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Economic Cooperation

Using More Inland Rivers in Intermodal Transport
(FINAL REPORT)

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1.1.1 Inland waterway system in China

There are as many as 5000 rivers within China territory with total length over 400,000 kilometers, including more than 100,000 kilometers navigable waterways. After construction in recent years, the total length of navigable waterways reached 122,800 kilometers until the end of 2008, among which, the ranked waterways is 61,100 kilometers and accounts for 49.8% of the total. There are 836 ship locks and 42 shiplifts on the navigable rivers as well as 1803 units of navigation obstructing dams and locks.

By the end of 2007, there are 7951 working berths in scaled inland waterways ports, of which 250 berths are above 10000 tons class and accounts for 3.3 percent. Of the 64 main inland waterways ports, a quarter (16) is equipped with special railway lines, and among them 15 ports own loading and unloading railway lines. The above mentioned ports totally have 3779 cranes and 2888 conveyors, the average loading and unloading equipment per berth is 0.97 units.

In 2007, the freight traffic volume carried by IWT reached 1.29 billion tons, accounts for 45.9 percent of the total freight transport (exclude seaborne trade), an annual growth rate of 11.1 percent over last year, lower than the national total freight transport annual growth rate, which is 13.1 percent in the same period.

In 2007, there are 355.3 billion ton-km of freight traffic on China's IWT system, accounts for 5.5 percent of the total, an annual growth rate of 17.4 percent over last year, higher than the national total ton-km annual growth rate, which is 15.8 percent in the same period.

The port traffic of IWT in China reached 2.36 billion tons in 2007, of this total, liquid bulk accounts for 7.1 percent, dry bulk 71.3 percent, general cargo 16.6 percent, and the rest containers accounts for 3.9 percent. There are three ports, Port of NANJING, Port of SUZHOU and Port of NANTONG, handle more than 100 million tons per year and there are 5 other ports handle more than 50 million tons per year. The

number of ports that handle more than 100 million tones is 27, whose traffic volume accounts for 50.9 percent of the national total IWT ports traffic.

By the end of 2007, the total IWT fleet is 326,229 units with total tonnages of 93.26 million DWT. Of the total fleet 146,064 units are self-propelled and 180,165 units are barges. The average tonnages/unit of self-propelled ship is 278; For the self-propelled fleet, 701 units are container fleet with net deadweight accounts for 2.2 percent and average tonnages/unit 1386 tons; 3620 units are tanker fleet, with net deadweight accounts for 3.6 percent and average tonnages/unit 368 tons.

1.1.2 Yangtze River

(1) Freight traffic

IWT in China mainly concentrate on three main rivers named Yangtze River, Pearl river and JINGHANG canal. The traffic of these three rivers accounts for 80% percent of the national total. Yangtze River area covers seven provinces and 2 big Metropolis, is the most important inland river in China. In 2007, the cargo traffic in Yangtze river system reached 0.53 billion tons, the ton-km of freight traffic reached 202.2 billion （exclude sea-river traffic）.

The freight traffic in Yangtze River mainly concentrated on JIANGSU, HUBEI AND HUNAN province. The traffic in these provinces accounts for more than half of the total Yangtze River traffic. Since 2000, the freight traffic growth rate in CHONGQING and JIANGXI province is above 20 percent, the highest in the whole river area, while in the lower reach of the River(SHANGHAI, JIANGSU) the traffic growth more slowly, as detailed in table 1-1.

Table 1-1 freight traffic in Yangtze river unit: 10000tons

	Freight traffic	**Proportions in Yangtze river**	**00~06annual growth rate**
SHANGHAI	3538	7.7%	2.1%
JIANGSU	10311	22.4%	2.6%
ANHUI	4571	9.9%	6.7%
JIANGXI	3624	7.9%	21.4%
HUBEI	7679	16.7%	11.7%
HUNAN	6793	14.8%	12.8%
CHONGQING	4450	9.7%	21.5%
SICHUAN	3167	6.9%	5.9%

(2) Main ports

In Yangtze River, the main ports include: port of LUZHOU, CHONGQING,

YICHANG, JINGZHOU, WUHAN, HUANGSHI, CHANGSHA, YUEYANG, NANCHANG, JIUJIANG, WUHU, ANQING, MAANSHAN, HEFEI, HUZHOU and JIAXING, as shown in table 1-2. Most of the ports is small ports with poor equipments, many of their berths is in natural condition and man power responsible for loading and unloading. But in recent years, some large scaled and modern specialized container and bulk berths has been constructed and put into use in some ports like WUHAN and CHONGQING.

Table 1-2 IWT main ports

	traffic	Railway lines
Name	10000tons	Yes/no
Yangtze river		
LUZHOU	1017	NO
CHONGQING	4257	YES
YICHANG	734	YES
JINGZHOU	253	NO
WUHAN	5278	YES
HUANGSHI	962	NO
CHANGSHA	2088	NO
YUEYANG	4100	YES
NANCHANG	766	NO
JIUJIANG	733	YES
WUHU	4681	YES
ANQING	2852	NO
MAANSHAN	3684	NO
HUZHOU	4204	YES
JIAXING INLAND WATER	902	NO

(3) Inter-modal transport

Due to the restricted infrastructure conditions and small scale of ownership in China's IWT system, the inter-modal transport developed very slowly. In 2007, the container traffic in IWT port only accounts for 7 percent of the total container port traffic.

The joint transport between river and ocean in container sector developed very quickly in the lower reach of Yangtze and Pearl River. The national IWT container traffic in 2007 reached 9.74 million TEU, of which, 4.24 million TEU in JIANGSU province(lies in lower reach of Yangtze River) and 3.91 million TEU in GUANGDONG province(lies in lower reach of Pearl river). As the Three Gorges reservoir area develop, the navigation infrastructure became better, the container traffic in CHONGQINQ and HUBEI province (lies in three Gorges reservoir area) reached 0.43 million TEU and 0.49 million TEU respectively. The total container traffic in the above mentioned three area accounts for 93.2 percent of the national IWT container traffic.

(4) Administrative Structure

The IWT industry in China is governed by MOT, whose main responsibility is the planning of waterborne transportation; draft industry and financial policies; responsible for prophase and anaphase evaluation work for centre government invested and centre and local government co-invested and foreign invested transportation infrastructure project; responsible for the layout and review of coastal lines; responsible for levying fees and dues in waterborne transportation and administration of domestic waterborne transportation, port and other waterborne services; organize and carry out key commodities and emergency transportation.

In order to realize the united administration in IWT sector, MOT set up Yangtze River Administration of Navigational Affairs and Pearl River Administration of Navigational Affairs to administrate the IWT in Yangtze River and Pearl River respectively. Their main responsibility is carry out the developing strategy study on Yangtze and Pearl river IWT sector, compiling and revising planning of IWT and ports layout; coordinating water resource comprehensive utilization; responsible for IWT administrative management, market management, coordinating transportation among provinces and industry administration.

--port Administration

Before 1980s, China ports were highly concentrated, in the beginning of 1980s, China carried out first port reform, the port and shipping enterprises was separated and became independent legal entity. In later 1980s, China reformed port administrative for the second time, the 25 ports which previous managed by centre government directly handled to the regional government, a system of “dual leadership by regional and centre government, with regional government dominant” was set up. Except the 25 ports in Yangtze river was governed by both centre and regional government, the rest of inland waterways ports were all handled to regional governments administration. Regional governments and port enterprises dominate the investment; centre government gives subsidy to some important projects. For the dual leadership ports, centre government department responsible for port planning, investment and financing, technical instruction and equipment procurement, accounting and production organizing; regional government responsible for the major leadership management; in financial sector it perform a “port support itself, revenue recover cost” system. In 2004, the “port law” was promulgated and all ports were handled to regional governments. Every government set up different administrative system according to their own actual situation.

--financing administrative

Before 1995, the fund for construction, maintenance and management of inland waterways depend mainly on government subsidy and navigation charges and lock charges, but it proved that it is not sufficient. After the 1995 meeting on national IWT,

it is authorized by the national council that the national budget adjusting fund which comes from exemption of vehicle purchase surcharge, port construction dues and the energy and traffic key project fund which comes from waterways passenger and freight surcharge will not restitute but used for IWT infrastructure and safeguard system, therefore the IWT construction funds was established. The national fund put into the construction of Yangtze and Pearl river and JINGHANG canal, and at the same time, according to the principle of “comprehensive planning, strips and blocks combining together, delegation of responsibility and coordinating construction”, the regional government’s enthusiasm was fully exert. There are different ways of raising funds for every government, which include “power generation support navigation” and “land subsidy waterways” models. The model of “coordinate power generation and IWT” was encouraged in some proper place and multi investment body was allowed in the construction of navigational and hydroelectric junction. For the important waterways construction and regulation projects, it is recommended to use international financial organization and governmental preferential loan. Large enterprises are encouraged to invest in inland waterways construction according to the principle that “the investor makes the investment decisions, reaps the profits and bears the risks”.

1.2 Mississippi River in the United States of America

1.2.1 Inland waterway system in USA

The Inland Waterway System (IWWS) is a key element in the nation’s transportation system. The IWWS includes approximately 12,000 miles of navigable waterways and 240 lock sites that incorporate 275 lock chambers. It handles shipments to/from 38 states each year. The system is part of a larger system referred to as “America’s Marine Highways” which encompasses both deep draft and shallow draft shipping.

In 2005, inland waterways maintained by the U.S. Army Corps of Engineers (Corps) handled over 624 million tons of freight (274 billion ton-miles)1 valued at over $70 billion,2 resulting in an average transportation cost savings of $11/ton (as compared to other modes).3 This translates into more than $7 billion annually in transportation savings to America’s economy.

A wide variety of public, semi-public, and private entities is involved in the maintenance and operation of the waterway. The following list illustrates the types of enterprises that directly depend on the waterways:

- Ports

- Ocean-going ships

- Towboats and barges
- Ship-handling tugs
- Marine terminals
- Shipyards
- Offshore supply companies
- Brokers and agents
- Consultants, maritime attorneys
- Cruise services
- Suppliers and others

The federal agencies most directly involved with the inland waterways are the U.S. Department of Transportation, the Corps, and the U.S. Coast Guard.

Figure 1 major inland waterways in USA and CANADA

1.2.2 Mississippi river system

Much of the commercially important waterways of the United States consist of the Mississippi River System—the Mississippi River and connecting waterways. The Mississippi River System, including the Gulf Intracoastal Waterway (GIWW) connects Gulf Coast ports, such as Mobile, New Orleans, Baton Rouge, Houston, and Corpus Christi, with major inland ports, including Memphis, St. Louis, Chicago, St. Paul, Cincinnati, and Pittsburgh. The Lower Mississippi River from Baton Rouge to the Gulf of Mexico allows ocean shipping to connect with the barge traffic, thereby making this segment vital to both the domestic and foreign trade of the United States. In the Pacific Northwest, the Columbia-Snake River System allows navigation 465 miles (750 km) inland to Lewiston, Idaho.

(1) Traffic levels:
In 2007, the Mississippi river system handled 699 million tons of freight of which 187.2 million tons were international imports and exports, 32.6 million tons were domestic coastal wise freight with origins/destinations ‘over the ocean’ outside the Mississippi and GIWW system and 479.2 million tons were internal, defined as traffic on vessel movements that take place solely on the inland waterway system within the United States. (Table) Most of the foreign traffic is handled at the international ports on the deep draft sections of the Mississippi and GIWW.

