STATE ROAD ADMINISTRATION (UKRAVTODOR)
GOVERNMENT OF UKRAINE

PREPARATORY SURVEY
ON
THE PROJECT
FOR
CONSTRUCTION OF MYKOLAIV BRIDGE
IN
UKRAINE

FINAL REPORT

Volume 1 : Main Report

NOVEMBER 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.
CHODAI CO., LTD.

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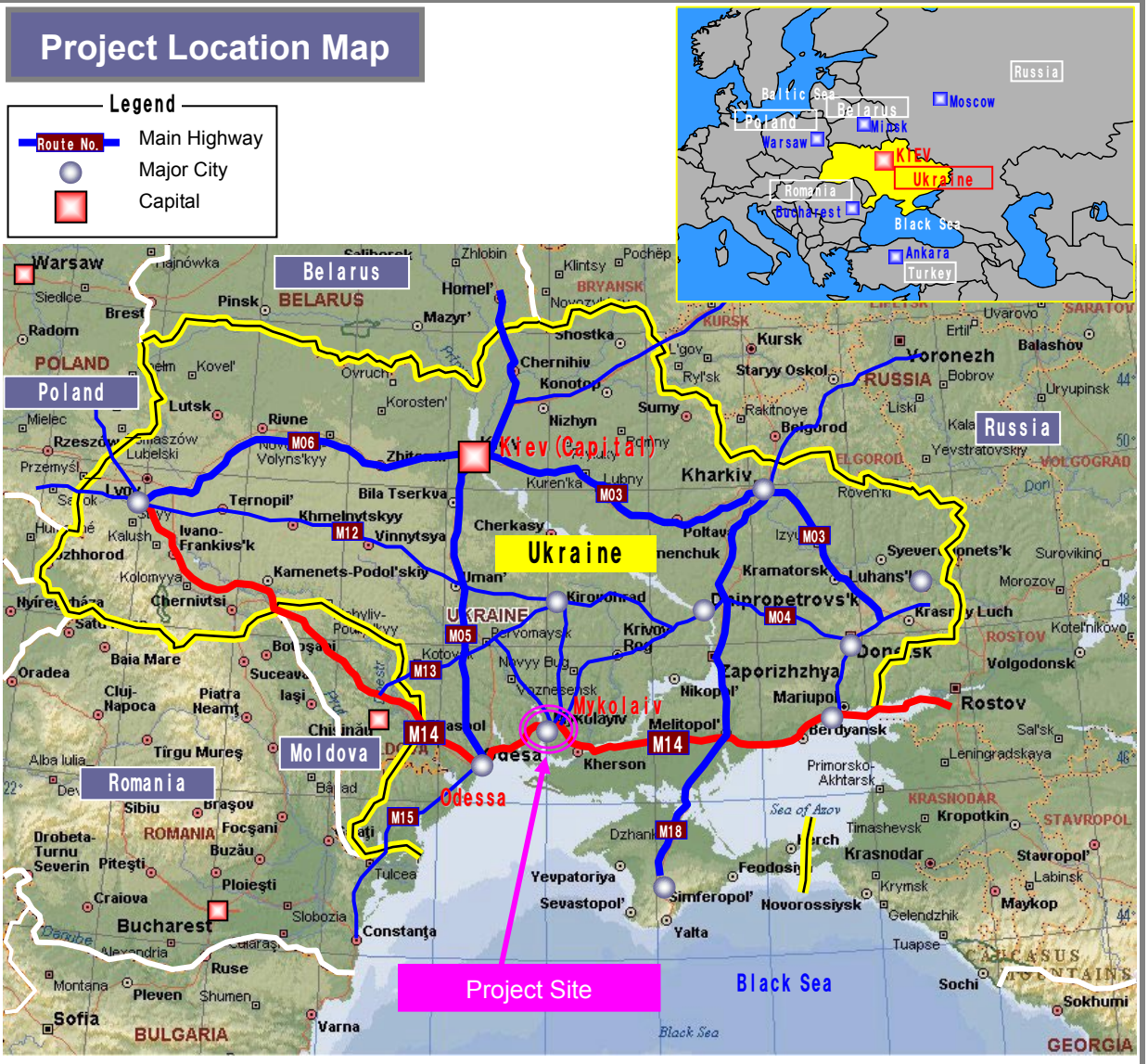
Ukraine

Project Location Map



Basic Data of Ukraine

Source: Ministry of Foreign Affairs

- ■Area 603,000 km^2 (about 1.6 times area of Japan)
- ■Population 46 million（2008:WB）
- ■Capital Kiev
- ■Ethnic Ukrainian (77.8%), Russian (17.3%), Belarusian (0.6%), Moldovan、Crimean Tatars (2001, National Population Census)
- ■Language Ukrainian (Official), Russian
- ■Religion Ukrainian Orthodox Church, Ukrainian Catholic, Others (Muslim, Jewish)
- ■Major Industry Industry (30.0%), Agriculture (7.4%), Construction (4.0%), Service Business (58.6%) (2008: CIS Statistics Committee)
- ■GNI per capita US$ 3,210 (2008:WB)
- ■Economic Growth -15.1% (2009：CIS Statistics Committee)
- ■Inflation Rate 13.0% (2009：CIS Statistics Committee)
- ■Total Amount of Trade (2009：CIS Statistics Committee)
  - （1）Exports：US$ 39.7 billion
  - （2）Imports：US$ 45.4 billion
- ■Main Item of Trade
  - （1）Export：Non-metal, Organic Products、Mechanical Equipment
  - （2）Import：Mineral Products, Mechanical Equipment、Chemical Products
- ■Currency Ukrainian Hryvnia (UAH) US$ 1=7.9UAH (2010：National Bank of Ukraine)
- ■ODA Performance of GOJ (Cumulative Value till 2008)
  - （1）Grant Aid：2.68 bil.Yen
  - （2）Government Loans：19.09 bil.Yen
  - （3）Emergency Grant Aid：US$ 0.1 mil.＋Emergency Supplies

(equivalent to 25.9 mil. Yen)

CG Image of the New Mykolaiv Bridge (1)

CG Image of the New Mykolaiv Bridge (2)

Current Site Condition (around New Route)

Existing Intersection

Regional Road(P-06)

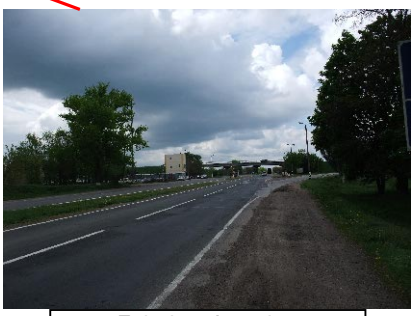
Railway along P-06

Airport

Access road to Matvievka

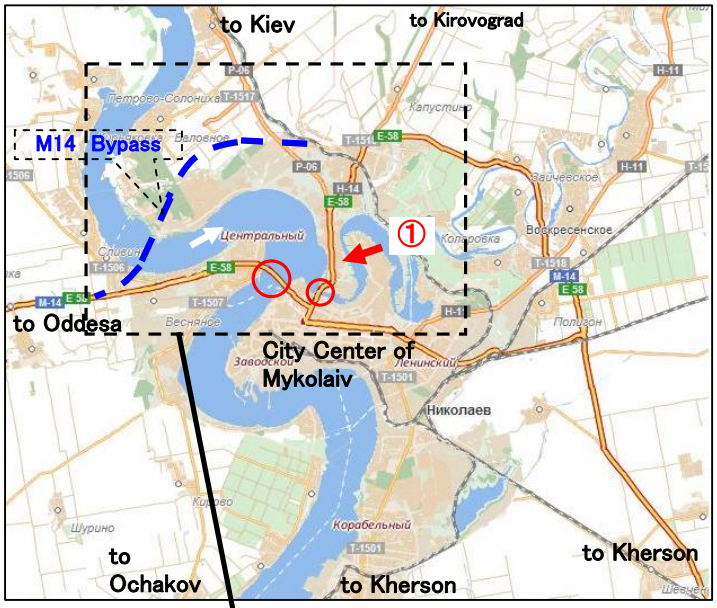
Existing M-14
(2 Lanes)

Southern Bug River
(from Right Bank)

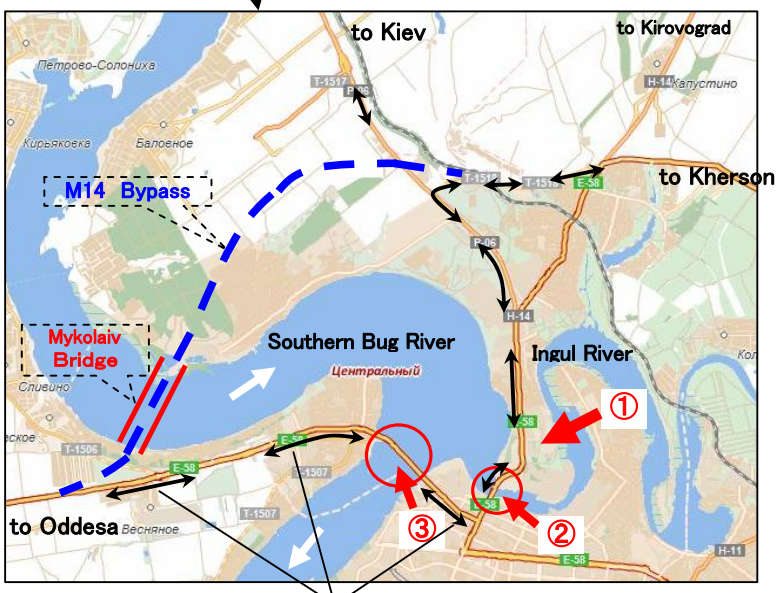


Existing Junction
(M-14 and T-1506)

Site View of Existing Bridges (Vavarovsky, Ingul)



① Ingul Bridge, Vavarovsky Bridge

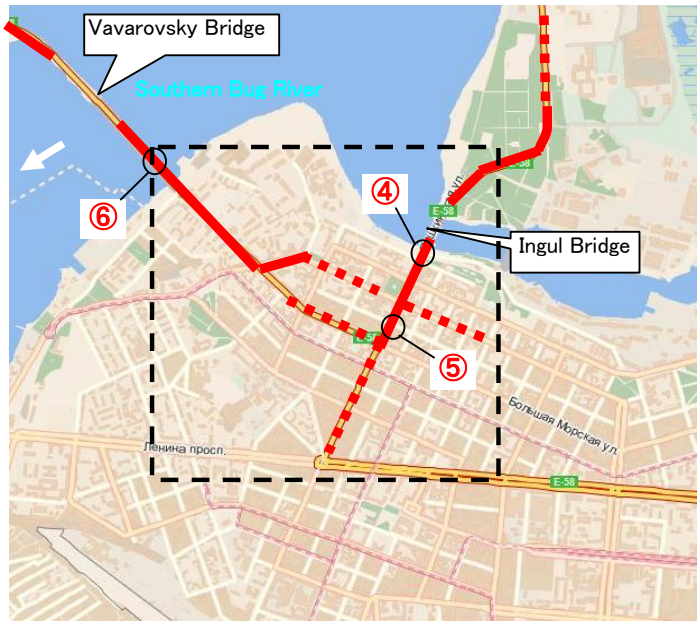


Existing Route for Logistics

② Ingul Bridge(Navigation Open time)

③ Vavarovsky Bridge(Navigation Open time)

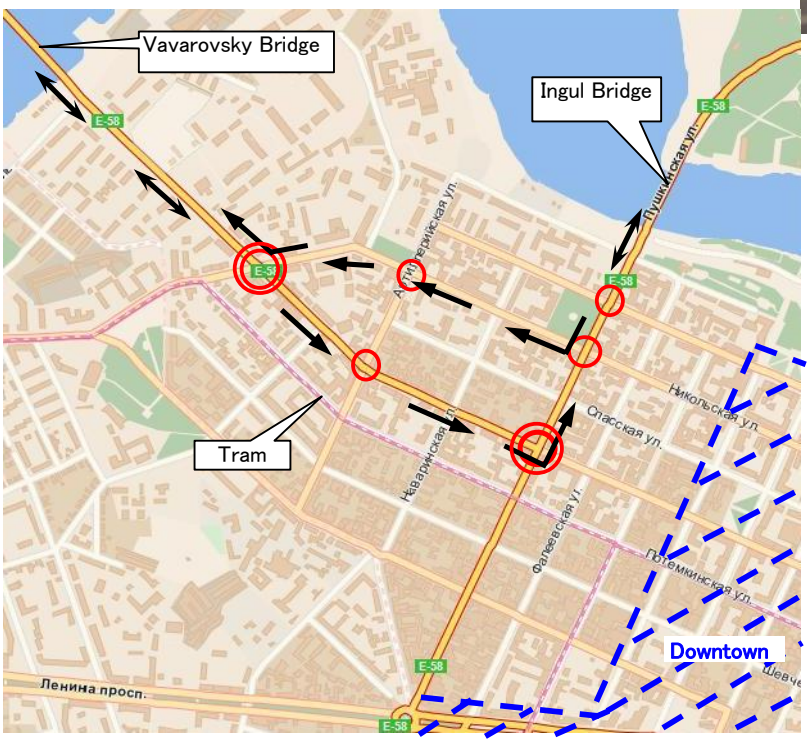
View of Central City and Traffic situation



Main congestion at central City (Navigation open time)

④ Normal Situation (Ingul side)

⑤ Traffic Congestion(Ingul side)



⑥ Traffic Congestion(Vavarovsky Bridge)

Minor Intersection (signal control)
Major Intersection (signal control)
Main route for heavy traffic
ditto (One-way)

Large vehicles for logistics (Trailers, 3-Axle Truck....) run through the routes in the upper map (central city) between 2 long bridges.
Along the route, there are university, parks, museum, shops and houses, as space for life and culture.
Traffic jam often occurs at major intersection caused by large vehicles in general days.

Large vehicles run through in central city

Semi trailer truck(6-Axles)

Heavy truck(5-Axles 25t)

Semi trailer truck(4-Axles):Car transporter

Full trailer truck(5-Axles)

Full trailer truck(6-Axles)

Full trailer truck(5-Axles)

Outline of the Project

1. Country: Ukraine

2. Project Name: Preparatory Survey on the Project of Construction of Mykolaiv Bridge in Ukraine

3. Execution Agency: State Road Administration (SRA or UKRAVTODOR)

4. Survey Objective:

Over all goal of the Project is to secure the function of the M-14 as a part of the Europe-Asia Corridor (Eurasian Corridor) and to improve the civil life of Mykolaiv. The out come of the Survey will be referred to appraise the feasibility of the project as a Japanese ODA Loan project.

5. Survey Contents:

Stage 1: Survey on Current Conditions & Collection of Data
- (1) Survey on Background of the Project
- (2) Investigation of regulations and Standards
- (3) Natural Condition Survey
- (4) Traffic Survey & Traffic Demand Forecast

Stage 2: Review of existing F/S and selection of route and bridge type
- (5) Review of existing F/S for Mykolaiv Bridge
- (6) Evaluation of applicable route and bridge Type

Stage 3: Preliminary Design
- (7) Preliminary design for road and bridge
- (8) Study on construction and procurement plan
- (9) Project cost estimation
- (10) Study on implementation and operation plan
- (11) Technical assistance to SRA on environmental issue
- (12) Consideration to apply Japanese ODA Loan
- (13) Project evaluation and Conclusion

6. Conclusion and Recommendations:

1) Conclusion

The survey concluded that:

- The Project is technically and economically feasible
- The location of the Mykolaiv Bridge shall be the same location selected by "Feasibility Study in 2003" (Route 2). However, the alignment of the approach road has to be adjusted considering the latest city plan of Mykolaiv.
- The minimum navigation width at the bridge site shall be 240m according to the recommendation by State Enterprise "Ukrainian Water Way" who has an authority to specify the navigation clearance for each river. Considering this minimum navigation width, the suspension type bridge with centre span of 510m is most appropriate for the main bridge from comprehensive evaluation with construction cost, navigation safety, merits for Ukraine (less environmental effect and possibility of technical transfer), aesthetic feature, construction difficulty and maintenance cost.
- The execution agency for this project will be State Road Administration of Ukraine (Ukravtodor). In case of applying Japanese Yen Loan, it is expected the procurement of consultants for preparation of tender documents will be scheduled in July 2013, and procurement of contractor for construction of the bridge will be scheduled in March 2015.

2) Recommendations

As the consequence of this survey, the followings are recommended by the survey team.

- It is necessary to prevent river contamination and to protect fishery resources during the bridge construction work considering environmental requirements. The construction schedule for bridge section must be reflect with these restrictions of river work from the environmental aspects as well as the navigation close in winter.
- It is recommended to adopt international tender for procurement of consultants and contractor(s) considering the lack of experience of suspension bridge among local consultants and contractors in Ukraine.
- Support by the consultant who carried out the preliminary design will be necessary for the local consultant who has responsible to implement feasibility study (project documentation) to get approval from concerned Ministries, and after that, from the Cabinet of Ministers of Ukraine.

EXECUTIVE SUMMARY

Preparatory Survey on the Project of Construction of Mykolaiv Bridge in Ukraine

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Background of the Survey

The road M-14 is one of the most important trunk roads in the Ukraine, connecting the western border (with Romania and Moldova) and eastern border (with Russia) through cities in southern Ukraine, such as Odessa and Mykolaiv. M-14 is also a part of the international corridor of the Black Sea Economic Cooperation (BSEC). However M-14 suffers serious traffic jams because of the number of heavy vehicles, even transit cargo, that must pass through the downtown portion of Mykolaiv city and the existing swing-bridge (Varvarovsky Bridge).

In order to solve the above problems, the Government of Ukraine planned a bypass project to detour around the downtown area of Mykolaiv. However, the project for the new bridge across the Southern Bug River (Mykolaiv Bridge) has not been started because of lack of funds, consequently all vehicles must still pass over the existing swing-bridge to cross the river in Mykolaiv.

In 2005, the Government of Ukraine requested Japan to apply a Yen Loan for the Mykolaiv bridge project (hereinafter called "the Project"). In response to this request, the Government of Japan sent the TOR Mission to Ukraine and agreed to the scope of the "Preparatory Survey on the Project of Construction of Mykolaiv Bridge in Ukraine" (hereinafter called as "the Survey"), as stated in the Minutes of Meeting of August 5, 2010. According to the minutes, the preparatory survey was started in November 2010 in order to review and update the Feasibility Study Report for the Mykolaiv Bridge undertaken in 2003.

1.2 Objective of the Survey

The objective of the Survey is to prepare materials to appraise the feasibility of the project as a Japanese ODA Loan project. The Survey area is Mykolaiv city as shown in the "Project Location Map".

2. COMPREHENSION OF BACKGROUND OF THE PROJECT

2.1 Related Development Plans and International Assistance

The "State Program for the development of public highways for 2007-2011", a National Development Plan in the road sector in Ukraine, was established in August 2003 and approved by the Cabinet of Ukraine in April 2006. The program seeks to improve traffic safety, speed, comfort and economy for passengers and goods by road. This program is based on the "Comprehensive Program for Consolidation of Ukraine as a Transit Country for 2002–2010".

Ochakov Port Development Plan commenced under authorization of the Minister of Transport and Communication in 2008. Ochakov Port is located in the Dnepro-Bugskiy basin in

Mykolaiv region in the North-East suburb of Ochakov town. After developing the port of Ochakov, some of the shipping cargo is expected to shift from the port of Odessa to Ochakov, this will necessitate improvement of the land transport access to the industrial cities in the Eastern Ukraine through Mykolaiv City, and the inland waterway transport on Dnieper and the Southern Bug River through the port of Ochakov.

The Government of Japan has been offering multi-sector economic assistance to Ukraine to contribute to liberalization of the market and attainment of sustainable economic prosperity. The assistance extends into the development of various infrastructures as well as the agricultural sector. The assistance also includes technical transfer and capacity development in sustainable industry development, energy-saving technologies to improve energy efficiency and environmental pollution remediation.

Table-1 Economic Assistance to Ukraine

(Expenditure basis. Unit: million US$)

	Loan	Grant Aid	Technical Assistance	Total
2004	-	-	-	-
2005	-	0.77	1.75	2.53
2006	1.34	3.37	1.88	6.59
2007	1.85	2.05	1.83	5.72
2008	1.56	4.76	2.10	8.42
Total	4.75	19.59	17.68	42.02

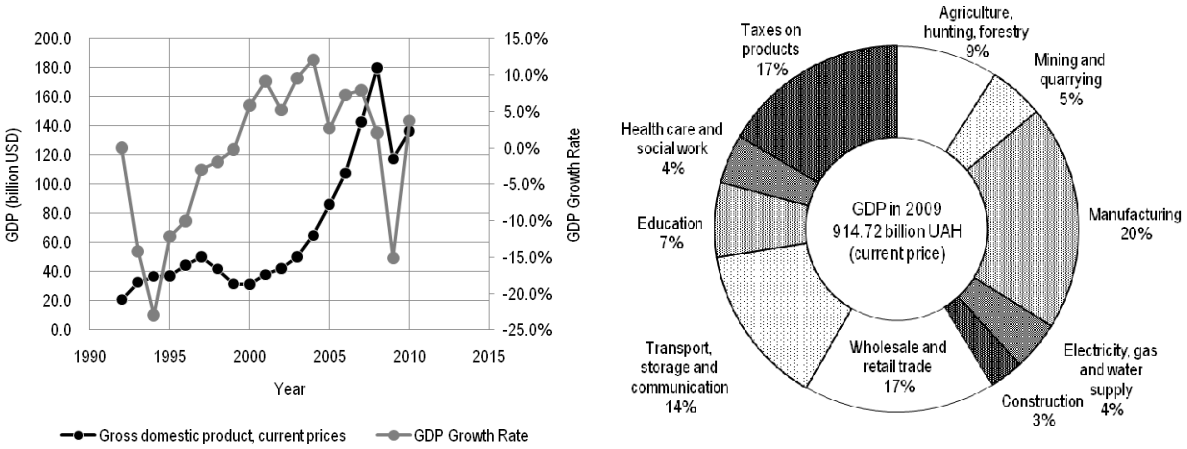
Source: OECD/DAC

The European Union (EU) is seeking an increasingly close relationship with Ukraine that extends beyond cooperation, to gradual economic integration and deepening of political cooperation. Ukraine is said to be a priority partner within the European Neighbourhood Policy (ENP). A joint EU–Ukraine Action Plan was endorsed by the European Council on 21 February, 2005. On 16 June, 2009, a new practical instrument was adopted - the EU-Ukraine Association Agenda.

The World Bank's Country Partnership Strategy (CPS) for Ukraine for 2008-2011, prepared in partnership with the Government of Ukraine and in consultation with the business community, civil society and donors, was endorsed by the World Bank's Board of Directors in December 2007. It focuses on the strategic priorities of the country's development including sustained economic growth, improved competitiveness of Ukraine, reform of public finance and administration and the improvement of public services.

2.2 Socio-Economic Conditions of Ukraine

Ukraine is a unitary state composed of 24 oblasts (provinces), and one autonomous republic (Crimea). The figures below show the GDP growth and the contribution of various industries and sectors to the GDP.



Source: IMF, World Economic Outlook Database, October 2010 and State Statistics Committee of Ukraine

Figure-1 GDP Growth Rate and Contribution of Industries

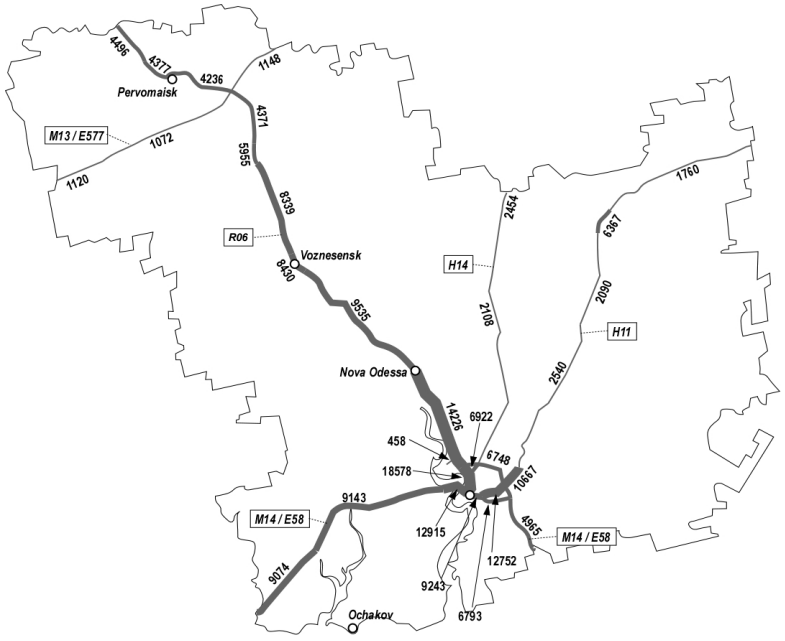
2.3 Socio-Economic Conditions of Mykolaiv

In Mykolaiv region, the machine building and metalworking industry, which includes shipbuilding and power engineering, is the most prominent sector. Mykolaiv industrial enterprises provide up to 60% of the Ukraine's shipbuilding production, over 90% of the state gas turbine production, and 80% of the alumina which is the main input product in aluminium production. As of 1st October, 2009, the population of Mykolaiv City was 501,700, which accounted for 42.1% of the population of the region.

The trunk road network in Mykolaiv includes M-14 (E-58) and regional roads R-06 that serve as supplementary roads that collect and distribute freight traffic. M-14 (E-58) motor road provides communication between the eastern and western parts of the country, while motor road R-06 is the main road from Mykolaiv to Kiev through Uman.

Vavarovsky Bridge is currently essential for eastern and western trips from Mykolaiv central area. The situation is such that lots of heavy vehicles come into the city centre daily. The roads in Mykolaiv city centre are regularly arranged and have sufficient width. Trams, buses and trolleybuses are widely used means of public transportation. However, roads, especially those with asphalt-concrete pavements, are not in good condition; concrete pavement bases of tram railways are also not in good condition. It seems regular maintenance is not carried out due to tight budgets.

An automatic traffic count system was installed in 2005 at arterial roads in Ukraine and has been operated since. In Mykolaiv Region, traffic volume is surveyed at about 30 points on arterial roads, namely, M-14 (E58), M-13, H-11, H-14 and R-06. As shown in the following figure, large traffic volumes were observed at M-14 (E-58) and R-06 in Mykolaiv City Centre and its environs. The Annual Average Daily Traffic (AADT) on existing Varvarovsky Bridge was about 12,900 vehicles per day in 2009.



Source: Укрдіпродор

Figure-2 Traffic Volume in Mykolaiv Region in 2009 (AADT, vehicle/day)

2.4 Expected Benefits for Japan from the Project

Japan is endeavouring to improve its food self-sufficiency ratio and diversification of food imports for emergency food supply. For stability in Japan's food supply, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries in Japan established the "International Conference on Investment Promotion for Food Security" in April 2009. The purpose of the conference was to achieve diversification of sources of food imports by "promoting overseas investment in grain production, harvesting and logistics" under public-private partnership.

Ukraine is the one of the important countries in regard to food supply to strengthen Japan's food security. Ukraine's trade balance with Japan up to September, 2010 is a deficit of 440 million U.S. dollars. In order to ease trade imbalances, imports from Ukraine should be encouraged. Mykolaiv Bridge is in a strategic position in relation to land and maritime transport. Therefore, the construction of the Mykolaiv Bridge is important for both countries.

2.5 Regulations and Standards for the Road Sector

Before 1991, during the Soviet Union era, SNiP and GOST were used as a building codes and standards for design and construction of roads and bridges. After acquiring independence from USSR, Ukraine established its own building codes named DBN instead of SNiP. DBNs for the road design and construction, bridge design and construction and related various testing methods have been completed. However, many SNiPs are used as reference codes and the DBN is based on the GOST standard. The DBN (Ukrainian design standard) was referred to in the design of roads in the feasibility study in 2004. The SNIPs were changed to DBN for Ukrainian projects, and they have been updated several times.

3. NATURAL CONDITION SURVEY AT THE PROJECT SITE

The topographic survey (on land) was carried out from December 2010 to the end of February 2011. The Geological survey was carried out from December 2010 to the end of February 2011 on Land, and July 2011 to the end of August 2011 on the River. The map below shows the locations of the boring sites of the geological survey.

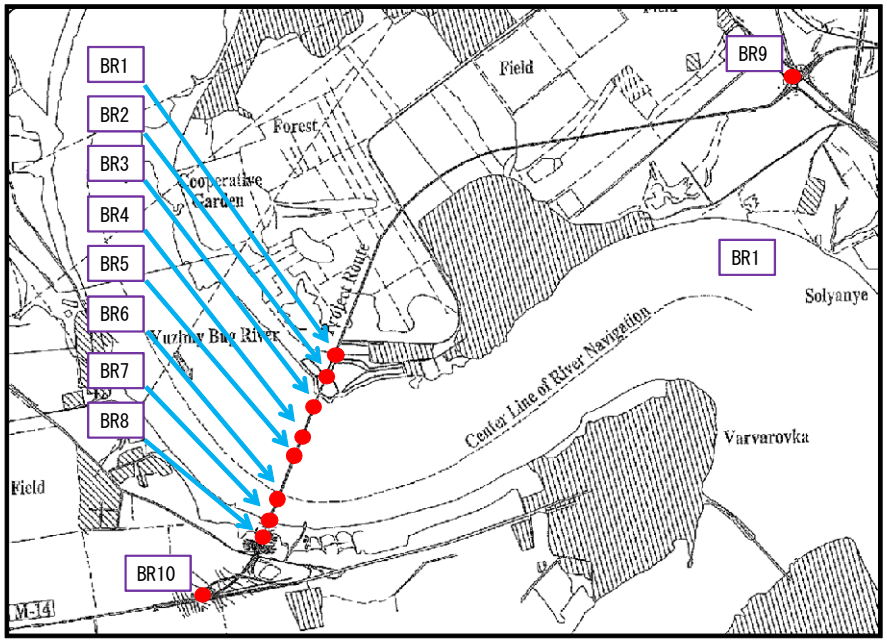


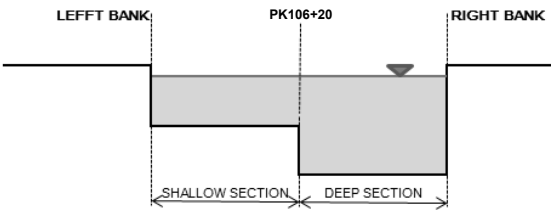
Figure-3 Location of the Boring Sites

The geological survey was done at the minimum number of points with Ukraininan equipment because it is still in a preliminary investigation stage. At the time of the detailed design stage, it is recommended to increase the number of investigation points, and apply standard penetration test (SPT).

