INTERNATIONAL SAVA RIVER BASIN COMMISSION

Feasibility Study and Project Documentation for the Rehabilitation and Development of Transport and Navigation on the Sava River Waterway

FINAL REPORT

Executive Summary

Version: ***Final Report***

Date: ***25 September 2008***

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Feasibility Study and Project Documentation for the Rehabilitation and Development of Transport and Navigation on the Sava River Waterway

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25 September 2008	**Project No. 01/2-07-ZM Sava River Feasibility Study**	**685R5493_sari**
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Dr. Eddy Declercq	**+385 (0) 99 418 5945**	**FINAL REPORT** **Executive Summary**

Dear Mr Milkovic,

It is with pleasure that I herewith submit the Final Version of the **FINAL REPORT, containing a summary of the Feasibility Study and Project Documentation for the Rehabilitation and Development of Transport and Navigation on the Sava River Waterway.**

Contrary to the Draft Version of the Final Report, the definitive version of the Final Report thus consists of the Executive Summary of the Study while the **Action Plan for the Rehabilitation to SCC Class Va of Sava River, section Belgrade–Sisak** will be submitted separately

The structure and content of this document is consistent with formats and tenets voiced in the *Inception Report*, as well as directives received from the Sava River Commission and the comments submitted in association with the Draft Final Report.

In this Executive Summary, all relevant topics investigated in the individual Task Reports have been taken into consideration. It should be emphasized that some final corrections have been made to numbers, based upon final revisions of calculations.

Distribution of the report will, as agreed, remain limited to soft-copy versions.

It was both a pleasure and honor to have been selected to carry out this important and challenging project. I and all members of the Study Team are most appreciative of this opportunity.

Kindest regards,

Dr Eddy Declercq
Project Manager
Pacific Consultants International

Included:
Electronic version (Word & PDF)

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AWZ	Section Waterways and Sea Affairs
AGR	European Agreement on Main International Traffic Arteries
ANS	Air Navigation System
AOC	Air Operator Certificate
ASG	Assignment Group
ATC	Air Traffic Control
ATS	Air Traffic Services
AWZ	Section Waterways and Sea Affairs
BiH	Bosnia and Herzegovina
BiHTMAP	Bosnia and Herzegovina Transport Master Plan
BiHDCA	Directorate of Civil Aviation of Bosnia and Herzegovina
BOT	Build-Operate-Transfer
BAD	Brcko Administrative District
BNX	IATA Code, Banja Luka International Airport
BRIC	Joint Road Infrastructure Public Corporation
BHZJK	Joint Railway Public Corporation
B/C	Benefit Cost Ratio
CAA	Civil Aviation Authority
CB	Central Bank of Bosnia and Herzegovina
CEE	Communauté Economique Européenne
CEEC	Central and Eastern European Countries
CEFTA	Central European Free Trade Agreement
CEMT	Conference of European Ministers of Transport
CFR	Crash/ Fire/ Rescue
CFS	Container Freight Station
CIS	Commonwealth of Independent States
CTT	Combined Transport Terminals
CTP	Common Transport Policy
DvS	Dienst voor de Scheepvaart (Belgium)
DOTS	IMF Direction of Trade Statistics
EASA	European Aviation Safety Agency
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECAC	European Civil Aviation Conference
EDI	Electric Data Interchange
EDS	Economic Development Strategy
EIB	European Investment Bank
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plans
ESCAP	Economic and Social Commission for Asia and the Pacific

ESPO	European Sea Ports Organisation
ETRP	Emergency Transport Reconstruction Program
EU	European Union
EUR	Euro
EUFOR	European Union Security Force
FAA	US Federal Aviation Authority
FASRB	Framework Agreement on the Sava River Basin
FBiH	Federation of Bosnia and Herzegovina
FFDI	Facilitating Foreign Direct Investment
FED	Federal Institute of Statistics, Federation of Bosnia and Herzegovina
FDI	Foreign Direct Investment
FIATA	international freight forwarders' association
FRY	Former Republic of Yugoslavia
FYROM	Former Yugoslav Republic of Macedonia
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GPS	Global Positioning System
HDM-4	Highway Development and Maintenance - 4
HST	Hypersonic Transport
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICB	International Competitive Bidding
IEE	Initial Environment Examination
IFC	International Financing Corporation
ILS	Instrument Landing System
IMF	International Monetary Fund
IMG	International Management Group
INA	Industrija Nafte d.d.
INTERBUS	International Passenger Transport by Road
IPO	Initial Public Offering
IRU	International Road Transport Union
ISO	International Organization for Standardization
ISRBC	International Sava River Basin Commission
IT	Information Technology
ITT	Intermodal Transport Terminals
IWT	Inland Waterway Transport
JAA	Joint Aviation Authorities
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
JSC	Joint Stock Company
KM	Konvertibilna Marka
kW	kiloWatt

kWA	kiloWattAmpere
l/b	left bank
LoI	Letter of Intent
LOS	Level of Service
LPG	Liquefied Petroleum Gas
M tonnes	Million tonnes
MAC	Mine Action Center
MOCT	Bosnia and Herzegovina Ministry of Communications and Transport
MOTC	Ministry of Transport and Communication
MTEF	Medium Term Expenditure Framework
NATO	North Atlantic Treaty Organization
NIS	National Institute for Statistics
NGO	Non-Governmental Organization
NVZ	NV Zeekanaal en Watergebonden Grondbeheer Vlaanderen (Belgium)
OBB	Austrian Railways
OMO	IATA Code, Mostar International Airport
OSCE	Organization for Security and Cooperation in Europe
OHR	Office of High Representatives
PCU	Passenger Car Unit
PD	Project Descriptions
PFI	Private Finance Initiatives
PPP	Public Private Partnership
r/b	right bank
ROI	Return on Investment
RS	Republika Srpska
RPC	Railway Public Corporation
RUC	Road User Charges
SAA	Stabilization and Association Agreement
SD	Site Descriptions
SEE	South East European
SEETO	South-East Europe Transport Observatory
SECI	Southeast European Cooperative Initiative
SFOR	Security Force
SJJ	IATA Code, Sarajevo International Airport
SME	Small and Medium Enterprise
SRWTS	Sava River Waterway Transport System
TEM	Trans European Motorways
TEN	Trans-European Transport Network
TEN-T	Trans-European Network for Transport
TEU	Twenty foot Equivalent Unit
TINA	Transport Infrastructure Needs Assessment
TIR	Transport Internationale Routière

TOR	Terms of Reference
TSM	Transportation System Management
TZL	IATA Code, Tuzla International Airport
UIC	Union Internationalle der Chemins de Fer (International Union of Railways)
UIRR	International Union of Rail – Road Transport Companies
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
UNDP	United Nations Development Program
UNHCR	United Nations High Commission for Refugees
USAID	United States Agency for International Development
USD	United States Dollar
VAL	Value Added Logistics
VAT	Value Added Tax
V/C	Volume to Capacity Ratio
WB	World Bank (International Bank for Reconstruction and Development)
WFD	EU Water Framework Directive
WTO	World Trade Organization
ZBH	Bosnia and Herzegovina Railways
ZRS	Republika Srpska Railways

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Chapter 1. Study Background

1.1. The Study

The International Sava River Basin Commission is conducting the ***Feasibility Study and Project Documentation for the Rehabilitation and Development of Transport and Navigation on the Sava River Waterway*.** Pacific Consultants International, headquartered in Tokyo (Japan), has been selected as the lead consultant in association with Witteveen+Bos (The Netherlands); NEA – Transport Research and Training (The Netherlands); CRUP – Inland Navigation Development Centre Ltd. (Croatia); and Dvokut – ECRO (Croatia).

The Study commenced on 1 December 2007 and terminated 31 July 2008 with the submission of underlying Final Report, presenting the Action Plan for the Rehabilitation to SCC Class Va of Sava River, section Belgrade–Sisak.

The main objective of the Study was to recommend the strategy and programs for the development of the Sava River waterway and to provide an appropriate economic and organizational framework for restoring trade and navigation (cargo and passengers) on the Sava with an aim to do as follows:

1. Improve public and private investments into transport on the Sava River, in accordance with adequate economic and financial analysis;
2. Propose enhancement of coordination of activities regarding inland navigation and to set up priorities of public interests;
3. Obtain an integrated approach considering water management, energy production, flood control and environmental aspects in the Sava River basin; and
4. Propose improvement of the infrastructure.

The final outcome of the Study is the Rehabilitation to SCC Class Va of Sava River, section Belgrade–Sisak, as detailed in underlying Final Report with respect to (re)construction, operation, maintenance, and development of waterway infrastructure and:

1. Provides guidelines for Sava Commission for the short-term, mid-term, and long-term policy for the development of the Sava River;
2. Setting the priorities concerning investments, operations and maintenance, based on the cost benefit analysis; and
3. Discussing access to international financial institutions as this will speed up the process of (re)construction, maintenance, and development of infrastructure.

Based upon the Terms of Reference (TOR) and the proposal for services, submitted by PCI, the project was finally divided into 5 different phases (See Table 1-1):

1. **PHASE 1**: Detailed analyses for the rehabilitation of Sava River up to minimum standard Class IV and divided into Tasks 1 to 9; The 10th Task can be considered a separate Phase. In addition, some first conclusions and recommendations can be formulated which will be basic input for the Action Plan (Phase 4) and if relevant to Phase 2, Phase 3 and Phase 5;
2. **PHASE 2**: Preliminary assessment of the extension of Sava River, divided into 6 Tasks and conclusions and recommendations;
3. **PHASE 3**: Preliminary assessment of the further upgrading of Sava River to Class Va which constitutes of 3 Tasks and conclusions and recommendations;
4. **PHASE 4**: which translates the results into a concrete Action Plan.; and
5. **PHASE 5**: which is in reality Task 10 of Phase 1 but because this Task can only be initiated after completion of the nine Tasks of Phase 1, and given that drafting the Terms of Reference can be considered as a "stand-alone" activity, it is seen as a separate Phase in the project.

Table 1-1 Task Summary

Nr	Task	From	To
	Mobilization on site (Zagreb)	Monday 3/12/2008	
1	Inception Phase	01/12/2007	31/12/2007
2	Phase 1 - Rehabilitation of the Sava River waterway to Class IV (Task 1 – 9)	01/01/2008	30/04/2008
3	Phase 2 - Extension of Navigation from Sisak, rkm 586.0, to Brezice (Task 1 – 7)	01/03/2008	31/05/2008
4	Phase 3 - Improvement of the Sava River waterway to the Sava Commission Class Va (Task 1 – 4)	01/04/2008	30/06/2008
5	Phase 4 - Development of Action Plan	01/04/2008	31/07/2008
6	Phase 5 - (Task 10 of Phase 1): Preparation of Terms of Reference for Detailed Design Works and Studies	01/05/2008	30/06/2008
7	FINAL REPORT (Action Plan)	01/07/2008	31/07/2008
	Demobilization from site (Zagreb)	Thursday 31/07/2008	

1.2. Reporting

According to the TOR, Task-specific Reports had to be submitted as detailed in Table 1-2.

During the course of the Study, the reporting structure underwent several changes:

1. Phase 1: Minor changes were introduced as compared to the original reporting structure:
    a. The Report on Transport and Cargo and the Report on Ports have been integrated into a single report;
    b. The Report on Preliminary Design and Costing for Phase 1 was extended to include the Preliminary Design and Costing for Phase 2 (Sisak – Brezice extension of navigation) and for Phase 3 (upgrading Belgrade – Sisak section to Class Va).
    c. The Report on the TOR was considered as a separate task and the Report was submitted beginning of July. The Report was submitted as Task 10 of Phase 1 and NOT as Phase 4 report;
2. Phase 2: Efficiencies in reporting and presentation could be achieved by combining six separate Phase 2 reports into two cohesive documents. Specifically:
    a. Phase 2, Report 1, *Phase 2 – Tasks 1 & 2: Report on traffic and transport, river classification and the save river waterway transport system from Sisak to Brezice, including institutional, legal and policy issues*, combined three tasks; to wit, demand forecasting, river classification needed as a result of forecasting, and policy/legal/institutional implications.
    b. Phase 2, Report 2, *Phase 2 – Tasks 3 to 7: Report on river classification and preliminary design, including a study of costs and benefits and of environmental impacts. Recommendations and conclusions related to the rehabilitation and optimal utilization of the save river waterway from Sisak to Brezice*, Investigates requisite needs in terms of preliminary design, costing, environmental assessment and cost-benefit analysis.
3. Phase 3: The Study Team, in consultation with the Sava Commission, planned to submit an integrated report for Phase 3, combining all relevant issues into one document. However, this approach had to be abandoned and separate reports were at the end submissed.

All reports were submitted within the time limits imposed by the TOR, as can be observed in Table 1-2. In addition to the original copies, revised reports were submitted beginning of July on the Detailed Design and Costing for the 3 Phases (integrated report), and on the CBA for Phase 3.

Table 1-2 Submission of Reports (actual schedule & reports)

Task no	*Official date*	*Submission*	*Report title*
PHASE 1			
TASK 2	30 April 2008	15/03/2008	PHASE 1 TASKS 2 & 4 REPORT ON TRANSPORT AND CARGO AND ON PORT DEVELOPMENT
TASK 3		14/04/2008	PHASE 1 TASK 3 REPORT ON THE INVENTORY AND EVALUATION OF SAVA WATERWAYS
TASK 4		15/03/2008	*Report integrated in the report for Task 2*
TASK 5		13/05/2008 (13/07/2008)	PHASE 1 TASK 5 / PHASE 2 TASK 3 / PHASE 3 TASK 1 REPORT ON PRELIMINARY DESIGN & COST ESTIMATES TO IMPROVE SAVA RIVER TO CLASS IV AND TO CLASS Va, INCLUDING RIVER SECTION SISAK - BREZICE (date of submission of revised version)
TASK 6		30/04/2008	PHASE 1 TASK 6 REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT
TASK 7		09/04/2008	PHASE 1 TASK 7 REPORT ON RIVER INFORMATION SERVICES
TASK 8		25/05/2008	PHASE 1 TASK 8 COST BENEFIT ANALYSIS
TASK 9		12/03/2008	PHASE 1 – TASK 9 REPORT ON POLICY, INSTITUTIONAL AND LEGAL FRAMEWORK
TASK 10		10/07/2008	PHASE 1 - TASK 10 REPORT ON TOR FOR DETAILED DESIGN
		14/04/2008	PHASE 1 REPORT ON SAVA RIVER INLAND WATERWAY TRANSPORT SYSTEM
PHASE 2			
TASK 1,2	31 May 2008	30/04/2008	PHASE 2 – TASKS 1 & 2: REPORT ON TRAFFIC AND TRANSPORT, RIVER CLASSIFICATION AND THE SAVE RIVER WATERWAY TRANSPORT SYSTEM FROM SISAK TO BREZICE, INCLUDING INSTITUTIONAL, LEGAL AND POLICY ISSUES
TASK 3		31/05/2008	PHASE 2 – TASKS 3 TO 5: REPORT ON RIVER CLASSIFICATION AND PRELIMINARY DESIGN, INCLUDING A STUDY OF COSTS AND BENEFITS AND OF ENVIRONMENTAL IMPACTS. RECOMMENDATIONS AND CONCLUSIONS RELATED TO THE REHABILITATION AND OPTIMAL UTILIZATION OF THE SAVE RIVER WATERWAY FROM SISAK TO BREZICE
TASK 4			
TASK 5			
		31/05/2008	PHASE 2 – TASK 4 REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT
PHASE 3			
	30 June 2008	30/06/2008	PHASE 3 REPORT ON SAVA RIVER INLAND WATERWAY TRANSPORT SYSTEM (rkm 0.0 - rkm 586.0)
TASK 1		Not submitted	PHASE 3 – TASK 1 REPORT ON PRELIMINARY DESIGN AND COST ESTIMATES
TASK 2		30/06/2008	PHASE 3 – TASK 2 REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT
TASK 3		30/06/2008 (13/07/2008)	PHASE 3 – TASK 3 COST BENEFIT ANALYSIS (date of submission of revised version)

In mutual consultation, the new reporting structure which integrated several reports for Phase 2 and Phase 3 was abandoned and it was agreed to submit as final version individual reports in accordance with the Terms of Reference.

Given this late change in reporting structure,:

1. Some Delays occurred in submitting the Report on the Terms of Reference for the Detailed Design works (Phase 1 – Task 10);

2. The Report on Preliminary Design and Costing for Phase 3 was not submitted but a revised version of the integrated report was submitted beginning of July;

3. A revised version of the Report on CBA for Phase 3 had to be submitted beginning of July that incorporated several corrections to the calculations in the first draft. Time pressure and late rescheduling of the Phase 3 reporting method, combined with the report on EIA for Phase 3 which was unavailable at the time of submitting the CBA, and the changes made to the costing report required a revised version of the CBA for Phase 3.

Table 1-3 presents the final submission schedule of all Task Reports, which is in full accordance with the TOR.

The final versions of these reports are attached as individual annexes of this Final Report.

The individual reports are referenced in Table 1-3 as [Lit XX] as can be observed in the column with the “REF” heading. In the summary report, presented in Part 1 of this report, this reference will be used whenever one of the task reports is referenced in the text.

Table 1-3 Reporting schedule

PHASE 1			
Task no	***Task subject***	***REF***	***Report title for FINAL REPORT***
TASK 1	Data collection		
TASK 2	Traffic and transport study;	[Lit 01]	PHASE 1 TASKS 2 & 4 REPORT ON TRANSPORT AND CARGO AND ON PORT DEVELOPMENT
TASK 3	Inventory & Evaluation of Sava River (survey);	[Lit 02]	PHASE 1 TASK 3 REPORT ON THE INVENTORY AND EVALUATION OF SAVA WATERWAYS
TASK 4	Port development;	[Lit 03]	*Report integrated in the report for Task 2*
TASK 5	Preliminary design and cost estimate;	[Lit 04]	PHASE 1 TASK 5 REPORT ON PRELIMINARY DESIGN AND COST ESTIMATE
TASK 6	Environmental impact assessment;	[Lit 05]	PHASE 1 TASK 6 REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT
TASK 7	River Information Services;	[Lit 06]	PHASE 1 TASK 7 REPORT ON RIVER INFORMATION SERVICES
TASK 8	Cost Benefit Analysis; and	[Lit 07]	PHASE 1 TASK 8 COST BENEFIT ANALYSIS
TASK 9	Institutional, policy & legal framework;	[Lit 08]	PHASE 1 – TASK 9 REPORT ON POLICY, INSTITUTIONAL AND LEGAL FRAMEWORK
TASK 10	TOR	[Lit 09]	PHASE 1 - TASK 10 REPORT ON TOR FOR DETAILED DESIGN
		[Lit 10]	PHASE 1 REPORT ON SAVA RIVER INLAND WATERWAY TRANSPORT SYSTEM
PHASE 2			
TASK 1	Traffic and cargo analysis	[Lit 11]	PHASE 2 – TASK 1 REPORT ON TRANSPORT AND CARGO
TASK 2	Assessment of waterway classification	[Lit 12]	PHASE 2 – TASK 2 REPORT ON SAVA INLAND WATERWAY TRANSPORT SYSTEM SISAK – BREŽICE
TASK 3	Preliminary design, cost estimate & implementation schedule;	[Lit 13]	PHASE 2 – TASK 3 REPORT ON PRELIMINARY DESIGN AND COST ESTIMATES
TASK 4	Environmental impact assessment;	[Lit 14]	PHASE 2 – TASK 4 REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT
TASK 5	Cost Benefit Analysis	[Lit 15]	PHASE 2 – TASK 5 COST BENEFIT ANALYSIS
	No task related to this report	[Lit 16]	PHASE 2 - REPORT ON POLICY, INSTITUTIONAL AND LEGAL FRAMEWORK
PHASE 3			
		[Lit 17]	PHASE 3 REPORT ON SAVA RIVER INLAND WATERWAY TRANSPORT SYSTEM (rkm 0.0 - rkm 586.0)
TASK 1	Prepare Preliminary designs and costs estimate	[Lit 18]	PHASE 3 – TASK 1 REPORT ON PRELIMINARY DESIGN AND COST ESTIMATES
TASK 2	Environmental impact assessment	[Lit 19]	PHASE 3 – TASK 2 REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT
TASK 3	Cost Benefit Analysis	[Lit 20]	PHASE 3 – TASK 4 COST BENEFIT ANALYSIS

1.3. Structure of the Final Report

The current report is the final version of the FINAL REPORT, presenting an EXECUTIVE SUMMARY OF THE FEASIBILITY STUDY AND PROJECT DOCUMENTATION FOR THE REHABILITATION AND DEVELOPMENT OF TRANSPORT AND NAVIGATION ON THE SAVA RIVER WATERWAY.