Table1-3: Mississippi river system 1988-2007 traffic by traffic of type (million short tons)

	1988	2000	2005	2006	2007
Total	601.6	715.5	678.0	702.1	699
Foreign					
Inbound	45.3	87.7	90.2	91.0	90.8
Outbound	97.5	100.5	75.3	93.3	96.4
Domestic					
Coastwise	35.8	34.1	28.9	27.2	32.6
Internal	423.0	493.1	483.7	490.6	479.2

Source: *U.S. Army Corps of Engineers Waterborne Commerce Statistics center*

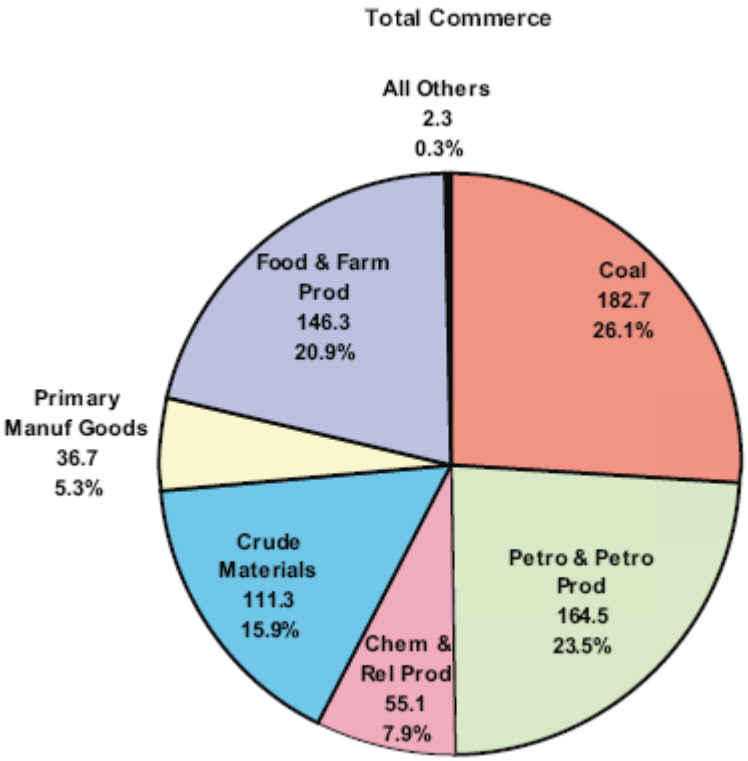
(2) Commodities
The traffic of Mississippi river system by commodity group is shown in the table. The traffic pattern by commodity has not changed much over the past 20 years, other than a decline in grain. The commodity mix in 2007 is dominated by coal, which is just over a quarter of the tons (26.1%); petro and petro products (23.5%); food and farm products (21%) ,but dominated by grain; crude materials (15.%) which include sand and gravel, stone, forest products, iron ore and scrap. If look through the patterns in foreign trade and domestic trade which include coastwise and internal, it shows big difference, in foreign trade traffic the farm and food products which is mainly grain and petro and petro products is in a leading proportion (74%); while in domestic, coal

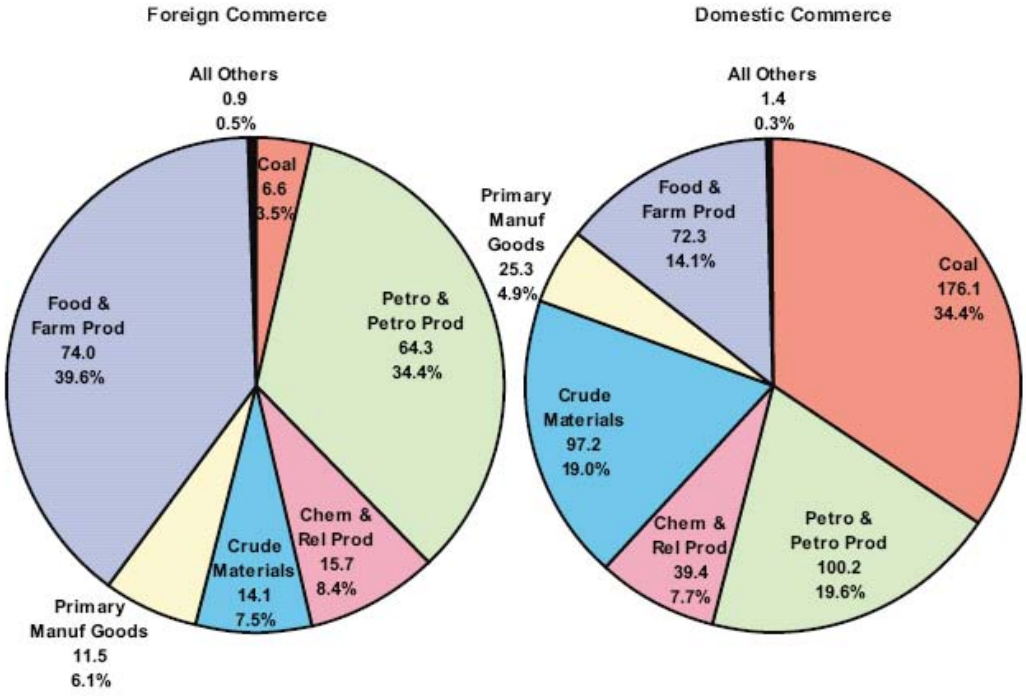
and petro and crud material and food and farm products is in the dominate position. See figure.

Table1-4: Mississippi river system all traffic by commodity group 1988-2007 (million short tons)

	1988	2000	2005	2006	2007
Coal	173.8	177.2	185.9	184.9	182.7
Petro and petro products	124.4	150.0	142.8	149.4	164.5
Chemicals and rel products	50.8	50.3	53.3	52.5	55.1
Crude materials	78.6	115.8	120.4	120.7	111.3
Primary manufactured goods	18.3	50.4	46.0	48.8	36.7
Food and farm products	156.4	169.0	127.3	143.5	146.3
All manufactured equipment	0.8	2.1	1.8	1.5	2.0
Other	0.4	0.7	0.5	0.7	0.3
Total	**601.6**	**715.5**	**678.0**	**702.1**	**699.0**

Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics center





(3) Services

The Mississippi river system consists of nearly 10 , 000 km of waterway with minimum 9 foot (2.74 m) draft. Table 3 summarizes the main river sections of the Mississippi river system and typical lock characteristics. The lock lengths shown are the main 'ruling' locks. On the less busy upper reaches of some rivers there are sometimes one or two much smaller locks. On the Mississippi main stem, while 183 m locks predominate, there are three locks of 366 m length at busy points. On the Ohio River all the locks are doubled-chambered and while main locks are 366 m the auxiliary chamber is generally 183 m long.

Table 1-5: Lock Characteristics, main rivers on Mississippi System*

River	Length (km)	No. of locks	No. of chambers	lock length (m)	Lock width (m)
Mississippi	2919	28	34	183	33.5
Ohio	1578	20	40	366	33.5
Tennessee	1049	9	14	183	33.5
Illinois	1578	7	7	183	33.5
Monongahela	208	9	13	183-219	17-26
Allegheny	116	8	8	110	17
Missouri	1178				
Red	341	5	5	239	26
Cumberland	613	4	4	121-242	26-33.5

* These rivers account for more than 85 percent of tonneage on this system.

The key service characteristic of the U.S, system is the use of large capacity tows of standard barges for regular shipments of bulk commodities carried at contract freight

rates from point to point on the waterway system. Single tows of 15 barges lashed together in the Upper and Lower Mississippi basin above Baton Rouge are common, while up to 45 barges are lashed in a tow below Baton Rouge. Apart from the Ohio River, where 366 m locks are the norm, the standard lock size on the Mississippi system is 183 m. This requires that 15 barge-tows, which are twice that length, must be split and 'double-locked' which adds to barging costs. A small number of 366m lock chambers have been added in recent years at congested locks and some others are planned, though constrained by limited funding as described in Section 2.

The basic objective of the industry has been to provide reliable transport to non-time sensitive bulk traffic, at lowest possible cost. In this regard IWT has been very successful in specific markets. These include grain from the mid-west heartlands (e.g. Minnesota, Iowa, Illinois, Indiana, Ohio, Kentucky, Tennessee, Arkansas) down the Mississippi for export from deep water ports; agricultural fertilizers in the reverse direction; coal from mines to power plants (particularly in the Ohio Valley between Pennsylvania and Tennessee); petroleum (to over 1000 terminals along the inland and intra-coastal waterways); and others.

Although there is little published data on the (mainly) contract freight rates charged by barging companies, it has been estimated that, on a like with like basis , IWT costs in the USA are about two-thirds of the costs of railways and about a third of the costs of transport by road truck.1

IWT in the USA operates a very efficient and effective barging service, probably the most cost-efficient in the world. But it is essentially a 'niche' mode in the US. Its market niche is determined by, amongst others:

- The geographic limitations of the IWT network. Although an extensive network in the Mississippi and GIRR system, the overall IWT system is a relatively small network by national standards. IWT can only compete where it exists. The commercially significant waterway network consists of around 19,300 route-km of waterway. This compares with nearly 97,000 route-km of Class 1 railways, nearly 1.65 million km of pipelines and around 4 million km of public roads;[2]
- The evolution of the USA economy from an agricultural and resource-based economy to a manufacturing and then services economy. This has seen slower growth or stagnation in some of the industries that generate bulk traffic most favourable to IWT;
- The limited ability to reap further productivity benefits from an already high level without massive and probably unrealistic levels of public investment in navigation infrastructure;

IWT in the USA is also competing with what is the most efficient freight railway

[1] David Grier, Waterway Services, Issues and Capacity: The Corps of Engineers Role, paper to Midwest Agricultural Conference, 2007.
[2] http://www.bts.gov/publications/transportation_statistics_annual_report/2006

system in the world. The IWT industry has not been able successfully to extend its market reach to new traffic types that value other attributes of transport more highly than lowest tariff, or to much higher levels of inter-modal transport. By contrast, the US Class 1 railways have invested in the technologies and infrastructure (such as double-stacking of containers) that have enabled them to attained substantial growth from container and other inter-modal traffic in recent years.

There is now some concern in the US that, at a time when national transport strategy is consistent with making greater use of IWT, the reliability of the system may be deteriorating. The average age of the 192 commercially active locks is over 50 years. Most of the locks on the Upper Mississippi, Illinois and Tennessee Rivers were built in the 1930's. It appears that planned maintenance interventions and times are increasing, as well as unplanned engineering interventions following failures and other serious malfunctions (Grier 2006). 3 THE USACE Lock Performance Monitoring System indicates that lock unavailability time has more than doubled in 10 years. If the problem were to worsen this could be expected to hit both transit times and service reliability, and feed through to higher costs. The modal share of IWT would then further reduce.

(4) Policy and administration

Two Federal Government agencies have the main responsibilities for the IWT system in the US; they the Maritime Administration of the USDOT (MARAD) and the US Army Corps of Engineers (USACE). The role of each is discussed below.