Meteorological and hydrological data was assembled by Mykolaiv Regional Hydrometeorology Centre. According to the Centre, average annual rainfall is 447mm/year, while maximum and minimum annual rainfalls are 743 mm/year (1955) and 230 mm/year, respectively. Average monthly temperature is the highest in July up to 23.6 ℃, and the lowest in January down to -3.3 ℃, however the actual lowest temperature may be as low as -30 ℃. Therefore the Southern Bug River is usually frozen form the middle of December until the middle of March, and the thickness of the ice can be as much as 30cm.

From the seismic hazard map, the Project area is located in a low-risk earthquake zone. There hasn't been any remarkable earthquake event in/around the survey area since 1900 except for the region of Crimea and the south-western border with Rumania.

The proposed bridge site is located 9km upstream of the Varvarovsky Bridge: this stretch is tidal-prone. Varvarovsky Bridge forms the boundary between the river and sea regime. The stretch upstream of Varvarovsky Bridge has fresh water while its



Discharge Distribution (%)	21	79
Width of Section (m)	780	1,048
Discharge (m^3/s)	**930**	**3,570**
Flow Velocity (m/s)	**0.50**	**0.83**

Source: JICA Survey Team (data from 2004 F/S Report)

Figure-4 Hydrological Factors of 1% Exceedance Probability

downstream side has brackish water. There are two flow sections at the proposed bridge crossing, one is the shallow section (left bank to PK106+20) and the other is the deep section (PK106+20 to right bank). Hydrological factors of 1% exceedance probability for each section are shown in Figure-4.

The proposed bridge level was designed considering the navigation clearance. The navigation clearance was estimated by adding vessel height to the navigation level.

The navigation level was estimated at 0.78 m BS in the F/S (2004) and these results are available at this stage.

4. TRAFFIC SURVEY AND TRAFFIC DEMAND FORECAST

4.1 Results of Traffic Survey

For understanding the characteristics of traffic on the existing Varvarovsky Bridge, a traffic survey was conducted on the 16th-17th and 20th-21st of December in 2010. The traffic survey consisted of continuous 24 hour traffic count survey for 2 days and roadside driver interview survey for 1 day. Survey location was west of the existing Varvarovsky Bridge. Vehicular traffic was categorized into 6 categories for the traffic survey, namely: motorcycle, passenger cars, buses, 2-axle trucks, 3 and more axles rigid trucks and semi/full trailer. Roadside driver interviews included queries on number of passengers, trip purpose, origin and destination and preference for using the new Mykolaiv Bridge. In addition, for freight trucks including trailers, queries concerned with commodities/cargo being transported and loading weight were included in the interviews.

At the existing Varvarovsky Bridge, the observed 24 hour traffic volume is summarized in following table. Average daily traffic volume is about 17,000 vehicles. Passenger cars account for 64% of total traffic volume while buses and trailers account for 18% and 8% respectively. Motorcycles were not observed in the survey period.

Table-2 24 Hour Traffic Volume (both directions)

	Motor-cycles	Passenger Cars	Buses	2 Axle Trucks	3+ Axle Trucks	Trailers	Total (veh/day)
Day 1	0	10,610	3,608	1,129	486	1,397	17,230
Day 2	0	10,680	2,423	1,175	510	1,207	15,995
Ave.	0	10,645	3,016	1,152	498	1,302	16,613
Share	0.0%	64.1%	18.2%	6.9%	3.0%	7.8%	100.0%

Source: JICA Survey Team

4.2 Traffic Demand Forecast

Future traffic demand for the new Mykolaiv Bridge was estimated by the following three steps.

1) Forecasting of future traffic volume at Southern Bug River Crossing based on existing traffic and economic data.
2) Estimation of induced traffic by relevant development projects such as Ochakov Port development.
3) Build and apply of a route choice model estimated by the results of the traffic survey.

Ochakov port will have a capacity almost equivalent to Odessa and Ilyichevsk ports under the development plan as shown below.

Table-3 Planned Capacity of Ochakov Port

	Dry Bulk Cargo	Container
Stage I (2012)	7 million tons p.a. - Coal : 1 million tons - Iron ore, raw material : 5 million tons - Grain : 1 million tons	0.5 million TEU p.a.
Stage II (2017)	21 million tons p.a. - Coal : 6 million tons - Iron ore, raw material : 13 million tons - Grain : 3 million tons	2 million TEU p.a.

Source: The European Federation of Inland Ports (EFIP)

Based on the monthly traffic volume fluctuation in 2007 and results of the traffic count survey in December, monthly average traffic volumes and Annual Average Daily Traffic volume (AADT) in 2010 were estimated. Future traffic volume, including future traffic volume generated at Ochakov port, was also forecasted. Based on the roadside interview survey, diversion ratio in accordance with travel time savings and toll fees of the New Mykolaiv Bridge are also summarized.

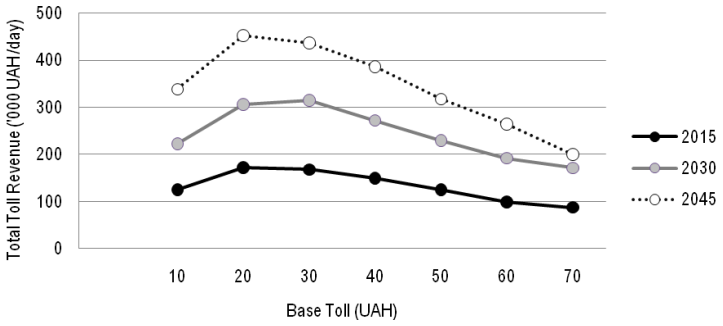
For the calculation of total traffic volume in the future, passenger car units (PCU) and three toll structures are defined as shown in following table.

Table-4 PCU and Assumed Toll Structure

	PCU	Toll Structure (UAH/vehicle)			
		Free	Toll-1	Toll-2	Toll-3
Passenger Cars	1.0	0	10	20	30
2 Axle Trucks	2.0	0	15	30	45
3+ Axle Trucks	2.5	0	20	40	60
Trailers	3.0	0	30	60	90

Source: JICA Survey Team

Based on the estimated travel times, the diversion ratio to New Mykolaiv Bridge was calculated for each origin-destination pair. From this diversion ratio, future traffic volume of Mykolaiv Bridge was calculated. Then, forecasted toll revenue based on the forecasted traffic volumes and toll structures was calculated and is shown in the following figure. Toll-2 (20 UAH for passenger cars) is optinum for maximization of toll revenue.



Source: JICA Survey Team

Figure-5 Total Toll Revenue by Toll Structure (Case 1)

4.3 Traffic on the Southern Bug River

Numbers of ships passing the location of Mykolaiv Bridge are shown in the following table. Although these numbers are currently shrinking, it is expected to increase considering the plan that new barges are to be introduced by private enterprise in order to transport inland products to Ochakov Port in the near future.

Table-5 Numbers of Ships at the Location of the Mykolaiv Bridge

	Towing Type			Self-propelled Type		
Year	2008	2009	2010	2008	2009	2010
Total	31	33	11	11	21	5

5. APPLICABLE ROUTE AND BRIDGE TYPE

5.1 Review of Existing Feasibility Study

Four different feasibility studies as shown below, were carried out in the period running from 1989 to 2004. These feasibility studies are identified and summarised herein.

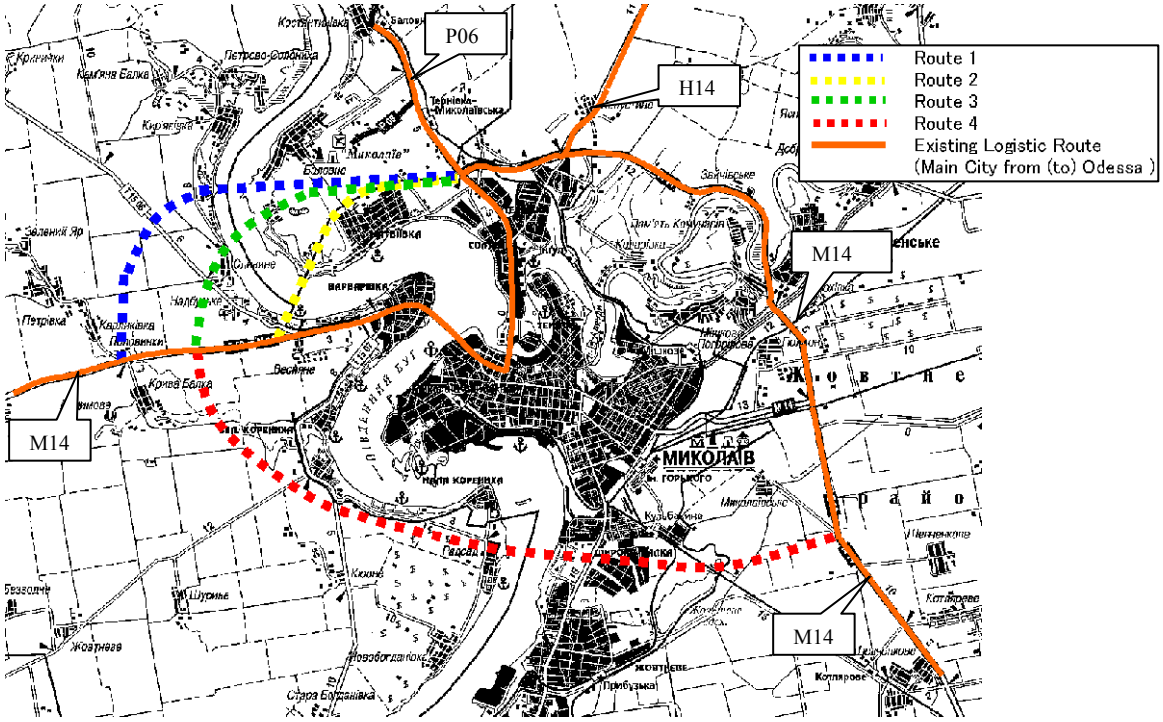
Table-6 Comparison of Basic Features in Existing Feasibility Studies

	1989 F/S※	2000 F/S	2003 F/S	2004 F/S
Implementation Country	Soviet-Union	Japan	Japan	Ukraine
Counterpart	No information	Mikolaiv City	Mikolaiv City	Mykolaiv Region
Survey Company	Kievsoyuizdorproject	Japan Consulting Institute	Pacific Consultants International	Kievsoyuizdorproject
Reason for Survey		This project was identified as a key national project by the Ukrainian government.	Design Condition for Bridge was changed (aviation and navigation clearance)	The two F/S's executed by Japan reported that the Government of Japan had expressed interest in providing a loan for this project.
Outline of Survey Result	[Road Alignment Selection] 4 routes (different crossing points on Southern Bug river) were proposed and compared. The Bridge position selected by this F/S is the same as that for the current design stage.	[Comparison of Bridge Types] Comparison of Bridge types involved 3 types. A cable-stayed bridge was recommended.	[Comparison of Bridge Types] Comparison of Bridge types involved 3 Types. A suspension bridge was recommended.	[Road Alignment Selection] Comparison of Road alignment on the left-bank was implemented. It recommended "Route 1", which is located far from the city boundary line, was tchosen as the best route. [Comparison of Bridge Types] Comparison of Bridge types involved 3 Types. A steel box-girder bridge was recommended.
Design Standard	SNIP	SNIP	SNIP	DBN (and SNIP)

Source: JICA Survey Team

5.2 Selection of the Highest Priority Route

Candidate bridge locations at Southern Bug River are based on the following four routes selected in the first F/S executed by Kievsoyuizdorproekt in 1989.



Source: JICA Survey Team (refer to F/S 2003)

Figure-6 Four Alternative Routes across the Southern Bug River (F/S in 1989)

Table-7 shows the comparison of four alternative routes considering changes to the environment at the project site from the original date of the F/S up to the time of review.

Table-7 Comparison of 4 Alternative Routes Considering Changes to the Environment

	Route-1		Route -2		Route -3		Route -4	
	F/S	Review F/S	F/S	Review F/S	F/S	Review F/S	F/S	Review F/S
Road length	△	⇒△	◎	⇒◎	○	⇒○	×	⇒×
Bridge construction costs (Bridge length, Height)	◎	⇒◎	○	⇒○	△	⇒△	×	⇒△
Geological conditions	◎	⇒◎	△	⇒△	○	⇒○	○	⇒○
Relocation of houses	×	⇒×	◎	⇒◎	△	⇒△	△	⇒×
Location as East-West corridor along Black Sea		○		○		○		◎
Alignment with land-use plan for Mykolaiv city		○		○		○		×
Relationship with Ochakov Port		○		○		○		◎

◎ : Excellent, ○ : Good, △ : Below Average, × : Poor

Source:JICA Survey Team

The northern bypass routes (routes 1, 2 and 3) would be implemented at lower cost than the south bypass route because of shorter approach roads and lower traffic volume of ships. Furthermore, “Route 2” is considered the best route because of its alignment being in agreement with the land-use plan for Mykolaiv city and the least relocation of houses.

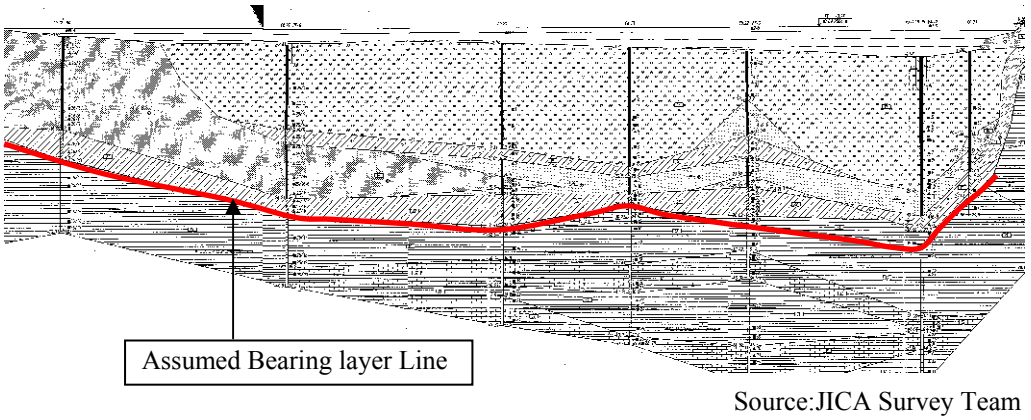
5.3 Design Conditions for Mykolaiv Bridge

The bridge location is proposed to be approximately 9 km upstream of the existing Varvarovsky Bridge. The right bank (western side) of the crossing point is observed as a landslide prone area with a slope of 15 degrees. On the left bank (eastern side), there is a flat area with forest, cultivated field and the Mykolaiv Air Port which is located 5-km north-northeast of the proposed bridge.

The location of the centreline for the waterway should be defined 400m from the waterline of the right river bank. Minimum navigation clearance for this river is 2x (120m x 13.5m) according to the Ukrainian Regulations. However, a single course 240m-waterway instead of two courses of 2x120m was adopted for the Project because of the curved river and foggy weather condition of the bridge site, in accordance with the recommendation of Ukrainian Water Way. The case of "two-courses of 2x120m" was also studied for reference only.

According to a letter from the International Airport Mykolaiv, the location of Mykolaiv Bridge is outside of the building height restricted area. However, obstruction marking shall be required and submission of approval with exact location of bridge dimensions should be considered at the next design stage.

Geological profile at the bridge area is shown in Figure-7. Bearing layer of the foundation for bridges is composed of stiff and semi-stiff lime clay as indicated in the Figure.



Source:JICA Survey Team

Figure-7 Geological Profile

Vessel Collision Force, Ice Load and Live Load will be considered for the design of Mykolaiv Bridge. Seismic Load can be negligible because the proposed site for the Mykolaiv Bridge is located in an area of seismic scale "MKS 6".

5.4 Main Bridge Type

The superstructure type was determined based on the case in which the navigation channel of 240m would not be divided (single course of 240m-waterway). The centre span length of the main bridge should be around 480m because the span shall include the navigation width (240m) and a half of pier width and construction margin (120m from both sides). From the relationship of the maximum span and bridge types, the viable bridge types will be a Suspension Bridge (Type A), Cable Stay Bridge (Type B), and Steel Truss Bridge (Type C). Reference alternative with shorter span (the case of "two-courses of 2x120m") will be Steel Box Girder (with orthotropic deck) Bridge. Alternatives for the Main Bridge type are shown in Figure-8.

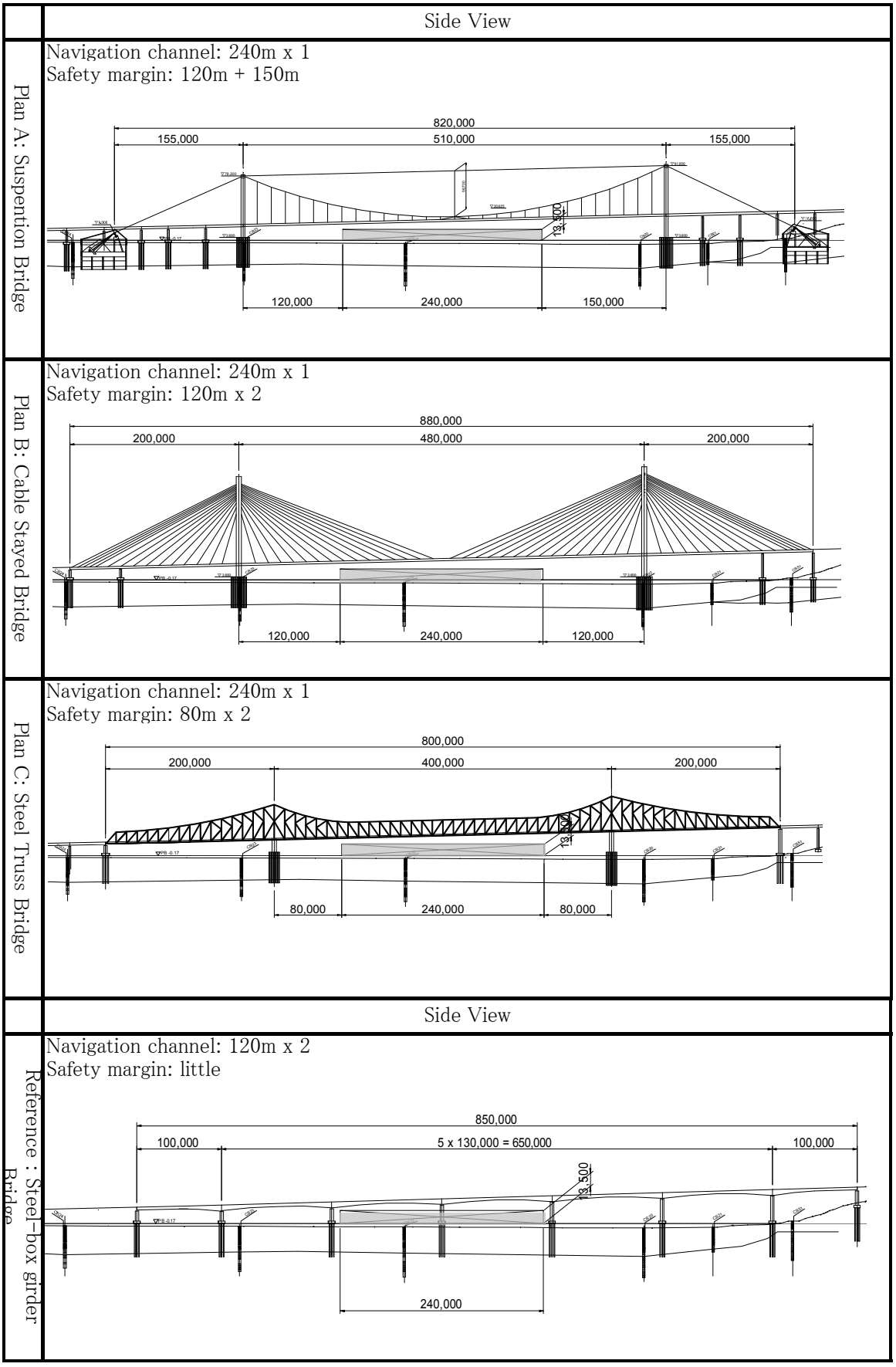


Figure-8 Alternatives for Main Bridge Type

Evaluation of the alternatives was carried out by the AHP (Analytic Hierarchy Process) method with the following attributes; construction cost, navigation safety, merit for Ukraine, aesthetic features, construction difficulty and maintenance cost. Weights for the attributes were determined as follows.

Table-8 Weight for Attributes

	Construct-ion cost	Navigation safety	Merit for Ukraine	Aesthetic feature	Construction difficulty	Maintenance cost	Multiple mean
Construction cost	1.00	2.00	3.00	4.00	5.00	6.00	2.994
Navigation safety	0.50	1.00	2.00	3.00	4.00	5.00	1.258
Merit for Ukraine	0.33	0.50	1.00	2.00	3.00	4.00	1.258
Aesthetic feature	0.25	0.33	0.50	1.00	2.00	3.00	0.792
Construction difficulty	0.20	0.25	0.33	0.50	1.00	2.00	0.505
Maintenance cost	0.17	0.20	0.25	0.33	0.50	1.00	0.335
Total	2.45	4.28	7.08	10.83	15.50	21.00	7.862
Weight	0.38	0.25	0.16	0.10	0.06	0.04	-

Table-9 shows that the “AHP”. Bridge Type-A (i.e. Suspension bridge) has the highest-priority.

Table-9 Estimation of Priority

	Evaluation factor						Evaluated priority	
	Construct-ion cost	Navigation safety	Merit for Ukraine	Aesthetic feature	Construction difficulty	Maintenance cost	Priority	Rank
Weight	0.38	0.25	0.16	0.10	0.06	0.04		
Suspension bridge	0.13	0.48	0.48	0.56	0.39	0.23	0.34	(1)
Cable-stayed bridge	0.21	0.29	0.27	0.26	0.39	0.23	0.26	(2)
Truss bridge	0.06	0.18	0.16	0.05	0.07	0.12	0.11	(3)
Referential alternative								
Steel-box bridge	0.60	0.05	0.09	0.12	0.15	0.42	0.30	-

5.5 Approach Bridge Type

The economic and rational bridge types for middle-scale girders shown in Figure-9 are investigated for applicable in the span range from 30m to 60m. The optimum span length is estimated which minimizes the total construction cost of super- and sub-structures.

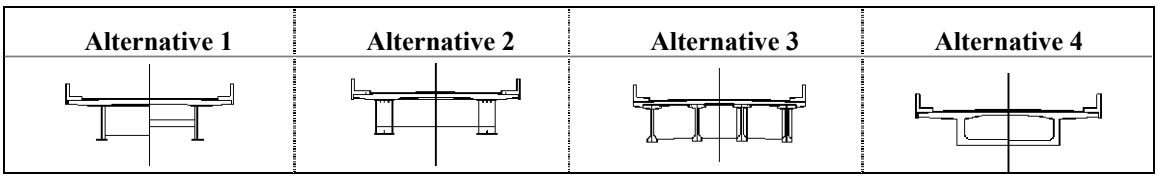


Figure-9 Alternatives for Approach Bridge

1) Alternative 1 : Steel I-girder type with prestressed concrete slab
2) Alternative 2 : Steel box-girder type with prestressed concrete slab
3) Alternative 3 : Prestressed concrete I-girder type
4) Alternative 4 : Prestressed concrete box-girder type

Evaluation of the alternatives was carried out by the AHP (Analytic Hierarchy Process) method. Attributes and weights used in AHP are same as the case for the Main Bridge.

Table-10 shows the conclusion of the "AHP". The alternative 1, i.e. Steel I-girder, has the highest-priority.

Table-10 Estimation of Priority

	Evaluation factor						Evaluated priority	
	Construct-ion cost	Navigation safety	Merit for Ukraine	Aesthetic feature	Construct-ion difficulty	Maintenance cost	Priority	Rank
Weight	0.38	0.25	0.16	0.10	0.06	0.04		
Steel I-girder	0.45	0.25	0.27	0.29	0.38	0.13	0.338	(1)
Steel box-girder	0.14	0.25	0.27	0.29	0.38	0.13	0.220	
PC-I girder	0.25	0.25	0.16	0.14	0.10	0.37	0.220	
PC-box- girder	0.15	0.25	0.29	0.29	0.13	0.37	0.221	-

As regards the substructure type of the approach bridge, the T-shaped pier, which is the most popular type for the medium scale spans, was applied.

The following foundation alternatives were evaluated up considering the loading scale (span: from approx. 30m to 60m), the construction condition (Water depth of constructed area: from approx. 1m to 3m, winter concreting etc.) and the foundation condition (Depth of bearing layer: approx. 35m from river bed).

1) Alternative 1: Cast in Place Pile Foundation
2) Alternative 2: Steel Pipe Pile Foundation
3) Alternative 3: Steel Pipe Sheet Pile Foundation (SPSP)

As a result of the study, the alternative 2 of Steel Pipe Pile Foundation was selected due to its high level of applicability and economic efficiency.

5.6 Preliminary Design for Bridge

The most appropriate bridge type of the main and approach bridges are a suspension bridge and Steel I-girder type with prestressed concrete slab respectively. The general view of these combined bridges is shown in Figure-10. Design Condition and other drawings are shown in "Volume.2. Preliminary Design Drawings":

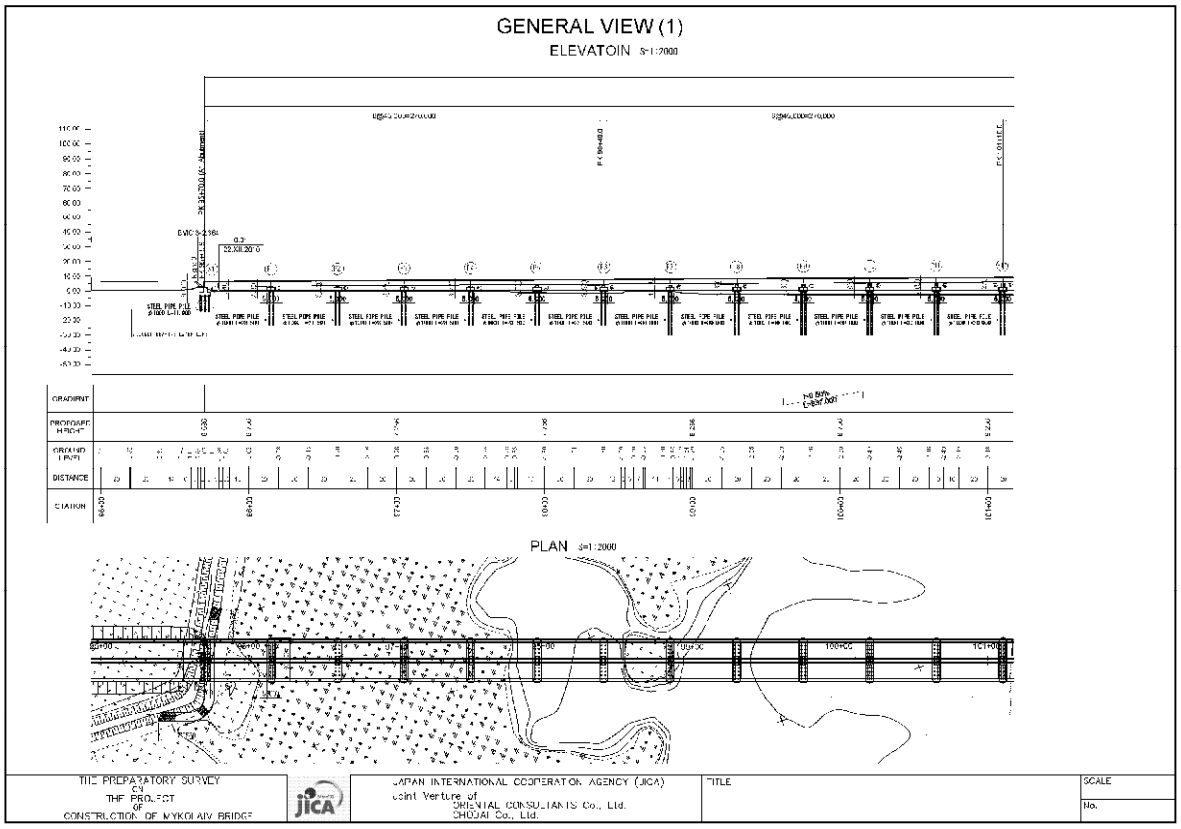


Figure-10 (1) General View of the Mykolaiv Bridge (1)

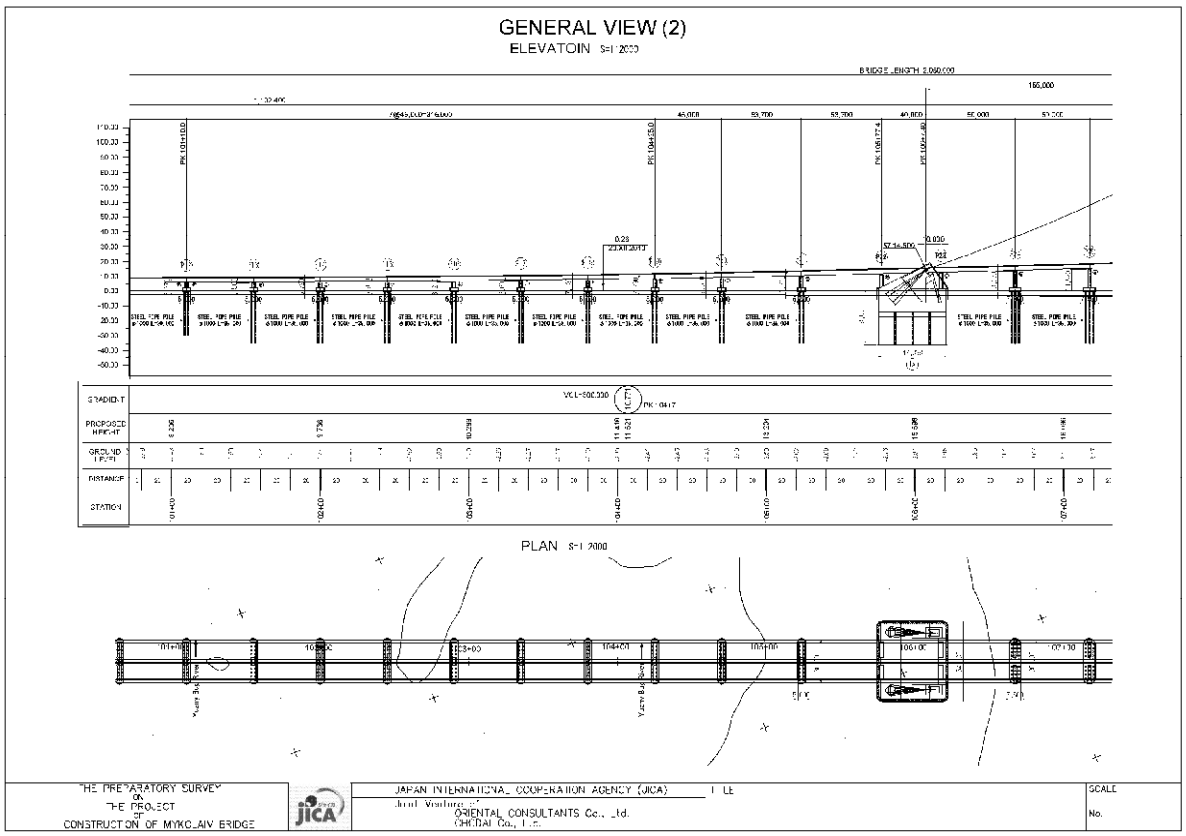


Figure-10 (2) General View of the Mykolaiv Bridge (2)

