IV and Vinh Xuong customs • Simplifying procedures for cross-border passenger transport • Improving the connections between Can Tho/Chau Doc and Phnom Penh

2.11 EDUCATION AND TRAINING

2.11.1 Inland Waterway Transport related Universities, Colleges, Schools and Training Centers

LAO PDR

The **Navigation Training and Research Center**, Vientiane was inaugurated in May 2011 at Km 19 Thanaleng, Vientiane, Lao PDR (under the Department of Waterways of MPWT).

Today, the Center has 10 directors, administration and training staff and organises short courses (Basic English, Computer skills, River Hydrodynamics, Design and Maintenance and Navigation Safety, among others) for MPWT officials on special request by the MPWT Department of Waterways.

THAILAND

Thailand Merchant Marine Training Center - MMTC is a university level institute, giving courses for marine officer students, meaning that they have limited courses fully related to the Mekong Inland Waterway Transport.

CAMBODIA

In the "Master Plan for Waterborne Transport on the Mekong River System in Cambodia", 2006, three actions were proposed:

(1) **Action C6:** The establishment of a National Inland Waterway, Ferries and Maritime Transport School dedicated to education and training (regular & professional) at middle and lower levels;

(2) **Action C7:** The establishment of an inter-university program in waterborne transport operation and management; and

(3) **Action C13:** Immediate capacity building and on the job training for professionals.

(4) After intensive consultations with the Ministry of Education, Youth and Sport (MEYS) and with the Task Force for the Establishment of a University level "Maritime Institute" it was decided to establish:

(5) A "Cambodian Maritime Institute" in Phnom Penh, Cambodia, dedicated to give courses at the university associate (2 years) and bachelor level (4 years);

(6) An "Inland Waterway and Ferries School" at the baccalaureate (3 years) and vocational (1 year) level; and

(7) A "Navigation Training Centre" and a "Port Training Centre" to organise short courses and seminars for personnel with professional experience.

In 2008, the Cambodian Royal Government approved a Sub-Decree on the establishment of a **"Cambodian Maritime Institute"** (CMI), under the management of the Phnom Penh Autonomous Port in cooperation with Sihanoukville Autonomous Port and under the supervision of the Ministry of Public Works and Transport. Until now, only two "associate level" training programs for pilots (2 years of theory and 1 year of practice) have been conducted. However, given that the CMI has only a Class E Simulator (desktop model) and no training vessel, but the cadets could practice directly on board ship in and out of Phnom Penh Autonomous Port and Sihanouk Ville Autonomous port. For the STCW certificate cannot be given yet.

In May 2013, the Ministry of Public Works and Transport started a **"Navigation Training Centre"**, dedicated to organise short courses in Phnom Penh and in the provinces for skippers' and engineers' certification, as well as for ministry officials on ship inspection and registration, transport of dangerous goods and other topics.

Until now, 16 short courses have been organized in Phnom Penh and in the provinces for 127 skippers/engineers class 3 (including certification), for 127 ship inspectors/surveyors (ship inspection and registration) and for 19 MPWT officials (dangerous goods).

VIET NAM

Viet Nam Maritime University - VINAMARU in Haiphong is giving courses for waterway engineering students.

The Waterway Transport Vocational College No 2 in Ho Chi Minh City is giving three-year vocational training programmes, two-year certification training programmes and short courses for inland waterway skippers and engineers. The WTVC2 has some 130 teachers and instructors, some 1,500 regular students and some 4,000 participants per year for the short courses. The college meets with 70 percent of the training demands in the South of Viet Nam.

Conclusions

During visits to CMI/NTC Cambodia, NTC Lao PDR, MMTC Thailand and WTVC2 Viet Nam in the framework of the project **"Formulation of a Training Plan to implement the Activities under the Navigation Programme",** December 2014, it was noticed that, so far, neither training courses nor certificates are given to skippers and/or boat mechanics in the Lao PDR. In Thailand, it was noticed that no training courses are given to inland waterway skippers and/or boat mechanics; instead, some courses on safety of navigation and dangerous goods transportation are provided while certificates are practically given after a number of years of on-the-job experience.

Furthermore, during these visits, all universities, colleges and training centres indicated a great need for a "Training of Trainers" program.

2.11.2 Existing Projects

LAO PDR

In 2012 the MPWT was decided to expand the Navigation Training and Education Center into a **"Public Works and Transport Training Center"** (PTTC) with four sections:

(1) Road Engineering Section;

(2) Waterways and Land Transport Section;

(3) English, IT and Management Section; and

(4) Finance, Administration and Personnel Section.

The Center was inaugurated on 12 May 2015 and the proposed training concept reflects the status of the PTTC: being an "in-house" training institute of MPWT, including the provincial departments and district offices, local consultants, state enterprises and private contractors, shipping lines and crew as target groups for the training activities.

THAILAND

In Thailand, Marine Office 1 Chiang Rai Branch is preparing a Mekong River training course for professionals who are working on the Mekong River such as in ports, shipping, crew, etc. The course will include four basic training courses and certification will be issued after passing the training. Lao participants will be invited to attend this course as well.

2.11.3 Planned Project

CAMBODIA

In January 2015, MPWT asked an international consultant to prepare a "Project Choice and Project Preparation Study on a Public Works and Transport/Inland Waterway Transport School and/or Training Center". Three possibilities were studied:

(1) The establishment of an **"Inland Waterway and Ferries School"** at the baccalaureate (3 years) and vocational (1 year) level;

(2) An upgrade of the **"Navigation Training Center"** for ministry and provincial officials, professional and new crew; and

(3) The establishment of a **"Public Works and Transport Training Center"** for ministry and provincial officials, transport enterprises, crew, consultants and construction companies.

In 2015, the Cambodian Ministry of Public Works and Transport is expected to make a decision on the expansion of education and training opportunities in Cambodia's transport sector and, thereafter, draft a project preparation study.

2.12 INSTITUTIONAL AND ORGANISATIONAL ASPECTS

2.12.1 Shipping Lines, Shipping Associations, Forwarders, Freight Forwarder Associations

LAO PDR

In the Lao PDR, transport services are mainly provided by the private sector and several ports have their own vessel association: Ban Mom Port, Khone Keo Port, Ton Peug Port, Don Mai Port, Tha Luang Port, Pak Beng Port, Pak San Port, Tha Khet Port, Sebangfai Port, Savannakhet Port and Nakasang Port.

A freight forwarding industry has been in existence in Lao PDR for more than 30 years.

Since the late 1980s, the number of freight forwarding companies entering the market has increased quite significantly both for local and foreign companies.

THAILAND

Thailand has no vessel or fleet association for inland waterway vessels. There is only one association for sea-going vessels (Thai Ship Owner Association).

On March 10, 1987, the Thai International Freight Forwarders Association (TIFFA) was officially inaugurated. In line with its objective to provide an integrated scope of services that would enhance the transport and its related infrastructure, TIFFA today has four business units: TIFFA Transport, TIFFA International Transport and Business Academic Institute, TIFFA Inland Container Depot and TIFFA EDI.

CAMBODIA

Cambodia only has a Tourist Boat Association. All owners of tourist vessels that operate on the Mekong and Tonle Sap River are members of the Association, which is located at Songkat Chaktomuk Khan Don Penh in Phnom Penh.

The shipping lines that have entered into contract with PPAP to load and unload containers are:

- Sovereign Base Logistics Company (3 vessels and 2 - 3 calls per week);
- Gemadept Company (10 vessels and 2 - 5 calls per week);
- Hai Minh Company (3 vessels and 1 - 2 calls per week);
- New feeder shipping line "New Port Cypress; and
- Other shipping lines such as MOL, Hyundai, Hanjin and Maersk.

Freight forwarder companies have formed an association under the Cambodian Freight Forwarders Association (CAMFFA).

In 1979, Cambodia established Kampuchea Shipping Agency and Brokers (KAMSAB) under the MPWT as a shipping and freight forwarding service, providing Total Logistic Services. The business of KAMSAB ranges from shipping and freight forwarding, husbanding all kinds of non-cargo vessels to booking, chartering, brokering and providing Total Logistic Services.

VIET NAM

Aside from the National Transportation Association of Viet Nam, almost every province has its own ship-owners and/or transport association.

The Viet Nam Freight Forwarders Association (VIFFAS) is located in Hanoi with a subsidiary in Ho Chi Minh City. It was founded in 1994 and has 100 ordinary members and 20 associate members. VIFFAS is working with four committees: The Legal and Insurance Committee, the Membership Committee, the Training and Human Resources Development Committee and the Foreign Affairs Committee.

2.12.2 Inland Waterway Transport related Public authorities

LAO PDR

Ministry of Public Works and Transport (MPWT)

The Ministry of Public Works and Transport (MPWT) is the national government agency primarily in charge of transport. Prior to 2006, the MPWT was the Ministry of Communication, Transport, Post and Construction (MCTPC). The Ministry of Public Works and Transport consists of ten Departments: Department of Organization and staff, Department of Inspection, Department of Planning and Cooperation, Department of Finance, Department of Roads, Department of Transportation, Department of Waterways, Department of Housing and Urban Planning, Department of Railways and the Department of Civil Aviation. And there are the Institute of Public Transportation, the Council for Science and Technology, Training Centre of Public Works and Transport, Airports Division Management, Airport Division Traffic and Regulated Water Supply Office.

Department of Waterways (DoW)

The Department of Waterways takes responsibility for management, construction and maintenance of waterways facilities, including ports and navigation aids, navigation channel improvements and all river engineering works.

National Disaster Management Committee (NDMC) and National Disaster Management Office (NDMO)

The NDMC and NDMO are under the Ministry of Labor and Social Welfare.

The functions of the Office include the establishment of disaster management implementation teams at the national, provincial and district levels.

THAILAND

Ministry of Transport (MoT)

The Ministry of Transport (MoT) has five departments and one office: Marine Department, Department of Land Transport, Department of Civil Aviation, Department of Highways, Department of Rural Roads and the Office of Transport and Traffic Policy and Planning (OTP).

Marine Department (MD)

In connection with safe navigation on Thai's waterways, the Marine Department controls the Navigation in Thai Waters Act, B.E. 2456 (1913) and its regulation. The Marine Safety and Environment Bureau, the Channel Development and Maintenance Bureau and the Ship Standard Bureau are the key responsible bureaus under the Marine Department. Besides the officials from the Ship Standard Bureau and the Marine Safety and Environment Bureau, the Marine Department has its Marine Office Branches throughout the provinces along the Mekong River. These branches include

Marine Office Branch 1, which covers Chiang Rai Province, and Marine Office Branch 7, which covers other Mekong River provinces.

Disaster Management

The Marine Department, as part of the Ministry of Transport, is the principal lead agency for dealing with marine pollution incidents.

The Marine Department, the Royal Thai Navy, the provincial administration and the Oil Industry Environmental Safety Association are the main agencies involved in oil pollution prevention and response. The Committee on the Prevention and Combating of Oil Pollution, established in 1982, incorporates all interested government bodies to review the current state of response readiness and to provide a suitable infrastructure at the time of a spill.

The Pollution Control Department of the Ministry of Natural Resources and Environment is responsible for land-based pollution. Although established primarily to set and enforce discharge standards, this department can advise on shoreline cleanup.

Oil companies have developed Tier 1 contingency plans to respond to spills at their facilities and have formed the Industry Environmental Safety Association.

CAMBODIA

The Ministry of Public Works and Transport (MPWT)

There are four General Directorates under MPWT as follows:

- **General Directorate of Public Works:** in charge of all construction of transport infrastructure with a Waterways Department for the Waterway Transport Infrastructure;
- **General Directorate of Transport[8]:** in charge of controlling all means of transport with three departments: Merchant Marine Department, Inland Waterway Transport Department and Land Transport Department;
- **General Directorate of Administration:** in charge of administrative work such as accounting and finance, human resources, planning, international cooperation and administration; and
- **General Directorate of Inspection:** in charge of auditing all organisations within the MPWT.

Inland Waterway Transport Department (IWTD)

The main role of the Inland Waterway Transport Department (IWTD) is to manage all vessels navigating the inland waterways of Cambodia and all national legislation that addresses the Inland Waterway Transport (IWT) sector.

The responsibilities of the IWTD are very extensive and are described in Sub-Decree 14/ANKr/BK on the organisation and functions of the Ministry of Public Works and Transport (03 March 1998). There are five offices under IWTD: The Office of Ship Registration, the Office of Pilot and Crew Certificates, the Office of Technical Inspection, the Office of Business Licensing and the Office of Administration and Finance.

[8] MPWT has plans to subdivide the General Department of Transport into a General Department of Land Transport and a General Department of Ports and Marine Transport. The General Department of Ports and Marine transport should then have four departments: Merchant Marine Department, Inland Waterway Transport Department, Waterways Department (which is now under the General Department of Public works) and Port Department.

Registration of vessels is carried out by the General Department of Transport (Department of Water Transport) for vessels of 40 tonnes, 90HP or 50 passenger seats or more and by the provincial/city public works and transport offices for smaller vessels.

Waterways Department (WD)

The Waterways Department under the General Department of Public Works of the MPWT is responsible for all waterway infrastructure works on the inland waterways of Cambodia. This includes surveys and mapping, dredging works, installation and maintenance of Aids to Navigation, river training and engineering works, domestic port planning and construction.

National Committee for Disaster Management

This committee, under the authority of the Prime Minister, is responsible for contingency planning and disaster-relief activities. Cambodia has no Search and Rescue organization.

VIET NAM

The national legislation for the Inland Waterway Transport sector is prepared by the Ministry of Transport – Viet Nam Inland Waterway Administration (VIWA), the Viet Nam Register (VR), the Ministry of Public Security (MPS) and the Public Security Departments of cities and provinces.

Viet Nam Inland Waterway Administration (VIWA)

The Viet Nam Inland Waterways Administration (VIWA) is the government agency of the Ministry of Transport that governs and maintains the ports, rivers, canals and navigable lakes of Viet Nam.

Duties and powers of VIWA are regulated by Decision No. 4409/QĐ-BGTVT dated 31/12/2013 of the Minister of transport.

VIWA has jurisdiction of over 6,000 km of waterways, operating 15 waterway management stations and over 140 substations throughout the country (nine waterway management sections No. 1 to No. 9 in the north and six waterway management stations No. 10 to No. 15 in the south).

Inland waterway ports are managed by four port authorities, of which two are in the South;

Port Authority No. 3: Ports in HCMC and 11 surrounding provinces, and Port Authority No.4: Ports in Can Tho and surrounding provinces.

Viet Nam Register

Viet Nam Register (VR) is a non-profit state body which has functions and jurisdictions on the organization and performance of technical supervision and certification for Quality and Safety of means of transport including water-craft offshore installations, roadway and railway motor vehicles and industrial products. The registration system consists of an unified system from the Head Office to local provinces, including the Classification and Registration of River-going Ships Department in the VR Head Office, and VR Offices/Branches and water-craft Registration Offices in the provincial authorities. VR technical supervision system of river-going ship consists of 27 Offices and Branches and 37 watercraft Registration Offices under the Provincial Authorities. Registration Units are carrying out function of management, technical supervision and quality certification for inland watercraft in accordance with Decision No 2059/QĐ/PC of the Ministry of Transport.

Committee for the Prevention and Control of Natural Disasters

The permanent body of this committee is the Ministry of Agriculture and Rural Development and the committee is responsible for the permanent organization, disaster response, synthesis, statistics and assessment of the damage caused by natural disasters;

Committees for Search and Rescue

Under the command of the Central Government:

- National Committee for Search and Rescue; and
- Central Committee for Prevention of Natural Disasters.

Under the command of the Local People's Committees:

- Each province and city has a Provincial or City Committee for Prevention of Natural Disaster

Under the command of the Ministry of Defense:

- Department of Rescue of Viet Nam People's Army;
- Office of Rescue of Viet Nam People's Navy; and
- Office of Rescue of Viet Nam Coast Guard.

Under the command of the Ministry of Public Security:

- Department of Fire and Rescue Police

Under the command of the Ministry of Transport:

- Department of Maritime Administration: Viet Nam Maritime Search and Rescue Coordination Center (VMRCC).

2.12.3 Environment-related Public Authorities

LAO PDR

Environmental management and EIAs

The management and inspection of environmental protection is the responsibility of the Ministry of Natural Resources and Environment (MONRE), the Provincial or Capital Departments of Natural Resources and Environment (DONRE) and the District or Municipality Offices of Natural Resources and Environment.

Water quality

MONRE is responsible for monitoring the water quality in the tributaries and canals, while the MRC Water Quality Monitoring Network (WQMN) is responsible for monitoring the water quality on the Mekong mainstream.

Pollution control and waste management

There is currently limited pollution control and contingency planning for existing ports and IWT activities in Lao PDR.

Dredging sand mining

The responsibility for the dredging of the navigation channel and licensing for sand mining operators requires further investigation.

Climate change

The main duties of the Department of Disaster Management and Climate Change (DDMCC) under the MONRE are to research, disseminate, and implement directions, policies, resolutions, orders, strategies, laws and legislations of the government on national disaster and climate change.

THAILAND

Environmental management and EIAs

The Office of Natural Resources and Environmental Policy and Planning (ONEP) under the Ministry of Natural Resources and Environment (MONRE), is responsible for preparing EIA guidelines and approving and monitoring EIA reports.

The Thailand Marine Department (MD) and Ministry of Transport (MOT) reported that an EIA is required before making a decision to build transport projects, including the construction of inland ports and terminals. Ports/terminals, shipping companies and dredging/sand mining operators are required to develop Environmental Management Plans (EMPs).

Water quality

The Pollution Control Department (PCD) under MONRE is responsible for water quality monitoring.

Pollution control and waste management

The Pollution Control Department (PCD) of MONRE is responsible for water quality and management, hazardous materials and pollution control.

Dredging and sand mining

MONRE is responsible for monitoring dredging and sand mining operations in Thailand. Under the Ministry of Interior, the Department of Public Works, Town and Country Planning is responsible for planning dredging activities. The Thailand Marine Department is responsible for maintaining the navigation channel. There are no specific licensing or environmental requirements for dredging or sand mining in the Mekong River.

Climate change

The Office of Transport and Traffic Policy and Planning (OTP) has developed the "Master Plan for Sustainable Transport and Climate Change Mitigation". It could not be determined whether any IWT projects are under this Master Plan.

Coordination

Coordination mechanisms exist between the Marine Department (MD) under the Ministry of Transport (MOT) and the Office of Natural Resources and Environmental Policy and Planning (ONEP) under the Ministry of Natural Resources and Environment (MONRE) to manage the environmental and social impacts of IWT.

CAMBODIA

Environmental management and EIAs

The Ministry of Environment (MOE), the Ministry of Public Works and Transport (MPWT) and the Ministry of Water Resources and Meteorology (MOWRAM) provided information related to the requirements of EIAs for the construction of new ports and navigation infrastructure and the management and monitoring of existing IWT on the Mekong River.

Water quality

MOWRAM reported that water quality monitoring is undertaken in Cambodia around ports/terminals and IWT operations.

Pollution control and waste management

The MOE is responsible for monitoring the existing IWT operations for pollution control and the management of solid and liquid wastes.

Dredging and sand mining

The licensing and managing of environmental impacts of dredging the navigation channel and sand mining operations is complex. The MPWT is responsible for dredging the navigation channel and waterway conditions and the Ministry of Industry, Mines and Energy (MIME) for sand mining. Due to concerns around sand mining, the government recently delivered responsibility to MIME to issue licenses to all sand mining activities and to establish a Committee on Sand Resources Management with relevant ministries and institutions (dated 20th March 2015).

Climate change

Cambodia has developed and documented action plans to respond to climate change, including Sectoral Action Plans prepared by MOWRAM, the Ministry of Agriculture, Forestry and Fisheries, MPWT, the National Committee of Disaster Management and other line agencies.

Coordination

It was reported that there is limited coordination between MOE and MPWT for monitoring IWT and future planning due to unclear role and responsibilities. Coordination between MPWT, MOE and MOWRAM for water quality monitoring will be important for future planning in the IWT sector.

VIET NAM

Environmental management and EIAs

The Ministry of Natural Resources and Environment (MONRE) and the Ministry of Transport (MOT) are both responsible for monitoring IWT operations.

The appraisal of an EIA is required by MONRE for projects that may have serious impacts or that are being undertaken in more than one province. MONRE reported that EIA legislation requires private transport enterprises and port/terminal operators to develop Environmental Management Plans (EMPs). However, the inspection of environmental functions is not implemented or enforced.

Water quality

The Agency of Water Resources Management (WRM) under the Ministry of Natural Resources and Environment (MONRE) is responsible for water quantity (flow) monitoring. The Agency for Environmental Management (EM) under MONRE undertakes water quality monitoring for ports and terminals.

Pollution control and waste management

MONRE is responsible for liaising with ministries, departments and provincial People's Committees to enforce the "*Law on Environmental Protection 2014",* outlining actions against causing serious environmental pollution.

All port operators (maritime, military and inland) are required to develop emergency and oil spill response plans. Port authorities are responsible for coordinating local monitoring and evaluating the effectiveness of the response plans.

Dredging and sand mining

To strengthen the management of sand mining, the government has issued specific instructions for the survey, transportation and extraction of gravel and sand from the riverbed. Under this directive, the Provincial People's Committee consult with other ministries (i.e. Construction, Transportation, Agriculture and Rural Development, Public Security and Finance) to restrict illegal sand mining activities and MOT reviews and approves the dredging plans and ensures that the operators register the volume of sand and gravel to be extracted to the provincial Department of Environment.

Climate change

MOT has developed specific adaptation and mitigation plans for transport infrastructure including roads, bridges, and maritime and inland ports.

Coordination

MOT is required to coordinate with MONRE and relevant ministries to implement and monitor laws on environmental protection for construction of traffic infrastructure and transport activities. The Department of Environment under the MOT is the responsible agency for coordinating environmental and social issues.

2.12.4 Port-related Authorities

LAO PDR

In the Lao PDR, all ports are owned by the Provincial Department of Public Works and Transport and operated by the Provincial Port Associations, except for private ports.

THAILAND

In 2003, the Cabinet resolved to authorize the Port Authority of Thailand (PAT) to manage and operate Chiang Khong Port and in 2011, the Cabinet resolved to authorize the Port Authority of Thailand (PAT) to manage and operate Chiang Saen Commercial Port (CSCP). Haciang Commercial Port is a relative small private port with a simple organizational structure.

CAMBODIA

The Phnom Penh Autonomous Port (PPAP) is the second main port in Cambodia and was operated as a government department until 2001 when the port became an Autonomous Port. The port operates under the supervision of the Ministry of Public Works and Transport (MPWT) and the Ministry of Economy and Finance (MEF). Under the supervision of the two ministries, the PPAP manages and operates the port and its facilities with some twelve offices: Internal Audit Office, Planning and Marketing Office, Finance and Accounting Office, Administration and Personnel Office, Harbour Domain and Domestic Port Office, Commercial Office, Harbor Master and Pilotage Office, Stevedoring Office, Warehouse Office, Technical and Research Office, Dredging Office and Handling Equipment, and Transport Office.

All other ports in Cambodia are under the responsibility of the provincial authorities. Some of these ports are operated by the Provincial Departments of MPWT; others are given in concession to the private sector (Kompong Chhnang Port, Chong Kneas Port).

VIET NAM

In the Ho Chi Minh and Cai Mep-Thi Vai area, there are 11 international container terminals, all privately operated.

Can Tho Port is considered to be a seaport and is under the authority of the Viet Nam National Shipping Lines (VINALINES).

All other public ports in the Mekong Delta are managed by two Port Authorities under VIWA:

- **Port Authority No.3:** Ports in HCMC and 11 surrounding provinces;
- **Port Authority No.4:** Ports in Can Tho and surrounding provinces.

2.12.5 Customs and Immigration Authorities

LAO PDR

The Lao PDR Customs Department is under the Ministry of Finance and has its own official website: http://laocustoms.laopdr.net/

THAILAND

The Thai Customs Department under the Ministry of Finance applies the ASEAN National Single Window (NSW) policy and also has its own official website: www.customs.go.th/**.**

CAMBODIA

The General Department of Customs and Excise of Cambodia (GDCE), under the guidance of the Ministry of Economy and Finance (MEF), has an official website at: www.customs.gov.kh/.

VIET NAM

The General Department of Viet Nam Customs, under the Ministry of Finance, gives all information on its website www.customs.gov.vn/

2.12.6 Data Management, Promotion and Marketing

The fourth component of the MRC Navigation Programme is dealing with "Information, Promotion and Coordination," and one of the immediate objectives of this component is to demonstrate the advantage and potentials of the waterborne transport sector.

Today in the four MRC Member Countries, information, data collection and management of waterway characteristics, IWT fleet, port infrastructure and throughput, cargo and passenger transport, dangerous goods transport/storage, and accidents, among others, is organised by many different organisations and authorities.

The Ministries of Transport, Ministries of Public Works and Transport (including National and Provincial IWT departments), Ministries of Economy, Ministries of Finance, Port Authorities, Water Authorities, boat associations and shipping lines, freight forwarders and regional and international organisations all take part in data collection and management. Some of these organisations and authorities perform this task with more motivation and dedication than others. Only in Cambodia is there a specific website for Inland Waterway Transport - **http://www.ciwn.mpwt.gov.kh** – but unfortunately, there has been no actualization of this website since 2010.

Nowadays, there is little promotion and/or marketing of waterborne transport in both the public and private sector in the MRC Member Countries. Negative perceptions of navigation among policy

makers and the public means that not enough resources are allocated to the development of inland water transport.

2.13 RECENT AND ONGOING BILATERAL AND REGIONAL PLANS AND PROJECTS

2.13.1 MRC: Regional Action Plan for Sustainable Transportation of Dangerous Goods along the Mekong River, 2014, MRCS NAP

Increase in transport volumes of dangerous goods on the Mekong River requires the Member Countries to adhere to a consistent and coordinated development of their policies on transport infrastructure, especially with regards to inland waterway safety and environmental protection.

Therefore, the MRCS NAP prepared a Regional Action Plan (RAP), acting as the guiding document for the Member Countries and MRC on inland waterway safety and environmental protection.

In 2010, the MRCS Navigation Programme commenced Phase 1 "Risk Analysis of the Carriage, Handling and Storage of Dangerous Goods". Phase 2 began in June 2013 to prepare the "Regional Action Plan for Sustainable Transport of Dangerous Goods along the Mekong River" (RAP) consisting of National and Cross-Border project documents as a basis to reduce the risks of accidents, spillages and pollution and enhance emergency response and regional coordination.

Phase 3 is expected to run from 2015 to 2020 with the implementation of the RAP.

Projects to be implemented:

Vessels

(1) Mekong Tanker Safety Management;

(2) Minimum Standards for Vessel Design, Construction and Equipment;

(3) Safe Manning on Inland Waterway Vessels;

(4) Implementation of the International Maritime Dangerous Goods (IMDG) Code and Provision of the Material Safety Data Sheet (MSDS) for Inland Waterway Vessels; and

(5) Emergency Response onboard Vessels.

Ports and terminals

(1) Standards for the Planning, Design and Construction of Ports and Terminals;

(2) Maintenance, Inspection and Testing of Critical Equipment;

(3) Port Safety, Health and Environmental Management System (PSHEMS); and

(4) Emergency and Oil Spill Response in Ports and Terminals.

Environment

(1) National Vessel and Port Waste Management ; and

(2) Cross-Border Vessel and Port Waste Management.

Waterways

(1) Introducing Geographical Zones in the Mekong River and related Technical and Operational Requirements for Tankers.

2.13.2 MRC: Formulation of a Training Plan to Implement the Activities under the Navigation Programme, December 2014, MRCS NAP

The MRCS NAP project "Formulation of a Training Plan to Implement the Activities under the Navigation Programme" is part of MRC's Navigation Programme 2013-2015. The objective of this Training Plan is to assist the Member Countries, their line agencies, the MRCS and relevant stakeholders, in strengthening their institutional mechanisms and their capacity to effectively implement the MRC Navigation Programme.

Although most of the MRC NAP outputs and activities are focused on only one or two of the four MRC member countries, this NAP Training Plan is based on a Training Needs Assessment for NAP disciplines and topics. Even some countries not involved in NAP outputs and activities have nonetheless a need for training.

Based on this, it is proposed that the "NAP Training Plan" is formed, approximately, as follows: 25 national seminars/workshops, 25 national short courses, 5 bilateral seminars/workshops, 10 bilateral short courses, 5 regional seminars/workshops and 5 training of trainers' courses, all MRC NAP related.

2.13.3 JICA: Connectivity enhancement of Inland Waterway Transport and logistics between Cambodia and Viet Nam including a trial voyage on motor vessel Tya Nam 19 between Phnom Penh and Cai Mep and including a study on the Intermodal Freight Simulation in the Southern Mekong Region: Route Choice Model for Container Shipping, 2014, Overseas Coastal Area Development Institute (OCDI), Japan.

Report on the trial voyage on motor vessel Tay Nam 19 along the Mekong River between Cambodia and Viet Nam, MRCS NAP, January 2015

In August 2014, the Cambodian Ministry of Public Works and Transport had a meeting with a Japan delegation, headed by H.E. Minister Akihiro Ohta, Ministry of Land, Infrastructure, Transport and Tourism (MLIT) where they discussed and approved a cooperation program for improving the transportation on the Mekong River between Phnom Penh and the seaports in Viet Nam.

A trial voyage between the Phnom Penh New Container Terminal in Cambodia and the Cai Mep International Terminal in Viet Nam was conducted in January 2015 in order to make infrastructure improvements (such as the depth of some sections of the route and the equipment for aids to navigation), as well as to streamline the procedures for custom clearance and port entering and departing.

The conclusions of this Trial Voyage were:

(1) **Infrastructure:** Captains and pilots make use of the Hydrographic Mekong River Atlas 1999 in order to navigate in Cambodia, although in many places, depths and river banks have changed due to dredging and bank erosion.

(2) **Formalities at the Cambodia – Viet Nam border:** For a variety of reasons, the implementation of the Agreement on Waterway Transportation between Cambodia and Viet Nam, which entered into force on 20 January 2011, has not progressed as expected.

(3) **Using the shortcut canal for navigation:** A shortcut is always useful to reduce oil consumption. However, safety of navigation, safety of crew, safety of cargo and safety of environment are more important than saving oil.

Intermodal Freight Simulation in the Southern Mekong Region: Route Choice Model for International Container Shipping, The Overseas Coastal Area Development Institute of Japan (OCDI), Proceedings of T-LOG 2014

JICA developed a logit model for route choice of Cambodian international containers including the Mekong River route, cross-border route to Cai Mep/Thi Vai port by land, the Laem Chabang port route and the Sihanoukville port route. The following scenarios were presented:

Scenario 1: average capacity of the vessels is increased from 85 to 170 TEUs and the vessel speed is assumed to increase from 8,2 knots to 10 knots.

Scenario 2: improvement of road infrastructure between Phnom Penh and Ho Chi Minh City (including opening of Neak Loeang Bridge).

Scenario 3: improvement of efficiency of cargo handling in Sihanoukville port.

Model estimated shares:

	Export				Import			
	PHN	CM/HCM	LC	SIH	PHN	CM/HCM	LC	SIH
Model est. 2010	29,7%	10,1%	4,0%	56,2%	16,1%	15,1%	9,3%	59,5%
Scenario 1	41,1	5,3	3,3	50,3	24,8	11,4	8,7	55,0
Scenario 2	31,7	10,1	3,8	54,4	17,0	16,7	9,7	56,6
Scenario 3	28,9	10,7	4,3	56,2	8,3	12,1	8,3	71,4

PHN = Phnom Penh Port, CM/HCM = Cai Mep/Ho Chi Minh by road, LC = Laem Chabang, SIH = Sihanoukville.

Simulation of Inland Waterway Transport Policy, National Institute for Land and Infrastructure Management (NILIM), PowerPoint presentation, January 2015

The same four shipping routes for Cambodian container cargoes have been considered with four scenarios:

Scenario 0: (base scenario) 2016: Neak Loeung bridge open, road improvement between Phnom Penh and the bridge, restriction of trucks entering Phnom Penh in the daytime;

Scenario 1: turnover rate of barges improved from 7 to 5 days due to the national border being open for 24 hours and due to an increase in vessel size, on average, from 85 to 170 TEU;

Scenario 2-1: average vessel capacity increased to 300 TEU, transiting Bassac River;

Scenario 2-2: average vessel capacity increased to 500 TEU, transiting Bassac River.

These scenarios would lead to the following results:

	Export				Import			
	PHN	CM/ HCM	LC	SIH	PHN	CM/HCM	LC	SIH
Situation 2010	26,1%	6,8%	-	67,1%	14,8%	18,5%	-	66,6%
Model est. 2010	29,0	10,2	4,3%	56,6	17,0	14,5	9,8%	58,7
Scenario 0	28,7	9,9	4,8	56,6	17,2	16,3	11,0	55,5
Scenario 1 (TD 2010)	38,3	8,1	3,3	50,3	19,6	14,5	9,0	56,8
Scenario 1 (TD 2020)	38,5	13,4	5,4	42,7	25,2	14,5	10,2	50,0
Scenario 2-1 (TD 2010)	43,8	5,2	3,2	47,8	17,2	12,7	9,1	61,7
Scenario 2-1 (TD 2020)	39,1	11,9	5,0	44,0	19,7	17,9	11,5	50,9
Scenario 2-2 (TD 2010)	46,1	4,8	3,1	46,0	17,0	15,2	9,1	58,8
Scenario 2-2 (TD 2020)	45,7	9,7	4,2	40,4	20,5	17,4	11,2	51,0

TD = Transport Demand

2.13.4 KOICA: Feasibility Study on Waterway Improvement for Port Logistics Development in Cambodia, February 2015, KOICA (with a proposal to dredge between Phnom Penh and Kratie).

In the framework of the MOU between the Ministry of Land, Transport and Maritime Affairs (MLTM) of Korea and the Ministry of Public Works and Transport (MPWT) of Cambodia, signed in March 2012, MPWT requested Korea International Cooperation Agency (KOICA) to conduct a "Feasibility Study on Waterway Improvement for Port Logistics Development in Cambodia".

During a kick-off meeting in January 2015, the following scope of work was presented:

(1) Establishment of a Master Plan for the Phnom Penh–Kratie stretch of the Mekong River (medium and long term strategy, economic analysis, environmental assessment and guidelines for waterway development and management of new ports – Km. 6 Port and Tonle Bet Port – operation).

(2) Bathymetric Survey and Soil Investigation;

(3) Basic and detailed design;

(4) Supply of survey equipment;

(5) Education and training; and

(6) Promotion: Prepare and recommend methods to promote the project and to make a sustainable project and financing plan.

During an Inception Workshop in April 2015, the status of the project was discussed:

(1) Baseline Logistics Situation Analysis with a survey of important data on the current situation;

(2) Medium and long term strategy for waterway development and operation;

(3) Guidelines for waterway development and management (numerical modelling);

(4) Waterway design (target vessel specifications 3,000 DTWT to Kompong Cham and 2,000 DWT to Kratie, estimated dredging volumes 14,250,000 m^3 capital dredging and 3,570,000 m^3/year maintenance dredging);

(5) Rules and regulations;

(6) Schedules for bathymetric surveys;

(7) Soil investigations;

(8) Future planning for the project (education and training, supply of equipment, data to be collected and requested).

2.13.5 JCCCN: Development plan on International Navigation on the Lancang-Mekong River (2015-2025), Department of Transport of Yunnan Province – Tianjin research Institute for Water Transport Engineering, Ministry of Transport, PR China.

This project is in line with the "Agreement on Commercial Navigation on the Lancang-Mekong River among the governments of the People's Republic of China, the Lao People's Democratic Republic, the Union of Myanmar and the Kingdom of Thailand", signed by the four countries in April 2000.

The 10th meeting of the Joint Committee on Coordination of Commercial Navigation on the Lancang-Mekong River (JCCCN) held in 2011 agreed to prepare a master plan for future development of international shipping in the Upper Mekong River. At the 11th JCCCN meeting in 2012, all contracting

parties reached a consensus to form a joint working group and a joint expert group in order to put together the master plan and provide relevant data needed.

According to the Quadripartite Agreement, the current navigable river section is 890 kilometers long from Simao, China, to Luang Prabang, Lao PDR. Simao to boundary marker 244 (290 km) will have grade V in 2015 for vessels of 300 DWT. Boundary marker 244 to Huay Xay (300 km) is a grade VI channel for vessels of 150 DWT throughout the year and 200-300 DWT seasonally. Huay Xay to Luang Prabang (300 km) has never been improved and maintained and is navigable for vessels of 60 ton in the dry season.

According to the Quadripartite Agreement, there are a total of 15 ports open to navigation. In China, the ports are: Simao, Jinghong, Menghan and Guanlei. In Lao PDR, they are Ban Sai, Xiengkok, Muongmom, Ban Khouane, Huay Xay and Luang Prabang. In Myanmar, they are Soploi, Wan Seng and Wan Pong; in Thailand, Chiang Saen, and Chiang Khong. This Plan includes two more ports which are Pak Beng, and Chiang Saen Commercial Port.

The planning goals are:

- To make the total length of the JCCCN Lancang-Mekong navigable for 500 DWT vessels by 2025;
- To upgrade the ports of Ban Sai, Xieng Kok, Muong Mom, Ban Khouane, Huay Xay, Pak Beng, Luang Prabang, Chiang Saen and Chiang Khong; and
- To establish a “Channel Management and Maintenance System”, a “Communication and Navigation Search and Rescue System” and a “Navigation Management System”.

The proposed implementation scheme is as follows:

Phase I Projects

(1) **Preliminary work:** environmental impact assessment, geological survey, design, training;

(2) **Improvement of Channel:** a 631 kilometer-long channel from China-Myanmar Boundary Marker 243 to Luang Prabang will be upgraded to be navigable for vessels of 500 DWT;

(3) **Construction of ports:** three cargo berths will be built in Guanlei, Xiengkok, Wan Pong, Pak Beng and Luang Prabang ports;

(4) **Establishment of a support system:** three channel maintenance and emergency response bases and four emergency response and rescue ships will be built.

(5) Estimated funds needed: 2.2889 billion RMB: 6,15 = 372 million US$

Phase II Projects

(1) Preliminary work

(2) **Improvement of channel:** a 259 kilometer-long channel from Simao Port to China-Myanmar Boundary Marker 243 will be upgraded to be navigable for vessels of 500 DWT;

(3) **Construction of ports:** one passenger berth will be built in Simao, Jinghong, Ban Sai, Xiengkok, Muongmom, Wan Pong, Chiang Saen, Huay Xay, Chiang Khong, Pak Beng and Luang Prabang ports. Three cargo berths of 500 tonnage will be built in Simao, Menghan, Suploi, Wan Seng, Ban Khouane, and Chiang Saen ports.