This document summarizes the continued research efforts in this Study and provides in annex the final reports of the different tasks of the study, taking into account the comments formulated by the Sava Commission Steering Committee.

The list of submitted reports is presented in Table 1-3 above.

Several estimates submitted in this Executive Summary differ (slightly) from the values and estimates presented in the different task reports. The values and estimates submitted in the underlying executive summary are the final values and were subject to a final revision that lead in some cases to corrections to the estimates and values presented in the task reports.

The structure of this Report is consistent with essential formats and tenets voiced in the Inception Report, as well as directives received from the Sava River Commission.

Chapter 2. Present Sava River Characteristics

2.1. Multi-functional role of rivers

Inland waters have multiple functions such as transport, leisure, water management and environment, as summarized in Figure 2-1[1].

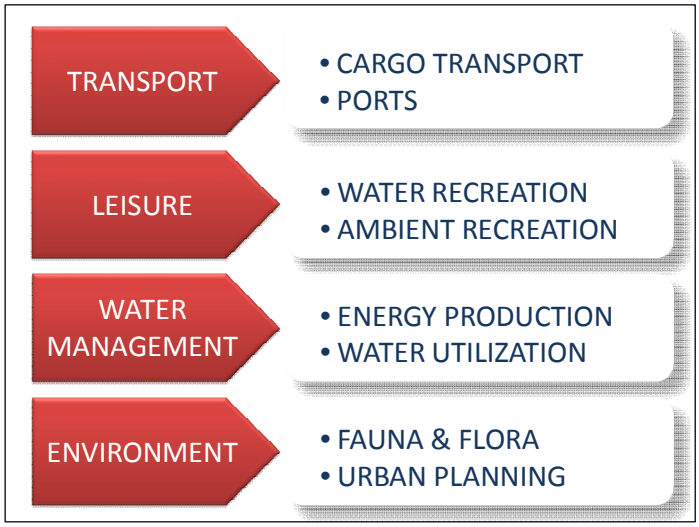


Figure 2-1 Principal functions of inland waterways

The most commonly known utilization of inland waterways is for the transport of cargo and related therewith the handling of cargo in river ports. Under impulse of modern logistics and a political commitment to shift a portion of cargo from the roads to inland waterways, inland waterway transport (IWT) is rapidly expanding its traditional activity of transporting bulk cargo over long distances with specialized transports such as short distance (container) transport as part of global / cross-border intermodal transport networks.

Figure 2-2 : Water-related activities

Waterways suitable for commercial cargo transport are in general also open to recreational navigation with private pleasure boats or cruise lines. However, inland waterways offer not only nautical recreation but have a wide range of ambient opportunities that attract growing numbers of people (Figure 2-2). The river finally has an important energetic and environmental function.

[1] See for details [Lit 10], [Lit 12] and [Lit 17]

2.2. Cargo Transport on Sava River

In spite a range of functions, rivers are generally associated to environmental benefits, emphasized and becoming in particular evident when shifting cargo from the road to the waterways. This shift of cargo to rivers is one of the core arguments of public authorities for increasing the investments in the sector: "*Inland navigation has also been shown to be the most environmentally friendly land transport mode with total external costs currently calculated at 10 Euro per 1 000 tonne-kilometres (by comparison: 35 Euro for road and 15 Euro for rail transport). If inland navigation cargoes were carried by road, emissions to air in Europe would be at least 10% higher.*"[2]

But achieving such shift and establishing sustainable commercial river transport is not evident or easy to achieve because of the direct and intrinsic relationship between transport and economy. Demand for river transport, in fact for transport in general, and the therewith related volume of river port throughput is driven by economic activity. This is also true for Sava River.

As a result, the overall port throughput and associated Sava River traffic has been drastically reduced since the end of the eighties and came almost to a standstill in 2000.

Along the Sava River, several river ports are present in Croatia, Bosnia Herzegovina (BiH), and Serbia[3]. The different ports along Sava River are visualized in Figure 2-3.

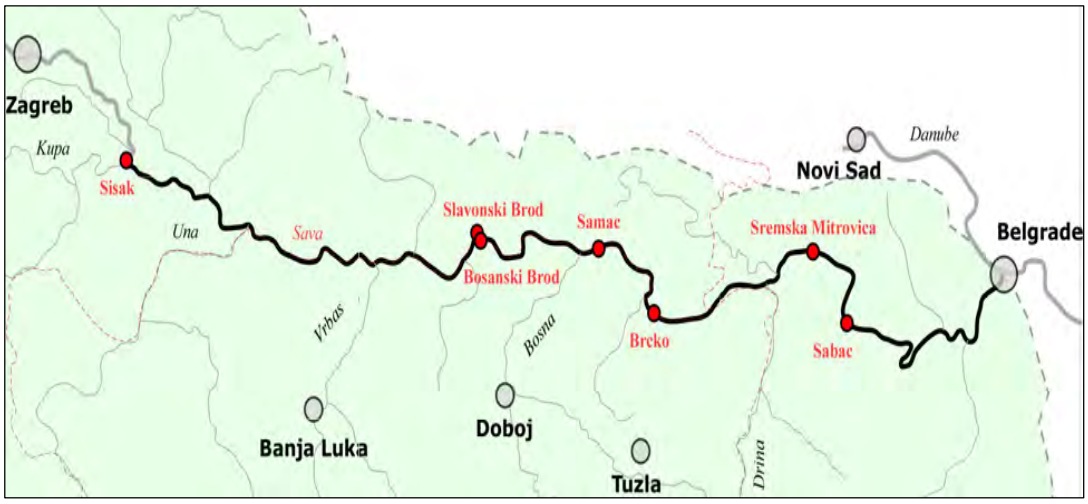


Figure 2-3 Sava River Port network

[2] Communication from the Commission on the Promotion of Inland Waterway Transport "Naiades": an Integrated European Action Programme for Inland Waterway Transport. Brussels, 17.1.2006; COM(2006) 6 final {SEC(2006) 34}; p 4 cit.

[3] See for details [Lit 01]

The port of Sisak and the port of Slavonski Brod are Croatian ports. The port of Sisak is actually located along the left bank of the river Kupa close to the confluence of the rivers Kupa and Sava. Slightly downstream of the confluence is located the oil terminal of Crnac on the right bank of the Sava River. The port of Slavonski Brod consists of the actual port on the left bank of the Sava River downstream of the city of Slavonski Brod, and the oil terminal at Ruscica, downstream of the port on the same bank. The ports of Brcko, Samac and Bosanski Brod are ports in Bosnia and Herzegovina (BiH), all located on the right bank of the Sava River. Brcko port has a special status because it is governed by the Brcko District Administration. The Serbian sector of the Sava River has only two common user ports, the port "Leget" of Sremska Mitrovica at the left bank and the industrial port of Sabac at the right bank. Apart from that, there is another freight centre and free zone in Sabac at the right bank at some 5 kilometer downstream of the industrial port, which is largely promoted by the local government as a future port.

In Croatia, plans exist to develop a dedicated port in Sava River near Zagreb (at Rugvica) predominantly for servicing the Zagreb region. However, concrete developments have not been initiated yet and the possible development will depend upon a policy decision in respect of the future of Sisak port, now promoted as “gateway for Zagreb”. From Slovenian side, the idea exists in some circles to develop a river port in Brezice, near the Croatian border, to open Slovenia and in particular the Ljubljana region to commercial traffic along Sava River. But independent of the economic and financial feasibility, structural complications make such development complicated because Slovenia depends upon the willingness of Croatia to open the stretch Slovenian – Croatian border till Sisak for navigation, a stretch with various bottlenecks (bridges, sills) and uncertainty regarding the construction of several the hydroelectric power plants.

Finally, in Bosnia and Herzegovina, there is an old plan for the development of a river port in Gradiska (rkm 465). Several studies were prepared with the objective of building the port but construction was never started and it is unlikely that these will happen in a foreseeable future, given that all studies conducted are fully outdated, some even 40 years old and more.

An inventory of the ports and their characteristics are shown in the following Tables 2-1 and 2-2.

The condition of the infrastructure is relatively poor with equipments being outdated and not suitable anymore for modern operations. Maintenance of facilities and equipment has been neglected. The length and condition of berths and the water depth along berths are generally sufficient for general cargo and dry bulk handling. Bottlenecks occur in the ports during periods of low water levels when vessels cannot berth alongside the vertical quay structures.

Commercial traffic on Sava River, that is, excluding sand and gravel operations reached 408,000 tonnes during year 2007 (Table 2-3) of which 241,000 tonnes were imports (unloading) and 167,000 tonnes exports (loading). Containers are rarely or not transported via Sava River but are

transported to the project region by railways and trucks. The routing of these cargoes is mainly via the Adriatic ports of Ploce (BiH) and Rijeka (Croatia) and from the Danube port of Budapest.

Table 2-1 Ports along the Sava River

Port	River	km	Main commodities handled
Sisak	Kupa l/b	5	Sand, gravel
Sisak oil terminal	Sava r/b	579	Crude oil
Slavonski Brod	Sava l/b	360	Sand, gravel, crude oil
Bosanski Brod	Sava r/b	360	None
Samac	Sava r/b	306	Steel coils, iron ore
Brcko	Sava r/b	220	Steel coils, agri products, coal
Sremska Mitrovica	Sava l/b	133	Sand, gravel
Sabac industrial	Sava r/b	103	Dry bulk
Sabac Free Zone	Sava r/b	98	None (at waterside)

Source: Study Team

Table 2-2 Main physical characteristics of IWT ports along Sava

Port	Berth length (m)		Quay cranes (nos)		Storage area (ha)	
	Total	Vertical	Total	>20tonnes	Open	Covered
Sisak	400	400	2		0.8	0.6
Sisak oil terminal	pontoon	0	0		0	tanks
Slavonski Brod	120	120	0		0.2	0
Bosanski Brod	pontoon	0	0		0	tanks
Samac	311	311	3		3.0	0.4
Brcko	180	76	2		6.0	0.8
Sremska Mitrovica	100	100	1		2.0	1.8
Sabac industrial port	125	125	1		0.1	1.2
Sabac Free Zone	0	0	0		1.0	2.0

Source: Study Team

Table 2-3 Port throughputs (1,000 tons)

Port	2006	2007
Sisak	0	0
Sisak oil terminal	160,000	140,000
Slavonski Brod	160,000	140,000
Bosanski Brod	0	0
Samac	17,000	60,000
Brcko	81,000	52,000
Sremska Mitrovica	5,000	1,000
Sabac industrial port	27,000	15,000
Sabac Free Zone	0	0
Total Sava River ports	464,000	408,000

Source: Study Team Note: sand and gravel is excluded

2.3. Sava River, more than transport infrastructure

Ambient opportunities for inland waterways include but are not limited to:

- *Sport events*, such as rowing, speed-boat racing, waterskiing, and swimming;
- *Adventure tourism* including (white water) rafting, kayaking and similar activities; and
- *River recreation* like fishing, walking and bicycling, camping, etc.

Inland waterways can also be integrated into the *utilization of nature and urban spaces*. The former include the development of the rapidly growing segment of "eco-tourism" such as bird watching, nature walks etc. The latter include the development of the city's waterfront as integral part of the city landscape, combining housing complexes with recreational / sport facilities.

2.3.1. Tourism and recreation

Although not (yet) fully exploited, several locations along Sava River are developing tourist and/or recreational infrastructure with Sava River as central attraction.

The river banks in the Belgrade urban area of Sava and Danube rivers combined are 200 km long and includes 16 river islands with *Ada Ciganlija* and *Veliko ratno ostrvo* as best known islands / destinations. Veliko Ratno Ostrvo is situated on the mouth of the Sava as it empties into the Danube. The island is now a popular destination for nature lovers and recreational tourist appreciate the famous Zemun beach on its northern tip called Lido. The "island" of Ada Ciganlija on Sava River is a not only a natural resort and popular picnic spot, it is also a sporting and cultural venue. There are 2 lakes on the island, the smaller lake "Ada Safari" is used for sport fishing and all kinds of related events while the larger "Savsko Lake" offers facilities for swimmers, boats, and water skiers on one end and an impressive jet fountain. On Ada Ciganlija there are further over 50 different open-air sports grounds, among which there are a golf course and a lift for water-skiing. The beach is a popular spot for sunbathing and relaxation and is lined with cafés and dozens of rustic restaurants. The island also serves as a cultural and entertainment centre of Belgrade, especially during the summer.

Upstream the Sava River in Serbia, there are more interesting tourism attractions, although best know by local and to a lesser extent regional tourists. *Sabac* for example, is a beautiful town where each year, the Sabac Swimming Marathon, one of the oldest European open water swimming events, is organized on Sava River. In 2007, the 38th edition of the traditional event attracted over 1,000 spectators at the beach of 'Old Tower'. Sabac itself is a historic town with several impressive historic sites and buildings, of which the fortress built in 1470 by the Turks is a well-known and appreciated tourist destination and tourists are in particular attracted by its

cultural and historic heritage. The city not only offers a beautiful city center but many Archaeological sitesdating back since early Stone Age and the Roman and Turkish rule. Sabac also utilizes Sava River for recreational and sporting purposes. *Sremska Mitrovica* along Serbian Sava River is undeniably another tourist destination with important growth potential. Build on the ruins of the Roman city Sirmium, the capital of the Roman Empire at one time, the city offers a wealth of historic and archaeological treasures. The city beach on Sava River is a second tourist attraction and is considered to be one of the most beautiful waterfronts in Serbia where several sports and cultural manifestations are organized.

Although concentrating on its coastline, Croatia does recognize the tourism potential of Sava River upstream *Sisak* and the river is generally included in the tourism development plans of communities along the river. According to obtained information, construction of a private marina is expected to start in the middle of 2008, located some 3 km upstream along the Kupa River near Sisak port, and is designed to hold 160-200 motorboat-sized pleasure boats.

In *Zagreb*, the surroundings of the Sava River have long since been altered from their natural state, constituting a potential site for different kinds of urban development. Zagreb plans to "reconnect" the city with its river and it will be important to consider what kind of development will be pursued along the river banks and how the river be used to enhance the city's architectural and touristic value. The entire central area with its abundant natural space offers ample potential for outdoor activities along the rivers: walks, biking, fishing, riding, horse and cart riding, camping, canoeing, sporting competitions along the Sava and on the river itself, and pending the water quality even swimming in summer time[4].

The Posavje Region along Sava River, adjacent to Croatia and including the cities of Brezice, Krsko and Sevnica, accounted for more than half million tourists during 2006, including some 14,100 tourist arrivals from Croatia. The 47,500 Croatian overnights during 2007 represented some eight percent of the total 591,200 Posavje tourist overnights[5]. Brezice, Krsko and Sevnica are aggressively proceeding with the implementation of nautical tourism and recreational opportunities for both tourists and citizens, with as principal catalyst Slovenia's largest (45 hectare) health and tourist resort Terme Čatež, located on the banks of the Sava River some 2 kilometer from Brezice center. Brezice has always been intrinsically linked with the Sava River and the advent of the Brezice dam on the lower Sava River will allow implementation of a vast touristic, sport and leisure development which "rediscovers the roots" of the old Brezice. The municipality of Krsko, located upstream from Brezice, is also using the on-going construction of the Krsko hydroelectric facility in order to enhance tourist and recreational amenities along the

[4] Master Plan for Tourism – Regional Concept for the Lonjsko Polje Nature Park – Posavina, op. cit.
[5] Data source: Regional Development Agency Posavje

Sava River. A recreational port, sport facilities, multi-use paths and other facilities are contemplated, linked with more established attractions such as mountains, medieval castle and tourist establishments. Further upstream, at the Blanca and Bostanj hydroelectric facilities, efforts are also underway, spearheaded by Sevnica municipality, to enhance the riverside ambiance of the Sava, and to maximize the collateral benefits catalyzed by the presence of the dam reservoirs. For example, at Bostanj dam, the Orehovo recreational port, now under implementation, is slated to include an inn with large terrace and benches, tables and sun-protecting umbrellas; recreational port, docks and berths; boathouse; walking path; cycle track circumnavigating the reservoir; sport fields; camping area; and, riverfront picnic areas. The implications are clear. There exists a strong commitment within the Posavje Region for expanding and enhancing nautical tourism and recreation, focused on the Sava River and realized in concert with committed construction of hydroelectric facilities.

2.3.2. Hydropower energy

The Sava River is a vital component in the ***energy provision*** in particular for Slovenia. On 26th July 2001, the Government of the Republic of Slovenia established Holding Slovenske Elektrarne (HSE) to implement the construction of new hydropower plants along Slovenia's Lower Sava River (Figure 2-4). In 2002, HSE signed the concession worth some 405 million Euros for the construction of five hydroelectric power plants along the lower Sava River to generate upon completion some 721 GWh of annual output[6]. The Sava River is already an important energy generation with Savske Elektrarne Ljubljana (SEL) operating four hydropower plants along the upper portion of the Sava River, providing a combined total net capacity of 117 MW[7].

Source: HSE

Figure 2-4 Lower Sava River HPP plants

Croatia also looks at the potential of Sava River for the generation of energy although the river does not (yet) plays an important role in the countries' energy provision: "*Hydroelectric power is Croatia's largest source of domestic energy, accounting for approximately 35% of domestic energy production and around 20% of total energy consumption. The country's hydroelectric plants are located along the*

[6] See HSE: "The Power of Energy", p 10.
[7] See HSE: "The Power of Energy", p 19.

Adriatic coastline at Obrovac, Senj, and Zakucac, as well as along Croatia's border with Slovenia and Hungary at Varazdin."[8] There are for the moment no hydroelectric power plants located along Sava River although the development of such installation is at present contemplated to secure the energy supply of Zagreb.

Similarly, the "*... total hydropower potential of Bosnia and Herzegovina is 6,100 MW mostly located within the Drina, Neretva and Trebisnjika river basins. Only about 38.75% of this is utilized and this meets approximately 40% of the total electricity production. Additional unused potential that has already been studied exists in these river basins and is greater than in all other river basins."*[9] At present, the focus of attention is on the Ugar River where a 40 MW hydroelectric power plant will be constructed as a 50:50 venture between both Entities for an estimated cost of around 40 million Euros[10].

The current hydroelectric power capacity of Serbia is 10,200 GWh per year, while potential capacity is estimated at 14,200 GWh per year. But the country has at present no real plans to develop hydroelectric power plants along Sava River. The priority for the Serbian authorities is to restore and subsequently improve the faulting power system and rehabilitating existing power facilities. The construction of hydroelectric power plants along Sava River might become a topic in the future, considering the growing gap between energy demand and supply. "*Average daily import of electricity in the winter of 2000 was larger than the maximum possible output of the country's largest power plant, TENT B, or hydroelectric power plants Djerdap I and Djerdap II combined*"[11]. Comparing domestic production with the average import of energy, and considering the rapidly growing interest to reduce the dependence upon gas and oil, the construction of a range of new hydroelectric power plants could become a reality in the near future, with Sava River one of the candidate locations.

2.3.3. Environmental protection and waterfront development

The Sava River is no exception and has a substantial environmental value. The river is one of the prime European examples of natural flood protection with the Sava River floodplains serving as protection against floodwaters which can rise up to 10 meters above normal level. The natural wetlands and nature reserves along the Sava River house an abundant fauna and flora, therefore having a high environmental value. It will be a priority objective of managing the ecological and landscape diversity and in supporting the implementation of not only the EU Water Framework

[8] ENVIROS; "*Review of Status of Emissions Trading Activities in CG11 Countries*"; working version for CG11 workshop in Zagreb, Croatia, 28.-29.May 2002; project nr ECZ-2024, p 3 cit.
[9] "National Environmental Action Plan – NEAP"; March 2003, p 39 cit.
[10] Financial Times, December 11, 2007
[11] Serbian Government, *Facts about Serbia"*, see http://www.arhiva.serbia.sr.gov.yu/cms/view.php?id=1018

Directive[12] but also the EU Birds and the Habitats Directives[13] focusing on long-term protection of the unique biodiversity of the Sava floodplains.

There are two principal areas along Sava River of environmental importance, namely Lonjsko Polje Nature Park in the Sisak region and the nature reserve "Zasavica", located close to Sremska Mitrovica, east of the Drina River and south of the Sava River.

Lonjsko Polje Nature Park covers the Sava valley in the Sisak and Moslavina Counties, from the Sisak city gate via Jasenovac to the town of Stara Gradiska including in particular Lonjsko Polje Nature Park, a UNESCO World Heritage site. The park and Sava River combination is first of all of prime importance for natural flood protection and an important area for nature preservation and cultural heritage. The natural wetlands house an abundant fauna and flora, adding to the area's environmental value. With a total surface of 50,650 hectares, the park is one of the largest wetland areas in the entire Danube basin and represents a unique landscape and ecological systems of flooded river plain (Figure 2-5), protected since 1990 and included in the list of important bird areas in Europe (IBA) and in the list of Wetlands of International Importance (Ramsar site). Given the abundance of bird species, specific areas of Lonjsko Polje are also protected as special ornithological reserve[14].