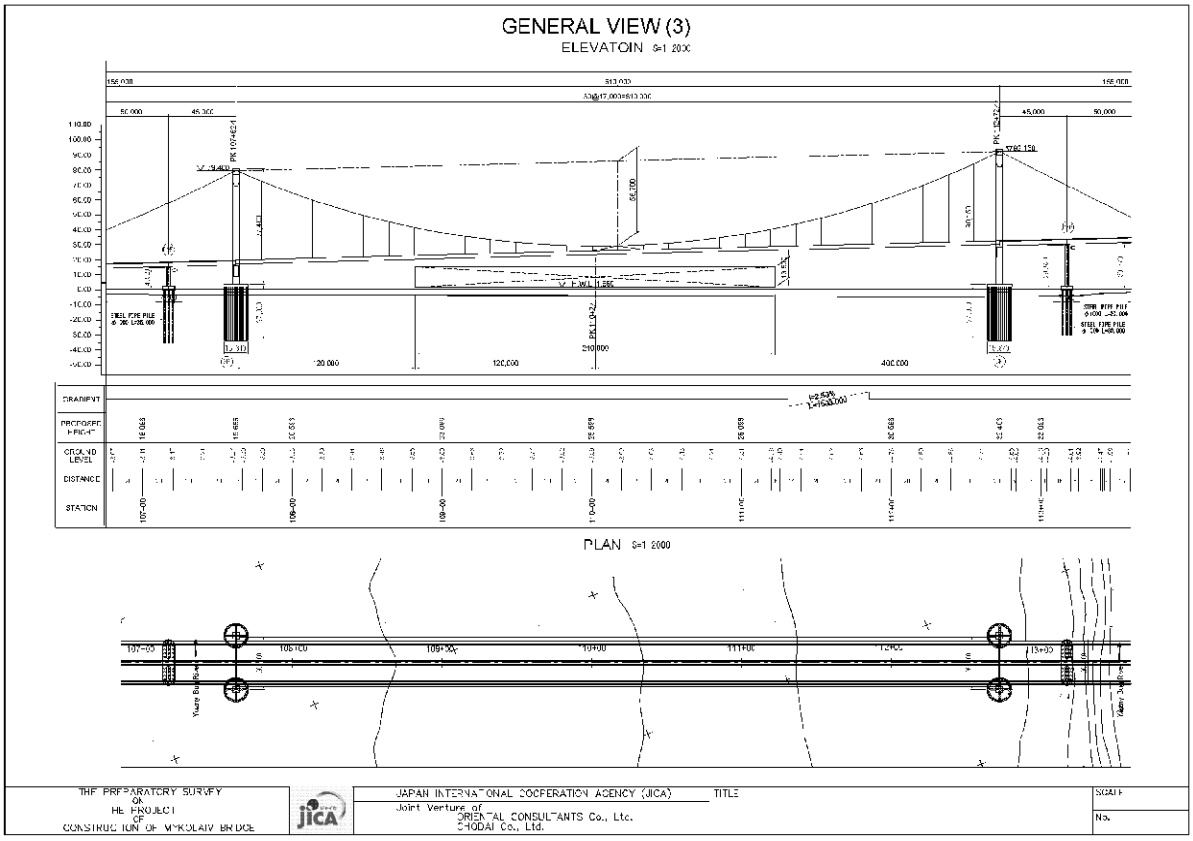


Figure-10 (3) General View of the Mykolaiv Bridge (3)

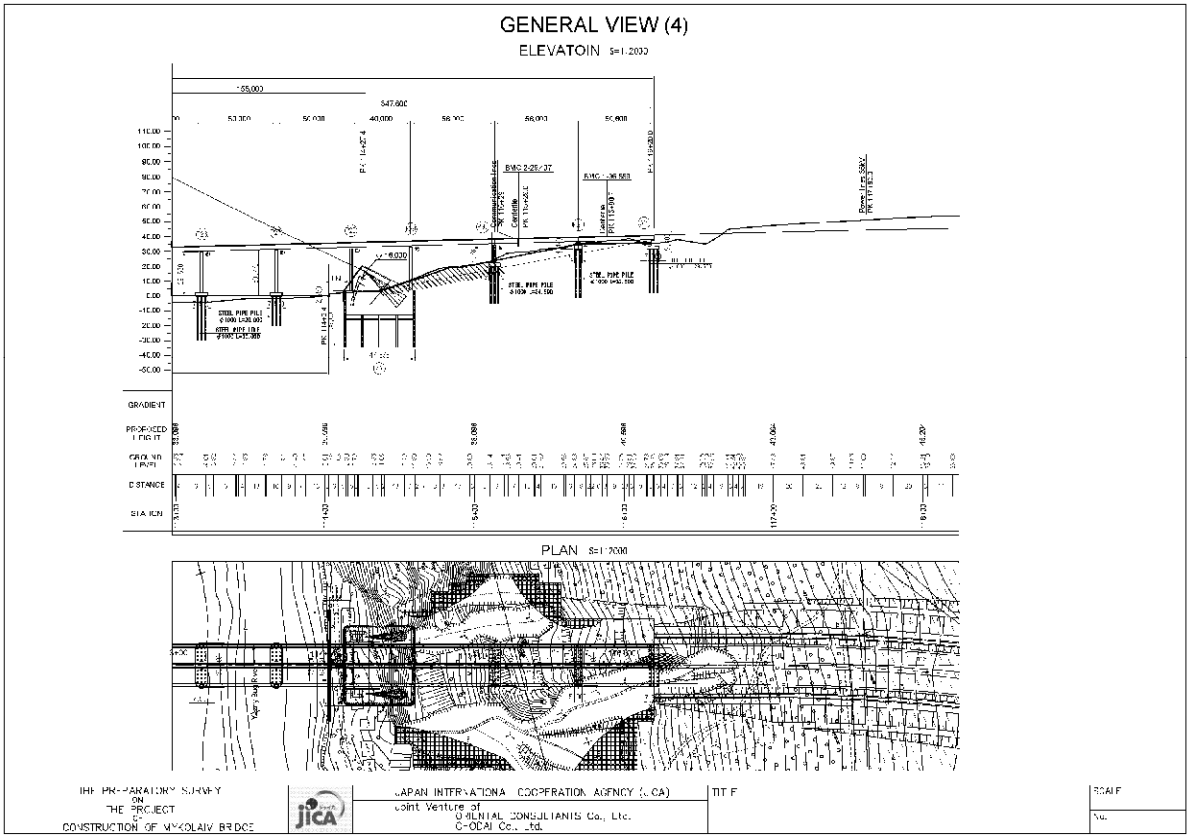


Figure-10 (4) General View of the Mykolaiv Bridge (4)

5.7 Preliminary Design for Approach Road

Design Conditions for the Road are follows.

a) Road category: 1-b
b) Design speed: 140 km/h
c) Dimensions of the road width:

(Side walk is not installed in the cross-section of Road.)

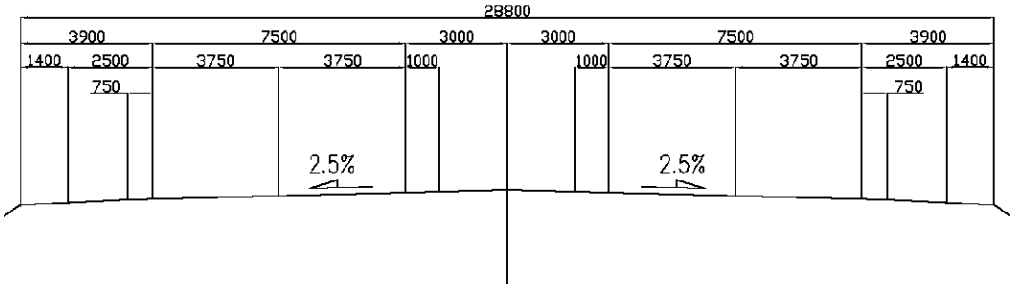
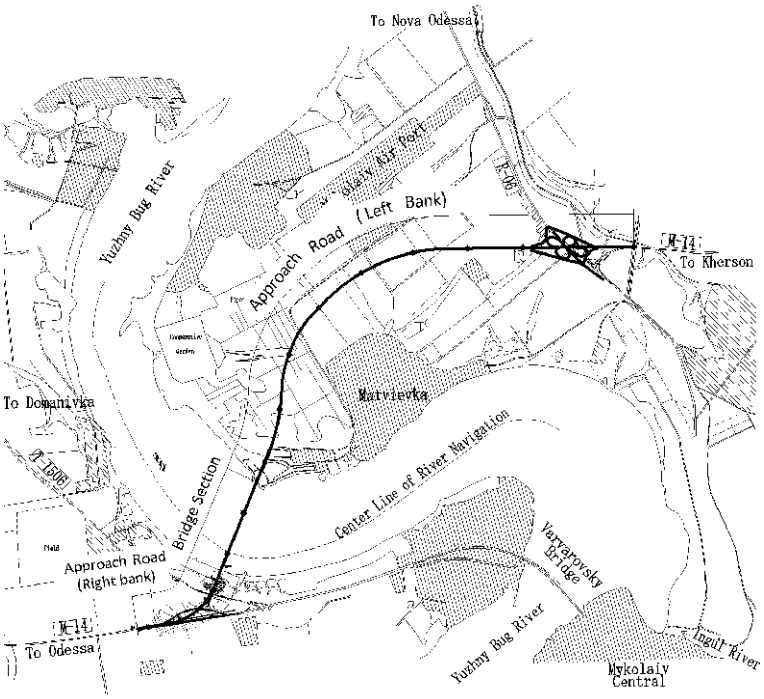


Figure-11 Dimension of Road Width

The location of the road is determined to be the same location proposed as "Alignment 1" in the F/S in 2004. The M-14 bypass road consists of 3 sections; the approach road on the left bank, the bridge section and the approach road on the right bank. Furthermore, it has 2 junctions to connect existing trunk roads (M-14, R-06) and relocation of R-06 as shown in Figure-12.



Source：JICA Survey Team

Figure-12 Location of the road (M-14 Bypass Road)

Design Condition and other drawings are shown in "Volume.2. Preliminary Design Drawings".

6. TECHNICAL ASSISTANCE TO SRA ON ENVIRONMENTAL ISSUES

6.1 Environmental and Social Considerations

(1) Project Components

The aim of planned activity is to construct a highway stream crossing over the River Southern Bug of city Mykolaiiv. A highway stream crossing including the bridge and approaches to it on the road M-14 Odessa – Melitopol – Novoazovsk (to Taganrog): beginning on the right bank of the river Southern Bug near the village Vesniane that is out from M-14; end – on the left bank to the M-14 at the crossing with autoroad P-06 Ulianovka – Mykolaiiv. Construction of approaches to the bridge structures requires allocation of land for permanent use within the projected band allocation of the road. At present these lands are owned by individuals and legal entities.

Project components are as follows.

- Left bank ····· PK 0 - PK 95+70 ========== 9.57km
- Bridge section ····· PK 95+70-PK116+20 ========== 2.05km
- Right bank ····· PK 116+20 - PK131+92.987 ====== 1.57km

(2) Baseline of Environmental Condition

Common flora species, common wild animal species, common fish, benthos invertebrates, natural reserves and cultural asset are studied around the Project area in order to comprehend the baseline of environmental condition.

(3) Pollution

Current condition of surface water quality, air pollution, soil and soil contamination were surveyed and monitoring points for those were identified.

(4) Environmental Legal Frame Work

The main sections of the Environmental Protection Law relevant to this project are;

- Article 27. Facilities of Ecological Examination
- Article 28. State Ecological Examination by Experts
- Article 29. Mandatory Execution of Conclusions of a State Ecological Examination by Experts
- Article 30. Public Ecological Examination

Relevant Ukrainian laws and regulations, such as “Article 146: Purchase of Plots of Land for Public Needs” of the Land Code of Ukraine, allow the government to acquire private lands for economic development, protecting the rights of property owners and ensuring just compensation.

(5) Scoping of Project Impact

Impact of Project during construction and during operation is described in Table-11 based on the information of site condition.

Table-11 Scoping of Project Impact

	Affected item	Impact	
		Construction	Operation
1	Involuntary Resettlement	B	B
2	Local Economy	C	C
3	Land use	C	C
4	Split of Communities	C	C
5	Local infrastructure Traffic/public facilities	C	C
6	Poverty, indigenous people	C	C
7	Misdistribution of benefits and damage	C	C
8	Cultural heritage	C	C
9	Local conflict of interests	C	C
10	Water usage or water rights and Rights of Common	C	C
11	Sanitation	C	C
12	Infectious diseases such as HIV/AIDS	C	C
13	Accident disaster	C	C
14	Traffic congestion	C	C
15	Topography and Geology	C	C
16	Soil Erosion	B	C
17	Ground water	C	C
18	Hydrological situation	C	C
19	Coastal Zone	C	C
20	Fauna, Flora and Biodiversity	C	C
21	Climate change	C	C
22	Landscape	C	C
23	Global warming	C	C
24	Air pollution	C	B
25	Water pollution	B	B
26	Soil contamination	B	B
27	Waste	C	C
28	Noise and Vibration	C	B
29	Ground subsidence	C	C
30	Offensive odors	C	C
31	Bottom sediment	B	C

A：significant impact to be foreseen, B：some impact to be foreseen, C：little impact to be foreseen

Source: JICA Survey Team

(6) Impact Forecast and Mitigation Measures

Summary of environmental impact forecast and mitigation measures are shown in Table-12.

Table-12 Impact Forecast and Mitigation Measures

No	Item	Forecast summary	Mitigation measures
1	Involuntary resettlement	There is 43 private enterprise and 6 public land owner on project areas. Based on Land acquisition Law, Notification document is necessary one year before implementation of project.	RAP with not only Ukrainian Law but also JICA Guideline will be considered.
2	Soil erosion	During road construction incorrect planning may activate erosion on right bank where linear erosion develops on fragile slopes. To prevent soil erosion during construction works to the embankment construction, development or extraction reserve after removal of sod and vegetation cover should provide a temporary wastewater. It may consist of highland ditches, fencing of shafts on the slopes, and drainage ditches discharge in decreased areas, selective vertical planning in places with difficult runoff.	Vegetation on early stage of construction is preferable.
3	Air pollution	Air pollution by traffic stream may impact to resident near by. Based on forecast air pollution concentration by traffic does not exceed the standard at existing building (including resident) and within environmental protection zone (100 m from road). This forecast does not consider back ground level.	installation of an improved pavement, which excludes dust formation; strengthening of the roadside with asphalt curb, adjacent area with grass;
4	Water pollution (bottom sediment)	During construction excavation work for basement may affect water quality of the Southern Bug River. The less effected work and design of bridge type is selected in F/S to reduce contamination caused by bottom sediment. Basement will be constructed by sheet pile well concrete method.	During excavation works silt fence is installed to prevent diffusion of contamination of bottom sediment.

No	Item	Forecast summary	Mitigation measures
		During operation run off water on road may contaminate water quality of the Southern Bug River. Along road drain pipe on bridge and side ditch are installed, and effluent water is treated or infiltrating.	
5	Soil contamination	Emission form vehicle fuel especially Lead may contaminates soil along road. By the supposed calculation contamination level is below the standard.	In Ukraine Lead is prohibited to contain in gasoline, but effect of prohibition will arise within several years based on other countries case.
6	Noise	Transportation noise may affect resident along road. Noise level at existing building and without environmental protection zone (100 m) will not exceed the standard.	

6.2 Land Acquisition

Number of project affected units and affected persons are shown in Table-13.

Table-13 Number of Project Affected Units (PAUs) and Affected Persons (APs)

Type of loss	No of PAUs			No of APs		
	Legal	Illegal	Total	Legal	Illegal	Total
Required for displacement (1 – 7)	0	0	0	0	0	0
Not required for displacement						
8 Land owners	65	0	65	0	0	0
9 Wage earners	0	0	0	0	0	0
Grand Total(1-9)	65	0	65	0	0	0

Source: department of State land committee in Mykolaiv region

Detailed affected area by the Project and compensation cost estimated by Mykolaiv Region are shown in Table-14.

Table-14 Affected Area and Estimated Compensation Cost

Land Owner	Area (ha)	UAH/hectares	Total cost, UAH
Individual	60.1		
Legal Entities of Private from of Ownership	2.3		
Lands of Forest Fund	12.8		
Lands of Auto Road	1.5		
Land of City Mykolaiv	12.2		
Lands of Odessa Railway	0.2		
Lands of International Airport "Mykolaiv"	Not defined		
Lands of Military Unit A 0224	2.0		
Totally, UAH	91.1		

Source: department of State land committee in Mykolaiv region
(according to the letter dated on Feb 2011)

A Draft schedule of EIA and RAP procedures to get environmental approval is shown in Figure-13.

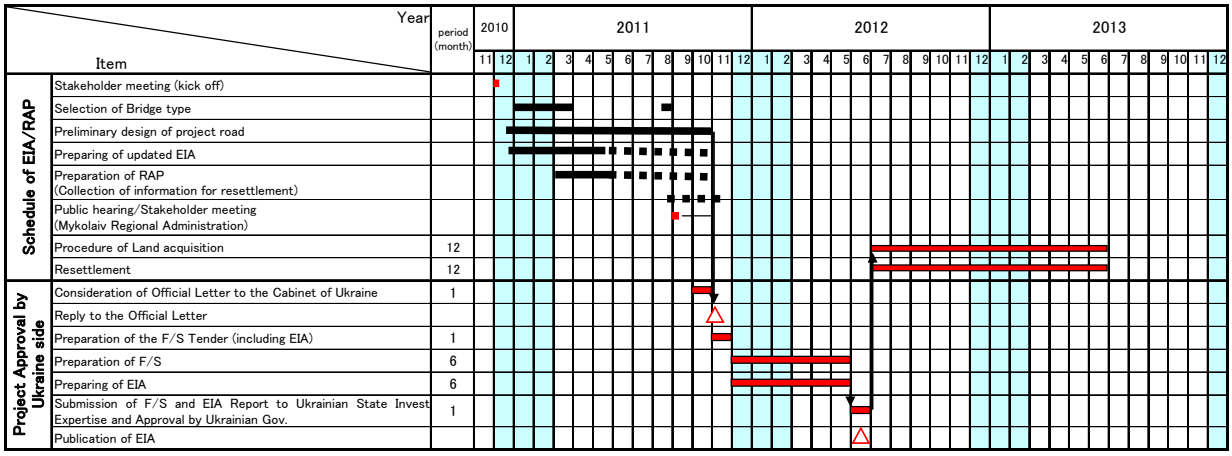


Figure-13 Schedule of EIA/Land Acquisition

6.3 Public Consultation

During survey period, two times of stake Holder Meeting was held as shown in Table-15.

Table-15 List of Stake Holder Meeting

No.	Date	Venue	No. of participant	Object
1	1/12/2010	Mykolaiv Regional Administration	27	Explanation of the Project Question and Answer session
2	9/9/2011	Mykolaiv Regional Administration	20	Project abstract, Opinion for Environmental Impact

Main points at issue and answer from the organizer are as follows.

- Environmental issues on the Project site are clear at the point of EIA in 2004.
- Land owners of the project site basically agreed to buy out the land during work group established in 2007.
- Compensation for residual land by split of land may be caused by the Project, but actual compensation means are not decided as of now. But, SRA Mykolaiv has many experience of land rearrangement in the other road construction project.

7. CONSTRUCTION AND PROCUREMENT PLAN

7.1 Construction Plan

The construction outline of the suspension bridge is divided into the following construction work: temporary work, foundation work, tower work, and superstructure.

1) Temporary Works

Suspension bridge work inside the river (main tower foundations and anchorage foundation works) will be conducted using constructing work barges. Tugs will be used to carry heavy machinery and materials onto the barges.

2) Foundations

Foundation works on the main tower and anchorage will comprise the steel pipe sheet pile (SPSP) foundation method which was selected in the text of Chapter 5.

3) Towers (Pylons)

Concrete mixer trucks will be loaded onto the work barges to supply raw concrete to the works site in the river. Concrete will be cast by bucket using a concrete pump or tower crane.

Figure-14 shows the schematic drawing for foundation work.

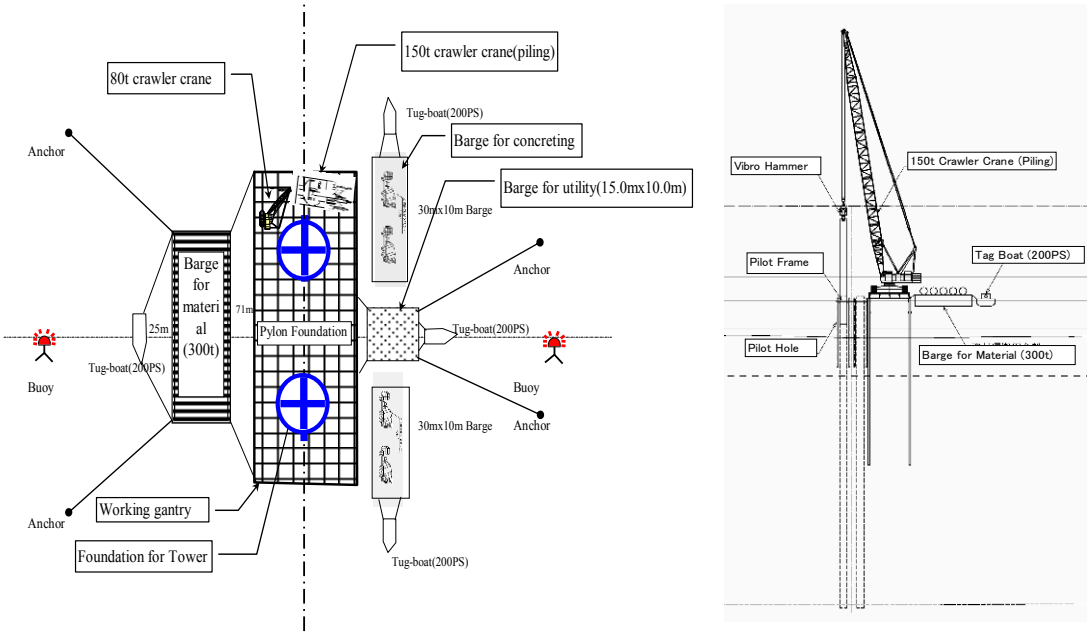


Figure-14 Construction Planning for Foundation

4) Construction outline of the superstructure for the suspension Bridge

The air spinning method (AS) is planned for the main cables. This entails installing the cables aboveground by spinning one cable wire at a time. The yard for the AS cables is located on the right bank (on shore). The construction procedure for suspension bridge cables is shown in the following figure.

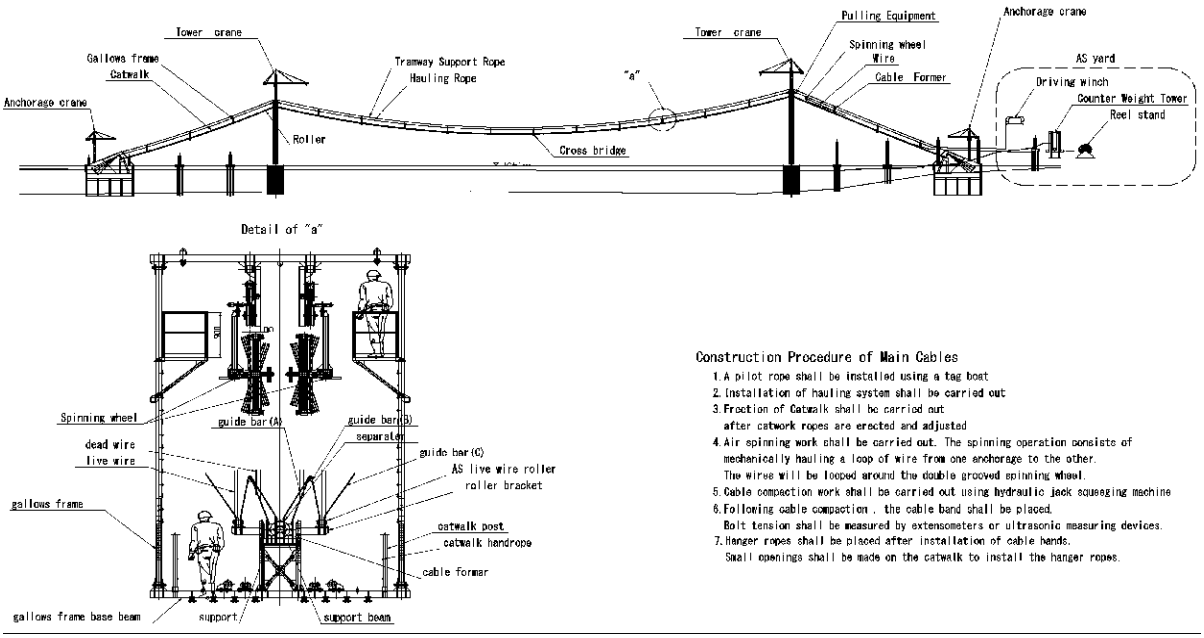


Figure-15 Construction procedure of main Cables

A draft construction schedule, considering the local climate especially the frozen period of the Southern Bug River (three months from December to February), is shown in the "Figure-16 Project Implementation Plan".

7.2 Procurement Plan

Main materials for construction of the suspension bridge, such as steel, cement, aggregates and sand are to be procured from the domestic market; on the other hand, some of the other materials, such as high tension steel and concrete additives will be imported from foreign countries.

Some foreign expertise and technicians, as well as local engineers, are assumed to be necessary for supervising the bridge and road construction work. The foreign expertise will be mainly in charge of the suspension bridge. On the other hand, a local engineer will be mainly in charge of the approach bridge and road as well as assisting the foreign expertise.

Equipment for construction work is mostly available from local contractors in Ukraine although some special equipment such as those for erection of the main cables shall be temporarily imported. This temporary imported equipment is to be demobilized and sent back to the original country in order to ensure import tax exemption.

8. PROJECT IMPLEMENTATION AND OPERATION PLAN

8.1 Project Implementation Plan

Figure-16 shows the tentative project implementation plan which includes all necessary procedures for project implementation. As shown in the Figure, the Basic Design stage (project documentation) shall follow this preparatory survey in order to get approval from the Ukrainian Cabinet prior to getting into the Detailed Design stage and tendering stage. Total construction stage will last 5 years and 2 months considering site closure of 3 months of every year in winter.

8.2 Structure for Project Implementation

The road sector in Ukraine is under the jurisdiction of the State Road Administration (SRA or UKRAVTODOR) of Ukraine. SRA is the state governing body of automobile roads, whose activities are directed and coordinated by the Cabinet of Ministers of Ukraine, and supervised by the Ministry of Transportation and Communications. The total length of streets and highways in Ukraine is 438,500km. Among them, SRA manages roads of total length of 169,500km, including important national roads of 20,000 km and 16,000 bridges with a total length of 364km. SRA will also be the execution agency for this Project with cooperation of the Ministry of Finance and the Department of Economic Affairs of Ukraine.

The budget of SRA in 2009 was 16,700 million UAH, 9,800 million UAH was for payments on a loan and 3,900 million UAH was the expenditure for the repair and reconstruction of the roads.

As for Mykolaiv Bridge, it is recommended to adopt international tender for procurement of consultants and contractor(s) considering the lack of experience with suspension bridges among local consultants and contractors in Ukraine. In addition, support by the consultant who carried out the preliminary design will be necessary for the local consultant who is responsible to implement the basic design (project documentation) to get approval from concerned Ministries, and after that, from the Cabinet of Ministers of Ukraine.

Project Implementation Plan (Draft)

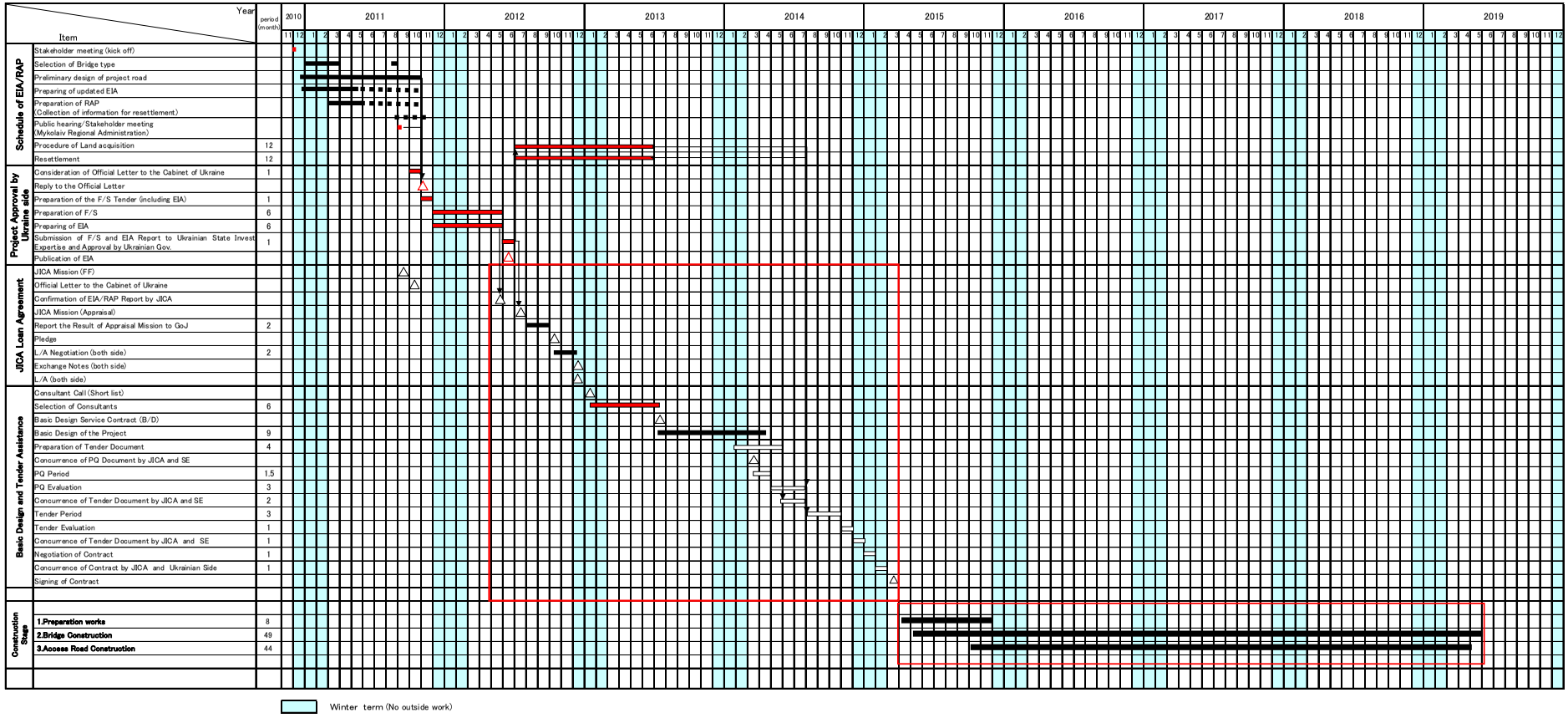


Figure-16 Project Implementation Plan

8.3 Structure for Operation and Maintenance

The State Road Administration (SRA) of Ukraine is an execution agency of road projects, and is also responsible for repair and maintenance of state roads and bridges as shown in figure-17. Maintenance and repair work of roads and bridges by SRA is governed by the official maintenance manual namely "DBN V.3.1-218-190-2004, Maintenance of Bridge on General Highways".