---MARAD and the IWT sector

As already noted, the USDOT has responsibility for overall Federal transport policies in the USA. In the IWT sector it is also specifically responsible for vessel and navigation safety, and for navigation aids. While USDOT determines overall transport policies, the executing agency for most of its IWT and other maritime responsibilities is the Maritime Administration (MARAD) one of ten operating administrations of the USDOT.4

MARAD's main stated objective is to improve and strengthen the US marine transportation system - including infrastructure, industry and labor - to meet the economic and security needs of the USA. Following the 1920 Merchant Marine Act (also known as the Jones Act) it promotes the development and maintenance of a US-owned, built and crewed domestic fleet of vessels sufficient to carry all domestic waterborne commerce and a substantial portion of its waterborne foreign trade, and

[3] David V Grier: The Declining Reliability of the US Inland waterway system, USACE 2006.
[4] The other nine are: Federal Aviation Administration; Federal Highway Administration: Federal Motor Carrier Safety Administration; Federal Railroad Administration; Federal Transit Administration; National Highway Traffic Safety Administration; Saint Lawrence Seaway Development Corporation; Pipeline and Hazardous Materials Safety Administration; Research and Innovative Technology Administration

capable of service as a naval and military auxiliary in time of war or national emergency. MARAD also seeks to ensure that the United States maintains adequate shipbuilding and repair services, efficient ports, effective inter-modal water and land transportation systems, and reserve shipping capacity for use in time of national emergency. In terms of USDOT's Strategic Plan, MARAD gives particular weight to the goal of commercial mobility by reducing congestion on the nation's inland waterway, marine and landside infrastructure

As noted, USDOT policy in IWT is based on the idea that the US waterway system could help alleviate some congestion in the US land-transport system. Those parts of NARAD's own strategy (2003-2008) that that are most relevant to IWT, and which are intended to cohere with USDOT's Strategic Plan for Transport, include measures to:

- preserve US Cabotage laws (that, among other things, preserve IWT to US owned, built and crewed vessels);
- support maritime education institutions and the development of public-private partnerships to expand maritime education and training;
- work closely with state and local governments to implement programs to educate the public to the importance and impact of the maritime transportation system;
- manage agency financial assistance programs in an effective and efficient manner to preserve and protect the interests of the government while maximizing flexibility and efficient operations for the private sector;
- partner with public and private organizations to increase the use of waterborne transportation to relieve landside congestion, improve overall transportation safety and mitigate environmental problems;
- partner with industry, state, and local governments, and other Federal agencies to identify new business opportunities for US inland, domestic, and international maritime industries;
- foster public-private partnerships to improve land and waterside access to ports and marine terminals and transportation infrastructure;
- partner with industry and other government organizations, both foreign and domestic, to reduce barriers to intermodal transportation through the adoption of safe and environmentally responsible national/international containerized and non-containerized standards;
- transfer surplus Federal property to State or local ports to improve services at those facilities. support efforts to eliminate unnecessary US regulatory standards, to reduce major bridge impediments that restrict full utilization of navigable waterways, and to assure effective solutions to environmental issues, including dredging, which inhibits the throughput of US ports and waterways;
- support and facilitate development of innovative, safe, secure, and environmentally sound vessel designs, technologies, shipbuilding processes, and consensus standards to improve US maritime efficiency;

- exercise leadership in working with national and international partners to develop and implement marine transportation related national and international environmental standards and requirements;
- adopt transport policies and promote marine related technologies and systems that reduce degradation of environmental quality;
- serve as a catalyst with federal and state agencies and stakeholders to conduct research and identify, demonstrate, and promote energy efficient, alternative fuels, and air pollution reduction technologies for maritime applications;
- work proactively with transport partners to implement integrated multi-modal approaches to resolving transport challenges that harmonize transportation and environmental protection goals and enhance intermodal transportation planning tools through the development and use of multi-modal models that incorporate environmental impact considerations;
- partner with federal and state environmental regulatory agencies and the private sector to develop guidelines and best management practices to assist maritime industry partners in improving environmental stewardship and compliance;
- Continue to partner with other federal agencies and stakeholders to establish appropriate testing protocols and test and verify ballast water treatment technology to reduce the introduction of aquatic nuisance species.

--USACE and the IWT sector

USACE is made up of approximately 34,600 Civilian and 650 military personnel. Its overall responsibilities include: planning, designing, building and operating water resources and other civil works projects; designing and managing the construction of military facilities for the Army and Air Force; and providing design and construction management support for other Defense and federal agencies.

USACE has the responsibility to facilitate safe, reliable and economically efficient movement of vessels which it does by building and maintaining navigation channels and harbors, operating most locks[5], and regulating water levels on inland waterways. It's responsibilities in the IWT area are supported by its Institute for Water Resources (IWR). The IWR was set up by USACE in 1969 to provide the Corps with long-range research and planning capabilities to assist in improving the civil works planning and evaluation process. It provides specialist expertise in hydrological engineering, integrated water resources management, international trends and experience, planning, policy analysis and project management.

The USACE defines its mission in Navigation as:

'*to provide safe, reliable efficient, effective and environmentally sustainable waterborne*

[5] A few of USACE-owned locks (particularly seasonal locks) are operated by companies under contract and a few by State administrations. On the Tennessee River, locks are owned by the Tennessee Valley Authority but operated by USACE.

transportation systems for the movement of commerce, national security needs and recreation'[6].

The major role of the military in the administration of IWT in the USA is unusual by international standards. USACE attained this role in the early nineteenth century through the constitutional authority of the Federal Government to regulate commerce and navigation between states (maritime and inland waterway transport were then the main trading modes), to clear river obstructions and to provide improvements to navigation. In 1824, Federal laws authorized the USACE to improve safety on the Ohio and Mississippi Rivers and several ports. During the Civil War of 1861-1865 federal military domination of the Mississippi River was of great strategic value to the Union forces and reinforced the concept of federal control of inland waterways. USACE maintains more than 19,000 km of commercially significant inland waterways, operates 235 locks, and maintains 300 commercial ports and more than 600 smaller ports.

In addition to its responsibilities for navigation, the USACE is responsible for various other aspects of water resources management on the inland waterway system, including:

- environmental management;
- flood protection;
- hydro-electric power
- recreational use of waterways
- regulation of development affecting waterways
- water supply

The USACE, in its literature, gives specific endorsement to the concept of environmental sustainability. It has published a set of "Environmental Operating Principles" applicable to all its decision-making and programs. These include, among other environmental aims, the intention to:

- strive to achieve environmental sustainability; an environment maintained in a healthy, diverse and sustainable condition is necessary to support life;
- recognize the interdependence of life and the physical environment;
- seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another;
- seek ways and means to assess and mitigate cumulative impacts to the environment.

The concentration of responsibilities for administration of inland waterways in the USA contrasts the great numbers of governments, levels of government, and

[6] http://www.marad.dot.gov/

inter-governmental organizations that impinge upon the administration of IWT transport in Europe. As a result, there is a much more integrated responsibility for management of water resources. As might be expected, the physical inventories and usage data on the IWT system are also more comprehensive and standardized.

However, in the IWT area, the USACE primarily sees itself not as transport policy maker but as a planning and implementing body that focuses on:

> *'developing and implementing solutions through collaboration with stakeholders (regions, states, tribes, local entities, other federal agencies and other governments, etc.) and playing a leadership or support role as appropriate'.*

In addition to wider collaboration with other groups, the need for more structured stakeholder input into the governance of navigation is reflected in the establishment of the Inland Waterways User Board (IWUB). The IWUB is an industry Federal advisory committee established by the 1986 Water Resources Development Board. The eleven-member Board represents all geographic areas on the fuel-taxed inland waterways system of the United States. (The significance of the fuel tax is explained below). The composition of the Board is balanced between freight customers and barge companies of different sizes and specializing in different commodities. The IWUB is chaired by the Director of Civil Works of the USACE. It makes recommendations to the Congress and the Secretary of the Army on the priorities and spending from the Inland Waterways Trust Fund for construction and rehabilitation projects on the fuel-taxed system. The Board typically meets three times a year with the meetings open to the public.

--Intermodal

Very little container traffic is found on main inland waterways although overall IWT traffic is quite high in the United States.
Due to the general orientation of the river network, which is north-south, and which therefore does not coincide with the container movements, generally going east-west, no stable container traffic has developed on the Mississippi River. Furthermore, rail with its double stack trains, has become strong competition.
However, since July 2002, the port of Baton Rouge on the Mississippi River has been operated a weekly regular line between Louisiana and Texas, which has the advantage of running in an east-west rather than the dominant north-south direction. Traffic has reached 40,000 TEUs in 2002.
Recently, the US Department of Transportation funded studies on container-on-barge transport in the Mississippi River basin, notably a feasibility assessment of truck-barge intermodal freight transport and empty container management for container-on-board transport. This is one of the key issues in order to break new ground and demonstrate the relevance of IWT for the transport of containers, even in a highly competitive environment.

Chapter TWO European river's role in the multimodal transport

Together with rail and short sea shipping, inland waterway transport is considered to be a mode of transport which can contribute to sustainable mobility and help improve the sustainability of the transport system. Per ton-km, inland waterway transport is extremely energy-efficient and is regarded as one of the most environmentally-friendly and safest modes of transport. The Community has more than 35 000 km of inland waterways linking many towns and areas of industrial concentration. Inland waterways exist in 18 out of the 25 Member States. The modal share of inland waterway transport currently accounts for 7% of total inland transport in the European Union. In the hinterland of the largest seaports, the modal share of inland waterway transport can reach up to 43%.

2.1current situation of European inland waterway

In the present European Union (EU-15),IWT ranks third in inland freight transport after road and rail with 440 million tons per year; representing a 3.5% market share in volume and 125 billion ton-km or a 6.5% market share in transport performance. IWT has been unable to keep pace with the rapidly expanding road sector and has therefore gradually lost its modal share since 1970. However, its transport performance in ton-km has grown by 23 billion ton-km or over 20% during this 30-year period. The enlargement in 2004 has added about 3.5% in ton-km (of IWT); the accession of Romania and Bulgaria would raise that figure to 5%.

European inland waterway networks mainly include: the Rhine and its tributaries (Netherlands, mid-western Germany, north of Belgium, Luxembourg, France and Switzerland); the East-West corridor(northern and eastern Germany, Poland and Czech Republic);the Danube corridor (south-eastern Germany, Austria, Slovakia, Hungary, Romania, Bulgaria);The North-South corridor (parts of the Netherlands and Belgium, France).

The importance of IWT in the various countries and regions shows a great diversity. Its centre of gravity undoubtedly lies in the Rhine corridor and this is not expected to change. The Netherlands, Germany and Belgium on their own provide some 113 billion ton-km or 90% of the IWT performance in the EU-15; IWT’s modal share amounts to 40%, 14% and 12% respectively in these countries and is thus higher than the rail share in the Netherlands and some regions in Germany. A precondition for this

high modal share of IWT is adequate demand and above all the availability of an efficient infrastructure in terms of waterways and ports.

In other countries and corridors, IWT can also significantly contribute to environmentally acceptable transport. In this way IWT not only contributes to and assists the integration of these countries to the EU-core but IWT can also offer relief for road and rail transport, whose infrastructure in many accession countries still lags far behind EU standards and is currently already overburdened on a number of routes.