(4) **Estimated funds needed:** 1.80570 billion RMB: 6,15 = 294 million US$

2.13.6 ASEAN: ASEAN-Mekong Basin Development Cooperation (AMBDC) including an ASEAN Initiative on Inland Waterway Management, Phnom Penh, March 2015 and a Master Plan on ASEAN Connectivity – Strategies for Water Transport Connectivity.

The Second ASEAN Initiative Seminar on Inland Waterway Management was held on 23-25 March 2015 in Phnom Penh, Cambodia. The seminar proposed a number of recommendations based on group discussions of ASEAN Member State officials from customs, port authorities and the police, on customs border management, improvement of safety and security in ports and waterways, capacity building and the establishment of a committee in the Mekong Sub-Region under the Mekong River Commission.

In the Master Plan on ASEAN Connectivity (2009) and the ASEAN Strategic Transport Plan 2011-2015 (October 2010), most of the attention is given to land transport (road and rail), maritime transport, air transport and transport facilitation. ASEAN completely relies on the GMS' strategies and scenarios for Inland Waterway Transport (IWT) on the Mekong River.

In the final report on the ASEAN Strategic Transport Plan 2011-2015, only some general comments and reasons for the under-utilisation of the existing IWT are given.

2.13.7 Mekong Institute: Development Potential of the International Shipping on the Lancang-Mekong River in China, Lao PDR, Myanmar and Thailand, Inception Workshop 26-27 February 2015, Mekong Institute, Khon Kaen, Thailand.

The Mekong Institute has been commissioned by the Central Government of China to conduct regional research in order to assess the development potential of international shipping on the Lancang-Mekong River covering the four countries of China, Myanmar, Lao PDR and Thailand -- the four signatories of the "Agreement on Commercial Navigation on the Lancang-Mekong River 2000".

The expected outputs of this research are:

Output 1: Agreement on the approach and methodology;

Output 2: Data collection and assessment on the current situation and ongoing or planned projects;

Output 3: Analysis and economic appraisal;

Output 4: Analysis of transportation trends, performance and development potential;

Output 5: Draft of future development plan (recommendations to policy makers) on enabling environment, strategic choices and required joint actions to realize the international shipping development potentials in the Lancang-Mekong River.

Based on this, an inception workshop on the "Development Potential of International Shipping on the Lancang-Mekong River in China, Lao PDR, Myanmar and Thailand" was organized on 26-27 February 2015 at the Mekong Institute in Khon Kaen, Thailand.

2.13.8 GMS: Greater Mekong Sub-region Economic Cooperation - Transport and Economic Corridors, 2009, ADB and Overview of the GMS Regional Investment Framework (2013-2022).

The backbone of the GMS Economic Cooperation Program is to create road and rail transport corridors, including:

- The East-West Corridor connecting Thailand, Lao PDR and Viet Nam.

- The Southern Corridor connecting Thailand, Cambodia and Viet Nam.
- The North-South Corridor connecting southern China through Lao PDR or Myanmar to Thailand.

The Regional Investment Framework 2013-2022 was endorsed at the 19th GMS Ministerial Conference in Lao PDR in December 2013, detailing the pipeline of investment and technical assistance projects for the third decade of the GMS program.

Concerning IWT on the Mekong River, only the following projects are withheld in the Regional Investment Framework:

- **Upgrade of Xiengkok River Port, Lao PDR:** Indicative timeline 2016–2019, estimated cost 12.0 million US$, high priority;
- **Upgrade of Ban Mom River Port, Lao PDR:** Indicative timeline 2014–2017, estimated cost 12.0 million US$, low priority;
- **Upgrade of Huay Xay River Port, Lao PDR:** Indicative timeline 2015–2018, estimated cost 13.0 million US$, medium priority;
- **Upgrade of Pak Beng River Port, Lao PDR:** Indicative timeline 2015–2019, estimated cost 24.0 million US$, high priority; and
- **Upgrade of Luang Prabang River Port, Lao PDR:** Indicative timeline 2016–2019, estimated cost 22.0 million US$, high priority.

Remark: For the Xiengkok, Pak Beng and Luang Prabang ports, the Ministry of Public Works and Transport has signed a contract with the construction company of China.

3 ECONOMIC ASSESSMENT AND FORECASTS

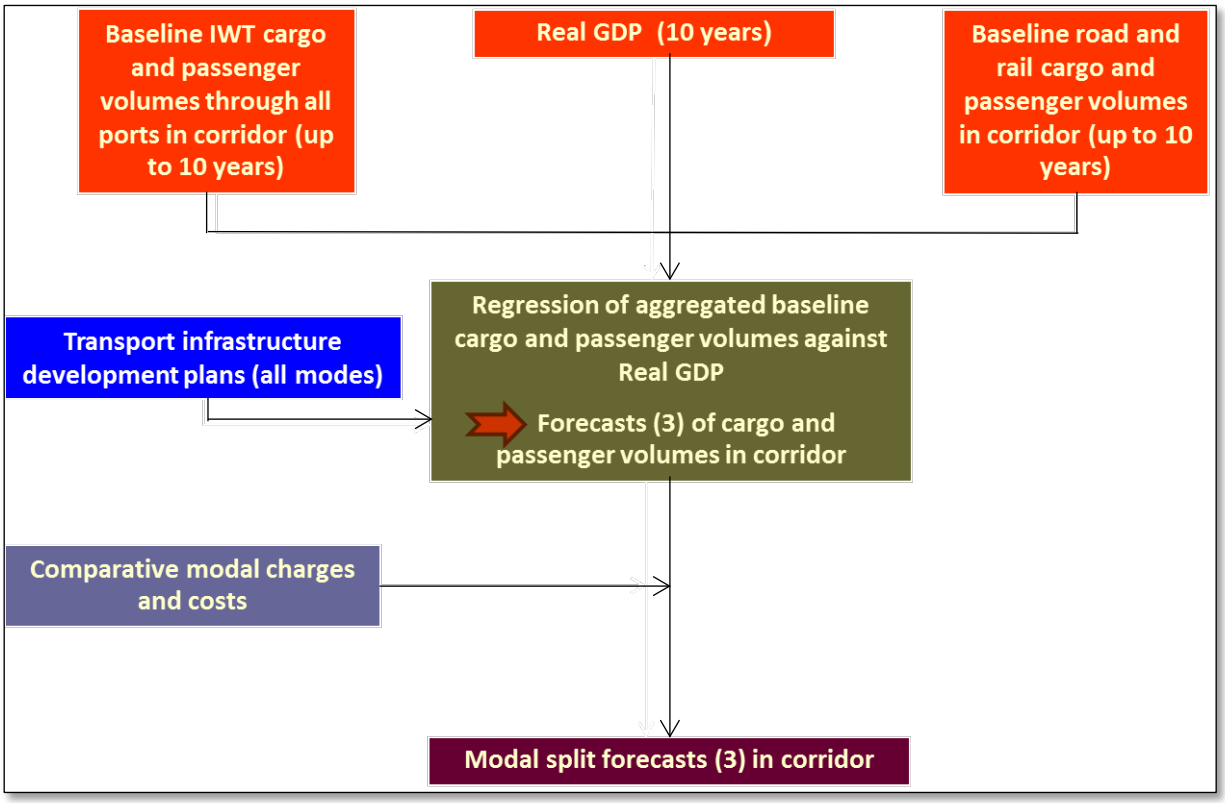
An economic assessment has been carried in order to determine future development strategies and actions for the Master Plan for the upper and lower Mekong regions Master Plan.

The economic assessment considers the socio-economic factors, market factors and transport policies and development plans which influence, or are likely to influence, the level of transport demand within each region. The ultimate goal of the assessment is to produce a set of transport-demand forecasts.

The focus of the forecasts is the demand for IWT services and infrastructure, taking into account the potential influenceson the development of other transport modes such as road and, where relevant, rail. The forecasts encompass both passenger and cargo traffic. However due to time and resource constraints, the forecasts have had to focus on regional or cross-border traffic.

3.1 FORECAST METHODOLOGY

The forecasts cover a 25-year horizon, from 2015-2040, and have been calculated taking 2014 as the base year. The methodology used is constrained by data availability. In general, where adequate traffic data is available, the methodology used for forecasting transport flows within regions and corridors is as shown in the figure below:



Navigation Programme 2015

The essential feature of this methodology is the use of regression techniques to establish a relationship between transport demand and real GDP growth. Based on this relationship and GDP

forecasts developed by the International Monetary Fund (IMF), forecasts of overall passenger and cargo transport flows were derived by corridor.

While, ideally, the modal splits of the overall transport-demand forecasts should be determined by transport costs as perceived by users, i.e. effectively passenger fares and cargo haulage charges, time constraints prevented the assembly of such information for transport modes other than IWT. Consequently, estimates of comparative mode operating costs were used as the basis for deriving modal share estimates. These cost estimates (IWT, road and, where relevant, rail) were generated by running specialized transport cost models developed for the Master Plan project.

The forecasting methodology used for this Master Plan involves the application of regression analysis in order to indicate the level of correlation between transport volume and real GDP. As can be seen in the baseline conditions report, in most cases the analysis revealed a very close correlation between these two variables. In most cases, the application of regression equations (showing transport demand as a function of real GDP) indicated that transport demand was growing considerably faster than GDP. Indeed, throughout the Mekong region, GDP growth very often defines a *lower bound* for transport demand growth.

The IMF's 5-year forecasts were extended to 2040 in order to provide a demand-forecasting base up until the end of the forecast period adopted for the Master Plan.

Data for the four riverine countries in the Mekong Basin are given in the Table below. GDP growth has been particularly robust in Lao PDR and Cambodia with growth rates in the order of 7 to 8 percent in recent years. Meanwhile in Viet Nam GDP growth has been moderate at about 5.4 percent, down from the about 7 percent growth experienced in the first decade of the millennium. In Thailand, political upheaval has resulted in a sharp fall in GDP growth and in one year (2009) GDP actually contracted.

In forecasting the future GDP growth over the 25-year Master Plan timeframe, it is assumed that with the exception of Thailand, which is expected to return to a higher growth path, growth will moderate slightly as the national economies mature. The expectation is that all four economies will end up with GDP growth of around 5 percent by 2040.

Year	Lao PDR		Thailand		Cambodia		Viet Nam	
	GDP at constant 2002 values, Kip billion	Real GDP growth	GDP at constant 2002 values, THB billion	Real GDP growth	GDP at constant 2002 values, KHR billion	Real GDP growth	GDP at constant 2002 values, VND billion	Real GDP growth
2014	42,594.00	7.4%	5,088.28	1.0%	40,278.67	7.2%	2,683,481.21	5.5%
2015	45,673.52	7.2%	5,323.49	4.6%	43,224.57	7.3%	2,833,756.16	5.6%
2016	49,172.53	7.7%	5,557.66	4.4%	46,394.97	7.3%	2,995,280.26	5.7%
2017	52,964.23	7.7%	5,797.56	4.3%	49,859.40	7.5%	3,169,006.52	5.8%
2018	56,881.66	7.4%	6,044.94	4.3%	53,617.05	7.5%	3,355,977.90	5.9%
2019	61,140.72	7.5%	6,302.85	4.3%	57,653.66	7.5%	3,557,336.58	6.0%
2020	65,726.27	7.5%	6,586.48	4.5%	61,920.03	7.4%	3,770,776.77	6.0%
2025	92,184.49	7.0%	8,406.20	5.0%	86,846.05	7.0%	4,998,724.04	5.8%
2030	126,300.74	6.5%	10,831.25	5.2%	118,986.62	6.5%	6,564,153.86	5.6%
2035	165,070.02	5.5%	14,089.05	5.4%	159,230.93	6.0%	8,538,504.40	5.4%
2040	210,675.83	5.0%	18,413.82	5.5%	203,223.50	5.0%	10,897,535.74	5.0%

IMF Forecast

Master Plan Forecast

Navigation Programme 2015

3.2 UPPER PART OF THE MEKONG RIVER BASIN

3.2.1 LAO PDR

IWT cross border passenger traffic between China and Thailand to the Lao PDR

Two projections of tourist arrivals through the Huay Xay checkpoint were made.

The first, representing a higher growth forecast, involves the application of the regression equation $y=0.0496x^{1.4124}$ (which expresses tourist arrivals (y) as a function of real GDP (x)) to derive future tourist arrival numbers up until the end of the forecast period (2040).

The second, representing a lower growth forecast, involves the direct application of the projected growth of real GDP throughout the forecast period.

The actual growth of tourist arrivals through the Huay Xay border checkpoint averaged 12.4 percent per year from 2005-2013. For the higher and lower growth scenarios, growth is estimated, respectively, at rates averaging 9.1 percent and 6.3 percent per year.

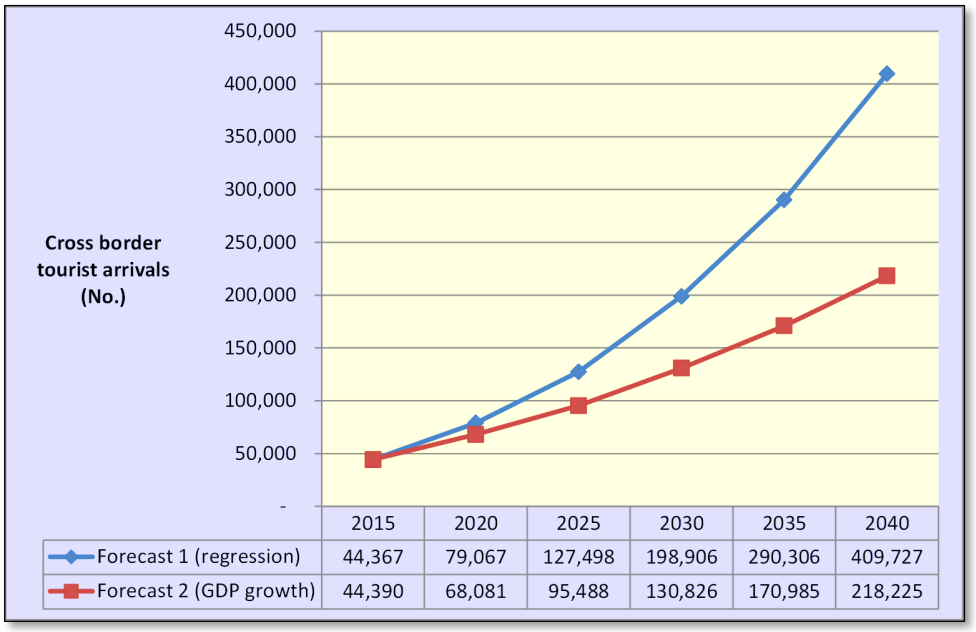
The estimated numbers of tourists arriving at the river border in 2013 and 2014 were added to the numbers of tourists arriving at the Huay Xay land border, in order to deduce an estimate of all tourist arrivals in the Upper Mekong region of Lao PDR. The IWT share of total arrivals was estimated at 13.1 percent in 2013 and at 18.8 percent in 2014. It is possible that this share could rise to 20 percent by 2020.

Based on the assumption that this share could be maintained throughout the balance of the forecast period, future IWT tourist volumes were estimated for the two growth scenarios up until 2040. The resulting forecasts are given in the table below:

Year	Real GDP growth %	Tourist arrivals through Huay Xay Checkpoint		Tourist arrivals (IWT) Golden Triangle		Total tourist arrivals Lao PDR (Upper Mekong)		IWT arrivals % of total
		Forecast 1	Forecast 2	Forecast 1	Forecast 2	Forecast 1	Forecast 2	
2014	7.4%	171,385	176,481	39,702	39,702	211,087	216,183	18.8%
2015	7.2%	189,144	189,241	44,367	44,390	233,511	233,630	19.0%
2020	7.5%	316,269	272,326	79,067	68,081	395,336	340,407	20.0%
2025	7.0%	509,993	381,951	127,498	95,488	637,492	477,439	20.0%
2030	6.5%	795,623	523,306	198,906	130,826	994,529	654,132	20.0%
2025	5.5%	1,161,225	683,940	290,306	170,985	1,451,531	854,925	20.0%
2040	5.0%	1,638,910	872,900	409,727	218,225	2,048,637	1,091,125	20.0%
AARG 2005-2014	7.9%	12.4%	12.4%					
AARG 2015-2020	6.3%	9.1%	6.3%	9.4%	6.8%	9.1%	6.4%	

Navigation Programme 2015

The forecasts of cross-border IWT tourist volumes are summarized in the figure below. It is likely that port improvements at the Golden Triangle will be necessary if these forecasts are to be realized.



Navigation Programme 2015

IWT tourist traffic, Huay Xay-Luang Prabang

The forecast of tourist numbers travelling by slow tour boat between Huay Xay and Luang Prabang is based on the projected growth in overall tourist arrivals in the Lao PDR as well as the projected growth in real GDP. The baseline traffic data obtained by questionnaire is somewhat unreliable, but it does suggest that IWT tourists make up just over 1 percent of all tourists arriving in Lao PDR and that this number has been declining slightly over the past seven years. Between 2007 and 2014, IWT tourist numbers *declined* at an average annual rate of 0.4 percent. By contrast, over the same period tourist arrivals in Lao PDR grew by 15.1 percent per year, nearly double the rate of real GDP growth.

Tourist arrivals were projected to the end of the forecast period (2040) by applying the regression equation $y = 4E\text{-}07x^{2.1811}$ which expresses tourist arrivals (y) as a function of real GDP (x). These results, given in the table below, indicate a forecast annual growth rate in tourist arrivals of 15 percent over the 25-year period from 2015-2040.

Year	Real GDP Growth %	Tourist arrivals '000	Annual tourist arrival growth %	Status quo		With IWT investments		% GDP growth
				Forecast share %	Forecast number	Forecast share %	Forecast number	Forecast number
2014	7.4%	4,335.9	14.7%					
2015	7.2%	4,962.8	14.5%	1.00%	49,628	1.00%	49,628	51,282
2020	7.5%	10,026.5	15.0%	0.55%	55,146	0.95%	95,251	73,621
2025	7.0%	26,944.8	21.9%	0.25%	67,362	1.00%	269,448	103,258
2030	6.5%	53,347.2	14.7%	0.15%	80,321	1.10%	589,019	141,472
2035	5.5%	96,009.9	12.4%	0.10%	96,010	1.20%	1,152,119	184,899
2040	5.0%	163,454.2	11.2%	0.07%	114,418	1.20%	1,961,450	235,963
AARG 2007-2014		15.1%						
AARG 2015-2040		15.0%			3.4%		15.4%	6.3%

Navigation Programme 2015

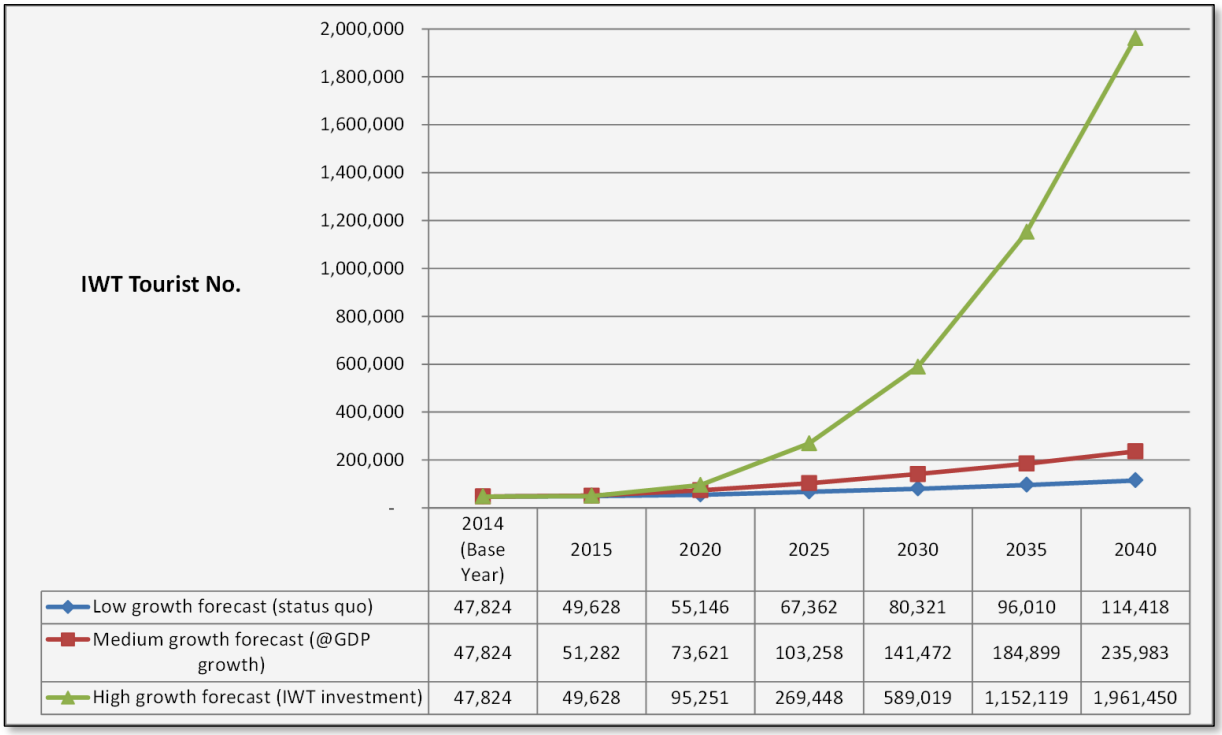
A likely reason for the failure of IWT tourist numbers to grow is the poor safety record of tourist boat operations along the stretch of the Mekong between Huay Xay and Luang Prabang, coupled with a lack of adequate safety equipment on vessels and of equipment which allow for ease of boarding and alighting by passengers. These conditions suggest that tourist demand is unlikely to grow, let alone realize the strong growth potential indicated by tourist arrivals into the country, unless investments are undertaken to rectify the outlined deficiencies.

Consequently three sets of forecasts were derived for IWT tourist volumes:

- A high forecast, which assumes that the share of IWT tourists in total tourist arrivals would grow slightly over the forecast period as a result of IWT investments in boat safety and boarding improvements;
- A medium forecast, which also assumes IWT investments but with growth realized only in line with GDP growth; and
- A low forecast, reflecting no IWT investments and a continuation of the status quo with nearly zero growth.

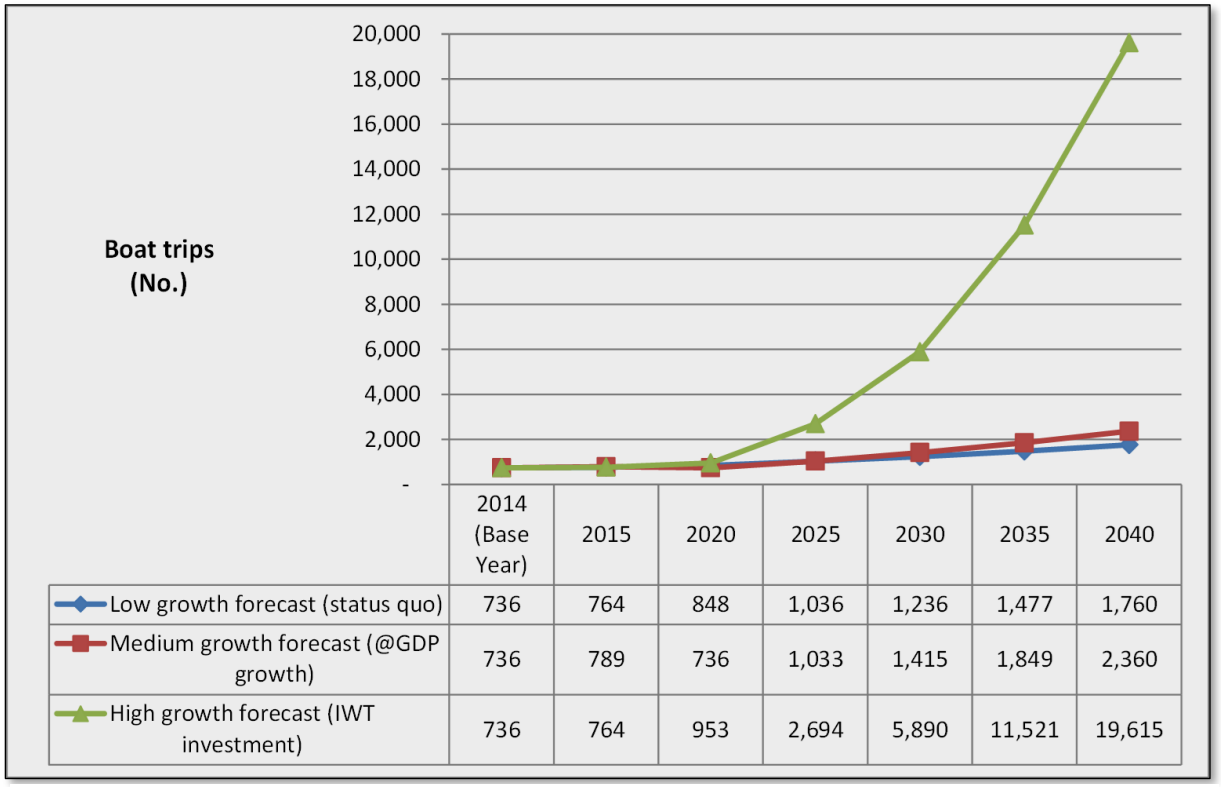
The conversion of these tourist forecasts into a forecast number of boat trips was done by assuming that for the low forecast, the current average number of tourists per boat (65) would continue to apply throughout the forecast period, while that under the higher growth scenarios, fleet investments would allow average boat loading to increase to 100 passengers.

The forecasts of tourists and boat numbers are illustrated in the two figures below:



	2014 (Base Year)	2015	2020	2025	2030	2035	2040
Low growth forecast (status quo)	47,824	49,628	55,146	67,362	80,321	96,010	114,418
Medium growth forecast (@GDP growth)	47,824	51,282	73,621	103,258	141,472	184,899	235,983
High growth forecast (IWT investment)	47,824	49,628	95,251	269,448	589,019	1,152,119	1,961,450

Forecast number of tourists travelling by boat between Huay Xay and Luang Prabang, Navigation Programme 2015



	2014 (Base Year)	2015	2020	2025	2030	2035	2040
Low growth forecast (status quo)	736	764	848	1,036	1,236	1,477	1,760
Medium growth forecast (@GDP growth)	736	789	736	1,033	1,415	1,849	2,360
High growth forecast (IWT investment)	736	764	953	2,694	5,890	11,521	19,615

Forecast number of tour boats navigating in each direction between Huay Xay and Luang Prabang, Navigation Programme 2015

Cargo forecasts

Cargo volume forecasts were made for border crossing IWT and road traffic.

IWT vessels cross the river border between Lao PDR and China near the Lao port of Ban Sai (294 km from Simao), while trucks cross the land border with China at Boten, opposite Mohan, China.

Estimates of future cargo volumes by mode in the Upper Mekong transport corridors was based on the share of these volumes *vis a vis* the overall cargo volume moved in the Lao PDR. Statistics relating to the total volume of cargo moved by road and water nationwide are published in the Statistical Yearbook of Lao PDR for 2013. Overall cargo volume data for the 10-year period 2002- 2012 was regressed against real GDP, in order to determine the "fit" between these series. This was done both for total cargo and for the volume of cargo reported as moving by road.

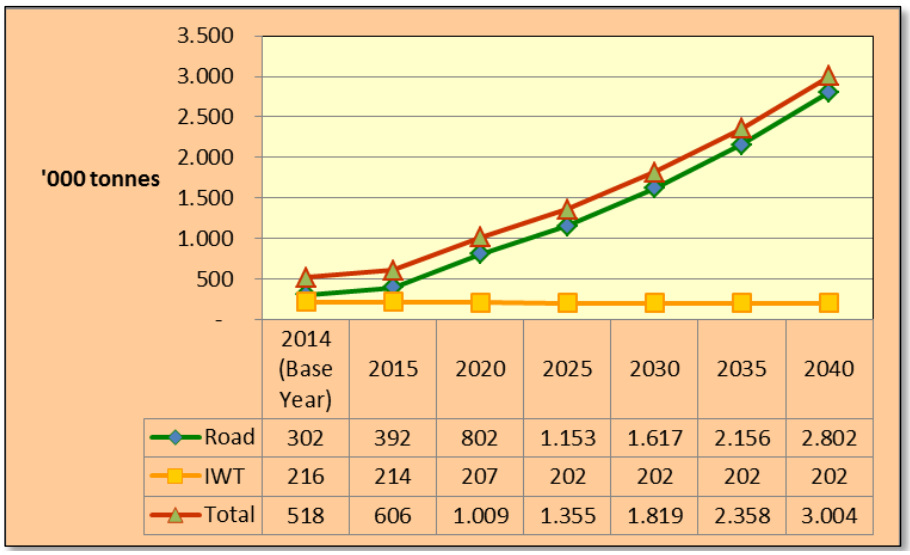
In both cases the R^2 values indicate an acceptable correlation between the two series. The regression equations derived from this analysis were used to estimate the future volume of overall and road-hauled cargo, as shown in the table below. Water-borne cargo volumes were derived as the difference between these series.

Year	GDP Growth rate	Lao PDR			Upper Mekong (investment case IWT 500 DWT)			
		Overall cargo volume	Cargo volume by road	Cargo volume by IWT	Share of total road cargo volume	Forecast road volume	Share of total cargo volume	Forecast IWT volume
	%	'000 tonne	'000 ton	'000 tonne	%	'000 tonne	%	'000 tonne
2012	7.9	5,968	4,548	1,418	22.8	1,037		
2014	7.4	6,765	5,594	1,171	6.5	302	3.2	216
2015	7.2	7,234	6,029	1,205	7.0	392	3.0	214
2020	7.5	10,266	8,912	1,353	8.0	713	17.0	296
2025	7.0	14,212	12,816	1,396	7.0	897	17.0	458
2030	6.5	19,236	17,972	1,265	6.0	1,078	17.0	741
2035	5.5	24,884	23,957	926	5.0	1,198	17.0	1,160
2040	5.0	31,462	31,131	330	4.0	1,245	17.0	1,759
AARG 2002-2012		8.1%	8.9%					
AARG 2014-2040			6.8%			5.6%		8.4%

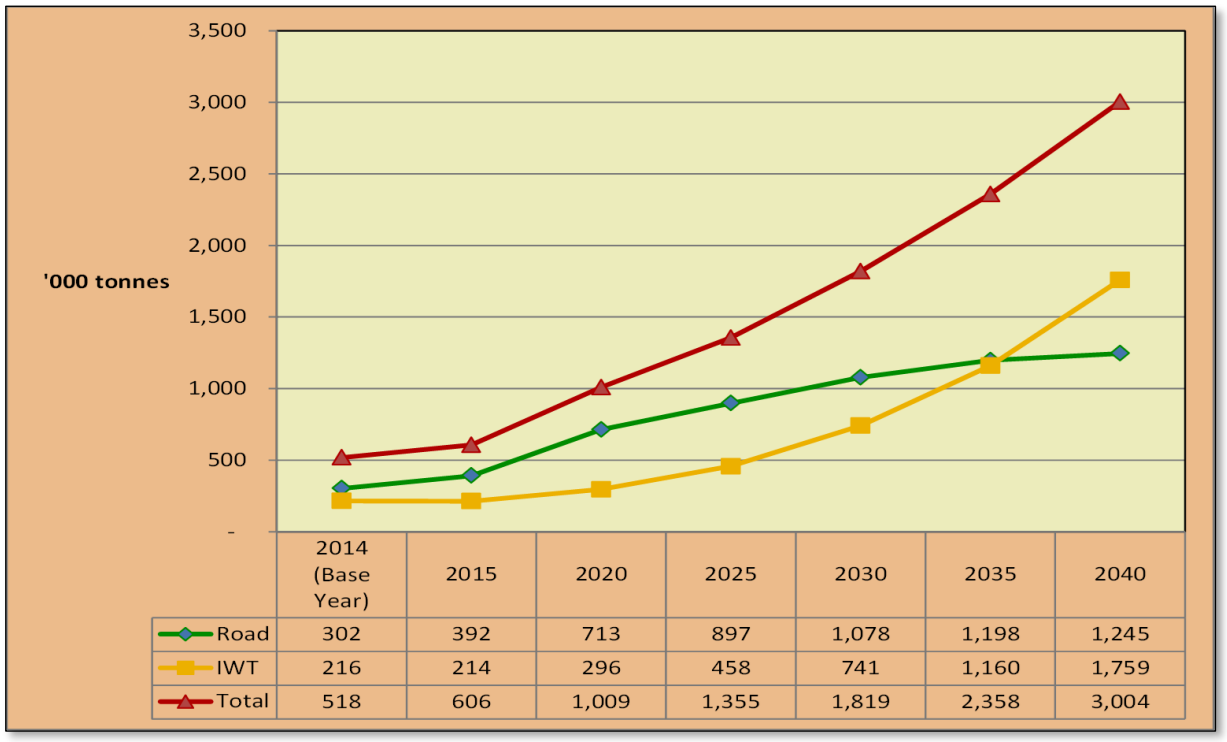
Calculation of future road and IWT cargo volumes in the Upper Mekong (Lao PDR), Navigation Programme 2015

Two sets of forecasts were produced for IWT cargo volumes in the upper part of the Mekong Basin. The first set assumes a continuation of the status quo in which there is no increase in average vessel size (assumed to be about 100DWT) and there is a gradual decline in IWT cargo volume. The second set assumes that investments in the improvement of IWT infrastructure and in larger vessels, of up to 500 DWT, will begin by 2020 and will result in a reduction in IWT operating costs and a reversal of road and IWT shares (with IWT share increasing to 60% and road share reducing to 40%) by 2040.

These forecasts are illustrated in the figures below:



Border crossing cargo volume, China-Lao PDR – Forecast 1 (status quo). Navigation Programme 2015



	2014 (Base Year)	2015	2020	2025	2030	2035	2040
Road	302	392	713	897	1,078	1,198	1,245
IWT	216	214	296	458	741	1,160	1,759
Total	518	606	1,009	1,355	1,819	2,358	3,004

Border crossing cargo volume, China-Lao PDR – Forecast 2 (IWT investment 500 DWT), Navigation Programme 2015

Conversion of these volume forecasts into number of vessel movements resulted in the following:

Forecasts of vessel movements, cross-border traffic China-Lao PDR

Year	Forescast 1 Stutus quo	Forecast 2 IWT investment
2014 base year	2,158	2,158
2015	2,142	2,142
2020	2,070	1,346
2025	2,019	1,762
2030	2,020	2,471
2035	2,020	3,413
2040	2,020	4,628

Note: 500 DWT vessels to be introduced from 2020 (Forecast 2), Navigation Programme 2015

The estimate of the relative operating costs of road and IWT was undertaken for the purpose of establishing the future modal shares underlying the cargo volume forecast. Operating costs for IWT were estimated for current vessels of limited size (about 100 DWT) and for vessels of 500 DWT (the operation of which might be made possible with future improvements in channel depths and port infrastructure).

Share calculations are sensitive to the relative weights assigned to costs and transit times. In this instance, since there is a large difference in transit times between the two modes, it was considered that shippers would express a greater preference for time than for cost in making their mode choices. Consequently, the weights assumed here are one, for costs and two, for transit time. The modal shares derived are provided in the tables below. It can be observed that an increase in boat size will result in a higher modal share for IWT, but this increase is restrained by the much higher transit time of IWT.

			Indicated Rates	
			IWT	Road
Costs				
IWT US$/1000 km	Road US$/1000 km	Ratio IWT/Road	66.7%	33.3%
31.03	62.20	0.4990		
Transit time				
IWT hours	Road hours	Ratio IWT/Road	17.6%	82.4%
89	19	4.6842		
Combined	Costs	Transit time		
Weights	1	2	40.0%	60.0%

Modal share calculation 100 DWT case (status quo), Navigation Programme 2015

			Indicated Rates	
			IWT	Road
Costs				
IWT US$/1000 km	Road US$/1000 km	Ratio IWT/Road	81.5%	18.5%
14.11	62.20	0.2269		
Transit time				
IWT hours	Road hours	Ratio IWT/Road	17.6%	82.4%
89	19	4.6842		
Combined	Costs	Transit time		
Weights	1	2	59.5%	40.5%

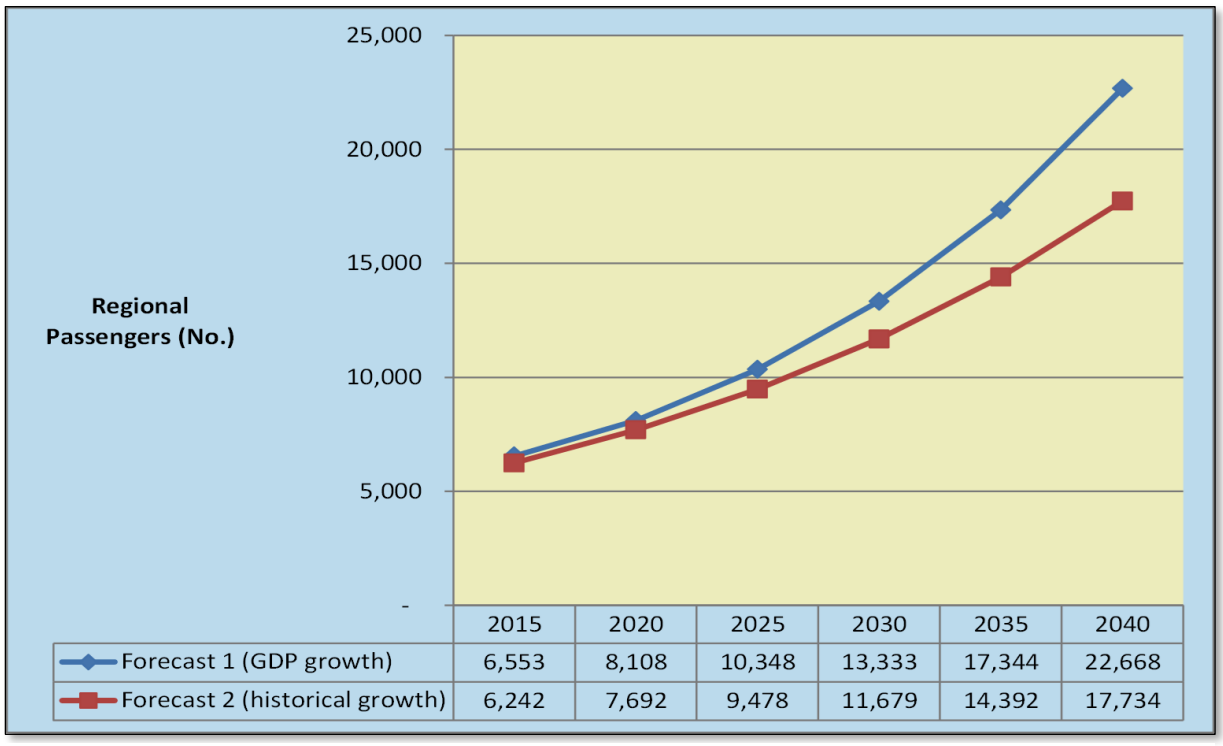
Modal share calculation 500 DWT case (IWT investments), Navigation Programme 2015

3.2.2 Thailand

Passenger forecasts

Two forecasts were produced: one, a higher growth forecast which assumes that Chiang Saen – China tourist traffic will grow at about the same rate as that projected for real GDP (5.1% per annum) and a lower growth forecast which assumes a continuation of historical growth (at a rate of 4.3% per annum) up until 2040. These forecasts are illustrated in the table and the figure below.