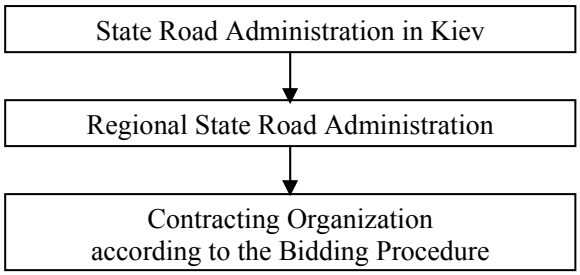


Figure-17 System of Road Maintenance Work

9. PROJECT COST ESTIMATION

9.1 Estimated Cost

Compensation cost, construction cost, engineering cost and operation and maintenance cost are estimated for the Project. The costs at Construction Stage are estimated in BQ (Bill of Quantities) bases considering the consistency of "Technical Specifications" to be prepared in the Basic Design stage.

9.2 Conditions of Cost Estimate

The unit prices of resources (materials, equipment and labours) adopted for this cost estimation are those prices at the time of May, 2011. The exchange rates adopted for this cost estimate is as follows;

1 US Dollar (USD) = 7.97 Ukrainian Hryvnia (UAH).

1 US Dollar (USD) = 79.5 Japanese Yen (JPY).

VAT rate of Ukraine is 20 % until December 2013. The rate is to be reduced to 17% from January 2014. 5.0% tariff is proposed for cost estimation of this Project.

Consumer Price Index (CPI) for Ukraine is summarized as shown in the table below. Inflation rate between year 2003 and 2010 was 170.2 %.(average escalation rate is 6.87%). Since current rate became stable, 1.6% of escalation rate for local currency is applied for this project.

Table-16 Price Escalation Index

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
2003	101.50	102.60	103.70	104.50	104.50	104.60	104.50	102.70	103.30	104.70	106.60	108.20	**104.28**
2004	105.69	110.35	110.08	108.43	112.12	109.88	111.05	106.18	103.18	104.20	103.60	104.70	**107.46**
2005	101.70	102.70	104.40	105.10	105.70	106.40	106.70	106.70	107.10	108.10	109.40	110.40	**106.20**
2006	101.20	103.00	102.70	102.30	102.80	102.90	103.80	103.80	105.90	108.70	110.60	111.60	**104.94**
2007	100.50	101.10	101.30	101.30	101.90	104.20	105.60	106.20	108.60	111.70	114.20	116.60	**106.10**
2008	102.90	105.70	109.70	113.10	114.60	115.50	114.90	114.80	116.10	118.00	119.80	122.30	**113.95**
2009	102.90	104.40	105.90	106.90	107.40	108.60	108.50	108.20	109.10	110.10	111.30	112.30	**107.97**
2010	101.80	103.70	104.70	104.40	103.70	103.30	103.10	104.30	107.40	107.90			**104.43**

Infration Rate from Year 2003 to 2005	**114.64%**
Infration Rate from Year 2005 to 2010	**175.90%**

Escalation rate for foreign currency is to be 0.0% for this project.

The unit prices of resources (labours, materials and equipments) adopted for cost estimation are based on "PRICE FORMATION IN CONSTRUCTION" issued by INPROEKT No.4, April 2011.

Physical contingencies for both foreign and local currencies are 5.0% of total construction cost. Base year is August 2011, and construction work will start form April 2015 and end May 2019. 5.0% of direct construction cost will be the administration cost. As for rate of interest during construction, 1.4% for the construction work and 0.01% for the consultant work will be applied. Rate of commitment charges will be 0.1%.

9.3 Cost Estimation for Preliminary Design

Results of cost estimation are as follows and the BQ table is shown in Table-17.

(1) Construction Cost (BQ section A1: 1 to 15)

Construction cost (without tax and contingencies) is estimated approximately ***** AH (equivalent to ***** USD) including Main Bridge (*****. UAH), Approach Bridge (***** UAH) and Approach Road and others (***** UAH).

(2) Engineering Service Cost without Tax and Contingency (BQ section B1)

Engineering service cost (without tax and contingencies) is estimated approximately ***** UAH (equivalent to ***** USD)

(3) Construction and Engineering Service Cost with Contingencies (Price Escalation and Physical Contingency) (BQ section A1+A2+A3+B1+B2+B3)

Construction cost including contingencies is estimated approximately ***** UAH (equivalent to ***** USD). Within the total amount, foreign currency portion is ***%, whereas local currency portion is ***.

(4) Construction and Engineering Service Cost with Contingencies and Administration Cost (BQ section A1+ A2+A3+ B1+B2+B3+D)

Construction cost including contingencies and administration cost is estimated approximately ***** UAH (equivalent to ***** USD).

(5) Total Project Cost (BQ section A1+A2+A3+B1+B2+B3+C1+C2+D+E+F+G)

Total project cost including engineering services and compensation (land acquisition and others) is estimated approximately ***** UAH (equivalent to ***** USD).

Table-17 Result of Cost Estimation

		Work Item	Foreign (JPY)	Local (UAH)	Total Amount (UAH)	Total Amount (1000 JPY)	Remarks
A1	Construction Cost						
1		Preliminaries & General					
	1.1	Preliminaries & General					
		Total 1					
2		Site Clearing					
	2.1	Site Clearing					
		Total 2					
3		Earth Works					
	3.1	Excavation					
	3.2	Embankment					
	3.3	Slope Protection					
		Total 3					
4		Drainage					
	4.1	Pipe Culvert					
	4.2	Ditches					
	4.3	Catch Basin					
	4.4	Underground Ditch					
		Total 4					
5		Incidentals					
	5.1	Greenery Works					
	5.2	Road Furniture					
		Total 5					
6		Subbase and Base Course					
	6.1	Subbase Course					
	6.2	Aggregate Road Base					
	6.3	Stabilized Base					
	6.4	Leveling					
		Total 6					
7		Pavement					
	7.1	Prime Coat and Tack Coat					
	7.2	Asphaltic Concrete Surfacing					
	7.3	Waterproofing					
		Total 7					
8		Concrete Structure for Approach Road Section					
	8.1	Substructure					
	8.2	Superstructure Work					
		Total 8					
9		Concrete Structure for Long Bridge					
	9.1	Tower					
	9.2	Anchorage					
	9.3	Pier					
	9.4	Abutment					
		Total 9					
10		Steel Structure					
	10.1	Fabrication of Steel Girders					
	10.2	Traial Erection for Sttel Girder					
	10.3	Erection of Steel Girders					
	10.4	Haulaging I Girder					
	10.5	Shoe (Bearing)					
	10.6	Expansion Joint					
	10.7	Deck Slab					
	10.8	Bridge Surfacing					
	10.9	Suspension Bridge					
		Total 10					
11		Miscellaneous Items					
	11.1	Slope Protection					
		Total 11					
12		Electrical Road Facilities					
	12.1	Electrical Road Facilities					
		Total 12					
13		Diversion and Protection					
	13.1	Diversion and Protection					
		Total 13					
14		Daywork					
	14.1	Daywork					
		Total 14					
15		Provisional Sums					
	15.1	Provisional item					
	15.2	Relocation of Existing Facilities					
		Total 15					
		Construction Cost (Total A1)					

Table-17 Result of Cost Estimation (cont'd)

A2	Price Escalation						
		Total A2					
A3	Physical Contingency						5% of (A1+A2)
		Total A3					
		Construction Cost (A1+A2+A3)					
B	Engineering Services						
	B1	Engineering Cost					
	B2	Price Escalation					
	B3	Physical Contingency					5% of (B1+B2)
		Total B					
		Total (A+B)					
C	Land Acquisition & Others						
	C1	Land Acquisition					
	C2	Compensation for Buildings					
	C3	Price Escalation					
	C4	Physical Contingency					
		Total C					
D	Administration Cost of SRA						5% of (B+C)
		Total D					
E	Tax						
	E1	VAT					20% of (A+B)
	E2	Import Tax					5% of (A+B)
		Total of E					
F	Interest						1.4%/Year of Construction Cost
	F1	Construction					1.4%
	F2	Consultant					0.01%
		Total F					
G	Commitment Charge						0.1%/Year
		TOTAL PROJECT COST					

10. CONSIDERATION TO APPLY JAPANESE ODA LOAN

10.1 Risk Analysis for the Project

There will be the following risks for implementing Mykolaiv Bridge Project.

Table-18 Risks for Mykolaiv Bridge Project

Nature of Risk	Response
Country Risk	Updating political and economical information of the recipient country is required to avoid the effect of those risks.
Economic Fluctuation Risk	Updating political and economical information of the recipient country is required to avoid the effect of those risks.
Foreign Exchange Risk	Updating political and economical information of the recipient country is required to avoid the effect of those risks.
Market Risk	1.6 % of price escalation is considered for cost estimation of this project.
Project Management Risk	The consultants who prepare the preliminary design shall assist Ukravtodor and the local consultants. Close communication between the two sides at the design stage is required to avoid the misunderstandings.
Demand Forecasting Risk	Sensitive analysis was done in this report (chapter 11) to grasp the effect of the risk.

10.2 Safety Countermeasures for the Project

During the construction stage, outside work in winter is sometimes dangerous, especially on a river. Ukrainian labour law restricts outside work in heavy snow. The work on the river is also restricted in the frozen period. To ensure the safety of workers, 3 month halts in winter was considered in implementation of the Mykolaiv Bridge Project.

The suspension bridge construction requires special machinery and equipment in order to carry out stiffening girder construction work and operation of the cable work. Handling that machinery and equipment is sometimes dangerous for the general workers. Because of the lack of experience of these special works of the local contractors, it is recommended to procure skilled labourers and bridge engineers for the suspension bridge internationally.

Temporary structures require "quality assurance" in order to secure safe work during the construction stage. Establishment of a Check system for the temporary work is also essential to assure safe work. Usually, the consultants will act as the inspector for these temporary works on behalf of the Client. The suspension bridge construction also requires special temporary works in order to carry out stiffening girder construction work and operation of the cable work. Therefore it is recommended to procure international experienced consultants for the Mykolaiv Bridge Project.

10.3 Technical Assistance and Transfer

Technical Assistance and Technical Transfer to Ukrainian side regarding the suspension bridge will be necessary for feasibility sutudy phase, basic design phase, construction phase and operation and maintenance phase as shown in Table-19.

Table-19 Technical Assistance and Technical Transfer Plan

Phase	Counterpart	Contents	Duration	Assisting Agency
Feasibility Study Phase	SRA (assisting local consultants)	• To provide the result of preliminary design (calculation and drawings) • To collaborate on feasibility study of suspension bridge	2 months	• Consultants of Preliminary Design Phase
Basic Design Phase	SRA (Bridge Design Engineers)	• To collaborate on basic design of suspension bridge	3 months	• Consultants of Basic Design Phase
Construction Phase	SRA (Bridge Engineers)	• Construction supervision for Suspension bridge (on-the-job training)	6 month s	• Consultants of Construction Supervision Phase
Operation and Maintenance Phase	SRA (Operating and Maintenance Staff)	• Training in the assisting country	2 weeks	• JICA

11. PROJECT EVALUATION AND CONCLUSION

11.1 Effect of the Project

Regarding the induced domestic products, which consists of direct impacts and primary effects, the construction of the new Mikolaiv Bridge is expected to induce 7.19 billion UAH of domestic products in Ukraine as shown in the following table. By using the estimated I-O

Table in 2010 and Leontief Inverse Matrix and consumption expenditure, secondary effects due to the construction of the New Mykolaiv Bridge are estimated to total 1.376 billion UAH as shown in the following table. Total of direct and primary effects and secondary effects is estimated at 8.57 billion UAH which is 0.79% of GDP of Ukraine in 2010.

Table-20 Ripple Effect due to the New Mikolaiv Bridge

	million UAH	% of GDP (2010)
Direct Impact and Primary Effect	7,192.4	0.664%
Secondary Effect	1,375.5	0.127%
Total	8,567.9	0.791%

Source: JICA Survey Team

The New Mykolaiv bridge is, especially, expected to contribute to cost saving of cargo transport between major seaports such as Odessa, Ilyichevsk and Ochakov ports and the industrial areas in the eastern part of Ukraine and Kiev that are the major centres of consumption in Ukraine. This traffics are, currently passes through Mykolaiv city center and over the existing Varvarovsky Bridge in spite of the longer travel distance because of heavy vehicle restriction in the city centre.

Cargo transport cost saving is calculated by the distance related travel cost of vehicles and travel distance reduction by the New Mykolaiv bridge. Distance related travel cost of trailer is estimated 4.88 UAH per km. Travel distance reduction by the New Mykolaiv bridge is about 4.6 km, therefore, travel cost saving of a trailer is expected 22.4 UAH per vehicle.

11.2 Economic Evaluation for the Project

Economic evaluation of the New Mykolaiv Bridge was conducted by means of a Cost Benefit Analysis (CBA). The CBA is a means-end assessment defined by economic circumstances and where the investment is decided upon the conditioned evaluation cycle where input generates a result. The CBA in this chapter was made by comparing the case "With the Project" and the case "Without the Project". The following table shows that the estimated socio-economical benefit consists of travel cost and travel time saving by demand forecast cases. Project benefit is calculated by demand forecast case for a toll system as shown in Table-4 and demand of Ochakov Port development.

Table-21 Estimated Project Benefit in 2015 (1,000 UAH/day)

	Year	Free	Toll-1	Toll-2	Toll-3
Case 1 (100% demand at Ochakov Port capacity)	2015	1,316	1,376	760	399
	2030	6,347	4,262	3,925	3,526
	2045	8,177	5,350	6,437	5,401
Case 2 (75% demand at Ochakov Port capacity)	2015	1,271	1,331	966	372
	2030	6,389	3,949	3,623	3,279
	2045	8,177	5,350	6,437	5,401
Case 3 (50% demand at Ochakov Port capacity)	2015	1,187	1,253	1,018	319
	2030	5,424	3,581	3,287	2,999
	2045	7,856	6,068	5,856	4,914
Case 4 (No induced traffic demand at Ochakov Port)	2015	1,104	1,107	1,072	275
	2030	2,667	2,509	1,367	1,065
	2045	5,869	4,726	3,917	3,146

Source: JICA Survey Team

The economic analysis conducted produced the results shown in the following table. The EIRR was calculated as 18.5% and NPV as 7,546 million UAH in the case of 100% demand for Ochakov port capacity and freeway. In the case of toll-way, EIRR and NPV are decreased in accordance with toll fare.

Table-22 Results of Cost Benefit Analysis

		Evaluation Indicator		
		Net Present Value (at discount rate 8%, million UAH)	EIRR	B/C (at discount rate 8%)
Case 1 (100% demand of Ochakov port capacity)	Free	7,546	18.5 %	3.22
	Toll-1	4,390	15.5 %	2.29
	Toll-2	3,771	13.8 %	2.11
	Toll-3	3,419	12.7 %	2.01
Case 2 (75% demand of Ochakov port capacity)	Free	7,395	18.3 %	3.18
	Toll-1	4,000	14.9 %	2.18
	Toll-2	3,709	13.9 %	2.09
	Toll-3	3,097	12.3 %	1.91
Case 3 (50% demand oft Ochakov port capacity)	Free	6,309	17.0 %	2.86
	Toll-1	3,823	14.3 %	2.12
	Toll-2	3,201	13.3 %	1.94
	Toll-3	2,446	11.5 %	1.72
Case 4 (No induced traffic demand at Ochakov Port)	Free	2,534	12.3 %	1.75
	Toll-1	2,022	11.8 %	1.59
	Toll-2	368	8.7 %	1.11
	Toll-3	-370	7.3 %	0.89

Source: JICA Survey Team

Cost overruns and lower traffic demand are considered as major risks that could affect the results of the economic analysis of the project. The following patterns of sensitivity analysis were conducted.

- Initial investment cost: +10%,
- Operation and maintenance cost: +10%, and
- Traffic demand: -10%,

Summary of the sensitivity analysis is shown in the following table.

Table-23 Summary of Sensitivity Analysis (100% demand of Ochakov Port, Freeway)

	Sensitivity Analysis Cases				
	Base Case	Case A	Case B	Case C	Case D
Initial Investment Cost	-	+10%	-	-	+10%
O&M Cost	-		+10%	-	+10%
Traffic Demand	-		-	-10%	-
EIRR	18.5%	17.4%	18.5%	16.8%	17.4%

Note: The case of 100% demand of Ochakov port capacity and free.

Source: JICA Survey Team

11.3 Financial Analysis

The FIRR is the rate of discount for which the present value of the net revenue stream becomes zero, or at which the present value of the revenue stream is equal to the present value of the cost stream. It should be compared with the opportunity cost of capital, or the weighted average cost of capital, to assess the financial sustainability of a project.

The results of the financial analysis show that the annual toll revenue is expected to compensate for annual maintenance cost, however, FIRR including initial investment cost was not available in all cases. It was the same result in the case of 50 years for the project evaluation.

11.4 Other Project Impacts

Other than these economic impacts, one of the positive impacts for the people in Mykolaiv is improvement of their environmental situation, such as less air pollution and noise caused by heavy vehicles. On the other hand, one of the main negative impacts is water contamination of Southern Bug River during construction stage which should be carefully mitigated. Regarding air pollution and noise caused by heavy vehicle, it is recommended to execute a baseline survey along the trunk road M-14 in Mykolaiv city before the construction stage.

11.5 Justification of the Project

National road M-14 is a part of the international transport corridor between Europe and Asia (so called the Eurasian corridor) and also a part of the international corridor of the Black Sea Economic Cooperation (BSEC) . The amount of cargo transportation over M-14, especially in the Mykolaiv region, will increase with development of Ochakov port, in addition to the current rule of the road connecting the international port of Odessa in south-western Ukraine and industrialized cities along Dnieper River in south-eastern Ukraine.

In spite of the importance of the road M-14, the current route has a traffic bottleneck at the western part of Mikolaiv city, where the road passes the Southern Bug River with a rotating bridge, called Varvarovsky Bridge. At the bridge, the number of vehicles in 2010 was calculated at 11,000 per day in winter and 54,000 in summer, and around 30% of them were heavy vehicles. Currently Mykolaiv city is trying to maintain and renovate public transportation more ecologically by upgrading the tram and trolley bus, however, the actual situation is getting worse because of traffic jams, noise and air pollution caused by those heavy vehicles.

This project is to provide an M-14 bypass road in Mikolaiv including a construction work of a new Mykolaiv bridge on the Southern Bug River. It is expected that the Project will promote local employment and activate the local economy in the Mykolaiv region in addition to the expectation of resolving the above issues.

Ukraine is also important for Japan as one of the countries for diversification of sources of mineral imports. Mykolaiv Bridge is in a strategic position in relation to land and maritime transport. Therefore, the construction of the Mykolaiv Bridge is important for both countries: Japan will enjoy significant benefits from the project.

The technical feasibility of the main bridge construction is sufficiently high because the design method for a suspension bridge of this scale is established and there is no pronounced issue with execution of the construction work. However, it is recommended to adopt international tender for procurement of consultants and contractor(s) considering the lack of experience with suspension bridges among local consultants and contractors in Ukraine.

Regarding the environmental aspects, it is necessary to prevent river contamination and to protect fishery resources during the bridge construction work as stated in Chapter 6. The construction schedule for the bridge section must reflect these restrictions of river work from the environmental aspects as well as the navigation close in winter.

The average daily traffic in 2010 is around 27,600 vehicles at the existing bridge on Southern Bug River in Mykolaiv city. Based on the GDP growth rate of Ukraine (3.7～4.8% : by IMF), the future traffic demand is estimated to reach 37,400 vehicles per day in 2020, and 71,400 in 2040. Economic Internal Rate of Return (EIRR) is 18.6% (toll free and 100% demand of Ochacov port capacity case) based on the benefits and the project cost shown in Chapter 9. The benefits are calculated from the effect on travel time and cost reduction for the vehicles whose drivers choose the new Mykolaiv Bridge instead of the existing bridge (based on the result of the traffic interview survey done by the JICA Study team).

The discount rate for Ukraine is 12% (percentage for "low middle income country") by World Bank (WB) and 8% (percentage for "middle class country) by Asian Development Bank (ADB). Compared to these discount rates, EIRR calculated for this project is sufficiently high, therefore the economic feasibility of the Project is positive and the Project is economically viable.

11.6 Conclusions

In this preparatory survey, the objective, outline, cost, schedule, procurement method, execution, maintenance and operation structure and environmental issue of the Mykolaiv bridge project, and the request from the Ukrainian side, are clarified through field surveys and review of the existing feasibility studies. An implementation plan for the Project is also proposed in order to provide basic data for appraisal of the Japanese Yen Loan application.

As the consequence of this survey, it is concluded that:

(1) The Project is technically and economically feasible

(2) The location of the Mykolaiv Bridge shall be the same location selected by the "Feasibility Study in 2003" (Route 2). However, the alignment of the approach road has to be adjusted considering the latest city plan of Mykolaiv.

(3) The minimum navigation width at the bridge site shall be 240m according to the recommendation by the State Enterprise "Ukrainian Water Way" who has an authority to specify the navigation clearance for each river. Considering this minimum navigation width, a suspension type bridge with centre span of 510m is most appropriate for the main bridge from comprehensive evaluation consdering construction cost, navigation safety, merits for Ukraine (less environmental effect and possibility of technical transfer), aesthetic features, construction difficulty and maintenance cost.

(4) The execution agency for this project will be the State Road Administration of Ukraine (Ukravtodor). In case of applying a Japanese Yen Loan, it is expected the procurement of consultants for preparation of tender documents will be scheduled in July 2013, and procurement of contractor for construction of the bridge will be scheduled in March 2015.

11.7 Recommendations

As the consequence of this survey, the following are recommended by the survey team.

(1) It is necessary to prevent river contamination and to protect fishery resources during the bridge construction work considering environmental requirements. The construction schedule for the bridge section must reflect these restrictions of river work from the environmental aspects as well as the navigation close in winter.

(2) It is recommended to adopt international tender for procurement of consultants and contractor(s) considering the lack of experience with suspension bridges among local consultants and contractors in Ukraine.

(3) Support by the consultant who carried out the preliminary design will be necessary for the local consultant who is responsible to implement the feasibility study (project documentation) to get approval from concerned Ministries, and after that, from the Cabinet of Ministers of Ukraine.

PREPARATORY SURVEY
ON
THE PROJECT
OF
CONSTRUCTION OF MYKOLAIV BRIDGE
IN
UKRAINE

FINAL REPORT

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AASHTO..... American Association of State Highway and Transportation Official
AADT..... Annual Average Daily Traffic
ADB ..... Asian Development Bank
AHP..... Analytic Hierarchy Process
B/C ..... Benefit per Cost ratio
BOD ..... Biochemical Oxygen Demand
BOT..... Built Operation Transfer
BQ ..... Bill of Quantities
BS..... Baltic System (of Heights)
BSEC..... Black Sea Economic Cooperation
CBA..... Cost Benefit Analysis
CBD..... Central Business District
CEC ..... Commission of the European Community
CIF, C.I.F..... Cost, Insurance and Freight
CIS..... Commonwealth of Independent States
COD ..... Chemical Oxygen Demand
CoE..... Council of Europe
CPI..... Consumers Price Index
CPS..... (The World Bank's) Country Partnership Strategy
DAC ..... Development Assistance Committee
DBN ..... State Building Codes of Ukraine
DCP ..... Dynamic Cone Penetration Test
DD, D/D ..... Detailed Design
DSTU ..... State Standards of Ukraine (Derzhavni Standarty Ukrainy)
EBRD ..... European Bank for Reconstruction and Development
EIA ..... Environmental Impact Assessment
EIB ..... European Investment Bank
EIRR..... Economic Internal Rate of Return
EMP..... Environmental Management Plan
ENP ..... European Neighbourhood Policy
EU..... Europe Union
FIRR..... Financial Internal Rate of Return
FOB, F.O.B..... Free On Board
FS, F/S..... Feasibility Study
GDP..... Gross Domestic Product
GNI..... Gross National Income
GNP..... Gross National Product
GOST ..... Russian State Standards
GRDP ..... Gross Regional Domestic Product
IBRD ..... International Bank for Reconstruction and Development
IMF..... International Monetary Fund
I-O Table..... Input-Output Table
IUCN ..... International Union for Conservation of Nature and Natural Resources
JBIC..... Japan Bank for International Cooperation
JETRO..... Japan External Trade Organization
JICA ..... Japan International Cooperation Agency
JPY ..... Japanese Yen
MAC..... Maximum Acceptable Concentration
NASU ..... National Academy of Sciences of Ukraine

NPV ..... Net Present Value
O&M ..... Operation and Maintenance
OD ..... Origin and Destination
ODA ..... Official Development Assistance
OECD ..... Organisation for Economic Co-operation and Development
PAP ..... Project Affected People
PC ..... Pre-stressed Concrete
PCU ..... Passenger Car Unit
PFI ..... Private Finance Initiative
PPP ..... Public Private Partnership
QV ..... Quantity-Velocity
RAP ..... Resettlement Action Plan
ROW ..... Right of Way
SCF ..... Standard Conversion Factor
SES ..... Sanitary Epidemiological Service
SEZ ..... Special Economic Zone
SNiP, SNIP ..... Russian Industry Standards
SPC ..... Special Purpose Company
SPSP ..... Steel Pipe Sheet pile.
SPT ..... Standard Penetration Test
SRA ..... State Road Administration (UKRAVTODOR)
TDS ..... Total Dissolved Solids
TEU ..... Twenty-foot Equivalent Unit
TTC ..... Travel Time Cost
UAH ..... Ukrainian Hryvnia (Grivna)
UN ..... United Nations
UNHCR ..... United Nations High Commissioner for Refugees
UNICEF ..... United Nations Children's Fund
USAID ..... United States Agency for International Development
USD, US$ ..... United States Dollar
USSR ..... Union of Soviet Socialist Republics
VAT ..... Value Added Tax
VOC ..... Vehicle Operation Cost
WB ..... World Bank

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1 Background of the Survey

Ukraine is located in Eastern Europe and is surrounded by seven countries; Romania, Moldova, Slovakia, Hungary, Poland in the west, Belarus in the north, and Russia in the east, as well as the Black Sea in the south. In order to exploit this geographical condition, the Government of Ukraine established the "Comprehensive Program for Consolidation of Ukraine as a Transit Country for 2002-2010" which indicates the importance of establishing an international trunk road providing a new traffic system for cross-border logistics. The current trunk road development plan in Ukraine is based on this Program.

The road M-14 is one of the most important trunk roads in the Ukraine, connecting the western border (with Romania and Moldova) and eastern border (with Russia) through cities in southern Ukraine, such as Odessa and Mykolaiv. M-14 is also a part of the international corridor of the Black Sea Economic Cooperation (BSEC). However M-14 suffers serious traffic jams because of the number of heavy vehicles, even transit cargo, that must pass through the downtown portion of Mykolaiv city and the existing swing-bridge (Varvarovsky Bridge).

In order to solve the above problems, the Government of Ukraine planned a bypass project to detour around the downtown area of Mykolaiv. However, the project for the new bridge across the Southern Bug River (Mykolaiv Bridge) has not been started because of lack of funds, consequently all vehicles must still pass over the existing swing-bridge to cross the river in Mykolaiv.

In 2005, the Government of Ukraine requested Japan to apply a Yen Loan for the Mykolaiv bridge project (hereinafter called "the Project"). In response to this request, the Government of Japan sent the TOR Mission to Ukraine and agreed to the scope of the "Preparatory Survey on the Project of Construction of Mykolaiv Bridge in Ukraine" (hereinafter called "the Survey"), as stated in the Minutes of Meeting of August 5, 2010. According to the minutes, the preparatory survey started on November 10 in order to review and update the Feasibility Study Report for the Mykolaiv Bridge undertaken in 2003.

1.2 Objective of the Survey

The overall goal of the Project is to secure the function of the M-14 as a part of the Europe-Asia Corridor (Eurasian Corridor) and to improve the civil life in Mykolaiv. If the Project is realized, it is expected that;

- An effective transportation route for cargo will be secured
- Serious traffic jams will be dissolved

- Civil life in Mykolaiv will be improved
- Share of traffic on the existing swing-bridge will be alleviated

In the Survey, the profile and objectives of the above project will be confirmed through analyzing the economic and technical aspects of the project along with socio-environmental considerations. The Environmental Impact Assessment Report, conducted by Mykolaiv city in 2004, will be reviewed based on the relevant law in Ukraine and the JICA Environmental Guideline (Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations April 2002).

The Survey area is Mykolaiv city as shown in the "Project Location Map".

The outcomes of the Survey will be referred to appraise the feasibility of the project as a Japanese ODA Loan project. It is important for both sides to understand that no commitment has yet been made concerning the realization of the Project at the stage of this survey.

1.3 Structure of the Report

This Final Report for "the Preparatory Survey on the Project of Construction of Mykolaiv Bridge" is composed of the following eleven chapters.

In Chapter 1 "Introduction", the background and objectives of this survey was overviewed.

Chapter 2 "Comprehension of Background of the Project" includes review of related national development plans, socio-economic data of Mykolaiv region, expected benefit for Japan and standards for roads and bridges.