Figure 2-5 Lonjsko Polje Nature Park

But the area, and in particular the park is also potentially a primary catalyst for attracting tourists[15]. Lonjsko Polje Nature Park is by many considered a central component of Croatia's tourism development strategy. In addition to being of extremely high environmental importance, the park is also an "*experience-rich tourist product*" that can add value to the touristic attractiveness of Zagreb and provide its inhabitants a high-quality rest and recreation area.

[12] Directive 2000/60/EC of The European Parliament and of The Council of 23 October 2000 establishing a framework for Community action in the field of water policy; Official Journal of the European Communities L 327/1, 22.12.2000

[13] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora – Official Journal of the European Communities L 206, 22.7.1992; and Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds – Official Journal of the European Communities L 103, 25.4.1979, commonly referred to as the Birds Directive.

[14] The importance of the park and the Sava River Basin is fully recognized by the EU who participates in the preservation and development of the area via LIFE funds (LIFE CRO/TCY 000111: Central Posavina – Wading toward Integrated Basin Management)

[15] "Master Plan for Tourism – regional concept for the Lonjsko Polje Nature Park – Posavina"; **N**ature Park Bulletin Vol.2/No. 1, 2000; p 16

The second nature park of major importance is the nature reserve "Zasavica", located east of the Drina River and south of the Sava River near the town of Sremska Mitrovica. Zasavica is dominated by a reverie biotope of the Zasavica River, in the length of 33 kilometer. The protected area covers 1,825 ha and although the center of the reserve consists of the Jovaca and Prekopac canals, Batar creek, and the Zasavica River, the reserve is connected to the Sava River through the Bogaz canal. Also Zasavica Nature Park is included in the List of Wetlands of International Importance. Zasavica represents one of few authentic and preserved wetlands of the region and offers a wealth of aquatic and wetland ecosystems with fragments of flooded forests, habitat of diverse flora and fauna, some of which are rare and endangered. There have been over 600 plant species recorded so far (Figure 2-6). The area thus provides the adequate condition for a numerous and diverse wildlife preservation and was therefore put under protection in 1997 to safeguard this important natural asset.

Figure 2-6 Fauna and flora in Zasavica park

Similar to the Croatian nature park, Serbian "Zasavica" could become an international destination for nature tourists[16]. The park offers forests, meadows, river banks, abundance of plants and animals, traditional way of life presented in folklore style, and historical heritage dating from ancient time making Zasavica an interesting touristic destination that offers visitors attractive nature-based experience such as recreation, sailing, bird watching and nature study. Sport anglers will find specially designed locations for fishing carp, pike, or golden carp. The park finally proposes photo-safaris via a boat sailing tour.

[16] See : Ö.T.E. e.V./CenORT: Development of a methodology and a tourism management plan for the special nature reserve Zasavica - Serbia and Montenegro; Bonn/Belgrade, 2005.

Chapter 3. Options for Sava River rehabilitation

3.1. The principles

From Samac (km 305.7) to the confluence with the Danube in Serbia (km 0.0) the Sava is classified as a Sava Commission Classification (or SCC) Class IV waterway[17], in theory accessible for vessels up to 1,500 tons. At present, the Sava River is not completely accessible for vessels from SCC Class IV different sections up to Sisak and the classification descends until class II (vessels up to 630 tons) between Sisak and Rugvica (Zagreb).

The Sava Commission aims at fulfilling the AGN agreement, improving Sava River between Belgrade and Sisak, along the stretch km 0.0 to km 586.0, to SCC Class IV waterway. The question remains open whether navigability should be extended upstream Sisak and if and when the river section downstream Sisak should be upgraded to Class Va.

Detailed surveys during underlying study indicated that there is at present a navigable fairway of modest quality on the Sava River between Sisak and Belgrade but overall navigation conditions are poor.

The physical parameters of the Sava cause unfavourable navigation conditions related to:

- Limited draft during large periods;
- Limited width of the fairway;
- Sharp river bends limiting the length and width of vessels and convoys.

Other substantial problems for navigation are:

- Limited width under bridges;
- Insufficient marking;
- Sunken vessels or objects;
- UXO presence.

The quality of the Sava River as a transport mode mostly depends on the availability of sufficient depth for navigation. In line with SCC regulations, the Sava Commission applies two standards:

- Navigation must be possible with a reduced draft 95% of the time;
- Navigation with maximum draft must be possible 65% of the time.

[17] See [Lit 04]

According to SCC for class IV waterways, this means that the fairway should have a depth of 2.3 m, 95% of the time, and a depth of 3.3 m, 65% of the time. The width of the fairway for 2 lane traffic should be 55 m in straight sections and 75 m in curves, measured along the river bed center line of the curve.

The situation in the field is far from meeting these requirements. The shallow sections in Serbia and around the Drina confluence make it at present very difficult to reach Croatia / Bosnia for SCC Class IV categorized vessels, presumable for less than 50% of the year. The situation in Croatia is slightly better where category Class III vessels can navigate with full draft around 65% of the time. But important improvement works are also required on this section of the river to increase the availability of the fairway for fully loaded vessels and for SCC Class IV categorized vessels.

Although the "official" policy of the Sava Commission and riparian states is the rehabilitation of Sava River to Class IV, the principal aim of underlying study was to investigate whether the gradual approach for the Sisak-Belgrade section – first SCC Class IV and later Class Va – really is the best approach in terms of upgrading and to assess whether navigability should be extended to Brezice (or Rugvica).

3.2. Rehabilitation to Class IV or Class Va?

3.2.1. The difference

Although initial efforts were oriented towards a rehabilitation of Sava River to SCC Class IV, underlying study also investigated the possibility of upgrading the river to SCC Class Va and compared both options to identify the best strategy to follow[18].

The differences for navigation between both classes are:

- The depth of the fairway is 2.4 m for SCC Class Va and 2.3 m for SCC Class IV (at low navigable water level);
- The width of the waterway in bends is 90 m for SCC Class Va instead of 75 m for SCC Class IV; and
- The horizontal clearance below bridges is 55 m for SCC Class Va and 45 m for SCC Class IV.

[18] See [Lit 04]; [Lit 18], and [Lit 17]

3.2.2. The works and costs to upgrade to Class Va

To improve navigability of Sava River between Belgrade and Sisak, a variety of works is necessary[19]:

- Construction of groynes to concentrate the flow, causing higher flow velocities in the central part of the river. Higher erosion rates will then cause a deepening of the river;
- Construction of bank protections to avoid erosion caused by new groynes and to protect eroding banks. Due to the water level decrease the Sava is carving itself deeper in the landscape, as a result steep, vulnerable banks occur;
- Construction of sills on the bottom of the river to increase the water level;
- Rehabilitation of existing groynes and bank protections. The majority of the rehabilitation works are related to the existing bank protection works. The stability of the existing bank protections is threatened because of the continuous water level decrease;
- Dredging to increase the water depth;
- Removal of sunken vessels;
- Marking; and
- River Information Services (RIS).

All values should be considered accurately because in the respective task reports, differences were made in cost upstream and downstream rkm 202. In addition, the calculations have been reviewed for the final report and have been adjusted where necessary to reflect more accurately actual estimated costs.

An important source of information for the calibration of final results were the estimates from the Pre-Feasibility Study for Rehabilitation and Development of the Sava River Waterway (2007) and the Master plan and Feasibility Study – Inland Waterway Transport for Serbia (2006).

Dredging and training works

The Master plan and Feasibility Study in Serbia already described in detail dredging and river training projects needed for the river section km 0.0 and 202.0, for a total amount of 7,570,800 Euros while dredging and river training works on the river section between rkm 202 and Sisak will require a combined investment of 29,725,500 Euros.

[19] These works are independent whether upgrading is to Class IV or Class Va. Value added tax has not been included.

River bend improvements

There are 20 river bends with a radius smaller than 360m. A total of 12 river bends have a radius less than 240 m, which is the minimum radius for one-way traffic, leaving a total of 8 river bends with a radius between 240m and 360m. It has been assumed that for the one-way traffic with traffic guidance will be imposed on the 8 sections having a radius 240m < R < 360m, requiring waiting areas for vessels and for each bend additional marking, and traffic signs.

Total costs for river bend improvements are estimated at 1,304,000 Euros for the river bends having a radius 240m < R < 360m and 10,056,000 Euros for the river bends with less than 240m.

The costs related to excavation, bank protection works total 675,000 Euros and are equal to 260,000 Euros for excavation and 415,000 Euros for construction of bank protection.

Bridges and power cables

It is assumed that the available horizontal and vertical clearances of the power cable crossings comply with the requirements for SCC Class IV and Class Va waterway, so no projects are defined.

There are a total of 4 bridges with insufficient vertical clearance for a SCC Class Va waterway, in particular when considering the transport of stacked containers. A clearance of 7.0 m is required enabling the transport of three layers of containers and a clearance of 5.25 m is required for transport of 2 layers of containers. But it is not expected that container transport with three layers of containers will start within the medium to even long term future. Therefore, only bridges that hinder “regular” traffic because of vertical clearance are recommended for replacement and are respectively:

1. The old railway bridge in Belgrade located at chainange 2.6;
2. The old Sabac road and railway bridge located at chainange 104.0; and
3. Replacement of the bridge at Jasenovac at chainange 509.0.

Costs for bridge replacement total 2,400,000 Euros for the bridge at Jasenovac and 6,480,000 Euros for the two other bridges combined.

Marking

In November 2007, the Sava Commission published a marking plan for the Sava River and its tributaries. First works regarding the establishment of the marking system are underway when on 23 April 2008, the contract on development of the Detailed Design of the Marking System of the Sava River Waterway on the BiH Marking Sector was signed in Zagreb between the Sava Commission and the Agency for Waterways from Vukovar (Croatia).

Total capital cost estimated for the marking of the River between Belgrade and Sisak equals 1,535,000 Euros. The construction costs over the river stretch Brcko – Oprisavci amounts to 460,000 Euros and for the stretch Oprisavci – Sisak it is 595,000 Euros. The outstanding cost is for the section Belgrade – Brcko.

River Information Services (RIS)

A RIS[20] should be established on the whole stretch of the waterway between Sisak (HR) and Belgrade (SR) at the moment the navigable channel has been marked and commercial traffic has reached sufficiently relevant volumes (most likely after full river rehabilitation). There are 4 basic and 2 additional services that should in time be implemented:

1. Fairway Information Service with ENC and Inland ECDIS feature;
2. Tracking and Tracing of the vessels by means of AIS network;
3. Notices to Skippers;
4. VHF voice direct radio link with shore-ship service messages feature;
5. Electronic Ship Reporting (additional service);
6. Calamity abatement (additional service);

Each country is competent and responsible for the implementation on their territory of RIS and the progress in the development of RIS varies from country to country. The cost for the implementation of the RIS over this river stretch (length 206 km) has been calculated in the Master plan and Feasibility Study in Serbia and amount to 2,020,000 Euros. The RIS capital investment for the remaining river stretch km 202 – km 579.5 is estimated at 3,770,000 Euros. Total costs for the full implementation of a comprehensive RIS over the entire river stretch equals 5,790,000 Euros.

The Phase 1 RIS Report [Lit 06] estimated the RIS capital investment differently and estimated the necessary capital investment for Phase 1 and Phase 2 of the RIS implementation to reach approximately 1,650,000.00 Euros. This cost is substantially lower because total capital investment costs needed to implement minimum RIS services on Sisak – Belgrade section of Sava River as estimated in [Lit 06] only cover additional capital investments and did not include prior investments (necessary to be included to conduct true CBA). The estimates in [Lit 06] also assume and appreciated benefits generated by economies of scale and joint development and utilization options, again something not considered in the prior estimates. Finally and most importantly, the estimated cost of 1.6 million Euros cover only the costs of Phases 1 and 2 and do

[20] See for details [Lit 06]

not cover the costs to establish a comprehensive full-scale RIS service, contrary to the estimates presented in the Master plan and Feasibility Study in Serbia.

Miscellaneous

Only costs for the removal of dangerous ship wrecks are considered, and total 300,000 Euros.

3.2.3. Cost review

Given above cost allocations, total cost for upgrading Sava River to Class IV equals 63,799,200 Euros (excluding contingencies and project costs) compared to 68,313,600 Euros (idem) for immediate upgrading to Class Va[21]. The difference in total cost, just over 7%, originates in large majority from increased dredging and training cost and higher environmental costs. All other costs remain relatively equal for both options[22].

Table 3-1 Comparative summary of rehabilitation costs

	Total for SCC Class IV	Total for SCC Class Va	Difference	Difference
	(Euro)	(Euro)	(Euro)	%
Dredging and training works*	34,929,200	39,108,600	4,179,400	12.0%
Environmental costs**	1,005,000	1,340,000	335,000	33.3%
Bridge replacements	8,880,000	8,880,000	0	0.0%
River bend improvements (total)	11,360,000	11,360,000	0	0.0%
Markings and sunken vessels	1,835,000	1,835,000	0	0.0%
RIS***	5,790,000	5,790,000	0	0.0%
Net cost	63,799,200	68,313,600	4,514,400	7.1%
Including contingencies (+10%)	70,179,120	75,144,960	4,965,840	7.1%
TOTAL project costs (+15%)	80,705,988	86,416,704	5,710,716	7.1%

* Dredging and training costs are the revised and final costs and differ from the values provided in different Task Reports
** Environmental costs increased compared to Phase 1 calculations and final revised costs have been used here [Lit05]
*** RIS costs differ from estimates in RIS report [Lit06]. The applied estimates assume full-range application of RIS with costs as estimated in the pre-feasibility Study and the Serbia Master Plan

Compared with the cost estimates for upgrading the same section to SCC Class IV, total capital cost increase (excluding annual maintenance costs) amounts to 4,514,400 Euros to upgrade Sava River to Class Va as compared to the necessary investment for upgrading the river to Class IV.

There is also an additional 492,000 Euros needed for operations and maintenance to maintain Class Va compared to the maintenance costs for Class IV.

[21] The final total cost estimates might differ from values provided in earlier task reports as these estimates have been reviewed several times during the course of the study. Above provided values are final estimates including higher end of R|S costs (and not the minimum estimates as presented in the RIS report [Lit06]).
[22] It should be noted that costs have been recalculated on several occasions during the project and adjusted on the basis of new information. Consequently, the estimated costs in the different task reports and in the final report differ.

Some of above summarized costs are specified in more detail in the next paragraphs.

Table 3-2 Bridge replacement costs

Project	Name	Chainage (km)	Quantity (m2)	Unit rate (Euro)	Construction costs (Euro)
B1	Belgrade railway bridge	2.6	1,200	1,800	2,160,000
B2	Old Sabac road and railway bridge	104	2,400	1,800	4,320,000
B3	Jasenovac bridge	509	1,200	2,000	2,400,000
Total					**8,880,000**

Table 3-3 River bend improvement costs 240 m < R < 360 m (km 202.0 – km 579.5)

Nr	Stretch (km)	Chainage (km)	Radius (m)	Nr. of waiting areas	additional marking	Construction costs (Euro)
RB1	286 – 288	287	310	1	5	163,000
RB2	298 – 300	299	250	1	5	163,000
RB3	452 – 454	453	240	1	5	163,000
RB4	481 – 483	482	360	1	5	163,000
RB5	492 – 494	492.9	260	1	5	163,000
RB6	495 – 497	495.2	330	1	5	163,000
RB7	549 – 551	550	280	1	5	163,000
RB8	552 – 554	553	240	1	5	163,000
Total						**1,304,000**

Table 3-4 River bend improvement costs R < 240 m (km 202.0 – km 579.5)

Nr	**Stretch (km)**	**Chainage (km)**	**Radius (m)**	**River bend improv (Euro)**	**Waiting areas (Euro)**	**additional marking (Euro)**	**Construction costs (Euro)**
RB9	425.8 – 426.8	426.3	230	675,000	160,000	3,000	838,000
RB10	477.9 – 478.9	478.4	180	675,000	160,000	3,000	838,000
RB11	483.3 – 484.3	483.8	150	675,000	160,000	3,000	838,000
RB12	484.9 – 485.9	485.4	230	675,000	160,000	3,000	838,000
RB13	509.5 – 510.5	510.0	170	675,000	160,000	3,000	838,000
RB14	527.2 – 526.2	527.2	190	675,000	160,000	3,000	838,000
RB15	529.2 – 530.2	529.7	200	675,000	160,000	3,000	838,000
RB16	534.5 – 535.5	535.0	170	675,000	160,000	3,000	838,000
RB17	538.5 – 539.5	539.0	150	675,000	160,000	3,000	838,000
RB18	542.0 – 543.0	542.5	230	675,000	160,000	3,000	838,000
RB19	558.9 – 599.9	559.4	230	675,000	160,000	3,000	838,000
RB20	581.4 – 582.4	581.9	230	675,000	160,000	3,000	838,000
Total							**10,056,000**

3.2.4. Comparing the costs

The bulk of the additional cost is immediately associated with dredging and training works, a difference amounting to 4,179,400 Euros (see Table 3-5).

Table 3-5 Dredging and training projects and costs comparison (Euro)

Project	From km.-km	Total for SCC Class IV	Total for SCC Class Va	difference
DTW1	79.9 - 85.8	232,400	290,500	58,100
DTW2	88.3 - 101.9	1,412,400	1,765,500	353,100
DTW3	103.5 - 109.8	400,000	500,000	100,000
DTW4	173.8 - 176.6	3,058,000	3,242,100	184,100
DTW5	177.8 - 187.4	716,800	896,000	179,200
DTW6	189.2 - 205.9	799,600	999,500	199,900
DTW7	202.5 - 225.1	1,190,000	1,487,500	297,500
DTW8	225.1 - 260.7	60,000	75,000	15,000
DTW9	260.7 - 306.8	600,000	750,000	150,000
DTW10	306.8 - 331.5	5,620,000	6,205,000	585,000
DTW11	331.5 - 364.4	50,000	62,500	12,500
DTW12	364.4 - 395.5	3,540,000	3,952,500	412,500
DTW13	395.5 - 417.1	-	-	-
DTW14	417.1 - 445.7	420,000	525,000	105,000
DTW15	445.7 - 459.9	110,000	137,500	27,500
DTW16	459.9 - 480.4	10,000	12,500	2,500
DTW17	480.4 - 511.8	90,000	112,500	22,500
DTW18	511.8 - 546.8	4,940,000	5,195,000	255,000
DTW19	546.8 - 568.8	8,490,000	9,125,000	635,000
DTW20	568.8 - 588.2	3,190,000	3,775,000	585,000
TOTAL:	**79.9 - 588.2**	**34,929,200**	**39,108,600**	**4,179,400**

A lower cost difference between immediate upgrading to SCC Class Va and gradual upgrading first to Class IV and later to Class Va is in the environmental costs, see Table 3-6.

Also these numbers should be considered with care because original values presented and used in the different Phases of the Study and reported in the different Task Reports have later been adjusted (increased).

Table 3-6 Environmental cost differences

Cost type and description	Class IV (EUR)	Class Va (EUR)	Difference
MEASURES			
Air	20,000	30,000	10,000
Water	145,000	155,000	10,000
Soil	170,000	170,000	-
Flora and fauna	150,000	150,000	-
Cultural heritage	200,000	265,000	65,000
Traffic and infrastructure	25,000	25,000	-
Landscape	250,000	500,000	250,000
Accidents	25,000	25,000	-
Waste	20,000	20,000	-
TOTAL	**1,005,000**	**1,340,000**	**335,000**
MONITORING (annual cost)	25,000	37,500	12,500

Next Figure 3-1 summarizes expenditures during the appraisal period (2009 – 2028) based on 2008 price levels, taking into account the upgrading to Class IV (Phase 1) and additional costs for upgrading to Class Va (Phase 3).