Year	GDP at constant 2002 prices	GDP Growth rate	Actual IWT passengers	Forecast 1 (GDP growth)	Forecast 2 (historical growth)
	Billion THB	%	number	number	number
2012	4,898.19	6.5	10,007		
2013	5,039.79	2.9	4,107		
2014	5,088.28	1.0	5,987		
2015	5,323.49	4.6		6,553	6,242
2020	6,586.48	4.5		8,108	7,692
2025	8,406.20	5.0		10,348	9,478
2030	10,831.25	5.2		13,333	11,679
2035	14,089.05	5.4		17,344	14,392
2040	18,413.82	5.5		22,668	17,734
AARG 2007-2014	4.1%		4.3%		
AARG 2015-2040	5.1%			5.3%	4.3%



Forecasts of border crossing IWT passenger volume, China-Thailand, Navigation Programme 2015

Cargo forecasts

Cargo forecasts have been prepared for the principal transport routes linking Thailand with China and the Lao PDR, namely:

- The waterway route linking the ports of Chiang Saen and Chiang Khong with ports in Yunnan Province, China and ports in Lao PDR;
- National Route 3A, which links Chiang Khong with the Boten checkpoint on the China/Lao border and with other intermediate destinations in Lao PDR.

Future cargo flows in the corridor were estimated in relation to the forecast growth of total waterway traffic in Thailand. Statistics of the latter are available from the website of the Ministry of Transport Thailand. Data extracted from this source was adjusted to exclude local traffic in sand and raw construction materials, and the volume of traffic in the upper part of the Mekong River Basin (which is excluded from the MoT series) was added. Total IWT cargo volumes for the period 2005-2013 were then regressed against real GDP to establish a robust base for forecasting.

The results of the regression analysis reveal an acceptable correlation of cargo volume with GDP.

Two sets of forecasts were generated for Thailand. The first set **(Forecast 1)** was derived through application of the regression equation, while the second set **(Forecast 2)** reflects the direct application of GDP rates of growth, as shown in the table below:

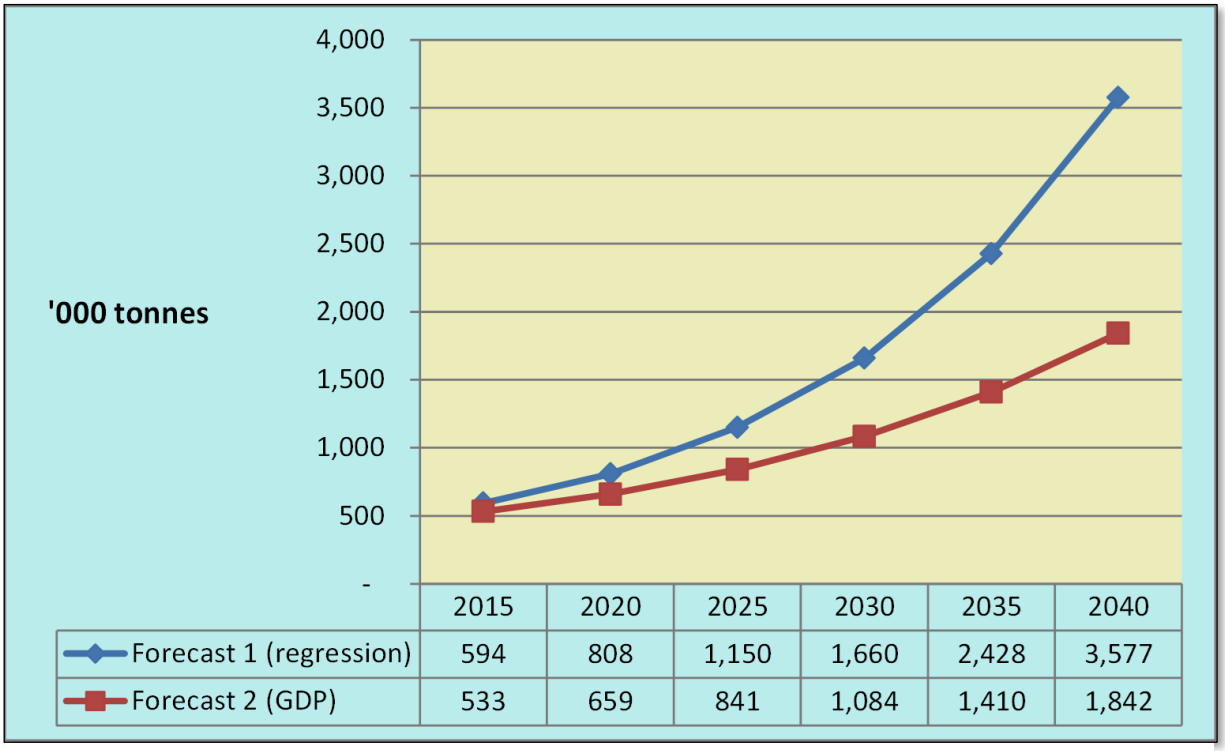
Year	GDP Growth rate	Thailand			Forecast cargo volume through SC/CK based on regression analysis		Forecast cargo volume through SC/CK based on GDP growth	
		Overall IWT cargo volume	Cargo volume through CS/CK	Share of overall IWT cargo vol.	Volume	Share of overall IWT cargo vol.	Volume	Share of overall IWT cargo vol.
	%	'000 tonne	'000 tonne	%	'000 tonne	%	'000 tonne	%
2012	6.5	34,509	288	0.8				
2014	1.0	37,081			556	1.5	509	1.4
2015	4.6				594	1.5	533	1.3
2020	4.5				808	1.5	659	1.2
2025	5.0				1,150	1.5	841	1.1
2030	5.2				1,660	1.5	1084	1.0
2035	5.4				2,428	1.5	1410	0.9
2040	5.5				3,577	1.5	1842	0.8
AARG 2005-2013	4.1%	4.1%	8.1%					
AARG 2014-2040	5.1%	7.4%			7.4%		5.1%	

Analysis and forecast of IWT regional cargo volume for Thailand, Navigation Programme 2015

The forecast results are also shown in the figure below:

Forecast 1: represents a higher growth scenario and shows that IWT cargo between China and Thailand would grow at an average annual rate of 7.4 percent over the 26-year period between 2014 and 2040. This compares with an achieved annual growth rate of 12.4 percent over the period 2004-2014, but this was influenced by the dramatic increase in the export cargo volume in 2013.

Forecast 2: representing a lower growth scenario, shows IWT cargo in the Upper Mekong corridor growing in line with GDP at an average rate of just over 5 percent per annum.



IWT border crossing cargo volume forecasts, Thailand, Navigation Programme 2015

It was assumed that Forecast 1 would reflect investments in IWT infrastructure and in larger vessels, resulting in a progressive increase in average vessel size from the current 300 DWT to 500 DWT starting from 2020. By contrast, Forecast 2 would reflect the status quo, or non-investment scenario, with no progressive increase in vessel size.

Year	Forescast 1 IWT investment	Forecast 2 Status quo (nil inv.)
2015	1,979	1,775
2020	2,245	2,197
2025	3,027	2,804
2030	4,149	3,612
2035	6,070	4,699
2040	8,942	6,141

Conversion of the cargo volume forecasts results in the following vessel movement forecasts, Navigation Programme 2015

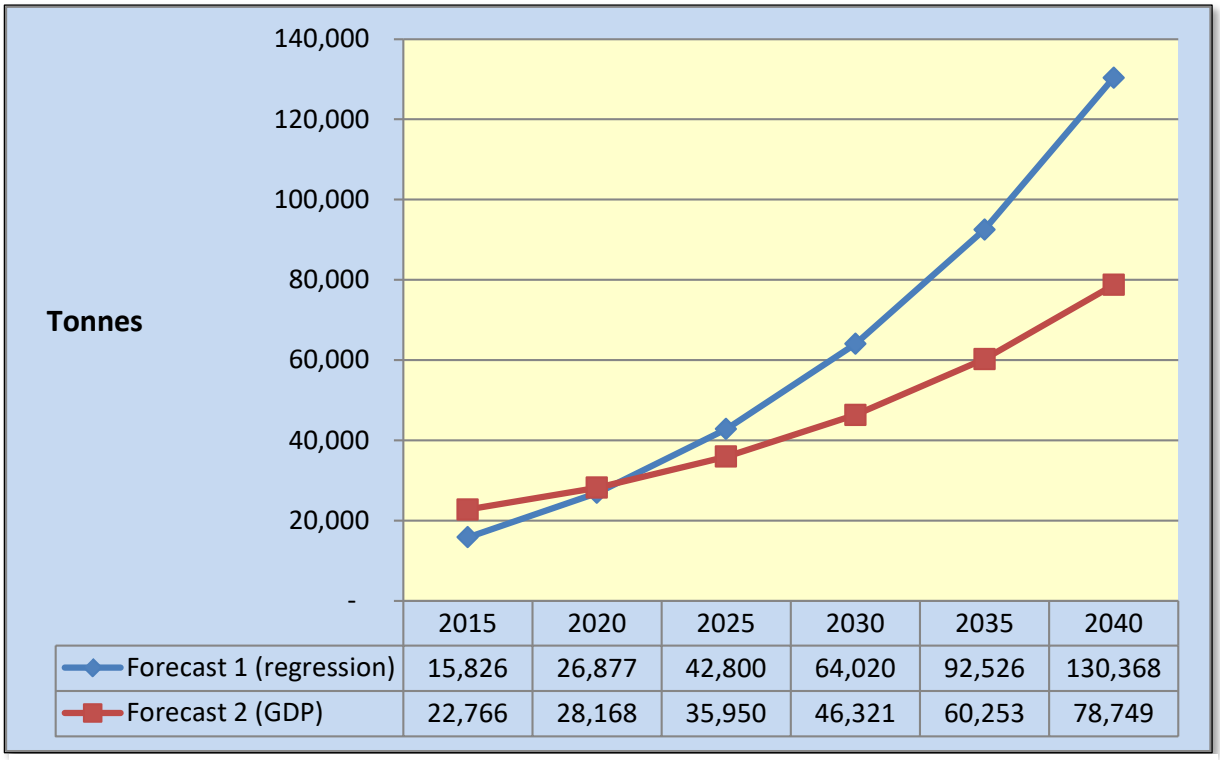
Petroleum forecasts

Two sets of forecasts were generated for IWT petroleum traffic from Chiang Saen to China. The first set **(Forecast 1)** was derived through application of the regression equation between real GDP and petroleum volumes, while the second set (Forecast 2) reflects the direct application of GDP rates of growth. The calculations for both sets of forecasts are shown in the table below:

Year	GDP at constant 2002 prices	GDP Growth rate	Actual IWT petroleum	Forecast 1 (regression analysis)	Forecast 2 (GDP growth)
	Billion THB	%	tonne	'000 tonne	'000 tonne
2012	4,898.19	6.5	9,329		
2013	5,039.79	2.9	15,791		
2014	5,088.28	1.0	21,761		
2015	5,323.49	4.6		15,826	22,766
2020	6,586.48	4.5		26,877	28,168
2025	8,406.20	5.0		42,800	35,950
2030	10,831.25	5.2		64,020	46,321
2035	14,089.05	5.4		92,526	60,253
2040	18,413.82	5.5		130,368	78,749
AARG 2007-2014	4.1%		20.3%		
AARG 2015-2040	5.1%			7.1%	5.1%

Navigation Programme 2015

These forecasts are illustrated in the figure below. The higher growth forecast envisages growth at a rate averaging 7.1 percent up until the end of the forecasted period in 2040. Meanwhile the lower growth forecast would see average growth of 5.1 percent over the same period.



IWT regional petroleum forecast 2015-2040, Navigation Programme 2015

3.3 LOWER PART OF THE MEKONG RIVER BASIN

Transport forecasts for the Lower Mekong region were focused on regional passenger and cargo flows in the Phnom Penh-Cai Mep and Ho Chi Minh City corridor. Forecasts were prepared separately for passenger traffic, container traffic, bulk or bagged cargo traffic to/from Phnom Penh, and agricultural exports from Kampong Cham.

Passenger forecasts

Passenger traffic on the Lower Mekong is of three types:

- Tourist passengers travelling from Phnom Penh to Siem Reap (Chong Kneas Port) on speedboats;
- Tourist passengers travelling by speedboat between Phnom Penh and Chau Doc Port, Viet Nam, near the Cambodia/Viet Nam border; and
- Tourists travelling on slow accommodation boats which ply between Ho Chi Minh City and Phnom Penh, some of which extend their voyages to Siem Reap during the high water season on the Tonle Sap River and Lake.

The share of IWT passenger numbers in the overall number of tourist arrivals in Cambodia was used as a basis for the forecast over the 25-year timeframe 2015-2040. The number of tourist arrivals, in turn, was projected by application of the regression equation $y = 0.0014x^{2.0653}$ with y = tourist arrivals and x = real GDP. The resulting forecasts are shown in the table below:

Year	GDP growth %	International tourist arrivals	IWT Tourism traffic actual and forecast (growth at GDP rate)				
			PHN-SRP	CHAU DOC speedboats	Tour boats	TOTAL	% of arrivals
2013	7.4	4,210,165	9,751	16,547	22,584	48,883	1.2%
2014	7.2	4,539,307	16,133	22,338	24,341	62,812	1.4%
2015	7.3	5,251,733	10,503	23,972	26,121	60,596	1.2%
2020	7.4	11,033,086		34,340	37,419	71,759	0.7%
2025	7.0	22,188,532		48,164	52,482	100,646	0.5%
2030	6.5	42,516,185		65,988	71,905	137,894	0.3%
2035	6.0	77,602,428		88,307	96,226	184,533	0.2%
2040	5.0	128,435,951		112,705	122,811	235,516	0.2%
AARG 2002-2013	7.9%	16.5%	-23.5%	14.3%	47.4%	-8.2	
AARG 2014-2040	6.4%	13.7%		6.4%	6.4%	5.2	

Navigation Programme 2015

Aside from this forecast, which may be considered a lower growth forecast, a second forecast was made in which passenger volumes grow at rates in line with the projected growth in international tourist volume, which is more than double the projected rates of GDP growth for Cambodia. In fact, in this case a projected growth in tour boat passengers at 14.9% per annum, exceeds that of tourist arrivals. This would be considered a higher growth forecast.

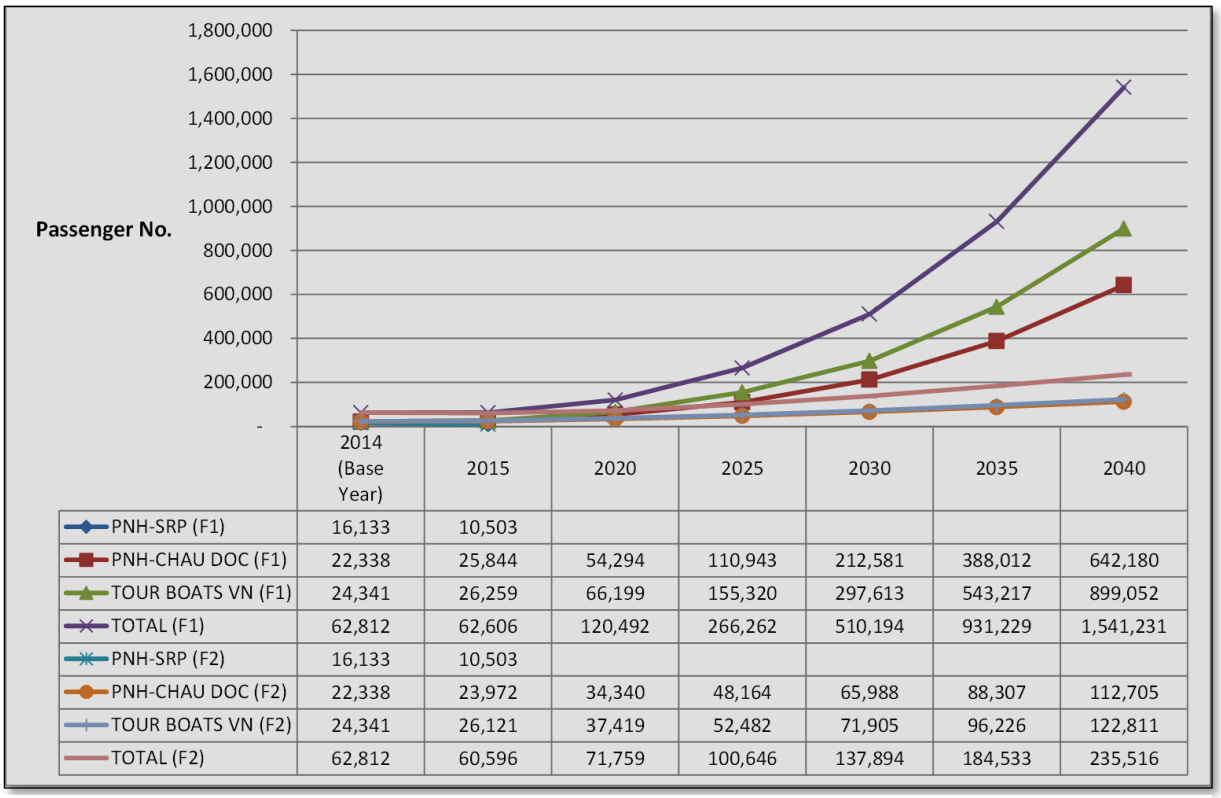
Underlying these forecasts are the following assumptions:

- It is assumed that fast boat services to Siem Reap will be discontinued completely by about 2017, since both the fares paid by foreigners and transit times are about double those of air-

conditioned buses. In addition, there are concerns about the safety and comfort of these services.

- It is considered that cross-border services of both fast and slow boat tourist boats are unlikely to be influenced by competition from bus services, since the very nature of a trip along the river is an essential part of the tour experience. In most cases, tickets for these services are purchased as part of a tour package.

The trends in these two sets of forecast are shown in the figure below:



	2014 (Base Year)	2015	2020	2025	2030	2035	2040
PNH-SRP (F1)	16,133	10,503					
PNH-CHAU DOC (F1)	22,338	25,844	54,294	110,943	212,581	388,012	642,180
TOUR BOATS VN (F1)	24,341	26,259	66,199	155,320	297,613	543,217	899,052
TOTAL (F1)	62,812	62,606	120,492	266,262	510,194	931,229	1,541,231
PNH-SRP (F2)	16,133	10,503					
PNH-CHAU DOC (F2)	22,338	23,972	34,340	48,164	65,988	88,307	112,705
TOUR BOATS VN (F2)	24,341	26,121	37,419	52,482	71,905	96,226	122,811
TOTAL (F2)	62,812	60,596	71,759	100,646	137,894	184,533	235,516

Regional passenger volume forecasts, Lower Mekong, Navigation Programme 2015

The current average number of passengers per vessel (45 for Siem Reap fast boats, 12 for Chau Doc speedboats and 45 for slow accommodation tour boats) was used to convert the passenger volume forecasts to future vessel movements, as shown in the table below. Note that it is likely that the average size of vessels would increase in future years, although it is not yet known what these increases would be.

Year	Forecast 1				Forecast 2			
	PNH-SRP (F1)	PNH-CHAU DOC (F1)	TOUR BOATS VN (F1)	TOTAL (F1)	PNH-SRP (F2)	PNH-CHAU DOC (F2)	TOUR BOATS	TOTAL (F2)
2014 (Base Year)	356	1,823	543	2,722	356	1,823	543	2,722
2015	232	2,109	586	2,927	232	1,956	583	2,771
2020		4,431	1,477	5,908		2,802	835	3,637
2025		9,054	3,465	12,519		3,931	1,171	5,101
2030		17,349	6,639	23,988		5,385	1,604	6,989
2035		31,666	12,118	43,784		7,207	2,147	9,353
2040		52,408	20,056	72,464		9,198	2,740	11,938

Forecasts of vessel movements – regional passenger traffic in the Lower Mekong, Navigation Programme 2015

At least in the case of Forecast 1, (the higher growth forecast) the implications of the passenger forecast are that substantial upgrading/expansion of passenger terminal facilities is likely to be required in Ho Chi Minh City, Chau Doc, Phnom Penh and Siem Reap (the latter for tour boats only). These improvements would inevitably have to focus on enhancements of boarding and alighting facilities to provide for the convenience and safety of passengers.

Container Forecasts

a) Volume forecasts Phnom Penh – Cai Mep/Ho Chi Minh City Traffic:

- Two sets of forecasts were generated. The first, described as a higher growth forecast, was based on the regressed relationship of container volume with GDP growth, effectively the result of applying the regression equation y = 0.0053x - 93.76 y = 0.0053x - 93.76. This forecast reflects an annual average rate of growth in container volume of 8 percent over the 26 years between 2014 and 2040. The second forecast, a lower growth forecast, was derived by applying GDP growth directly to container volumes. This forecast reflects growth at the projected annual average rate of growth for GDP (6.4%).

The resulting forecasts of overall and IWT container volumes are shown in the table below:

Year	GDP Growth	PHN-VN container volume forecast 1	PHN-VN container volume forecast 2	Modal share		IWT and road volume forecasts			
						Forecast 1		Forecast 2	
				IWT	Road	IWT	Road	IWT	Road
	%	'000 TEU	'000 TEU	%	%	'000 TEU	'000 TEU	'000 TEU	'000 TEU
2013	7.4	110.5	110.5	100	0				
2014	7.2	133.7	133.7	100	0	133.7	0.0	133.7	0.0
2015	7.3	135.3	143.4	95	5	128.6	6.8	136.3	7.2
2020	7.4	234.4	205.5	70	30	164.1	70.3	143.8	61.6
2025	7.0	366.5	288.2	70	30	256.6	110.0	201.7	86.5
2030	6.5	536.9	394.9	70	30	375.8	161.1	276.4	118.5
2035	6.0	750.2	528.4	70	30	525.1	225.0	369.9	158.5
2040	5.0	983.3	674.4	70	30	688.3	295.0	472.1	202.3
AARG 2002-2014	7.9%	54.1%	54.1%						
AARG 2014-2040	6.4%	8.0%	6.4%			6.5%	16.3%	5.0%	14.3%

Analysis and forecast of IWT container volume in the Lower Mekong, Navigation Programme 2015

Forecast 1 would result in growth of overall container volume from 133,700 TEUs in 2014 to 983,000 TEUs by 2040. By contrast, Forecast 2 would result in a container volume of 674,000 TEUs by 2040.

b) Modal share forecast:

- Up until the present, 100 percent of the Port of Phnom Penh's container throughput has been transported by barge to Viet Nam. However, with the opening of the new bridge over the Mekong at Neak Loeung on 6 April 2015, and subject to the relaxation of truck load limits on the bridge, it would be possible for truck operators to carry containers directly to terminals within the Cai Mep ports (a distance of 320 km from Phnom Penh) in an elapsed time of about 9 hours, including a delay at the border of about 2 hours. This compares with a transit time for barges of 36-38 hours, depending on the route used for navigation (Mekong mainstream or Cho Gao Canal in Viet Nam).
- It is difficult to forecast the extent to which road transport will succeed in diverting container traffic from barges, but an estimate may be made on the basis of the relative operating costs (or haulage charges) and transit times of the two modes. Ideally, freight rates or haulage charges, not operating costs, should be used for this assessment, since they represent the cost of transport as perceived by shippers when they make their

modal choices. However, in the absence of adequate data, the estimated operating costs of each mode may be used as alternative indicators of perceived transport cost.

- The assembly of reliable data on road haulage charges proved to be problematic in Cambodia, but it was considered that a rate of US$ 750 per TEU, as quoted in the meeting with GMAC, would be representative of container haulage by road between Phnom Penh and Cai Mep/Ho Chi Minh City. The corresponding IWT rate is about US$ 300 per TEU, about 60 percent lower than the road rate.

When assessed in conjunction with the relative transit times of each mode, the above price relationship gave estimates of IWT and road transport modal shares as shown in the table below:

Container Transport Charges PHN – Cai Mep			Share by 2020	
			IWT	Road
Costs				
IWT US$/TEU	Road US$/TEU	Ratio Road/IWT		
300.0	750.0	2.5		
Transit time				
IWT hours	Road hours	Ratio Road/IWT		
28	9	0.3247		
Costs	Transit time	Weighted average		
4	0.5	2.2583	69.3%	30.7%

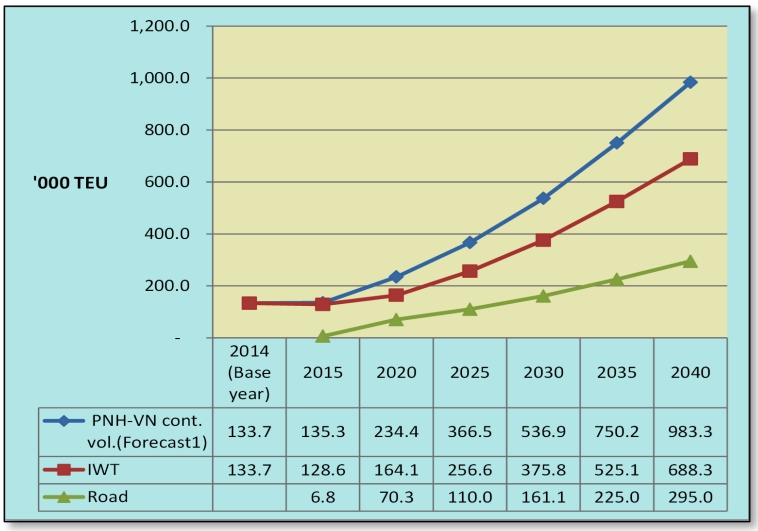
Modal share calculation, container transport in the Lower Mekong, Navigation Programme 2015

It has to be understood that modal share calculations are sensitive to assumptions about the weighting of costs and transit times in modal choice decisions.

In this case, it was considered that shippers would place a higher value on price relativities than on transit time relativities in making their modal choices. Thus, the weightings assumed were 4/4.5 = 89% for haulage charges and 0.5/4.5 = 11% for transit time. Based on these weightings, it was estimated that road transport could capture a 30 percent share of the container volume moving between Phnom Penh and Cai Mep/HCMC by 2020. It was assumed that this share would be maintained until the end of the forecast timeframe (2040).

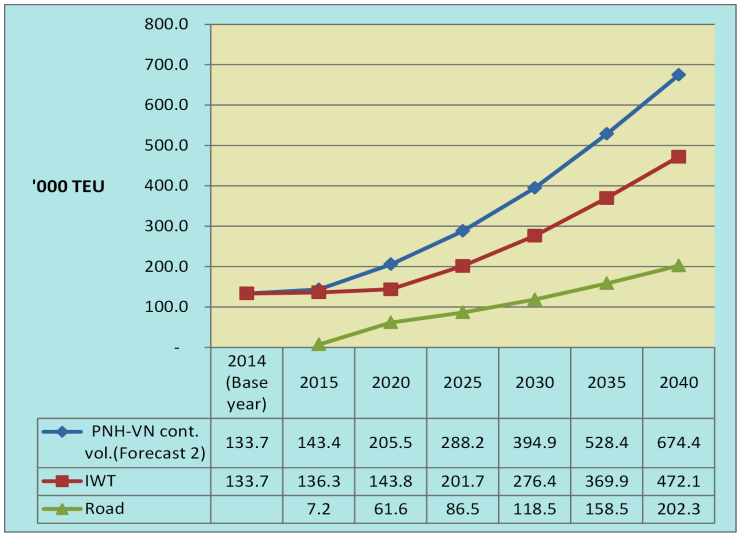
The container volumes transported by road and IWT in the corridor were then calculated in accordance with the above modal split, as shown in the table above.

The resulting volume forecasts for road and IWT are illustrated in the figures below:



	2014 (Base year)	2015	2020	2025	2030	2035	2040
PNH-VN cont. vol.(Forecast1)	133.7	135.3	234.4	366.5	536.9	750.2	983.3
IWT	133.7	128.6	164.1	256.6	375.8	525.1	688.3
Road		6.8	70.3	110.0	161.1	225.0	295.0

Phnom Penh-Viet Nam container volume and modal share, Forecast 1 (higher growth), Navigation Programme 2015



	2014 (Base year)	2015	2020	2025	2030	2035	2040
PNH-VN cont. vol.(Forecast 2)	133.7	143.4	205.5	288.2	394.9	528.4	674.4
IWT	133.7	136.3	143.8	201.7	276.4	369.9	472.1
Road		7.2	61.6	86.5	118.5	158.5	202.3

Phnom Penh-Viet Nam container volume and modal share, Forecast 2 (lower growth), Navigation Programme 2015

c) Vessel movement forecasts

- The container forecasts presented above were converted into future vessel movements by assuming a baseline average container load per vessel of 100 TEU, rising progressively to 200 TEU from 2020.

The resulting vessel movement forecasts are provided in the table below:

Year	Forecast 1	Forecast 2
2014 (Base)	1,337	1,337
2015	1,286	1,363
2020	1,367	1,199
2025	1,974	1,552
2030	2,684	1,974
2035	3,282	2,312
2040	3,442	2,360

Forecasts of vessel movements (No.) – containers Phnom Penh-Viet Nam, Navigation Programme 2015

d) Threat of competition from railway development

- While it is unlikely that within the Master Plan timeframe IWT will face competition from rail in the haulage of containers to/from Viet Nam, there is some possibility that both PPAP and PAS could experience a diversion of their container volumes to Laem Chabang Port within this period. Such a diversion would be conditional on the completion of work on the railway's Northern Line rehabilitation, which was suspended in mid-2012. Completion of this work, which includes construction of a missing line section of 20 km as well as upgrading of axle load and speed standards, would re-establish the rail connection with Thailand.
- Reconnection of the Cambodian and Thai railway networks would allow containers and other freight traffic to be transported between Laem Chabang Port and Phnom Penh over a distance of about 675 km, which would be an economic haul for railways (unlike the 269 km distance between Phnom Penh and Sihanoukville which is too short to provide operating economy for the railway).
- The opportunity to route Cambodian containers through Laem Chabang could provide an attractive alternative for shipping lines to the high cost of feeder shipping services

through Sihanoukville, with access being provided to low port and shipping unit costs through a major regional load port.

- It is probable that the movement of Cambodian containers through Laem Chabang would have a much greater impact on the Port of Sihanoukville than on the new Phnom Penh Container Port. However, it is possible that the latter could lose some container traffic to/from Europe.

Petroleum forecasts

a) Volume forecast

- The equation derived from the regression of petroleum tonnage against real GDP was applied to generate forecasts of the overall petroleum market volume for Cambodia. This resulted in the market volume growing at a rate averaging 7.6 percent over the 26-year forecast timeframe, somewhat faster than the projected GDP growth rate of 6.7 percent. The forecast result is provided in the table below:

Year	GDP Growth	Total petroleum	Forecast status quo 1,000 DWT vessels				Forecast 3,000 DWT vessels by 2025			
			Petrol. by road/ship		Petroleum by IWT		Petrol. By road/ship		Petroleum by IWT	
	%	'000 ton	'000 ton	% of tot.	'000 ton	% of tot.	'000 ton	% of tot.	'000 ton	% of tot.
2013	7.4	1,683.9	987.0	58.6	604.4	35.9	987.0	58.6	604.4	35.9
2014	7.2	1,774.4	1,020.7	57.5	753.7	42.5	1,020.7	57.5	753.7	42.5
2015	7.3	1,923.4	1,085.5	56.4	838.0	43.6	1,085.5	56.4	838.0	43.6
2020	7.4	2,899.8	1,510.3	52.1	1,389.6	47.9	1,510.3	52.1	1,389.6	47.9
2025	7.0	4,270.0	2,223.9	52.1	2,046.1	47.9	2,085.2	48.8	2,184.9	51.2
2030	6.5	6,119.8	3,187.3	52.1	2,932.5	47.9	2,988.4	48.8	3,131.3	51.2
2035	6.0	8,538.0	4,446.8	52.1	4,091.3	47.9	4,169.3	48.8	4,368.7	51.2
2040	5.0	11,283.8	5,876.8	52.1	5,407.0	47.9	5,510.1	48.8	5,773.7	51.2
AARG 2002-2014	7.2%	7.7%	9.8%		4.2%		9.8%		4.2%	
AARG 2014-2040	6.7%	7.6%	7.1%		8.8%		6.8%		9.1%	

Navigation Programme 2015

b) Modal share forecast

- A modal share analysis was undertaken for the purpose of determining the proportions of the overall market volume which would, in the future, be served through Viet Nam or alternatively through Singapore or Thailand. This was done by establishing the operating cost of feeder ship movement between Sihanoukville and Singapore plus the cost of trucking between Sihanoukville and Phnom Penh, as compared with IWT movement from Nha Be to Phnom Penh, a total distance of 428 km.
- The feeder ship cost was based on the assumed operation of a 7,000 DWT vessel, while two sets of costs were calculated in the IWT case, one assuming a vessel at current size (1,000 DWT) and the other assuming a gradual trebling of vessel size to 3,000 DWT. The results of this cost assessment were that a feeder ship plus truck option would have a weighted average cost of US$ 27.66 per '000 ton-km, while the comparable costs for

1,000 DWT and 3,000 DWT tanker barges were respectively US$ 68.93 and US$ 36.30 per '000 tonne-km.

- Next, the relative transit times of the two options were factored in to the analysis. The transit time for the feeder vessel plus trucking option was calculated at 101 hours, while that for the IWT option was calculated at 89 hours.

Modal shares were then calculated as shown in the tables below:

			Indicated Rates	
			IWT	Road + feeder ship
Costs				
IWT US$/1000 TEU-km	Road + feeder ship US$/1000 TEU-km	Ratio IWT/Road+ship	33.5%	66.5%
51.71	25.99	1.9895		
Transit time				
IWT hours	Road + feeder ship hours	Ratio IWT/Road+ship	53.0%	47.0%
89	101	0.8859		
Combined	Costs	Transit time		
Weights	1	2	47.9%	52.1%

Modal share calculation 1,000 DWT case, Navigation Programme 2015

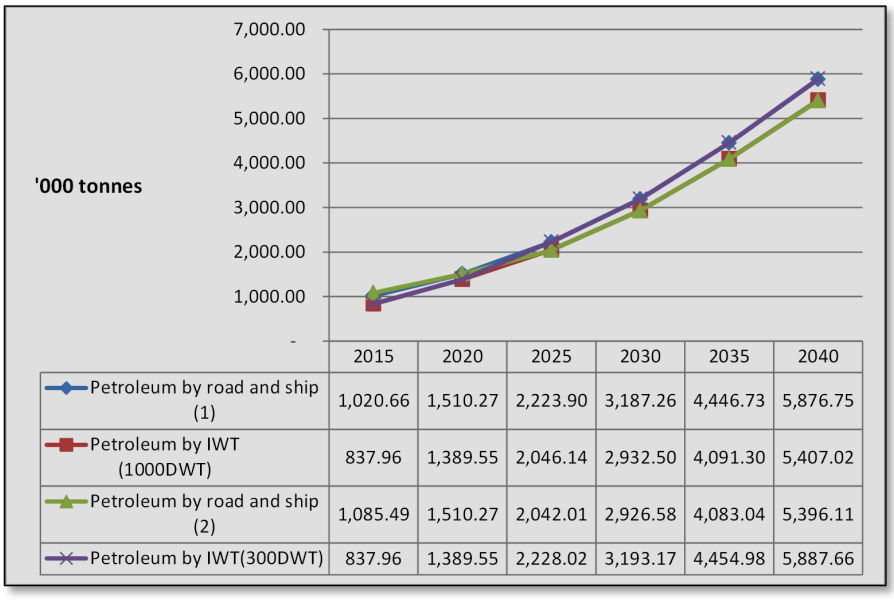
			Indicated Rates	
			IWT	Road + feeder ship
Costs				
IWT US$/1000 TEU-km	Road + feeder ship US$/1000 TEU-km	Ratio IWT/Road +ship	50.4%	49.6%
25.59	25.99	0.9845		
Transit time				
IWT hours	Road hours	Ratio IWT/Road	53.0%	47.0%
89	101	0.8859		
Combined	Costs	Transit time		
Weights	1	2	52.2%	47.8%

Modal share calculation 3,000 DWT case, Navigation Programme 2015

These modal shares were fed into the calculation table to produce two sets of forecasts, one reflecting a status quo (zero investment) scenario and the other an investment scenario which would permit a progressive increase in vessel size.

As shown in the figure below, the resulting modal share forecasts reflect an almost even division of petroleum volume between the feeder shipping plus road option and the IWT option. An increase in

boat size is shown to have some effect by improving the share of IWT in the volume of petroleum imported into Cambodia.



	2015	2020	2025	2030	2035	2040
Petroleum by road and ship (1)	1,020.66	1,510.27	2,223.90	3,187.26	4,446.73	5,876.75
Petroleum by IWT (1000DWT)	837.96	1,389.55	2,046.14	2,932.50	4,091.30	5,407.02
Petroleum by road and ship (2)	1,085.49	1,510.27	2,042.01	2,926.58	4,083.04	5,396.11
Petroleum by IWT(300DWT)	837.96	1,389.55	2,228.02	3,193.17	4,454.98	5,887.66

Petroleum volume and modal share forecast - Cambodia/Viet Nam, Navigation Programme 2015

Conversion of these volume forecasts into future vessel movements was done by assuming (a) the status quo in the case of Forecast 1, i.e. no change in vessel size, and (b) a progressive increase in average vessel size starting in 2020 with the introduction of 3,000 DWT vessels after investment in waterway facilities.

Year	Forescast 1 (1,000 DWT)	Forecast 2 (3,000 DWT)
2015	966	966
2020	1,657	1,036
2025	2,521	1,525
2030	3,723	2,027
2035	5,342	2,424
2040	7,226	2,623

Forecasts of vessel movements (No.) – petroleum traffic Viet Nam/Cambodia, Navigation Programme 2015

Bulked and bagged cargo

The historical growth trend for the general cargo category at PPAP is growth at around 16 percent per annum. It is unlikely that this can be sustained. Consequently, the forecast is that volume growth will be roughly in line with GDP growth.