Figure 2-1 European inland waterways network

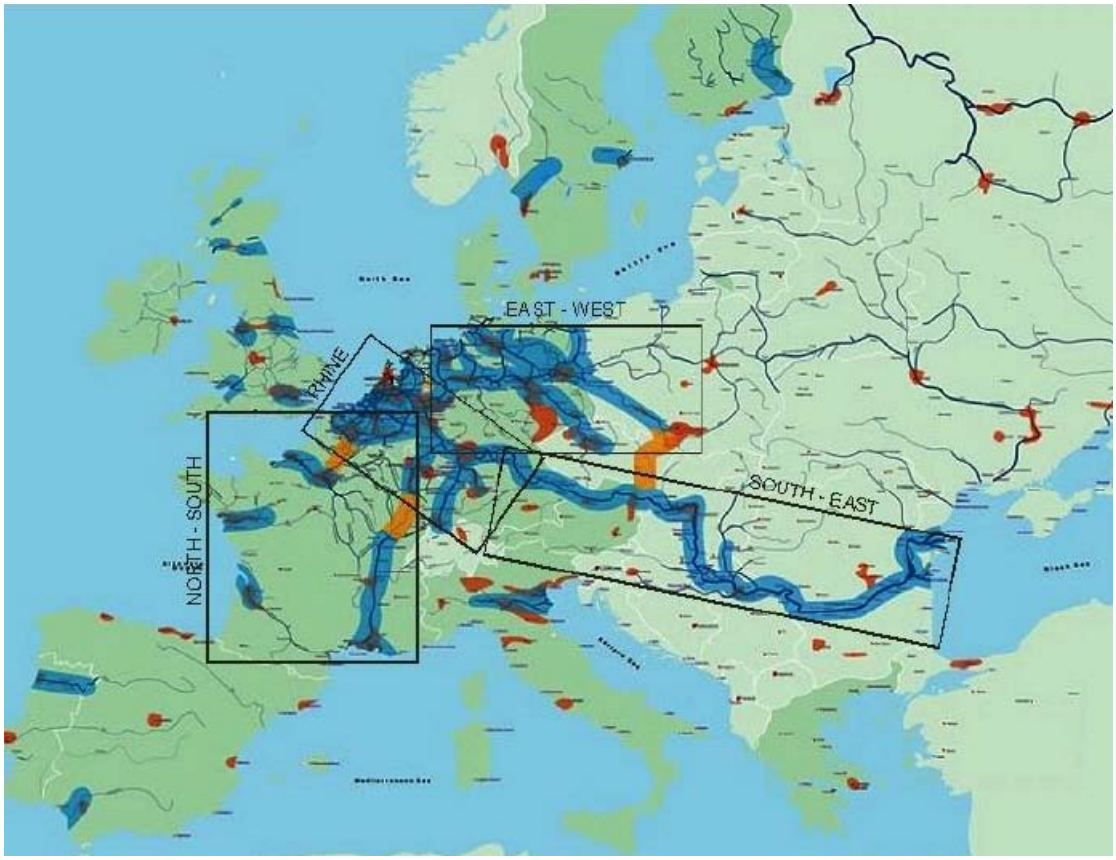


Figure 2-2 the main corridors in European inland waterway

The European inland navigation fleets are characterized by a large variety of vessels. However, two main types can be identified: single self-propelled vessels and push boat technology, both in different sizes and variations.

Self-propelled vessel load capacity in the four corridor fleets amounts to approx.7.5 million deadweight tons, of which 84% is registered in the Rhine corridor. The North-South and East-West corridors account for 6%each, whilst 4% is attributed to the Danube corridor.

Pushed barges with a total capacity of 6.4 million tons are more evenly distributed, with the Danube accounting for 44% followed by the Rhine with 34% and the East-West-and North-South fleets with 13 and 8%, respectively.

In general, relatively high safety standards are met, especially in the Rhine corridor. A further clear characteristic of all of the IWT fleet is the long lifetime of vessels. This has both advantages and drawbacks. Whilst investment for buying a ship can be extended over decades, the long lifetime also hinders fleet innovation. This applies both to size (scale enlargement) and the implementation of technological innovations. On balance, disadvantages arise from competition with other modes.

Modernization and innovation enhance efficiency, safety and an improvement of

environmental performance and, ultimately, also competitiveness. However, systematic research activities in this area are in most of the countries very limited or non-existent. In view of the long vessel life-time and the large number of financially restricted ‘single-vessel-operators’, these aspects are of vital importance.

Some parts of the fleets of the accession countries are insufficiently market-oriented: An example is the shortage of self-propelled vessels and the surplus of pushed barges on the middle and lower Danube. Interoperability between the corridors depends on technical standards and vessel sizes in relation to infrastructure standards. Also due to the required technical standards on the Rhine, access of Danube vessels to the Rhine corridor is limited.

The interaction between fleets and waterways as well as the influence of infrastructure standards on the fleets performance and competitiveness-as explained below-underline the importance of good and sufficient infrastructure conditions. As long as financial means (and/or infrastructure conditions) are not improved, an optimal use and exploitation of the existing infrastructure is of crucial importance. A targeted further optimization of the existing vessels so that they comply with the existing infrastructure conditions could strengthen the competitive position of inland navigation.

2.2Comparative advantage of inland navigation

Based on an initiative of the Association of European Inland Shipping and Waterways the German Federal Water and Shipping Administration(WSV), represented by the Water and Shipping Directorate East, has commissioned a comparative study among transport modes. The main results of the study are:

(1) According to such differentiated comparative calculations for selected routes (O-D pairs), today’s inland shipping has the lowest specific energy consumption of three considered modes. On seven of eight selected bulk freight routes, and on all chosen container routes, inland ship transport has lower energy consumption than railway transport. The highest energy consumption occurs generally with truck transport. The figure below demonstrates the spread by routes and the average values of primary energy consumption per ton-km.

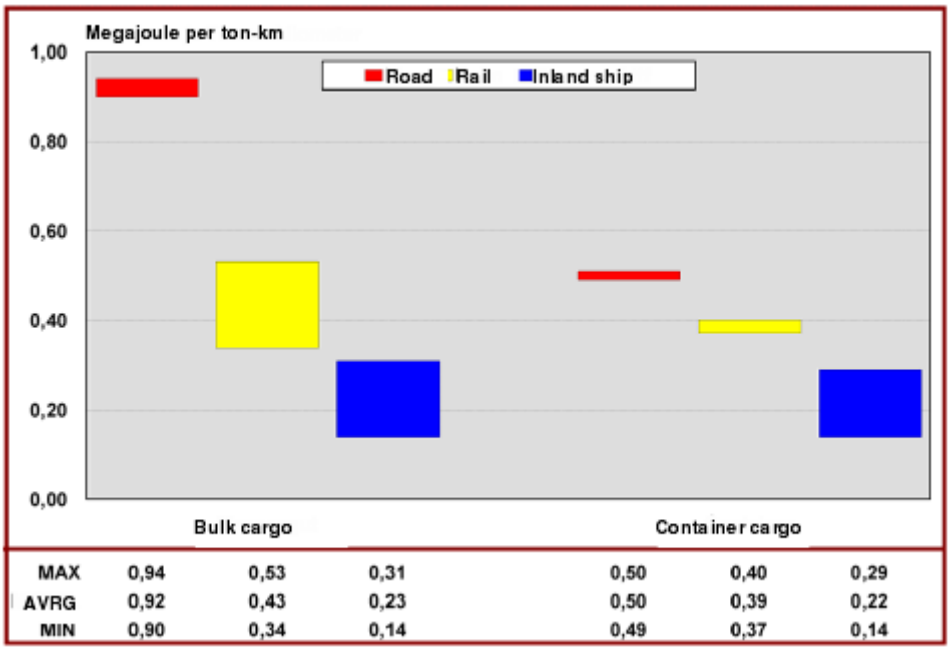


Figure 2-3 Spread and Averages of Primary Energy Consumption on Selected Transport Relations

（2）External Cost. External costs are defined as non-compensated impacts by transport agents on not involved third parties. ‘External’ means: the negatively affected third party receives no(no full)compensation. In the transport sector external effects occur in following fields: Transport safety, Noise, Climate gases, Air pollution, Landscape dissection and area consumption.

A. Transport Safety，These analyses and calculations confirm the position of inland shipping as the safest transport mode compared to road and railways. On the average, in the years 2000 to 2005 accidents with the involvement of freight vessels caused 0.04 death cases. For railway freight, the comparative figure is 0.28, and 2.48 for road freight of all economic costs caused in Germany by freight transport accidents in the period 2000 to 2005, 96.9%are due to trucks, 2.0%to railways and 1.1%to inland shipping.

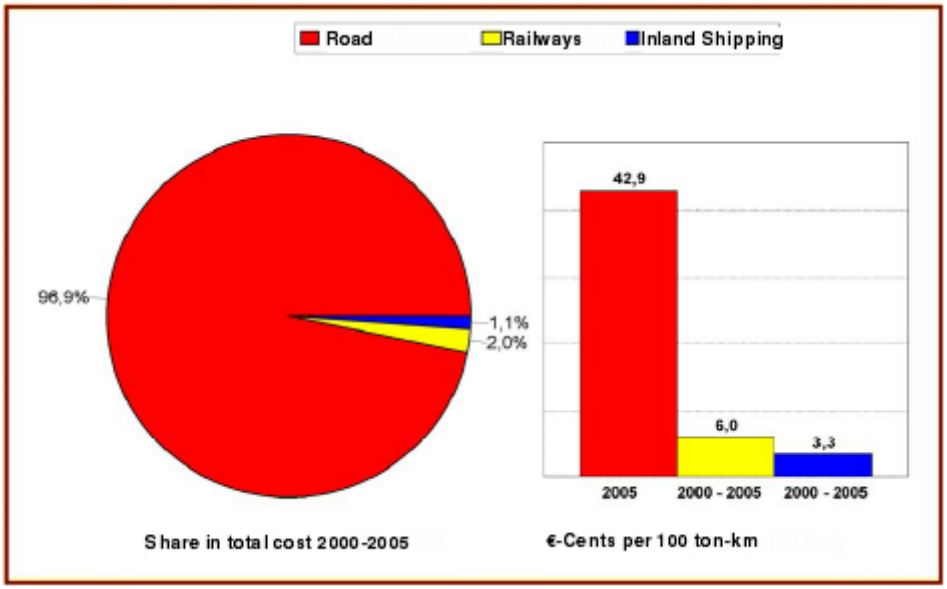


Figure 2-4 Total and Unit Economic Costs of Accidents in Freight Transport on Road, Rail and Inland Waterways

B. Traffic Noise

To evaluate the negative impact of noise on the affected populations, the INFRAS report analyses various studies on the willingness to pay, of the affected people, for reducing noise levels. The report also considers the increased risk of heart attacks and of treating cardiovascular diseases due to continued exposition to noise. Combined with the number of affected people, INFRAS arrives at average costs of noise per ton-km of€-Cents 0.79 for trucks and 0.33 for railways.