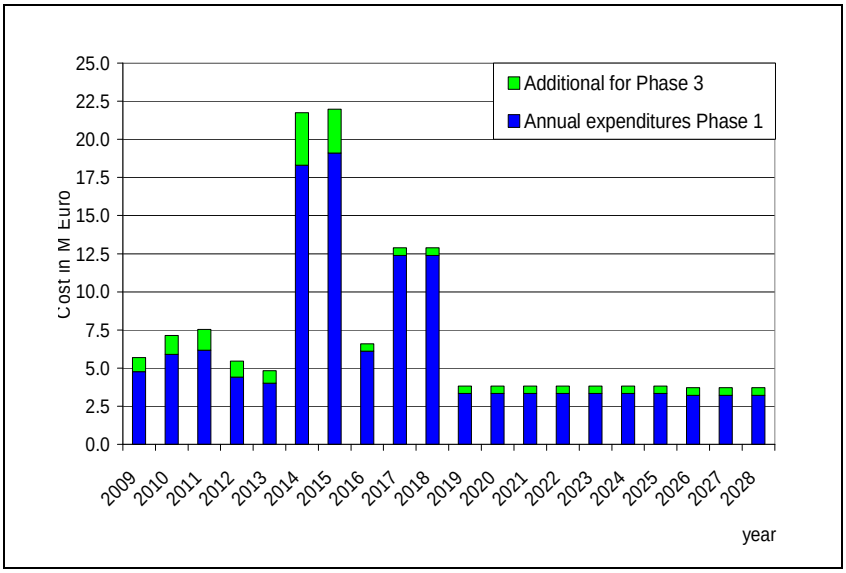


Figure 3-1 expenditures during the appraisal period 2009 – 2028 (2008 price levels)

These costs include the initial investments costs, the operations and maintenance costs and the cost for the measures and monitoring system as result from the Environmental Impact Assessment.

The timing of the expenditures is tentative and can vary pending actual implementation schedules and the time needed for the preparation of the rehabilitation (Detailed Design Study, EIA, financing, etc.).

The distribution of costs over the riparian states is important because international donors such as World Bank cannot provide financing directly to Sava Commission for the execution of the works and need to work with the public authorities of the riparian states, in particular Serbia, Bosnia and Herzegovina, and Croatia.

To allow a tentative allocation of costs attached to the proposed physical works, an attempt was made to distribute the total rehabilitation cost per state and based upon a "best-guess" geographical delineation of the Sava River as specified in Table 3-7.

Table 3-7 Geographical delineation of river per riparian state

Identification	From KM	To KM	Total KM	% of total	Responsibility (Theory)
RELEVANT RIVER SECTION:	0	586	586	Belgrade - Sisak river section	
Sisak – Jasenovac	586	507	79	14%	exclusive Croatia
jasenovac – Oprisavci	507	335	172	29%	joint Croatia / BiH
Oprisavci – Racinovci	335	207	128	22%	joint Croatia /BiH
Račinovci – Drina confluence	207	174.8	32.2	06%	joint Serbia / BiH
Drina confluence – Belgrade	174.8	0	174.8	30%	Exclusive Serbia

The tentative distribution was achieved as presented in Table 3-8.

Consequently, a tentative distribution of total costs is presented in the next Table 3-9.

Table 3-8 Approach to estimate distribution of costs

Total construction costs			SERBIA	BIH	CROATIA
Project	**Chainage**	D=A+B+C Investment (Euro)			
DTW1	69.7 - 72.9	157,113	157,113		
DTW2	79.9 - 85.8	330,734	330,734		
DTW3	88.3 - 101.9	2,010,022	2,010,022		
DTW4	103.5 - 109.8	569,250	569,250		
DTW5	173.8 - 176.6	4,351,916	4,351,916		
DTW6	177.8 - 187.4	1,020,096	510,048	510,048	
DTW7	189.2 – 202.5	1,137,931	568,965	568,965	
DTW8	202.5 - 225.1	1,580,618		790,309	790,309
DTW9	225.1 - 260.7	79,695		39,848	39,848
DTW10	260.7 - 306.8	796,950		398,475	398,475
DTW11	306.8 - 331.5	7,464,765		3,732,383	3,732,383
DTW12	331.5 - 364.4	66,413		33,206	33,206
DTW13	364.4 - 395.5	4,702,005		2,351,003	2,351,003
DTW14	395.5 - 417.1	-		-	-
DTW15	417.1 - 445.7	557,865		278,933	278,933
DTW16	445.7 - 459.9	146,108		73,054	73,054
DTW17	459.9 - 480.4	13,283		6,641	6,641
DTW18	480.4 - 511.8	119,543			119,543
DTW19	511.8 - 546.8	6,561,555			6,561,555
DTW20	546.8 - 568.8	11,276,843			11,276,843
DTW21	568.8 - 588.2	4,237,118			4,237,118
RB1	286 - 288	206,195		103,098	103,098
RB2	298 – 300	206,195		103,098	103,098
RB3	452 – 454	206,195		103,098	103,098
RB4	481 – 483	206,195		103,098	103,098
RB5	492 – 494	206,195		103,098	103,098
RB6	495 – 497	206,195		103,098	103,098
RB7	549 – 551	206,195			206,195
RB8	552 – 554	206,195			206,195
RB9	425.8 – 426.8	1,060,070		530,035	530,035
RB10	477.9 – 478.9	1,060,070		530,035	530,035
RB11	483.3 – 484.3	1,060,070		530,035	530,035
RB12	484.9 – 485.9	1,060,070		530,035	530,035
RB13	509.5 – 510.5	1,060,070			1,060,070
RB14	527.2 – 526.2	1,060,070			1,060,070
RB15	529.2 – 530.2	1,060,070			1,060,070
RB16	534.5 – 535.5	1,060,070			1,060,070
RB17	538.5 – 539.5	1,060,070			1,060,070
RB18	542.0 – 543.0	1,060,070			1,060,070
RB19	558.9 – 599.9	1,060,070			1,060,070
RB20	581.4 – 582.4	1,060,070			1,060,070
B1	2.6	2,732,400	2,732,400		
B2		5,464,800	5,464,800		
B3	509	3,036,000			3,036,000
M1	0 - 202	607,200	607,200		
M2	202 - 335	752,675		376,338	376,338
M3	335 - 579.5	581,900		290,950	290,950
S1	0 – 202	227,700	227,700		
S2	202 – 579.5	151,800		75,900	75,900
RIS 1	0 – 202	2,555,300	2,555,300		
RIS 2	202 – 579.5	4,769,050		2,384,525	2,384,525
Total construction costs			24%	18%	58%

Table 3-9 Distribution of cost per riparian state (Class Va option – latest numbers)

Riparian State	SERBIA	BiH	CROATIA
Capital investment			
Euro	21,085,676	15,382,173	49,948,855
% of total budget	24%	18%	58%
Annual maintenance costs			
% of total budget	24%	18%	58%
Euro/year	814,966	594,395	1,935,194

An accurate division of costs can only be made after completing the detailed design works which will include a clear cost distribution between each of the riparian states.

3.3. Upgrading Sava River upstream Sisak?

3.3.1. Introduction

The second issue that was investigated in detail was the question of extending navigation upstream Sisak. At present, the river gradually diminishes its size in upstream direction. This effect is on one hand caused by a diminishing discharge and on the other hand by an increasing slope causing higher velocities and a further reduction of the depth. As a result the required works to comply with SCC Class IV increase river upstream, resulting in much bigger required investments to comply with SCC class IV in comparison with the works downstream Sisak.

3.3.2. The necessary works

Dredging and training works

Below a description is given of the proposed dredging and river training projects in the river section km 579.5 and 653.0. All works in this section should be regarded in close connection with the improvement of the river bends. The following works are necessary:

- Construction of groynes to concentrate the flow and to increase river friction causing a permanent deepening of the river;
- Construction of bank protections to avoid erosion caused by the proposed new groynes and new river alignment to protect vulnerable banks;
- Construction of sills on the bottom of the river to increase the water level[23];
- Rehabilitation of existing groynes and bank protections;

[23] Other option is lengthening of the river with new bends. Considering the usually high costs this was not projected.

- Dredging works are executed to equilibrium depth, uncontaminated dredged material is redeposited in the river at bend reconstructions;
- Construction of waiting areas, since the river is relatively narrow (compared to ships and the previous sections) additional work is needed to provide waiting areas up and downstream of sharp bends (R<360 m) where one lane traffic is needed,
- Clearing (deforestation) of vegetation in inner bends within a radius of 360 m (in order to provide sufficient navigation visibility)[24],
- Realignment of bends aimed at improving the fairway while maintaining the slope of the watertable. Shortening of the river is avoided. As much as possible the negative effects of shortening are fully compensated at lower and higher stages.

Table 3-10 provides an overview of the necessary dredging and training works.

Table 3-10 Proposed dredging and river training projects

Project	Chainage	Description	Works				
			Groynes	bank protections	Sills	recon. bankpr. & groynes	dredging
DTW21	580.0 - 584.5	Execute training works to improve Sava fairway depth	X	X	X		X
DTW22	586.0 - 587.8	Execute training works to improve Sava fairway depth	X	X	X		X
DTW23	588.0 - 589.0	Execute training works to improve Sava fairway depth	X	X	X		X
DTW24	593.0 - 594.0	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW25	595.5 - 598.7	Execute training works to improve Sava fairway depth	X		X		X
DTW26	599.0 - 601.5	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW27	606.8 - 608.0	Execute training works to improve Sava fairway depth	X		X		X
DTW28	609.0 - 611.0	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW29	614.5 - 617.1	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW30	617.5 - 622.5	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW31	622.0 – 624.0	Execute dredging to improve Sava fairway depth					X
DTW32	627.0 - 627.0	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW33	628.5 – 630.8	Execute dredging and training works to improve Sava fairway depth	X	X	X	X	X
DTW34	633.4 - 635.3	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW35	638.3 – 638.5	Execute dredging with training works to improve Sava Fairway	X				X
DTW36	639.5 - 640.5	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW37	642.6 – 642.7	Clear and repair groynes				X	
DTW38	648.1 – 648.1	Clear and repair groynes				X	
DTW39	642.6 – 641.9	Execute training works to improve Sava fairway depth	X	X	X	X	X
DTW40	650.9 - 653.1	Bank protection safety measure		X			

[24] Trees and scrubs in the inner bends are usually most of a young age. They can easily be compensated for. Pasture lands at the inner bend however, may hold a wide variety of valuable and sometimes rare flora and fauna that is difficult to find elsewhere.

The location of the sills has to be determined through hydraulic modelling at various discharges. On average in this section every 1 km shortening of the river will require 12 sills to compensate the increase of slope. The sills in this section serve foremost to maintain adequate draft for navigation at low discharges (maintain the slope of the watertable while altering river geometry).

River bends improvements

Since bends with radii less than 240 m, occur at a regular interspacing (averagely at every 4 km, at maximum 12 km) throughout this river section, bend realignment is, in this section, mandatory to enable the passing of SCC class IV vessels. Therefore the assumption is made that bend realignment will take place. In this section of the river from km 579.5 til 953 a total of 17 bends have a radius smaller than 240 meter. Bends at km 607 and km 607.5 are regarded as one bend leaving a total of 16 bends in this section that need upgrading prior to any further activity. Besides, this section has 13 bends with a radius smaller than 360 meter.

River bends 240 m < R < 300 m.

Assuming all bends in this section will be realigned to a minimum radius of 240 m, the proposed works are summarized in Table 3-11.

Table 3-11 Proposed river bend improvement projects 240 m < R < 360 m

Nr	Chainage	Description	Nr of bends
RB21	579.5 – 585.0	Construction of waiting areas, one way traffic, and traffic guidance in 2 sharp river bends	**1**
RB22	585.6 – 587.5	Construction of waiting areas, one way traffic, and traffic guidance in 1 sharp river bend	**1**
RB23	587.5 – 595.0	Construction of waiting areas, one way traffic, and traffic guidance in 3 sharp river bends	**1**
RB24	595.0 – 599.0	Construction of waiting areas, one way traffic, and traffic guidance in 2 sharp river bends	**1**
RB25	599.0 – 605.0	Construction of waiting areas, one way traffic, and traffic guidance in 3 sharp river bends	**1**
RB26	605 – 610.5	Construction of waiting areas, one way traffic, and traffic guidance in 2 (3) sharp river	**2 (3)**
RB27	613.0 – 617.5	Construction of waiting areas, one way traffic, and traffic guidance in 2 sharp river bends	**1**
RB28	617.5- 623.0	Construction of waiting areas, one way traffic, and traffic guidance in 2 sharp river bends	**2**
RB29	623.0 – 632.0	Construction of waiting areas, one way traffic, and traffic guidance in 3 sharp river bends	**2**
RB30	632.0 – 636.0	Construction of waiting areas, one way traffic, and traffic guidance in 1 sharp river bend	**1**
RB31	636.0 – 646.0	Construction of waiting areas, one way traffic, and traffic guidance in 1 sharp river bend	**1**
RB32	646.0 – 652.0	Construction of waiting areas, one way traffic, and traffic guidance in 2 sharp river bends	**2**

River bends R < 240 m

There are 16 (17) bends with radius smaller than 240 m, being the minimum radius for one-way traffic. These bends will be realigned. One-way traffic is introduced for all bends with a radius shorter than 360. The bends that will be realigned are summarized in Table 3-12.

Table 3-12 Realignment of bends R < 240m

Nr	Stretch (km)	Chainage (km)	Radius (m)	Description
1	580 – 585	582	231	Increase to one lane traffic, construct waiting areas,
2	585.6-587.5	586.3	231	Increase to one lane traffic, construct waiting areas,
3	588.0 - 589.0	589	192	Increase to one lane traffic, construct waiting areas,
4	595.0 - 597.5	596.5	115	Increase to one lane traffic, construct waiting areas,
5	597.5 – 602.0	600.5	205	Increase to one lane traffic, construct waiting areas,
6	606.3 – 607.7	607	192	Increase to one lane traffic, construct waiting areas,
7	606.3 – 607.7	607.5	192	Increase to one lane traffic, construct waiting areas,
8	608.8 – 610.2	609.5	231	Increase to one lane traffic, construct waiting areas,
9	614.0 – 617.2	615.5	185	Increase to one lane traffic, construct waiting areas,
10	614.0 – 617.2	616.5	150	Increase to one lane traffic, construct waiting areas,
11	619.0 - 622.5	621.5	157	Increase to one lane traffic, construct waiting areas,
12	619.0 - 622.5	620.3	210	Increase to one lane traffic, construct waiting areas,
13	626.5 – 629.0	627.5	218	Increase to one lane traffic, construct waiting areas,
14	633.0 – 635.0	634.0	80	Increase to one lane traffic, construct waiting areas,
15	636.0 – 640.5	639.5	120	Increase to one lane traffic, construct waiting areas,
16	652.0 – 652.5	652	192	Increase to one lane traffic, construct waiting areas,
17	652.0 – 652.5	652.5	231	Increase to one lane traffic, construct waiting areas,

Bridges

The bridge in this section (at Martinska Ves) complies with the requirements for SCC Class IV.

Markings

Upstream from km 586 till 934 the Sava has very little marking for navigation. The works as proposed in Table 3-13 are necessary.

Table 3-13 Proposed markings section km 586 – km 934

Type of signs	Description	Total number required
Main signs for waterway marking	Prohibitory, mandatory, restrictive, recommendatory, informative signs	11
Buoyage of the waterway	Lighted buoy Unlighted buoy (Float)	6 1
Marks on land indicating the position of the fairway in relation to the banks	Lighted bank mark Unlighted bank mark	80
Bank marking for danger points and obstacles	Unlighted bank mark	3
Special signs	Kilometer mark	148

Miscellaneous

The miscellaneous costs are limited to the costs of the related River Information Services mostly related to the required river guidance. Within this Feasibility Study a separate report has been prepared on this issue.

3.3.3. Cost review

As the river gradually diminishes its size in upstream direction the demanded work to comply with a SCC Class IV navigation channel increases. As a result of this, upgrading of the Sava from Rugvica to Brezice needs from the river engineering point of view[25], to be done with dams and locks.

Most ideally from the environmental and river engineering point of view is the implementation of a series of small dams with locks at close internal spacing. Because locks are notoriously expensive this is usually not feasible and the absolute minimum amount of dams has to be used as alternative solution.

Considering the effects of backwaters in the Zagreb city centres the absolute minimum number of dams is 2 (Alternative A). The first dam will be located just upstream from Rugvica (at about km 660) and the second dam just upstream of the bridge of the A2 at Zagreb. If 2 dams with locks are build with an optimized spacing at chainage km 660 and km 700 the contraction at each dam needs to be sufficient to provide an additional (at least) 15 meters[26] of extra local height of the watertable.

If dams are build at Mokrice (Sovenia), Drenje (km 686), Zagreb (km 699), Preco (km708), and Podsused (718) as projected (Alternative B), the contraction at the new dams in Croatia has to be approximately 7 to 9 meters to provide adequate depth in the reservoirs. In between Drenje and Rugvica an additional dam is needed to provide adequate depth in that section. If this first section contains only one dam the required contraction amounts to approximately 13 meters to provide adequate depth downstream of the Drenje dam.

Following Table 3-14 presents the infrastructure costs and the operation and maintenance costs depending on the types of alternatives and the approach used to assess these costs[27].

[25] Consortium considers the improvement of the river up to SCC Class IV for the section upstream of Rugvica impossible or at the least extremely difficult and risky. If it is possible the costs will then roughly be 3 times higher than the previous section. The costs will largely be caused by a huge array of sills and groynes and intensive armoring of bridge foundations.

[26] Backwater effects included.

[27] As was also shown in previous chapters there is very limited information available of the section upstream of Rugvica. Therefore only very rough estimations with respect to the works to be implemented and related costs could be made.

Table 3-14 Overall cost overview for rehabilitation of section Sisak - Brezice

Project	Investment costs (Euro)	Operation and Maintenance costs (Euro)
Section 1: Sisak – Rugovica:		
Approach 1	€ 22,785,000	€ 56,950
Approach 2	€ 32,816,883	€ 56,950
Section 2: Rugovica – Brezice:		
Alternative 2 dams	€ 299,046,000	€ 4,476,000
Alternative 2 dams + Mokrice dam	€ 324,346,000	€ 5,476,000
Alternative 5 dams	€ 353,947,000	€ 7,144,000
Alternative 5 dams + Mokrice dam	€ 379,247,000	€ 8,144,000
Combined:		
Minimum	€ 321,831,000	€ 4,532,950
Maximum	€ 412,063,883	€ 8,200,950

An observation that can be made is that the (additional) costs to make the river navigable is, per kilometer, upstream from Rugovica, is almost 9 times higher than downstream from Rugovica.

Based upon above estimates, the total investment costs for the rehabilitation of Sava River upstream Sisak, section Sisak – Brezice, sum up to a total investment between 322 million Euros and 412 million Euros. Moreover the annual costs for operation and maintenance are between 4.5 and 8.2 million Euros. These costs are much higher compared to the figures for rehabilitation of the river downstream Sisak.

Chapter 4. River rehabilitation and future commercial traffic on Sava River

4.1. Class IV rehabilitation and future traffic

4.1.1. General considerations

Having identified the necessary works to rehabilitate the Sava River to SCC Class IV or Class Va (the only difference being the amount of dredging) and the therewith associated costs, the question is what these investments could generate in terms of benefits, in particular in respect with the development of commercial traffic on the River.

The class difference is directly related to the number of ships passing along any given segment of the Sava River, a critical determinant of operational sufficiency. At first inspection, a considerable reduction in vessel movements should be possible in that maximum permissible vessel size has doubled[28].

One of the main questions for the future rehabilitation of Sava River is therefore what will be the traffic pending upon SCC Class IV and Va. A Class Va navigation categorization allows, in the most general sense, navigation by "bigger" vessels. The Class IV maximum vessel displacement is listed as 1,500 tonnes, which increases to 3,000 tonnes under Class Va[29].

The main objective of the Feasibility Study is therefore not port feasibility, but navigability of the Sava River. In other words, is the planned upgrading of the Sava River to Category IV (or Class Va) economically and financially viable, and, from an engineering perspective, is the resulting river capacity (and subsystems thereof) sufficient to absorb forecast volume. While the former focuses on cargo tonnes and tonne kilometers of transport, the latter is more concerned with numbers of vessel movements.

Thus, from a river engineering point of view, it is more important to understand the number of directional vessel movements, rather than what these vessels carry. This section formulates river activity in terms of tonnes, tonne kilometers and vessel movements, stratified by Sava River segment.

[28] See [Lit 01], [Lit 11], and [Lit 17]
[29] Detailed Parameters for Waterway Classification on the Sava River, The International Sava River Basin Commission, Zagreb, Croatia, 2006.

4.1.2. Tonne Movements

During year 2012 (representative of post-upgrading of Sava River to Category IV navigation), commercial cargo traffic is expected to reach between 3.5 million and 7.9 million tonnes, depending on the realization of the low or high economic growth scenario. These volumes are likely to increase to 6.1 million and 15.3 million tonnes in 2022, and to ultimately reach between 7 million and 18.7 million tonnes during year 2027, again depending on the low and high growth scenarios, respectively (Table 4-1).