Year	Tonnes
2014 (Base year)	266,922
2015	286,445
2020	410,338
2025	575,520
2030	788,512
2035	1,055,207
2040	1,346,741
AARG	**6.4%**

General Cargo volume forecast (PPAP), Navigation Programme 2015

Agricultural exports from Kompong Cham

It is estimated that during the 7-year period between 2007-2014, the total production of cassava in Cambodia grew at an average annual rate of 20 percent, from 2.2 million tonnes in 2007 to 7.9 million tonnes in 2014.

Owing to its favourable climate and soil conditions, Kompong Cham Province produces annually the highest tonnage of cassava in Cambodia.

Year	Production	Total cassava exports		Exports to China		Kompong Cham – China	
	'000 tonne	'000 tonne	% of production	'000 tonne	% of production	'000 tonne	% of exports to China
2013	7,541	300	4.0				
2014	7,933			60	0.8		
2015	10,000			150	1.5	36	24.0
2020	13,000			260	2.0	62	24.0
2025	19,000			475	2.5	114	24.0
2030	24,000			624	2.6	150	24.0
2035	29,000			783	2.7	188	24.0
2040	33,500			938	2.8	225	24.0
AARG 2007-2014	20.0%						
AARG 2014-2040	5.7%			11.2%		7.6%	

Production and exports of cassava, Cambodia, Navigation Programme 2015

Cassava is traded in two forms, either as raw material (fresh or dried) or as a processed starch in powder form. Historically, it has been used for animal feed, but more recently has found a strong market as a feedstock for the production of ethanol.

China has emerged as the principal buyer of cassava products on international markets. The signing in 2010 of a Memorandum of Understanding for cassava exports between China and Cambodia has resulted in a more organized and consistent pattern of shipments to China.

It is expected that in 2015, 150,000 tonnes of cassava will be shipped to China, up from 60,000 tonnes in 2014. Most of these shipments have been made through Sihanoukville Port, but there is strong potential for shipments to be made through Kompong Cham, which is closer to the main supply source.

Forecasts of cassava shipments from Kompong Cham were based on the assumption that exports to China would grow by about 11 percent per annum to reach 940,000 tonnes by 2040, and that Kompong Cham shipments would maintain a 24 percent share of these exports. Thus, it is expected that cassava shipments from Kompong Cham will:

- by 2020 reach about 62,000 tonnes (as compared with the estimated volume for 2015 of 36,000 tonnes); and
- by 2040 reach about 225,000 tonnes.

3.4 CONCLUSIONS

Transport demand forecasts were prepared as a basis for identifying the development scenarios and action plans to be proposed in the Master Plan.

These forecasts were prepared for the Upper and Lower regions of the Mekong Basin, the former running from the Green Triangle at the border of China, Myanmar and Lao PDR to Vientiane, and the latter from the Khone Falls to the Mekong and Bassac estuaries at the Sea. Owing to data and time limitations, the forecasts are restricted to regional (or cross-border) cargo and passenger flows on the river, as well as (wherever relevant) on alternative modes of transport. For this reason, the forecasts were not prepared for the mid-region of the Mekong Basin (from Vientiane to the Khone Falls) on which only small domestic traffic volumes are carried.

The forecasts were prepared for all identified transport corridors comprising river, road and, where relevant, railway transport routes within the Upper and Lower Mekong regions (three within each region).

A strong correlation between aggregate transport demand and real GDP was identified in the case of all four riverine countries covered in the Master Plan. Thus, transport demand forecasts were primarily based on (but were not necessarily matched with) the forecast growth of real GDP. In most cases, GDP growth defined a lower bound for transport demand growth. With long term GDP growth settling at around 5 percent per annum, IWT transport volumes forecast for 2020 are at least 125 percent of their baseline levels, while those forecast for 2040 are at least 250 percent of their baseline levels.

Relatively strong IWT cargo growth has been achieved in all riverine countries, with the exception of Lao PDR. Here, IWT growth is restricted by the poor condition of boats and port infrastructure as well as by increasing competition from road transport, which has benefitted from improved highway infrastructure. However, the progressive increase in cargo boat capacity from the current 100 DWT to 500 DWT in future will reduce IWT operating cost and increase IWT competitiveness and modal share against road transport in Lao PDR, thereby boosting its growth prospects.

In Lao PDR, the tourist potential of the Mekong has yet to be fully realized owing to the poor safety record and poor comfort of passenger boat operations on scenic stretches of the river, particularly between Huay Xay and Luang Prabang. Significant improvements to on-board safety and to landing facilities are expected to allow IWT tourist traffic to grow at rates approaching the growth in overall tourist arrivals in Lao PDR (recently about 16% per annum).

The growth of IWT tourist traffic between Viet Nam and Cambodia has been very robust over the past decade and its future rapid growth will be assured by investments in upgraded passenger terminal facilities in Ho Chi Minh City, Phnom Penh and Chong Kneas (Siem Reap).

4 SHORT AND LONG TERM DEVELOPMENT SCENARIOS

4.1 OBJECTIVES

The **main objective** of the project is "*To design a short term and a long term development programme which implementation will rehabilitate and improve the national and international transport network using the Mekong River in the Mekong River Commission Member Countries*" including:

- To fully realise the regional trade and transport potential of the Mekong River which is the most cost-effective mode of the regional transport system and to attract foreign and domestic investments;
- To fully use the vast potential for waterborne tourism and ecotourism as well in the upper part as in the lower part of the Mekong River Basin as a major impulse to private sector growth in all MRC Member Countries;
- To gear, where possible, the economic and financial function of navigation also towards opportunities for poverty reduction. For many riparian people, the river is the lifeline to the outside world and the only way to access basic social services and this transport of people and goods by small craft might grow considerably if rural navigation networks can be linked to regional networks;
- To make navigation safer and more sustainable for the people and for the environment.

4.2 BASELINE INFORMATION AND ASSUMPTIONS

Baseline information

- The current situation and baseline conditions, as delivered by the National Experts and completed by the International Consultants;
- The ongoing and planned studies and projects and national strategies and development plans, as well for the upper part of the Mekong River as for the lower part;
- The economic forecasts, providing scenarios for which the sustainability of waterborne transport on the Mekong River Basin should be guaranteed;

Assumptions

- That in the long term, ASEAN will lead to higher integration and transport facilitation in and between the member countries; and
- That in the long term, all planned dams in the PR China and five dams in the Huay Xay - Vientiane stretch of the River will be built (all except Pakchom dam).

Based on the above baseline information and assumptions, short and long-term development scenarios for Regional Waterborne Transport on the Mekong River Basin have been prepared.

4.3 GOAL OF THE MASTER PLAN

"The goal of the Master Plan for Regional Waterborne Transport in the Mekong River Basin is to increase waterborne transport in the MRB to at least 125% of the actual waterborne transport

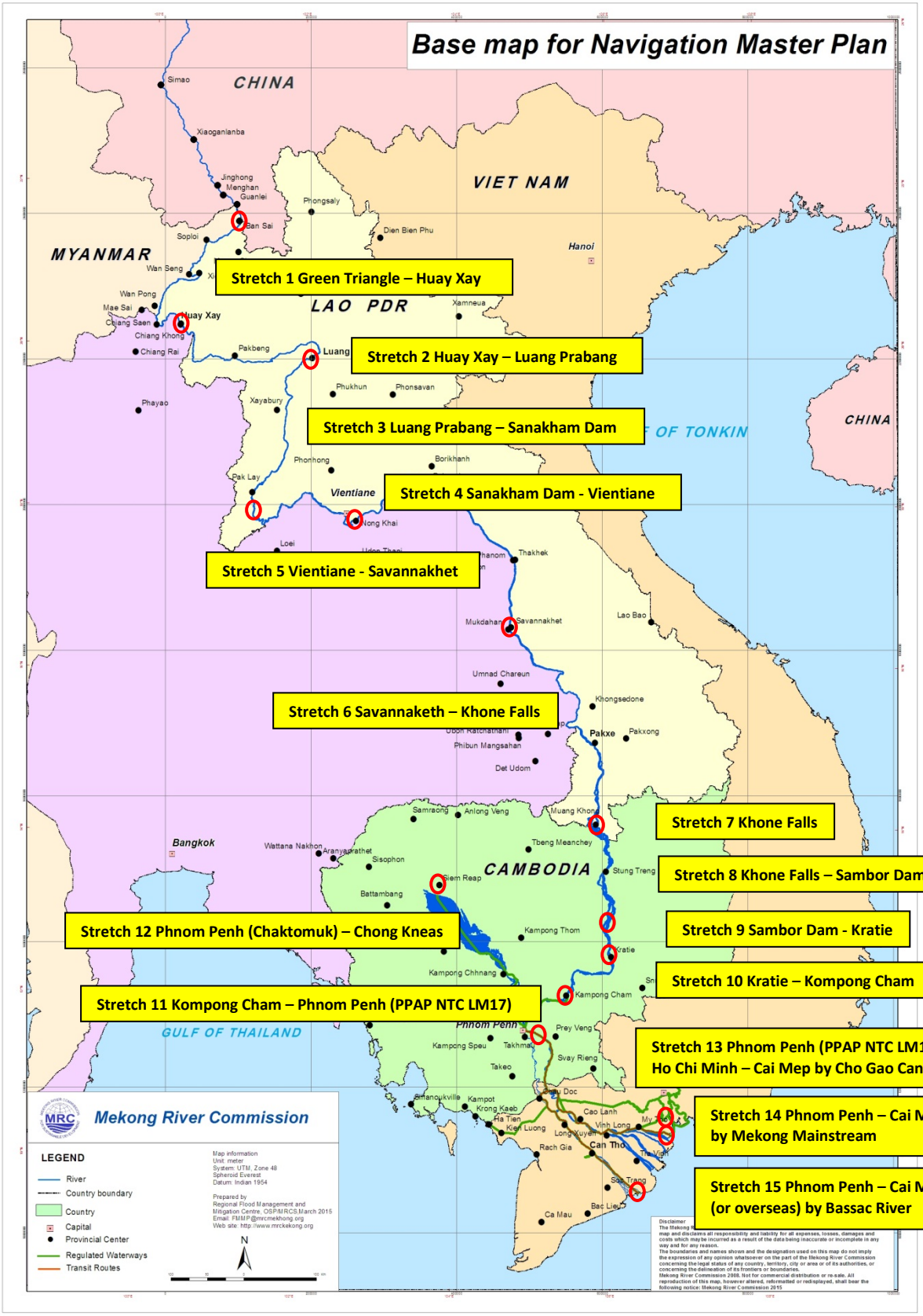
volume in 2020 and to at least 250% of the actual waterborne transport volume in 2040 and to make navigation safer and more sustainable for the people and for the environment."

This goal should be achieved by:

- The use of larger ships used over the total length of the Mekong River and over the whole year, including the use of sea-river ships in the Mekong Delta;
- The improvement of safety of all types of ships, including the use of more save passenger ships and ships carrying dangerous goods;
- The promotion of the concept of "clean" river transportation, focusing on strategic prevention of environmental damage from waterway infrastructures or from shipping or port accidents;
- The development of safe and efficient passenger ports and multimodal nodal points in the main cargo ports and dry ports;
- The creation of a safe navigation channel, able to accommodate the larger ships over the whole year;
- The coordination of a regional river information service and waterborne transport marketing;
- The establishment of education and training courses on all aspects of inland waterway transport;
- The full implementation of cross-border agreements and harmonization of standards, rules and regulations;
- The integration of Strategic Environment Assessment (SEA)/Environmental Impact Assessment (EIA) into IWT planning to effectively manage social and environmental impacts, including the predicted impacts of climate change;
- The creation of socio-economic opportunities to link local IWT transport with national and regional routes; and
- The creation of positive social and environmental impacts in the global MRB transport sector.

4.4 SHORT AND LONG-TERM DEVELOPMENT SCENARIOS

To develop short-term (2020) and long-term (2040) development scenarios for the Master Plan for Regional Waterborne Transport in the Mekong River Basin, the River has been subdivided into 15 stretches.


Base map for Navigation Master Plan
CHINA
VIET NAM
MYANMAR
LAO PDR
CAMBODIA
GULF OF THAILAND
Bangkok
Hanoi
Vientiane
Phnom Penh
Stretch 1 Green Triangle – Huay Xay
Stretch 2 Huay Xay – Luang Prabang
Stretch 3 Luang Prabang – Sanakham Dam
Stretch 4 Sanakham Dam - Vientiane
Stretch 5 Vientiane - Savannakhet
Stretch 6 Savannaketh – Khone Falls
Stretch 7 Khone Falls
Stretch 8 Khone Falls – Sambor Dam
Stretch 9 Sambor Dam - Kratie
Stretch 10 Kratie – Kompong Cham
Stretch 11 Kompong Cham – Phnom Penh (PPAP NTC LM17)
Stretch 12 Phnom Penh (Chaktomuk) – Chong Kneas
Stretch 13 Phnom Penh (PPAP NTC LM17) – Ho Chi Minh – Cai Mep by Cho Gao Canal
Stretch 14 Phnom Penh – Cai Mep by Mekong Mainstream
Stretch 15 Phnom Penh – Cai Mep (or overseas) by Bassac River
Mekong River Commission
LEGEND
River
Country boundary
Country
Capital
Provincial Center
Regulated Waterways
Transit Routes

As mentioned before, the scenarios are developed with the assumption that, in the long term, all planned dams in the PR China and five dams in the Huay Xay - Vientiane stretch of the River will be built. In contrast, between Savannakhet and Kratie two long term scenarios are proposed: one scenario with all dams in this reach built, one scenario in case **one of these** dams is not built.



Existing and Planned Mainstream Hydropower dams

For each of the stretches, a short term and long term development scenario is proposed for the fleet, waterway design, port development and safety while for the legal and socio-environmental aspects, the elements are given that must be taken into account to reach the proposed scenarios.

Stretch 1 Green Triangle to Huay Xay (293 km)

	Current Situation – Baseline Conditions (2015)	Short-Term Scenario (2020)	Long-Term Scenario (2040)
Fleet	300 DWT seasonal 150 DWT whole year No vessel classification. No government fleet policy.	300 DWT seasonal 150 DWT whole year Standardized vessel classification system that is in harmony with the Chinese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	500 DWT whole year National or Regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	300 km relatively good navigation between Km marker 244 and Chiang Saen (11 rapids and 10 shoals cleared by the Chinese in a previous project). Downstream Chiang Saen dangerous navigation due to numerous rapids.	It may be that the Chinese Lancang-Mekong study will be party or fully implemented. However, hydrographic surveys and conditions surveys of the most difficult rapids and	The Chinese Lancang-Mekong project will be fully implemented and ships of 500 DWT can ply all year round between the Green Triangle (Km marker 244) and Huay Xay. All rapids and reefs obstructing

		reefs will have to be carried out first, including the channel design and environmental screening.	navigation for ships of 500 DWT fully laden will be cleared in an environmentally friendly way.
Navigation safety	Unacceptable conditions for tourists regarding safety and comfort on board and ashore. Dangerous goods transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Lao PDR:** very limited national regulations; **Thailand:** limited national regulations (Act on navigation in Thai waters B.E.2456 and regulation on ship survey B.E. 2534). The Lancang-Mekong River Regional Agreement is not adopted in national law, not implemented and no law enforcement.	Increased safety of inland waterway transport, especially regarding safe and comfortable transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Department of Waterways in Lao PDR and Marine Department in Thailand. Contingency plan available, with efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth traffic and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids to navigation	Only daytime navigation (average 13 hrs. per day) *. Navigation in this stretch still remains an issue because there are only limited navaids (markers) available. Accidents occur because of this. * Even though the river stretch is only navigable during daylight hours, because it is too dangerous at night, many vessels are sailing at night using big floodlights that are installed on the navigation bridge.	Still only daytime navigation but much more efficient and safe because of the introduction of more comprehensive aids to navigation (improved marks and GPS equipment).	Still only daytime navigation but much more efficient and safer because of the introduction of more comprehensive aids to navigation. All commercial boats need the GPS equipment.

Ports	**Ban Sai Port** Provincial level checkpoint. Located at the natural bank of the River. No cargo handling facilities. **Xiengkok Port** National level checkpoint. No concrete berth and no cargo handling facilities. **Moung Mom Port** Port with sloped ramp in concrete. Port is relatively well equipped but has no cargo handling facilities. **Ban Khouane Port** Natural port with no cargo handling facilities. **Chiang Saen (2003 PAT)** Two floating pontoons with bridge linking to the quayside. Cargo handling facilities available. **Chiang Saen CP (2012)** Port is not located along the river; the port has an access channel. Newly build port with proper infrastructure and cargo handling facilities. **Chiang Khong (2003)** One berth port with a concrete quayside. Limited infrastructure and no cargo handling facilities available. Port was an important ferry port before the bridge construction.	Ports with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods) and passengers. Ports to be compliant with the forecasted cargo and passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Ports with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods) and passengers. Ports to be compliant with the forecasted cargo and passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.
Regulatory aspects	Freedom of navigation and partial regulatory harmonization under the Quadrangle Agreement.	Implementation of harmonized rules adopted under the Quadrangle Agreement.	Comprehensive, fully-harmonized and effectively implemented legal framework.
Environment Aspects	Water Quality Monitoring detected high levels of phenol, heavy metals at Chiang Saen and Chiang Kong Pier. Waste management and emergency response plans at Chiang Saen CP.	SEA for Lancang-Mekong Project completed. EIA for specific port construction and waterway improvement completed.	Sustainable navigation: Integrated planning, energy efficient vessels, pollution control, Environmental Management Plan (EMP) and monitoring.

Social aspects	Local cargo and passenger transport. Chinese cargo and tankers.	Socio-economic risks and opportunities integrated into EIA.	Inclusive development of cargo and passenger transport creates economic opportunities for rural communities.

Stretch 2 Huay Xay – Luang Prabang (306 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario (2040)
Fleet	150 DWT seasonal. 60 DWT whole year. No vessel classification. No government fleet policy.	150 DWT seasonal. 60 DWT whole year. Standardized vessel classification system that is in harmony with the Chinese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	Classification 2,000 DWT. Use 500 DWT whole year. National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	Difficult navigation due to numerous rapids and dangerous areas, some of which have been condition surveyed and channel design projects have been made.	In this stretch there is a plan to construct two hydropower dams: Pak Beng and Luang Prabang. The short term scenario should study the need and the scope of a "Water Management Authority" responsible for setting the operational levels of each hydro-power dam (including the rules of operation) allowing the river design engineer to study the remaining sections of "free flow" where river improvement works have to be carried out in order to allow navigation for ships	The hydropower dams of Pak Beng and Luang Prabang are constructed. Clearance of remaining rapids and reefs, including the removal of dangerously submerged rock outcrops in the upstream end of the impounded stretches, is completed in accordance with the environmental screening or EIA's for the subject works.

		of 500 DWT all year round. Navigation channel improvement studies will largely depend on the outcome of the defined operational water levels (including the allowed minimum operational levels in every impounded stretch).	
Navigation safety	Unacceptable conditions for tourists regarding safety and comfort on board and ashore. Dangerous goods transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Lao PDR:** very limited national regulations; **Thailand:** limited national regulations (Act on navigation in Thai waters B.E.2456 and regulation on ship survey B.E. 2534). The Lancang-Mekong River Regional Agreement is not adopted in national law, not implemented and there is no law enforcement.	Increased safety of inland waterway transport, especially regarding safe and comfortable transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Department of Waterways in Lao PDR and Marine Department in Thailand. Contingency plan available, with efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth traffic and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids to navigation	Only daytime navigation. Navigation has recently become safer and more efficient because of the GPS Navigation Guided System. **Note:** Old French markers exist but form an additional danger when submerged. Other installed visual aids (buoys and spring coiled beacons) failed due to heavy debris.	Still only daytime navigation. By 2020 all boats will be using the GPS Navigation Guided System. Navigation will also be easier because the French markers are rehabilitated.	Navigation will be safer and easier on the reservoirs upstream of the hydropower dams. **Note:** If the hydropower dams are built, visual aids and floating visual aids can be reintroduced in the reservoirs

Ports	**Huay Xay, Pak Beng and Luang Prabang** Ports still in natural condition with unsafe landing facilities for passengers. Limited or no cargo handling facilities	Ports with adequate and well maintained infrastructure for the efficient and safe transfer of passengers. Ports to be compliant with the forecasted passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Ports with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers. Ports to be compliant with the forecasted cargo and passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.
Regulatory aspects	Freedom of navigation and partial regulatory harmonization under the Quadrangle Agreement	Implementation of harmonized rules adopted under the Quadrangle Agreement	Comprehensive, fully harmonized and effectively implemented legal framework
Environment Aspects	Limited Environmental Management Plan, Waste Management and pollution control.	EIA for specific port construction and waterway improvement.	Sustainable navigation: Integrated planning, energy efficient vessels, pollution control, Environmental Management Plan and monitoring.
Social aspects	Rural IWT provides access to national and cross-border ports.	Socio-economic risks and opportunities integrated into EIA.	Inclusive development of cargo and passenger transport creates economic opportunities for rural communities. Landing facilities installed.

Stretch 3 Luang Prabang – Planned Sanakham Dam (279 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario (2040)
Fleet	60 DWT seasonal 15 DWT whole year No vessel classification. No government fleet policy.	60 DWT seasonal 15 DWT whole year Standardized vessel classification system that is in harmony with the Chinese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	Numerous rapids and dangerous areas, as well as some difficult shoals. The most difficult of these areas has been condition surveyed and channel design proposals have been made.	The Xayabury dam is operational. The impounded stretch reaches Luang Prabang (+275.00) and is at its maximum possible flood level is (+278.30). All dangerous areas in the downstream stretch between the Xayabury dam and the location of the Sanakham dam have to be condition surveyed and channel designed, including environmental screening or EIAs.	The three hydro-power dams are built: Xayabury, Paklay and Sanakham. Most of the dangerous areas for navigation are impounded and need no further attention. The remaining rapids and reefs to be cleared depend on the operational levels in the impounded stretches (which at the moment of writing this report were not known with certainty yet), including the dangerous submerged rock outcrops and steep riverbanks at the upstream end of each impounded section.
Navigation Safety	Unacceptable conditions for tourists regarding safety and comfort on board and ashore. Dangerous goods transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers:	Increased safety of inland waterway transport, especially regarding safe and comfortable transport of passengers and safe carriage and handling of dangerous goods. Regulations	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet

	Lao PDR: very limited national regulations; **Thailand:** limited national regulations (Act on navigation in Thai waters B.E.2456 and regulation on ship survey B.E. 2534). Regional Agreement not applicable. No implementation, no law enforcement.	implemented and law enforcement conducted by Department of Waterways in Lao PDR and Marine Department in Thailand. Contingency plan available, with efficient emergency response and search and rescue units installed.	demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids To Navigation	Only daytime navigation. Navigation not safe and restricted due to lack of navigational aids except for presence of some French markers	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Navigation will be safer and easier on the reservoirs upstream of the hydropower dams. **Note:** If the hydropower dams are built, visual aids and floating visual aids can be reintroduced in the reservoirs.
Ports	**Pak Lay** Passenger port with no cargo handling facilities. Port in poor condition and has been abandoned after completion of the bridge over the Mekong.	Port with adequate and well maintained infrastructure for the efficient and safe transfer of passengers. Port to be compliant with the forecasted passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Port with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods if applicable) and passengers. Port to be compliant with the forecasted cargo and passenger throughput. Port managed with a focus on: • Safety of both port users and port workers • Security • Environmental protection Efficiency.

Regulatory Aspects	No multi- or bilateral agreements in place.	Common safety rules adopted and implemented by Lao PDR and Thailand.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	WQM showed high levels of phenol, oil, grease and heavy metals. Solid waste. Limited EMP and monitoring.	Initial Environmental Impact Assessment (IEIA) and/or EIA completed for new port developments or waterway improvements.	Sustainable navigation: Integrated planning, energy efficient vessels, pollution control, Environmental Management Plan and monitoring.
Social Aspects	International and local passenger and tourist transport.	Identify socio-conomic opportunities for rural IWT.	Inclusive development of cargo and passenger transport creates economic opportunities for rural communities. Landing facilities installed.

Stretch 4 Planned Sanakham Dam – Vientiane (148 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario (2040)
Fleet	60 DWT seasonal 15 DWT whole year No vessel classification. No government fleet policy.	60 DWT seasonal 15 DWT whole year Standardized vessel classification system that is in harmony with the Chinese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	The river is extremely difficult for navigation especially in mid-water levels, where the rocky embankments of the channel are submerged. The most dangerous areas for navigation have been condition surveyed and channel design proposals	This stretch is considered to be extremely dangerous for navigation with small channels with steep rocky low water embankments. Therefore a full detailed hydrographic	The entire stretch, where no dams are planned (the Pak Chom dam has been deleted), is cleared from rapids and dangerous reefs and navigable for ships of 500 DWT.

	made.	survey is needed in order to complete the channel design in full.	
Navigation Safety	Unacceptable conditions for tourists regarding safety and comfort on board and ashore. Dangerous goods transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Lao PDR:** very limited national regulations; **Thailand:** limited national regulations (Act on navigation in Thai waters B.E.2456 and regulation on ship survey B.E. 2534). No implementation, no law enforcement.	Increased safety of inland waterway transport, especially regarding safe and comfortable transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Department of Waterways in Lao PDR and Marine Department in Thailand. Contingency plan available, with efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids to Navigation	Only daytime navigation. Navigation in this stretch still remains an issue because there are only limited and old French markers available. Accidents occur because of this. The old French markers form an additional danger when submerged.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Still only daytime navigation but much more efficient and safe because of the introduction of a GPS Navigation Guided System, compulsory for all commercial boats.
Ports	**Vientiane Km 4 (Laksi Port)** Port with a concrete sloped ramp. Port in poor condition due to a lack of maintenance. Port has two underground storage tanks in poor condition for the storage of fuel and diesel. **Remarks:** Study and plans for relocating the port are on-going. Current port has no expansion possibilities and is	Port with adequate and well-maintained infrastructure for the efficient and safe handling, storage and transfer of cargo (including dangerous goods). Port to be compliant with the forecasted cargo throughput. Ports managed with a focus on:	Port with adequate and well-maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods) and passengers. Port to be compliant with the forecasted cargo and passenger throughput.

	close to the city centre.	• Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.
Regulatory Aspects	No multi- or bilateral agreements in place.	Common safety rules adopted and implemented by Lao PDR and Thailand.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	No significant environmental impacts reported.	Initial Environmental Impact Assessment (IEIA) and/or EIA completed for new port or waterway developments.	Environmental Impact Assessment and Environmental Management Plan incorporated into integrated planning for IWT sector.
Social Aspects	Limited cargo and passenger transport.	Socio-economic opportunities for rural IWT identified.	IWT integrated with hydropower, agricultural, mining, industrial and other sectors. Landing facilities installed.

Stretch 5 Vientiane – Savannakhet (455 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario (2040)
Fleet	300 DWT seasonal 150 DWT whole year No vessel classification. No government fleet policy.	300 DWT seasonal 150 DWT whole year Standardized vessel classification system that is in harmony with the Chinese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	Classification 2,000 DWT Use 500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	Probably the best stretch for navigation in the upper Mekong. Only four mild dangerous areas, amongst	This is the most beautiful navigation stretch in the upper Mekong. Only four	Water depths at the four identified cleared rapids are increased to -4.00 below chart

	them the Keng Kabao rapids. There are obstacles but do not stop navigation.	rapids will be studied and cleared for boats of 300 DWT. No other dredging or reef clearance except for some isolated rock outcrops, which do not have a significant environmental impact on the river behavior and morphology. These are in the vicinity of the four mentioned rapids.	datum.
Navigation Safety	Dangerous goods transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Lao PDR:** very limited national regulations; **Thailand:** limited national regulations (Act on navigation in Thai waters B.E.2456 and regulation on ship survey B.E. 2534). No implementation, no law enforcement.	Increased safety of inland waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Department of Waterway in Lao PDR and Marine Department in Thailand. Contingency plan available, with efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids to Navigation	Only daytime navigation. Navigation in this stretch still remains an issue because there are only limited and old French markers available. Accidents occur because of this. The old French markers form an additional danger when submerged.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Still only daytime navigation but much more efficient and safe because of the introduction of a GPS Navigation Guided System, compulsory for all commercial boats.
Ports	**Pak Sane, Thakhet, Nakhon Phanom and Savannakhet** Mainly ferry landing sites.	Ports with adequate and well-maintained infrastructure for the	Ports with adequate and well-maintained infrastructure for the

	Floating landing facilities for passengers are unsafe and outdated. Ports are mainly in poor condition due to a lack of maintenance.	efficient and safe handling of passengers. Ports to be compliant with the forecasted passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers • Security • Environmental protection Efficiency.	efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers. Ports to be compliant with the forecasted cargo and passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers; • Security; and • Environmental protection Efficiency.
Regulatory Aspects	No multi- or bilateral agreements in place.	Common safety rules adopted and implemented by Lao PDR and Thailand.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	WQM detected high levels of phenol, oil and grease at Vientiane. Solid wastes. Nam Kading National Protected Area (NPA).	Initial Environmental Impact Assessment (IEIA) and/or EIA completed for new port developments or waterway improvements.	EIA and Environmental Management Plan incorporated into integrated planning for IWT sector.
Social Aspects	Low levels of cargo and passenger transport.	Socio-economic survey to determine future opportunities for IWT is completed.	IWT integrated with hydropower, agricultural, mining/industrial and other sectors. Landing facilities installed.

Stretch 6 Savannakhet – Khone Falls (390 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario 1 (2040) Without all 5 dams	Long-term scenario z2 (2040) With all 5 dams
Fleet	80 DWT seasonal 20 DWT whole year No vessel classification. No government fleet policy.	80 DWT seasonal 20 DWT whole year Standardized vessel classification system that is in harmony with the Chinese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	80 DWT seasonal 20 DWT whole year Standardized vessel classification system that is in harmony with the Chinese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	Upstream of Pakxe, a few dangerous areas (Keng Chong Yai and Hin Han Don Sa) are strong limitations to safe navigation. Downstream of Pakxe, the waterway is very wide and with many islands criss-crossed by channels, mostly shallow. This is the tourist-area known as “Siphandon”.	This river stretch is mostly wide riverbeds with lots of islands and sand banks which have to be properly surveyed. A full-scale channel design needs to be prepared including river training works in the area of Siphandon. Ongoing environmental screening is needed.	Status quo. No physical works and/or upgrading of the navigation channel.	Ban Khoum dam creates an impounded area, and downstream of Pakxe the Latsua dam will create another impounded area, substantially improving the navigation conditions in these dam-reservoirs. Together with substantial river training works and some dredging, a sustainable channel that needs no further intervention to remain navigable will be created for boats of 500 DWT.

Navigation Safety	Dangerous goods transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Lao PDR:** very limited national regulations; **Thailand:** limited national regulations (Act on navigation in Thai waters B.E.2456 and regulation on ship survey B.E. 2534). No implementation, no law enforcement.	Increased safety of inland waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Department of Waterways in Lao PDR and Marine Department in Thailand. Contingency plan available, with efficient emergency response and search and rescue units installed.	Increased safety of inland waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Department of Waterways in Lao PDR and Marine Department in Thailand. Contingency plan available, with efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids to Navigation	Only daytime navigation. Navigation in this stretch still remains an issue because there are only limited and old French markers available. Accidents occur because of this. The old French markers form an additional danger when submerged.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Still only daytime navigation but much more efficient and safe because of the introduction of A GPS Navigation Guided System, compulsory for all commercial boats.

Ports	**Pakxe** No information received.	Port with adequate and well-maintained infrastructure for the efficient and safe handling of passengers. Port to be compliant with the forecasted passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Port with adequate and well-maintained infrastructure for the efficient and safe handling of passengers. Port to be compliant with the forecasted passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Port with adequate and well-maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers. Port to be compliant with the forecasted cargo and passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.
Regulatory Aspects	No multi- or bilateral agreements in place.	Common safety rules adopted and implemented by Lao PDR and Thailand.	Common safety rules adopted and implemented by Lao PDR and Thailand.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	Phou Xieng Thong National Protected Area (NPA).	EIA for new port or waterway projects.	IEIA and/or EIA completed for new port developments or waterway improvements,	EIA and EMP incorporated into integrated planning for IWT sector.
Social Aspects	Limited economic opportunities for IWT.	Socio-economic opportunities for rural IWT identified.	Local IWT transport for local products.	IWT integrated with hydropower, agricultural, mining, industrial and other sectors. Landing facilities installed.

Stretch 7 Khone Falls

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario 1 (2040) Without all 5 dams	Long-term scenario 2 (2040) With all 5 dams
Fleet	0 DWT No vessel classification. No government fleet policy.	0 DWT	0 DWT	500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	The Khone Falls are the absolute and ultimate obstacle and stop to all navigation all-year-round. Navigation is ZERO.	No development: Status quo.	No development: Status quo.	A bypass canal of about 11 km to be constructed, matching as close as possible the natural terrain, with two or three shiplocks of 15 to 20 meter-level difference. The project includes the reconstruction of a section of the RN13 (alongside the canal) and at least one bridge (over one of the ship locks).

Navigation Safety	Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Lao PDR:** very limited national regulations. No implementation, no law enforcement.	No navigation. Regulations implemented and law enforcement conducted by Department of Waterways. Contingency plan available, with efficient emergency response and search and rescue units installed.	No navigation. Regulations implemented and law enforcement conducted by Department of Waterways. Contingency plan available, with efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids To Navigation				GPS Navigation Guided System is fully functional and compulsory for all boats carrying cargo and passengers.
Ports	None			
Regulatory Aspects	No multi- or bilateral agreements in place.	No multi- or bilateral agreements in place.	No multi- or bilateral agreements in place.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	High biodiversity/ fisheries. WWF Flagship species: Irrawaddy dolphins.	Environmental and social impacts of Don Sahong hydropower project (DSHPP). .	Increased conservation in National Protected Area (NPA) to restore social and natural conditions from DSHPP.	EIA for waterway improvements to mitigate, avoid or offset significant environmental impacts. Consider trans-boundary impacts.
Social Aspects	Ecotourism and passenger transport. Local people highly vulnerable to changes in natural resources for food security and livelihoods.	Increased ecotourism and passenger transport.	Conserved as NPA for ecotourism activities.	EIA includes social risks and opportunities.

Stretch 8 Khone Falls – Sambor Dam (142 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario 1 (2040) Without all 5 dams	Long-term scenario 2 (2040) With all 5 dams
Fleet	70 DWT seasonal 20 DWT whole year No vessel classification. No government fleet policy.	70 DWT seasonal 20 DWT whole year Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	70 DWT seasonal 20 DWT whole year Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	The river remains very wide (usually between 2.5 and 3.5 km) with many islands but the channel is narrow, generally deep with sharp bends. During the dry season in some places the riverbed is very shallow and impassable.	No physical improvement works foreseen. Study of some local situations and improvement/repair of the navigational aid system (French markers). Otherwise status quo.	Safety will be improved by some local deepening works. No upgrading otherwise to the channel dimensions. Waterway classification remains unchanged.	The Stung Treng and Sambor dams will considerably improve the navigation conditions in the impounded areas. Other sections of free flow need either dredging, bedrock deepening and clearance of rock outcrops or submerged rocky rivers in the upstream end of the impounded section, or more substantial improvements by sustainable river training works.

Navigation Safety	Dangerous goods waterway transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Cambodia:** very limited regulation, only drafted Law on Inland Water Navigation and Circular 003/MPWT on the Management of Means of Water Transport. No implementation, no law enforcement.	Increased safety of inland waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Inland Waterway Transport Dept. Contingency plan available, with efficient emergency response and search and rescue units installed.	Increased safety of inland waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Regulations implemented and law enforcement conducted by Inland Waterway Transport Dept. Contingency plan available, with efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids to Navigation	Only daytime navigation. Navigation in this stretch still remains an issue because there are only limited and old French markers available. Accidents occur because of this. **Note:** The old French markers form an additional danger when submerged.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Still only daytime navigation but much more efficient and safe because of the introduction of a GPS Navigation Guided System, compulsory for all commercial boats. Marking of highest flooded obstacles to be done before impounding the reservoir. If the hydropower dam is built, visual aids and floating visual aids reintroduced in the reservoirs.

Ports	**Stung Treng** Floating pontoon for embarking/disembarking passengers is in poor condition, most likely due to the age of the pontoon and the lack of a proper maintenance system. No cargo handling facilities.	Port with adequate and well-maintained infrastructure for the efficient and safe handling of passengers. Port to be compliant with the forecasted passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Port with adequate and well-maintained infrastructure for the efficient and safe handling of passengers. Port to be compliant with the forecasted passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.	Port with adequate and well-maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods) and passengers. Port to be compliant with the forecasted cargo and passenger throughput. Port managed with a focus on: • Safety of both port users and workers; • Security; • Environmental protection; and • Efficiency.
Regulatory Aspects	No multi- or bilateral agreements in place.	No multi- or bilateral agreements in place.	No multi- or bilateral agreements in place.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	High biodiversity/ fisheries. Anlong ChheuTeal: Irrawaddy dolphins.	Fish conservation zones established in connection with Don Sahong Hydro Power Project (DSHPP).	Increased conservation in National Protected Area (NPA) to restore social and natural conditions from DSHPP.	EIA for waterway improvements to mitigate, avoid or offset significant environmental impacts. Transboundary management.
Social Aspects	Ecotourism and passenger transport.	Increased ecotourism and passenger transport.	Conserved for ecotourism and fish conservation zone.	EIA incl. social risks and opportunities. Landing facilities installed.

Stretch 9 Planned Sambor Dam – Kratie (32 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario 1 (2040) Without all 5 dams	Long-term scenario 2 (2040) With all 5 dams
Fleet	80 DWT seasonal 20 DWT whole year No vessel classification. No government fleet policy.	80 DWT seasonal 20 DWT whole year Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	80 DWT seasonal 20 DWT whole year Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	The waterway splits into many branches, is wide and shallow and often has sharp bends. Navigation is extremely tricky and difficult although well indicated. Only summary hydrographic information is available.	Several river sections need more detailed hydrographic surveys and rapids must be condition surveyed. Channel design and improvement engineering drawings need to be prepared and environmental screening or impact assessment completed. Substantial bedrock deepening to be studied.	Mostly status quo, except for a very limited number of places where shallow places have to be deepened in mostly bedrock areas. This is the habitat of the Irrawady soft water dolphin, which in this scenario will remain untouched.	All shallows and dangerous areas cleared to allow bigger boats reaching Stung Treng, upstream of the Sambor dam. One single 40 meter-wide channel to be deepened and cleared from rock outcrops and reefs in the area of the Irrawady dolphins.