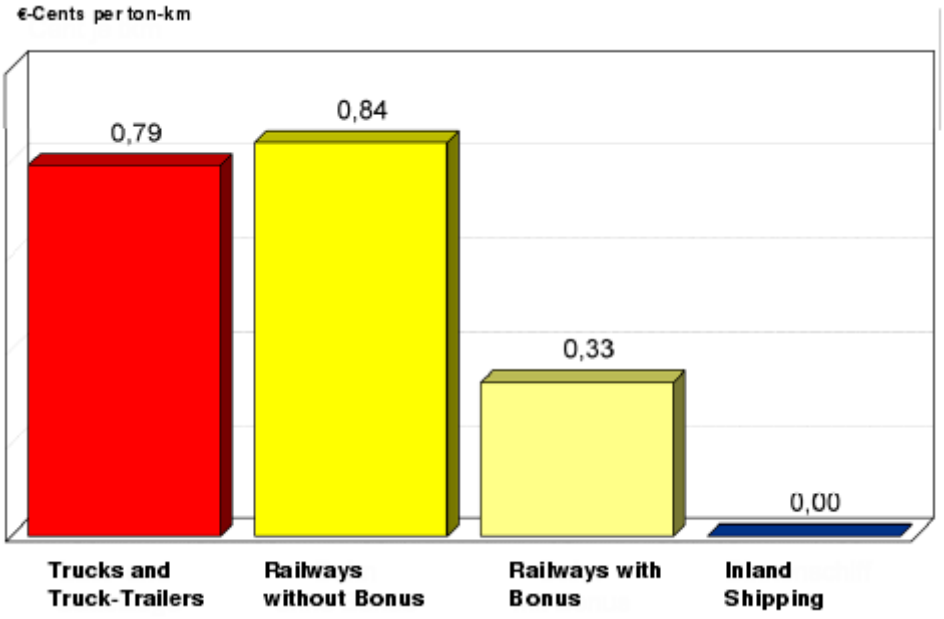


Figure 2-5 Average External Costs of Traffic Noise

C. Climate Gases

Calculations have been prepared for selected OD pairs (routes). Clearly, the highest specific CO_2 emissions are caused by road trucks. This remains valid if the additional collection and distribution transport by trucks is considered for containers carried by railways or ships on their main route section. For five of eight analyzed bulk freight transport cases, inland shipping causes lower CO_2 emissions than railways. As regards container transport in the Rhine corridor, the CO_2 emission per TEU of inland shipping is by 19% to 55% lower than for railways. For the Elbe River, railways have an advantage by 15% per TEU, if compared to pusher-lighter combinations on the river. The following figure shows the spread and average values of climate costs for selected transport routes.

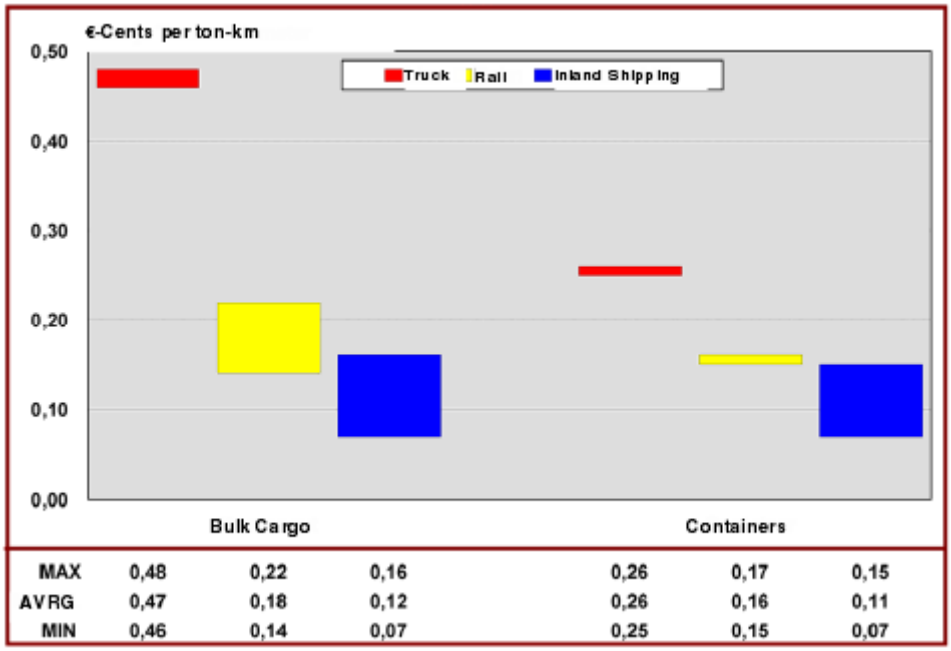


Figure 2-6 Spread and Averages of External Costs of Climate Gas(co2) For Selected Transport Routes

D. Air Pollution

Exhaust emissions from inland shipping will decrease significantly due to the introduction of more strict regulations. This is also valid for road freight (transition to vehicles of emission class EURO 5). As regards electricity for railway transport the development largely depends on the future structure of primary energy used by power plants.

Both further improvements and deterioration are possible. Therefore, unchanged emission factors will be assumed here. This leads to a significant improvement of the competitive position of competing modes till 2025.

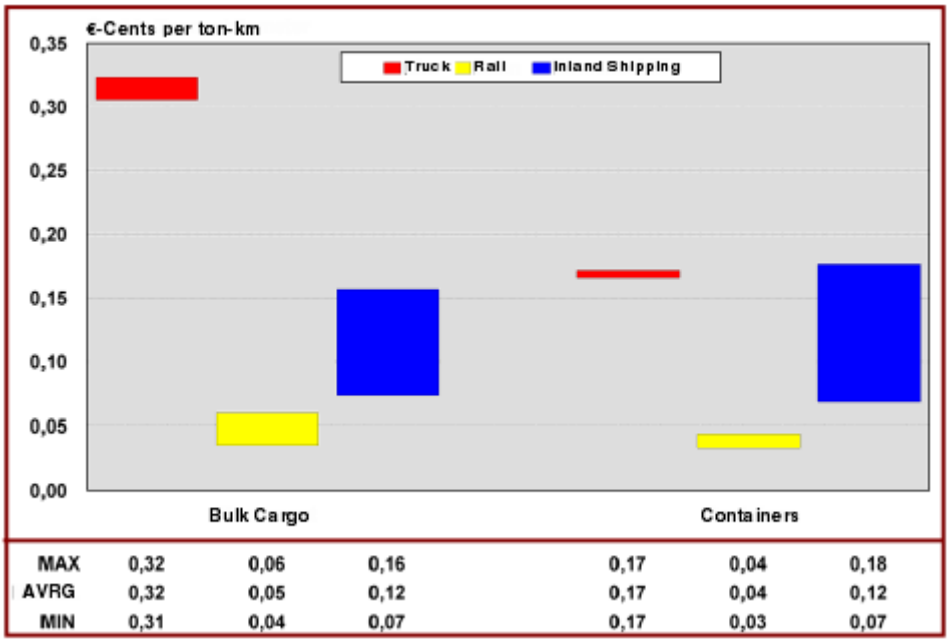


Figure 2-7 Spread and Averge Values of External Costs of Air Pollution for Selected Routes in 2006

E. Landscape Dissection and Area Consumption

The three transport modes road, railways, waterways differ in the magnitude of required areas as well as in their quality impacts. The waterway network of 6,700 km (of which 1,742 km canals) is much shorter than the railway network (34,200 km)or the road network(231,600 km). While roads and railways directly consume areas, waterways, being largely natural water courses, have only an indirect impact on landscape consumption.

When summarizing the external costs from traffic noise, accidents, climate gas and air pollution, a clear advantage of inland shipping becomes obvious for all selected routes, for bulk freight as well as for containers. This advantage remains valid even if a bonus is assigned to railways regarding noise pollution.

On bulk freight routes, the external costs of inland shipping are on the average by 83% lower than those of road transport, and by 70% lower than for railway transport. The spread of external costs, with minimum and maximum values, confirms this clear advantage of inland shipping.

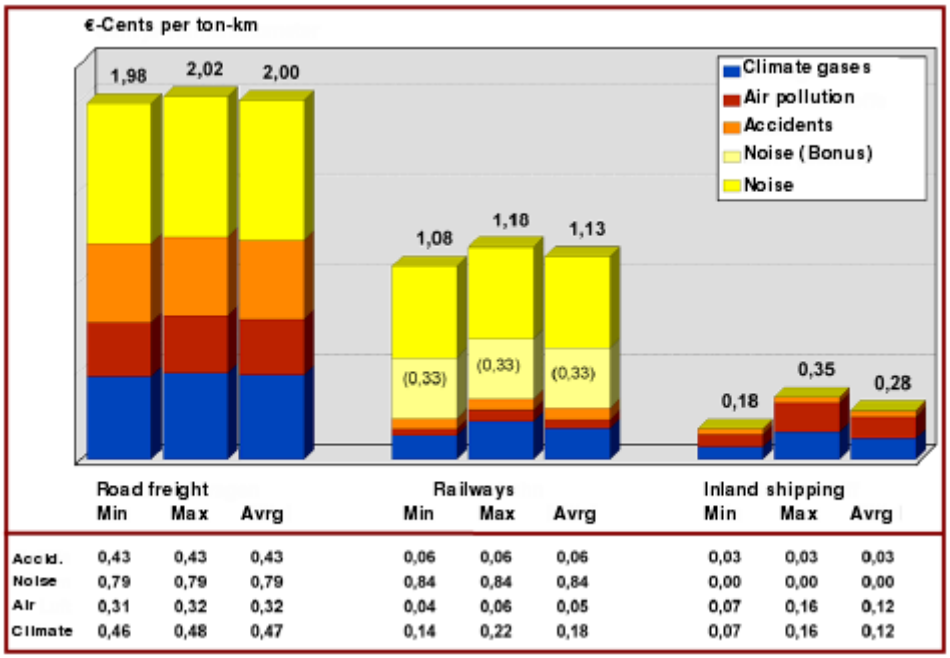


Figure2-8 Spread and Averge Values of All External Costs for Bulk Freight on Selected Routes

2.3Policy and legislation

IWT operates within the political and legislative framework, set by EU and national authorities, including international agreements. During the past couple of decades, significant changes have led to liberalization of (large segments of) the transport markets. Despite the principle of equal treatment of all modes, some IWT issues at EU level have been tackled more slowly because of international IWT arrangements(Rhine and Danube Conventions, UN-ECE etc.) and the fact that some Member States have no or only insignificant waterway transport.

Waterway countries (B,D,F,NL,A) have applied national IWT policies of their own, while the other Member States have not given such policies much national attention; this also applies to the accession countries. A review of these policies gives the impression that IWT is not always treated according to its potential importance. For example, on the basis of the current share in transport performance, rail sometimes seems to be favored compared to IWT in terms of infrastructure budgets. Investments in waterways, locks and ports and even maintenance appear to have suffered from insufficient government funding.

The economics of water transport are strongly tied up with the location of industrial activities. European industry, close to waterways, has favored IWT, especially for bulk products. In contrast, current spatial planning for the newly developing service and light industries has concentrated on road access–and sometimes rail. Where

appropriate, this tendency could, in view of the competitiveness and environmentally favorable aspects of water transport, be redirected. The task is up to regional and local government, but stimulation from national and EU authorities could give the support needed.

2.4 Intermodal competition

A precondition for fair competition is harmonization of the competitive conditions. On the European scale, harmonization has come a long way but has not been universally achieved. For example, the study has pointed out that missing links and bottlenecks limit overall operating efficiency. Because of this, there are significant areas where IWT can only compete in a limited way with the dominating rail and road transport modes. Where there is adequate infrastructure, however, IWT has considerable advantages over rail and road:

- IWT usually has the lowest line haul cost(per ton-km)between ports, especially for bulk products;
- IWT services are reliable in meeting established deadlines(except in extreme and unpredictable weather conditions)especially important for scheduled container shipments;
- IWT provides a high level of safety which is vital for shipments of dangerous goods;
- IWT is linked on average with the lowest external costs (emissions of pollution and noise) of the three inland modes (road, rail, IWT).