The results and/or current progress of natural condition surveys and traffic surveys are stated in Chapter 3 "Natural Condition Survey at the Project Site" and Chapter 4 "Traffic Survey and Traffic Demand Forecast".

Chapter 5 "Applicable Route and Bridge Type" is the main part of this Final Report including review of existing F/S and proposing the most feasible bridge type.

The results of Environmental Impact Assessment (EIA) and the contents of Technical Assistance to SRA related to the EIA are stated in Chapter 6 "Technical Assistance to SRA on Environmental Issue".

The result of preliminary Design is compiled in Volume 2 "Preliminary Drawings" and from Chapter 7 to Chapter 9, namely "Construction and Procurement Plan", "Project Implementation and Operation Plan" and "Project Cost Estimation".

Chapter 10 includes "Considerations to Apply Japanese ODA Loan" and finally "Project Evaluation and Conclusions" are stated in Chapter 11.

Other information such as meeting minutes and corresponding letters related to the Project are indicated as the Appendices.

CHAPTER 2

COMPREHENSION OF BACKGROUND OF THE PROJECT

2. COMPREHENSION OF BACKGROUND OF THE PROJECT

2.1 Related Development Plans and International Assistance

2.1.1 Relevant National Development Plans

2.1.1.1 Program of Economic Reforms 2010-2014[1]

The proposed Program of Reforms was developed as part of fulfilment of the task of economic recovery and modernization the country's economy, posed by the President of Ukraine. According to the instruction of the President of Ukraine Viktor Yanukovych, Cabinet of Ministers adopted the National Action Plan for 2011 to implement the Program of economic reforms in 2010-2014: "Prosperous society, competitive economy, effective government".

The reforms are designed to facilitate building of a modern, sustainable, open and globally competitive economy, establishment of a professional and effective system of public administration, and, eventually, improvement of the wellbeing of the Ukrainian nation.

The Program encompasses a wide range of strategic transformations; it is mentioned that upgrading of infrastructure and primary economy sectors by way of elimination of long-standing structural problems in energy, coal, oil and gas industries and in housing and utilities sectors, as well as the development of the transportation infrastructure and land market.

For the transportation infrastructure development, the purpose of the reform is in improvement of the present and construction of the new transportation infrastructure for satisfaction of the needs for economic development and improvement the quality of life of population. To meet the objective of the Reform, the following tasks should be fulfilled:

- increase of the volume of funds allocated for development of the state portion of the infrastructure
- creation of favorable terms for attraction of private investments
- development and implementation of complex program on privatization and development of maritime ports
- increasing the responsibility of the local authorities for the situation with the local infrastructure assets.

In order to improve the management in railway and road-transport sectors, it is necessary to take the following steps:

[1] "PROGRAM OF ECONOMIC REFORMS 2010-2014",Committee on Economic Reforms under the President of Ukraine ,7 July 2010

- distribution in railways and "Ukrzaliznytsia" functions of the state and economic management;
- realization of reforming of railway taking into consideration its functioning specifics;
- enhancing the efficiency of corporate governance
- allocation of non-core assets and further partial or full privatization of segments that are not natural monopolies
- providing private operators with non-discrimination access to infrastructure networks.

2.1.1.2 Comprehensive Program for Consolidation of Ukraine as a Transit Country for 2002-2010

The goal of the Comprehensive Program for Consolidation of Ukraine as a Transit Country for 2002–2010 is to ensure the optimal use of the available infrastructure and further development of Ukraine's transit potential by creating favourable conditions for participants in transit transportations, increasing foreign currency proceeds from exports of transport and other services.

In the road sector, the main goal is creation of a developed network of modern automobile roads, which will help to establish stable socio-economic development of the state, integrate Ukraine into the European Community, stimulation of development of production sectors, work creation and accomplishment of social tasks, and development of regions. Activities of the road complex are directed to solve such problems as:

- Construction of new and reconstruction of existing automobile roads, which correspond to routing with international transport corridors, and integration of automobile roads of Ukraine into the international network.
- Implementation of the most significant investment projects are directed to development of international transport corridors, development of tourist routes, and some road sections which require safety improving, including on a concessionary basis.
- Quality improvement of construction, repair and maintenance of automobile roads.
- Implementation of modern technologies for execution of construction and repair work.

For example, development of the highway link between the capital city of Kiev and European countries, also route M-14 which connects the port of Odessa and Russian territory along the Black Sea coast are included in this program.

2.1.1.3 State Program for the Development of Public Highways for 2007-2011[2]

The National Development Plan in the road sector in Ukraine, the "State Program for the Development of Public Highways for 2007-2011" was established in August 2003 and approved by the Cabinet of Ukraine in April 2006. This program is based on the "Comprehensive Program for Consolidation of Ukraine as a Transit Country for 2002-2010".

The program seeks to improve traffic safety, speed, comfort and economy for passengers and goods by road. It also seeks to improve transportation operational condition of roads, bridges and road infrastructure. The goal of the plan is to ensure the orderly development of the road network, improvement and enhancement of competitiveness of road transport, promotion of tourism and socio-economic development, and environmentally sustainable development.

[2] Source: Parliament of Ukraine Website

So as to solve the problems pertinent to the current state of the road network, the following goals were stated under the program;

- Improvement of road safety and environmental safety of highways,
- Development of roads that combine with the international transport corridors,
- Development of the rural road network,
- Improvement of transportation operational condition of roads,
- Improvement of roads through the introduction of advanced design solutions and modern technologies,
- Development of road infrastructure and improving the information support for road users,

The action plan is as follows;

- Prevent destruction of the road network and ensure its effective functioning
- Development of the road network
- Improving road safety, road service and information support to road users
- Environmental protection in the designing, construction, reconstruction, repair and maintenance of roads to meet the needs of the country's ecological network
- Strengthening innovation and investment
- Institutional change and improvement of the legal control of traffic management
- Openness and transparency in the management bodies
- Social security and training

The budget for recent 5 years is summarized in Table 2.1.1. The budget allocated for development of the network and maintenance of public roads is approximately 4 to 5 billion UAH in each year. It consists of 60 % for construction, reconstruction, repair and maintenance of principal roads, and 30 % for local roads. Also 6 to 7 % of the budget is allocated for capacity building of the road sector.

Table 2.1.1 Budget for Development of the Network and Maintenance of Public Roads for 2007-2011

Unit ; Million UAH

Source and Purpose of Budget \ Year	Total	2007	2008	2009	2010	2011
Special Fund of the State Budget	33,376.6	5,149.9	6,389.7	6,837.0	7,281.5	7,718.5
(Brakedown) Development of the Network and Maintenance of Public Roads	22,566.0	4,086.1	4,784.0	4,806.0	4,554.7	4,335.2
(Brakedown) **Construction, Reconstruction, Repair and Maintenance of Principal Roads**	**13,966.1**	**2,341.6**	**3,031.6**	**3,040**	**2,857**	**2,695.9**
(Brakedown) Construction and Reconstruction	3,822.6	653.9	820.4	835.2	807.8	705.3
(Brakedown) Capital Repairs	3,344.6	525.2	819.2	801.3	638.9	560
(Brakedown) Co-financing of Joint Projects with International Financial Institutions and Groups of Project Management	1,097.4	209.7	395.2	343.6	148.9	
(Brakedown) Capital Repairs of Other Roads	2,247.2	315.5	424.0	457.7	490.0	560
Current Repair and Maintenance	6,798.9	1,162.5	1,392.0	1,403.5	1,410.3	1,430.6
Construction, Reconstruction, Repair and Maintenance of Local Roads	**6,978.4**	**1,434.3**	**1,435.2**	**1,442**	**1,366**	**1,300.6**
(Brakedown) Construction and Reconstruction	2,167.2	430.0	512.6	504.6	400.0	320.0
(Brakedown) Capital Repairs	1,248.9	265.0	222.2	231.7	260.0	270.0
(Brakedown) Current Repair and Maintenance	3,562.3	739.4	700.4	705.5	706.4	710.6
Development of Productive Capacities of Road Maintenance Organizations	**1,450.0**	**280.0**	**285.0**	**290.0**	**295.0**	**300.0**
Development of Productive Capacities of Scientific-research. Design Institutes and Other Organizations of Road Sector	**50.0**	**10.0**	**10.0**	**10.0**	**10.0**	**10.0**
Applied Scientific Developments of Road Facilities	**81.2**	**12.7**	**14.5**	**16.2**	**17.9**	**19.9**
Support of Medical Institutions related to Road Sector for Rehabilitation of Participants in Post-accident Clean-up at the Chernobyl Atomic Power Plant	**35.8**	**6.5**	**6.8**	**7.1**	**7.5**	**7.9**
International and Concessionary Activities	**4.5**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**
Repayment of Credit obtained under the Guarantee of the Cabinet of Ministry of Ukraine	10,810.6	1,063.8	1,605.7	2,031.0	2,726.8	3,383.3
Local Budgets for Construction, Reconstruction, Repair and Maintenance of Local Roads	2,481.1	431.2	464.0	496.5	528.8	560.6
Total	35,857.7	5,581.1	6,853.7	7,333.5	7,810.3	8,279.1

Source: Parliament of Ukraine

The scope for the development of major trunk roads is shown in Table 2.1.2. The planned road network development up to the year 2011 is approximately 4,500 Km in length and 31 billion UAH.

As shown in the Table, the amount of financial resources of concessionaires[3] is increasing and the amount of credit funds is decreasing. Also the amount of finance from international financial organizations is decreasing and the amount of foreign credits is stable at the amount of 2 billion UAH.

New construction projects are the Ring Road of Kiev and Mykolaiv Bridge. The project of Kiev Ring Road is carried out under concession fund.

[3] Concession : in the case of a public service concession, a private company enters into an agreement with the government to have the exclusive right to operate, maintain and carry out investment in a public utility (such as a toll road) for a given number of years.

Table 2.1.2 Scope for the Development of Major Trunk Roads in 2007-2011

Unit ; Million UAH

	Route No.	Name of Road (Road section)	Region	Year / Length (Km)	Total	2007	2008	2009	2010	2011	Comp-letion
Financial Resources of Concessioners for Construction of Automobile Roads				1857.9	13041	55	1260	2380	3810	5536	
(Brakedown)		01) Lviv-Krakovets	Lviv region	84.4	981	50	120	190	270	351	2011
		02) Scherbakivka– (Kiev–Kharkiv– Dovzhanskiy)	Kharkiv region	48.7	1080		60	280	360	380	2011
		03) Lviv - Brody	Lviv region	78.8	775	5	60	180	250	280	2012
		04) Brody - Rivne	Rivnenska region	48	860		20	180	290	370	2012
		05) Vinnitsa - Kyiv	Vinnitsa region	50	250			50	100	100	2015
			Zhitomir region	50	5					5	2015
			Kyiv region	46	90				40	50	2015
		06) High ring road around Kiev City	Kyiv region	206	5700		1000	1000	1400	2300	2015
		07) Lviv-Ternopil-Vinnitsa-Uman- Znamyanka-Dnipropetrovsk	Lviv region	50	300			100	100	100	2014
			Ternopil region	50	250				100	150	2015
			Khmelnitsk region	132	250				100	150	2016
			Vinnitsa region	143	600			200	200	200	2017
			Cherkassy region		600			200	200	200	2012
			Kirovograd region		150				50	100	2014
		08) Novomoskovsk-Zaporizhya-Melitopol-Djankoy-Simferopol	Dnipropetrovsk region	46	200				50	150	2015
			Zaporizhya region	194	350				100	250	2016
			Kherson region	60	150				50	100	2017
			Autonomous Republic of Crimea	120	150				50	100	2017
		09) Odesa - Reni	Odesa region	327	300				100	200	2016

Table 2.1.2 Scope for the Development of Major Trunk Roads in 2007-2011(Continued)

Unit ; Million UAH

	Route No.	Name of road (road section)	Region	Year Length (Km)	Total	2007	2008	2009	2010	2011	Comp-letion
Credit Funds				2641.2	17925.3	5561.9	3950.9	3693.1	2719.4	2000	
(Brakedown)	M-02	10) Kipty – Gluhiv Bachivsk (to Bryansk)	Chernigiv region	93	693	693					2007
			Sumy region	98	625	625					2007
	M-03	11) Kyiv – Kharkiv – Dovjanskiy (to Rostov-na-Donu)	Kyiv region	87	1256		351.8	417.2	487		2010
			Poltava region	31	279		100	100	79		
			Poltava region	216	370	170				200	2016
			Kharkiv region	91	380				180	200	2016
	M-04	12) Znamyanka-Lugansk-Izvarine (to Volgograd through Dnipropetrovsk, Donetsk)	Dnipropetrovsk region	153	720		20	225	225	250	2016
			Donetsk region	187	1140	250	30	300	260	300	2013
			Lugansk region	130	968	238	30	245	205	250	2018
	M-05	13) Kyiv - Odesa	Kyiv region	140	883			350	283	250	2012
			Cherkassy region	20	200			100	100		2010
			Odesa region	60	972	442	530				2008
	M-06	14) Kyiv – Chop (to Budapest through Lviv, Mukacheve, Uzhgorod)	Kyiv region	54	510			200	200	110	2011
			Zhitomir region	172	1363.4		660	700	3.4		2010
			Rivne region	188	1349.8	455.5	624.4	270.9			2008
			Lviv region	183	472.1	407.4	64.7				2008
	M-07	15) Kyiv – Kovel – Yagodin (to Lublin)	Kyiv region	3	20	20					2007
			Zhitomir region	120	791	200	189	200	117	100	2011
			Rivne region	87	330	80	60	100	90		2010
			Volyn region	133	360	60	60	100	140		2010
	M-12	16) Lviv -Kirovograd - Znamyanka (bypass Grozdevo)	Cherkassy region	5	75	75					
	M-14	17) Odessa- Melitopol-Novoazovsk (to Taganrog)	Mykolaiv region	10	200	100	100				2008
			Kherson region	18	306	70	236				2008
	H-05	18) Krasnoperekopsk-Simferopol	Autonomous Republic of Crimea	115	300	70	20	70	70	70	2014
		(Landslide control works)	Autonomous Republic of Crimea		390	250	110	10	10	10	2011
	M-18	19) Kharkov- Simferopol-Alushta - Yalta	Autonomous Republic of Crimea		50	50					
	P-51	20) Kharkiv- Krasnograd-Pereschepine	Kharkiv region	122.6	1037	622	415				2008
		Pereschepine- Novomoskovsk	Dniepropetrovsk region	30.6	500	500					2007
	P-52	21) Dniepropetrovsk-Tsarichanka- Kobelyaki-Reshetilivka	Dniepropetrovsk region	19	270			50	60	160	2011
			Poltava region	75	210				60	100	2012
	-	(Liquidation of dangerous sections with high concentration of road traffic accidents)			505		150	205	150		2009
	-	(Acquisition of equipment and facilities for repair and maintenance of roads)			400	200	200				
	Finances of International Financial Organizations				5225.3	861.9	1950.9	1693.3	719.4		
	Foreign Bonds for Development of Trunk Roads and Procurement of Technological Equipment				12700	4700	2000	2000	2000	2000	
Total				4500.1	30966.3	5616.9	5210.9	6073.1	6529.4	7536	

Source: Parliament of Ukraine

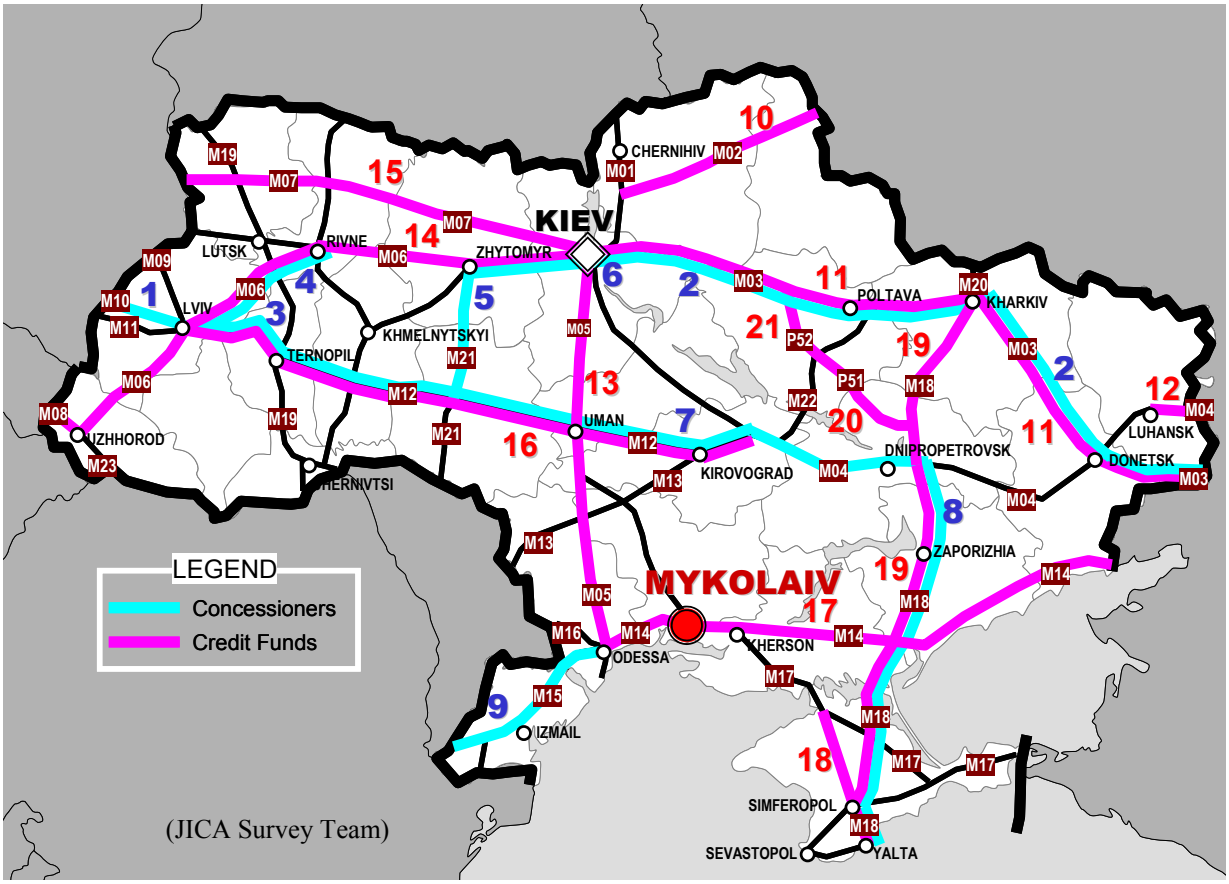


Figure 2.1.1 Scope for the Development of Major Trunk Roads in 2007-2011

The scope for the development of rural roads is shown in Table 2.1.3. The planned road network development up to the year 2011 is approximately 2,600 Km in length and 7 billion UAH. Budget in each year is planned for approximately 1.4 billion UAH.

Table 2.1.3 Scope for the Development of Rural Roads in 2007-2011

Unit : Km (Length), Million UAH (Budget)

Type of Work	Total		2007		2008		2009		2010		2011	
	Length	Budget	Length	Budget	Length	Budget	Length	Budget	Length	Budget	Length	Budget
Construction and Reconstruction of Roads	1443.9	2157.2	187	420	515.7	512.6	381.2	504.6	200	400	160	320
Capital Repairs of Roads	1136	1258.9	220	275	215	222.2	218	231.7	240	260	243	270
Current Repair and Maintenance of Roads		3562.3		739.4		700.4		705.5		706.4		710.6
Total	2579.9	6978.4	407	1434.4	730.7	1435.2	599.2	1441.8	440	1366.4	403	1301

Source: Parliament of Ukraine

The scope of construction and repair of rural roads is shown in Table 2.1.4. The plan for the period of the years from 2007 to 2009 is 370 section, 1.2 billion UAH.

Table 2.1.4 Scope of Construction and Repair Works including Construction of Approach Hard-Surface Roads to Rural Communities

Unit ; Million UAH

Name of the Region	Total		2007		2008		2009	
	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Autonomous Republic of Crimea	6	0.7	4	0.3	2	0.4		
Volyn region	1	2.1	1	2.1				
Zaporizhzhya region	1	2.3	1	2.3				
Lugansk region	5	20.3	3	13.5	2	6.8		
Lviv region	15	25.9	9	12.2	6	13.7		
Mykolaiv region	8	68.0	4	13.8	1	3.2	3	51.0
Odesa region	30	185.8	8	36.4	9	66.8	13	82.6
Poltava region	9	24.4	4	16.3	5	8.1		
Rivne region	31	124.5	10	36.6	21	87.9		
Sumy region	89	77.7	25	15.7	38	30.0	26	32.0
Ternopyl region	2	8.4	1	2.7	1	5.7		
Kharkov region	45	115.6	13	41.0	26	55.7	6	19.0
Khmelnitsk region	5	17.4	1	0.5	4	16.9		
Chernovtsy region	8	35.7	3	7.7	5	28.0		
Chernigiv region	115	494.3	23	59.3	35	205.0	57	230.0
Total	370	1203.2	110	260.4	155	528.1	105	414.6

Source: Parliament of Ukraine

Financial resources of the above plan are a Special fund of the state budget, Local budgets and other sources. The amount and the break down in each year are summarized in Table 2.1.5.

Table 2.1.5 Approximate Volume and Source of Financing for Public Road Development for 2007-2011 (Million UAH)

Unit ; Million UAH

Year / Source of Financing for Works			Total	2007	2008	2009	2010	2011
Special Fund of the State Budget			33376.6	5149.9	6389.7	6837	7281.5	7718.5
(Brakedown)	Excise Duties from Produced Petroleum Products and Transport Facilities		12825	1989.8	2452.8	2624.5	2795.1	2962.8
	Excise Duties from Imported Petroleum Products and Transport Facilities		4885.2	757.9	934.3	999.7	1064.7	1128.6
	Import Duties for Petroleum Products, Transport Facilities and Tires		15483.4	2402.2	2961.2	3168.5	3374.5	3577
	Road Toll Collections including Fees charged at Border Checkpoints		153.6		34.8	37.2	39.6	42
	Road Toll for use of Roads by Cargo Vehicles and Other Mechanical Vehicles and Machines which don't exceed Specified Parameters. at Border Checkpoints		29.4		6.6	7.1	7.6	8.1
Local Budgets for Construction, Reconstruction, Repair and Maintenance of Local Roads			2481.1	431.2	464	496.5	528.8	560.6
(Brakedown)	Tax from Owners of Cargo Vehicles and Other Mechanical Vehicles and Machines		2405.1	418	449.8	481.3	512.6	543.4
(Brakedown)	Fee for Purchasing of Trade Patents by POS Terminals of Petroleum Products (Gasoline Service Stations, Petrol Filling Stations)		76	13.2	14.2	15.2	16.2	17.2
Other Sources for Trank Road Development			30966.3	5616.9	5210.9	6073.1	6529.4	7536
(Brakedown)	Financial Resources of Concessioners for Construction of Automobile Roads		13041	55	1260	2380	3810	5536
	(Brakedown)	Lviv – Krakovets	981	50	120	190	270	351
		Scherbakivka – (Kiev – Kharkiv – Dovzhanskiy)	1080		60	280	360	380
		Lviv – Brody	775	5	60	180	250	280
		Brody - Rivne	860		20	180	290	370
		Vinnitsa – Kiev	345			50	140	155
		High ring road around Kiev City	5700		1000	1000	1400	2300
		Lviv – Ternopil – Vinnitsa – Uman – Znamyanka - Dnipropetrovsk	2150			500	750	900
		Novomoskovsk- Zaporizhya- Melitopol- Djankoy- Simferopol	850				250	600
		Odesa – Reni	300				100	200
	Credit Funds		17925.3	5561.9	3950.9	3693.1	2719.4	2000
	(Brakedown)	Credit of European bank for Reconstruction and Development under the Second Project "Repair of the Automobile Road Kiev- Chop"	472.1	407.4	64.7			
		Credit of European bank for Reconstruction and Development under the Third Project "Repair of the Automobile Road Kiev- Chop"	1356.6	217.1	651.5	484.6	3.4	
		Credit of European Investment Bank under the Third Project "Repair of the Automobile Road Kiev- Chop"	1356.6	237.4	632.9	486.3		
		Credit of the World Bank	2040		601.8	722.2	716	
		Foreign Credits for Development of Trunk Roads and Procurement of Technological Equipment	12700	4700	2000	2000	2000	2000
Total			66824	11198	12064.6	13406.6	14339.7	15815.1

Source: Parliament of Ukraine

Amount of expenditures for repayment of loans obtained for development of the road network for the year 2007 to 2011 are shown in Table 2.1.6.

Table 2.1.6 Calculation of Depth of Obligations under Loans Obtained for Development of The Road Network for 2007- 2011

Unit : Million UAH

Name and Amount of the Loan		Total	2007	2008	2009	2010	2011
Execution of Debt Obligations on the Account of Money of Special Fund of the State Budget		10810.6	1063.8	1605.7	2031	2726.8	3383.3
(Break down)	Loan from European bank for Reconstruction and Development under the Project "Renewal of the highway M-06 Kiev – Chop and Reforming of Financing of the Road Sector" (75 Million Euro)	341.4	74.8	72.2	68.1	64.8	61.5
	Loan from European Bank for Reconstruction and Development under the Second Project "Repair of the Automobile Road Kiev-Chop" (100 million Euro)	409.6	20	101	100.3	96.2	92.1
	Loan from Doyche Bank AG under the Project of Reconstruction of the automobile Road Kiev – Odesa (480 Million US Dollars)	3181.7	756.2	708.9	640.2	572.2	504.2
	Loan from Doyche Bank AG under the Project of Reconstruction of the automobile Road Kiev – Odesa (100 Million US Dollars)	470.6	52.8	56.5	128.5	120.4	112.4
	Loan in Accordance with Article 15 of the Law of Ukraine "On the State Budget of Ukraine for 2006" (1800 million UAH)	1399	153.7	164.3	292.7	405.1	383.2
	Loan from European bank for Reconstruction and Development under the Third Project "Repair of the Automobile Road Kiev-Chop" (200 Million Euro)	449.3	1.5	23.8	67	152.4	204.6
	Loan from European Investment Bank under the Third Project "Repair of the automobile Road Kiev-Chop" (200 million Euro)	357	4.8	23.3	62.9	90.5	175.5
	Loan from the World Bank (400 Million US Dollars)	422.9		19.1	80.5	142.7	180.6
	Loans from foreign Banks that will be Obtained for Development of Trunk Roads and Procurement of Technological Equipment during 2007-2011	3779.1		436.6	590.8	1082.5	1669.2

Source: Parliament of Ukraine

2.1.2 Development Plans in Mykolaiv City[4]

(1) Economic and Social Development Plans of Mykolaiv City in 2010

The economic and social development of multiple sectors is provided for the normalization of city functions, securing of the trends of growth of the city economy and environmental recovery. In the transportation sector, ways of resolving the principal problems are to achieve the renewal, modernization and stable operation of the public transport of the city.

Objectives of the plan for the transportation sector are as follows;

- Perfection of organization of management of the transport complex of the City,
- To improve the quality of services rendered to the passengers at the given price of transportation services,
- Achievement of the proper rational interrelationship between the various types of transport facilities involved in the city transportation,
- Improvement of the transportation networks to provide the regular transportation services to the remote areas of the city; organization of the socially important routes of the public transportation with consideration for interests of the people that are entitled to discounts and privileges ,
- Creation of unified traffic services,
- Creation of an attractive investment environment and securing of guarantees of return on investments by enterprises.

(2) City Development Programs in 2011-2014

Currently ongoing city development programs are listed as the City Development Programs in 2011- 2014 in Table 2.1.7. Of particular relevance to the traffic and transportation sector are the plans for the development of public transportation and improvement of traffic safety.

In the road transportation sector, the emphasis has been placed on improvement of road safety and traffic capacity such as installation of walkways, introduction of one-way regulations, prohibition of on-street parking, and improvement of public transportation services such as updating trams and trolley buses.

Table 2.1.7 List of Transportation Development Programs in Mykolaiv City in 2011- 2014

Name of the Program	Jurisdiction	Date and No Registered
Program on Developing of Electric Transport in 2007-2015 in Mykolaiv City	Department of Passenger Transportation, Communication and Developing Telecommunications	04.07.07 №13/39
Program on Developing of Automobile Transport of General Usage in 2008-2015 in Mykolaiv City	Department of Passenger Transportation, Communication and Developing Telecommunications	28.02.08 №22/10
Development Program of Road Traffic Safety in Mykolaiv City in 2008-2012	Department of Passenger Transportation, Communication and Developing Telecommunications	28.02.08 №22/11

Source: Mykolaiv City Council

[4] Source: Mykolaiv City Council Website

(3) Development of Electric Transport in Mykolaiv City for 2007- 2015

"Development of Electric Transport in Mykolaiv City for 2007- 2015" was established for the Transportation sector in 2006.

The main target and programs are summarized below;

- The purpose of the program is to create appropriate conditions for the provision of high quality transportation services, trams and trolleybuses to ensure continuous operation and further development of urban electric transportation.
- The priority of its development in cities is due to the increased level of pollution in areas of mass rest and dense residential development.

The Program will be implemented in two stages;

The first phase (2007-2010)

- Development of primary regulations for the effective functioning of municipal electric transportation in a market economy,
- Improve the financial condition of the company "Mykolaivelektrotrans". This will be particularly implemented through economic compensation of reasonable costs of provision of transport services,
- Improvement of integrated circuits for development of urban passenger transport and patterns of movement,
- Eliminate unnecessary duplication of private transporters' tram and trolley bus routes,
- Development of new types of rolling stock, making proposals to introduce new energy saving technologies in manufacturing, construction, reconstruction and modernization of urban electric transportation,
- Stop further reduction in park trams and trolleybuses.

The second phase (2011- 2015)

- Increase the standard of quality transport services by "Mykolaivelektrotrans",
- Modernization and technical re-rolling of urban electric transportation to reduce its energy consumption,
- Replacement of worn-out trams and trolley buses with modern rolling stock,
- Increase the length of the network of tram and trolleybus lines.

The state budget for development activities of urban electric transport for the previous four years is summarized in Table 2.1.8.