Navigation Safety	Dangerous goods waterway transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Cambodia**: very limited regulation, only Circular 003/MPWT on the Management of Means of Water Transport. No implementation, no law enforcement.	Increased safety of waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Law enforcement by Inland Waterway Transport Dept. Contingency plan available and efficient emergency response and search and rescue units installed.	Increased safety of waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Law enforcement by Inland Waterway Transport Dept. Contingency plan available and efficient emergency response and search and rescue units installed.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS, and RIS installed.
Aids to Navigation	Only daytime navigation. Navigation in this stretch still remains an issue because there are only limited and old French markers available. Accidents occur because of this. The old French markers form an additional danger when submerged.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places.	Still only daytime navigation but much more efficient and safe because of the introduction of a GPS Navigation Guided System, compulsory for all commercial boats.
Ports	No ports.	Port development not cost effective.	Port development not cost effective.	Port development not cost effective.
Regulatory Aspects	No multi- or bilateral agreements in	No multi- or bilateral agreements in	No multi- or bilateral agreements in	Comprehensive, fully harmonized and effectively

	place.	place.	place.	implemented legal framework.
Environment Aspects	Limited environmental impacts from IWT. NPAs in Stung Treng/ Kratie province. Prakas for protection of Irrawaddy dolphins has restrictions for IWT.	Increased environmental impact from passenger transport (solid wastes, oil and grease). NPAs and conservation zones promoted.	Further fishing conservation zones and NPAs established.	Integrated planning include EIA and dredging environmental management procedures (DEMP) for waterway improvement.
Social Aspects	Some eco-tourism and local transport.	Increased eco-tourism and local passenger transport.	Increased eco-tourism and passenger transport.	Large-scale cargo and passenger transport. Landing facilities installed.

Stretch 10 Kratie – Kompong Cham (114 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario (2040)
Fleet	400 DWT seasonal 80 DWT whole year No vessel classification. No government fleet policy.	400 DWT seasonal 80 DWT whole year Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	2,000 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	Downstream of Kratie the river mainly returns to one major branch, mostly deep and with gentle curves. Some shallow areas exist where the channel shifts from the left to the right	Project area of KOICA study: results are awaited and eventual approval of the study. Revise the study and produce more sustainable solutions such as river training	In case the KOICA project is approved and carried out (physical implementation), provide additional river training works to reduce costly yearly maintenance dredging.

	bank (Km 553, 550, 528, 525, 522.50, 496, 453).	works, groynes, and overflow dykes, instead of the substantial dredging works that would require yearly maintenance dredging.	The navigation channel is accessible for boats and barges of 2,000 DWT.
Safety	Dangerous goods waterway transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: **Cambodia:** very limited regulation, only drafted Law on Inland Water Navigation and Circular 003/MPWT on the Management of Means of Water Transport. No implementation, no law enforcement.	Increased safety of waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods and law enforcement by Inland Waterway Transport Department. Contingency plan available and efficient emergency response and search and rescue units installed. Navigation safety improved by obligatory use of AIS and VHF.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.
Aids to Navigation	Only daytime navigation. Navigation in this stretch still remains an issue because there are only limited and old French markers available. Accidents occur because of this. Note: The old French markers form an additional danger when submerged.	Still only daytime navigation but much more efficient and safe because of the introduction of a GPS Navigation Guided System, compulsory for all commercial boats.	Still only daytime navigation but much more efficient and safe because of the introduction of a GPS Navigation Guided System, compulsory for all commercial boats.
Ports	**Kratie** Floating pontoon for embarking/disembarking passengers and one for fuel transfer operations. Both pontoons are in poor condition probably due to the age of the pontoon and the lack of a proper maintenance	**Kratie** Development of a safe oil transfer point and fuel handling facilities. ***Study on the Agricultural and Logistic Infrastructure Development in Western Region of Mekong River (JICA).***	**Kratie** Development of two berths for 2,000 DWT vessels mainly for agriculture products. Port with adequate and well-maintained infrastructure for the efficient and safe handling, storage and

	system. No cargo handling facilities available.	This study was carried out to investigate the viability of an integrated project of agriculture and river transport together with a cassava bio-ethanol project.	transfer of both cargo (including dangerous goods where applicable) and passengers. Port to be compliant with the forecasted cargo and passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency. ***Feasibility study on waterway improvement for port logistics development in Cambodia (KOICA):*** Development of two berths for 3,000 DWT vessels mainly for agriculture products.
Regulatory Aspects	No multi- or bilateral agreements in place.	No multi- or bilateral agreements in place.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	High biodiversity and fishing conservation zones. Critical fish migration routes. Natural floodplains/ important wetlands.	Requirements for SEA, EIA and DEMP established during feasibility studies.	Sustainable navigation: Energy efficient vessels, Environmental Management Plan and environmental monitoring to ensure impacts are mitigated.
Social Aspects	Ecotourism and local passenger transport.	Socio-economic risks and opportunities integrated into SEA/EIA or integrated planning.	Inclusive development of rural IWT for poverty alleviation and socio-economic opportunities.

Stretch 11 Kompong Cham – Phnom Penh NTC LM17 (125 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario (2040)
Fleet	2,000 DWT seasonal 1,500 DWT whole year No vessel classification. No government fleet policy.	2,000 DWT seasonal 1,500 DWT whole year Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	3,000 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	The waterway is actually being dredged in the Sdao canal where the channel shifts from the left to the right bank in an area that is close to 2.9 km wide and very shallow.	Study and implementation of dredging the Sdao channel or deepened by river training works (preferably). River training works are preferred in order to reduce the costly yearly maintenance dredging to keep the channel open for barges of 3,000 DWT.	Dredge and river training works for creating a channel for sea-going vessels of 3,000 DWT calling the port of Tonlé Bet at Kompong Cham. Study and implement a sustainable solution for the Sdao canal.
Navigation Safety	Dangerous goods waterway transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: Cambodia: very limited regulation, only Circular 003/MPWT on the Management of Means of Water Transport. No implementation, no law enforcement.	Increased safety of waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods and law enforcement by Inland Waterway Transport Department. A contingency plan is available, and efficient emergency response and search and rescue units are installed. Navigation safety	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS and RIS installed.

		improved by obligatory use of AIS/VHF.	
Aids to Navigation	Issues with the fishing community about the use of the waterway for navigation have high priority. For this stretch the fishermen are (unreasonably) unwilling to come to an agreement with the MPWT to allow floating aids to navigation to be installed and maintained. About eight medium sized buoys remain. Many of the installed buoys have been swept away by debris or through theft.	Day and night navigation. No solutions are found yet with the fishing community. Due to this, safety is still an issue. Phnom Penh Port Authority has installed beacons and markers. ***For more details, see the Assessment of Navaids in Cambodia by MRC, 2014***.	Day and night navigation. Much improved, safe and efficient navigation. Solutions are found with the fishing community. Installation of Aids to Navigation need to be continued and safety is improved. Note: a combination of visual aids to navigation such as buoys and channel markers is used and virtual aids to navigation in line with ENCs.
Ports	**Kompong Cham (Tonle Bet)** Port can accept seagoing vessels. Poor port infrastructure and cargo handling facilities.	**Kompong Cham (Tonle Bet)** ***MRC Master Plan for waterborne transport on the Mekong river system in Cambodia (2006).*** New passenger port infrastructure (pontoon) and new general cargo infrastructure (ramp) in the right bank of the river. Oil distribution facilities and construction of container facility at the left bank of the river.	**Kompong Cham (Tonle Bet)** Development of two berths for 3,000 DWT vessels mainly for agriculture products. Port with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers. Port to be compliant with the forecasted cargo and passenger throughput. Port managed with a focus on: • Safety of both port users and port workers; • Security;

			• Environmental protection; and • Efficiency. ***Feasibility study on waterway improvement for port logistics development in Cambodia (KOICA):*** Development of two berths for 3,000 DWT vessels mainly for agriculture products.
Regulatory Aspects	Regulated waterway under Agreement CA-VN but not yet implemented.	CA-VN Agreement implemented.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environment Aspects	No significant impact reported from IWT. Dredging and sand mining extraction.	DEMP implemented for dredging and EIA for IWT projects/activities. Guidelines for sustainable navigation developed.	Sustainable 'green' navigation achieved to protect water quality, the environment, livelihoods and to reduce carbon emissions.
Social Aspects	Cargo and passenger transport opportunities.	Socio-economic risks and opportunities integrated in EIA.	Inclusive development of inland navigation sector. Landing facilities installed.

Stretch 12 Phnom Penh (Chaktomuk) – Chong Kneas (244 km)

	Current situation – baseline conditions (2015)	Short-term scenario (2020)	Long-term scenario (2040)
Fleet	200 DWT seasonal 30 DWT whole year No vessel classification. No government fleet policy.	200 DWT seasonal 30 DWT whole year Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	500 DWT whole year National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.

Waterway Design	Chhnock Trou entrance of the Great Lake is problematic during the dry season and impassable for most of the vessels with more than 1.20m draught.	Status quo in the physical implementation. Study of the dredging and environmental impact assessment.	Dredging of the Great Lake entrance at Chhnock Trou and a 110 km long channel in the lake will allow all year round vessels of 500 DWT to reach Chong Kneas from the Chaktomuk Area. Channel dimensions approximately 30 meters wide, 3.30 m deep and with underwater slopes of 1/10. This corresponds to a volume of approximately 7 million m^3 sand, sludge, silt and mud to be removed and dumped at well defined places in the lake.
Navigation Safety	Dangerous goods waterway transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers: Cambodia: very limited regulation, only drafted Law on Inland Water Navigation and Circular 003/MPWT on the Management of Means of Water Transport. No implementation, no law enforcement.	Increased safety of waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods and law enforcement by IWT Dept. Contingency plan available and efficient emergency response and search and rescue units installed. Navigation safety improved by obligatory use of AIS and VHF.	Approved vessel construction standards implemented. Well-designed, safely and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS, and RIS installed.
Aids to Navigation	Issues with the fishing community about the use of the waterway for navigation have high priority. For this stretch the fishermen are (unreasonably) unwilling to come to an agreement with the Ministry of Public Works and Transport to allow	Day and night navigation. No solutions are found yet with the fishing community. Due to this, safety is still an issue. Phnom Penh Port Authority has replaced 12 lanterns on the existing beacons.	Day and night navigation. Much improved, safe and efficient navigation. Solutions are found with the fishing community. Installation of Aids to Navigation need to be continued and safety is improved.

	floating aids to navigation to be installed and maintained. River cruises are highly on demand and represent a very good opportunity for socio-economic development in this area. About eight medium sized red and green buoys remain. About 18 red and green beacons on 6m medium pole remain. Some of the lanterns are dysfunctional.	Lights and marks have been installed at the Chrouy Chanwar, Prek Pnov, Prek Kdam bridges. For more details, see ***the Assessment of Navaids in Cambodia by MRC, 2014.***	Note: a combination of visual aids to navigation such as buoys and channel markers is used and virtual aids to navigation in line with ENCs.
Ports	**Kompong Chhnang** Given in concession. **Chong Kneas** Passenger port with poor landing facilities, given in concession.	***MRC Master Plan for waterborne transport on the Mekong river system in Cambodia (2006).*** **Kompong Chhnang** Development of a passenger port with floating pontoon. Chong Kneas Construction of a port with a cargo terminal, a fish market, a passenger terminal and a bunkering jetty.	**Kompong Chhnang and Chong Kneas** Ports with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers. Ports to be compliant with the forecasted cargo and passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers; • Security; • Environmental protection; and • Efficiency.
Regulatory Aspects	Regulated waterway under Agreement CA-VN but not yet implemented.	CA-VN Agreement implemented.	Comprehensive, fully harmonized and effectively implemented legal framework.

Environment Aspects	**WQM:** High levels of phenol, oil and grease and heavy metals. Solid wastes, sand mining and dredging. UNESCO Biosphere: Tonle Sap Lake	EIA for ports, terminals and waterway improvements. Sand mining/dredging Tonle Sap Lake conservation of fishing zones, wetlands and flooded forest.	EIA, Environmental Management Plan and monitoring to ensure that significant impacts can be mitigated, avoided or offset.
Social Aspects	Local and passenger transport. High vulnerability: 1.2 million people rely on natural resources for food security and livelihoods.	Increased local and passenger transport.	Inclusive development of tourist, passenger and cargo transport. Landing facilities installed.

Stretch 13 Phnom Penh (NTC LM17) – Ho Chi Minh – Cai Mep by Cho Gao Canal (372 Km)

	Current Situation – Baseline Conditions (2015)	Short-Term Scenario (2020)	Long-Term Scenario (2040)
Fleet	Classification 1,000 DWT Use 2,000 DWT No vessel classification. No government fleet policy.	Classification 2,000 DWT Use 2,000 DWT Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	Classification 2,000 DWT Use 2,000 DWT National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	Apart from a few water depth problems, the Mekong mainstream is a good waterway for 2,000 DWT IWT barges. The shortcut canal Cho Gao and further to Cai Mep has insufficient air clearance and water depth. The canals are way too busy for big barges that have to proceed with reduced speed.	There is a World Bank project under implementation to widen and deepen the Cho Gao shortcut canal to Cai Mep and Thi Vai ports. Air clearance under the bridges over the Cho Gao canal has to be increased to 6.0 m. The Mekong mainstream channel does not need any capital dredging. There is only local maintenance dredging in some areas in	World Bank project for the improvement and upgrading of the shortcut canals in the Mekong Delta is completed. Big barges can now reach safely the Cai Mep and Thi Vai ports without crossing the open sea.

		Cambodia for which dredging approval has been issued (Koh Keo channel), as well as the Ksom channel (in front of the new container terminal of the PPAP). Some maintenance dredging at Km 234, downstream Tan Chau.	
Navigation Safety	Dangerous goods waterway transport is not safe. Regulations for safety of navigation, ships, crew, waterway environment, cargo and passengers very limited regulated and no law enforcement. Cambodia: very limited regulation, only Circular 003/MPWT on the Management of Means of Water Transport. Viet Nam: extensive regulation, also missing regulations, implementation and law enforcement lacking. Limited AIS and VTS system in use in Cambodia and Viet Nam.	Increased safety of waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods. Law enforcement by efficient waterway department, IWD in Cambodia and VIWA in Viet Nam. Contingency plan available and efficient emergency response and search and rescue units installed. Navigation safety improved by obligatory use of AIS and VHF.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS, and RIS installed.
Aids to Navigation	Day and night navigation. Waterway not fully fitted with navaids so efficiency and safety still not good. Problem of theft of buoys and lanterns. Steel buoys too expensive for maintenance.	Day and night navigation. Navaids in Cambodia: Waterway better fitted with navaids but efficiency and safety still not perfect. Problem of theft of buoys and lanterns is less given that there are GSM modules in lanterns. Steel buoys slowly replaced by plastic to reduce costs. Navaids in Viet Nam: The Mekong Mainstream down to	Navaids in Cambodia and Viet Nam fully fitted, safe for day/night navigation. All buoys are maintained according to standard, and monitored against theft, fitted with GSM and AIS locators. **Note:** a combination of plastic buoys and channel markers is used and virtual aids to navigation in line with ENCs.

		the Cho Gao Canal is fitted with buoys and lanterns, and beacons. Fitted with GSM and AIS locators.	
Ports	**Phnom Penh NCT LM 17** Modern container port Handling Capacity 140,000 TEU – PSHEMS system in place and ISPS compliant. ***PPAP Passenger port*** Pontoon type. ***Phnom Penh – Private fuel transfer facilities*** Condition depends on the owner/operator of the port. Some terminals are in excellent conditions others are in very bad condition and should not continue to operate anymore. **Viet Nam:** Many small IWT ports. Condition of the ports depends on owner/operator of the port. ***Ho Chi Minh*** Modern Sea Port with all necessary cargo handling facilities. ***Cai Mep-Thi Vai*** Modern Sea Port with all necessary cargo handling facilities.	**Phnom Penh NCT LM 17** Expansion of the container terminal. ***PPAP Passenger Port*** Second modern passenger port with safe and efficient landing facilities. ***PPAP General Cargo Port*** Create efficient and competitive Port with modern well maintained cargo handling facilities. Phnom Penh - Private fuel transfer facilities Enhance safety. Rehabilitation of older ports to comply with contemporary cargo handling facilities. **Ho Chi Minh – Cai Mep** See ***"Transportation development plan for the Mekong Delta in Viet Nam"*** Port with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers. Ports to be compliant with the forecasted cargo and passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers • Security • Environmental	Port with adequate and well maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers. Ports to be compliant with the forecasted cargo and passenger throughput. Ports managed with a focus on: • Safety of both port users and port workers • Security • Environmental protection • Efficiency.

		protection • Efficiency.	
Regulatory Aspects	Regulated waterway under Agreement CA-VN but not yet implemented.	CA-VN Agreement implemented.	Comprehensive, fully harmonized and effectively implemented legal framework.
Environm. Aspects	Increased water pollution from IWT. Impacts of sand mining, dredging and solid wastes. Multimodal transport planning. Climate change threat and vulnerability (navigation clearance).	Standards and guidelines for sustainable navigation Integrating environmental protection in the IWT sector.	Sustainable 'green' navigation achieved to protect water quality, the environment, livelihoods and reduce carbon emissions. Climate mitigation plans for sea level rise and increased flooding.
Social Aspects	Local and passenger transport increasing.	Increased local passenger transport, cross-border and international cruises.	Inclusive development of rural inland navigation sector.

Stretch 14 Phnom Penh (NTC LM17) – Cai Mep by Mekong Mainstream (322 Km + 44 Km sea)

	Current Situation – Baseline Conditions (2015)	Short-Term Scenario (2020)	Long-Term Scenario (2040)
Fleet	IW Barges + Seagoing Vessels 2,000 DWT (tidal) No vessel classification. No government fleet policy.	IW Barges + Seagoing Vessels 2,000 DWT (tidal) Use of sea-river and estuary vessels examined. Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	IW Barges + Seagoing Vessels 2,000 DWT (tidal) National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	The Tien Estuary is a serious hindrance to big ships entering or leaving the estuary of the Mekong mainstream. Ships have to wait for the tidal window before	Apart from the same maintenance dredging problems mentioned above, the tidal window navigation remains the only way to reach the Cia Mep-Thi Vai	Same as short-term scenario.

	entering or leaving the Mekong (Tien).	seaports by open sea. The option to substantially dredge the sand bar in the Cua Tien is considered unsustainable.	
Navigation Safety	Dangerous goods waterway transport is not safe. Regulations for the safety of navigation, ships, crew, waterway environment, cargo and passengers in Cambodia: very limited regulation, only Circular 003/MPWT on the Management of Means of Water Transport. Viet Nam: extensive regulation, also missing regulations, implementation and law enforcement lacking. Limited AIS and VTS system in use in Cambodia and Viet Nam. Pilot project started in Viet Nam (MP) for compulsory use of AIS for vessels with DWT of 1,000 MT and more, and S1 vessels (allowed max. 12 NM from coast), from 2017-2020.	Increased safety of waterway transport, especially regarding safe transport of passengers and safe carriage and handling of dangerous goods and law enforcement by efficient waterway department, IWD in Cambodia and VIWA in Viet Nam. Contingency plan available and efficient emergency response and search and rescue units installed. Navigation safety improved by obligatory use of AIS and VHF.	Approved vessel construction standards are implemented. Well-designed, safely constructed and environmentally friendly inland waterway vessels according to fleet demands. Efficient, safe and smooth waterway transport and cargo flow monitoring and guidance with ENC, AIS, VTS and RIS installed. To optimize IWT and coastal transport, full AIS system, VTS and RIS in place.
Aids to Navigation	Day and night navigation. Waterway not fully fitted with navaids so efficiency and safety are still not good. Problem of theft of buoys and lanterns. Steel buoys too expensive for maintenance.	Day and night navigation. Navaids in Cambodia: Waterway better fitted with navaids but efficiency and safety still not perfect. Problem of theft of buoys and lanterns is less because of GSM modules in lanterns. Steel buoys slowly replaced by plastic to reduce costs. Navaids in Viet Nam: The whole Mekong	Navaids in Cambodia and Viet Nam fully fitted and safe for navigation day and night. All buoys are maintained according to standard, and monitored against theft, fitted with GSM and AIS locators. Note: a combination of plastic buoys and channel markers is used and virtual aids to navigation in line with

		River is fitted with buoys and lanterns, and beacons. Fitted with GSM and AIS locators.	ENCs.
Ports	See stretch 13	See stretch 13	See stretch 13
Regulatory Aspects	See stretch 13	See stretch 13	See stretch 13
Environment Aspects	See stretch 13	See stretch 13	See stretch 13
Social Aspects	See stretch 13	See stretch 13	See stretch 13

Stretch 15/1 Phnom Penh (NTC LM17) – Cai Mep by Mekong, Vam Nao, Bassac and Quan Chan Bo (315 Km + 118 Km sea)

	Current Situation – Baseline Conditions (2015)	Short-Term Scenario (2020)	Long-Term Scenario (2040)
Fleet	5,000 DWT possible but not done No vessel classification. No government fleet policy.	Sea-river barges and seagoing ships 5,000 DWT. Use of sea-river and estuary vessels examined and implemented. Vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	Sea-river barges and seagoing ships 10,000 DWT. National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	By Mekong mainstream, Vam Nao Pass, Bassac River and the Quan Chanh Bo Canal (which is almost completed but not yet operational: end of 2015). Not done due to longer distance and open sea travel to Cai Mep.	Same maintenance dredging works in Cambodia as for stretch 13 above. Some minor maintenance dredging in the Vam Nao pass as well.	Quan Chanh Bo canal fully completed and operational. Open sea transport only by reinforced sea-river barges. No further physical work envisaged.
Navigation Safety	Dangerous goods waterway transport is	Increased safety of waterway transport, especially regarding safe	To optimize waterway transport and coastal transport, full AIS

	not safe. Regulations for the safety of navigation, ships, crew, waterway environment, cargo and passengers in **Cambodia:** very limited regulation, only Circular 003/MPWT on the Management of Means of Water Transport. Viet Nam: extensive regulation, also missing regulations, implementation and law enforcement lacking. Limited AIS and VTS system in use in Cambodia and Viet Nam.	transport of passengers and safe carriage and handling of dangerous goods. Effective law enforcement by efficient waterway department, the IWD in Cambodia and VIWA in Viet Nam. Contingency plan available and efficient emergency response and search and rescue operations. Navigation safety improved by obligatory use of AIS and VHF.	system, VTS and RIS in place. Waterway maintenance plan in use.
Aids to Navigation	Day and night navigation. Waterway not fully fitted with navaids so efficiency and safety are still not good. Problem of theft of buoys and lanterns. Steel buoys too expensive for maintenance.	Day and night navigation. Navaids in Cambodia: Waterway better fitted with navaids but efficiency and safety still not perfect. Problem of theft of buoys and lanterns is less because of GSM modules in lanterns. Steel buoys slowly replaced by plastic to reduce costs. **Navaids in Viet Nam:** The whole Mekong River, Bassac River and the Cho Gao Canal are fitted with buoys and lanterns, and beacons. Fitted with GSM and AIS locators.	Navaids in Cambodia and Viet Nam fully fitted and safe for navigation day and night. All buoys are maintained according to standard, and monitored against theft, fitted with GSM and AIS locators. **Note:** a combination of plastic buoys and channel markers is used and virtual aids to navigation in line with ENCs.
Ports	See stretch 13 **Can Tho** Cargo handling berths for up to 10,000 DWT. Several Fuel transfer ports - condition	See stretch 13 **Can Tho** See ***"Transportation development plan for the Mekong Delta in Viet Nam".***	

	depends on the port.		
Regulatory Aspects	Transit route under Agreement CA-VN but not yet implemented.	CA-VN Agreement implemented.	Comprehensive and fully harmonized legal framework.
Environment Aspects	See stretch 13	See stretch 13	See stretch 13
Social Aspects	See stretch 13	See stretch 13	See stretch 13







Examples of reinforced sea-river barges

Stretch 15/2 Phnom Penh (PPAP NTC LM17) – Overseas by Mekong, Vam Nao, Bassac and Quan Chan Bo (to Singapore 315 Km + 1,013 Km sea / to Hong Kong 315 Km + 1,663 Km sea)

	Current Situation – Baseline Conditions (2015)	Short-Term Scenario (2020)	Long-Term Scenario (2040)
Fleet	5,000 DWT possible but not done No vessel classification. No government fleet policy.	Seagoing ships 5,000 DWT or 10,000 DWT from/to Can Tho with transshipment Standardized vessel classification system that is in harmony with the Vietnamese vessel classification system. Short-term government fleet policy promoting and facilitating IWT.	Seagoing ships 10,000 DWT National or regional vessel construction and shipyard government policy. Long-term government fleet policy promoting and facilitating IWT.
Waterway Design	By the Mekong Mainstream, Vam Nao Pass, Bassac River and Quang Chanh Bo Canal to the open sea.	Same minor maintenance dredging as for stretch 15.1 (Mekong mainstream in Cambodia and Vam Nao pass).	Same minor maintenance dredging as for stretch 15.1 (Mekong mainstream in Cambodia and Vam Nao pass).
Navigation Safety	According to national and IMO-adopted regulations.	Increased safety of navigation by use of AIS system, VTS and RIS. Efficient waterway maintenance plan and pilotage in use.	To optimize waterway transport and coastal transport, full AIS system, VTS and RIS in place. Waterway maintenance plan in use.
Aids To Navigation	See stretch 15/1	See stretch 15/1	See stretch 15/1
Ports	See stretches 13 and 15/1	See stretches 13 and 15/1	See stretches 13 and 15/1
Regulatory Aspects	Transit route under Agreement CA-VN but not yet implemented.	CA-VN Agreement implemented.	Comprehensive and fully harmonized legal framework.
Environment Aspects	See stretch 13	See stretch 13	See stretch 13
Social Aspects	See stretch 13	See stretch 13	See stretch 13

4.5 SHORT-TERM AND LONG-TERM DEVELOPMENT SCENARIO TO BE APPLIED FOR THE WHOLE MEKONG RIVER BASIN

4.5.1 Short-term (2020)

In order to manage and coordinate *The Implementation of the Master Plan for Regional Waterborne Transport in the Mekong River Basin*, a "Regional Mekong Navigation Center" should be established under the supervision of the Mekong River Commission and the National Mekong Committees.

Moreover, national, bilateral and regional IWT education and training actions should be implemented according to the "Training Plan to implement the Activities under the Navigation Programme".

National IWT data management and river information services and IWT promotion and marketing agencies should be established. Finally, to enhance cooperation between the Mekong Countries, opportunities for bilateral and/or regional cooperation on IWT data management and river information services, on IWT promotion and marketing and on hydrodynamic, sedimentological and navigation research should be studied.

4.5.2 Long-term (2040)

If the Master Plan leads to a navigable Mekong River from the Green Triangle to the Sea, a regional "Mekong River Navigation Commission" (eventually with the cooperation of PR China and Myanmar) should be established.

Furthermore, depending on the results of the short-term studies, a regional "Mekong River IWT Information Management Centre", a regional "Mekong River IWT Promotion and Marketing Agency" and a regional "Hydrodynamic and Nautical Research Centre" could be established.

4.6 CONCLUSIONS

"*The goal of the Master Plan for Regional Waterborne Transport in the Mekong River Basin is to increase waterborne transport in the MRB to at least 125% of the actual waterborne transport volume in 2020 and to at least 250% of the actual waterborne transport volume in 2040 and to make navigation safer and more sustainable for the people and for the environment."*

Fleet

In the short-term scenario no changes are proposed to the actual situation (with the assumption that the JCCCN plan to improve the navigation channel between the Golden Triangle and Luang Prabang will be postponed), except for the use of reinforced sea-river barges and seagoing ships for the Phnom Penh Mekong Mainstream and Phnom Penh – Bassac navigation to Cai Mep and overseas.

Moreover, it will be important to have a standardized vessel classification system developed and in use, in harmony with the existing Chinese vessel classification system for the Upper part of the Mekong Basin and with the recently drafted Viet Nam vessel classification system for the Lower part of the Mekong Basin.

Furthermore, to have an increased and more efficient use of the Mekong River, favourable conditions for IWT will have to be created. Therefore, the inland waterway transport sector should be promoted and facilitated by the government. The government needs to make a plan, including an ambitious short-term fleet policy on how to encourage stakeholders to use inland waterway transport and what strategy will be followed to reach sustainable development.

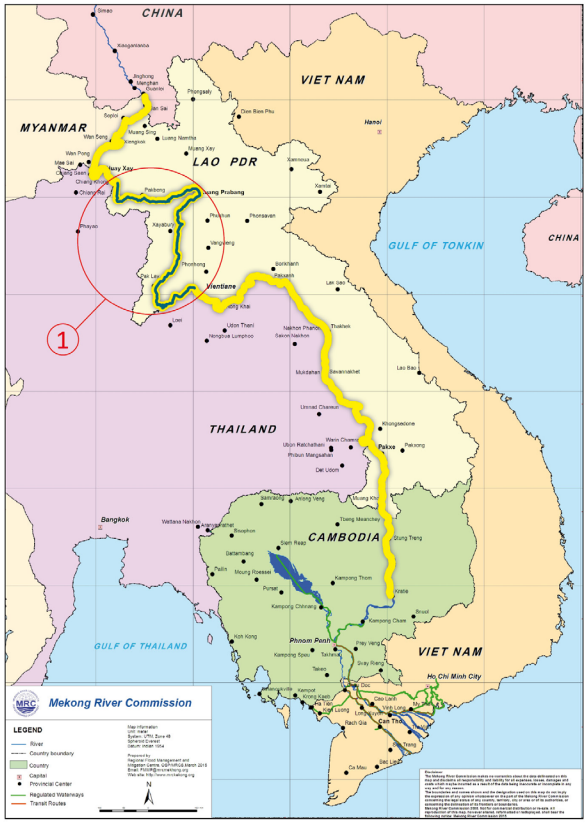
In the long-term scenario, creating a 500 DWT navigation between the Golden Triangle and Kratie (with the assumption that all dams between Huay Xay and Sanakham should be built) is proposed. However if one of the downstream dams (Ban Koum Dam, Latsua Dam, Don Sahong Dam, Stung Treng Dam and Sambor Dam) should not be built, then the actual situation between Savannakhet and Kratie should remain the same. From Kratie to Kompong Cham, 2,000 DWT navigation of seagoing vessels is proposed, and for the Kompong Cham – Phnom Penh stretch, 3,000 DWT navigation is proposed.

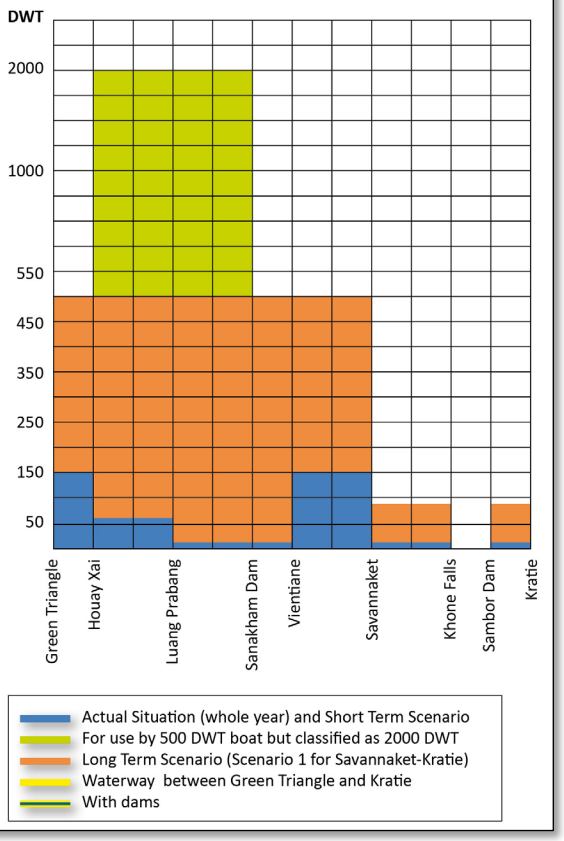
It should be noted that for the stretches, where the Mekong mainstream forms the borderline between Thailand and the Lao PDR, this development can only start when the official border demarcation between the two countries is finalized.

Also for the Phnom Penh – Kompong Chhnang – Chong Kneas stretch, in the long-term scenario, 500 DWT navigation is proposed. For the Phnom Penh – Ho Chi Minh – Cai Mep stretch and Phnom Penh – overseas navigation, it is strongly recommended to use reinforced sea-river barges and/or seagoing ships over the Bassac River and the Quang Chang Bo Canal.

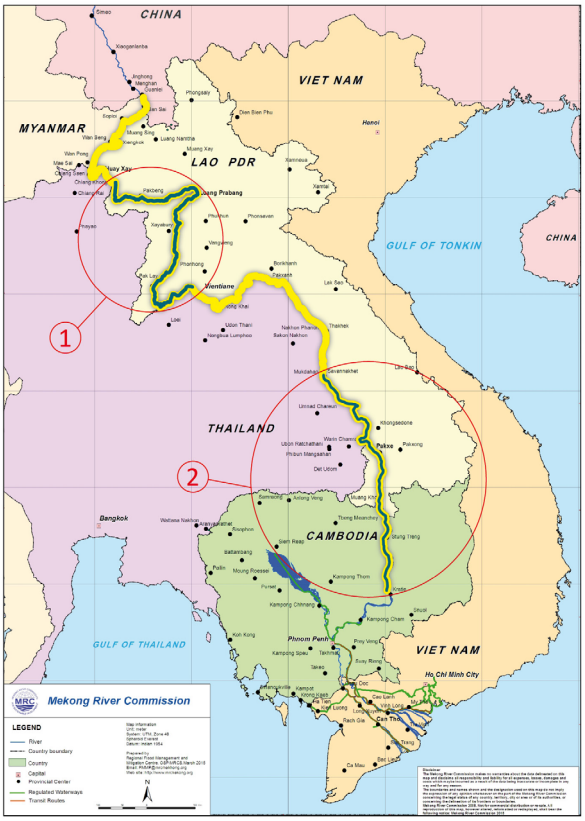
Moreover, the governments need to develop a policy to encourage new vessel construction according to approved vessel standards and requirements and to facilitate new and existing ship yards.