Table 4-1 Forecast Throughput: Sava River Ports

Port	Economic Growth Scenario	Thousand Tonnes per Annum by Year			
		2012	2017	2022	2027
Sisak	Low	410	480	540	590
	Medium	830	1,070	1,380	1,690
	High	1,340	1,880	2,270	2,800
Slavonski Brod	Low	920	1,360	1,540	1,700
	Medium	1,520	1,870	2,230	2,580
	High	2,140	2,830	3,530	4,190
Bosanski Brod	Low	0	200	400	600
	Medium	200	400	600	800
	High	400	600	1,000	1,400
Samac	Low	1,090	1,270	1,430	1,580
	Medium	1,500	1,830	2,170	2,520
	High	1,910	2,500	3,120	3,700
Brcko	Low	540	630	710	780
	Medium	750	910	1,070	1,240
	High	950	1,240	1,540	1,830
Sremska Mitrovica	Low	380	440	540	630
	Medium	610	710	900	1,090
	High	880	1,070	1,360	1,650
Sabac Industrial	Low	160	190	230	260
	Medium	260	300	380	460
	High	370	450	580	710
Sabac International	Low	n.a.	640	760	890
	Medium	n.a.	1,020	1,280	1,550
	High	n.a.	1,520	1,930	2,410
Total	Low	3,500	5,210	6,150	7,030
	Medium	5,670	8,110	10,010	11,930
	High	7,990	12,090	15,330	18,690

Source: Study Team. Totals exclude sand and gravel. Sabac International Port not operational by year 2012.

This positive future is not the consequence of one particular port along Sava River, but the results of a combined strong performance of all river ports. It is therefore logical that loadings on the Sava River will gradually increase in the downstream direction. The year 2027, high growth scenario confirms that near 19 million tonnes may be transported along the highest activity segment (between Danube River and Sabac International Port) with upstream (imports) being the dominant direction in terms of loaded tonne transport (Table 4-2).

Table 4-2 Tonne Movement by Year, Growth Scenario and River Segment

Port	Thousand Annual Tonnes by River Segment, Year and Economic Scenario											
	Low Growth Scenario				Medium Growth Scenario				High Growth Scenario			
	2012	2017	2022	2027	2012	2017	2022	2027	2012	2017	2022	2027
Sisak	787	857	917	967	1,585	1,825	2,135	2,445	2,472	3,012	3,402	3,932
Slavonski Brod	1,432	1,942	2,182	2,392	2,453	3,043	3,713	4,373	3,585	4,815	5,905	7,095
Bosanski Brod	1,328	2,038	2,478	2,888	2,646	3,436	4,306	5,166	4,073	5,503	6,993	8,583
Samac	2,361	3,251	3,851	4,411	4,131	5,251	6,461	7,671	6,012	8,032	10,142	12,312
Brcko	2,914	3,894	4,574	5,204	4,909	6,189	7,559	8,939	7,003	9,313	11,723	14,183
Sremska Mitrovica	3,191	4,231	5,011	5,731	5,313	6,693	8,253	9,823	7,574	10,074	12,774	15,524
Sabac Industrial	3,309	4,379	5,198	5,948	5,487	6,907	8,547	10,197	7,816	10,396	13,225	16,105
Sabac International	3,468	5,178	6,118	6,998	5,806	8,246	10,146	12,066	8,294	12,394	15,634	18,994
Danube River												

Source: Study Team

4.1.3. Tonne Kilometers

The calculation of tonne kilometers is based on river kilometers within the Sava River. That is, distance of commodity between port and Danube River. However, sand and gravel transport occurs over considerably shorter distances.

The *Sava River Pre-feasibility Study* previously adopted an average shipment distance of 25 kilometers. This is still seen as being a reasonable estimate.

The year 2027, high growth scenario suggests that, on a cumulative basis, some 5,605 million tonne kilometers may be expended along the highest activity segment between Danube River and Sabac International Port.

Table 4-3 Tonne Kilometers by Year, Growth Scenario and River Segment

Port	Million Annual Tonne Kilometers by River Segment, Year and Economic Scenario											
	Low Growth Scenario				Medium Growth Scenario				High Growth Scenario			
	2012	2017	2022	2027	2012	2017	2022	2027	2012	2017	2022	2027
Sisak	248	289	324	353	503	643	823	1,004	810	1,124	1,352	1,661
Slavonski Brod	537	737	838	925	1,000	1,267	1,578	1,886	1,522	2,087	2,569	3,117
Bosanski Brod	473	745	918	1,078	1,010	1,349	1,733	2,113	1,607	2,245	2,871	3,565
Samac	776	1,103	1,325	1,530	1,439	1,879	2,367	2,854	2,163	2,980	3,796	4,666
Brcko	896	1,244	1,484	1,705	1,607	2,083	2,606	3,131	2,375	3,258	4,140	5,075
Sremska Mitrovica	944	1,300	1,553	1,786	1,683	2,172	2,721	3,271	2,485	3,392	4,313	5,287
Sabac Industrial	960	1,319	1,575	1,811	1,708	2,201	2,758	3,316	2,520	3,435	4,370	5,357
Sabac International	964	1,385	1,654	1,903	1,716	2,309	2,891	3,476	2,532	3,596	4,571	5,605
Danube River												

Source: Study Team

4.1.4. Vessel Movements

The number of ships passing along any given segment of the Sava River is a critical determinant of operational sufficiency; that is, to determine if the volume (number of vessels) is less than the calculated river capacity. Several considerations influence this calculation such as: the size of vessels; the fleet that will not be uniform but is likely to be represented by a cross-section of vessel types each with its unique capacity; the existence of backload operations; or loading patterns that may well change over time; etc. The analysis of vessel movements should therefore be for a “fail safe” condition; that is, “worst case” demand. It is logical to surmise that lesser demand levels can invariably also be accommodated by the Category IV upgrading. However, should vessel movements lie above calculated “fail safe” capacities (i.e. volume to capacity ratio in excess of unity), adjustments in river engineering, operational policies and/or plans will be needed.

The highest number of vessel movements is, unsurprisingly, noted in river segments carrying highest volumes. Thus, for year 2027 conditions, in the Sava River segment between Sabac International Port and the Danube River, near 48,700 annual two-way vessel movements may be expected under an average 800 tonne loading condition, and without backload cargo. For the low and medium economic growth scenarios, similar totals are 17,900 and 31,000 movements, respectively (Table 4-4).

Table 4-4 Year 2027 Vessel Movements by River Segment (No Backload Activity)

Port	Annual Bi-directional Vessel Movements by Average Capacity and Growth Scenario								
	800			1,000			1,200		
	Low	Med	High	Low	Med	High	Low	Med	High
Sisak									
	3,362	7,999	12,660	3,067	7,154	11,260	3,444	6,590	10,327
Slavonski Brod									
	5,984	10,942	17,751	4,789	8,757	14,206	4,790	7,300	11,842
Bosanski Brod									
	7,464	13,403	22,192	6,069	10,918	18,047	6,167	9,261	15,283
Samac									
	11,378	19,882	31,835	9,243	16,187	25,890	9,384	13,723	21,926
Brcko									
	13,397	23,119	36,616	10,872	18,804	29,756	11,026	15,927	25,182
Srmska Mitrovica									
	14,457	24,814	39,196	11,617	19,954	31,511	11,669	16,714	26,388
Sabac Industrial									
	14,893	25,535	40,328	11,923	20,445	32,288	11,931	17,052	26,928
Sabac International									
	17,915	31,005	48,745	14,500	25,140	39,500	14,668	21,230	33,337

Source: Study Team.

Increasing average vessel load to 1,000 and 1,200 tonnes carries direct implications in terms of vessel movements. For example, under the high growth scenarios, annual movements in the highest activity segment decreases from 48,700 to 39,500 and 33,300 movements, respectively.

The programming of a 30 percent backload factor at four ports will also decrease vessel movements, although not at the scale achieved by average vessel loadings. For year 2027 high growth conditions and 800 tonne average load for example, the number of vessel movements decreases from 48,700 (at no backload) to 44,700 with backload.

Thus, the “worst case” demand is clearly represented, for each economic growth scenario, by an 800 tonne average vessel capacity and no backload. Daily movements can be approximated based on an operational year encompassing 350 days. This suggests, for the “fail safe” high economic growth scenario, 800 tonne average vessel load and no backload, daily two-way movements ranging from 36 along the Sisak-Slavonski Brod river segment, to 139 along the Sabac International-Danube River segment. Similar totals for the medium growth scenario are 23 and 89 movements, respectively, and for the low economic growth 10 and 51 movements, respectively.

A final calculation would be to derive hourly peak directional vessel movements. Under an equivalent 22 hour day, and 60 percent directional peak hour factor, hourly one-way movements for the Sabac International-Danube River segment, under "fail safe" conditions, would be four vessels; that is, in the peak hourly direction, a ship every 15 minutes. Similar headways for the medium and low economic growth scenarios would be (rounded) a ship every 20 and 30 minutes, respectively. As a comparison, the peak directional flow in the lowest demand segment (Sisak-Slavonski Brod), under the high demand scenario, would be approximately one ship per hour.

4.2. Class Va rehabilitation and future traffic

It is important to surmise that two events will likely occur from the river utilization point of view under a Class Va navigation environment;

- There will be some increase, and, inter alia, some reduction in vessel movements, as the average unit volume of cargoes carried will increase in line with the new Class Va permissible limits.
- Some marginal increase in cargo movements may be expected in line with enhanced industry efficiencies of scale. It is unlikely this marginal increase will, in toto, increase cargoes by more than 10 percent over forecast Phase 1 volumes (the Class IV shipping fleet) based purely on the introduction of new (larger) vessels.

The estimates for rehabilitation to Class IV and the inclusion of sand and gravel activities confirms that for the year 2027, high growth scenario, nearly 19 million tonnes may be transported along the highest activity segment (between Danube River and Sabac International Port). Sand and gravel is, on a relative basis, modest vis-à-vis commercial cargoes, with exception of the Sisak-Slavonski Brod segment which extends over some 220 river kilometers. This is the base scenario. Application of similar calculations to other forecast years, by economic scenarios, yields forecast demand under the base, base plus 5 percent and base plus 10 percent conditions.

The indicated base conditions for the rehabilitation to Class IV have been adjusted for Class Va (Table 4-5).

Table 4-5 Tonne Movement by Year, Growth Scenario and River Segment Class Va Navigation Conditions

Port	Thousand Annual Tonnes by River Segment, Year and Economic Scenario											
	Low Growth Scenario				Medium Growth Scenario				High Growth Scenario			
	2012	2017	2022	2027	2012	2017	2022	2027	2012	2017	2022	2027
Base (Phase 1) Condition												
Sisak	2,065	2,135	2,195	2,245	2,674	2,914	3,224	3,534	3,373	3,913	4,303	4,833
Slavonski Brod	1,438	1,948	2,188	2,398	2,458	3,048	3,718	4,378	3,589	4,819	5,909	7,099
Bosanski Brod	1,659	2,369	2,809	3,219	2,928	3,718	4,588	5,448	4,307	5,737	7,227	8,817
Samac	2,837	3,727	4,327	4,887	4,537	5,657	6,867	8,077	6,348	8,368	10,478	12,648
Brcko	3,079	4,059	4,739	5,369	4,997	6,277	7,647	9,027	7,014	9,324	11,734	14,194
Sremska Mitrovica	3,245	4,286	5,066	5,786	5,342	6,721	8,282	9,852	7,578	10,078	12,777	15,528
Sabac Industrial	3,317	4,388	5,208	5,958	5,492	6,911	8,552	10,202	7,816	10,396	13,225	16,106
Sabac International	3,647	5,358	6,298	7,178	5,902	8,341	10,242	12,162	8,306	12,405	15,644	19,006
Danube River												
Base Condition plus 5 Percent Commercial Cargo												
Sisak	2,086	2,159	2,222	2,275	2,715	2,967	3,293	3,618	3,440	4,007	4,417	4,974
Slavonski Brod	1,505	2,040	2,292	2,513	2,575	3,195	3,898	4,591	3,763	5,055	6,199	7,450
Bosanski Brod	1,726	2,471	2,933	3,364	3,055	3,885	4,798	5,701	4,501	6,003	7,567	9,238
Samac	2,958	3,892	4,522	5,111	4,739	5,915	7,185	8,456	6,638	8,759	10,974	13,255
Brcko	3,227	4,256	4,970	5,632	5,237	6,581	8,019	9,468	7,352	9,777	12,307	14,893
Sremska Mitrovica	3,413	4,505	5,324	6,080	5,612	7,061	8,699	10,348	7,960	10,584	13,418	16,310
Sabac Industrial	3,493	4,616	5,477	6,265	5,775	7,266	8,988	10,721	8,216	10,924	13,895	16,924
Sabac International	3,823	5,618	6,605	7,529	6,185	8,747	10,742	12,759	8,706	13,010	16,412	19,944
Danube River												
Base Condition plus 10 Percent Commercial Cargo												
Sisak	2,106	2,183	2,249	2,304	2,757	3,021	3,362	3,703	3,507	4,101	4,530	5,113
Slavonski Brod	1,571	2,132	2,396	2,627	2,693	3,342	4,079	4,805	3,937	5,290	6,489	7,798
Bosanski Brod	1,792	2,573	3,057	3,508	3,183	4,052	5,009	5,955	4,695	6,268	7,907	9,656
Samac	3,079	4,058	4,718	5,334	4,942	6,174	7,505	8,836	6,927	9,149	11,470	13,857
Brcko	3,375	4,453	5,201	5,894	5,477	6,885	8,392	9,910	7,688	10,229	12,880	15,586
Sremska Mitrovica	3,580	4,724	5,582	6,374	5,882	7,400	9,117	10,844	8,340	11,090	14,059	17,085
Sabac Industrial	3,668	4,845	5,747	6,572	6,058	7,620	9,425	11,240	8,615	11,453	14,565	17,734
Sabac International	3,998	5,879	6,912	7,881	6,468	9,152	11,243	13,354	9,105	13,615	17,178	20,874
Danube River												

Source: Study Team. Segment totals are cumulative.

4.3. Class Va Tonne Kilometers

The calculation of tonne kilometers is based on river kilometers within the Sava River. The year 2027, high growth scenario for Class Va suggests that, on a cumulative basis, some 5,605 million tonne kilometers may be expended along the highest activity segment (between Danube River and Sabac International Port). This would increase to the order of 6,177 million tonne kilometers under the base condition plus 10 percent commercial cargo scenario.

The tonne kilometer contribution of sand and gravel is, on a relative basis, minimal. Application of similar calculations to other forecast years, by economic scenarios, yields forecast demand under the base, base plus 5 percent and base plus 10 percent conditions (Table 4-6).

4.4. Class Va Vessel Movements

The number of ships passing along any given segment of the Sava River is a critical determinant of operational sufficiency. Several considerations influence this calculation, as previously discussed during Phase 1 investigations. The analysis of vessel movements should be for a "fail safe" condition; that is, "worst case" demand. It is logical to surmise that lesser demand levels can invariably also be accommodated by river class upgrading.

However, should vessel movements lie above calculated "fail safe" capacities, adjustments in river engineering, operational policies and/or plans will be needed. To ensure a conservative approach, the following parameters are adopted:

- Ultimate demand (year 2027) is the adopted benchmark, for low, medium and high growth forecasts.
- Sand/gravel barges are calculated at an average load of 400 tonnes. Thus, while modest vis-à-vis commercial cargoes in terms of tonnes and tonne-kilometers, impacts in terms of vessel movements are more pronounced due to smaller average loads.
- A range of average commercial vessel capacity to near the limit of Class Va loadings, for the base, base plus five percent and base plus 10 percent commercial loading conditions.

Table 4-6 Tonne-Kilometers by Year, Growth Scenario and River Segment Class Va Navigation Conditions

Port	Million Annual Tonne-Kilometers by River Segment, Year and Economic Scenario											
	Low Growth Scenario				Medium Growth Scenario				High Growth Scenario			
	2012	2017	2022	2027	2012	2017	2022	2027	2012	2017	2022	2027
Base (Phase 1) Condition												
Sisak	280	321	356	385	530	670	851	1,031	832	1,147	1,374	1,683
Slavonski Brod	537	738	838	925	1,000	1,267	1,578	1,886	1,522	2,087	2,569	3,118
Bosanski Brod	481	754	926	1,086	1,017	1,356	1,740	2,120	1,613	2,251	2,877	3,570
Samac	787	1,115	1,337	1,542	1,449	1,889	2,377	2,864	2,171	2,989	3,804	4,674
Brcko	900	1,248	1,488	1,709	1,609	2,085	2,608	3,133	2,376	3,258	4,140	5,075
Sremska Mitrovica	946	1,302	1,554	1,787	1,684	2,173	2,721	3,271	2,485	3,392	4,313	5,287
Sabac Industrial	960	1,319	1,576	1,812	1,708	2,201	2,758	3,316	2,520	3,435	4,370	5,357
Sabac International	968	1,390	1,658	1,907	1,718	2,311	2,893	3,478	2,532	3,597	4,571	5,605
Danube River												
Base Condition plus 5 Percent Commercial Cargo												
Sisak	293	335	372	403	554	701	891	1,080	871	1,202	1,441	1,765
Slavonski Brod	566	776	882	974	1,051	1,332	1,659	1,982	1,600	2,194	2,699	3,276
Bosanski Brod	510	796	977	1,145	1,072	1,429	1,832	2,231	1,698	2,368	3,026	3,754
Samac	833	1,177	1,409	1,625	1,527	1,989	2,501	3,013	2,285	3,144	4,000	4,915
Brcko	952	1,317	1,568	1,801	1,696	2,195	2,745	3,296	2,501	3,427	4,353	5,336
Sremska Mitrovica	1,000	1,373	1,638	1,883	1,774	2,288	2,864	3,441	2,616	3,569	4,535	5,559
Sabac Industrial	1,015	1,391	1,661	1,909	1,800	2,317	2,902	3,488	2,652	3,614	4,595	5,632
Sabac International	1,023	1,465	1,747	2,009	1,810	2,433	3,044	3,658	2,665	3,783	4,806	5,893
Danube River												
Base Condition plus 10 Percent Commercial Cargo												
Sisak	304	349	388	420	578	732	931	1,130	910	1,256	1,507	1,846
Slavonski Brod	594	815	925	1,021	1,103	1,397	1,740	2,078	1,678	2,300	2,829	3,433
Bosanski Brod	538	838	1,028	1,204	1,128	1,501	1,923	2,342	1,783	2,485	3,174	3,936
Samac	878	1,239	1,482	1,708	1,606	2,090	2,626	3,162	2,399	3,299	4,196	5,153
Brcko	1,003	1,386	1,649	1,892	1,783	2,306	2,881	3,459	2,625	3,596	4,566	5,595
Sremska Mitrovica	1,053	1,445	1,723	1,979	1,865	2,403	3,006	3,612	2,746	3,745	4,757	5,828
Sabac Industrial	1,069	1,464	1,747	2,006	1,892	2,434	3,047	3,661	2,785	3,792	4,820	5,906
Sabac International	1,077	1,541	1,837	2,110	1,902	2,554	3,195	3,838	2,797	3,968	5,040	6,177
Danube River												

Source: Study Team. Segment totals are cumulative.

The analysis of Class Va operation is influenced by two key parameters; that is, the amount of additional cargo loading above the base condition, as well as average vessel size. For the initial step, analyses focus on what has been established as the highest demand (vessel movement) section along the Sava River; that is, the segment between Sabac International Port and the Danube River.

Main conclusions are (Figure 4-1):

- Economic activity is the principal catalyst of vessel movements. Under the high economic growth scenario, 800 tonne average loading, vessel movements range from only 141 to 155 for the base, base plus 5 percent and base plus 10 percent demand scenarios. For 2,000 tonne average loading, the vessel movement range is 61 to 66.
- While decreasing vessel movements naturally follow increasing average load, the trendlines exhibit asymptotic patterns. This is due to underlying activity by sand and gravel barges, whose movements are not influenced by scenarios involving changes in commercial cargo.