Table 2.1.8 The Estimated State Budget for Development Activities of Urban Electric Transport

Unit ; Million UAH

Measure		Total	2007	2008	2009	2010	2011-2015
Renewal of Tram Wagons		1884	144	160	180	200	1200
Renewal of Trolley-Buses		2184	156	208	221	234	1365
Construction and Reconstruction of the Tram Lines		161.55	20.6	19.95	31.85	28.4	60.75
Construction and Reconstruction of the Trolley-Bus Lines		503	41.4	49.4	46.65	62.4	303.15
Regulatory and Legal Framework for Functioning and Development of City Electric Transport		2.94	0.36	0.36	0.36	0.36	1.5
Scientific and Technological Provisions of Functioning and Development of City Electric Transport		26.99	4.6	4.65	3.5	2.95	11.29
Total		4762	367	442.4	483.4	528.1	2941.69
(Brakedown)	State Budget	2049.2	185	217	228.9	244.7	1173.62
	Local Budgets	2026.6	181	212.9	225.7	242	1165
	Other Sources	686.66	0.92	12.48	28.8	41.39	603.07

Source: Parliament of Ukraine

Upgrading trams and trolleybuses and construction and reconstruction programs for tram and trolleybus lines in Mykolaiv Region are listed in Tables 2.1.9 and 2.1.10.

Table 2.1.9 Renewal of the Park for Tram and Trolley-Bus Wagons in Mykolaiv

		Quantity that Needs to be Renewed	Total Amount of Financing. Millions UAH
Tram Wagons		54	108
Year	2007		
	2008	3	6
	2009	3	6
	2010	5	10
	2011-2015	41	82
Trolley Buses		64	41.6
Year	2007	4	2.6
	2008	6	3.9
	2009	7	4.55
	2010	7	4.55
	2011-2015	40	2.6
Total		118	149.6

Source: Parliament of Ukraine

Table 2.1.10 Renewal of the Park for Tram and Trolley-Bus Lines in Mykolaiv

		Length. Km	Total Amount of Financing. Millions UAH
Tram Lines		-	-
Trolley Bus Lines		35	35.5
Year	2007	-	-
	2008	2.3	2.3
	2009	4.4	4.4
	2010	4.4	4.4
	2011-2015	24.4	24.4
Total		35	35.5

Source: Parliament of Ukraine

(4) Development Program of Road Traffic and Road Traffic Safety in Mykolaiv City for 2008- 2012

The following measures pertinent to improvement of safety levels for road traffic will be undertaken under the program.

- Smoothing road traffic called "Greenway" for trunk roads
- Installation and replacement of road signs
- Installation of pedestrian fences
- Installation of guardrails
- Applying and renewal of road markings
- Installation of new traffic signals at 14 locations
- Repairing of traffic signals

Furthermore, the following tasks are to be undertaken for the period running from 2008 to 2012.

- Development of an automatic road traffic control system by using modern equipment
- Diverting the through traffic from the city centre by applying one-way traffic regulations
- Construction of parking lots off the streets and applying roadside parking tolls
- Construction of pedestrian subways
- Applying speed reduction rules in school zones
- Construction of pedestrian and bicycle passageways

2.1.3 Development Plan for Ochakov Port[5]

Ochakov Port Development Plan commenced under authorization of the Minister of Transport and Communication in 2008. Ochakov Port is located in the Dnepro-Bugskiy basin in Mykolaiv region in the North-East suburb of Ochakov town. The Project was brought to a standstill during the financial crisis.

According to this plan, additional land area of 40 hectares will be in-washed, the river bed and navigation canal of the port will be deepened by about 17 m, a railway line will be brought to port by an extension of 75 km and the highway will be repaired. Terminals for trans-shipment and storage of iron ore with a capacity of 15 million tonnes per year, coked coal and grain of 5 million tonnes per year each and the terminal for trans-shipment of containers with capacity of 3 million TEU are to be constructed in the port.

After developing the port of Ochakov, some of the shipping cargo is expected to shift from the port of Odessa to Ochakov, this will necessitate improvement of the land transport access to the industrial cities in the Eastern Ukraine through Mykolaiv City, and the inland waterway transport on Dnieper and Southern Bug Rivers through the port of Ochakov.

[5] Source: "Context-Prichernomorie" website

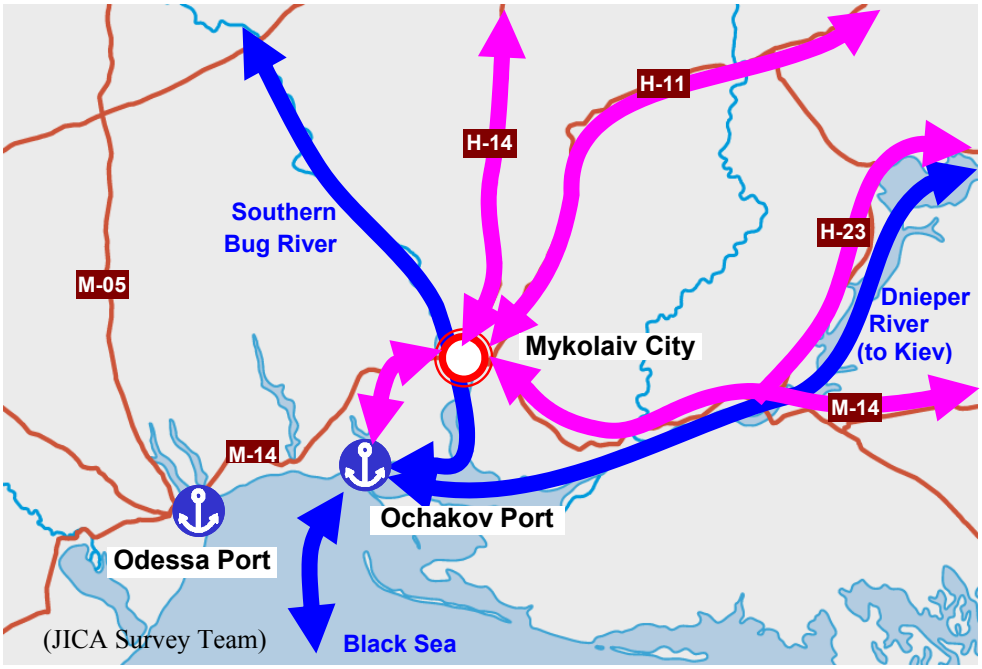


Figure 2.1.2 Location of Ochakov Port, Land and Inland Water Transport Network

Table 2.1.11 Estimated Future Turnover of Goods at Ochakov Port

Unit: 1000 Ton

Cargo	Stage I (2012)	Midterm perspective
Coking coal	1000	5000
Iron ore raw materials	5000	13000
Grain	1000	3000
Containers	5000 (500 th'd TEU)	20000 (2000 th'd TEU)
Total	12000	41000

Source: Mykolaiv State Government

2.1.4 Situation Pertaining to International Assistance to Ukraine

2.1.4.1 Japan's Assistance[6]

(1) Basic Policy

The Government of Japan has been offering multi-sector economic assistance to Ukraine to contribute to liberalization of the market and attainment of sustainable economic prosperity. The assistance extends into the development of various infrastructures as well as the agricultural sector. The assistance also includes technical transfer and capacity development in sustainable industry development, energy-saving technologies to improve energy efficiency and environmental pollution remediation.

[6] Source: ODA Data Book 2009. Ministry of Foreign Affairs of Japan

Table 2.1.12 Economic Assistance to Ukraine

(Expenditure basis. Unit: million US$)

	Loan	Grant Aid	Technical Assistance	Total
2004	-	-	-	-
2005	-	0.77	1.75	2.53
2006	1.34	3.37	1.88	6.59
2007	1.85	2.05	1.83	5.72
2008	1.56	4.76	2.10	8.42
Total	4.75	19.59	17.68	42.02

Source: OECD/DAC

(2) Results in 2008

For the year 2008, Japan's Official Development Assistance (ODA) to Ukraine was 4.76 million US$ in grant aid and 2.10 million US$ in technical assistance. By 2008, the total ODA extended to Ukraine since 2005 reached 42 million US$ including 4.75million US$ in loans, 19.59 million US$ in grant aid and 17.68 million US$ in technical assistance.

The grant aid extends to the field of democratic environment, with grant assistance provided for grass-roots human security projects in the medical sector to support life, environmental improvement in radioactive contamination and medical equipment improvement in hospitals.

The technical assistance extends to the field of administrative training and involves dispatch of experts in civil contribution.

2.1.4.2 Foreign Countries' Assistance

(1) The European Union (EU)

The EU is seeking an increasingly close relationship with Ukraine that extends beyond cooperation, to gradual economic integration and deepening of political cooperation.

Ukraine is said to be a priority partner within the European Neighbourhood Policy (ENP). A joint EU- Ukraine Action Plan was endorsed by the European Council on 21 February, 2005. On 16 June, 2009, a new practical instrument was adopted, the EU- Ukraine Association Agenda.

Table 2.1.13 Ranking of the Foreign Countries' Assistance

(Expenditure basis. Unit: million US$)

	1st	2nd	3rd	4th	5th	Japan	Total
2005	USA 99.43	Germany 53.16	Canada 18.62	French 15.50	Switzerland 13.45	2.53	238.19
2006	USA 130.24	Germany 58.70	Sweden 18.41	Canada 15.77	French 14.31	6.59	280.56
2007	USA 91.09	Germany 69.11	Sweden 22.14	French 15.96	England 7.75	5.72	244.25

Source: OECD/DAC

Table 2.1.14 Ranking of the International Donors' Assistance

(Expenditure basis. Unit: million US$)

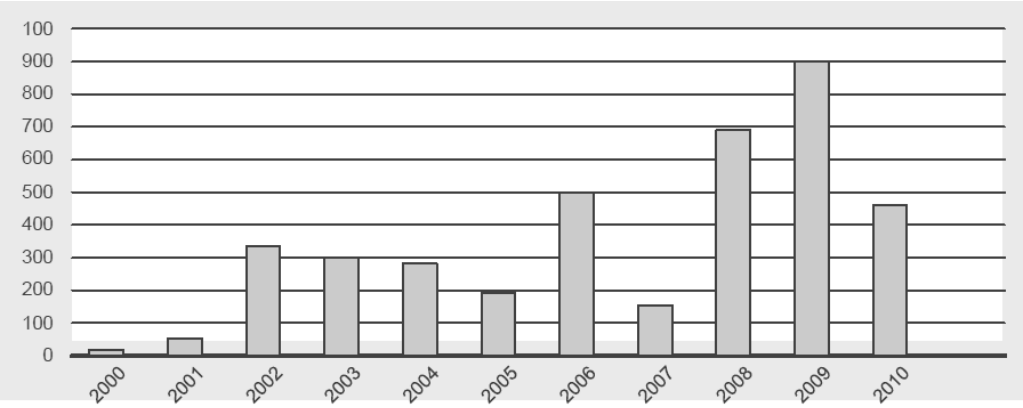
	1st	2nd	3rd	4th	5th	Other	Total
2005	CEC 102.14	EBRD 5.70	UNDP 2.76	UNHCR 2.22	UNICEF 1.40	17.50	131.72
2006	CEC 133.41	UNDP 3.65	UNHCR 2.68	EBRD 1.62	UNTA 1.40	28.28	171.04
2007	CEC 88.99	UNDP 4.07	UNHCR 1.92	UNTA 1.68	EBRD 1.39	29.25	127.30

Source: OECD/DAC

(2) World Bank

The World Bank's Country Partnership Strategy (CPS) for Ukraine for 2008-2011, prepared in partnership with the Government of Ukraine and in consultation with the business community, civil society and donors, was endorsed by the World Bank's Board of Directors in December 2007. It focuses on the strategic priorities of the country's development including sustained economic growth, improved competitiveness of Ukraine, reform of public finance and administration and the improvement of public services.

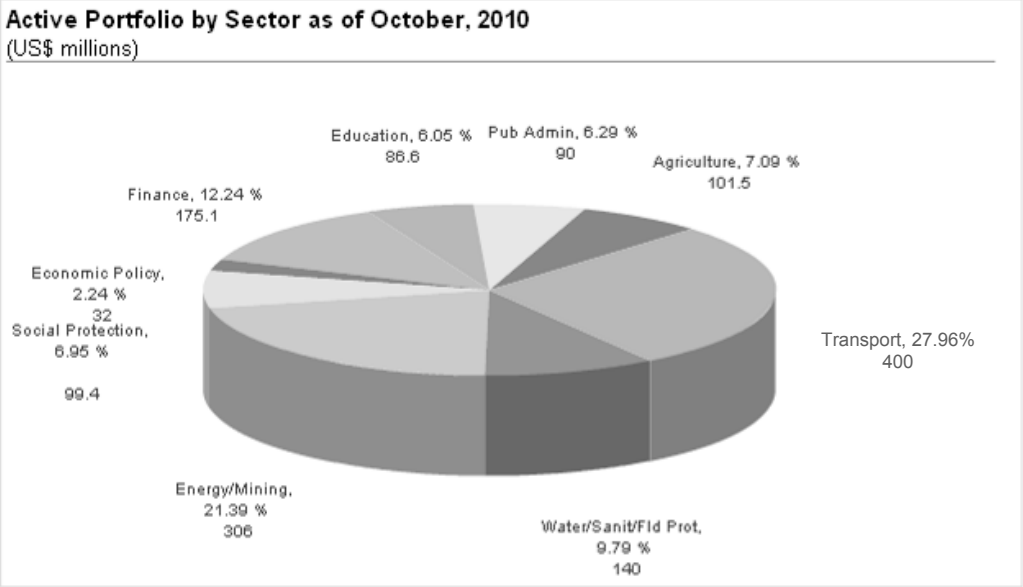
Unit: Million US$



NB: Lending is per fiscal year. July 1-June 30

Source: World Bank- Country Brief 2010

Figure 2.1.3 Ukraine: World Bank Commitments. Fiscal Years 2000- 2010



Source: World Bank- Country Brief 2010

Figure 2.1.4 Active Portfolio by Sector as of October 2010 (US$ millions)

(3) Donors, Partnerships and Communication

Many donors have adjusted their assistance to the modest pace of change and are emphasizing advocacy, capacity building of civil society, training of public officials and the allowance for national debate. The Bank's GAC (Governance and Anti-corruption) agenda is aligned with the strategic priorities of major donors, including the European Institutions (EC, CoE, EIB, EBRD and IBRD) and the United States Agency for International Development (USAID).

As shown in Table 2.1.14, EU, EBRD and EIB support in the transportation sector to complete the modernisation of the main transport corridor connecting the country to the EU and to promote commercialisation of municipal utilities through projects with large demonstration effects or energy efficiency gains.

Table 2.1.15 Donor Assistance to Ukraine for Governance and Institutional Reforms

	EU/CoE	EBRD	EIB	OECD	USAID	UNDP	DFID	OSCE	France	Germany	Netherlands	Canada	Switzerland	Sweden
Public Sector reforms, Governance and Decentralization														
PA and Governance Reforms	■	■		■	■	■			■	■	■	■		■
Local Government	■				■	■	■					■	■	
Tax Administration	■	■		■	■				■					
Civil Society	■				■	■	■	■			■		■	
Economic Management and Planning														
Economic Macro-stability	■			■						■				■
Statistics	■			■										
Technical Support and Advice	■	■	■	■					■	■		■		■
Rule of Law														
Judiciary	■			■	■			■	■			■		
Property Rights	■	■		■	■									
Security and Police	■			■	■								■	
Private Sector Development														
Corporate Governance	■	■									■			
Investment Climate	■	■	■		■		■		■					
SMEs	■	■	■		■		■		■	■				■
Regulatory Reforms	■	■	■				■					■		
Infrastructure														
Energy	■	■	■							■				
Transport	■	■	■											
WSS	■	■												
Municipal Management	■				■	■					■	■	■	
Social Sectors														
Health	■				■	■	■				■			
Education	■				■	■								
Social Service							■							
Social Protection	■				■	■	■			■				

Source: World Bank

Donors' projects in the road sector were shown in Table 2.1.2. Ongoing major road development programs by EBRD ,EIB and IBRD are shown in Table 2.1.15.

Table 2.1.16 Major Road Development Programs by Foreign Donors

Donor	Section
IBRD	"Improvement of road traffic routes and traffic safety" Kiev, Poltava regions (project implementation period: 2009 – 2012).
IBRD/EIB	Third Project "Repair of the automobile road Kiev-Chop" (project implementation period: 2010 – 2011).
EBRD	Project 1-3 "Restoration of Trunk Road M-06 at the section Chop town -Striy town", "Continuation of Restoration of the trunk road M-06 at the section Striy town – Brody town" and "Restoration of M-06 at the section of Brody town - Zhitomir town"
EBRD	"Improve to European level automobile road M-03 Kiev-Kharkov-Dovjanskiy at the section from Boryspol town (km44_500) to Lubny town (km 191+400）" (corresponding to national transport corridor Europe-Asia)

Source: State Road Administration

2.2 Socio-Economic Conditions of Ukraine

2.2.1 Country Profile

(1) Geography

Ukraine is a country in the East of Europe. It has an area of 603,628 km², making it the largest contiguous country on the European continent. Ukraine borders the Russian Federation to the east and northeast, Belarus to the northwest, Poland, Slovakia and Hungary to the west, Romania and Moldova to the southwest, and the Black Sea and Sea of Azov to the south and southeast, respectively.

The Ukrainian landscape consists mostly of fertile plains (or steppes) and plateaus, crossed by rivers such as the Dnieper, Seversky Donets, Dniester and the Southern Bug River as they flow south into the Black Sea and the smaller Sea of Azov. To the southwest, the delta of the Danube forms the border with Romania. Its various regions have diverse geographic features ranging from the highlands to the lowlands. The country's only mountains are the Carpathian Mountains in the west, of which the highest is the Hoverla at 2,061 metres (6,762 ft), and the Crimean Mountains on the Crimean peninsula in the extreme south along the coast. However Ukraine also has a number of highland regions such as the Volyn-Podillia Upland (in the west) and the Near-Dnipro Upland (on the right bank of Dnieper); to the east there are the south-western spurs of the Central Russian Uplands over which runs the border with Russia. Near the Sea of Azov can be found the Donets Ridge and the Near Azov Upland. The snow melt from the mountains feeds the rivers, and natural changes in altitude form a sudden drop in elevation and create many opportunities to form waterfalls of Ukraine.

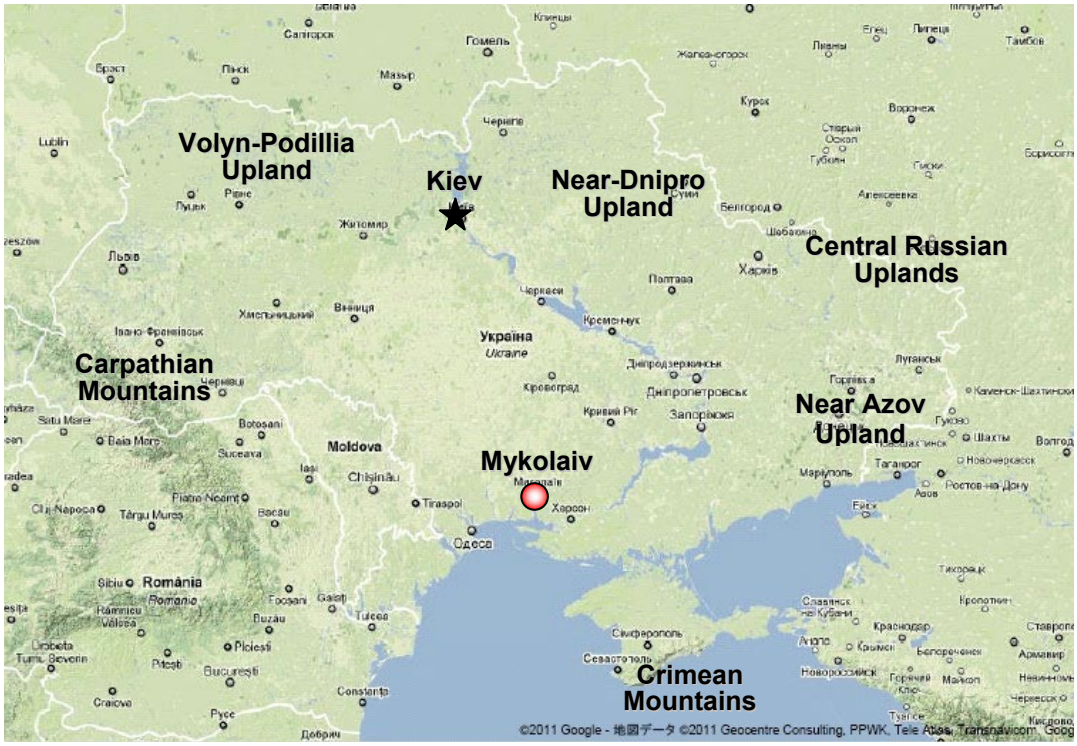


Figure 2.2.1 Geography of Ukraine

(2) Politics

Politics of Ukraine take place in a framework of a presidential representative democratic republic and of a multi-party system. Ukraine is a republic under a mixed semi-parliamentary semi-presidential system with separate legislative, executive, and judicial branches. Executive

power is exercised by the Cabinet. Legislative power is vested in the parliament (Verkhovna Rada).

The president is elected by popular vote for a five-year term. The President nominates the Prime Minister, who must be confirmed by parliament. The Prime-minister and cabinet are de jure appointed by the Parliament on submission of the President and Prime Minister respectively pursuant to Article 114 of the Constitution of Ukraine.

The Parliament has 450 members, elected for a five year term. Prior to 2006, half of the members were elected by proportional representation and the other half by single-seat constituencies. Starting with the March 2006 parliamentary election, all 450 members of the Verkhovna Rada were elected by party-list proportional representation. The Verkhovna Rada initiates legislation, ratifies international agreements, and approves the budget.

Ukraine is a unitary state composed of 24 oblasts (provinces), and one autonomous republic (Crimea).

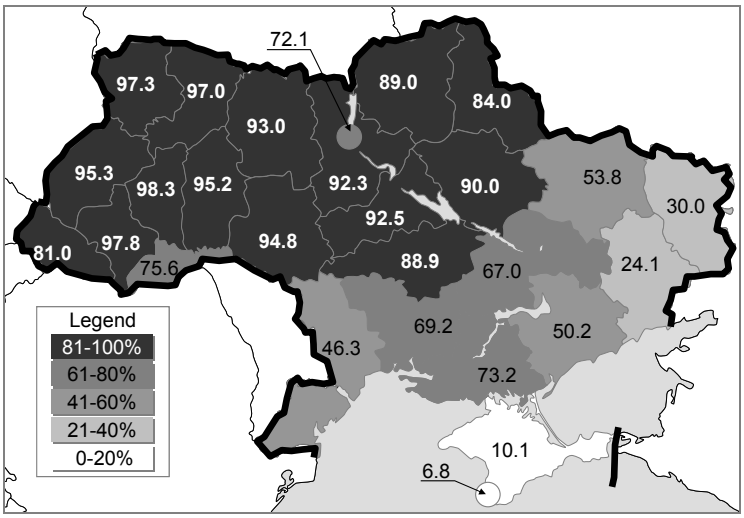
Figure 2.2.2 Oblasts of Ukraine

(3) History

Ukraine's history began with the Kievan Rus', the precursor to the East Slavs. From the 9th century the Kievan Rus' became a large and powerful nation but disintegrated in the 12th century. Ukraine was the center of the medieval living area of the East Slavs. After the Great Northern War (1700–1721) Ukraine was divided between a number of regional powers and, by the 19th century, the largest part of Ukraine was integrated into the Russian Empire with the rest under Austro-Hungarian control. After a chaotic period of incessant warfare and several attempts at independence (1917–21) following World War I and the Russian Civil War, it emerged on December 30, 1922 as one of the founding republics of the Soviet Union. The Ukrainian Soviet Socialist Republic's territory was enlarged westward shortly before and after World War II, and southwards in 1954 with the Crimea transfer. In 1945, the Ukrainian SSR became one of the founding members of the United Nations.

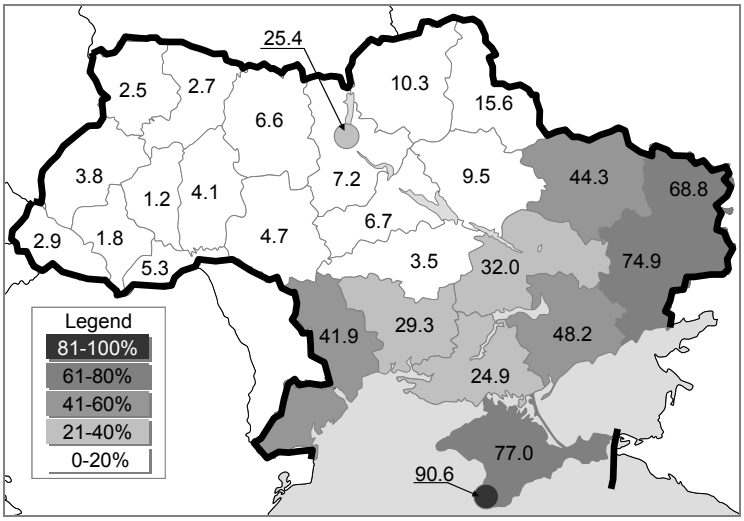
(4) Language

Percentage of native Ukrainian speakers by subdivision and percentage of Russian speakers by subdivision are shown in Figure 2.2.3 and Figure 2.2.4.



Source: Population Census of Ukraine 2001

Figure 2.2.3 Percentage of Native Ukrainian Speakers by Subdivision



Source: Population Census of Ukraine 2001

Figure 2.2.4 Percentage of Native Russian Speakers by Subdivision

According to the Constitution, the state language of Ukraine is Ukrainian. Russian, which was the de facto official language of the Soviet Union, is widely spoken, especially in eastern and southern Ukraine. According to the 2001 census, 67.5 percent of the population declared Ukrainian as their native language and 29.6 percent declared Russian. Most native Ukrainian speakers know Russian as a second language.

These details result in a significant difference across different survey results, as even a small restating of a question switches responses of a significant group of people. Ukrainian is mainly spoken in western and central Ukraine. In western Ukraine, Ukrainian is also the dominant language in cities (such as Lviv). In central Ukraine, Ukrainian and Russian are both equally used in cities, with Russian being more common in Kiev, while Ukrainian is the dominant

language in rural communities. In eastern and southern Ukraine, Russian is primarily used in cities, and Ukrainian is used in rural areas.

For a large part of the Soviet era, the number of Ukrainian speakers declined from generation to generation, and by the mid-1980s, the usage of the Ukrainian language in public life had decreased significantly. Following independence, the government of Ukraine began restoring the image and usage of Ukrainian language through a policy of Ukrainisation. Today, all foreign films and TV programs, including Russian ones, are subbed or dubbed in Ukrainian.

(5) Religion

Table 2.2.1 shows the composition ratio of religion in Ukraine. The dominant religion in Ukraine is Orthodox Christianity, which is currently split between three Church bodies: the Ukrainian Orthodox Church, an autonomous church body under the Patriarch of Moscow, the Ukrainian Orthodox Church – Kiev Patriarchate, and the Ukrainian Autocephalous Orthodox Church.

Table 2.2.1 Composition Ratio of Religion in Ukraine

Religion	Percent
Ukrainian Orthodox Church – Patriarch of Moscow	50%
Ukrainian Orthodox Church – Kiev Patriarchate	14.9%
Ukrainian Autocephalous Orthodox Church	2.8%
Ukrainian Greek Catholic Church	8%
Roman Catholicism	2.2%
Protestantism	2.2%
Islam	1.0%
Judaism	0.6%
Others	2.2%

A distant second by the number of the followers is the Eastern Rite Ukrainian Greek Catholic Church, which practices a similar liturgical and spiritual tradition as Eastern Orthodoxy, but is in communion with the Holy See of the Roman Catholic Church and recognises the primacy of the Pope as head of the Church.

Additionally, there are 863 Latin Rite Catholic communities, and 474 clergy members serving some one million Latin Rite Catholics in Ukraine. The group forms some 2.19 percent of the population and consists mainly of ethnic Poles and Hungarians, who live predominantly in the western regions of the country.

Protestant Christians also form around 2.19 percent of the population. Protestant numbers have grown greatly since Ukrainian independence. The Evangelical Baptist Union of Ukraine is the largest group, with more than 150,000 members and about 3,000 clergy. The second largest Protestant church is the Ukrainian Church of Evangelical faith (Pentecostals) with 110,000 members and over 1,500 local churches and over 2,000 clergy, but there also exist other Pentecostal groups and unions and together all Pentecostals are over 300,000, with over 3,000 local churches. Also there are many Pentecostal higher education schools such as the Lviv Theological Seminary and the Kiev Bible Institute. Other groups include Calvinists, Jehovah's Witnesses, Lutherans, Methodists and Seventh-day Adventists. The Church of Jesus Christ of Latter-day Saints (Mormon) is also present.

There are an estimated 500,000 Muslims in Ukraine, and about 250,000 of them are Crimean Tatars. There are 487 registered Muslim communities, 368 of them on the Crimean peninsula. In addition, some 50,000 Muslims live in Kiev; mostly foreign-born.

The Jewish population is a tiny fraction of what it was before World War II. The largest Jewish communities in 1926 were in Odessa, with 154,000 or 36.5% of the total population; and Kiev, with 140,500 or 27.3%. The 2001 census indicated that there are 103,600 Jews in Ukraine, although community leaders claimed that the population could be as large as 300,000. There are no statistics on what share of the Ukrainian Jews are observant, but Orthodox Judaism has the strongest presence in Ukraine. Smaller Reform and Conservative Jewish (Masorti) communities exist as well.

(6) Education

According to the Ukrainian constitution, access to free education is granted to all citizens. Complete general secondary education is compulsory in the state schools which constitute the overwhelming majority. Free higher education in state and communal educational establishments is provided on a competitive basis. There is also a small number of accredited private secondary and higher education institutions. Because of the Soviet Union's emphasis on total access to education for all citizens, which continues today, the literacy rate is an estimated 99.4%.

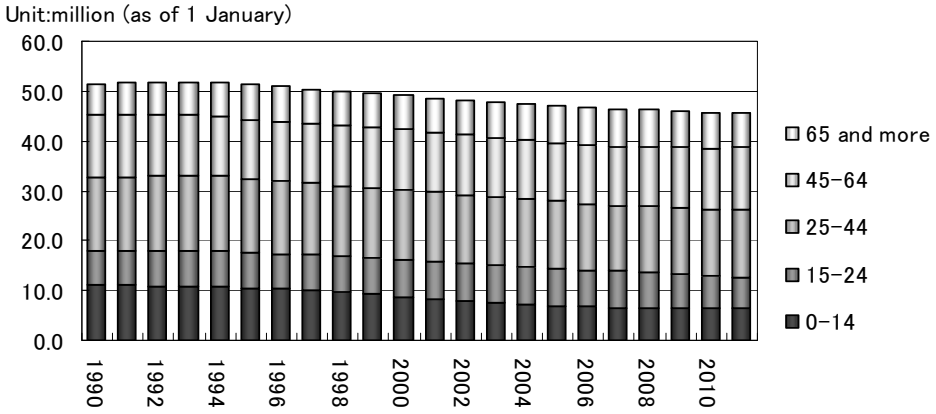
The Ukrainian higher education system comprises higher educational establishments, scientific and methodological facilities under federal, municipal and self-governing bodies in charge of education. The organization of higher education in Ukraine is built up in accordance with the structure of education of the world's higher developed countries, as is defined by UNESCO and the UN.