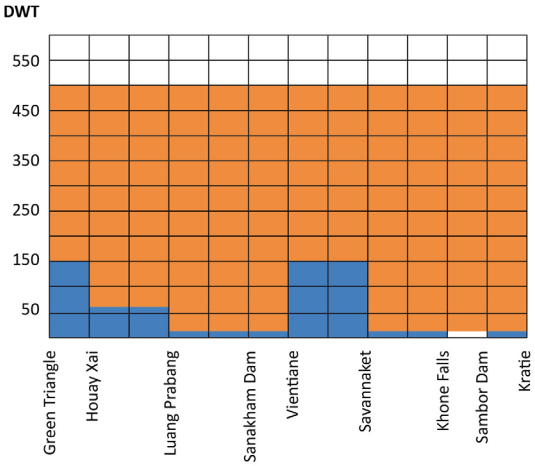
Development Scenario between Green Triangle and Kratie with one cascade of dams
(1) Dams between Pak Beng and Sanakham





Development Scenario between Green Triangle and Kratie with two cascades of dams
(1) Dams between Pak Beng and Sanakham and (2) Dams between Savannakhet and Kratie

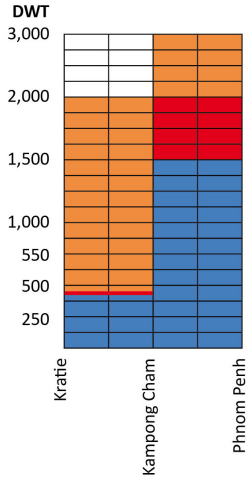


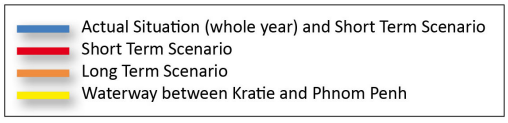




Development Scenario between Kratie and Phnom Penh

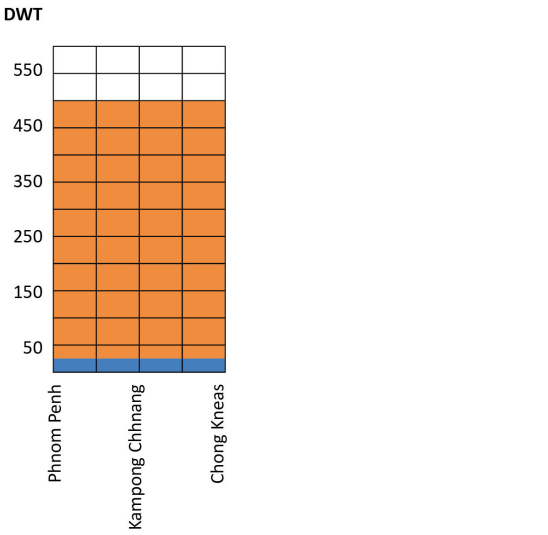






Development Scenario between Phnom Penh and Chong Kneas

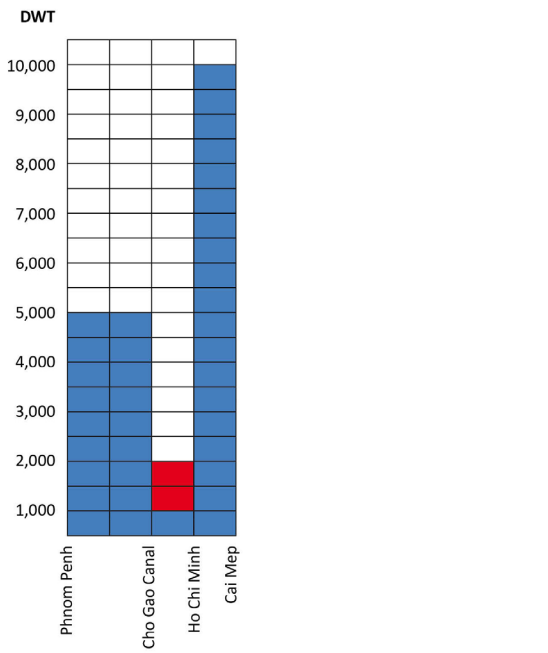




Actual Situation (whole year) and Short Term Scenario
Long Term Scenario
Waterway between Phnom Penh and Chong Kneas

Development Scenario between Phnom Penh and Cai Mep via Cho Gao canal

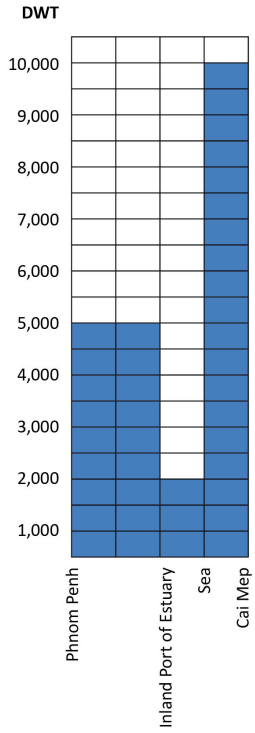




Actual Situation (whole year) and Short Term Scenario
Short Term Scenario
Waterway between Phnom Penh and Cai Mep via Chao Gao canal

Development Scenario between Phnom Penh and Cai Mep via estuary

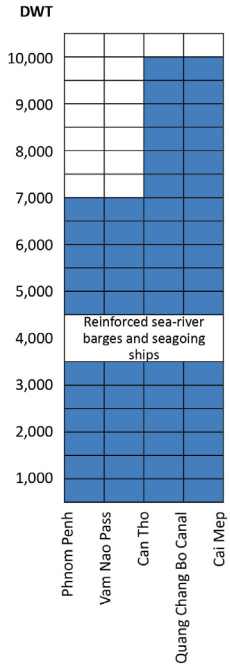




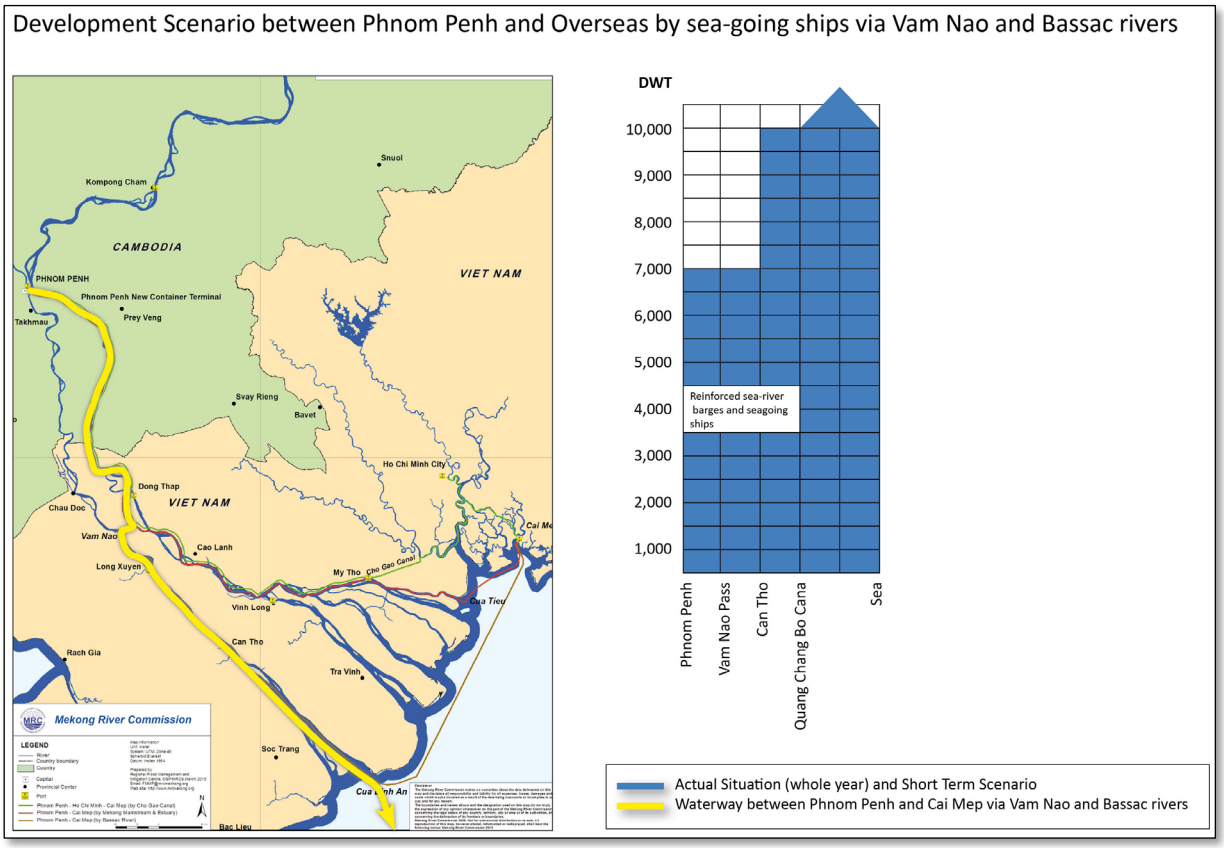
Actual Situation (whole year) and Short Term Scenario
Waterway between Phnom Penh and Cai Mep via estuary

Development Scenario between Phnom Penh and Cai Mep via Vam Nao and Bassac rivers





Actual Situation (whole year) and Short Term Scenario
Waterway between Phnom Penh and Cai Mep via Vam Nao and Bassac rivers



Waterway Design

In the short-term scenario, recent channel conditions for all dangerous areas should be collected (where not available) and channel design proposals made.

Regarding river design development scenarios, in light of the ongoing uncertainties of the hydropower dam constructions, it was agreed that for the short-term scenario no major physical work to the channel improvement should be carried out (except for the usual and ongoing river maintenance works such asdredging and bank protections, river groynes and construction of navigational aids).

In terms of river design, the short-term scenario would therefore mainly focus on things such as channel studies, clearance of rapids, reefs, shoals and rock outcrops, eliminating dangerous areas and sharp bends, studies of improved access channels to port and landing places, among others. These studies all have to be done in line with the principles of environmental protection and be in line with the outcome of environmental screenings and impact assessments.

For the long-term scenario, in the upper part of the Mekong River Basin, a navigation channel with LAD = 3 m and LAW = 60 m has to be created upstream Huay Xay, in some remaining “natural free-flow areas” downstream of the dams, and between the Sanakham Dam and Savannaketh.

Between Savannakhet and the Khone Falls, only in the long-term scenario 2, a navigation channel with LAD = 3 m and LAW = 60 m should be created in the Siphandon area.

It should be noted that for the stretches, where the Mekong mainstream forms the borderline between Thailand and the Lao PDR, all these developments can only start when the official border demarcation between the two countries is finalized.

For the Khone Falls, a bypass-canal of about 11 Km long with two or three ship locks of between 15 and 20 meter-level difference is proposed in long-term scenario 2.

Between the Khone Falls and Kratie, only in the long-term scenario 2, a navigation channel with LAD = 3 m and LAW = 60 m should be created in the free flow areas downstream of the Stung Treng and Sambor Dams.

Downstream between Kratie and Phnom Penh, extensive river works have to be carried out to reach a navigation channel for 2,000 DWT ships between Kratie and Kompong Cham and a navigation channel for 3,000 DWT ships between Kompong Cham and Phnom Penh.

At the Great Lake entrance in Chhnock Trou and in the lake, a navigation channel with LAD = 3 m and LAW = 60 m will be created to accommodate ships up to 500 DWT between Phnom Penh and Chong Kneas all year-round.

For the shortcut canals in the Mekong Delta, a World Bank project to improve navigability in these canals will be completed and for the Phnom Penh to Cai Mep navigation over the Bassac River, only some minor channel adaptations on the Mekong Mainstream between Phnom Penh and the Vam Nao Pass and in the Vam Nao Pass will be carried out.

Fleet and Navigation Safety

The short-term scenario should focus on the transport conditions of passengers and the carriage and handling of dangerous goods that are presently very unsafe for various reasons. Therefore priority should be to immediately increase safety and create acceptable living conditions for passengers and tourists on passenger vessels and safe carriage and handling of dangerous goods. The necessary law and regulations need to be implemented by the respective waterway department.

Furthermore, safety should be increased by the implementation of the Regional Action Plan on Dangerous Goods and the implementation of search and rescue units. In the lower part of the MRB (downstream of the Khone Falls) the obligatory use of AIS is proposed.

The long-term scenario should focus on increased safety, efficiency and protection of the environment by improving vessel design and construction and by the installation of VTS and RIS over the total length of the Mekong River.

Especially for the Mekong Delta (downstream of Phnom Penh), an efficient waterway maintenance plan and the use of an AIS system, VTS, RIS and pilotage should increase safety of navigation.

Aids to Navigation

In the short-term scenario, between the Green Triangle and Luang Prabang only daytime navigation will be possible but it will be safer and more efficient due to the introduction of a GPS navigation guided system and the rehabilitation of French markers. Between Luang Prabang and Kompong Cham, navigation will become easier because French markers are rehabilitated over the whole stretch and low water alert gauges are installed at critical places. Downstream of Kompong Cham to the sea, day and night navigation will be possible with installed buoys and beacons.

In both the short and long-term, marking of the highest flooded obstacles in the impounded sections upstream of the dams is a priority and should be done before impounding the reservoirs.

In the long-term scenario, between the Green Triangle and Kompong Cham, all commercial boats need compulsory GPS navigation guided systems except between Savannakhet and Kratie, where one of the downstream dams should not be build.

Floating visual aids can be reintroduced in the reservoirs upstream of the dams.

Downstream of Kompong Cham to the sea and from Phnom Penh to Chong Kneas, further installation of visual aids to navigation, fitted with GMS and AIS locators and virtual aids to navigation in line with ENCs should be introduced.

Ports

In the short-term scenario, focusing on to the rehabilitation and construction of new, safe and efficient passenger ports over the total length of the Mekong River is proposed. The infrastructure of these ports should be compliant with the forecasted passenger throughput and should be managed with a focus on the safety of both port users and port workers, security, the environment and efficiency.

In the long-term scenario, a focus on the development of ports with adequate and well-maintained infrastructure for the efficient and safe handling, storage and transfer of both cargo (including dangerous goods where applicable) and passengers, is proposed. The infrastructure of these ports should be compliant with the forecasted passenger and cargo throughput and should be managed with a focus on the safety of both port users and port workers, security, the environment and efficiency. The improvement of hinterland connections should be taken into consideration when new facilities are constructed.

Moreover, the proposed outstanding actions of the *"Master Plan for Waterborne Transport on the Mekong River System in Cambodia (2006)"* should be executed. Kompong Cham: New passenger port infrastructure (floating pontoon) and new general cargo infrastructure (ramp) at the right bank of the river. Construction of an oil distribution facility and development of a container facility at the left bank of the river; Kompong Chhnang: New passenger port infrastructure (floating pontoon); Chong Kneas: Development and construction of a new port with a cargo terminal, a fish market, a passenger terminal and a bunkering jetty.

Legal Aspects

For the short-term scenario, the harmonized rules adopted under the "Agreement on Commercial Navigation on the Lancang-Mekong River among the Governments of the People's Republic of China, the Lao People's Democratic Republic, the Union of Myanmar and the Kingdom of Thailand" and under the "Agreement between the Royal Government of Cambodia and the Government of the Socialist Republic of Viet Nam on Waterway Transportation" should be fully implemented.

Common safety rules should be adopted and implemented by Lao PDR and Thailand and by Cambodia and Viet Nam.

For the long-term scenario, a comprehensive, fully harmonized and effectively implemented legal framework is necessary.

Environmental Aspects

For the short-term scenario, SEA/integrated planning is needed for IWT sector strategies and plans and EIAs are needed for specific port and terminal constructions and waterway improvement projects. Standards and guidelines should be drafted for environmental assessment in order to achieve sustainable navigation. Ecoregions, protected areas, fisheries conservation zones, socio-economic conditions and important wetlands should be included in assessments for specific stretches.

The increased environmental impact from inland waterway transport (water pollution and air emissions) requires urgent attention to reduce water pollution. The implementation of a DEMP for navigation dredging and EIAs for sand mining are required.

The conservation of fishing zones, wetlands and flooded forest on the Tonle Sap Lake requires special consideration.

For the long-term scenario, SEA, EIAs and EMP and monitoring needs to be incorporated into integrated planning for the IWT sector. Meanwhile, energy efficient vessels, pollution control and environmental monitoring are needed for sustainable inland waterway navigation. DEMP must be implemented for all modification and maintenance of waterways.

Increased conservation in National Protected Areas (NPAs) to restore social and natural conditions is needed. Zones could be developed to restrict the transport of dangerous goods, dredging, rock trimming and other navigation activities in specific stretches to enhance environmental protection.

Sustainable 'green' navigation has to be achieved in order to protect water quality, the environment, livelihoods and to reduce carbon emissions.

Climate Change adaptation plans for sea level rise and increased flooding have to be in place in order to protect IWT infrastructure and IWT vessels. This can be incorporated into contingency planning for flooding.

Social Aspects

For the short-term scenario, socio-economic risks and opportunities have to be integrated into the EIAs. Planning for linking local IWT with domestic and cross-border transport is required.

A socio-economic survey to determine future risks and opportunities for rural/domestic IWT should be completed.

For the long-term scenario, the development of rural/domestic cargo and passenger transport should be fully integrated and IWT should be also integrated with hydropower, agricultural, mining, industrial and other sectors.

Landing facilities will be installed at priority locations to link local transport and eco-tourism with national ports.

Education, Training and Institutional Aspects

For the shor-term scenario, national, bilateral and regional IWT education and training actions should be planned and implemented.

A regional "Mekong River Navigation Commission" to coordinate the implementation of the actions of the Master Plan and national IWT data management and river information services and IWT promotion and marketing agencies should be established.

Finally, the need and scope of bilateral and/or regional cooperation on IWT data management and river information services, of bilateral and/or regional cooperation on IWT promotion and marketing and of regional cooperation on hydrodynamic and nautical research should be studied.

For the long-term scenario, depending on the results of the short-term studies, a regional "Mekong River Navigation Commission", bilateral or a regional "Mekong River IWT Information Management Centre" and "River Information Services", bilateral or a regional "Mekong River IWT Promotion and Marketing Agency" and a regional "Hydrodynamic and Nautical Research Centre" could be established.

5 ACTION PLAN & INVESTMENT PROGRAM

5.1 ACTION PLAN

For the long term actions it has to be repeated that in the long term scenario 1 when one of the five downstream dams on the Mekong Mainstream should not be built, 500 DWT navigation should be possible between the Green Triangle and Savannakhet with no navigation over the Khone Falls and that in the long term scenario 2 with all five downstream dams on the Mekong Mainstream built, 500 DWT navigation should be possible between the Green Triangle and Kratie with a bypass canal with locks at the Khone Falls.

5.1.1 Fleet actions

Short-Term Fleet Actions (2016-2020)

SFL1: Standardize the vessel classification in harmony with all the Greater Mekong River States

This involves the study of the present fleet and fleet forecasts regarding type, number, dimensions and capacity. For the Upper part of the Mekong Basin, the Chinese and Myanmar vessel classification system should be taken into account. Meanwhile for the Lower part of the Mekong Basin, the draft version of the new Viet Nam vessel classification system, together with the study by the Cambodia Navigation Coordination Committee (MPWT): "Calibrating the Navigable Waterways of the Mekong River System into a Classification Standard" and the proposed "Mekong Vessel Classification" (May 2009, MPWT), should be taken into account.

SFL2: Conduct a Feasibility Study on the use of reinforced sea-river barges in the Lower part of the Mekong Basin, in particular for regional and coastal trade

This involves the Phnom Penh Mekong Mainstream and Phnom Penh – Bassac navigation to Cai Mep. Sea-river vessels have important advantages as they can be used on inland waterways (bridge and mast can be lowered) as well as on sea stretches with restrictions for wind force and wave height. The present use of the sea-river vessels or estuary vessels for the transport between Zeebrugge and Antwerp over sea and river stretch is fully regulated (Belgian law) and can serve as reference and example.

SFL3: Develop a short-term and long-term fleet policy

The government should introduce a policy on how to promote and how to modernise the national inland navigation fleet by measures such as tax advantages, subsidy of IWT, and scrapping subsidies. To increase the use of IWT, the government should facilitate IWT and promote the sector. If not, undercapitalization by private companies, combined with insufficient investment and neglected maintenance, will contribute to the deterioration of the inland navigation fleet. The market needs special attention from governments and special financing solutions.

SFL4: Implement the Fleet Projects of the Regional Action Plan for Sustainable Transport of Dangerous Goods along the Mekong River

For vessels that carry dangerous goods (a number of the projects are also applicable for other vessels), this involves the implementation of five projects, two national and three with cross-border impact:

- Implementation of the IMDG Code and provision of MSDS for Inland Waterway Vessels;

- Emergency Response on Board Vessels;
- Mekong Tanker Safety Management;
- Minimum Standards for Vessels Design, Construction and Equipment;
- Safe Manning on Inland Waterway Vessels.

Long-Term Fleet Actions (2021-2040)

LFL1: The government develops a national or regional ship construction and ship yard policy.

The government policy should facilitate and promote ship construction, such as developing shipyards and financial incentives for ship construction. The purpose is to bring into line vessel standards across member states, improve safety and facilitate free movement and competition. The government should provide codes, best practice guides, standards and classifications that vessel owners, operators, designers and builders should refer to. As in Thailand, the government gives financial support to the inland waterway sector by reducing taxes on vessel equipment such as main engine and navigation equipment.

LFL2: Implement standards for construction of new vessels.

Construction of vessels should be done according to approved standards and the designed DWT of the river stretch (vessel and channel classification), and taking into account restrictions such as the LAD (Least Available Depth), lock dimensions, bridge clearances and port limitations.

5.1.2 Waterway Design Actions

Short-Term Waterway Design Actions (2016-2020)

SWD1: Perform condition survey of the dangerous areas for navigation between the Green Triangle and Huay Xay and between Sanakham and Kratie to have recent information on the needed optimization works.

The stretch between the Golden Triangle and Huay Xay and the stretch downstream of Sanakham are not impounded stretches (until the planned dams at Ban Khoum and Latsua are constructed).

Pakxe is situated between the two planned dams of Ban Khoum and Latsua. Navigation upstream of Kratie depends on the hydropower schemes and the economic development of navigation.

Between Huay Xay and Savannakhet, some of the rapids and dangerous areas have already been condition surveyed and channel design projects have been made.

SWD2: Standardize the waterway classification in harmony with the Chinese waterway classification in the Upper part of the Mekong Basin related to modern shipping.

SWD3: Standardize the waterway classification in harmony with the Vietnamese waterway classification in the Lower part of the Mekong Basin related to modern shipping.

SWD4: Design river training works at the Sdao Canal in Cambodia.

The Sdao canal in Cambodia at Km 385 is a continuous nightmare for shipping. The more the canal is dredged, the more it is silted up.

SWD5: Carry out experimental test dredging in the Tonle Sap and the Great Lake.

Experimental test dredging and deposition test should be carried out, including a couple of trapping observations by placing special collector tubes to study the bed-load movement of the Great Lake.

Long-Term Waterway Design Actions (2021-2040)

LWD1: Provide the Mekong River with a minimum 500 DWT navigation channel between the Green Triangle and Vientiane through dredging and/or excavating:

(1) Between the Green Triangle and Huay Xay;

(2) In the free flow section upstream of the Pak Beng hydropower dam;

(3) In the free flow section upstream of the Luang Prabang dam;

(4) In the free flow section upstream of the Xayabury dam;

(5) In the free flow section upstream of the Paklay hydropower dam;

(6) In the free flow section upstream of the Sanakham hydropower dam;

(7) In the section between the Sanakham hydropower dam and Vientiane.

Each waterway improvement should correspond to the design study, which has been made after the condition survey and is in line with the recommendations from the environmental screening.

LWD2: Improve and clear the navigation channel of the rapids in the Vientiane – Savannakhet stretch (Keng Sam Hong at Km 1,288, Keng Muoang at Km 1,214, Keng Ka Phouang at Km 1,156 and Keng Ka Bao at Km 1,151).

These rapids and dangerous areas are situated in the stretch Vientiane – Savannakhet.

LWD3: (Scenario 2) Improve and clear the navigation channel of rapids and dangerous areas between Savannakhet and the Khone Falls through excavation, dredging, rock trimming, removal of scattered rock outcrops, bedrock deepening and/or river training works, among others.

This stretch contains 77 known rapids and dangerous areas from which only three have been condition surveyed.

LWD4: (Scenario 2) Construct an 11 km long bypass canal around the Khone Falls, including bank protection and two or three ship locks with dimensions of the lock chamber 120 x 12 x 4.00 meters.

From this project, it is recommended to make a “turn-key” project which should also include all the studies required for implementation.

LWD5: (Scenario 2) Improve the navigation channel between the Khone Falls and Kratie by dredging, rock excavation and bedrock deepening, clearance of reefs and rock outcrops, and river training works like groynes and overflow dikes.

The project heavily depends on the decision to construct the hydropower dams at Sambor and/or Stung Treng. Without this decision, no further useful or practicable planning for waterway improvement can be made.

LWD6: Improve the navigation channel between Kratie and Kompong Cham up to 2,000 DWT through dredging and excavation including eventual river training works.

This particular stretch has a navigation potential well identified by the KOICA project, which aims to dredge a channel between the new container terminal of the Phnom Penh port and Kratie.

LWD7: Improve the navigation channel for sea going vessels up to 3,000 DWT between Kompong Cham and the New Container Port of Phnom Penh, by dredging and river training works.

Since maintenance dredging has resumed in this stretch, sea-going vessels can again sail up the river to Kompong Cham (Tonle Bet). The KOICA project and the Port of Phnom Penh only

dredge for the Sdao Canal, even though river training works have been suggested but never been envisaged.

LWD8: Improve the navigation channel for vessels up to 500 DWT all year round between Phnom Penh (Chaktomuk) and Chong Kneas (Siem Reap) by dredging the Tonle Sap.

The project foresees a channel to be dredged in the Great Lake with a bottom width of 30 meters, slopes of 1/10 and an average depth to be dredged of 1.3 meters.

LWD9: Improve the navigation channel between the New Container Port of Phnom Penh and Ho Chi Minh City/Cai Mep ports for self-propelled barges of 3,000 DWT via the Cho Gao canal.

The World Bank has a project (WB 5 project) of approximately 200 million US$ for the upgrading of two canals in the Mekong Delta.

LWD10: Improve the navigation channel for sea going vessels 10,000 DWT between the New Container Port of Phnom Penh and the Quang Chanh Bo Canal.

The project will require some dredging in the Vam Nao pass and in the Mekong mainstream in Cambodia.

LWD11: Conduct a morphology study producing feasible proposals for river training works in the areas between Phnom Penh and the sea to reduce yearly maintenance dredging in order to keep the required water depths for sea going vessels.

Having bigger ships enter the Mekong mainstream or the Bassac and the Vam Nao pass will definitely require yearly maintenance dredging, which in some places may incur in cost overruns. Cheaper solutions exist to keep certain water depths in case the river has sufficient scouring effect.

5.1.3 Navigation Safety Actions

Short-Term Navigation Safety Actions (2016-2020)

SNS1: Introduce a vessel inspection system for the waterway authority.

This should be according to national and adopted regional and bilateral regional agreements and safe working practices. Vessels need to be inspected at random and at regular intervals with a focus on the condition of the vessel in terms of safety for passengers, crew and cargo. This will allow the vessel to keep its certified registration and operational license.

SNS2: Establish a framework for reporting marine accidents in the respective MRC member countries.

Useable accident statistics are only recently available, and not reliable. Given the lack of safety awareness and absence of a regulated safety regime, many more accidents occur and are not reported. A framework is needed for a national, standardized maritime accident reporting and investigation system to allow the government to determine causes, responsibilities, costs and trends and make decisions regarding educational, regulatory and enforcement actions.

SNS3: Develop a contingency plan for efficient accident response.

Developing a contingency plan involves making decisions in advance about the management of human and financial resources, coordination and communications procedures, and being aware of a range of technical and logistical responses and restrictions.

This involves procedures for accident reporting, the establishment of a response team and defining the roles and responsibilities in the response system. This includes planning and coordinating responses, providing guidance to regional or local response teams, coordinating

a national program of preparedness planning and response, and facilitating research to improve response activities.

SNS4: Implement search and rescue units on the Mekong River, which are prepared for vessel emergencies such as collision, grounding, sinking, fire and explosion and oil and chemical spills.

Regional agreements and national regulations in MRC member countries require an emergency response and search and rescue committee (such as the National Committee for Disaster Management (NCDM) in Cambodia). However, the practical implementation of these units is lacking and a strengthening program needs to be made in order to establish units with trained and qualified staff and with necessary equipment.

SNS5: Introduce general safety booklets that give a comprehensive explanation of safety issues and safe working practices and special safety booklets on-board inland waterway vessels that carry dangerous goods to enhance the crew's awareness of the risks of carriage and handling dangerous goods and to introduce safe working practices.

This involves the preparation and dissemination of booklets that highlight the key areas where accidents arise and to draw attention to safe routines and procedures, refresh minds and improve the safety awareness presented in a way that is easy to understand.

Start awareness campaign for operators and captains of passenger vessels regarding the minimum safety requirements and emergency procedures.

This involves the waterway authorities contacting vessel associations, boat owners and captains to inform them about recent accidents, the consequences, minimum safety requirements and best-known safety practices.

SNS6: Introduce the obligation of AIS and radio communication (VHF) in the whole MRB for registered inland waterway vessels.

This involves the installation of AIS equipment on registered vessels and the further development of the existing VTS in Cambodia and Viet Nam to monitor vessel location and movement for traffic management, collision avoidance, and other safety applications. This is also included in the Master Plan of Viet Nam as it will be obligatory for vessels with DWT of 1,000 MT or more, and SI vessels (allowed maximum 12 NM from the coast) from 2017-2020.

SNS7 Immediate improvement of passenger safety on the passenger boats between Huay Xay and Luang Prabang.

Long-Term Navigation Safety Actions (2021-2040)

LNS1: Develop Electronic Navigation Charts (ENC) for the whole Mekong River.

This involves the hydrographic office making vector charts with digitized data that records all the charted features necessary for safe navigation such as riverside, bathymetry, buoys and lights.

LNS2: Implement River Information Services (RIS) over the total length of the Mekong River.

This involves information technology (IT) related services designed to optimise traffic and transport processes in inland navigation, i.e. to enhance a swift electronic data transfer between water and shore through in-advance and real-time exchange of information.

5.1.4 Aids to Navigation Actions

Short-Term Aids to Navigation Actions (2016-2020)

SAN1: Reconstruct and rehabilitate the old concrete French markers (priority from Huay Xay to Luang Prabang).

Many of the old French concrete markers are badly damaged, collapsed or broken. A great number of them are an obstacle during the high water season or cannot sustain the impact of floating debris such as logs or fallen trees.

SAN2: Construct and install clearly visible low water alert gauges in all remaining important places for navigation along the Mekong to indicate the water levels above the local chart datum.

These constructions should be clearly visible from the middle of the channel and constructed near shallow areas where groundings are occurring frequently. The locations have to be indicated by the MRC. In 2015 the Thai Marine Department will conduct a Feasibility Study on AIS, Radio Communication and Low Water Alert Systems. The results of the study will be used to select the locations.

SAN3: Develop and Install a GPS Navigation Guidance System, compulsory for all boats carrying cargo and passengers along the Mekong River between the Green Triangle and Huay Xay.

This involves multi-beam echo sounding, charting, identifying the Optimal Navigation Route, training and installation, initiating new law, and law enforcement, plus repairing the French markers downstream of Xayabury. In addition, there will be buoys and beacons marking the access to the ship's locks at the hydropower dams but these are the responsibility of the dam developers.

SAN4: Improve the existing GPS Navigation Guidance System and make it compulsory for all boats carrying cargo and passengers along the Mekong River between Huay Xay and Luang Prabang.
This involves updating echo sounding and charting, initiating a new law, and law enforcement. Repairing the French markers needs to be done.

SAN5: Install Lights, Marks and Air Clearance at all Mekong, Bassac and Tonle Sap bridges crossing the river.

SAN6: Upgrade the Existing Aids to Navigation System along the Mekong River between Kompong Cham and the Entrance (Estuary) to the Mekong River.

This involves making a comprehensive Channel Marking Design, preparing the tendering process, conducting procurement, fitting and installing the Navaids, and conducting training. The World Bank will procure and install the Aids to Navigation in the Cho Gao Canal.

SAN7: Upgrade the Existing Aids to Navigation System along the Vam Nao Pass and the Bassac River between the East Entrance of the Vam Nao Pass and the Entrance to the Quan Chan Bo Canal.

This involves making a comprehensive Channel Marking Design, preparing the tendering process, conducting procurement, fitting and installing the Navaids, and training.

Long-Term Aids to Navigation Actions (2021-2040)

LAN1: (Scenario 1) Develop and install the GPS Navigation Guidance System and make it compulsory for all commercial boats carrying cargo and/or passengers along the Mekong River between Luang Prabang and Savannakhet to carry it.

This involves updating echo sounding and charting, initiating a new law, and law enforcement.

In addition, and when and where applicable, there will be buoys and beacons marking the access to the ship's locks but these are the responsibility of the dam developers.

LAN2: (Scenario 2) Develop and install the GPS Navigation Guidance System and make it compulsory for all commercial boats carrying cargo and/or passengers along the Mekong River between Luang Prabang and Kratie to carry it.

This involves updating echo sounding and charting, initiating a new law, and law enforcement.

In addition, there will be buoys and beacons marking the access to the ship's locks but these are the responsibility of the dam developers.

LAN3: Develop and Install a GPS Navigation Guidance System, compulsory for all boats carrying cargo and passengers along the Tonle Sap River and Lake.

This involves multibeam echo sounding, charting, identifying the Optimal Navigation Route, training and installation, initiating a new law, and law enforcement.

LAN4: Install buoys and beacons between Kratie and Kompong Cham for day and night navigation.

LAN5: Monitor and Maintain the Aids to Navigation System along the Mekong River between Kompong Cham and the Entrance (estuary) to the Mekong River, including the Cho Gao Canal, between 2020 and 2040.

LAN6: Monitor and Maintain the Aids to Navigation System along the Mekong River, the Vam Nao Pass and the Bassac River between Phnom Penh and the Entrance to the Quan Chan Bo Canal between 2020 and 2040.

5.1.5 Port Development Actions

Short-Term Port Development Actions (2016-2020)

SPD1: Develop general arrangements concerning the creation of landing sites and the rehabilitation and maintenance system for both cargo and passenger ports.

Some ports have been constructed and operated for a long time without no or limited maintenance. In some cases equipment maintenance in ports only takes place when equipment has broken down (breakdown maintenance). Preparation and implementation of a good maintenance policy/program will increase the integrity and reliability of the equipment, reduce unplanned breakdowns of equipment and reduce maintenance costs. Furthermore, it will extend the lifespan of the equipment and result in higher productivity and increased safety levels.

SPD2: Develop general arrangements for a minimum port Health, Safety and Environmental (HSE) Management System for all passenger and cargo ports specific for the Mekong River ports (see DG RAP Project 8).

Cargo and passenger ports should prepare a Safety, Health and Environmental Management System specific to each port in order to build a culture that promotes safety, health and environmental protection as well as reducing accidents and operating costs and improving community relations. This will results in the ports being recognized as safe and efficient. This should include a checklist, drafted according national legislation and which can be used as a guiding tool for the competent authority to verify if ports comply with applicable legislation.

SPD3: Implement the "Regional Action Plan for Sustainable Transport of Dangerous Goods along the Mekong River 2015-2020" for ports handling dangerous goods (see DG RAP Projects 6, 7, 9, 10 and 11).

THE “Regional Action Plan for Sustainable Transport of Dangerous Goods along the Mekong River” consists of national and cross-border project documents that serve as a basis to reduce the risks of accidents, spillages and pollution and enhance emergency response and regional coordination. For ports there are three national project documents, one with cross-border impact:

- Standards for the Planning, Design and Construction of Ports and Terminals;
- Maintenance, Inspection and Testing of Critical Equipment;
- Port Safety Health and Environmental Management System (PSHEMS);
- Emergency and Oil Spill Response in Ports and Terminals.

SPD4: Rehabilitate, extend and/or reconfigure the existing passenger ports and landing facilities in Chiang Saen Port, Haciang Commercial Port (passengers going to Ban Khouane) and Phnom Penh Passenger Port in order to increase the capacity of the passenger ports and to allow for more efficient and safe embarking and disembarking of the passengers.

Existing passenger ports are currently not always provided with proper landing facilities and infrastructure for passengers, or they are not adjusted to the current and forecasted passenger volumes. Emphasis should be on the safe landing of passengers, sufficient quay capacity, parking facilities in the area, luggage handling facilities, security, immigration and customs facilities and waste disposal facilities.

SPD5: Construct new passenger ports and landing facilities in Ban Sai Port, Muong Mom Port (Ban Mom) and Ban Khouane, Huay Xay, Pak Beng and Luang Prabang, Kratie, Kompong Cham, Kompong Chhnang and Chong Kneas suitable to handle the forecasted passenger volumes. These ports should be constructed for efficient and safe processing of passengers.

The new ports should be developed with an emphasis on the safe landing of passengers, sufficient quay capacity, parking facilities in the area, luggage handling facilities, security, immigration and customs facilities and waste disposal facilities.

SPD 6: Construct new port infrastructure for cargo ports with proper berthing and cargo handling facilities in Xieng kok, Pak Beng, Luang Prabang. The new cargo ports should be located in order to assure good hinterland connection (road and rail) - Two fully equipped vertical 500 DWT berths and one sloping ramp berth.

These new ports should be developed with an emphasis on the safe and efficient handling of the anticipated cargo and volumes. The ports should be suitable to handle the forecasted cargo volumes and be equipped with proper cargo handling facilities, sufficient quay capacity, cargo storage area, container yard, parking facilities, security, immigration and customs facilities, office space, necessary IT equipment and waste disposal facilities.

SPD7: Establish standards on petrochemical transfer ports (both public and private) in Lao PDR, Thailand and Cambodia and organize an international audit for the existing petrochemical transfer ports in order to create safe processing and storage of fuel.

Some (private) fuel transfer facilities are currently substandard and are operating with an increased risk for accidents and damage to the environment. These facilities require urgent rehabilitation.

SPD8: Expand the existing container yard at New Phnom Penh Container Terminal – NCT LM 17 in order to accommodate forecasted container traffic.

Current capacity of 140,000 TUE will not be sufficient to handle the forecasted container traffic. The container yard needs to be expanded in order to be able to handle the forecasted container traffic.

SPD9: Rehabilitate the existing petrochemical transfer ports in Viet Nam according to the Vietnamese Master Plans.

Viet Nam has many fuel transfer ports. The condition of these ports depends on the owner/operator. Substandard facilities should be identified and rehabilitated.

Reference: *"Master* plan *for Viet Nam Inland Waterway Sector to 2020 and Orientation to 2030"*.

SPD10: Rehabilitate the existing cargo ports in Viet Nam according to the Vietnamese Master Plans.

Viet Nam has many (often small) cargo ports. The condition of these ports depends on the owner/operator. Substandard facilities should be identified and rehabilitated.

Reference: "*Master plan for Viet Nam Inland Waterway Sector to 2020 and Orientation to 2030*".

SPD11: Update and amend the *"Master plan for Viet Nam Inland Waterway Sector to 2020 and Orientation to 2030"*.

Viet Nam has requested the MRC's assistance to update the "Master Plan for Viet Nam Inland Waterway Sector to 2020 andOorientation to 2030" for the ports that are under the agreement between Cambodia and Viet Nam (currently 40 Vietnamese ports are part of the agreement).

Reference: *"Master plan for Viet Nam Inland Waterway Sector to 2020 and Orientation to 2030" and "Decision No.* 1071*/QD-BGTVT dated 24/4/2013 of Ministry of Transport approved the amendment Inland waterway development master plan to 2020 and vision to 2030".*

Long-Term Port Development Actions (2021-2040)

LPD1: Develop a port strategy and policy and see where there would be an opportunity to create a Port Authority.

The governments should recognize the critical national importance of their port gateways and supply chains. They should identify the key issues and risks facing their port sectors and supply chains such as the impact of larger ships, requirements to expand capacity to meet future growth, the need to increase efficiency and competitiveness and the need for intermodal hubs to be developed. In response to these issues, governments should take a pro-active role in setting objectives, mitigating risks, and providing certainty and guidance for investments through the formulation of strategies or policy documents for ports and/or freight.

LPD2: Construct new passenger ports and landing facilities in Pak Lay, Vientiane Capital City (Laksi* Port*), Nakhon Phanon, Savannakhet and Pakxe suitable to handle the forecasted* passenger *volumes. These ports should be constructed for efficient and safe processing of the passengers.

The new ports should be developed with an emphasis on the safe landing of passengers, sufficient quay capacity, parking facilities in the area, luggage handling facilities, security, immigration and customs facilities and waste disposal facilities.

LPD3: Construct new port infrastructure for cargo ports with proper berthing and cargo handling facilities in Ton Pheung, Haciang Commercial Port (private port), Pak Lay, Vientiane, Nakhom Phanom, Savannakhet, Pakxe (only scenario 2) and Stung Treng (only scenario 2). The new cargo ports should be located in order to assure good hinterland connection (road and rail) - Two fully equipped vertical 500 DWT berths and one sloping ramp berth.

These new ports should be developed with an emphasis on the safe and efficient handling of the anticipated cargo and volumes. The ports should be suitable to handle the forecasted cargo volumes and be equipped with proper cargo handling facilities, sufficient quay capacity, cargo storage area, container yard, parking facilities, security, immigration and customs facilities, office space, necessary IT equipment and waste disposal facilities.

LPD4: Analyse/study what ports are suitable to handle containers in the Green Triangle to Savannakhet stretch and determine which ports need extra infrastructure to handle containers.

LPD5: Expand the existing container yard at the New Phnom Penh Container Terminal – NCT LM 17 in order to accommodate forecasted container traffic.

Current capacity of 140,000 TEU will not be sufficient to handle the forecasted container traffic. The container yard needs to be expanded in order to be able to handle the forecasted container traffic (forecasted TEU throughput 2040 about 700,000 TEU).

LPD6: Develop a cargo port in Kratie able to accommodate two seagoing barges up to 2,000 DWT suitable to handle the forecasted cargo volumes on an efficient and safe way.

At present this port is basic with insufficient landing facilities and almost no proper cargo handling facilities. The cargo port should be able to accommodate two vessels of 2,000 DWT and consist of an office building, parking lot, warehouse, open storage yard and a silo.

Reference: "Master *Plan for Waterborne Transport on the Mekong River system in Cambodia 2006*" Action B10: Kratie Port Development.