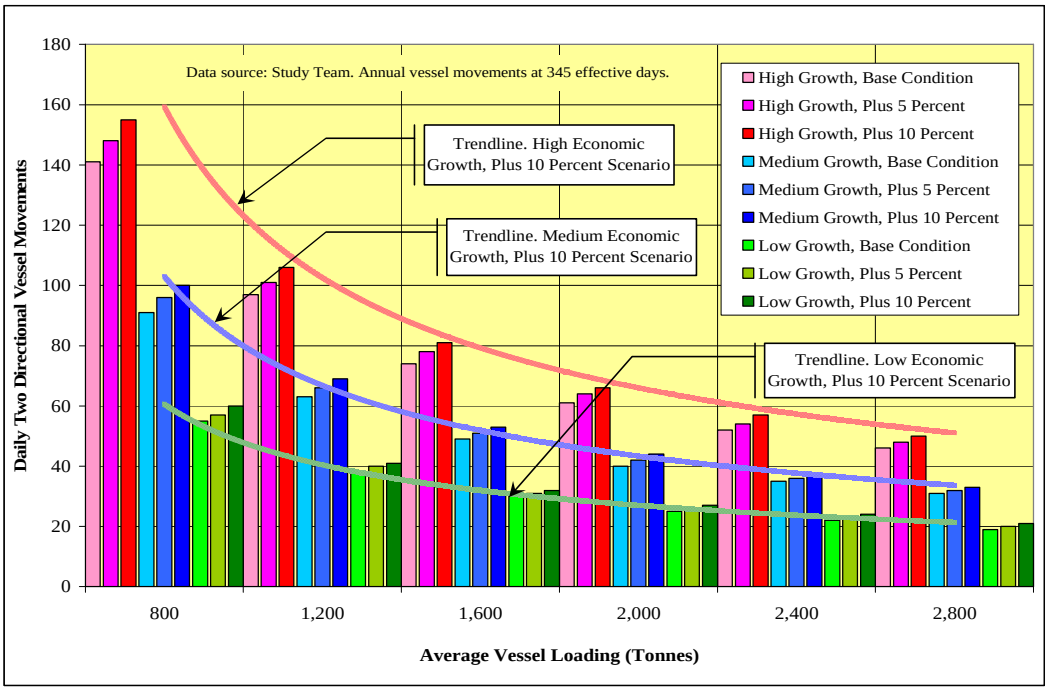


Figure 4-1 Year 2027 Daily Vessel Movements: Sabac International Port-Danube River Segment Class Va Navigation Conditions and Alternative Demand Profiles

- As a direct example, under high economic growth, base demand plus 10 percent, 106 vessel movements are catalyzed under 1,200 tonne average load conditions. Under 2,400 tonne load conditions, daily two-directional vessel movements reduce to 57.

Loadings on all Sava River segments, under 2,000 tonne average loads, base case plus 10 percent demand scenario, and high economic growth range from 66 for the Sabac International-Danube

River segment of the Sava River, to 23 for the short (one kilometer) Slavonski Brod-Bosanski Brod segment (Figure 4-2).

The total number of vessel movements is less than the upstream Sisak-Slavonski Brod segment since the latter, which extends over roughly 220 river kilometers, has a much higher net level of dredging activity.

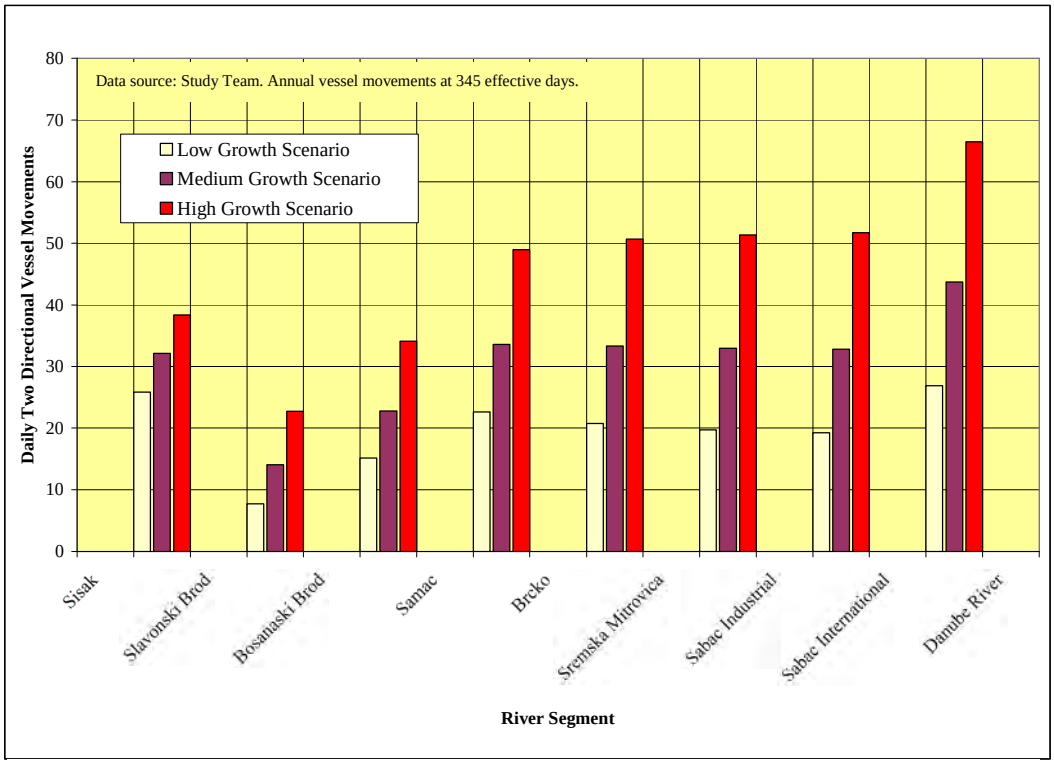


Figure 4-2 Daily 2027 Vessel Movements by River Segment and Economic Growth Scenario Class Va Navigation, Base Case Plus 10 Percent Demand

Hourly one-way peak directional vessel movements for the Sabac International-Danube River segment, under an equivalent 22 hour day, and 60 percent directional peak hour factor, would be 1.8 vessels per hour; that is, in the peak hourly direction, a ship every 33 minutes. Similar headways for the medium and low economic growth scenarios would be a ship every 50 and 85 minutes, respectively.

4.5. The traffic volume benefits of Class Va upgrading

From a purely traffic volume perspective, the immediate upgrading to Class Va has a notable positive effect on the estimated future cargo volumes, as can be observed in Table 4-7.

Table 4-7 Difference between Class IV and Class Va traffic volumes

	Thousand Annual Tonnes by River Segment, Year and Economic Scenario											
	Low Growth Scenario				Medium Growth Scenario				High Growth Scenario			
	2012	2017	2022	2027	2012	2017	2022	2027	2012	2017	2022	2027
Base Condition (Upgrading to Class IV traffic conditions)												
TOTAL	2,497	2,500	2,500	2,500	2,000	1,998	2,001	2,001	1,501	1,501	1,498	1,502
Plus 5 Percent Commercial Cargo (additional benefits of scale)												
TOTAL	3,441	3,787	4,015	4,229	3,563	4,028	4,503	4,983	3,746	4,580	5,390	6,259
Plus 10 Percent Commercial Cargo (additional benefits of scale)												
TOTAL	4,379	5,077	5,532	5,954	5,130	6,057	7,013	7,968	5,984	7,656	9,279	10,974

Keeping the same evaluation base, the total additional cargo volume after upgrading to Class Va ranges from 1.5 million additional tones in the high growth scenario to 2.5 million tonnes in the low growth scenario, covering the entire evaluation period.

Assuming a possible scale benefit of respectively 5% and 10% on total base traffic, the benefits notably increase for all economic scenarios and the benefits increase in time. For example, with a 5% traffic benefit, the immediate upgrading would lead to 3.4 million tonnes of additional cargo in 2012 according to the low growth scenario, increasing to 6.2 million additional tonnes of cargo in 2027 according to the high growth scenario. Assuming a 10% scale benefit, the benefits of an immediate upgrading to Class Va would reach 4.3 million tonnes in 2012 according to the low growth scenario, climbing to almost 11 million tonnes by 2027 assuming a high growth scenario.

4.6. Commercial traffic upstream Sisak?

The issue of commercial navigation upstream Sisak has until now never been seriously investigated and no assessment was ever made of the potential volumes river traffic could capture on the river section upstream Sisak. This first effort in estimating possible cargo volumes of river transport upstream Sisak is subject to a number of preliminary observations:

- The share of IWT vis-à-vis the rail and road modes is, on a national tonne basis, modest and unlikely to absorb, in the vast majority of cases, more than five percent (at the outside 10 percent) of commercial cargo. This is confirmed by historic performance in the Sava River catchment. Furthermore, cargoes tend to be “heavy and dirty”, typically oriented to specific industrial sectors or factories/mills, as opposed to time-sensitive commodities for national consumption.

- Container transport on inland waterways tends to be anchored to major seaports. Earlier reviews associated with the *Serbian IWT Master Plan* also confirmed that the dominant (some three-fourths) orientation of Serbian IWT cargo activity is in the downriver direction. Depending on choices, the rail and road modes can, and do, serve as aggressive competitors due to inherent advantages of speed and route flexibility. For example, roughly 90 percent of container activity in Serbia is truck and rail modes oriented. Furthermore, the IWT role in meeting Belgrade-based container activity, a metropolitan area of some two million persons, is, based on year 2007 shipment totals, modest. Indeed, not even all of the noted 2,500 containers directly interact with the Belgrade metropolitan area. The potential for capturing serious volumes of container transport on the river section upstream Sisak are very low.
- Economic efficiencies suggest that containers be shipped on the largest possible barge convoys which, in case of the Rhine River, accommodate three to four container layers. While smaller vessels can, and do, transport containers, additional costs are incurred due to economies of scale and are only used for very specific transport purposes, e.g., short distance transport.

In spite the low detail of available information on (cross-border) road and railway transport and the total lack of traffic estimates for river traffic upstream Sisak, the Feasibility Study made an assessment of the traffic volumes river transport could capture given the rehabilitation of the river to the same classification level as downstream Sisak, an assessment primarily based upon a detailed comparative study of transport demand and supply in Croatia and Slovenia. The investigations identified a logical candidate pool from which to draw potential diversions to IWT as presented in Table 4-8.

Table 4-8 Candidate Tonne Pool for Potential IWT Conversion

Sector	Candidate Pool (million tonnes)	Comments
Slovenia (Brezice) –Zagreb	1.83	Per border statistics, rail plus road potentials. All demand is expected to continue past Zagreb as trans-shipment of commercial cargo to IWT for Bresice-Zagreb trip seen as impractical.
Zagreb-Sisak	5.24	Border statistics plus Croatian demand. Rail pool (three million tonnes) reduced by one third to account for double counting of cargoes, plus the fact that some of these cargoes will already appear in border statistics. 1.4 million road tonnes added based on road/rail ratios of border potentials. However, some indicated demand will already be reflected as part of Phase 1 forecasts at other ports (logically Sisak and Slavonski Brod)

Source: Study Team.

Based upon observations in Serbia, Croatia and the EU, the highest annual IWT share (vis-à-vis road and rail modes) noted in Serbia has been some 14 percent and in Croatia near 7 percent. The Serbian average rate over almost a 15 year period has been slightly over eight percent, in Croatia between three and four percent. However, removing transit shares (on the Danube River) and the contribution of sand and gravel mining from the Serbian statistics reduces this period average to about three percent. This is virtually identical with the Croatian trend, and indicative of composite EU-25 patterns.

To estimate the possible river traffic volume, three ranges for diversion percentages vis-à-vis the candidate tonne pool were adopted:

- A high estimate of 14 percent based on historic IWT performance in Serbia;
- A medium estimate of 8 percent being slightly below the Serbian 15 year average, and slightly above the Croatian peak performance noted during the same period.
- A low estimate of 4 percent being near the Croatian 15 year average, and the Serbian share without IWT transit and sand/gravel activities.

The percentages were applied to the identified potential demand and extrapolated to future years based on ratios previously calculated for demand forecasts for the Sava River downstream Sisak[30].

Results for year 2027, under the high economic scenario, indicate a potential Brezice activity of some one million tons (but considerably less under other growth scenarios) and near two million tons for Zagreb (Rugvica) (Table 4-9).

Table 4-9 Forecast Throughput: new ports of Zagreb (Rugvica) and Brezice

Economic Scenario	Thousand Tonnes per Annum			
	2012	2017	2022	2027
Brezice				
Low	100	150	180	210
Medium	210	300	370	440
High	450	690	870	1,060
Zagreb (Rugvica)				
Low	190	280	340	380
Medium	390	550	680	810
High	850	1,280	1,620	1,980

Source: Study Team. Totals exclude sand and gravel.

[30] Refer [Lit 01]

These findings raise several implications. There exists an argument (although not an overly dominating one) for implementing Rugvica Port, depending on adopted economic growth rates. However, some of the Rugvica throughput would (more than likely) be at the expense of Sisak Port and Slavonski Brod Port. Justification for implementing a commercial cargo-based port at Brezice is highly questionable except under the highest economic growth scenarios if one accepts an industry benchmark that 500,000 annual tonnes are needed to support any sort of port. However, there exist and undeniable nautical tourism potential that calls for the appropriate infrastructure to accommodate high-order nautical tourism by means of locks for the planned hydroelectric dams and guaranteed Class II or Class III navigability, concurrently low-order commercial services (perhaps) are possible.

However, the feasibility of river traffic upstream Sisak, as well as the optimal river classification for the river section downstream Sisak, can only be evaluated by comparing costs versus benefits, which will be investigated in following chapter.

Chapter 5. Sava River rehabilitation feasibility analysis

5.1. General observations

The feasibility assessment is performed by means of a Cost Benefit Analyses (CBA)[31]. The scope and scale of this investigation is limited to inland waterway transport on the river and does not include possible indirect costs and benefits associated to river transport. Costs and benefits related to port development or to water management (e.g. flooding) are therefore disregarded, as well as indirect effects such as increased jobs and regional economic growth which are not taken into consideration. Only the costs and benefits for the different rehabilitation options are compared on the basis of following principal output values:

- *Net Present Value (NPV)*
- *Internal Rate of Return (IRR)*
- *Benefit-Cost Ratio (BCR)*
- *Pay-back period.*

These four output values provide a clear view on the macro economic viability, representing the value for society and the merits of improving the conditions for inland navigation on the Sava River. Moreover, sensitivity and risk analyses have been carried out for the following situations:

- *Transport volumes* that might be lower or higher compared to the average expectations, resulting in changed benefits for the transport and industrial sector
- *Infrastructure costs* that are higher than expected
- *Delays* that occur during reconstruction of the waterway
- *Lower or higher discount rate (3% and 9%),* representing estimation of low of high risks of the overall project

Also the following assumptions are relevant:

- Appraisal period: the costs and benefits for the project alternatives have been calculated over a period of 20 years (2009 – 2028).
- The standard discount rate used is 6%. This figure is based on HEATCO survey on used discount rates in Europe at an appraisal period of 20 years.

[31] See [Lit 07], [Lit 15], and [Lit 20]

5.2. Comparing the benefits between Class IV and Class Va

In order not to overestimate the benefits, it was assumed that these benefits can be realised after the year 2016 when all rehabilitation works along the Sava waterway are expected to be finished.

5.2.1. Savings on internal transport costs

Figure 5-1 presents the **yearly** transport savings for Phase 3 within the transport industry (based on transport price levels from 2008).

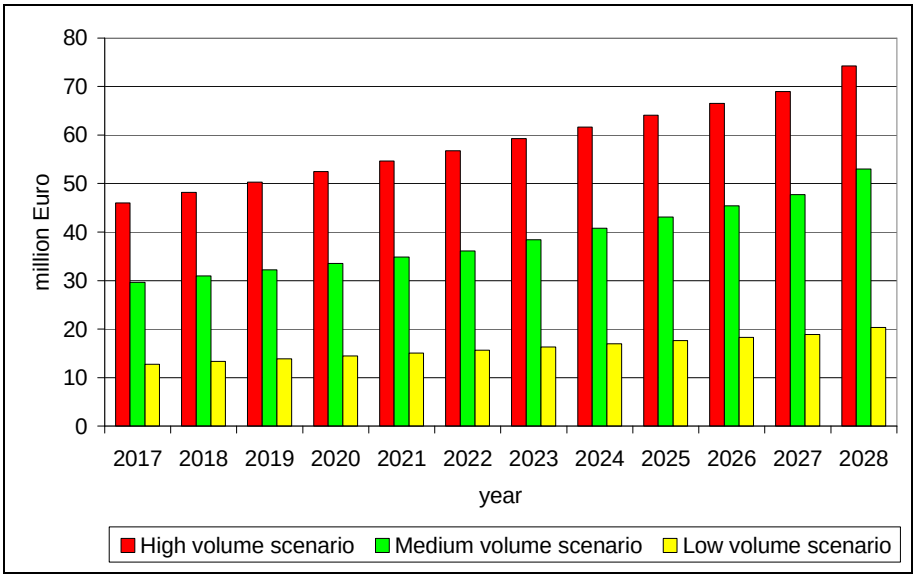


Figure 5-1 Yearly transport savings for Phase 3 within the transport industry (2008 price levels)

The high volume scenario shows savings when upgrading to Class Va from 46 million Euros per year up to 74 million Euros per year in the year 2028. The medium volume scenario starts at 30 million euro in 2017 and increases to annual savings of 53 million Euros in 2028. The low volume scenario starts at 13 million Euros of annual savings and increases to 20 million Euros annual savings in 2028.

When comparing the internal transport benefits with the results when upgrading to SCC Class IV, the benefits are much higher in case the river is upgraded to SCC Class Va. There is a factor 1.55 on the internal transport benefits.

Figure 5-2 presents the cumulated internal transport benefits at the standard discount rate of 6%.

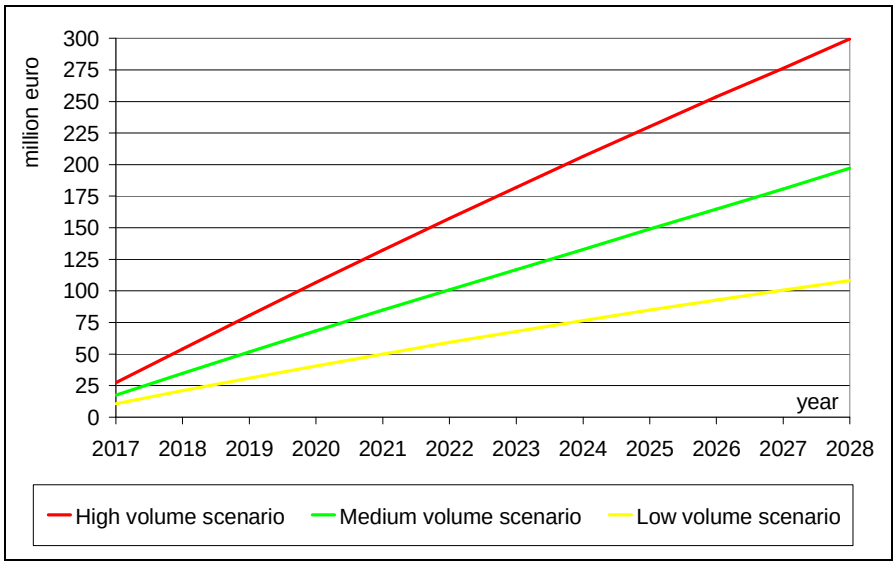


Figure 5-2 Cumulated internal transport benefits (discount rate of 6%)

The high volume scenario is obviously resulting in high internal transport benefits. The discounted cumulative value reaches 300 million Euros net present value over the appraisal period (2008 price level). The medium scenario is resulting in benefits of internal transport benefits of 197 million euro while the low volume scenario will result in benefits of 108 million euro.

Comparing these values with the values of a possible upgrading to Class IV, it can be concluded that immediate upgrading to SCC Class Va provides the following additional discounted benefits:

- *High volume scenario: +105 million Euros (+54%)*
- *Medium volume scenario: + 69 million Euros (+54%)*
- *Low volume scenario: +38 million Euros (+55%)*

5.2.2. Savings on external transport costs

Besides the benefits for the transport industry there will also be savings on externalities of transport due to smaller congestion on the roads and motorways, fewer accidents, less climate effect, less noise and smaller costs for up- and downstream processes.

The difference between Road and IWT class V amount to 1.29 eurocents per tonne-kilometre of single transport distance. Furthermore the difference in external costs between rail and IWT increases from 0.07 cent to 0.1 cent per tonne-kilometre. Moreover the existing IWT transport by class III that will shift to class V generates a benefit of 0.14 eurocents per tonne-kilometre.

Figure 5-3 presents the annual savings in external costs for the different scenarios with respect to the development of transport flow volumes in the region after upgrading Sava River to Class Va.