Whilst legally all inland freight transport in the European Union now operates under deregulated market conditions, in practice the status of liberalization of transport markets is quite unequal regarding the different transport modes: Whilst the IWT market has been completely liberalized within the European Union since 1.1.2000(through EU directive 96/75), rail freight is still far from this status. In both ‘old’ and ‘new’ EU member states, the (former)state-owned railway companies may still operate with direct or hidden subsidies, which distorts competition between rail and IWT.

Moreover, market structures influence intermodal competition. It has been argued that ‘single-vessel-operators’ have limited contacts to shippers and therefore largely depend on intermediaries like large logistics providers or freight forwarders. The railway sector, on the other hand, owns large rolling stocks and has its own or affiliated sales organizations.

Therefore large rail operators are able to lower transport prices on certain routes for strategic reasons, whilst the small IWT operators can only compete by reducing their own income.

Ranking the modal choice factors the following can be concluded:

- price/performance is the most important overall criterion;
- reliability(just-in-time)is the most important quality criterion;
- frequency of transport services and small batch quantities best meet industry logistics, followed by;
- easy availability of carrying units and shipping space;
- a certain regularity in the shipments is a prerequisite for intermodal transport;
- door-to-door service with clear responsibilities for all organizations and continuous information along the logistic chain is important for optimizing logistic chains.

The main IWT advantages, economic efficiency and traffic safety, coupled with ecological compatibility, are clearly not self-evident. Efficiency is strongly related to infrastructure conditions, volumes, loading units and distance, whilst environmental considerations hardly play a role in the decision-making processes.

2.5Potentials for IWT

EU-enlargement will increase transport demand significantly for all goods and modalities.

The highest growth rates are expected in the Danube corridor. To respond to this situation in a sustainable way will be the main challenge for IWT in the coming decades against the background of limited or poor road and rail infrastructure. The growth potentials for IWT can be found in:
A expansion in sectors where IWT traditionally has an important role: further growth e.g.in liquid and dry bulk
B penetration in niche markets, e.g. transport of new cars, or transport of waste/recycling goods
C penetration in promising/growing sectors, e.g. consumer products.

In all categories, an important IWT potential is the rising container transport. This is supported by the Ecorys Surviway study(2003). Container transport will witness a substantial increase and IWT will participate in this growth (up to 40%between 2000 and 2010). This applies also to river-sea transport. If conditions are optimal, the East-West and Danube corridors might see up to threefold increase in container volumes, although on a relatively modest base level. In this respect the Rhine will remain by far the largest container market on European waterways. The port Constanta may have considerable influence on the development of hinterland transports.

2.6 Promoting transport by inland waterway

Inland waterway transport is the mode which could provide a means of coping with the congestion of certain road infrastructure and the lack of railway infrastructure. Both these modes remain underused.

To reinforce the position of inland waterway transport, which, by nature, is intermodal, ‘waterway branches must be established and transhipment facilities must be installed to allow a continuous service all year round. Greater, fuller harmonization of the technical requirements for inland waterway vessels, of boatmasters certificate and of the social conditions for crews will also inject fresh dynamism into this sector.

This kind of reform requires equal treatment for operators and between modes of transport. Whether for airports, ports, roads, railways or waterways, the price for using infrastructure should vary in the same manner according to category of infrastructure used, time of day, distance, size and weight of vehicle, and any other factor that affects congestion and damages the infrastructure or the environment.

In a good many cases, taking external costs into account will produce more revenue than is needed to cover the costs of the infrastructure used. To produce maximum benefit for the transport sector, it is essential that available revenue can be channeled into specific national or regional funds in order to finance measures to lessen or offset external costs (double dividend). Priority would be given to building infrastructure that encourages intermodality, and offers a more environmentally-friendly alternative.

One final point for consideration is that different levels of taxation apply to the energy used by different modes, such as rail and IWT, and that this can distort competition on certain routes served by both modes.

Chapter THREE The economic impact analysis of IWT: a case study on Yangtze River

3.1Economic contribution

The economic impacts of IWT are estimated on the basis of theoretical and methodological development in economic impacts analysis. The theory and analytical methods include the input-output analysis, the multiplier analysis and so on. The economic and social contributions include direct impact, indirect impact and induced impact. The economic impact study for inland waterway industries has become increasingly important as it helps to measure the direct and indirect impacts on patterns of jobs, incomes and tax revenues in local economy. Impact study is also important since it can serve an educational purpose to facilitate the entire APEC community in understanding the structure of IWT and its dependent industries as well as its immediate economic effects.

In APEC region, USA and China are countries which IWT play important role in regional economics. As we know, when GDP in a region exceeds in 3000USD, IWT will develop rapidly because of pressure on land price, environmental protection and community. China has reached this phase in these years. IWT in China is very typical in APEC region. Economic impact analysis of IWT in all APEC regions is difficult because of integrated and coincident data. So we conduct economic impact analysis of IWT in Yangtze River as a case study on IWT.

The contribution of IWT to the Yangtze River basin is assessed in terms of: their impacts on added values, personal earnings, business revenue, taxes, employment and so on. The purpose of economic impacts study is to provide a good quantitative estimation for the impacts of IWT and the waterborne related industries on the economies of Yangtze River basin.

3.1.1Direct impact

Direct impacts include freight transport, waterway passenger transport, port storage, infrastructure maintenance, ship repair, and other management operations et al which produce gross domestic product. After measurement, in 2006 the direct impact of Yangtze River is 58.84 billion Yuan, accounts for 0.79% regional GDP (7 provinces and 2 municipalities directly under the Central Government). In 2007 the direct

impact increases to77.17 billion Yuan , accounts for 0.87% regional GDP , 31.16% increase than 2006. In 2008 the direct impact increases to86.04 billion Yuan ,accounts for 0.82% regional GDP , 11.49% increase than 2007.

The maximum impact is to Shanghai, followed by Jiangsu and Chongqing (as shown in Figure 1). Hubei Province is the fastest growing province, followed by Shanghai and Chongqing respectively. Port storage is the largest one accounting for about 41 ~ 48%, followed by water transport accounted for about 18 ~ 24%; the waterway freight is the fastest-growing item rate for 64.84%, followed by management and ship repair, namely, 64.59% and 29.74%. Infrastructure maintenance occurs the slowest growth, only 12.43 percent, mainly due to the total investment in this area in inland waterways only 12% increasing rate. The total input and contribution to GDP growth rate grow more than 40% in Shanghai, Yunnan, Anhui, Jiangxi and Chongqing, the contribution to GDP decreases more than 10% in Hubei, Hunan, Jiangsu, Sichuan. Infrastructure construction and maintenance has become a short-board to constraint the role of Yangtze River. If this situation is not rapidly changed, only rest on its laurels, it is bound to affect the sustainable economic development of the Yangtze River basin.

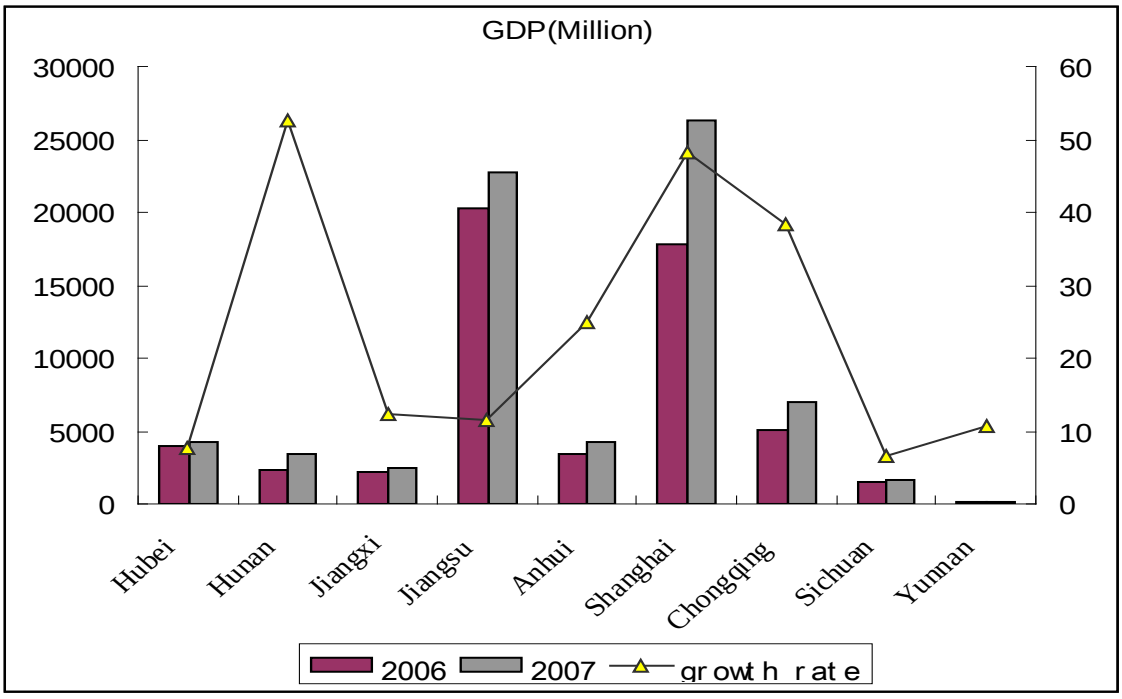


Figure 3-1 GDP impact of Yangtze River

3.1.2Indirect impact

Indirect economic contributions of the Yangtze River reflect the industrial linkage degree among waterway transport and other related industries, as well as the role of consumption promotion and important external economic indicators. The indirect

economic contributions include the forward ripple effect, backward ripple effect and the multiplier effect.

According to the input-output tables of the seven provinces and two municipalities, the indirect contribution of the Yangtze River in 2006 is 824.3 billion Yuan, 1.12 trillion Yuan in 2007 and 1.44 trillion Yuan in 2008. Consumption multiplier contributes the largest contribution, followed by backward ripple effect. The indirect economic contribution is 14 and 14.5 times than direct economic contributions, the pulling effect on the economy along the river is very obvious.

For each of the indirect economic contribution of industry, the largest contributions is in the manufacturing sector, followed by the modern service industry and public construction, the smallest contribution is agriculture; growth rates are between 35 to 40 percent, the fastest of which is the extraction of the common construction, followed by an integrated transport and logistics industry. According to the economic contribution of industries, the largest industry is integrated transport, followed by the extraction of public construction and logistics industry, agriculture is the minimum. The most closely related industries are an integrated transport, public construction and mining, logistics industry.[7]

3.1.3 Contribution of labor and employment

The contribution of labor and employment is a measure of its social contribution indicator.

As measured in 2006, 2007 and 2008, direct employments of related industries in Yangtze River are respectively 1499500, 2005700 and 2103300 person; direct employment contribution of 1.88 percent, 2.38 percent and 2.32 percent. Indirect impacts on employment are 7.71 million, 10.52 million and10.51 million person, with 5.14 times, 5.24 times and 5.00 times increase than direct impacts on employment. In direct employment, port storage industry absorbs the largest number of employment, followed by the ship repair industry and water freight transport. Direct employment creates 39240 Yuan GDP per capita, 37778 Yuan GDP per capita and 40904 Yuan GDP per capita, which is lower than the whole economy 92877 Yuan, 105265 Yuan and 116167Yuan. Show that the waterway industry along river is a lower level of capital and labor-intensive industry. In addition, input shortage is the import reason in a long period of time.