LPD7: Develop a cargo port in Kompong Cham (Tonle Bet) with vertical quays, able to accommodate two seagoing vessels up to 3,000 DWT (containers and general cargo), a domestic general cargo port for inland barges (ramp) and an oil distribution facility (jetty) suitable to handle the forecasted cargo volumes in an efficient and safe manner.

At present this port is basic with insufficient landing facilities and almost no proper cargo handling facilities.

The international cargo port should be able to accommodate two vessels of 3,000 *DWT (cfr. KOICA plan)* and consists of an office building, parking lot, warehouse, open storage yard and a silo.

The domestic cargo port and the oil distribution facility should be developed according to the Cambodian Master Plan.

Reference: *"Master Plan for Waterborne Transport on the Mekong River system in Cambodia 2006"* Action B9: Kompong Cham Port development

LPD8: Develop a cargo port in Kompong Chhnang able to accommodate vessels of up to 500 DWT suitable to handle the forecasted cargo volumes in an efficient and safe manner.

Currently this port is basic with insufficient landing facilities and almost no proper cargo handling facilities.

The cargo port should be able to accommodate two vessels of 500 DWT and consist of an office building, parking lot, warehouse, open storage yard and a silo.

Reference: "*Master Plan for Waterborne Transport on the Mekong River system in Cambodia 2006*" Action B8: Kompong Chhnang Port Development.

LPD9: Construct a new port in Chong Kneas. The port should have a new passenger terminal, cargo terminal, fish market and a bunkering jetty.

The port is currently in concession. However, the concession will terminate in the near future.

Reference: "*Master Plan* for *Waterborne Transport on the Mekong River system in Cambodia 2006*" Action A15: Upgraded passenger facilities at Chong Kneas Port and Action A16: Development of Chong Kneas Port facilities.

5.1.6 Regulatory Actions

Short-Term Regulatory Actions (2016-2020)

SRE1: Implement the Cambodian-Vietnamese Agreement on Waterway Transportation.

A number of actions need to be undertaken to effectively implement the Agreement between Cambodia and Viet Nam on Waterway Transportation, which was signed in 2009. This includes:

(1) Operationalize the Mekong Navigation Facilitation Committee

(2) Issue documents and permits for inland waterway vessels

(3) Implement the rules on formalities and dues and taxes

(4) Harmonize, implement and enforce rules and regulations

The Agreement between Cambodia and Viet Nam on Waterway Transportation entrusts the Mekong Navigation Facilitation Committee with the preparation of a number of harmonized rules and regulations. The following should be elaborated in the short-term:

(a) rules and regulations for safe navigation and the avoidance of collisions (including rules of the road); (b) pilotage regulations; (c) tariffs of fees, and related conditions; (d) rules and regulations on the transportation of dangerous goods; (e) rules and regulations on coordinated cross-border pollution prevention, response and contingency plans; (f) rules and regulations on the investigation of accidents; (g) technical regulations on surveys of waterways and vessels.

These rules and regulations should be applied in the national legal system of the countries.

(5) Elaborate a third party liability insurance system

The Agreement between Cambodia and Viet Nam on Waterway Transportation requires that vessel owners of either contracting party, as well as foreign vessel owner, have insurance cover or other financial security in order to cover their liabilities to third parties.

(6) Elaborate and adopt minimal technical and operational requirements for regulated waterways

SRE2: Adopt in the national law existing harmonized rules and regulations made under the Quadripartite Agreement on the Lancang-Mekong River, and enforce these.

Based on the Agreement on Commercial Navigation on the Lancang-Mekong River between China, Lao PDR, Myanmar and Thailand, which was signed in 2000, a number of common regulations were adopted in the JCCCN, which still need further implementation. First of all, these regulations should be adopted into domestic law. Next, they should be effectively implemented.

SRE3: Adopt, implement and enforce harmonized safety and anti-pollution rules for Lao PDR and Thailand.

In order to address serious safety issues, Lao PDR and Thailand should work towards the adoption of a set of common safety standards for those stretches of the Mekong outside the scope of the Quadripartite Agreement (i.e. downstream of Luang Prabang to the Khone Falls). To the extent that no national rules are available, it is preferable to immediately draft a common instrument rather than first elaborate two national instruments which would subsequently be harmonized. Safety rules should include a mechanism for the inspection of ships.

SRE4: Adopt plans and procedures for port safety and emergency response.

All ports, especially passenger ports, should have a minimum of safety equipment. In most ports emergency response planning and equipment is very limited or non-existing. Taking into consideration the (forecasted) passenger throughput, ports should be able to efficiently deal with an emergency.

SRE5: Study inclusive policy and regulatory recommendations on measures to enhance legal protection of passengers.

With a view to increasing passenger safety and enhancing the overall attractiveness of waterborne passenger transportation, a comprehensive study of current rules and mechanisms dealing with passenger protection would be useful. Such a study could look into liability rules for death, personal injury and loss of/or damage to luggage, rules on insurance, procedural rules, harmonization of rules across the borders and international benchmarks, among others. Concrete measures should also be proposed in order to improve the current situation.

SRE6: Ensure effective law enforcement.

Law enforcement is currently insufficient. National line agencies have limited budgets, resources and technical capacity to perform monitoring and compliance with regulations and standards. Hence a lack of compliance has no real impact. Several sub-actions should be undertaken to improve the level of implementation, such as:

(1) Capacity building and training;

(2) Create effective enforcement agencies.

Long-Term Regulatory Actions (2021-2040)

LRE1: Further implement the Cambodian-Vietnamese Agreement on Waterway Transportation.

Further actions are needed to effectively implement the Agreement between Cambodia and Viet Nam on Waterway Transportation including the elaboration and adoption of:

(a) Rules and regulations on aids to navigation;

(b) Rules and regulations on vessel traffic services;

(c) Rules and regulations on search and rescue services and on the provision of adequate salvage capacity;

(d) Rules and regulations laying down common training and certification standards;

(e) Rules and regulations on the use and operation of floating structures.

LRE2: Further implement the Quadripartite Agreement on Commercial Navigation on the Lancang-Mekong River.

In order to further elaborate and update the regulatory framework for navigation under the Quadripartite Agreement, a number of additional sub-actions will be needed, including:

(1) A study on gaps and updates of the regulatory framework for registration of vessels, including the drafting of a proposal for new rules and regulations;

(2) A study on gaps and updates of the regulatory framework for safety of vessels, including the drafting of a proposal for new rules and regulations;

(3) A study on gaps and updates of the regulatory framework for training, qualifications and certification of crews, including the drafting of a proposal for new rules and regulations and a proposal for the creation of a Mekong Navigation Certificate for ship masters;

(4) A study on gaps and updates of the regulatory framework for safety of and aids to navigation including collision regulations ('rules of the road'), including the drafting of a proposal for new rules and regulations;

(5) A study on gaps and updates of the regulatory framework for environmental protection and management, including the drafting of a proposal for new rules and regulations.

LRE3: Further elaborate and harmonize the regulatory framework for waterborne transportation between Luang Prabang and the Khone Falls.

The elaboration of a harmonized regulatory framework will facilitate international and cross-border waterborne transportation of cargo and passengers, increase the competitiveness of the Lao and Thai economies and enhance safety and sustainability of navigation and port operations. The governments of both countries may also wish to consider extending the territorial scope of the Quadripartite Agreement and its Annexes or agreeing on a specific bilateral navigation agreement among themselves.

LRE4: Develop a regulatory framework for ports.

Port-related regulatory actions include:

(1) Adopt, implement and enforce technical regulations and standards for port planning, design, construction and maintenance.

The purpose of this action is to establish uniform and enforceable technical minimum standards for all public and private ports handling passengers and/or cargo in order to ensure that they are properly planned, designed, constructed and maintained and that crews, passengers and port workers and the environment are protected.

(2) Complement and further integrate the regulatory framework for ports.

(3) Adopt, implement and enforce port regulations.

Port regulations (port bylaws) are usually issued by a governmental agency or a port authority and govern the conduct of vessels, safety and order in the port area, the protection of the environment, documentation of disembarking passengers, loading and discharging of goods, crisis management and the powers of harbour masters, among others. Every port (big or small) should have (at least) an adequate form of such a regulation.

LRE5: Ensure effective implementation and enforcement of rules and regulations.

In order to ensure effective implementation and enforcement by competent authorities and law courts, further training activities will be required.

5.1.7 Environmental Actions

Short-Term Environmental Actions (2016-2020)

SEN1: Develop environment assessment guidelines for IWT, including SEA, EIA and EMP and monitoring and consider trans-boundary impacts for port, vessel and waterway improvements.

This would include developing technical guidance and capacity building for environmental assessment and monitoring of future IWT planning and project/activities in the Mekong Basin.

Considering the type/scope, location and effect of proposed IWT projects, determine mechanisms for trans-boundary assessment and management.

SEN2: Conduct Strategic Environment Assessment (SEA) for the Lancang Mekong Development Plan on International Navigation on the Lancang - Mekong River (2014-2025).

Prior to this project being approved, a full SEA or a more detailed EIA for specific ports and waterway improvement stretches should be carried out. The action will be implemented only with the approval from Lao PRD and Thailand as Members of the JCCCN

SEN3: Conduct an optimisation study of dredging sand from the Mekong River at various places that does not create negative impacts on river behaviour or ecological status.

A morphological feasibility study should indicate the places where sand dredging or excavation (of dry sand banks) has no negative impact on river behaviour or ecological status.

SEN4: Determine the extent of oil spill pollution from existing ports, petroleum terminals and vessel operations to determine regional and national contingency planning and develop specific water quality parameters to monitor IWT operations.

Review and analyse MRC data and information to develop relevant scenarios of oil spills and/or water quality incident model simulation. The water quality parameters would include surface water and sediment, and include ports, vessels and dredging operations.

- Provide parameters for procedures for water quality;
- Include transport and storage of other dangerous goods;
- Results would feed into contingency planning: early warning and notification systems; Tier 1 (<20 tonnes), 2 (20-500 tonnes) or 3 (>500 tonnes); and local/national/trans-boundary response.

SEN5: Start awareness and education campaigns to reduce pollution by vessels and ports.

Inform crewmembers and port workers of the consequences of waste disposal in the river and the dangers of pollution for the environment. The crew and port workers should be trained in dealing with different kinds of waste generated on board and the use of the ship's waste management plan.

SEN6: Prepare an inventory of air emissions from key inland cargo ports in the Mekong Basin.

Determine approaches for reducing CO_2 and GHG emission from the IWT sector.

SEN7: Review the energy efficiency of existing vessels in the Mekong Basin and develop a case study in Cambodia and Viet Nam to compare the most sustainable routes from Phnom Penh to the sea.

The assessment could also take into account waterway safety, operational efficiency and a comparison with road transport in relation to CO_2 and GHG emissions.

Long-Term Environmental Actions (2021-2040)

LEN1: Establish trans-boundary environmental management and monitoring systems to ensure the effective management of wastes, water pollution, oil spill response and contingency planning for IWT.

The short-term actions for water pollution and environmental assessment would need to be completed prior to the long-term actions. The core function for water quality monitoring and pollution needs to evaluated.

LEN2: Conduct further environmental assessment to determine zones or restrictions for port/vessel operations, the transport of DG, dredging/sand mining activities and location of waste management facilities.

An assessment of the environmental and socio-economic conditions, ecotourism, waterway conditions (reefs, rapids, shoals, sandbars, etc.) and significance of existing and planned navigation activities would be required. It would need to reference the DG RAP.

LEN3: Conduct an IWT sector planning for climate change adaptation and mitigation integrated into regional and national actions plans and green growth/low carbon development strategies.

Design requirements for future IWT planning, navigation clearance (e.g. bridges) and regional and national plans for responding to floods. This action could reduce the costs and environmental impacts of waterway modification and maintenance.

5.1.8 Social Actions

Short-Term Social Actions (2016-2020)

SSO1: Conduct further analysis of a Social Impact Monitoring Vulnerability Assessment (SIMVA) and other household surveys (e.g. household income and expenditure survey (HIAS)) in the Mekong corridor for employment and education, access to infrastructure and ownership of transport assets.

Developing cargo and passenger transport on the Mekong River can provide direct and indirect economic benefits, improving livelihoods for rural communities. The socio-economic conditions require more assessment in relation to IWT.

SSO2: Undertake further surveys of passengers, boat owners and rural communities and develop case studies to determine how local boat transport can be integrated with national and regional Inland Waterway Transport.

Local passenger transport, ecotourism and the transport of local products (agricultural, fisheries, garments) to markets and ports can create economic opportunities for rural communities. It may be important to consider incentives and mechanisms to encourage rural communities to utilise IWT for the transport of local goods and passengers.

SS03: Identify and promote eco-tourist and river-related tourism areas along the Mekong River to create employment opportunities for rural communities.

The Kampong Cham-Kratie-Stung Treng stretch and the Tonle Sap are important areas for eco-tourism.

Long-Term Social Actions (2021-2040)

LS01: Develop landing facilities for local passenger transport to improve safety and create further economic opportunities for rural IWT users.

Ten sites will be prioritised in Lao PDR and Cambodia on the Mekong mainstream based on the socio-economic survey of rural IWT users and river-related tourism sites.

Smaller boats could be used to transport passengers upstream or downstream from national ports to smaller landing facilities on the Mekong, thereby improving passenger safety and creating more opportunities for river-related tourism.

5.1.9 Capacity Building Actions

Short-Term Capacity Building Actions (2016-2020)

SCB1: Plan and implement national, bilateral and regional IWT education and training actions on navigation techniques and equipment (crew certification); navigation safety, including carriage and handling of dangerous goods; hydrodynamics, hydrography and waterway design and maintenance; IWT vessel design and construction; registration and inspection, and IWT Socio-Environmental Issues (EIAs, SIAs, Environmental Management Plans, sand mining, dredging Environmental Management Plans, etc.).

The "Training *Plan to implement the Activities under the Navigation Programme*" is part of the MRC Navigation Programme 2013-2015 (Outcome 5 Institutional Arrangements and Capacity Building).

*Cfr. "*Formulation *of a Training Plan to implement the Activities under the Navigation Programme - Final Report", MRCS NAP, December 2014.*

5.1.10 Institutional Actions

Short-Term Institutional Actions (2016-2020)

SIN1: Establish a "Regional Mekong Navigation Center" in order to implement and coordinate the actions of the Regional Master Plan.

In order to centralise efforts for the implementation of the Master Plan, a "Regional Mekong Navigation Centre" should be established, that is directly connected to the National Mekong Committees and the Waterborne Transport related ministries and authorities.

SIN2: Set up "Mekong Navigation Data and Information Management Centers" in the four MRC Member Countries and study the need for and scope of bilateral and/or regional cooperation on Mekong Inland Waterway Transport data management and River Information Services.

Lack of data with respect to trade and traffic production and attraction, intra- and inter-regional trade and traffic flows and modal split is of concern. Without vital time-series of trade, port and transport statistics, O/D traffic flows and modal split, master planning and cost-benefit analyses of proposed infrastructure developments is an ineffective exercise.

Therefore, a "Regional Mekong Navigation Data and Information Management Centre" and a "River Information System" to support planning and policy formulation and to provide daily services on a regional level for safe and efficient passage by inland and sea-going vessels on the Mekong River System, should be considered.

SIN3: Set up "Mekong Navigation Promotion and Marketing Agencies" in the four MRC Member Countries and study the need for and scope of bilateral and/or regional cooperation on IWT promotion and marketing.

An essential pre-requisite of any move to support the IWT sector is to increase its visibility, and the recognition amongst policy makers and others of the sector's importance in the economic development of the region and the lives of rural people. A public relations and promotion program should be developed aimed at policy makers, financing agencies and the media to portray the importance of Mekong Inland Waterway Transport.

SIN4: Study the need for and eventual scope of regional cooperation on hydrodynamic, sedimentological and navigation research.

There is almost no knowledge about the hydraulic, hydrodynamic and sedimentological behaviour of the Mekong River system. Moreover, in almost all study and research projects, foreign expertise is needed.

Due to the fact that this is a task for the whole Mekong River system, establishing a "Regional Hydraulic and Nautical Research Centre", working in close co-operation with MRC, is proposed.

Long-Term Institutional Actions (2021-2040)

LIN1: Study the need for and scope of a regional "Mekong River Navigation Commission" (scenario 2).

In the (likely) event of better interconnection between the various navigable stretches of the Mekong and of stronger integration between the economies of the riparian countries, it appears logical to reinforce the current institutional mechanisms and further harmonize the legal framework, which governs the management of the waterway. In a scenario of unhampered 500 DWT navigability between China and the sea there might be a case for the establishment of a single intergovernmental navigation commission, which is competent for the entire Mekong (at least for the territory of the current MRC Member States). Such an integrated commission should have as its task the gradual elaboration of a fully harmonized legal framework for navigation for all the countries concerned. Its establishment should be based on a thorough preparatory legal and institutional study.

LIN2: Set up a "Mekong water level monitoring and management body" in Lao PDR.

The project has to investigate under whose authority this water monitoring management body should operate, being responsible for the water management of the hydropower dams, the water levels in the impounded stretches throughout the year, the coordination and operating rules for each of the dams and the daily monitoring of the water levels.

LIN3: Depending on the results of the short-term study, establish two bilateral, or one regional, "Mekong Navigation Data and Information Management Centre" and "River Information Service".

To support planning and policy formulation and to provide daily services on a regional level for safe and efficient passage by inland and sea-going vessels on the Mekong River system, two bilateral **(scenario 1)** or one regional **(scenario 2)** "Mekong Navigation Data and Information Management Centre" and "River Information Service" should be set up.

LIN4: Depending on the results of the short-term study, establish two bilateral, or one regional, "Mekong River IWT Promotion and Marketing Agency".

The project has to create one or two independent agencies that would actively pursue promotional and marketing activities in order to bring as much cargo as possible to the inland waterways, thus contributing to a more competitive position for Inland Waterway Transport.

LIN5: Depending on the results of the short-term study, establish a regional "Hydrodynamic and Nautical Research Centre".

There is almost no knowledge about the hydraulic, hydrodynamic and sedimentological behaviour of the Mekong River system. Moreover, in almost all study and research projects, foreign expertise is needed. Due to the fact that this is a task for the whole Mekong River system, establishing a "Regional Hydraulic and Nautical Research Centre", working in close co-operation with the MRC Secretariat, is proposed.

5.2 TIME FRAME

5.2.1 Short-Term Actions Time Frame

No	Title	2016	2017	2018	2019	2020
Short-term Fleet Actions						
SFL1	Standardize vessel classification		L,T,C,V			
SFL2	Conduct feasibility study on the use of reinforced sea-river barges		C,V			
SFL3	Development of short and long-term fleet policy	L,T,C,V				
SFL4	Implement the Fleet Projects of the RAP for Transport of DG	L,T,C,V				
Short-term Waterway Design Actions						
SWD1	Condition survey of the dangerous areas for navigation		L,T,C			
SWD2	Standardize waterway classification in the Upper Part of the MRB			L,T		
SWD3	Standardize waterway classification in the Lower Part of the MRB			C,V		
SWD4	Design of river training works at the Sdao Canal in Cambodia	C				
SWD5	Experimental test dredging in the Tonle Sap/Great Lake			C		
Short-term Navigation Safety Actions						
SNS1	Introduce a vessel inspection system		L,T,C,V			
SNS2	Establish a framework for reporting marine accidents			L,T,C,V		
SNS3	Development of a contingency plan			L,T,C,V		
SNS4	Implement search and rescue units on the Mekong River			L,T,C,V		
SNS5	Introduce safety books on safety issues and safe working practices			L,T,C,V		
SNS6	Introduce the obligation of AIS and VHF in the whole MRB		L,T,C,V			
SNS7	Passenger safety between Huay Xay and Luang Prabang	L,T				
Short-term Aids to Navigation Actions						
SAN1	Reconstruction and rehabilitation of the concrete French markers	L,T	L,T,C			
SAN2	Construction of clearly visible low water alert gauges	L,T	L,T	C,V	C,V	
SAN3	Install a compulsory GPS System from Green Triangle to Huay Xay			L,T		
SAN4	Improve compulsory GPS System from Huay Xay to Luang Prabang	L,T				
SAN5	Install lights and marks at Mekong, Bassac and Tonle Sap bridges		L,T,C,V			
SAN6	Upgrade AtN from Kompong Cham to mouth of the Mekong River			C,V		
SAN7	Upgrade AtN in Vam Nao Pass and Bassac River				V	
Short-term Port Development Actions						
SPD1	Development of a port maintenance system	L,C	L,T,C,V	L,T,C,V		
SPD2	Development of a port HSEM system	L,T,C,V				
SPD3	For ports handling DG, implement the RAP for Transport of DG		L,T,C,V			
SPD4	Rehabilitation and/or reconfiguring of 3 existing passenger ports		T,C			
SPD5	Construction of 10 new passenger ports and landing facilities		L,T,C			
SPD6	Consruction of 3 new cargo ports	L				
SPD7	Establish standards and organize audit for L, T, C - oil ports		L,T,C,V			
SPD8	Expansion of New Phnom Penh Container Terminal – NCT LM 17	C				
SPD9	Rehabilitation of existing petrochemical transfer ports in Viet Nam	V				
SPD10	Rehabilitation of existing cargo ports in Viet Nam	V				
SPD11	Update “Master Plan for Viet Nam Inland Waterway Sector”	V				
Short-term Regulatory Actions						
SRE1	Implement the Cambodian-Vietnamese Agreement	C,V				
SRE2	Enforce harmonized rules under the Quadrangle Agreement	L,T				
SRE3	Enforce harmonized safety rules for Lao PDR and Thailand	L,T				
SRE4	Adopt plans/procedures for port safety and emergency response	L,T,C,V				
SRE5	Policy/recommendations to enhance legal protection of passengers	L,T,C,V				
SRE6	Ensure effective law enforcement	L,T,C,V				

Short-term Environmental Actions						
SEN1	Develop environmental assessment guidelines for IWT	L,T,C,V				
SEN2	Conduct SEA for Lancang Mekong Development Plan	L,T				
SEN3	Optimisation study of dredging sand from the Mekong River		L,T,C,V			
SEN4	Determine oil spill pollution from ports, terminals and vessels		L,T,C,V			
SEN5	Start awareness campaigns on IWT pollution by vessels and ports		L,T,C,V			
SEN6	Inventory air emissions cargo ports and energy efficiency of vessels			L,T,C,V		
SEN7	Vessel energy efficiency and most sustainable route PHN to the sea			C,V		

No	Title	2016	2017	2018	2019	2020
Short-term Social Actions						
SSO1	Analysis of Social Impact Monitoring Vulnerability Assessment		L,T,C,V			
SSO2	Further surveys of passengers, boat owners and rural communities		L,T,C,V			
SSO3	Identify and promote eco-tourism and river-related tourism	L,T,C,V				
Short-term Capacity Building Actions						
SCB1	Plan and implement IWT education and training actions	L,T,C,V				
Short-term Institutional Actions						
SIN1	Establish a "Regional Mekong Navigation Center"	L,T,C,V				
SIN2	Setting up "Mekong Navigation Data Management Centers"	L,T,C,V				
SIN3	Setting up "Mekong IWT Promotion and Marketing Agencies"	L,T,C,V				
SIN4	Study the need for cooperation on hydrodynamic research			L,T,C,V		

Total 54 short-term actions

5.2.2 Long-Term Actions Time Frame

No	Title	2021-2024	2025-2028	2029-2032	2033-2036	2037-2040
Long-term Fleet Actions						
LFL1	Development of ship construction and ship yard policy	T,V				
LFL2	Implementation of standards for construction of new vessels			L,T,C,V		
Long-term Waterway Design Actions						
LWD1	Min. 500 DWT channel between Green Triangle and Vientiane			L,T		
LWD2	Improve channel in the Vientiane-Savannakhet stretch			L,T		
LWD3	**(Scenario 2)** Improve channel Savannakhet- Khone Falls stretch					L
LWD4	**(Scenario 2)** Bypass canal at the Khone Falls including ship locks				L	
LWD5	**(Scenario 2)** Improve channel in Khone Falls-Kratie stretch					C
LWD6	Improve channel Kratie-Kompong Cham stretch to 2,000 DWT		C			
LWD7	3,000 DWT channel in Kompong Cham-PPAP NTC stretch		C			
LWD8	Improve 500 DWT channel in Phnom Penh-Chong Kneas stretch			C		
LWD9	3,000 DWT Channel from PPAP NCT to Cai Mep via Cho Gao canal	V				
LWD10	10,000 DWT Channel from PPAP NCT to Quang Chanh Bo canal	C,V				
LWD11	Morphology study in the areas between Phnom Penh and the sea		V			
Long-term Navigation Safety Actions						
LNS1	Development of ENCs for the whole Mekong River		L,T,C,V			
LNS2	Implementation of RIS over the total length of the Mekong River		L,T,C,V			

Long-term Aids to Navigation Actions							
LAN1	**(Scenario 1)** Compulsory GPS System Luang Prabang to Savannakhet			L,T			
LAN2	**(Scenario 2)** Compulsory GPS System from Luang Prabang to Kratie			L,T,C			
LAN3	Compulsory GPS System along the Tonle Sap River and Lake		C				
LAN4	Install buoys and beacons from Kratie to Kompong Cham					C	
LAN5	Maintain the AtN from Kompong Cham/Cai Mep incl. Cho Gao		C,V				
LAN6	Maintain the AtN on the Vam Nao Pass and the Bassac River			V			
Long-term Port Development Actions							
LPD1	Development of a long-term port strategy and policy	L,T,C,V					
LPD2	Construction of 5 new passenger ports and landing facilities		L				
LPD3	Construction of 7 new port infrastructures for 500 DWT cargo			L,C			
LPD4	Study ports to handle containers from Green Triangle to Savannakhet				L,T		
LPD5	Expansion New Container Terminal – NCT LM 17	C					
LPD6	Kratie - Development of a 2,000 DWT cargo port		C				
LPD7	Kompong Cham - Development of a 3,000 DWT cargo port, a domestic general cargo port and an oil distribution facility		C				
LPD8	Kompong Chhnang - Development of a 500 DWT cargo port	C					
LPD9	Chong Kneas – Construction of a new passenger terminal, cargo terminal, fish market and bunkering jetty	C					
Long-term Regulatory Actions							
LRE1	Full implementation of the Cambodian-Vietnamese Agreement	C,V					
LRE2	Full implementation of the Quadrangle Agreement	L,T					
LRE3	Harmonize regulatory framework Luang Prabang to Khone Falls	L,T					
LRE4	Develop a regulatory framework for ports	L,T,C,V					
LRE5	Ensure effective enforcement of rules and regulations		L,T,C,V				
Long-term Environmental Actions							
LEN1	Trans-boundary environmental management and monitoring systems		L,T,C,V				
LEN2	Further SEA to determine zones for IWT or port restrictions	L,T,C,V					
LEN3	Climate change adaptation integrated in reg. and nat. strategies	L,T,C,V					
Long-term Social Actions							
LSO1	Develop 10 landing facilities for local passenger transport	L,C					
Lon- term Institutional Actions							
LIN1	Study the need for a “Mekong River Navigation Commission”				L,T	C,V	
LIN2	Setting up a water monitoring and management body in Lao PDR	L					
LIN3	Establishment of a “Mekong Navigation Data Management Center“	L,T,C,V					
LIN4	Establishment of a “Mekong River IWT Promotion Agency”	L,T,C,V					
LIN5	Establishment of a “Hydrodynamic and Nautical Research Center”	L,T,C,V					

Total 44 long-term actions

5.3 INVESTMENT PROGRAMME

Funding for the actions should come from several sources:

National public budgets: Ministry of Finance, Ministry of (Public Works and) Transport, Ministry of Environment, Provincial Authorities, Public Port Authorities, Public Transport Companies, etc.

National private budgets: Private Port Authorities, Transport Companies, Shipping lines, Shipping Associations, etc.

Regional loans: Asian Development Bank (ADB), Greater Mekong Sub Region (GMS).

Regional grants: MRCS NAP, Greater Mekong Sub region (GMS), ASEAN IAI (receiving funds from Australia, Japan).

International loans: World Bank, European Union, PR China, Japan, Korea, etc.

International grants: European Union, DANIDA (Denmark), NORAD (Norway), BTC (Belgium), Australia AID, KOICA (Korea), JICA (Japan), etc.

To prepare the investment program, the following assumptions are made:

- For projects funded by international or regional loans, it is assumed that the concerned country (ies) should contribute 5 percent of the total project cost from its own national budget(s). Eventually, this can be combined with a Public Private Partnership (PPP) with local private companies.
- For projects funded by international or regional grants, it is assumed that the concerned country (ies) should contribute 10 percent of the total project cost from its own national budget(s). Eventually this can also be combined with a Public Private Partnership (PPP) with local private companies.
- The eventual yearly costs for maintenance dredging are not included in this investment program.

These assumptions lead to the following proposed costs for the different actions:

Short-term actions (2016-2020)

No	Title	Lao PDR		Thailand		Cambodia		Viet Nam		Loan		Grant		Total
		Public	Private	Public	Private	Public	Private	Public	Private	Regional	Internat.	Regional	Internat.	
Short term Fleet Actions														
SFL1	Standardize the vessel classification	40,000 2017-2018		40,000 2017-2018		40,000 2017-2018		50,000 2017-2018				120,000 2017-2018		290,000 2017-2018
SFL2	Conduct feasibility study on the use of reinforced sea-river barges				**US$ Year(s)**		100,000 2017		100,000 2017			180,000 2017		380,000 2017
SFL3	Development of short and long term fleet policy											130,000 2016		130,000 2016
SFL4	Implement Fleet Projects of the RAP for Transport of Dangerous Goods	1,324,000 2016-2020	1,324,000 2016-2020	1,168,250 2016-2020	1,168,250 2016-2020	1,257,000 2016-2020	1,257,000 2016-2020	1,232,250 2016-2020	1,232,250 2016-2020					9,963,000 2016-2020
Short term Waterway Design Actions														
SWD1	Condition survey of the dangerous areas for navigation	400,000 2017-2018				55,100 2017-2018							4,100,000 2017-2018	4,555,100 2017-2018
SWD2	Standardize waterway classification in the Upper Part of the MRB											98,000 2018		98,000 2018
SWD3	Standardize waterway classification in the Lower Part of the MRB											51,600 2018		51,600 2018
SWD4	Design of river training works at the Sdao Canal in Cambodia					30,000 2016-2017							270,000 2016-2017	300,000 2016-2017
SWD5	Experimental test dredging in the Tonle Sap / Great Lake					150,000 2018-2019	150,000 2018-2019					370,000 2018-2019		670,000 2018-2019
Short term Navigation Safety Actions														
SNS1	Introduce a vessel inspection system	100,000 2017-2020		100,000 2017-2020		100,000 2017-2020		100,000 2017-2020			880,000 2017-2020			1,280,000 2017-2020
SNS2	Establish a framework for reporting marine accidents	60,000 2018-2019		30,000 2018-2019		45,000 2018-2019		80,000 2018-2019				140,000 2018-2019		355,000 2018-2019
SNS3	Development of a contingency plan	20,000 2018		10,000 2018		15,000 2018		30,000 2018				110,000 2018		185,000 2018
SNS4	Implement search and rescue units on the Mekong River	170,000 2018-2019		50,000 2018-2019		125,000 2018-2019		200,000 2018-2019				150,000 2018-2019		695,000 2018-2019
SNS5	Introduce safety books on safety issues and safe working practices	57,000 2018		57,000 2018		57,000 2018		57,000 2018						228,000 2018
SNS6	Introduce the obligation of AIS and VHF in the whole MRB	100,000 2017-2018		100,000 2017-2018		100,000 2018-2019		100,000 2018-2019				1,415,000 2017-2019		1,815,000 2017-2019

SNS7	Improve passenger safety between Huay Xay and Luang Prabang	100,000 2016	100,000 2016											200,000 2016
Short term Aids to Navigation Actions														
SAN1	Reconstruction and rehabilitation of the concrete French markers	4,000/y 2016-2020		4,000/y 2016-2020		5,000/y 2017-2021					265,000 2016-2017	50,000 2016		380,000
SAN2	Construction of clearly visible low water alert gauges	25,000 2016-2017		25,000 2016-2017		25,000 2018-2019		25,000 2018-2019			880,000 2016-2019	180,000 2016&2018		1,160,000

No	Title	Lao PDR		Thailand		Cambodia		Viet Nam		Loan		Grant		Total
		Public	Private	Public	Private	Public	Private	Public	Private	Regional	Internat.	Regional	Internat.	
SAN3	Install a compulsory GPS System from Green Triangle to Huay Xay												395,000 2018	395,000 2018
SAN4	Improve compulsory GPS System from Huay Xay to Luang Prabang	30,000 2016						**US$ Year(s)**					150,000 2016	180,000 2016
SAN5	Install Lights and marks at Mekong, Bassac and Tonle Sap bridges	30,000 2017		30,000 2017		30,000 2017							200,000 2017	290,000 2017
SAN6	Upgrade AtN from Kompong Cham to mouth of the Mekong River					70,000 2018-2019		80,000 2018-2019			2,500,000 2018-2019		130,000 2018-2019	2,780,000 2018-2019
SAN7	Upgrade AtN in Vam Nao Pass and Bassac River							80,000 2018-2019			1,250,000 2018-2019		60,000 2018-2019	1,390,000 2018-2019
Short term Port Development Actions														
SPD1	Development of a port maintenance system	150,000 2016		50,000 2016		150,000 2016		50,000 2016					452,000 2017-2018	852,000 2016-2018
SPD2	Development of a port HSEM system	78,333 2018-2019	78,333 2018-2019	98,333 2018-2019	98,333 2018-2019	100,000 2018-2019	100,000 2018-2019	111,667 2018-2019	111,667 2018-2019				388,334 2018-2019	1,165,000 2018-2019
SPD3	For ports handling DG, implement the RAP for Transport of DG	454,000 2017-2020	454,000 2017-2020	481,667 2017-2020	481,667 2017-2020	452,000 2017-2020	452,000 2017-2020	551,667 2017-2020	551,667 2017-2020			155,000 2017-2020	1,939,334 2017-2020	5,973,000 2017-2020
SPD4	Rehabilitation and/or reconfiguring of 2 existing passenger ports			10,000 2017		10,000 2017								20,000 2017
SPD5	Construction of ten new passenger ports and landing facilities										18,700,000 2017-2020			18,700,000 2017-2020

SPD6	Construction of three new cargo ports										10,800,000 2016-2020			10,800,000 2016-2020
SPD7	Establish standards and organize audit for L, T, C - oil ports		27,000 2017		27,000 2017		27,000 2017						200,000 2017	281,000 2017
SPD8	Expansion of New Phnom Penh Container Terminal – NCT LM 17										45,000,000 2016-2020			45,000,000 2016-2020
SPD9	Rehabilitation of existing petrochemical transfer ports in Viet Nam							646,000 2016-2020	646,000 2016-2020		646,000 2016-2020	646,000 2016-2020		2,584,000 2016-2020
SPD10	Rehabilitation of existing cargo ports in Viet Nam							646,000 2016-2020	646,000 2016-2020		646,000 2016-2020	646,000 2016-2020		2,584,000 2016-2020
SPD11	Update "Master Plan for Viet Nam Inland Waterway Sector"							646,000 2016-2020	646,000 2016-2020		646,000 2016-2020	646,000 2016-2020		2,584,000 2016-2020
Short term Regulatory Actions														
SRE1	Implement the Cambodian-Vietnamese Agreement					144,000 2016-2018		144,000 2016-2018						288,000 2016-2018
SRE2	Enforce harmonized rules under the Quadrangle Agreement	66,000 2016-2017		66,000 2016-2017										132,000 2016-2017
SRE3	Enforce harmonized safety rules for Lao PDR and Thailand	90,000 2016-2017		90,000 2016-2017										180,000 2016-2017
SRE4	Adopt plans/procedures for port safety and emergency response												156,000 2016-2017	156,000 2016-2017
SRE5	Policy/recommendations to enhance legal protection of passengers												84,000 2016-2017	84,000 2016-2017

No	Title	Lao PDR		Thailand		Cambodia		Viet Nam		Loan		Grant		Total
		Public	Private	Public	Private	Public	Private	Public	Private	Regional	Internat.	Regional	Internat.	
SRE6	Ensure effective law enforcement	30,000 2016-2018		30,000 2016-2018		30,000 2016-2018		30,000 2016-2018					96,000 2016-2018	216,000 2016-2018
Short term Environmental Actions														
SEN1	Develop SEA, EIA, EMP and monitoring guidelines for IWT												125,000 2016	125,000 2016
SEN2	Conduct SEA for Lancang Mekong Development Plan						**US$ Year(s)**						350,000 2016	350,000 2016
SEN3	Optimisation study of dredging sand from the Mekong River												200,000 2017	200,000 2017

SEN4	Determine oil spill pollution from ports, terminals and vessels												80,000 2017	80,000 2017
SEN5	Start awareness campaigns on IWT pollution by vessels and ports												150,000 2017	150,000 2017
SEN6	Inventory air emissions cargo ports												100,000 2018	100,000 2018
SEN7	Study energy efficiency vessels and most sustainable route PHN to the Sea												200,000 2018	200,000 2018
Short term Social Actions														
SSO1	Analysis of Social Impact Monitoring Vulnerability Assessment												100,000 2017	100,000 2017
SSO2	Further surveys of passengers, boat owners and rural communities												150,000 2017	150,000 2017
SSO3	Identify and promote the eco-tourism and river-related tourism	25,000 2016	25,000 2016	25,000 2016	25,000 2016	25,000 2016	25,000 2016	25,000 2016	25,000 2016					200,000 2016
Short term Capacity Building Actions														
SCB1	Plan and implement IWT education and training actions	100,000 2016-2018		100,000 2016-2018		100,000 2016-2018		100,000 2016-2018				600,000 2016-2018	400,000 2016-2018	1,400,000 2016-2018
Short term Institutional Actions														
SIN1	Establish a "Regional Mekong Navigation Center" to implement MP											92,000/y 2016-2020		460,000
SIN2	Setting up "Navigation Data Management Centers"	11,000/y 2016-2020		11,000/y 2016-2020		11,000/y 2016-2020		11,000/y 2016-2020						220,000 2016-2020
SIN3	Setting up "Mekong IWT Promotion and Marketing Agencies"	25,000/y 2016-2020	30,400/y 2016-2020	25,000/y 2016-2020	30,400/y 2016-2020	25,000/y 2016-2020	30,400/y 2016-2020	25,000/y 2016-2020	30,400/y 2016-2020			50,000/y 2016-2020		1,358,000 2016-2020
SIN4	Study the need for cooperation on hydrodynamic research												102,000 2018	102,000 2018