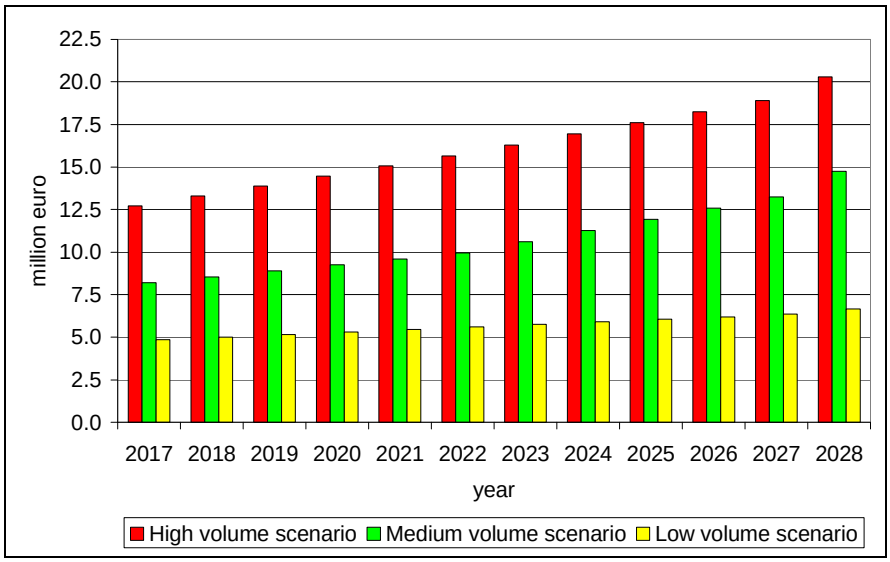


Figure 5-3 Annual savings in external costs for the different scenarios

The high volume scenario results in yearly savings starting from 12.7 million Euros in 2017 increasing to 20.3 million Euros of annual savings in 2028. The medium volume scenario runs between values starting at 8.2 million Euros (2017) to 14.7 million Euros (2028) while the low volume scenario has annual external cost savings of 4.9 million Euros in year 2017 to 6.7 million Euros in 2028. When cumulating savings, It can be concluded that the net present value of external costs savings will be 82.4 million Euros for the high volume scenario, 54.5 million Euros for the medium volume scenario and 29.4 million Euros for the low volume scenario.

Compared to the benefits on external costs when upgrading only to Class IV, the following increase is observed when upgrading to Class Va:

- *+13.0 million Euros for the high volume scenario (+19%)*
- *+8.4 million Euros for the medium volume scenario (+18%)*
- *+5.1 million Euros for the low volume scenario (+21%)*

The principal conclusion is that the immediate upgrading to SCC Class Va provides even more positive results as compared to the upgrading of Sava River to only SCC Class IV that in itself demonstrated already acceptable positive results. Since the relative change of benefits is bigger than the relative increase of costs, the conclusion is valid that the benefit/cost ratio for class Va will be more positive resulting in a higher Net Present Value of the CBA.

Upgrading Sava River to Class Va is feasible and provides a clear positive added value compared to upgrading the river to only Class IV, as conclusively demonstrated by the benefit/cost ratio

equal to 2.69. As soon as the transport benefits are generated, the investment will quickly provide positive cash flow from year 2019 and result in a total Net Present Value of 157.9 million Euros over the 20 year appraisal period.

5.3. Comparing the economic value

Table 5-1 presents the internal rate of return (IRR) for the different volume scenarios

Table 5-1 Internal rate of return (IRR) for the different volume scenarios

IRR per economic scenario	Class IV	Class Va
High volume scenario	13.9%	26.9%
Medium volume scenario	7.3%	20.2%
Low volume scenario	n.a.	11.6%

The following Table 5-2 presents the Net Present Values for the different scenarios at a 6% discount rate.

Table 5-2 Net Present Values for the different scenarios (6% discount rate, million Euros)

Net Present Value at 6% discount rate (million Euros)	NPV Class IV	NPV Class Va
High volume scenario	51.2	288.2
Medium volume scenario	6.8	157.9
Low volume scenario	-33.0	44.0

At 6% discount rate, the payback period is 10 years in case of high scenario, 11 years in case of the Medium volume scenario and 15 years in case of a Low volume scenario. Even when assuming a low volume and low growth of the cargo via the Sava River, the project is now more robust and the Net Present Values are overall positive. *These results not only allow concluding that the investment to upgrade Sava River to Class Va is economically feasible but confirms that the results are even more positive compared to upgrading to only Class IV.*The following Tables 5-3 and 5-4 provide the results at a different discount rate (3% and 9%).

Table 5-3 NPV at 3% discount rate

Net Present Value project 3% discount rate	NPV (million Euros)	
	Class IV	Class Va
High volume scenario	301.0	463.6
Medium volume scenario	166.3	267.4
Low volume scenario	43.4	92.6

Table 5-4 NPV at 9% discount rate

Net Present Value project 9% discount rate	NPV (million Euros)	
	Class IV	Class Va
High volume scenario	113.7	179.5
Medium volume scenario	52.9	91.1
Low volume scenario	-0.3	15.3

One can observe that the (small!) negative value for SCC class IV in case of a low volume scenario and a high project discount rate has now changed into a clear positive value in case the river is upgraded immediately to SCC class Va. Furthermore for all discount rates and volume scenarios there is an obvious advantage of immediately upgrading to Class Va as compared to upgrading Sava River to Class IV.

5.4. Extending navigation to Brezice

Comparing the river rehabilitation costs and benefits for river section Sisak – Brezice with the results for upgrading the section Belgrade – Sisak, both to SCC Class IV, the immediate and logical conclusion is that the extension of navigability upstream Sisak generates a clear negative CBA result. **An increase on the cost-side could be observed of 270% up to 290% while the benefits only increased between 2.4% and 3.3%.** Since the relative change of costs is much bigger than the relative increase of benefits, the benefit/cost ratio is strongly negative[32].

There is no doubt that extension of navigability upstream Sisak does not provide sufficient benefits to compensate for the huge investments. Even when integrating the investment into the development of Sava River downstream Sisak, the benefit/cost ratio for the combined investment is 0.60, meaning that only 60% of the total investments are recovered by internal and external transport benefits. However, once the investments are completed and there are only operations and maintenance costs, there is a positive annual cash flow and the balance between benefits and costs is improving during the years 2019 and 2028.

Due to the fact that there is a negative Net Present Value for scenarios Low Volume and Medium Volume the Internal Rate of Return could not be calculated. However, the High Volume scenario provides an Internal Rate of Return of only 4.3% IRR. Table 5-5 presents the Net Present Values for the different scenarios at a 6% discount rate for upgrading to Class IV downstream Sisak, upstream Sisak and for the combination of both.

[32] See in particular [Lit 15]

Table 5-5 Net Present Values for the different scenarios for different investment schemes, (6% discount rate)

Net Present Value project 6% discount rate,	NPV (million Euro)		
	Class IV downstream Sisak	Combined	Class IV upstream Sisak
High volume scenario	185.1	-27.2	-212.3
Medium volume scenario	95.5	-121.1	-216.6
Low volume scenario	15.5	- 203.2	-218.7

As can be seen also the Net Present Values for the combination of the rehabilitation downstream and upstream Sisak are all negative at the standard discount rate. Looking at the marginal impact of the rehabilitation upstream Sisak, it is obvious that the economic feasibility of extending navigability is economically unfeasible, in whatever investment combination.

If the appraisal period would be extended there is more time to generate transport benefits and to recover the high investments for extending navigability according to Class IV upstream, Sisak. The extended analysis demonstrated that the combined investment provides a positive figure between years 2042 and 2043. However the marginal impact of Phase 2 remains very negative. Also when extending the appraisal period, it is quite obvious that there is no change to get a positive result on the cost benefit analyses of extending navigation upstream Sisak as an individual project

5.5. Extending navigation only to Rugvica

Due to the huge capital investments for the dam and the locks upstream Zagreb, it was no surprise that the overall cost benefit analysis turned out very negative. However, when considering the section between Sisak and Rugvica, the necessary capital investment is modest compared to the section Rugvica – Brezice. A relevant question is therefore whether the introduction of Class IV navigability between Sisak and Rugvica could generate positive economic benefits.

As initial observation, combining the investment for the section Sisak – Rugvica with the rehabilitation downstream Sisak project generates positive outcomes. But again, comparing these results with the results of the investments downstream Sisak, it becomes clear once more that also the upgrading of the Sava River on the section Sisak – Rugvica creates no socio-economic added value, on the contrary, the combination increases the pay-back period and reduces the Net Present Value (Table 5-6).

Table 5-6 Net Present Value (million Euros)

	Class IV Downstream Sisak	Class IV Combined	Class IV Section Sisak – Rugvica
Net Present Value project 3%			
High growth variant	301.0	292.9	-8.1
Medium growth variant	166.3	153.3	-13.0
Low growth variant	43.4	27.9	-15.5
Net Present Value project 6%			
High growth variant	185.1	177.8	-7.3
Medium growth variant	95.5	85.1	-10.4
Low growth variant	15.5	3.5	-12.0
Net Present Value project 9%			
High growth variant	113.7	107.4	-6.3
Medium growth variant	52.9	44.5	-8.4
Low growth variant	-0.3	-9.7	-9.4

Table 5-7 shows the Internal Rate of Return.

Table 5-7 Internal Rate of Return values

	Class IV Downstream Sisak	Class IV Combined	Class IV Section Sisak - Rugvica
High growth variant	25.7%	24.4%	-1.4%
Medium growth variant	18.5%	16.8%	-1.7%
Low growth variant	8.9%	6.6%	-2.3%

The NPV and IRR values clearly demonstrate that there is a negative added value for all scenarios and discount rates. To further illustrate the unfeasibility of the investment, the development was investigated for the medium volume scenario and the standard discount rate (6%), but for an extended appraisal period till the year 2050, thus almost 25 years longer. But even if the appraisal period would be extended to 2050 there is no positive result.

5.6. The optimal solution

The Cost Benefit Analysis clearly demonstrated that the investment performance for immediate upgrading of the section between Belgrade and Sisak to SCC Class Va are very positive and is even better as the already positive appreciation of upgrading the river to Class IV. Especially the performance of the project at low transport volumes improves significantly, meaning that the

immediate upgrading to Class Va has less investment risk in case of lower than expected traffic / cargo volumes.

The river section between km 0 and km 362 shows the best socio-economic performance in case of upgrading to Class Va while the stretch between 362 and 583 (Slavonski brod – Sisak) is not yet positive at the end of the appraisal period in the year 2028, but calculation will break even in 2031, therewith showing clear potential in the longer term future[33].

The profitability of investments is substantially better for the upgrading to Class Va than to Class IV, which already were very positive, and the internal rates of return (IRR) are clearly better for SCC Class Va. Compared to the higher level of benefits when comparing the upgrading to Class IV with upgrading to Class Va, the increase in costs remains moderate at a 15% increase, discounted over 20 years. As a result, the Net Present Values are much higher for upgrading to SCC Class Va as compared to SCC Class IV. Also the benefits for the transport industry show big increases of about +55% compared to upgrading to Class IV and there is furthermore a notable increase of +20% on the external benefits.

Overall, the reference medium volume scenario shows an internal rate of return of 20% which is very good. The Net Present Value at 6% discount rate is 157.9 Million Euro and the Benefit/Cost ratio is 2.68. These figures illustrate that the project clearly provides an added value for the industry and society. Furthermore one should bear in mind that the appraisal period is short (20 years) and sand and gravel transport by IWT have been disregarded in the analysis. Therefore the results shall be considered to be robust and rather conservative.

In respect of the above economic analysis and associated results, two specific comments should be made:

1. The CBA has been conducted according to a specific assumed timetable. Possible changes in this timetable could change the outcomes of the CBA. This is in particular true if the capital costs are moved forward significantly, reducing the profitability of the project.

2. The CBA has assumed a sequential implementation of the rehabilitation works, starting in Belgrade and proceeding upstream towards Sisak. The CBA does not consider impacts related to alternative development scenarios which could have an impact on the outcome of the CBA.

[33] See for detailed analysis of investment priorities and benefits per river section / port [Lit 20]

The CBA has been realized using realistic assumptions and taking conservative positions. Given the limitations caused by the level of detail of available information, the investigation provided sufficiently robust information to recommend

- ***The immediate implementation of rehabilitation works to upgrade Sava River to Class Va between Belgrade and Sisak.***
- ***To abandon the idea of upgrading that section to Class IV and in the future upgrade to Class Va if demand warrants such additional investment;***
- ***Formally abandon the idea of upgrading Sava River upstream Zagreb for commercial river transport and concentrate on tourism development and energy production; and***
- ***In principle abandon the idea of introducing commercial traffic on the section Sisak – Rugvica because there is no economic or financial rationale for the investment.***

Chapter 6. Sava River Waterway Transport System

6.1. The integrated vision on Sava River

The research conducted during the Feasibility Study, summarized in the previous Chapters, leads to a integrated and structured system view on the Sava River that takes into account the characteristics of the different river sections and the complexity of providing guaranteed navigability on these sections[34].

From a system's point of view, the Sava River offers valuable development and commercialization opportunities and can, according to these opportunities, be divided into two principal sections (Figure 6-1).

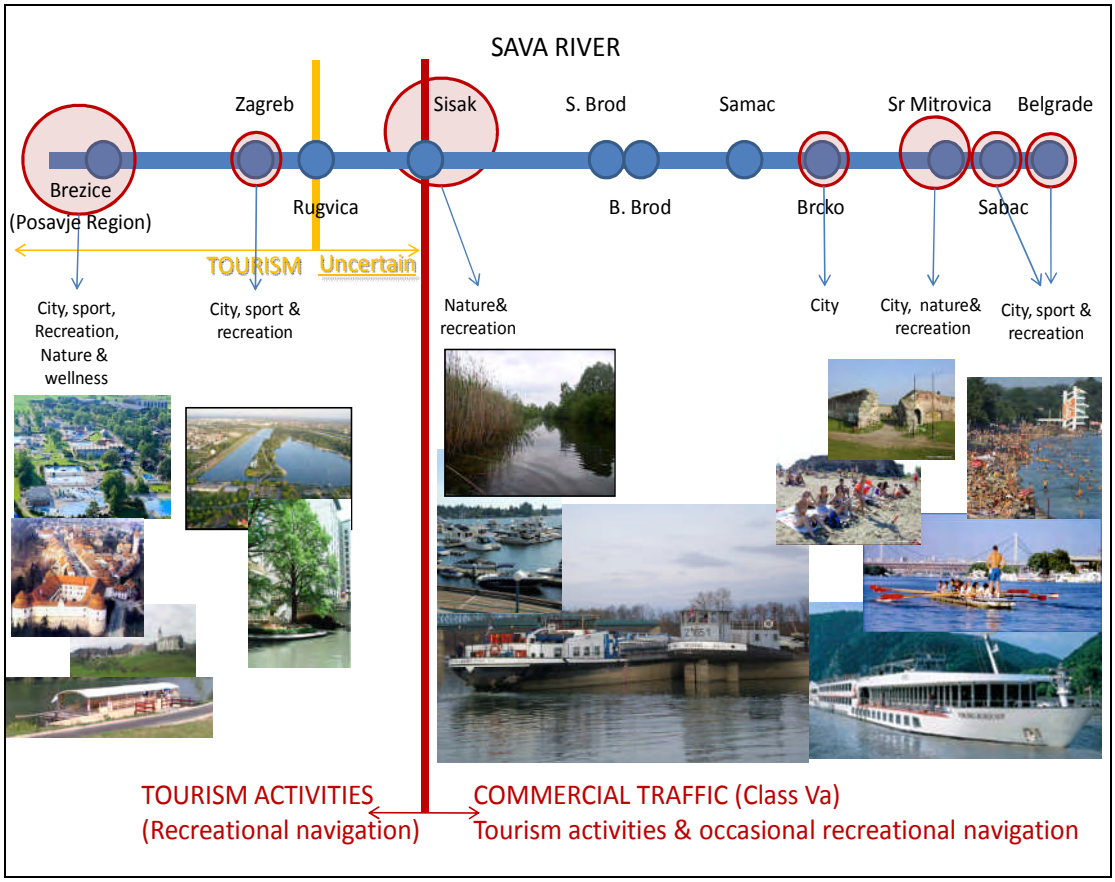


Figure 6-1 Sava River Waterway Transport System View (Final)

[34] See in particular but not exclusively [Lit 10], [Lit 12], and [Lit 17]

The first section is the section Belgrade – Sisak devoted principally to commercial cargo transport, the second section is Sisak – Brezice which in turn can be sub-divided in two parts, the part Sisak – Rugvica where commercial traffic could be developed although there is no real economic basis and the part Rugvica – Brezice where the focus should indisputably be on local water-based tourism developments. This segmentation is rather artificial because several cities along Sava River also downstream Sisak (marked in red in Figure 6-1) not only harbor an important river port but simultaneously offer major tourism development opportunities which directly relate to Sava River[35].

Each of these sections has their specific characteristics and lead to specific river utilization which are briefly discussed hereafter.

6.2. Section Belgrade – Sisak

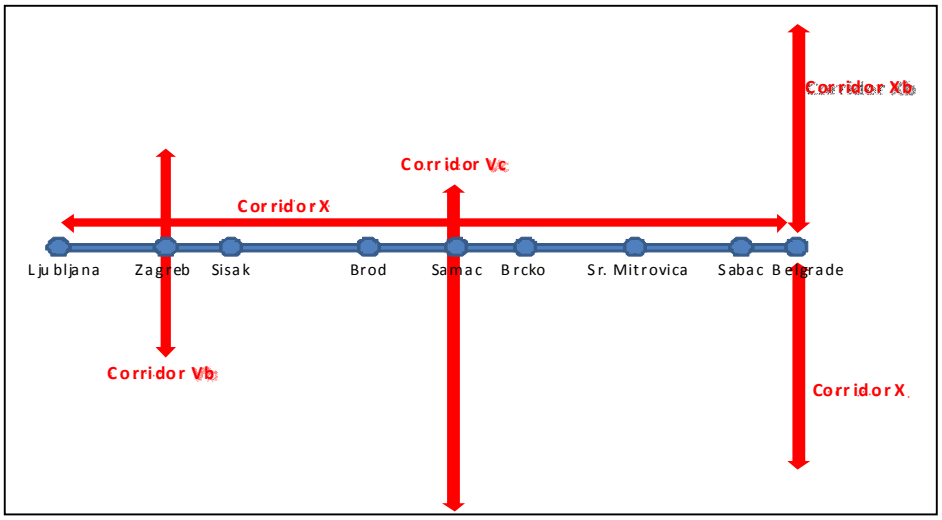
The Sava River section Belgrade – Sisak is oriented towards commercial river transport. All relevant ports are located on this section of Sava River, with the exception of Sisak, which is located on Kupa tributary.

Although the system view covers in theory all water infrastructures directly linking with the Sava River, the practical contribution of the tributaries is inexistent and possible benefits of increasing this role are highly uncertain, although as long as commercial cargo transport is considered. The different tributaries could prove to be highly valuable in terms of river tourism and nautical recreation developments, e.g., marinas, sport facilities, etc.

The river ports between Belgrade and Sisak play a capital role in providing interconnectivity with the land-based transport modes (rail and road) and are essential transit points for the major cargoes moving principally to and from the heavy industries in Bosnia and Herzegovina. The ports could be major catalysts for integrating Sava River into the European Corridors to created integrated and interconnected transportation network as schematized in Figure 6-2.

The Figure 6-2 clearly demonstrates that the Belgrade – Sisak section of Sava River is part of the in the east-west and north-south transport corridors in the region and could be complementary to the Core Transportation Network for South East Europe for road and rail as well as to the European waterway corridor focusing the Danube River.

[35] It should be noted that the above view does not include other opportunities such as (hydro) power generation and water management (irrigation, drinking water, water level control – wetlands).