[7] Source: Waterborne Transportation Institute and Changjiang River Administration of Navigational Affairs, MOT, Economic-social impact study of Yangtze River inland waterway transportation on Yangtze River basin, soft science Project of MOT, 2009

3.2Comparative advantage

The comparative advantages of the Yangtze River are mainly reflected in low investment, low cost, large capacity, small land occupies, low energy consumption, low pollution and safety and so on.

From an investment point of view, according to estimates, every 100 million investment in the seven provinces and two municipalities along Yangtze River, can generate the road freight performance growth by 10.49 million ton-kilometers, the railway freight performance growth by 28.57 million ton-kilometers, while the Yangtze River freight performance growth by 175 million ton-kilometers, the ratio of three is 17:6:1.

From the transport capacity, the Yangtze waterway has abundant water and huge capacity. Cargo capacity of 5000 tons of Bulk carrier is equivalent to 100 trucks or rail cars. Contrast to the Beijing-Guangzhou railway line, the freight volume of the Yangtze River in 2006 is 990 million tons, that of Beijing-Guangzhou line is 67.84 million tons. The capacity of the Yangtze River Route is equivalent to 14.6 times capacity of the Beijing-Guangzhou line. This value rose to 16.1 in 2007.

From energy consumption, ships in the Yangtze River in 2006 consumes 5.4 kilograms of standard coal per 1000 tons-km, trucks consume 75.2 kilograms of standard coal per 1000 tons-km, and railways consume 9.6 kilograms of standard coal per 1000 tons-km, the energy consumption ratio of highway, railway and waterway transport is 14:1.8:1.

From transportation costs, the container transport from Chongqing to Shanghai, the cost of highway route is about 13 ~ 15 thousand Yuan, the cost of railway route is 5000 ~ 6000 Yuan, while the cost of the Yangtze River Waterway route is 2,500 Yuan to 3,500 Yuan, the ratio of three is about 1:2:6.

From land occupation, traffic volume of unit land occupation of the Yangtze River waterway route is 143,000 tons / ha, 20 times to that of highway and 24 times to that of railway; the traffic performance of unit land occupation of the Yangtze River waterway route is 74.98 million ton-km / ha, 167 times to that of highway, 13 times to that of railway.

From pollution, the roads, railways, inland waterways of pollutants emissions are 38.19 kilograms / million ton-kilometers, 3 kg / million ton-kilometers and 2.58 kilograms / million ton-kilometers, the ratio of the three is 14.8:1.2: 1. At the same time, the noise pollution of waterway is also relatively little, the noise of a ship roughly equivalent to a car, unit volume of river trade cargo ship noise is equivalent to only 4.7% of trucks.

From a security perspective, with the Yangtze River Route compared to the road, a direct economic loss of unit freight is only 1 / 35, accident death toll of unit cargo is only 1 / 79, and accident death toll of unit freight is only 1 / 560. Through technological progress and modernization, the Yangtze River water will be the safest mode of transport.

Chapter FOUR Measures and Policies to promote IWT in intermodal transport in APEC regions and other regions

4.1 APEC regions

4.1.1 China

China has plenty IWT resources and Chinese government has put IWT in a strategically level to promote its development. Since 1999, China has carried a series of studies aiming at IWT.

In 1999, MOC of China organized a study named “the developing strategy of IWT sector” and summarizes a series of developing strategies and safeguard measures with waterways construction as core. In the MOC’s 2002 study “the developing strategy for waterway and road transportation”, the opinion “inland waterways advantage strategy” was proposed as the key of waterway transportation strategy. In 2004, MOC carried out a series studies concerned “inland waterways ship form standardization”. In 2007, the National Development and Reform Commission and MOC co-issued “national inland waterways and ports layout”, which evaluate the present situation of inland waterways, ports and transportation, analyze the advantages and functions of IWT, and propose the entire future inland waterways and ports layout plan. Combining with national sustainable development strategy, MOC is beginning the study on transportation energy-saving.

Based on these studies, China also gives some policies to encourage the IWT development. In the “ Outline of the 11th Five-Years Plan for National economic and Social Development”, it is pointed out that during the 11th five year period, China will enhance the inland waterways navigational conditions and construct the high ranked inland waterways network in Yangtze river and Yangtze river delta area and Pearl river delta area.

On Nov, 28th, 2005, MOC hold a meeting with 7 provinces and 2 municipalities alone the Yangtze River in Beijing; the topic of the meet is that “joint construct the Yangtze River golden waterway, prompt the economic development in Yangtze River area”. The meeting decided to establish a Yangtze River IWT coordinate and leading commission. In Nov 2006, the commission hold a meeting in the city of Nanjing and proposed that it must overall plan and outstand the key area of IWT construction and increase the policy and capital support; make full use of the advantages of Yangtze

river golden waterway and perfect the industry layout; fasten the IWT sector structure adjustment and change the growth mode in order to improve the IWT production level; utilize the coordinating mechanism and strengthen the study on key issues. On this meeting, “the overall prompting plan for Yangtze river waterway construction during the 11th five year period” was passed and acted as the instructional document for the future development. This plan indicates that on the support of national department concerned, with the six core project of navigational waterway regulation, port construction, ship form standardization, the Three Gorge passing capacity, safeguard and joint main stream and branch, MOC will mainly strengthen the main stream construction in Yangtze River and support other important branches, and appropriately support the public berths construction in western area.

On 2007 working conference of national waterborne transport, it was proposed that strategic goals of waterborne transport modernization will realized by the end of 2020, and the development of IWT became a strategic key. It means that China will construct a reasonable waterways network which can reach main stream and branch, river and ocean, with high ranked waterways as the base. By the end of 2020, China will have 19000 kilometers high ranked waterways. At the same time, China will construct IWT ports network with reasonable layout, perfect function, professional and high efficiency, develop matching large scale, standard and professional fleet, perfect policy framework and planning system, enhance information level and establish advanced safety supervision and life-saving system, make full use of IWT in water resource utilization and prompt the reasonable, high-efficient, protective and optimized use of IWT resources. In order to realize this goal, Chinese government will provide sufficient support in policy and the investment in the 11th five year period will exceed 20 billion YUAN.

4.1.2 USA

River Information Systems the USACE already has a comprehensive Navigation Data Service8. It is now planning to develop a number of new waterway management and safety sub-systems based on Automatic Vessel identification technology. The objective is to develop, integrate and implement a Coastal and River Information System (CRIS) that will transmit real time operational data to/from vessels including electronic navigation chart updates, availability and queues at locks, real time river current and wind velocities, dam water release information, navigation safety hazard notification, information on vessels and commodities.

Infrastructure cost recovery policies Vessels using the inland waterway system pay vessel licensing fees, harbor (port) maintenance fees, inspection fees and a fuel tax on commercial vessels.

[8] http://www.ndc.iwr.usace.army.mil/

Of these, the fuel tax is the main mode of cost recovery of IWT navigation infrastructure. The funds for financing of the USACE's Civil Works program on inland waterways come from a Federal Energy and Water Development budget, not the defence budget. To help recover these costs, the fuel tax was introduced by the 1978 Inland Waterways Revenue Act on 26 designated waterways (later 27, they are listed in Annex A) at a level of US 1.06 cents/litre. The 1986 Water Resources Act increased it progressively to US 5.3 cents/litre by 1995. It remains at the 1995 level.

The fuel tax revenue is used to replenish an Inland Waterways Trust Fund held by the US Treasury. The Fund is available, through the budget appropriation process, for construction and rehabilitation expenditures for navigation on inland and coastal waterways. It currently generates around USD100 million/year.

However, under the 1986 Water Resources Development Act, (which also established the IWUB) no more than 50 percent of construction costs can be funded from the Trust Fund. Project sponsors are in principle required to supply at least half of the funding need. The capital works program is basically reactive, rather than self-generated by USACE. The process for developing Civil Works projects begins when State or local governments or others see a need for flood protection, navigation, or other water-related infrastructure and request Congress (the legislative branch of government) for help. Congress directs USACE to do a two-part feasibility study: first an initial reconnaissance to determine if a feasible solution is likely, then a full feasibility study to examine alternatives and select the project that best meets national and local needs. Most feasibility studies are cost-shared with a local sponsor. If the conclusion is positive, Congress decides whether to authorize the project funding. Most projects are built with a combination of Federal funds and contributions by non-federal sponsors. Depending on project purpose, the USACE then either operates and maintains the completed project, or turns it over to local authorities to manage.

After building up in the 1990's the balance of the Inland Waterways Trust Fund has fallen markedly in recent years (to an end-2006 balance of about USD 240 million). This has been ascribed to lack of industry growth, industry consolidation, fewer empty voyages, better vessel utilization, more fuel-efficient vessels and less long-haul grain transport. Moreover, while construction costs have increased substantially since 1995, the purchasing power of the fuel tax, fixed since 1995, has been reduced by inflation by up to a third.

It should be noted that the Inland Waterway Trust Fund is only used for construction or major rehabilitations of infrastructure. When operations and maintenance costs are included, which can be 3-4 times as high as the Trust Fund revenue, the annual levels of recovery of USACE's total inland waterway expenditure is probably between about 10-15 percent. However, the operations and maintenance costs of waterways are not solely attributable to IWT: as was noted in Section 2.3 these expenditures also provide flood mitigation, recreational, drinking water, hydropower, wetland conservation and

other benefits. Even within the IWT sector only commercial freight boats contribute to the Inland waterways, Trust Fund. Ferries, passenger boast and recreational users do not pay the fuel tax or contribute to the Inland waterway Trust Fund.

The proportion of costs which is not recovered from is funded by federal taxpayers. With much inland waterway infrastructure ageing, costing more to maintain or requiring early rehabilitation, the current financing regime appears to be less than wholly consistent with USDOT ‘s strategies and measures to increase the role of IWT.

4.1.3 Thailand

In order to relieve Bangkok’s extreme and notorious road traffic congestion, the Government of Thailand and Bangkok Metropolitan Administration, in the early 1990s began to encourage the expansion of commuter services on the Chao Phraya River and on the main canals of the city. Three types of commuter service are provided: ferry services across the Chao Phraya River (about 60 piers are available); express boat services operating along the river between Bangkok and Nonthaburi (about 50 piers are available); and long-tail boat services along the canals (with about 30 piers available). Traffic on these services peaked between 1995 and 1997 at about 360,000 journeys per day, before dropping to the present level of about 300,000 per day. Commuters form a noticeable part of this figure as well as tourists.

4.1.4 The Greater Mekong River System

The Greater Mekong River System is one of the world’s great navigable waterways, but has long been underutilized because of the lack of adequate infrastructure, navigational aids and lack of consistency in rules and regulations.

An Agreement on Commercial Navigation on the Lancang-Mekong River among the four Greater Mekong Subregion countries, China, Lao People’s Democratic Republic, Myanmar and Thailand that was signed in 2000 is expected to promote substantial investment and river traffic growth.

As part of the Lancang-Mekong navigation cooperation agreement, the four contracting parties – the Governments of China, Lao People’s Democratic Republic, Myanmar and Thailand - have constructed a number of ports to support the emerging river traffic.

China has upgraded three ports, Simao (design annual capacity, 300,000 tons and 100,000 passengers; investment: about US$ 5 million; opened for operation in March 2001), Jinghong (design annual capacity, 100,000 tons and 400,000 passengers;

investment, US$ 5.7 million; opened for operation in December 2002); and Guanlei (design annual capacity, 200,000 tons; investment, US$ 4.44 million; to be opened for operation in 2004).