Total 2016-2020	**3,649,333**	**2,160,333**	**2,761,250**	**1,952,250**	**3,315,100**	**2,263,000**	**5,164,584**	**4,110,584**	**0**	**82,213,000**	**17,096,266**	**124,685,700**

Long-term actions (2021-2040)

No	Title	Lao PDR		Thailand		Cambodia		Viet Nam		Loan		Grant		Total
		Public	Private	Public	Private	Public	Private	Public	Private	Regional	Internat.	Regional	Internat.	
Long term Fleet Actions														
LFL1	Development of ship construction and ship yard policy											160,000 2021		160,000 2021
LFL2	Implementation of standards for construction of new vessels.	105,000 2029-2032		105,000 2029-2032		105,000 2029-2032		100,000 2029-2032				300,000 2029-2032		715,000 2029-2032
Long term Waterway Design Actions														
LWD1	Min. 500 DWT channel between Green Triangle and Vientiane	7,000,000 2029-2036		7,000,000 2029-2036							125,326,000 2029-2036			139,326,000 2029-2036
LWD2	Improved channel in the Vientiane-Savannakhet stretch	600,000 2029-2030		600,000 2029-2030			**US$ Year(s)**				10,980,000 2029-2030			12,180,000 2029-2030
LWD3	**(Scenario 2)** Improved channel in Savannakhet- Khone Falls stretch	5,960,000 2037-2040									88,000,000 2037-2040			93,960,000 2037-2040
LWD4	**(Scenario 2)** Bypass canal at the Khone Falls including ship locks										469,000,000 2033-2040			469,000,000 2033-2040
LWD5	**(Scenario 2)** Improved channel in Khone Falls-Kratie stretch					884,000 2037-2040					16,796,000 2037-2040			17,680,000 2037-2040
LWD6	Improved channel Kratie-Kompong Cham stretch to 2,000 DWT					1,470,000 2025-2028					27,960,000 2025-2028			29,430,000 2025-2028
LWD7	Improved 3,000 DWT channel from Kompong Cham to PPAP NTC					643,500 2025-2027					12,226,500 2025-2027			12,870,000 2025-2027
LWD8	Improved 500 DWT channel in Phnom Penh-Chong Kneas stretch					1,137,625 2028-2032	1,137,625 2028-2032				43,229,750 2028-2032			45,505,000 2028-2032
LWD9	3,000 DWT Channel from PPAP NTC to Cai Mep via Cho Gao canal										6,594,000 2021-2022			6,594,000 2021-2022
LWD10	10,000 DWT Channel from PPAP NTC to Quang Chanh Bo Canal.					532,455 2021-2022		299,640 2021-2022			15,809,805 2021-2022			16,641,900 2021-2022
LWD11	Morphology study in the areas between Phnom Penh and the sea					100,000 2028		200,000 2028				180,000 2028		480,000 2028
Long term Navigation Safety Actions														
LNS1	Development of ENCs for the whole Mekong River											911,000 2025-2027		911,000 2025-2027
LNS2	Implementation of RIS over the total length of the Mekong River	450,000 2024-2028		150,000 2024-2028		350,000 2024-2028		500,000 2024-2028				820,000 2024-2025		2,270,000 2024-2028

No	Title	Lao PDR		Thailand		Cambodia		Viet Nam		Loan		Grant		Total
		Public	Private	Public	Private	Public	Private	Public	Private	Regional	Internat.	Regional	Internat.	
Long term Aids to Navigation Actions														
LAN1	Compulsory GPS System Luang Prabang to Savannakhet							**US$ Year(s)**					1,190,000 2029-2030	1,190,000 2029-2030
LAN2	**(Scenario 2)** Compulsory GPS System from Savannakhet to Kratie												760,000 2037-2039	760,000 2037-2039
LAN3	Compulsory GPS System along the Tonle Sap River and Lake												410,000 2024-2025	410,000 2024-2025
LAN4	Install buoys and beacons from Kratie to Kompong Cham					60,000 2035-2036					530,000 2035-2036			590,000 2035-2036
LAN5	Maintain AtN from Kompong Cham to Cai Mep incl. Cho Gao Canal						104,000/y* 2023-2032		188,000/y* 2023-2032		*Channel fees			2,920,000 2023-2032
LAN6	Maintain the AtN on the Vam Nao Pass and the Bassac River								168,000/y* 2029-2038					1,680,000 2029-2038
Long term Port Development Actions														
LPD1	Development of a long term port strategy and policy	200,000 2021-2024		100,000 2021-2024		200,000 2021-2024		100,000 2021-2024					1,600,000 2021-2024	2,200,000 2021-2024
LPD2	Construction 5 new passenger ports and landing facilities		2,000,000 2025-2028								4,200,000 2025-2028			6,200,000 2025-2028
LPD3	Construction 7 new port infrastructures for 500 DWT cargo										13,200,000 2029-2040			13,200,000 2029-2040
LPD3	**(Scenario 2)** Construction 2 new port infrastructures for 500 DWT cargo										2,400,000 2037-2039			2,400,000 2037-2039
LPD4	Study ports to handle containers (Green Triangle to Savannakhet)												100,000 2031	100,000 2031
LPD5	Expansion New Container Terminal – NCT LM 17										45,000,000 2021-2024			45,000,000 2021-2024
LPD6	Kratie - Development of a 2,000 DWT cargo port										3,000,000 2025-2028		100,000 2024	3,100,000 2024-2028
LPD7	Kompong Cham - Development of a 3,000 DWT + domestic cargo port										5,850,000 2025-2028		100,000 2024	5,950,000 2024-2028
LPD8	Kompong Chhnang - Development of a 500 DWT cargo port										3,450,000 2022-2024		100,000 2021	3,550,000 2021-2024
LPD9	Chong Kneas – Construction of a new passenger + cargo terminal										20,300,000 2023-2026		1,500,000 2021-2022	21,800,000 2021-2026

Long term Regulatory Actions														
LRE1	Full implementation of the Cambodian-Vietnamese Agreement												156,000 2021	156,000 2021
LRE2	Full implementation of the Quadripartite Agreement	7,600/y 2021-2040		7,600/y 2021-2040										304,000 2021-2040
LRE3	Harmonise regulations for IWT from Luang Prabang to Khone Falls	7,600/y 2021-2040		7,600/y 2021-2040										304,000 2021-2040
LRE4	Develop a regulatory framework for ports												250,000 2021-2024	250,000 2021-2024

No	Title	Lao PDR		Thailand		Cambodia		Viet Nam		Loan		Grant		Total
		Public	Private	Public	Private	Public	Private	Public	Private	Regional	Internat.	Regional	Internat.	
LRE5	Ensure effective enforcement of rules and regulations	60,000 2025-2028		60,000 2025-2028		60,000 2025-2028		60,000 2025-2028		**US$ Year(s)**				240,000 2025-2028
Long term Environmental Actions														
LEN1	Trans boundary environmental management/monitoring systems												100,000 2026	100,000 2026
LEN2	Further SEA to determine zones for IWT or port restrictions												100,000 2021	100,000 2021
LEN3	Climate change adaptation within regional and national strategies												250,000 2021	250,000 2021
Long term Social Actions														
LSO1	Develop 10 landing facilities for local passenger transport	125,000 2021-2024				125,000 2021-2024								250,000 2021-2024
Long term Institutional Actions														
LIN1	Study the need for a "Mekong River Navigation Commission"												168,000 2033-2034	168,000 2033-2034

LIN2	Setting up of a water monitoring and management body in Laos		264,000/y* 2031-2040			*hydropower companies								2,640,000 2031-2040
LIN3	Setting up a "Mekong Navigation Data Management Centre"	16,025/y 2021-2040		16,025/y 2021-2040		16,025/y 2021-2040		16,025/y 2021-2040						1,282,000 2021-2040
LIN4	Establishment of a "Mekong River IWT Promotion Agency"	10,000/y 2021-2040	19,800/y 2021-2040	10,000/y 2021-2040	19,800/y 2021-2040	10,000/y 2021-2040	19,800/y 2021-2040	10,000/y 2021-2040	19,800/y 2021-2040					2,384,000 2021-2040
LIN5	Establishment of a "Hydrodynamic and Nautical Research Centre"	87,000/y 2021-2040		87,000/y 2021-2040		87,000/y 2021-2040		87,000/y 2021-2040					950,000 2021	7,910,000 2021-2040

Total Scenario 1 2021-2040	**11.104.500**	**5.036.000**	**10.579.500**	**396.000**	**7.044.080**	**2.573.625**	**3.520.140**	**3.956.000**	**530.000**	**334.056.055**	**9.445.000**	**393.710.900**

Total Scenario 2 2021-2040	**17.064.500**	**5.036.000**	**10.579.500**	**396.000**	**7.928.080**	**2.573.625**	**3.520.140**	**3.956.000**	**530.000**	**913.322.055**	**10.205.000**	**975,510.900**

Leading to following overview

Short term	Lao PDR	Thailand	Cambodia	Vietnam	Loan	Grant	Total	%
	Publ + Priv	Publ + Priv	Publ + Priv	Publ + Priv	Int + Reg	Int + Reg		
SFL	2,688,000	2,376,500	2,654,000	2,614,500	0	430,000	10,763,000	8.64
SWD	400,000	0	385,100	0	0	4,889,600	5,674,700	4.56
SNS	707,000	347,000	442,000	567,000	880,000	1,815,000	4,758,000	3.82
SAN	105,000	75,000	150,000	185,000	4,895,000	1,165,000	6,575,000	5.28
SPD	1,241,666	1,247,000	1,291,000	5,252,668	76,438,000	5,072,666	90,543,000	72.69
SRE	186,000	186,000	174,000	174,000	0	336,000	1,056,000	0.85
SEN	0	0	0	0	0	1,205,000	1,205,000	0.97
SSO	50,000	50,000	50,000	50,000	0	250,000	450,000	0.36
SCB	100,000	100,000	100,000	100,000	0	1,000,000	1,400,000	1.12
SIN	332,000	332,000	332,000	332,000	0	812,000	2,140,000	1.72
Total	5,809,666	4,713,500	5,578,100	9,275,168	82,213,000	16,975,266	124,564,700	100,00
%	4.66	3.78	4.48	7.45	66.00	13.63	100,00	

Long term	Lao PDR	Thailand	Cambodia	Vietnam	Loan	Grant	Total	%	%
	Publ + Priv	Publ + Priv	Publ + Priv	Publ + Priv	Int + Reg	Int + Reg		Scen 1	Scen 2
LFL	105,000	105,000	105,000	100,000	0	460,000	875,000	0.22	0.09
LWD	7,600,000	7,600,000	5,021,205	499,640	242,126,055	180,000	263,026,900	67.22	26.97
LWD3	5,960,000				88,000,000		93,960,000		9.64
LWD4					469,000,000		469000000		48.10
LWD5		884,000			16,796,000		17680000		1.81
LNS	450,000	150,000	350,000	500,000	0	1,731,000	3,181,000	0.81	0.33
LAN	0	0	1,100,000	3,560,000	530,000	1,600,000	6,790,000	1.74	0.70
LAN2						760,000	760,000		0.08
LPD	2,200,000	100,000	200,000	100,000	97,400,000	3,500,000	103,500,000	26.45	10.61
LPD3					2,400,000		2400000		0.25
LRE	364,000	364,000	60,000	60,000	0	406,000	1,254,000	0.32	0.13
LEN	0	0	0	0	0	450,000	450,000	0.11	0.05
LSO	125,000	0	125,000	0	0	0	250,000	0.06	0.03
LCB	0	0	0	0	0	0	0	0,00	0,00
LIN	5,296,500	2,656,500	2,656,500	2,656,500	0	1,118,000	14,384,000	3.68	1.48
Total scen 1	16,140,500	10,975,500	9,617,705	7,476,140	337,656,055	9,445,000	391,310,900	100,00	40,15
%	4.12	2.80	2.46	1.91	86.29	2.41	100,00		
Addit scenario 2	5,960,000	884,000	0	0	576,196,000	760,000	583,800,000		59,88
Total scen 2	22,100,500	11,859,500	9,617,705	7,476,140	913,852,055	10,205,000	975,110,900		100,00
%	2.27	1.22	0.99	0.77	93.72	1.05	100,00		

In red, the additional costs for long term scenario 2

Short term and long term overview table:

	Scenario 1				Scenario 2			
	Short term	Long term	Total	%	Short term	Long term	Total	%
LFL	10,763,000	875,000	11,638,000	2.25	10,763,000	875,000	11,638,000	1.02
LWD	5,674,700	263,026,900	268,701,600	51.85	5,674,700	843,666,900	849,341,600	74.16
LNS	4,758,000	3,181,000	7,939,000	1.53	4,758,000	3,181,000	7,939,000	0.69
LAN	6,575,000	6,790,000	13,365,000	2.58	6,575,000	7,550,000	14,125,000	1.23
LPD	90,543,000	103,500,000	194,043,000	37.44	133,743,000	105,900,000	239,643,000	20.92
LRE	1,056,000	1,254,000	2,310,000	0.45	1,056,000	1,254,000	2,310,000	0.20
LEN	1,205,000	450,000	1,655,000	0.32	1,205,000	450,000	1,655,000	0.14
LSO	450,000	250,000	700,000	0.14	450,000	250,000	700,000	0.06
LCB	1,400,000	0	1,400,000	0.27	1,400,000	0	1,400,000	0.12
LIN	2,140,000	14,384,000	16,524,000	3.19	2,140,000	14,384,000	16,524,000	1.44
Total	124,564,700	393,710,900	518,275,600	100,00	167,764,700	977,510,900	1,145,275,600	100,00

From the “Short Term Actions” table it can be seen that:

- The total estimated cost of the short term actions is about 125 million US$;
- About 80 million US$ or 70% of this amount is dedicated to Port Development, with the construction, upgrade or expansion of ports and terminals; and
- About 11 million US$ or 10% of this amount is dedicated to Fleet and Fleet Safety, especially the implementation of the Fleet Projects in the Regional Action Plan for Dangerous Goods.

From the “Long Term Actions” table it can be seen that:

- The total estimated cost of the long term actions in scenario 1 is about 394 million US$;
- About 260 million US$ or 66% of this amount is dedicated to the Waterway upgrade between the Green Triangle and Savannakhet and between Kratie and the Sea;
- About 108 million US$ or 27% of this amount is dedicated to Port Development, with the construction, upgrade or expansion of ports and terminals;

- The total estimated cost of the long term actions in scenario 2 is about 978 million US$; and
- The additional costs for scenario 2 (about 584 million US$) are for 99.5% dedicated to the upgrade of the waterway between Savannakhet and Kratie, including a bypass canal with locks at the Khone Falls.

And finally, from the "Overview" table it can be seen that:

- The total estimated cost of the Master Plan Actions in scenario 1 is about 518 million US$ of which about 53% is dedicated to waterway design and 37% to port development (together 90%);
- The total estimated cost of the Master Plan Actions in scenario 2 is about 1,145million US$ of which about 78% is dedicated to waterway design and 17% to port development (together 95%);

From these tables, the following tables with costs per year are deducted:

Total costs per year (US$)

US$	Lao PDR		Thailand		Cambodia		Viet Nam		Loan	Grant	Total
Year	public	private	public	private	public	private	public	private	Reg./Int.	Reg./Int.	
2016	743,633	420,200	482,483	289,050	568,733	306,800	836,383	689,450	11,900,100	2,044,933	18,281,765
2017	877,133	435,700	662,899	411,466	624,283	521,800	949,300	902,367	16,795,100	5,756,184	27,936,232
2018	987,800	447,867	688566	433,633	948,783	519,800	1,374,634	858,201	16,662,600	5,991,950	28,913,834
2019	597,466	447,866	508,233	433,633	737,900	519,800	1,171,299	858,199	16,662,600	2,144,018	24,081,014
2020	443,300	408,700	419,067	384,467	430,400	394,800	832,966	802,366	16,442,600	1,053,184	21,611,850
2021	209,475	19,800	153,225	19,800	460,502	19,800	287,845	19,800	22,451,903	2,928,500	26,570,650
2022	209,475	19,800	153,225	19,800	460,503	19,800	287,845	19,800	23,601,902	1,212,500	26,004,650
2023	209,475	19,800	153,225	19,800	194,275	123,800	138,025	207,800	17,475,000	462,500	19,003,700
2024	299,475	19,800	183,225	19,800	264,275	123,800	238,025	207,800	17,475,000	1,277,500	20,108,700
2025	233,225	519,800	173,225	19,800	780,025	123,800	228,025	207,800	19,403,000	918,667	22,607,367
2026	233,225	519,800	173,225	19,800	780,025	123,800	228,025	207,800	19,403,000	403,667	22,092,367
2027	233,225	519,800	173,225	19,800	780,025	123,800	228,025	207,800	14,328,000	303,667	16,917,367
2028	233,225	519,800	173,225	19,800	893,050	351,325	428,025	207,800	18,898,450	180,000	21,904,700
2029	1,329,475	19,800	1,329,475	19,800	366,800	351,325	138,025	375,800	30,901,700	670,000	35,502,200
2030	1,329,475	19,800	1,329,475	19,800	366,800	351,325	138,025	375,800	30,901,700	670,000	35,502,200
2031	1,029,475	283,800	1,029,475	19,800	366,800	351,325	138,025	375,800	25,411,700	175,000	29,181,200
2032	1,029,475	283,800	1,029,475	19,800	366,800	351,325	138,025	375,800	25,411,700	75,000	29,081,200
2033	1,003,225	283,800	1,003,225	19,800	113,025	19,800	113,025	187,800	16,765,750	84,000	19,593,450
2034	1,003,225	283,800	1,003,225	19,800	113,025	19,800	113,025	187,800	16,765,750	84,000	19,593,450
2035	1,003,225	283,800	1,003,225	19,800	143,025	19,800	113,025	187,800	17,030,750	0	19,804,450
2036	1,003,225	283,800	1,003,225	19,800	143,025	19,800	113,025	187,800	17,030,750	0	19,804,450
2037	128,225	283,800	128,225	19,800	113,025	19,800	113,025	187,800	1,100,000	0	2,093,700
2038	128,225	283,800	128,225	19,800	113,025	19,800	113,025	187,800	1,100,000	0	2,093,700
2039	128,225	283,800	128,225	19,800	113,025	19,800	113,025	19,800	1,100,000	0	1,925,700
2040	128,225	283,800	128,225	19,800	113,025	19,800	113,025	19,800	1,100,000	0	1,925,700
Total	14,753,832	7,196,333	13,340,748	2,348,249	10,354,179	4,836,625	8,684,722	8,066,583	416,119,055	26,435,270	512,135,596
%	2.88	1.41	2.60	0.46	2.02	0.94	1.70	1.58	81.25	5.16	100.00
av/yr	590,153	287,853	533,630	93,930	414,167	193,465	347,389	322,663	16,644,762	1,057,411	20,485,424

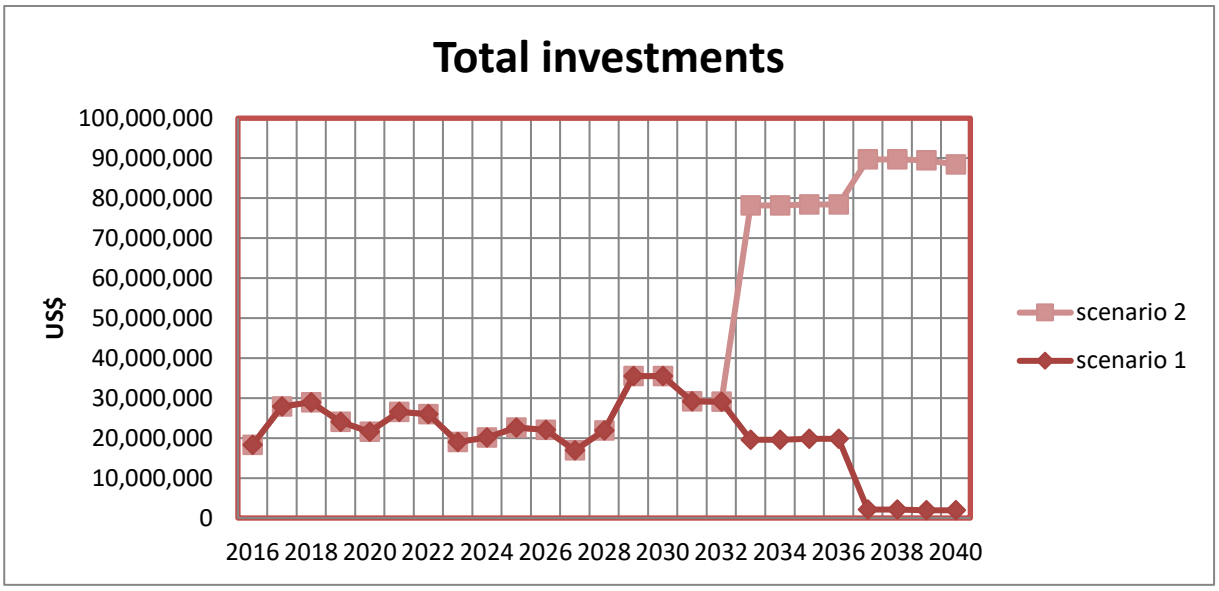
Long-term Scenario 1

US$	Lao PDR		Thailand		Cambodia		Viet Nam		Loan	Grant	Total
Year	public	private	public	private	public	private	public	private	Reg./Int.	Reg./Int.	
2016	743,633	420,200	482,483	289,050	568,733	306,800	836,383	689,450	11,900,100	2,044,933	18,281,765
2017	877,133	435,700	662,899	411,466	624,283	521,800	949,300	902,367	16,795,100	5,756,184	27,936,232
2018	987,800	447,867	688566	433,633	948,783	519,800	1,374,634	858,201	16,662,600	5,991,950	28,913,834
2019	597,466	447,866	508,233	433,633	737,900	519,800	1,171,299	858,199	16,662,600	2,144,018	24,081,014
2020	443,300	408,700	419,067	384,467	430,400	394,800	832,966	802,366	16,442,600	1,053,184	21,611,850
2021	209,475	19,800	153,225	19,800	460,502	19,800	287,845	19,800	22,451,903	2,928,500	26,570,650
2022	209,475	19,800	153,225	19,800	460,503	19,800	287,845	19,800	23,601,902	1,212,500	26,004,650
2023	209,475	19,800	153,225	19,800	194,275	123,800	138,025	207,800	17,475,000	462,500	19,003,700
2024	299,475	19,800	183,225	19,800	264,275	123,800	238,025	207,800	17,475,000	1,277,500	20,108,700
2025	233,225	519,800	173,225	19,800	780,025	123,800	228,025	207,800	19,403,000	918,667	22,607,367
2026	233,225	519,800	173,225	19,800	780,025	123,800	228,025	207,800	19,403,000	403,667	22,092,367
2027	233,225	519,800	173,225	19,800	780,025	123,800	228,025	207,800	14,328,000	303,667	16,917,367
2028	233,225	519,800	173,225	19,800	893,050	351,325	428,025	207,800	18,898,450	180,000	21,904,700
2029	1,329,475	19,800	1,329,475	19,800	366,800	351,325	138,025	375,800	30,901,700	670,000	35,502,200
2030	1,329,475	19,800	1,329,475	19,800	366,800	351,325	138,025	375,800	30,901,700	670,000	35,502,200
2031	1,029,475	283,800	1,029,475	19,800	366,800	351,325	138,025	375,800	25,411,700	175,000	29,181,200
2032	1,029,475	283,800	1,029,475	19,800	366,800	351,325	138,025	375,800	25,411,700	75,000	29,081,200
2033	1,003,225	283,800	1,003,225	19,800	113,025	19,800	113,025	187,800	75,390,750	84,000	78,218,450
2034	1,003,225	283,800	1,003,225	19,800	113,025	19,800	113,025	187,800	75,390,750	84,000	78,218,450
2035	1,003,225	283,800	1,003,225	19,800	143,025	19,800	113,025	187,800	75,655,750	0	78,429,450
2036	1,003,225	283,800	1,003,225	19,800	143,025	19,800	113,025	187,800	75,655,750	0	78,429,450
2037	1,618,225	283,800	128,225	19,800	334,025	19,800	113,025	187,800	86,724,000	253,333	89,682,033
2038	1,618,225	283,800	128,225	19,800	334,025	19,800	113,025	187,800	86,724,000	253,333	89,682,033
2039	1,618,225	283,800	128,225	19,800	334,025	19,800	113,025	19,800	86,724,000	253,333	89,514,033
2040	1,618,225	283,800	128,225	19,800	334,025	19,800	113,025	19,800	85,924,000	0	88,460,700
Total	20,713,832	7,196,333	13,340,748	2,348,249	11,238,179	4,836,625	8,684,722	8,066,583	992,315,055	27,195,269	1,095,935,595
%	1.89	0.66	1.22	0.21	1.03	0.44	0.79	0.74	90.55	2.48	100.00
av/yr	828,553	287,853	533,630	93,930	449,527	193,465	347,389	322,663	39,692,602	1,087,811	43,837,424

Long-term Scenario 2

From these tables, it can be concluded that :

- The total cost of **long-term scenario 1** is approximately 512,200,000 US$, or an average of 20,500,000 US$ per year;
- Each country should contribute 3 to 4 percent of this amount from its own public and private budgets;
- About 81 percent of these costs should be funded by international or regional loans;
- About 5 percent of these costs should be funded by international or regional grants.
- The total cost of **long-term scenario 2** is approximately 1,100,000,000 US$ (of which more than 50percent are investments in the 2033 -2040 period), or an average of 44,000,000 US$ per year;
- Each country should contribute 1.5 to 2.5 percent of this amount from its own public and private budgets;
- About 91 percent of these costs should be funded by international or regional loans;
- About 2.5 percent of these costs should be funded by international or regional grants.



6 CONCLUSIONS

The **Main Objective** of the Project was "To design a short term and a long term development programme which implementation will rehabilitate and improve the national and international transport network using the Mekong River in the Mekong River Commission Member Countries".

The **Specific Objectives** of the design of the Master Plan are:

1. To fully realize the regional trade and transport potential of the Mekong River as the most cost-effective regional transport mode and to attract foreign and domestic investments;
2. To fully use the vast potential for waterborne tourism and ecotourism in the upper part and lower part of the Mekong River Basin as a major impulse to private sector growth in all MRC Member Countries;
3. To combine, where possible, the economic and financial function of navigation with opportunities for poverty reduction by linking the rural navigation networks to the regional network; and
4. To make navigation safer and more sustainable for the people and the environment.

The Project started from the following **baseline conditions**:

- The **current situation and baseline conditions**, as delivered by the National Experts and completed by the International Consultants;
- The **ongoing and planned studies and projects** and national strategies and development plans, for the upper part of the Mekong River as for the lower part (e.g. Regional Action plan for Dangerous Goods, MRC – Development Plan on International Navigation on the Lancang-Mekong River, JCCCN – Feasibility Study on Waterway Improvement in Cambodia, KOICA – The Regional Investment Framework 2013-2022, GMS – Master Plan for Viet Nam Inland Waterway Sector to 2020 and Orientation to 2030, VIWA – etcetera.);
- The **economic forecasts**, providing scenarios for which the sustainability of waterborne transport on the Mekong River Basin should be guaranteed. These also showed a strong correlation between aggregate transport demand and real GDP in the case of all four riverine countries covered in the Master Plan. Moreover, it showed a strong rise in IWT competitiveness and modal share against road transport by the use of increased cargo boat capacity.

The Project started from following **assumptions**:

- That in the long term, ASEAN will lead to a higher integration and transport facilitation in and between the MRC member countries;
- That in the short term (2020), the Xayabury Dam and the Don Sahong Dam will be operational;
- That in the long term (2040), all planned dams in the PR China and four dams in the Huay Xay - Vientiane stretch of the River will be built (Pak Beng, Luang Prabang, Paklay and Sanakham, all except Pakchom dam);
- That in the long term Scenario 1, *not* all planned dams between Savannakhet and Kratie will be built (Ban Khoum, Latsua, Stung Treng and Sambor); and
- That in the long term Scenario 2, all four dams between Savannakhet and Kratie will be built.

*"The **goal of the Master Plan** for Regional Waterborne Transport in the Mekong River Basin is to increase waterborne transport in the MRB to at least 125% of the actual waterborne transport volume in 2020 and to at least 250% of the actual waterborne transport volume in 2040 and to make navigation safer and more sustainable for the people and for the environment."*

This goal should be achieved by:

- **FLEET:** The use of larger ships than actually used over the total length of the Mekong River and over the whole year, including the use of sea-river ships in the Mekong Delta;
- **RIVER DESIGN:** The creation of a safe navigation channel, able to accommodate larger ships over the whole year and provided with modern means of Aids to Navigation;
- **SAFETY:** The improvement of safety on all types of ships, including the use of more save passenger ships and ships carrying dangerous goods, including the promotion of the concept of "clean" river transportation, focusing on strategic prevention of environmental damage from waterway infrastructures or from shipping or port accidents;
- **PORTS:** The development of safe and efficient passenger ports and multimodal nodal points in the main cargo ports and dry ports;
- LEGAL: The full implementation of cross-border agreements and harmonization of standards, rules and regulations;
- **ENVIRONMENTAL:** The integration of Strategic Environment Assessment (SEA)/Environmental Impact Assessment (EIA) into IWT planning to effectively manage social and environmental impacts, including the predicted impacts of climate change;
- **SOCIAL:** The creation of socio-economic opportunities to link local IWT transport with national and regional routes; and
- **INSTITUTIONAL:** The coordination of a regional River Information Services and waterborne transport marketing.

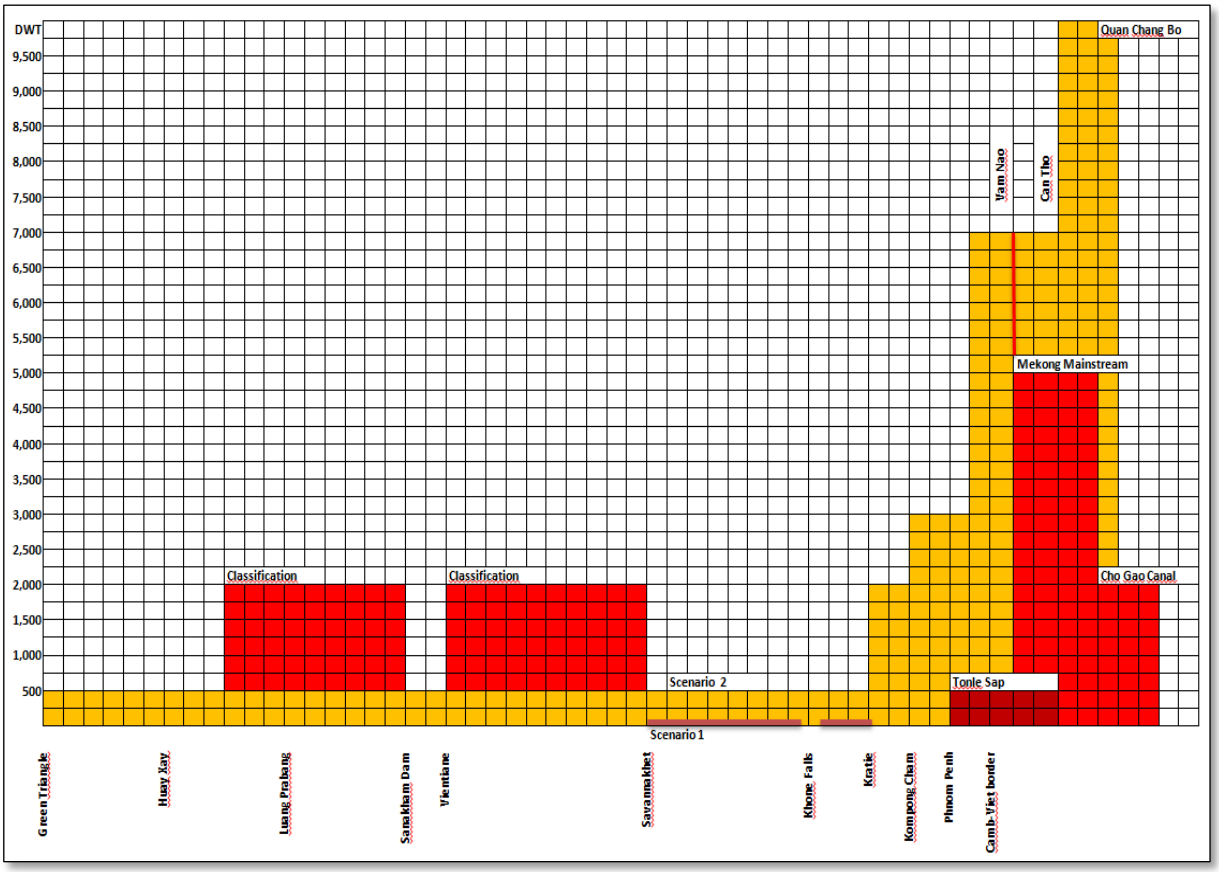
In order to achieve this, **short term (2025-2020) and long term (2021-2040) development scenarios** were drafted for fleet, waterway design, navigation safety, port development and management, socio-environmental and regulatory aspects.

As mentioned above, the long term scenario is developed with the assumption that in the long term, all planned dams in the PR China and five dams in the Huay Xay - Vientiane stretch of the River will be built. On the other hand between Savannakhet and Kratie, **two long term scenarios** are proposed: one scenario with all dams in this reach built and, one scenario in case *one of these* dams is not built.

In **long term scenario 1**, no investments are made between Savannakhet and Kratie, while in **long term scenario 2**, between Savannakhet and Kratie a waterway, able to receive 500 DWT vessels is proposed, including a bypass canal with two or three locks at the Khone Falls[9].

This leads to the following long term scenarios for the navigability of the Mekong Mainstream, the Bassac River and the Tonle Sap River and Lake:

[9] According to the economic consultant of the Master Plan, there is unlikely to be any significant demand for IWT in the stretch between Savannakhet and Kratie, other than for local and very limited tourist transport. While it is close to the large mineral reserves of the Bolovens Plateau, if these are ever deemed suitable for commercial exploitation, it is likely that any minerals would be transported by heavy haul railway to ports in Viet Nam (or possibly in Cambodia). Given the very limited outlook for cargo traffic in this stretch, coupled with the high capital cost of the project, it is unlikely that the by-pass canal at the Khone Falls can be economically justified.



Based on these development scenarios, the Master Plan Team prepared an **Action Plan** with some 54 short term actions (2016-2020) and some 44 long term actions (2021-2040), namely:

- 4 short term and 2 long term “Fleet Upgrade” actions;
- 5 short term and 11 long term “Waterway Design” actions;
- 7 short term and 2 long term “Waterway Safety” actions;
- 7 short term and 6 long term “Aids to Navigation” actions;
- 11 short term and 9 long term “Port Development and Management” actions;
- 6 short term and 5 long term “Regulatory” actions;
- 7 short term and 3 long term “Environmental” actions,
- 3 short term and 1 long term “Social” action;
- 1 short term “Capacity Building” action; and
- 4 short term and 5 long term “Institutional” actions.

In the **Actions Files**, objectives, outputs, deliverables and activities are described.

Furthermore, a time schedule (priority) and required human resources and budgets have been elaborated and a socio-environmental and economic assessment was made for every action (see **Final Report Volume II**).

Finally a financing plan was worked out and combined into a global **Investment Programme** for the whole Master Plan, leading to the following results:

Scenario 1	Lao PDR	Thailand	Cambodia	Viet Nam	Loan	Grant	Total
	Publ + Priv	Publ + Priv	Publ + Priv	Publ + Priv	Int + Reg	Int + Reg	
2016-2032	15,153,965	11,004,797	14,068,204	14,680,705	344,126,055	26,267,270	**425,300,996**
%	3.56	2.59	3.31	3.45	80.91	6.18	100.00
Average/year	891,409	647,341	827,541	863,570	20,242,709	1,545,133	25,017,705
2033-2040	6,796,200	4,684,200	1,122,600	2,070,600	71,993,000	168,000	**86,834,600**
%	7.83	5.39	1.29	2.38	82.91	0.19	**100.00**
Average/year	849,525	585,525	140,325	258,825	8,999,125	21,000	10,854,325
2016-2040	21,950,165	15,688,997	15,190,804	16,751,305	416,119,055	26,435,270	**512,135,596**
%	4.29	3.06	2.97	3.27	81.25	5.16	**100.00**
Average/year	878,006	627,559	607,632	670,052	16,644,762	1,057,410	20,485,423

- The total cost of **long term scenario 1** is approximately 512,200,000 US$ or an average of 20,500,000 US$ per year;
- Of this amount, about 53 percent is dedicated to waterway design and 37 percent to port development;
- Each country should contribute 3 to 4 percent of this amount from its own public and private budgets;
- About 81 percent of these costs should be funded by international or regional loans;
- About 5 percent of these costs should be funded by international or regional grants.

Scenario 2	Lao PDR	Thailand	Cambodia	Viet Nam	Loan	Grant	Total
	Publ + Priv	Publ + Priv	Publ + Priv	Publ + Priv	Int + Reg	Int + Reg	
2016-2032	15,153,965	11,004,797	14,068,204	14,680,705	344,126,055	26,267,270	**425,300,996**
%	3.56	2.59	3.31	3.45	80.91	6.18	100.00
Average/year	891,409.71	647,341.00	827,541.41	863,570.88	20,242,709.12	1,545,133.53	25,017,705.65
2033-2040	12,756,200	4,684,200	2,006,600	2,070,600	648,189,000	927,999	**670,634,599**
%	1.90	0.70	0.30	0.31	96.65	0.14	100.00
Average/year	1,594,525	585,525	250,825	258,825	81,023,625	115,999	83,829,324
2016-2040	27,910,165	15,688,997	16,074,804	16,751,305	992,315,055	27,195,269	**1,095,935,595**
%	2.55	1.43	1.47	1.53	90.55	2.48	**100.00**
Average/year	1,116,406	627,559	642,992	670,052	39,692,602	1,087,810	43,837,423

- The total investment cost of the Master Plan in scenario 2 is approximately 1,096,000,000 US$ (of which more than 50 percent are investments in the 2033-2040 period) or an average of 44,000,000 US$ per year;
- Of this amount about 78 percent is dedicated to waterway design and 17 percent to port development;
- Scenario 2 is influencing the investments at the earliest in the year 2033 (or 18 years from now), on the condition that all dams between Savannakhet and Kratie are operational.
- Each country should contribute 1.5 to 2.5 percent of this amount from its own public and private budgets;
- About 91 percent of these costs should be funded by international or regional loans;
- About 2.5 percent of these costs should be funded by international or regional grants.

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