2.2.2 Social Conditions

(1) Demography

Population in Ukraine by age group is shown in the Figure 2.2.5. Total population in the year 2011 was 45.60 million and it is gently decreasing.

Ukraine is forecast to lose around 25 % of its population by 2025 as a result of still relatively high mortality rates and very low birth rates. As Ukraine's population ages, the overall costs of providing care to the elderly will also increase, perhaps by as much as 5.2 % of GDP by 2020.[7]



Source: State Statistics Committee of Ukraine

Figure 2.2.5 Population in Ukraine by Age Group

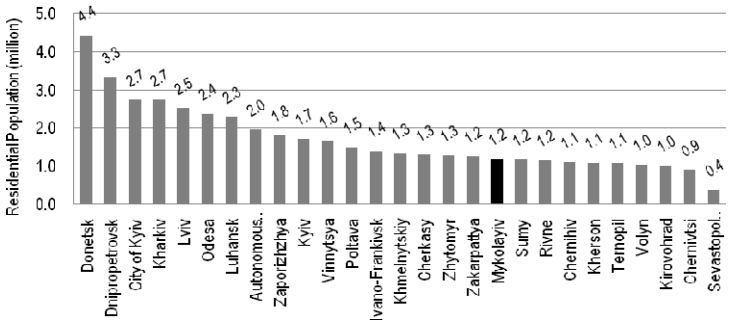
[7] Source: International Bank for Reconstruction and Development and the International Finance Corporation Country Partnership Strategy for Ukraine for the Period FY08-FY11, World Bank, November 2007

Table 2.2.2 summarizes the population and the annual average growth rates for Ukraine and Mykolaiv region. The population had decreased from 49.4 million in 2000 to 46.0 million in 2010. However, the decreasing rate is gradually diminishing from -1.02% in 2000 to -0.39% in 2010. Population of Mykolaiv oblast was about 1.19 million (2.6% of Ukraine) in 2010, which is lower-medium in Ukraine as shown in Figure 2.2.6. The population decreasing rate in Mykolaiv is higher than the national average.

Table 2.2.2 Population and Growth Rate

	Population ('000) and Growth Rate			
	Ukraine		Mykolaiv	
2000	49.430	-	-	-
2001	48.923	(-1.02%)	-	-
2002	48.457	(-0.95%)	-	-
2003	48.004	(-0.94%)	1.241	-
2004	47.622	(-0.79%)	1.231	(-0.84%)
2005	47.281	(-0.72%)	1.225	(-0.52%)
2006	46.930	(-0.74%)	1.216	(-0.73%)
2007	46.646	(-0.60%)	1.208	(-0.66%)
2008	46.373	(-0.59%)	1.200	(-0.66%)
2009	46.144	(-0.49%)	1.193	(-0.58%)
2010	45.963	(-0.39%)	1.187	(-0.45%)

Source: State Statistics Committee of Ukraine



Source: State Statistics Committee of Ukraine

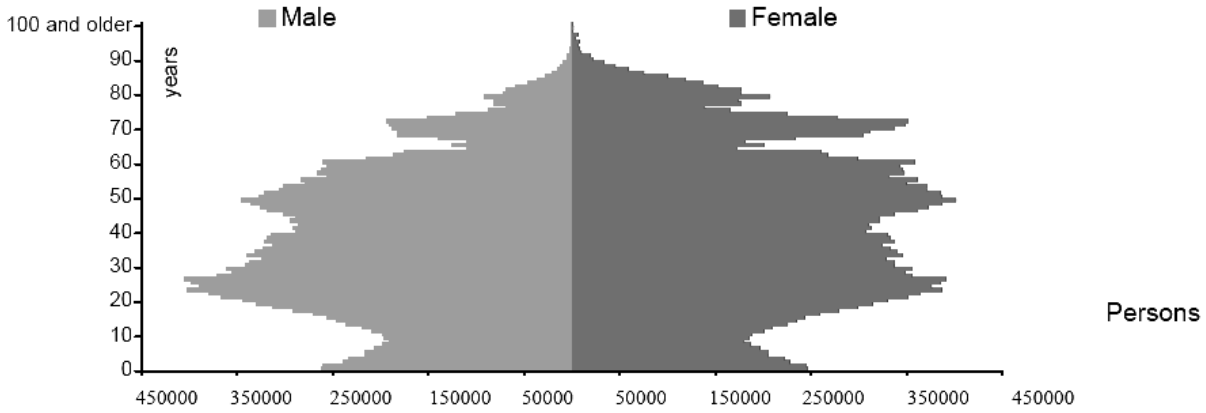
Figure 2.2.6 Population by Oblast in 2010

(2) Health

Ukraine's healthcare system is state subsidised and freely available to all Ukrainian citizens and registered residents. However, it is not compulsory to be treated in a state-run hospital as a number of private medical complexes do exist nationwide.

All the country's medical service providers and hospitals are subordinate to the Ministry of Health, which provides oversight and scrutiny of general medical practice as well as being responsible for the day to day administration of the healthcare system. Despite this, standards of hygiene and patient-care have fallen.

Ukraine currently faces a number of major public health issues, and is considered to be in a demographic crisis due to its high death rate and low birth rate (the current Ukrainian birth rate is 11 births/1,000 population, and the death rate is 16.3 deaths/1,000 population). In 2008, the country's population was one of the fastest declining in the world at -5% growth. The UN warned that Ukraine's population could fall by as much as 10 million by 2050 if trends did not improve.



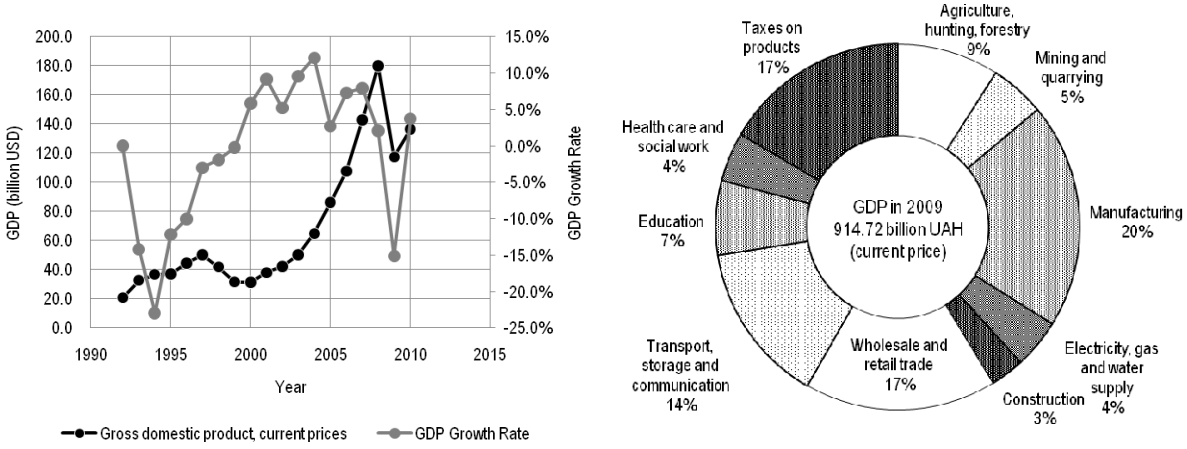
Source: State Statistics Committee of Ukraine

Figure 2.2.7 Population, by Sex and Age, at the Beginning of 2010

2.2.3 Economic Conditions

(1) Gross Domestic Products

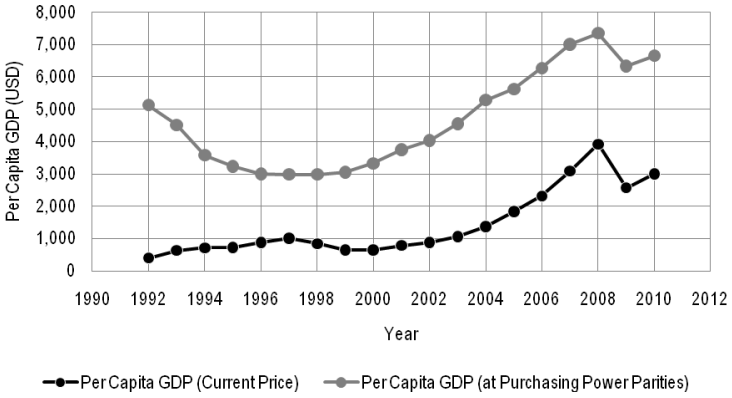
The Figures below show the GDP growth and the contribution of various industries and sectors to the GDP. After the devaluation in 1996, Ukraine economy showed steady growth until 2008: the GDP growth rate between 2000 and 2007 was 7.5% p.a. The worldwide financial crisis in September 2008 had a serious impact on the economy of Ukraine: the GDP growth rate in 2009 dropped to -15.4%. In 2010, GDP growth rate was estimated at 3.7%. Ukraine's economy is now gradually recovering.



Source: International Monetary Fund, World Economic Outlook Database, October 2010
and State Statistics Committee of Ukraine

Figure 2.2.8 GDP Growth Rate and Contribution of Industries

As shown in Figure 2.2.9, per capita GDP of Ukraine had increased steadily since 1992 until 2008. In 2008, per capita GDP reached about 4,000 US dollars at current prices (7,400 US dollars at purchasing power parties). Because of the worldwide financial crisis towards the end of 2008, the per capita GDP decreased to 2,600 USD (6,300 USD at PPP) in 2009.



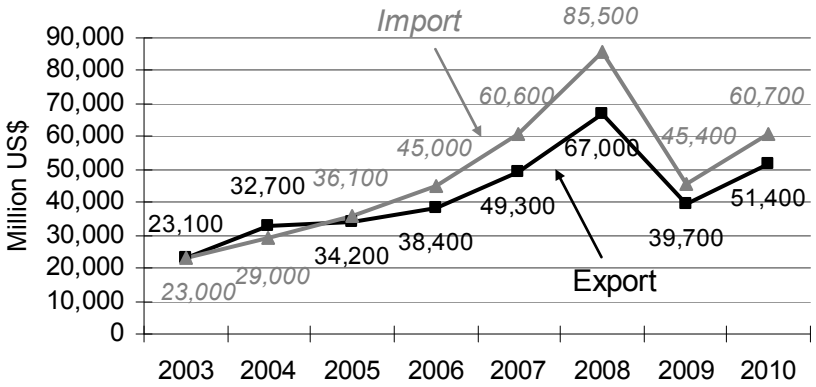
Source: State Statistics Committee of Ukraine

Figure 2.2.9 Per Capita GDP (upper) and GRDP in 2008 (lower)

After experiencing one of the sharpest downturns in the region in 2009, real GDP growth in the first half of 2010 was better than expected, helped by export-oriented industries, particularly steel. More recently, domestic demand has gained momentum on the back of improving consumer and business confidence and robust wage growth. As a result and notwithstanding a lower grain harvest due to bad weather conditions, GDP growth is set to reach, or slightly exceed, the program projection of 3.75% for 2010. Growth is expected to increase to 4.5% in 2011 helped by stronger private consumption and investment (including for the Euro 2012 soccer tournament). However, the output gap remains sizable and economic activity is not expected to surpass the pre-crisis peak until 2013.[8]

(2) Foreign Trade

The impact of the financial crisis also extended to foreign trade in Ukraine. Total exports and imports in 2009 decreased by 40.7% and 46.9% respectively. In particular, Base metals and preparations thereof, which accounted for 41.2% of total exports in 2008, decreased by 53.6% in 2009.



Source: State Statistics Committee of Ukraine

Figure 2.2.10 Foreign Trade in Ukraine

[8] IMF Country Report No. 11/52, February 2011

Table 2.2.3 Major Trade Commodities

Goods	Exports (Million US$)						
	2008	(in %)	2009	(in %)	2010	(in %)	10/09
Base Metals and Preparations thereof	27,594	(41.2%)	12,817	(32.3%)	17,333	(33.7%)	35.2%
Mineral Products	7,046	(10.5%)	3,900	(9.8%)	6,731	(13.1%)	72.6%
Machines, Equipment and Mechanisms, Electric and Technical Equipment, Audio and Video Equipment, TV Equipment	6,341	(9.5%)	5,014	(12.6%)	5,670	(11.0%)	13.1%
Plant Products	5,577	(8.3%)	5,035	(12.7%)	3,976	(7.7%)	-21.0%
Products of Chemical and Allied Industries	5,045	(7.5%)	2,515	(6.3%)	3,479	(6.8%)	38.3%
Ground, Air and Water Transport Facilities	4,321	(6.5%)	1,596	(4.0%)	3,262	(6.3%)	104.4%
Animal or Plant Fats and Oils	1,946	(2.9%)	1,796	(4.5%)	2,617	(5.1%)	45.7%
Finished Food Industry Products	2,518	(3.8%)	2,088	(5.3%)	2,571	(5.0%)	23.1%
Others	6,565	(9.8%)	4,941	(12.4%)	5,790	(11.3%)	17.2%
Export Total	66,954		39,703		51,431		29.5%

Goods	Imports (Million US$)						
	2008	(in %)	2009	(in %)	2010	(in %)	10/09
Mineral Products	25,441	(29.7%)	15,695	(34.5%)	21,128	(34.8%)	34.6%
Machines, Equipment and Mechanisms, Electric and Technical Equipment, Audio and Video Equipment, TV Equipment	13,380	(15.6%)	6,257	(13.8%)	8,167	(13.4%)	30.5%
Products of Chemical and Allied Industries	6,959	(8.1%)	5,319	(11.7%)	6,442	(10.6%)	21.1%
Base Metals and Preparations thereof	6,390	(7.5%)	2,677	(5.9%)	4,128	(6.8%)	54.2%
Ground, Air and Water Transport Facilities	12,091	(14.1%)	2,164	(4.8%)	3,664	(6.0%)	69.3%
Plastics and Rubber	4,477	(5.2%)	2,664	(5.9%)	3,661	(6.0%)	37.5%
Finished Food Industry Products	2,679	(3.1%)	2,034	(4.5%)	2,505	(4.1%)	23.1%
Textiles and Articles of Textiles	2,099	(2.5%)	1,417	(3.1%)	1,975	(3.3%)	39.4%
Others	12,019	(14.1%)	7,209	(15.9%)	9,070	(14.9%)	25.8%
Import Total	85,535		45,436		60,740		33.7%

Source: State Statistics Committee of Ukraine

2.2.4 State Budget

The law of Ukraine "On State Budget of Ukraine for 2011" is published in the "Governmental Courier" December 30, 2010.

Table 2.2.4 On State Budget of Ukraine for 2011

Unit; Million UAH

Revenue		281,465
(Breakdown)	General Fund Revenues	238,581
	Special Revenue Fund	42,884
Expenditures		321,921
(Breakdown)	General Fund Expenditures	279,087
	Special Fund Expenditures	42,834
Credit Refund		9,185
(Breakdown)	General Budget Fund	4,497
	Special Fund	4,688
Credits from State Budget Allocation		7,572
(Breakdown)	Credits from General Fund	836
	Credits to Special Fund	6,736
Threshold Amount of Deficit		38,843
(Breakdown)	General Fund Deficit	36,844
	Special Fund Deficit	1,999

Source: Web- Portal of Ukrainian Government

2.3 Socio-Economic Conditions of Mykolaiv

2.3.1 Economic Conditions

(1) Overview

The machine building and metalworking industry, which includes shipbuilding and power engineering, is the most prominent sector. Mykolaiv industrial enterprises provide up to 60% of the Ukraine's shipbuilding production, over 90% of the state gas turbine production, and 80% of the alumina which is a precursor product in aluminium production.

Shipbuilding - the leading industrial sector is represented in Mykolaiv by three large shipyards: the State Joint Stock Holding Company "Chernomorsky Shipbuilding Yard". State Enterprise "Shipyard named after 61 Communards" and "Damen Shipyards "Okean" Joint Stock Company. These enterprises mainly produce tankers, bulk and container carriers, refrigerator ships, trawlers, floating hotels and military ships of different types. However, the industry of Mykolaiv is not only capable of building the highly science-intensive ships but also the modern gas-turbine installations and radio-electronic equipment of the highest precision.

A number of shipbuilding related enterprises such as «Era» «Crystal» and «Equator» are joint Stock Companies that specialize in shipboard equipment and assembly of onboard power systems. Additionally, a number of electric-technical and electronic industry enterprises with highly qualified personnel are located in the city.

The transport infrastructure is well developed here. It includes sea and river ports, railway station, two airports and highways.

Currently, major systematic work is being done to support the functioning of the Special Economic Zone "Mykolaiv". SEZ "Mykolaiv" was created with the purpose of promoting investments into priority branches of production to preserve existing employment and create new avenues of employment, introduce modern production technology, promote foreign economic relations and entrepreneurial activity development, increase efficiency of the ship-building enterprises facilities and their export potential, increase high-quality goods and services deliveries, and create modern industrial, transport and market infrastructures.

The special legal regime for economic activity is established in the territory of SEZ "Mykolaiv". It is determined by the Law of Ukraine "On Special economic zone "Mykolaiv" in accordance with the Law of Ukraine "On general principles of special (free) economic zone creation and functioning".

(2) The Analysis on Economic and Social Development in Prior Period

Mykolaiv city council planned the Social and economic development of Mykolaiv City for 2010. The analysis on economic and social development in the prior period is summarized as follows;

1) Construction

For January-September of 2009, enterprises from the regional center performed construction works to the amount of 345 million UAH or 73.2% from a regional scope. In comparison to 2008, building volume has decreased to 58.9%.

2) Transport

For January-September of 2009, 2 million tons of cargo was shipped by truck and water transport; that is a decrease of 9.6% from the relevant period of the previous year. Cargo

turnover increased by 9.1% to reach 432.3 million tonne-kilometres. A total of 124.1 million passengers were transported by passenger transport and passenger turnover reached 1189.5 million passenger-km, which are respective declines of 5.5% and 8.9% from the relevant period of the previous year.

3) Prices

In September 2009, the Consumer Price Index was 100.5% in the region. The fundamental reason for the Consumer Price Index rise in the region was the rise in prices of alcoholic drinks and tobacco products, commodity items and services in the education sphere, transport, recreation, restaurant and hotel businesses as well as rises in prices of household articles and housekeeping supplies and equipment.

4) Salary

For September 2009, the average gross wages of a regular employee were 2042.79 UAH, which compared to August of the previous year represented an increase of 2.4%: this exceeded state social standards as follows: average gross wages were 3.1 times the minimum living wages established for able-bodied population (669 UAH) and 3.2 times the minimum salary (630 UAH).

Outstanding debt from payment of salary in the regional center (without taking into account hired workers of statistically small companies and employers hired by private entrepreneurs) as of 1st October of 2009 was 17.8 million UAH which is an increase of 1.3 % compared to 1st September of the previous year and an increase of 14.4% compared to 1st January 2009.

They accounted for 6.5% of debts accrued in the city labor compensation fund for September of the previous year (6.6% for the region).

Quantity reduction of employees that were on vacations by assent and initiative of the administration was fixed in September 2009 compared to August. Such employees were estimated to be 4,300 in number or 3.3% of the total number of employees that work in the economic sphere of the city. There was an observed reduction of 5.8% in number of employees who worked part time compared to the figure in August 2008. In September 2009, there were 10,500 such employees or 8% of the total working population.

5) Labour market

The number of registered unemployed people as of 1st October, 2009 decreased by 2.99% to 3,300.

The registered unemployment rate went down for the month by 0.1%, which accounted for 1% of able-bodied population as of 1 October 2009.

6) Investment activities

For January-September of 2009, companies and organizations of the city attracted 1304.5 million UAH of capital investment, which is less by 25.6% than in the same period of the previous year.

Foreign trade by goods and services: The exports from Mykolaiv City for January-September were valued at 973.8 million US dollars, a decrease of 13.6% compared to the same period of the previous year. Imports were valued at 312 million US dollars, a decrease of 43.1% from the previous year. Export of goods decreased by 15.6% and was valued at 110.2 million US dollars. Imports fell by 24.1% to reach 24.3 million US dollars. Positive balance of foreign

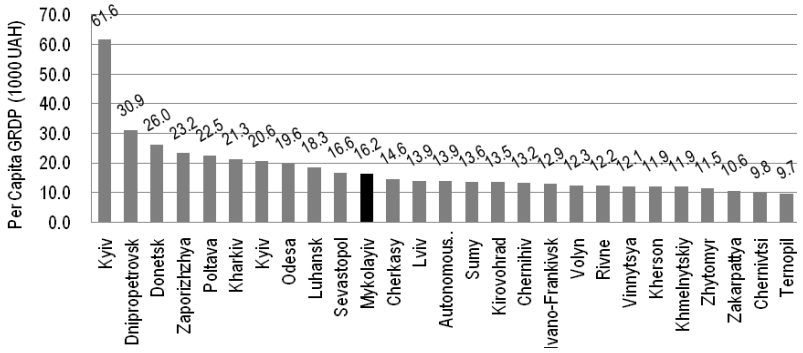
trade of goods was 661.8 million US dollars. The positive balance of services was 85.9 million US dollars. The import-export coverage ratio was 3.1 for exports and 4.5 for imports.

7) Population

As of 1 October, 2009, the population of Mykolaiv City was 501,700, which accounted for 42.1% of the population of the region. From January to September, the population decreased by 2,600 people, which includes natural reduction of population of 1,600 persons and migration reduction of 1,000 persons.

(3) Gross Regional Products

Per capita GRDP of Mikolaiv region in 2008 was more than 16,000 UAH (about 2,000 USD at current prices).



Source: State Statistics Committee of Ukraine

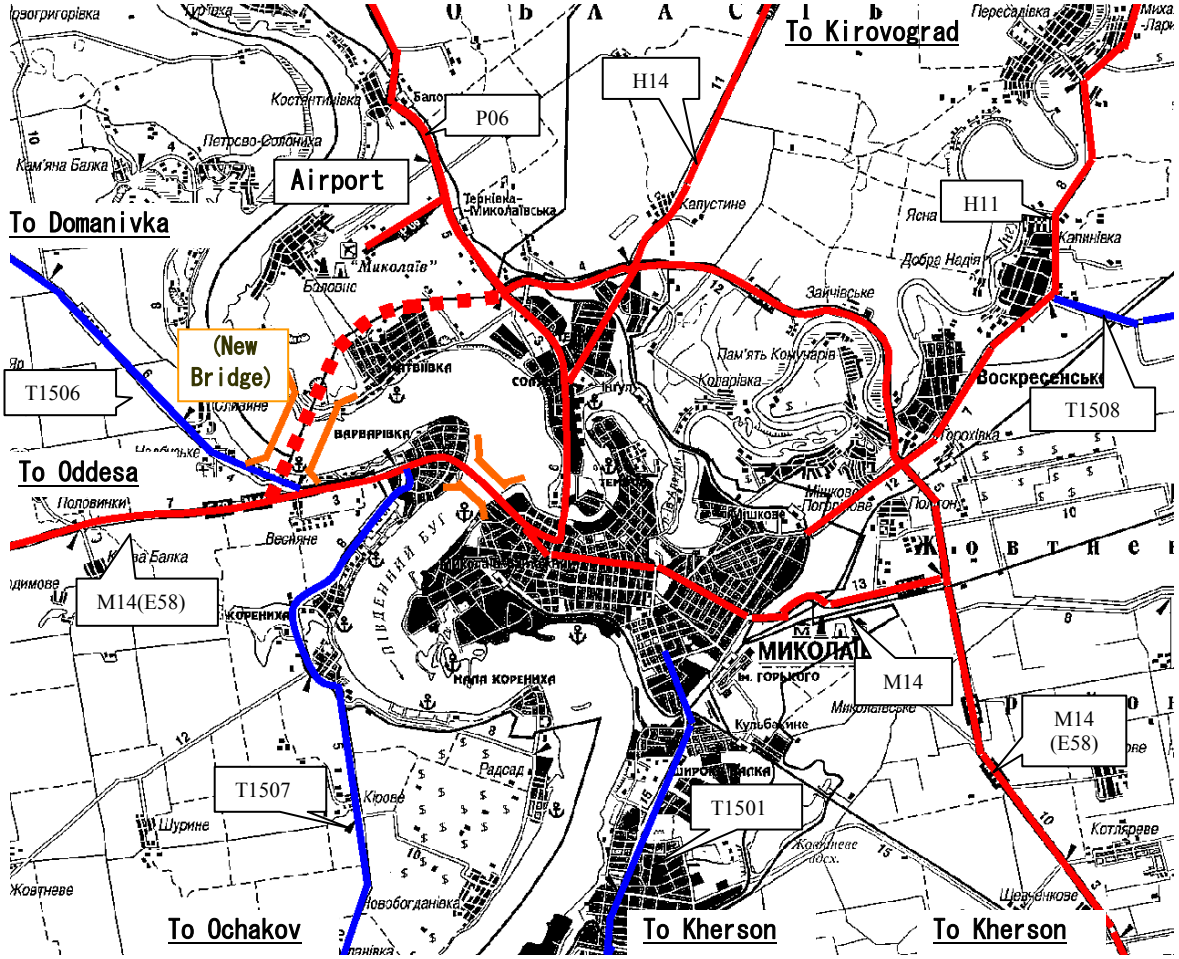
Figure 2.3.1 Gross Regional Domestic Products in 2008

2.3.2 Road Inventory of Study Area

The trunk road network in Mykolaiv includes M-14 (E-58) and regional roads P-06 that serve as supplementary roads that collect and distribute freight traffic. M-14 (E-58) motor road provides communication between the eastern and western parts of the country, while motor road P-06 is the main road from Mykolaiv to Kiev through Uman. Other local roads, T1501, T1506, T1507, etc radiate from Mykolaiv. If the project road connects with this road, a complete Northern Ring road for Mykolaiv will be formed.

Vavarovsky bridge is currently essential for eastern and western trips from Mykolaiv central area. The situation is such that many heavy traffic vehicles come into city centre daily.

Figure 2.3.2 shows the road network map of the Study Area. The inventory of roads in Mykolaiv region is shown in Table 2.3.1



Legend of Road

M (E)
Міжнародні : International Road (Euro value)

H
Національні : National Road

P
Регіональні : Regional Road

T
Територіальн: Territorial Road

Figure 2.3.2 Road Network of Mykolaiv

Table 2.3.1 Inventory of Roads in Mykolaiv

Route No.	Road Class	Length (km)	Role of the Road	Via City	Pavement
M-14 (E-58)	1-b	615.4	East-West Arterial Corridor	Odessa-Mykolaiv-Melitopol-Novoazovk (toTaganrog)	Asphalt Pavement
P-06	1-b	208.9	Trunk Road for Kiev	Ulianovka-Mykolaiv-(through Voznesensk)	Asphalt Pavement
H-11	2nd	239.3	Main Road to North-East	Dnipropetrovsk-Mykolaiv (through Kryvyi Rig)	Asphalt Pavement
H-14	2nd	210.6	Main Road to North	Oleksandrivka-Kirovograd-Mykolaiv	Asphalt Pavement
T-1501	3rd	21.2	Secondary Road to South (East Side of Southern Bug River)	Mykolaov-Stanislav-Kherson	Asphalt Pavement
T-1506	3rd	173.5	Secondary Road to North-West	Mykolaiv-Domanivka-Berizky	Asphalt Pavement
T-1507	3rd	66.3	Secondary Road to South (West side of Southern Bug River)	Mykolaiv-Parutino-Ochakiv	Asphalt Pavement
T-1508	3rd	77.1	Secondary Road to East	Kalynivka-Snigurivka-Berezneguvate	Asphalt Pavement
(P-06)	3rd	2.4	Access to Airport	Access to Mykolaiv Airport	Asphalt Pavement
M-14 (E-58)	1-b	20.5	Ring Road of Mykolaiv City	Mykolaiv-Voznesensk-Kirovograd, Kryvyi Rig-Kherson	Asphalt Pavement

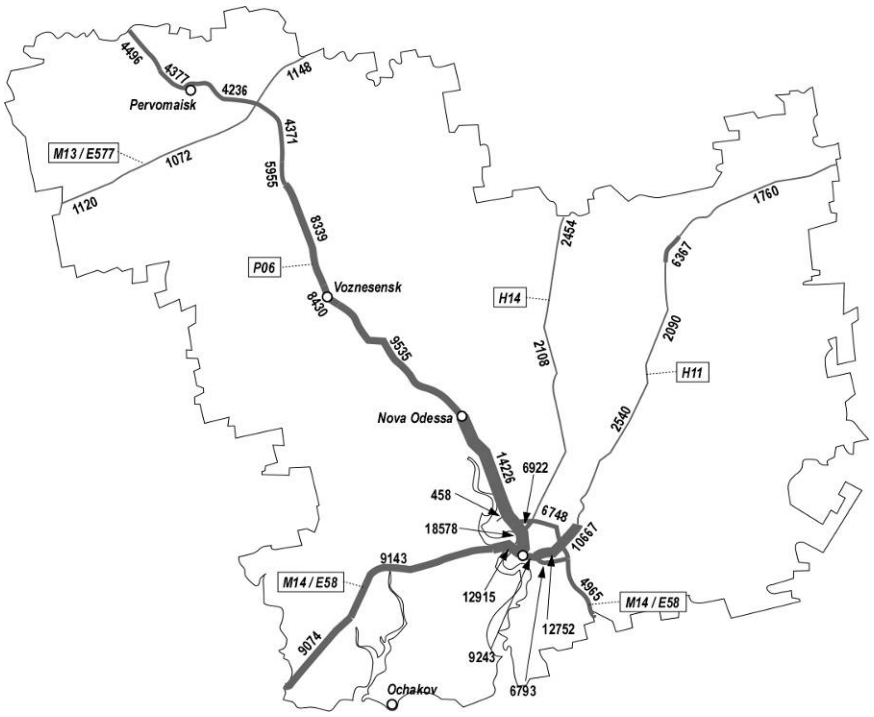
Source: F/S 2004 (updated by JICA Survey Team)

The roads in Mykolaiv city centre are regularly-arranged and have sufficient width. Trams, buses and trolleybuses are widely used forms of public transportation. However, roads, especially those with asphalt-concrete pavements, are not in good condition; concrete pavement bases of tram railways are also not in good condition.

2.3.3 Traffic Condition of Study Area

(1) Traffic Volume in Mykolaiv Region

An automatic traffic count system was installed in 2005 on arterial roads in Ukraine and has been operated since. In Mykolaiv Region, traffic volume is surveyed at about 30 points on arterial roads, namely, M14 (E58), M13, H11, H14 and P06. As shown in the following Figure, large traffic volumes were observed at M14 (E58) and P06 in Mykolaiv City Centre and its environs. The Annual Average Daily Traffic (AADT) on existing Varvarovsky Bridge was about 12,900 vehicles per day in 2009.