Lao People's Democratic Republic set up a new economic development zone near the Golden Triangle area, which consists of construction of the Ban Mom Port, new urban area development and bank protection. The port infrastructure was completed in 2001 and others will be completed in 2008 and 2010, respectively.

Myanmar has designated two ports for international traffic on the Upper Mekong River in the quadrilateral agreement, Wan Seng and Wan Pong. In addition, a port at Soploi has been built with the same scale as the Jinghong Port and opened for operation in 2002.

The Government of Thailand is building two ports in Chiang Saen (design annual capacity, 250,000 tons; investment: US$ 4.6 million) and Chiang Kong (design annual capacity, about 100,000 tons; investment: US$ 1.6 million), both of which are expected to be completed in 2003. The private sector of Thailand has built some terminals along the Upper Mekong River in Chiang Rai Province.

The river section within the territory of China has been improved for navigation of boats of 150 tons. Nine rapids and ten scattered reefs in the section bordering Lao People's Democratic Republic and Myanmar, which severely endanger navigation safety, were partially cut to open safe channel for boats of 100 tons. The Chinese funded project (US$ 5 million) was implemented under supervision of the Project Coordination Office composed of experts from the six riparian countries in the dry water seasons during the period March to April 2002 and December 2002 to April 2003.

In the lower Mekong, Viet Nam is undertaking a large scale IWT project in the Mekong Delta with a total investment of US$ 84 million, of which US$ 71 million is financed by the World Bank and US$ 13 million by the Government. The project will improve two waterway routes from Ho Chi Minh City to Ca Mau and Kien Luong respectively, a distance of 662 km, with dredging, building of shiplocks and sluices and bridges, bank protection and aids to navigation. In addition, the project will also upgrade the Can Tho Port through improvement of infrastructure and provision of new handling equipment. It was started in 1999 and is expected to be completed in 2003.

Vietnam has completed a feasibility study on improvement to the access channel of the Bassac River, a major branch of the Mekong River, to increase capacity to accommodate sea-going ships of deadweight tonnage of deadweight tonnage of 10,000. The estimated capital investment would be US$ 40 million with an annual maintenance cost of US$ 30million. The project will benefit transport for exporting

rice in the Mekong Delta.

A package of projects on river improvement for navigation between Cambodia and the southern region of the Lao People's Democratic Republic, which includes dredging, regulation of shoals, installation of aids to navigation, port construction, navigation agreement and institutional strengthening has also been proposed. Cambodia has also proposed to undertake feasibility study to build six general cargo berths at Phnom Penh Port.

The Mekong River Commission, composed of Cambodia, Lao People's Democratic Republic, Thailand and Viet Nam, is undertaking a study to formulate a comprehensive navigation strategy and programme. The strategy and programme will cover socio-economic analysis and planning, legal framework for cross-border navigation, institutional development, safety and environment, and promotion, coordination and information. The implementation of the programme requires US$ 42.5 million over a period of seven years. The study is expected to be completed in 2003.

4.2 Europe

4.2.1 TENs

The idea of Trans-European Networks (TEN) emerged by the end of the 1980s in conjunction with the proposed Single Market. It made little sense to talk of a big market, with freedom of movement within it for goods, persons and services, unless the various regions and national networks making up that market were properly linked by modern and efficient infrastructure.

The construction of Trans-European Networks is also an important element for economic growth and the creation of employment

The Treaty establishing the European Union provides a sound legal basis for the TENs. Under the terms of Chapter XV of the Treaty (Articles 154, 155 and 156), the European Union must aim to promote the development of Trans -European Networks as a key element for the creation of the Internal Market and the reinforcement of Economic and Social Cohesion. This development includes the interconnection and interoperability of national networks as well as access to such networks.

According with these objectives, the Community is developing guidelines covering the objectives, priorities, identification of projects of common interest and broad lines of measures for the three sectors concerned (Transports, Energy and

Telecommunications). The European Parliament and the Council approve these guidelines after consultation of the Economic and Social Committee and the Committee of the Regions.

A large number of projects of common interest have benefited from financial support of the Community budget through the TEN-budget line as well as the Structural Funds and Cohesion Fund. The European Investment Bank (EIB) has also greatly contributed to the financing of these projects through loans.

4.2.2 NAIADES

In January 2006 The European Commission issued the first comprehensive development programme for inland waterway transport designed to promote better use of rivers and canals for freight transport across Europe. Named NAIADES after the river nymphs of ancient Greece, the programme aims to set positive incentives and scrap barriers. By linking navigable waterways to the road, rail and short-sea shipping networks, the EU wants to contribute to relieving traffic congestion, mastering energy use and developing sustainable distribution solutions. It focuses on five strategic areas to make inland navigation more attractive:

(1) Creating a sound business climate and attracting new markets,
(2) Stimulating fleet modernization and innovation,
(3) Attracting new workforce and increasing investment in human capital,
(4) Promoting inland waterway transport and
(5) Providing an adequate inland waterway infrastructure.

The programme consists of support policy and legislative measures. The time frame for the implementation of the plan is the period 2006–2013. The programme is aimed at all inland waterway actors, the industry, Member States and the EU.

4.2.3 Marco Polo Programme

On 22 July 2003, the European Parliament and the Council adopted Regulation (EC) No 1382/2003 on the Marco Polo Programme. The financial framework for implementation of the Marco Polo Programme for the period 1 January 2003 to 31 December 2006 is EUR 75 million. The aim of the programme is to shift international road freight traffic to short sea shipping, rail and inland waterways as well as to promote innovative projects.

On 14 July 2004, the Commission presented a proposal to establish a 'Marco Polo II' programme [COM(2004)478]. Relying on the proven mechanisms of the current

programme, Marco Polo II includes two new actions: a) larger geographical scope for intermodal transport solutions and alternatives to road transport, including outside the EU, and b) motorways of the sea, which are intended to encourage a shift towards short sea shipping. During the negotiations on the financial perspective, the EP and the Council agreed a total budget of EUR 450 million for 'Marco Polo II' for the period 2007-2013.

So far the programme has not been succesful for inland shipping. With its high thresholds, the EU grant programme is primarily geared to larger companies and long distance traffic. That doesn't work for the bulk of small companies in the inland navigation sector mainly active on short and medium distances. Today, national grants are more popular among inland waterway businesses as they take better account of the specific needs of the sector.

Under the leadership of the European Parliament, the thresholds for waterway transport will be lowered to 13 million ton-km per year. The eligible costs for ancillary infrastructure will be raised to 20%. The European Parliament also followed INE's recommendation to advocate for an inland waterway grant programme geared to the special needs of the sector.

Under the Marco Polo II Programme, funding is available for short-term freight transport projects in five areas:

(1) Modal shift, i.e. a shift from the road to rail, short sea shipping and inland waterways;
(2) Catalyst actions directed at innovative aspects and aimed at overcoming structural barriers in the market;
(3) Common learning actions aimed at widening the innovation know-how;
(4) Development of "motorways of the sea", i.e. projects of short sea shipping;
(5) Reducing road freight transport, particularly by improving transport chains and introducing other innovative measures, in order to cut road transport by at least 10 %. "

Chapter FIVE Policies and suggestions

5.1 Legislation: improve and harmonize the legislative framework

In order to realize fair competition, it is essential to improve and harmonize the legislative framework conditions concerning, inter alia, technical regulations for vessels, manning requirements, social standards, and fiscal aspects. In this respect

harmonization, updating, monitoring and control of existing regulations and imposing penalties for violating them is more important than inventing new rules. Moreover, intermodal competitive conditions in terms of infrastructure budgets, subsidies for ships and rolling stock, etc. urgently need to be harmonized. In certain cases, in the new as well as the existing member states, rail transport is receiving preferential treatment as compared to IWT. These distortions of intermodal competition need to be resolved.

5.2 Waterway Infrastructure: improve and extend waterway infrastructure

The main policy objective is therefore to improve the waterway infrastructure by proper maintenance, by removing bottlenecks and, where necessary and justifiable, extending it. This should be based on an all-encompassing and coherent investment scheme. Modern hydraulic engineering and protection of the environment are not irresolvable contradictions. A well-balanced and consensus-orientated approach is required.

5.3 Ports: enhance performance of transhipment interfaces

Ports and transhipment sites are indispensable for the competitiveness of the entire intermodal network. As the costs for transhipment and pre-and end-haulage often make up 50% and more of the total transport costs, waterway and industrial activities should, where possible, be closely located to each other. In this way industrial areas along waterways could be made more attractive, by adopting a coordinated spatial planning policy in favor of IWT. Other important aspects are the improvement of hinterland connections of ports by rail and road, offering of new or improved logistic services as well as stimulation of tri-modality of interfaces and implementation of innovations in port equipment. These aspects are of particular importance for port development in the accession countries.

5.4 Human resources: provide sufficient supply of work force and improve skills and social standards

To overcome the shortage of skilled nautical personnel in some APEC ~~countries~~ Economies and the described shortcomings regarding knowledge, investing in education and training programmes would be of crucial importance. An additional approach would be to open labor market for employees from outside in terms of legal, long-term employment. Crucial in this respect are clear and harmonized social and education standards, coupled with a strong enforcement of the rules. In addition to

enlarging the supply, there is also the possibility of reducing the demand for personnel in the longer term, e.g. through productivity gains, larger and more efficient ships and automating certain tasks.

5.5 Fleet: modernize the fleets

A vital aspect is the long lifetime of vessels, which hinders scale enlargement as well as the adoption of innovative technologies. To create the right preconditions, additional systematic R&D programmes to develop innovative modernization measures as well as vessel technologies need to be boosted. The essential advantages of such measures are lower operating costs due to fuel savings and further automation of vessels, reduced negative environment emissions due to new propulsion technologies and more environmental friendly engines as well as further increase of transport safety e.g. through the implementation of double-hull technology. Above all many small and medium financially weak enterprises would clearly benefit from targeted financial incentives and would be able to adapt their vessels to the market requirements.

5.6 Market: integrate IWT into logistics chains

The success of the inland navigation system in new and more demanding markets depends on its integration into and adaptation to the requirements of the entire door-to-door logistics chain. In this context, several measures are needed like the further development of harmonized intermodal loading units(ILUs), incentives for shippers to apply modal shift in combined transport. Further co-operation with logistics service providers, between IWT and rail and road operators as well as within the sector could also support this aim. The increased usage of information-and communication technologies–supported through the implementation of RIS–within all actors and their improved networking will contribute to the integration of IWT into intermodal logistic chains.

5.7 Sector: improve co-operation between and innovation of enterprises

Whilst there are clear tasks for administrations at different levels to strengthen the position of IWT within the APEC transport system (e.g. providing waterway infrastructure, harmonized legislation), IWT enterprises do have their own responsibility to tackle the main challenges at hand. The major tasks to be taken up by the sector itself (professional organizations and IWT enterprises) are concentrated around co-operation and innovation.

5.8 Enhance awareness and acceptance of IWT

Strong–and in some cases unfortunately rather negative–perceptions exist in the minds of policy and logistics decision-makers about the performance and competitive strength of the inland waterway system. Improving this picture through systematic and professional processed information would contribute to a better competitive position of inland navigation. Facts and figures provide vitally important information for all decision-makers, be they skippers, shippers or policy makers. However, in various areas of this project, a clear lack of up-to-date, compatible and reliable data has been identified. Clearly, better knowledge than presently available is necessary. Possible approaches include a central IWT statistics database, as well as intensified efforts as regards the APEC market observation system.

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