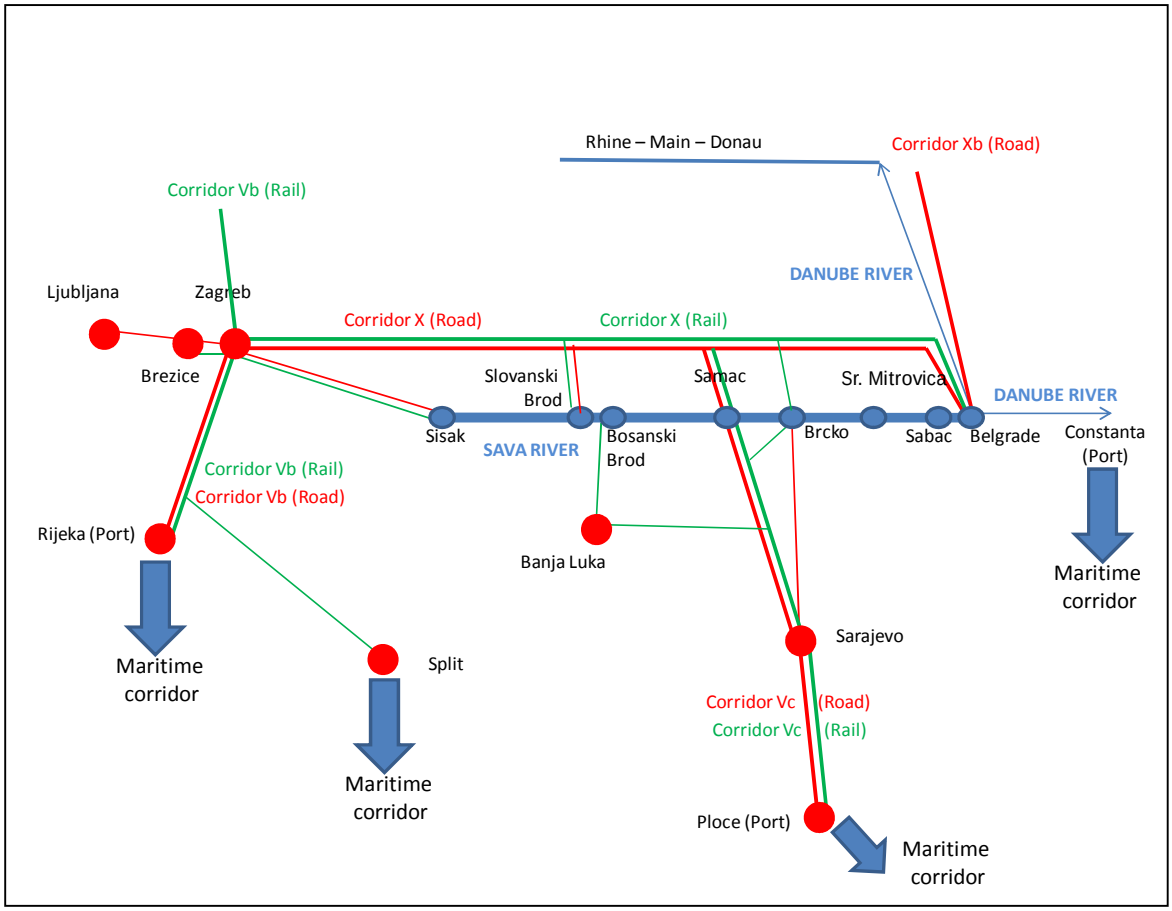
Source: Study Team on the basis of SEETO: South-East Europe Core Regional Transport Network Development Plan - Five Year Multi Annual Plan 2008 to 2012

Figure 6-2 The integrated view on SRWTS (Concept design)

The potential of Sava River is however not only defined by the connectivity with two SEE Core Transportation Network corridors. Given the vital importance of Sava River for the regional industries, the regional road and railway infrastructure provides efficient links with principal consumption and production centers in the riparian states.

The final integrated network which considers interconnectivity via the Core Network as well as via non-core road and rail links makes the Sava River an integral part of a regional transport infrastructure that connects the industries of the region by road, rail, river and sea with Europe and the rest of the world (Figure 6-3).

Although the present volumes transported via Sava River are insignificant, upgrading the Sava River section between Sisak and Belgrade to class Va will in time be essential to important river-based transport activity, as was demonstrated on several occasions and reported in different tasks during the Feasibility Study and summarized in previous Chapters of underlying Final Report.



Source: Study Team on the basis of SEETO: South-East Europe Core Regional Transport Network Development Plan - Five Year Multi Annual Plan 2008 to 2012

Figure 6-3 SRWTS integrated and multimodal network (concept vision)

To maximize the possibility for the Sava River transport system of attracting cargo in the catchment area and to be an integrated part of international transport networks, the quality of river transport need to be efficient at three levels that combined define the working of the sector:

- *Hardware*: transport infrastructure in its largest sense (e.g., also ports, terminals) but also the communication infrastructures (mobile and land communication, ADSL and WiFi), utilities (gas, electricity, etc…) and housing (e.g., corporate headquarter or logistics centers);
- *Software*: the elements necessary to benefit from the available infrastructures such as information and communication technologies, software applications (RIS, AIS, GPS, etc.);
- *Humanware*: the users of available hardware and software which includes personnel, expertise and know-how, public decision-makers, transport policies, sector development support, etc.

The hardware component is an exogenous factor, which is the basis for users, while the software and humanware components are indigenous factors and define how the infrastructure is used and the sector functions. The present efforts in determining the conditions for river rehabilitation are thus only a first step in a complex and long-term process, which cannot only be realized by infrastructure investments (hardware) and a demand for private investments.

The infrastructure development program that will emerge from underlying study is thus only a part of the infrastructure development program and should be interconnected to where possible and appropriate with existing road and railway infrastructure via a development program for river ports, (dedicated) terminals and other transfer points for river cargo. Several other aspects of the integrated approach to river transport have been investigated in length in underlying study. Aspects considered in more detail include in particular the public policy and the software applications.

An efficient and effective policy is not limited to the transposition over time of the EU rules and regulations, but should also and even more so take into consideration the important role of the public authorities in managing the Sava River Waterway Transport System (and the IWT sector) via the continued and adequate control of activities and operations on the one hand and the effective enforcement of rules and regulations for all infrastructure / system users.

The proposed RIS for Sava River is one of the essential software applications and will undoubtedly play a critical and pivoting role in the development of transport on the Sava River.

The issue will be further discussed in Part 2 of this Final Report where the Action Plan is discussed.

However, as was frequently argued, this section also offers interesting opportunities for tourism development, an opportunity that should not be overlooked and requires the attention it deserves. The different options already identified at present are:

1. Ada Ciganlija and Veliko ratno ostrvo islands in Belgrade (city sport and recreation)
2. Sabac beach and historic town;
3. Sremska Mitrovica beach and historic town;
4. Nature reserve “Zasavica” near Sremska Mitrovica;
5. Brcko town;
6. Sisak marina and town center; and
7. Lonjsko Polje Nature Park in the Sisak region.

6.3. Section Sisak – Brezice (Posavje Region)

The river section Sisak – Brezice can be sub-divided into two sections. The first section is Sisak – Rugvica (Zagreb) where navigability could be introduced at a reasonable effort and cost. The second section is Rugvica (Zagreb) – Brezice (Posavje Region) where restoring navigation is not only very costly but is also confronted with a range of uncertainties, making the introduction of navigability difficult if not impossible in the medium and probably even long-term future.

The commercial value of the entire section upstream Sisak of the river is, compared to the section downstream Sisak very low and the rehabilitation of this section of the river for commercial navigation should not be considered. The costs to make the river navigable is, per kilometer, almost 9 times higher upstream from Rugvica than downstream Rugvica. Compared to the restoration of commercial navigation downstream Sisak, introducing cargo transport upstream Sisak means on the cost-side a cost of 270% up to 290% higher than downstream while the benefits only represent between 2.4% and 3.3% of these generated downstream Sisak. Even if the development of commercial traffic upstream Sisak would be combined with the restoration of commercial traffic downstream Sisak, no economic rationale can be found to validate the investment

Section Sisak – Rugvica (Zagreb)

Introducing commercial navigation between Sisak and Rugvica is an option that finds some support from certain stakeholders. The principle is based upon the creation of a new river port in Rugvica to act as principal gateway for the Zagreb region. From an economic financial point of view, also this option does not find any rationale, even if combined with restoring navigation downstream Sisak.

However, other non-economic reasons could be formulated warranting the investment. The principal reason for investing in the establishment of navigation on the section Sisak – Zagreb, is not to use this section for commercial transport but to strengthen and contribute to the development of tourism in the region.

And several recent development initiatives could be stimulated by guaranteed navigation between Sisak and Zagreb. The interest for Zagreb is obvious but also Sisak and surroundings see interesting development initiatives, in particular the Lonjsko Polje Nature Park, which could directly benefit from introducing navigability of Sava River.

Section Rugvica (Zagreb) – Brezice (Posavje Region)

Introducing navigability on this section of the river is confronted with a range of complications, predominantly related to the question whether or not a number of hydropower plants will be build along this river stretch.

Not only the uncertainty of their construction but also the implications for the Posavje Region to link to Sava River is important and any positive development will depend upon the willingness of Croatia to invest in the rehabilitation of the river. This dependency will undoubtedly create substantial impediments for any action in the medium to long-term.

Concentrating on local tourism initiatives is therefore the only reasonable course of action and several initiatives have already been taken or are planned in that respect.

However, creating a navigable river connection between Zagreb and the Posavje Region should not be discarded without further detailed studies, given the important number of Croatian visitors coming each year to this region and the proximity of these two interesting tourism centers, Zagreb and the Posavje region.

Chapter 7. Conditions for sustainable development

7.1. The catalyst role of Sava Commission

After the break-up of Yugoslavia, Sava River became an international river flowing through four now independent States: Slovenia, Croatia, Bosnia and Herzegovina, and Serbia. During the conflict in the nineties, the river was heavily damaged resulting in devastating effects on the economy, transport, water supplies, and the environment[36].

The four new countries rapidly acknowledged the need for cooperation and coordination in management and enhancement of the river. The process, known as the *Sava Initiative*, was formally initiated with the "Letter of Intent concerning the International Sava River Basin Commission Initiative", signed in Sarajevo on 29 November 2001 by the Ministers of Foreign Affairs of Republic of Croatia, the Republic of Slovenia, the Federal Republic of Yugoslavia, and by the Minister for Civil Affairs and Communications of the Republic of Bosnia and Herzegovina.

After at the joint meeting held in Brcko on December 13, 2005, the governments of the riparian states[37] made explicit their continued commitment in a Joint Statement, focusing on the "cooperation on reconstruction and development of navigation on the Sava River", in which they declare (See Joint Statement):

1. Support is extended to legal, organizational and functional framework of the International Commission for the Sava River Basin and its activities on implementation of goals stated in the Framework Agreement on the Sava River Basin.

2. Necessity is confirmed for countries lying along the Sava River waterway to include development of navigation on the Sava River as priority in their development policies and strategies, with maximum possible coordination between development plans for the above mentioned.

3. Joint action toward international organizations will be ensured aiming to promote the goals stated in the Framework Agreement to the Sava River Basin, especially regarding

[36] See in particular [Lit 08] and [Lit 16]
[37] It is necessary to stress that the Republic of Slovenia joined this statement one year later (in accordance with the Government's decision)..

reconstruction and development of navigation and establishment of the international regime of navigation.

4. European Union, donors and other International Financial Institutions are invited to extend financial support.

The strong commitment was reconfirmed during the first meeting of the parties to the framework agreement on the Sava River basin, held in Zagreb (Croatia) on 1 June 2007[38]. The parties express the "... commitment to further development of the Strategy for Implementation of the FASRB and encourage all actions of the Parties toward the implementation of the respective Work plan of the Sava Commission. Encourage the Parties to update, with assistance of the Sava Commission when necessary, their bilateral agreements to avoid contradictions with basic principles of the FASRB."

They further *recognize* "... that cooperation between the riparian countries on transboundary watercourses impacts contributes to sustainable water management and mutual benefits of the Parties. *Recall* that good governance, capacity building and financing are of the utmost importance to succeed in our efforts on strengthening sustainable water-resources management, including the application of the water ecosystem approach and taking the climate changes into consideration. *Note* the need of water pollution prevention and control, as far as possible the adverse transboundary impacts on the integrity of the water regime in order to reduce hazards to health and protect the aquatic ecosystems in line with the FASRB. *Recall* the importance of development of the joint Sava River Basin Management Plan that shall be adopted by the Parties upon proposal of the Sava Commission. *Emphasize* all actions toward sustainable water management by taking appropriate measures to, at least, maintain and, where possible, improve the current water quality and environmental conditions of the Sava River."

Finally, acknowledging the work in the field of navigation, the members reaffirm "... the principle of free navigation on the Sava River in accordance with the FASRB and Protocol on the navigation regime to the FASRB, and express preparedness to undertake all necessary measures to ensure the freedom of navigation. *Recall* the importance of the rehabilitation and development of the navigation on the Sava, which constitutes an essential transport axis in the South East Europe Region and offers competitive and environmentally friendly means of freight transport, and in that context propose that the Project on rehabilitation and development of navigation on the Sava River is included into the priorities under the Action Plans of the SEETO and the competent

[38] Declaration of the First Meeting of the Parties to the Framework Agreement on the Sava River Basin, Doc. No. 5-07-16/4-3 (Annex III)

bodies of the European Union. *Take note* of the commitment of the ministers of transport of the Parties to the FASRB stated in the "Joint Statement on cooperation on reconstruction and development of navigation on the Sava River", and further encourage such approach in other fields covered by the FASRB."

But the strong commitment at the international level requires concrete follow-up at the state level, where still much work is to be done in order to align the institutional framework with the standing EU legislation (Acquis) and to create the necessary conditions for the development of a modern river transport section.

7.2. Further Institutional reforms in the riparian states

7.2.1. Transport strategy and regulatory framework

Overall, much progress was made in recent years in establishing the institutional framework for the development of river transport on Sava River. Although the process is not yet completed and in spite the relatively negative perception of the present situation, the national transport policies in the riparian countries show a clear political willingness to achieve regulatory alignment.

The unfavorable technical conditions of the ***Slovenian*** waterways is in principle a stronger weakness than the fact that public authorities did until now not take any formal position on the development of commercial river transport. If any commercial cargo transport is envisaged, the rules and regulations for river transport are fully compliant with governing EU legislation given Slovenia is member of the European Union. The *Ministry of Transport* is the highest governmental institution directly involved in inland waterway transport in Slovenia. Direct responsibilities of the Ministry regarding inland navigation include the adaptation of implementation rules on the basis of the "*Law on Navigation on Inland Waters*" that regulates navigation on the rivers. All issues concerning navigation safety that are not regulated by Law on Navigation on Inland Waters are regulated by the *Maritime Code*. Finally, the *Water Act* governs the management of marine, inland and ground waters and the management of water and waterside land. In 2006 Slovenian Parliament adopted a *Resolution on Slovenian Transport Policy* in an effort to harmonize Slovenian transport policy according to the EU White Paper[39] butthe official transport policy does not consider a possible development of inland navigation and potential investments in this sector.

[39] European Transport Policy for 2010: Time to Decide, 2001

As was made very explicit in the Feasibility Study, the introduction of commercial traffic on Sava River from Brezice upstream is not feasible from an economic and financial point of view and is further complicated by many external factors which are outside the control of Slovenian authorities and depend upon the willingness of Croatian authorities, suggesting that it would be best to concentrate on an integrated development of river-based tourism in the Posavje Region (and further downstream on middle and lower Sava River.

The implementation in ***Croatia*** over the next five years of the strategic plans for the inland waterway and river port sectors will solve many of the existing problems. The *Ministry of the Sea, Transport and Infrastructure* is directly responsible for inland waterway transport, in particular via the Department for Inland Waterway Navigation and the Directorate for Seafaring and Inland Waterway Navigation Safety and Sea and River Protection. The *Inland Navigation and Inland Waterway Ports Act*, adopted by Croatian Parliament in October 2007 incorporates two previous laws regulating inland navigation in Croatia, namely the Inland Navigation Act and the Inland Waterway Ports Act. The new law harmonizes existing Croatian regulatory framework and harmonizes legislation with EU Directives for the Inland waterway sector. The *Transport Development Strategy* was adopted by Croatian Parliament in November 1999 and sets out the framework for the development of the transport sector, including all transport modes and covering the period from year 2000 to 2020. In light of the future integration into the EU, the *Pre-Accession Strategy for River Transport* was developed in 2007 on the basis of the Transport Development Strategy. The document is still pending for adoption by Croatian Parliament. The objective of the Pre-Accession Strategy is to fully harmonize the Croatian transport policy with the EU White Paper on transport (transport Acquis). Two development plans were subsequently produced on the basis of Pre-Accession Strategy (section River Transport), namely the *Five-Year Development Plan for Inland Waterways* focusing the upgrading of the Sava River waterway up to class IV and the construction of Danube – Sava canal and the *Five-Year Development Plan for Inland Waterway Ports* focusing the rehabilitation of Croatian ports.

In practice, the transport sector of ***Bosnia and Herzegovina*** is regulated by three ministries and one Transport Department:

- Ministry of Communications and Transport of Bosnia and Herzegovina;
- Ministry of Transport and Communication of the Federation of Bosnia and Herzegovina;
- Ministry of Transport and Communications of Republic of Srpska; and
- Brcko Administrative District Transport Department.

At present there is no State-level law which regulates inland waterway transport. A draft Maritime and Inland Waterways Law (year 2007 version) is in the process of adaptation and is expected to become a formal law in the near future. Until new state-level legislation is approved, inland

waterway transport is governed by the Entity laws, the "*Law on Internal Navigation of the Republic of Srpska*" and the "*Law on Internal and Maritime Navigation of the Federation of Bosnia and Herzegovina*". The provisions of the two laws are applicable to all vessels (including military) and to inland waterways in the two Entities.

Substantial progress will be achieved in Bosnia and Herzegovina with the forthcoming adoption of the new state legislation and the implementation of the recently approved transport policy. Although the progress in introducing a new state-level regulatory framework is slow, the delay will allow guaranteeing that the new State law will be in full compliance with international rules and regulations, both from EU and the Sava Commission. The delay should also ensure that the existing legislative frameworks at the level of the two Entities "connect" to the forthcoming state legislation.

Although ***Serbia*** still applies old and outdated legislation, the country is in the process of replacing the outdated regulatory framework by a new one which – as confirmed in the national transport policy – will be in alignment with all international governing legislation. The *Ministry for Infrastructure*, established in May 2007 has the overall responsibility for railway, road, inland waterway and air transport. Within the Ministry, the "*Sector for Water Transport and Safety of Navigation*" is directly responsible for inland waterways. *Inland Waterway Maintenance and Development Agency "Plovput"* is the governmental agency responsible for maintenance and development of international and inter-state inland waterways in Republic of Serbia (Danube, Tisa and Sava rivers).

The "*Maritime and Inland Navigation Act*" of former Federal Republic of Yugoslavia still regulates maritime and inland navigation on the entire territory of Serbia. The new "Maritime and Inland Navigation Act", replacing the version of former Yugoslavia, is still in the process of drafting and it is expected the document is fully harmonized with EU regulations regarding inland navigation. The "*Inland Navigation Act*", legislation also originating from former Federal Republic of Yugoslavia, is the law regulating specifically inland navigation in Serbia and covers all components of inland navigation, including terminals, communication, accidents, inspections, etc. In 2004, the report "*Transport Policy and Strategy*" was made as an attempt to harmonize the country's existing transport policy with EU White Paper and the EU regulations in general (Transport Acquis).

The recently adopted "*Strategy for rail, road, water, air and intermodal transport of Republic of Serbia (2008-2015)*" presents priorities and future plans for the development of the sector and recognizes the favorable economic and technical conditions for cargo, passenger and tourist navigation on inland waterways. The hopefully swift approval of this strategy is a first important

phase in the rehabilitation of inland waterway transport in Serbia and can become a catalyst for the development of commercial cargo transport on Sava River.

7.2.2. More work is needed

The legislative and regulatory process for the IWT sector has been initiated via the elaboration of comprehensive strategies for (inland waterway) transport and the subsequent planned or actual introduction of framework legislation. But other legislation will also need to be developed and / or aligned with the EU inland waterways Acquis in order to complete the regulatory framework for the IWT sector. Albeit at different levels pending the country, initiatives will in particular be necessary to transpose relevant EU legislation on following issues[40]:

- Market Access / Cabotage
- Access to the Profession
- Boat Master's Certificates
- Technical and Safety Conditions
- Chartering and Pricing
- Inland Waterways Fund
- River Information Services

In addition to existing EU legislation on above elements and to which the riparian countries need to fully align, new legislative instruments are and will be further developed in the context of NAIADES which will thus also have to become part of the IWT legislative framework in Croatia, Bosnia and Herzegovina, Serbia and Slovenia (Table 7-1).

[40] See for more details [Lit 01]

Table 7-1 Planned EU legislation for inland waterway transport

Instrument	EU Priority	Target date
Harmonization of:		
• Technical requirements for vessels	+++	ongoing (prop.COM(1997) 644)
• Intermodal loading units (ILU)		2006 (prop.COM (2003) 155)
• Statistics of goods transport by inland waterways	+	2007 (prop.COM (2005) 366)
State aid guidelines for support schemes and possibly de minimis rules for IWT	++	2007
Harmonization of:		
• Transport of dangerous goods	+++	2007
• Engine emissions	++	2007
Package of proposals aiming to reinforce the position and the normative framework of inland waterway transport (including EC Membership in River Commissions)	+++	2008, partly proposed (SEC(2003) 897)
Harmonization of:		
• Boat masters' certificates	+++	2008
• Intermodal liability	-	2008
• Manning requirements	+++	2009
• Waste disposal	+	2009
• Education and training standards	+	2009
• Intermodal documentation	-	2010
• infrastructure charging	-	2013
• Fuel quality	++	

Source: Commission Staff Working Document: *Annex to the* Communication from the Commission on the Promotion of Inland Waterway Transport NAIADES, 2006

Concrete action is thus urgently needed to rapidly start the process of adopting already existing EU legislation, this to avoid increasing the existing gap between what is and what should be.

End of Document
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