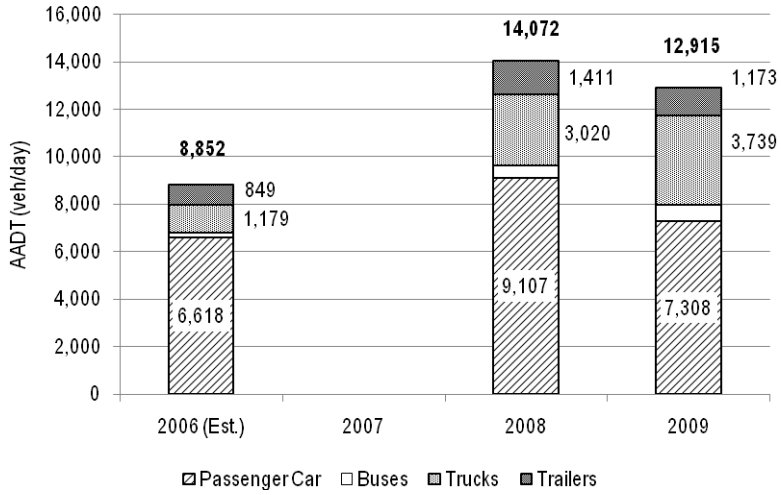
Source: State Road Administration

Figure 2.3.3 Traffic Volume in Mykolaiv Region in 2009 (AADT, vehicle/day)

(2) Traffic Volume and Characteristics at Southern Bug River Section

Traffic volume at the existing Varvarovsky Bridge increased from 8,900 vehicles per day in 2006 to 14,100 vehicles per day in 2008. As a consequence of the worldwide financial crisis in September 2008, traffic volume in 2009 decreased to 13,000 vehicles per day, in particular, passenger car volume fell by about 20% from 2008 volume.

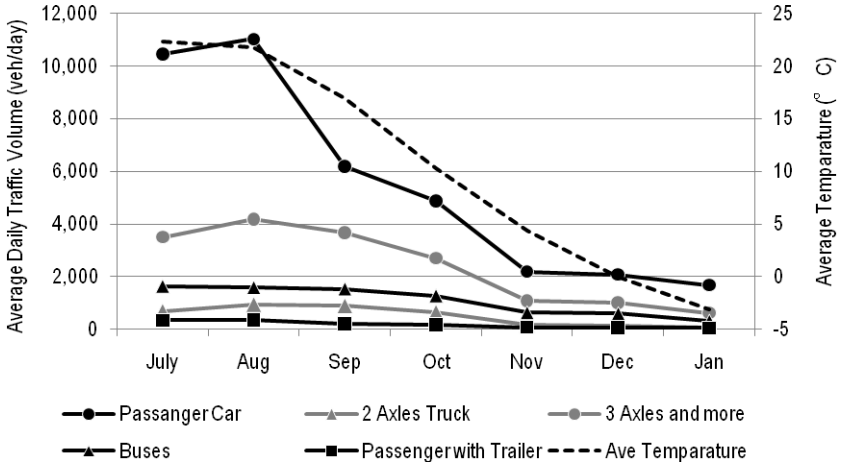
In 2010, the traffic volume was gradually restored to 13,800 in one direction (refer to the volume of Table 4.2.3 in both direction).



Source: State Road Administration

Figure 2.3.4 AADT and Vehicle Composition at Varvarovsky Bridge (M14, Section KM127)

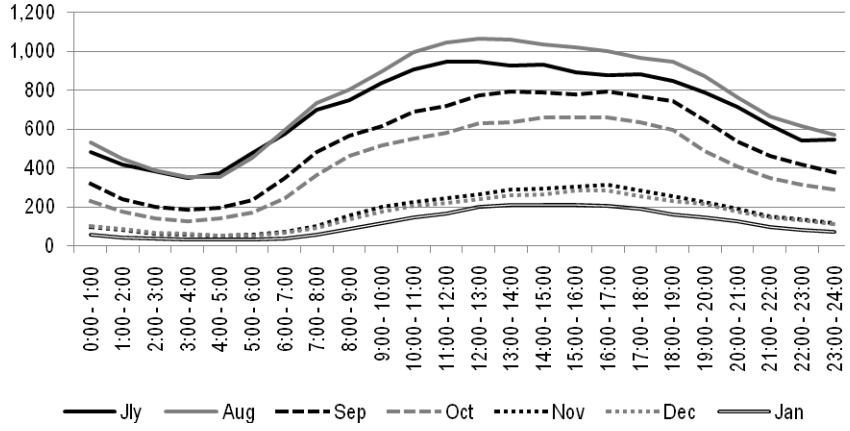
Annual average traffic volume data in 2007 was not available. However, daily and hourly traffic volume data at two locations from July 2006 to January 2007 was available. As shown in following Figure, AADT in the summer season (average of July and August) was 17,400 vehicles which is about 4.8 times the winter season AADT (average of November to January).



Source: State Road Administration

Figure 2.3.5 Traffic Volume by Month in 2007 (M14, Section KM163)

The following Figure and Table show hourly fluctuation in July to January in 2007. Peak ratio and 16 hours to 24 hours ratio in winter season when people are unwilling to go out, is higher than in the summer season.



Source: State Road Administration

Figure 2.3.6 Hourly Fluctuation in 2007 (M14, Section KM163)

Table 2.3.2 Peak Ratio

Month	Peak One Hour Ratio	16 hours (6:00 - 22:00) / 24 hours
July	5.7%	78.6%
August	5.9%	79.5%
September	6.3%	82.9%
October	6.6%	84.1%
November	7.4%	84.4%
December	7.3%	83.0%
January	7.7%	86.0%

Source: State Road Administration

2.4 Expected Benefits for Japan from the Project

2.4.1 Trends Related to Food and Rare Mineral Security in Japan

Japan is endeavouring to improve its food self-sufficiency ratio and diversification of food imports for emergency food supply. In the past, food supply decreased or was interrupted by the poor rice harvest due to cold weather damage in Japan in 1993, transportation interruption by floods in Mississippi State in the U. S. in 1993, transportation interruption by strikes, poor harvest of crops in China, lockout of ports in Canada, etc.

In order to avoid a food crisis in the world, "Global Food Security" was discussed by G8 leaders at the Toyako Summit in 2008 and a "Food Security Initiative" was adopted at L'Aquila Summit in 2009. In Japan, for stability of food supply, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries established the "International Conference on Investment Promotion for Food Security" in April 2009. The purpose of the conference was to achieve diversification of sources of food imports by "promoting overseas investment in grain production, pick-up and logistics" under public-private partnership.

Large-scale investment in agriculture in developing countries by highly populated nations such as China or India has been known as a "Land Grab", and is a subject that causes apprehension in the world. On the other hand, it is affirmed that Japan's agricultural investment in foreign countries should proceed based on a "Win- Win relationship" for both nations' benefit.

Ukraine, a country with fertile land, has promoted a market-oriented economy since 1991. Ukraine is the one of the important countries in regard to food supply to strengthen food security. JICA invited 13 food related authorities and business leaders for the workshop on the quality control of agricultural products, as part of strengthening relationship between both countries. Furthermore, 16 trainees were invited for a technical transfer program on quality and safety control up to 2008.

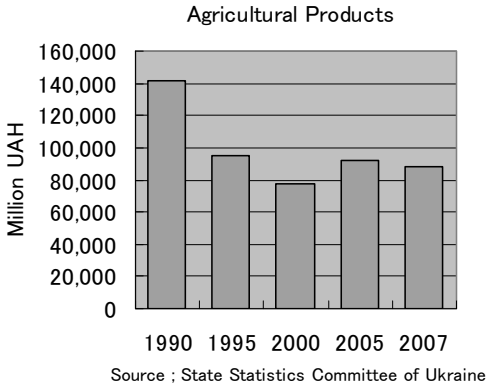
Ukraine also has abundant mineral resources exporting iron ore, aluminium and Titanium to Japan as shown in Figure 2.4.6. Ukraine also produces rare metals such as manganese and zirconium. Although the amount of rare metal and rare earth imported from Ukraine is currently not large, it is important for Japan to diversify trade partner countries, such as Ukraine, considering the present situation slanted to China and a few other countries for importing rare metal and rare earth.

2.4.2 Agriculture in Ukraine and Relationship with Japan

(1) Outline of Agriculture in Ukraine

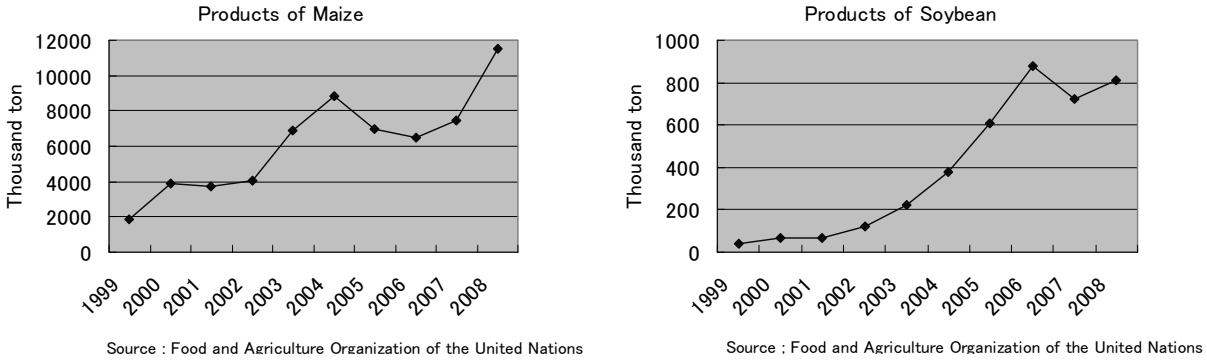
Agriculture is the key industry in Ukraine. In the Mid- South region, known as the "Granary of Europe", there is fertile land of rich black soil. Since 1991, the quantity of agricultural products reduced due to confusion during market transformation and inflation. After 2000, agricultural production has exhibited an increasing trend; agricultural production has recovered to 60% of the 1990 volume.

As shown below, the products of maize and soybeans have been drastically increasing recently.



Source: Ministry of Agriculture, Forestry and Fisheries of Japan

Figure 2.4.1 Agricultural Products in Ukraine



Source: Ministry of Agriculture, Forestry and Fisheries of Japan

Figure 2.4.2 Maize and Soybeans

Major producers of maize and soybeans are distributed in the Mid-Northern region. In the Autonomous Republic of Crimea, the production rate of maize is 7.7 t/ha: it is said that the area is small but the efficiency of production is high.

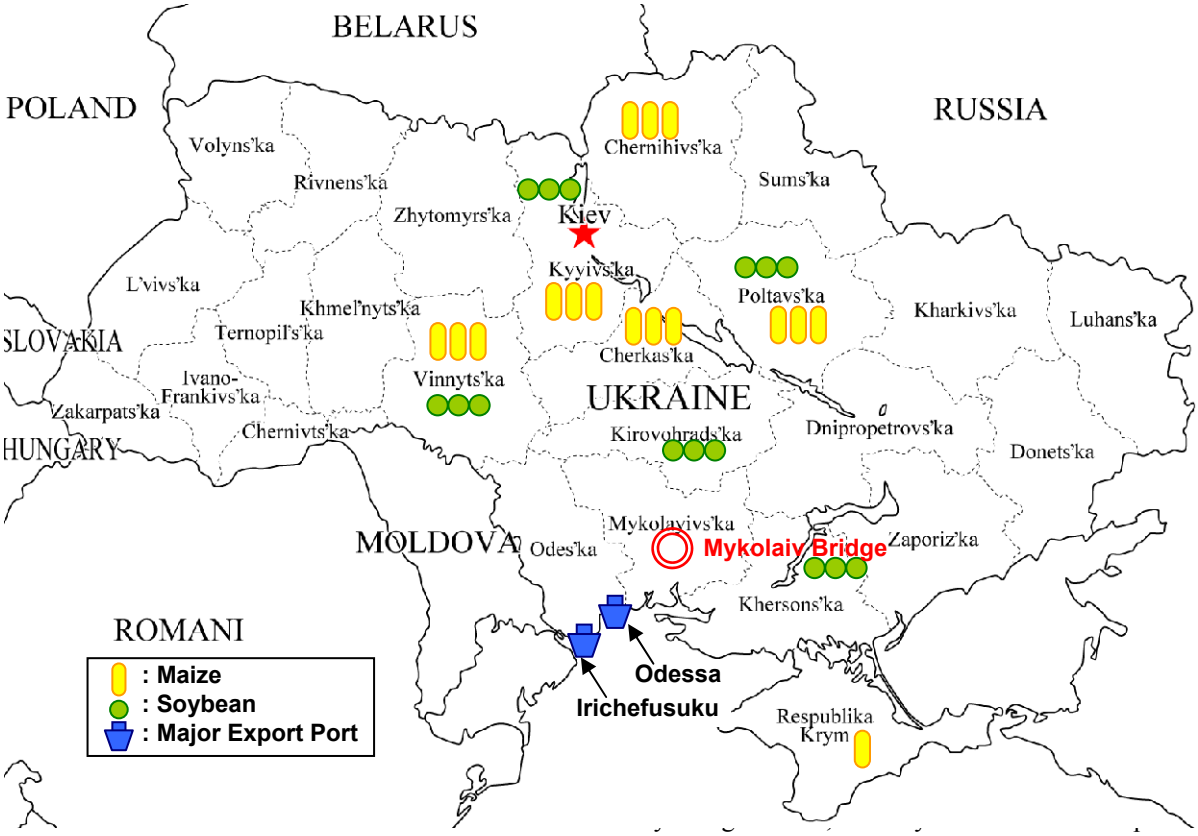
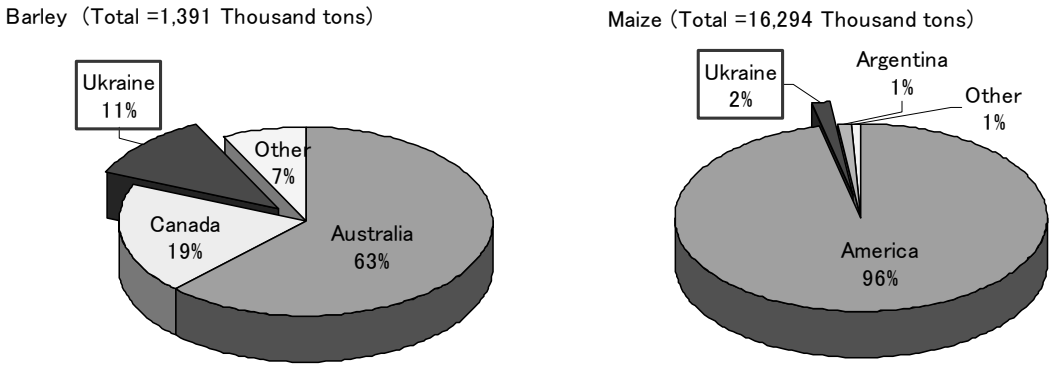


Figure 2.4.3 Major Producers of Maize and Soybeans

(2) Relationship between Ukraine and Japan

In 2009 Ukraine was the second largest exporter of maize in the world and third largest exporter of barley in the world.

Japan has provided technical assistance to the agricultural sector of Ukraine: 16 trainees have been sent for training in quality and safety control of agricultural products.



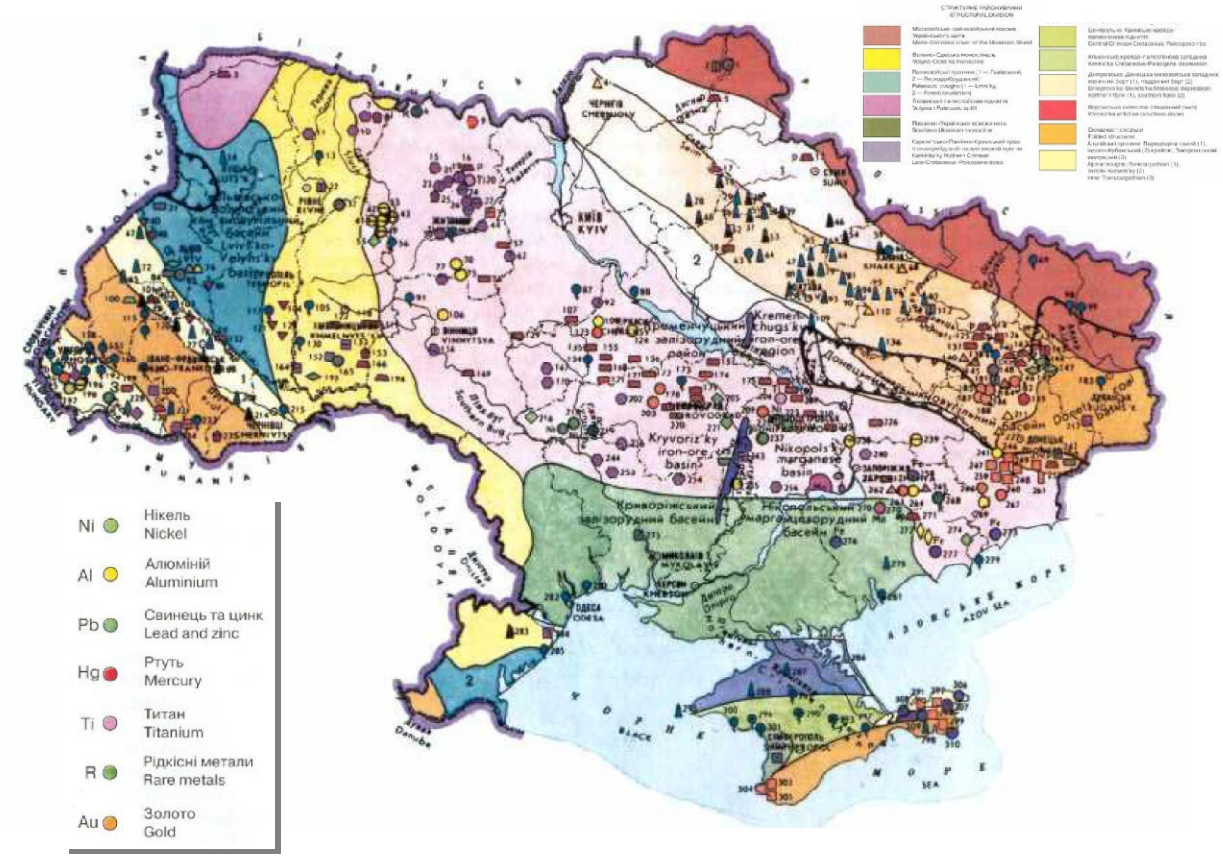
Source: Ministry of Agriculture, Forestry and Fisheries of Japan

Figure 2.4.4 Apportionment of Global Exports of Maize and Barley

2.4.3 Mining Industry in Ukraine and Relationship with Japan

(1) Outline of the Mining Industry in Ukraine

Ukraine, with one of the largest reserves of iron ore in the world, is a country rich in mineral resources. Approximately 150km northwest of Mykolaiv, iron ore is mined in Krivoi Rog mines, steel and metal products are also exported to Japan through the Dnieper River and Mykolaiv region.



Source: Japan Oil, Gas and Metals National Corporation

Figure 2.4.5 Distribution of Geology and Major Ore Deposits

Table 2.4.1 Volume of Production of Major Minerals

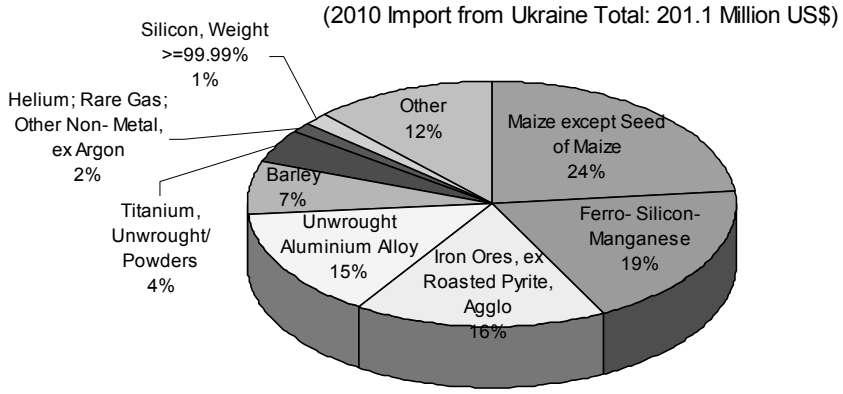
Unit; Thousand tones

	2005	2006	2007	2008	2009
Bituminous coal	58,000	66,600	62,255	63,400	59,000
Iron ore (pure Fe content)	37,700	40,700	42,800	40,000	36,600
Anthracite	16,204	13,444	13,000	14,000	13,000
Alumina	1,632	1,672	1,700	1,673	1,524
Manganese ore (pure Mn content)	770	546	580	492	316
Titanium ores (TiO2 content 59%)	222	276	294	306	295

Source: 2009 Mineral Yearbook, Ukraine (Advance Release): United States Geological Survey

(2) Relationship between Ukraine and Japan

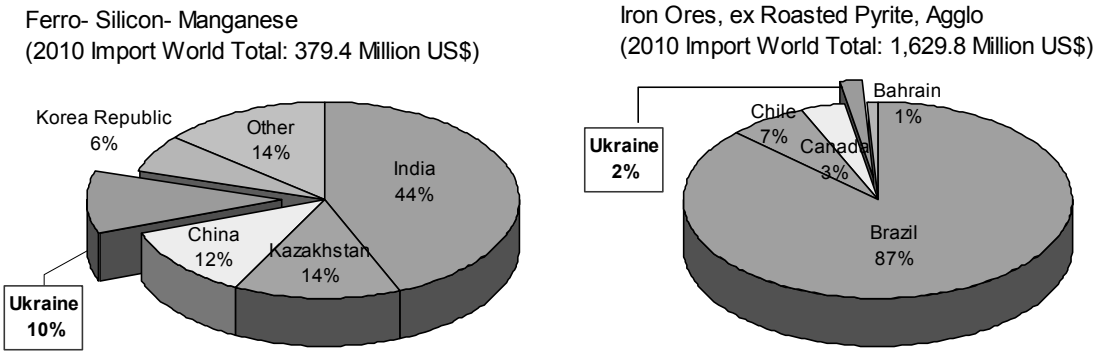
Among goods imported from Ukraine by Japan, ferro silicon manganese and iron ore are second and third to maize in value: these three commodities account for almost 60% of the value of the goods imported from Ukraine into Japan.



Source: Japan External Trade Organization (JETRO)

Figure 2.4.6 The Main Commodities Imported from Ukraine into Japan in 2010

In 2010, Ukraine was the fourth largest exporter of both ferro silicon manganese and iron ore in the world.



Source: Japan External Trade Organization (JETRO)

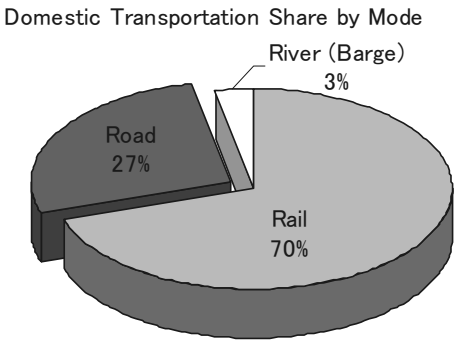
Figure 2.4.7 Apportionment of Global Exporters of Ferro Silicon Manganese and Iron Ore

2.4.4 Land Transport in Ukraine and Expected Benefits to Japan from The Project

(1) Outline of the Domestic Transport[9]

The main ports for export of agricultural products are the ports of Odessa and Irichevsk. Exports to Japan are shipped through the Black Sea and Suez Canal. The major mode of domestic transportation of grain products is rail. Road transport is used for short range (up to 200 km or 300 km) transportation between production areas and export ports and rail terminals.

[9] Source: Ministry of Agriculture, Forestry and Fisheries of Japan



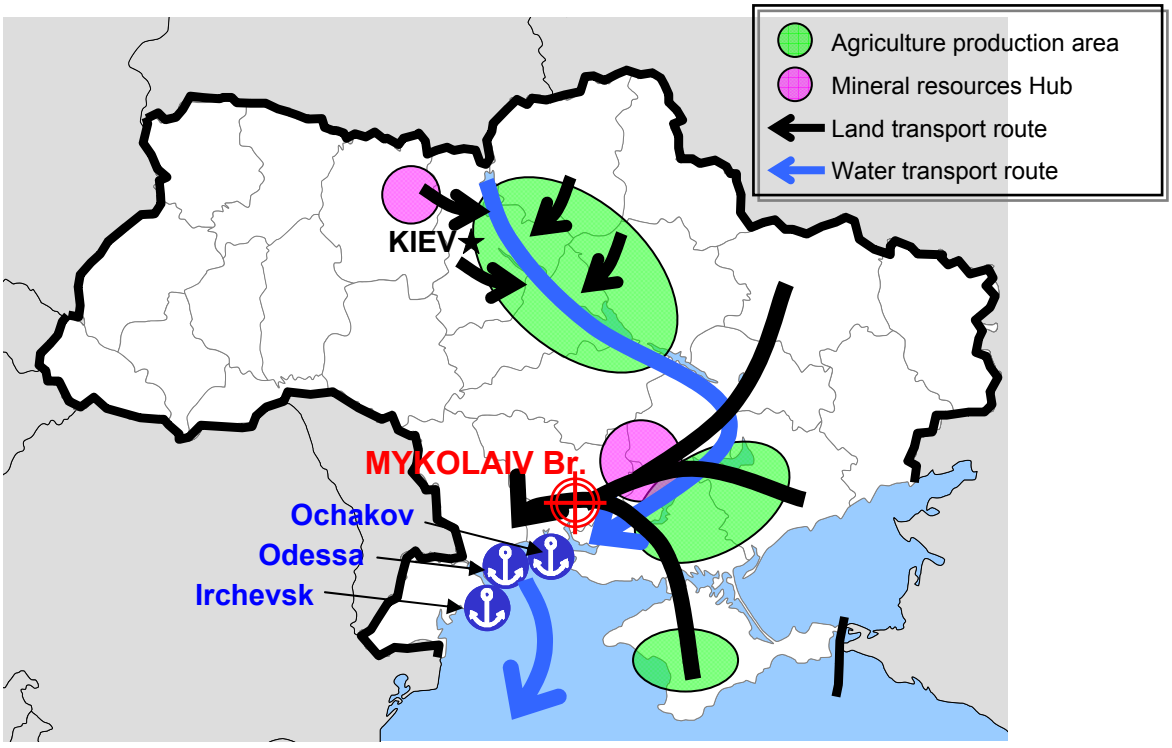
Source: Ministry of Agriculture, Forestry and Fisheries of Japan

Figure 2.4.8 Apportionment of Modes of Transportation of Grain Products

(2) Position of the Mykolaiv Bridge

Mykolaiv city is the key point in the intersection of land routes and waterways. Mykolaiv bridge will allow river traffic along the Southern Bug River and will ensure smooth movement of land traffic from the granary area of the Dniepur River surroundings to the Black Sea ports of Odessa and Irichevsk.

Furthermore, development plans of the Ochakov port, located on the estuary of the Southern Bug River, commenced in 2008. Therefore the importance of river transportation on Southern Bug River will increase.



Source: JICA Survey Team

Figure 2.4.9 Location of Agriculture Production Centres, Mines, Transportation Routes and Mykolaiv Bridge

The port of Odessa, Yuzhniy (30 km north-east of Odessa) and Iliychevsk (25 km south of Odessa) bears more than half of the whole marine transaction volume of all Ukrainian ports. Yuzhniy port is specialized for chemicals, fertilizers and oil transit (by pipelines). As for

general cargo, due to limitation of expansion of the capacity of the port of Odessa and Iliychevsk, Ochakov port will be positioned key terminal port in Ukraine marine transport.

Table 2.4.2 Transaction Volume of Major Ports in Ukraine

Unit: 1000 ton

Name of Port	2005	2006	2007	2008	Share in 2008 (%)
Odessa	26,846.5	28,009.6	31,368.6	34,562.2	26.1
Yuzhniy	20,698.6	20,764.3	21,500.1	21,697.9	16.4
Iliychevsk	14,968.6	14,841.7	16,034.3	18,904.0	14.3
Mariupol	14,774.4	15,829.0	17,403.3	15,961.1	12.1
Mykolaiv	5,556.4	6,380.8	7,951.9	9,254.5	7.0
Other Ports	31,748.9	33,098.9	37,430.9	41,056.2	31.1
Total of Ukrainian Ports	109,037.0	112,543.5	123,737.2	132,181.4	100.0

Source: Monthly Report June 2009, Institute for Russian & NIS Economic Studies

(3) Expected Benefits for Japan from the Project

Ukraine's trade balance with Japan up to September, 2010 is a deficit of 440 million U.S. dollars. In order to ease trade imbalances, imports from Ukraine should be encouraged.

Ukraine is one of the countries essential to the strategy of diversification of sources of food and mineral imports for Japan. Mykolaiv Bridge is in a strategic position in the agricultural and mineral products region in Ukraine, as the intersection of land and maritime transport. Therefore, the construction of the Mykolaiv Bridge is important for both countries: Japan will enjoy significant benefits from the project.

2.5 Regulation and Standards for Road Sector

Before 1991, during the Soviet Union era, SNiP and GOST were used as a building codes and standards for design and construction of roads and bridges.

After acquiring independence from USSR, Ukraine established its own building codes named DBN instead of SNiP. DBNs for the road design and construction, bridge design and construction and related various testing methods have been completed. However, many SNiPs are used as reference codes and the DBN is based on the GOST standard. The DBN (Ukrainian design standard) was referred to in the design of roads in the feasibility study in 2004. The SNIPs were changed to DBN for Ukrainian projects, and they have been updated several times.

Main design standards to be applied for this project are shown in Table 2.5.1.

Table 2.5.1 Inventory of Main Design Standards to be Applied for This Project

Name of Design Standard	Sub-Title	Design object
DBN V1.2-15:2009	Bridge and Pipe Loads and Impact	Bridges
DBN V.2.3-4:2007	Automobile Roads	Main Road 13km long (including bridge section)
DBN V.2.3-5:2001	Streets and Roads in Population Center	Intersections
DBN V.2.3-14:2006	Bridge and Pipe Design Rules	Bridges
DBN V.2.3-14:2007	Land Allotment for Construction of Motor Roads	Main Road 13km long
DBN V.2.3-22:2009	Bridge and Pipe Design Rules	Bridges
DBN V.1.1-12:2006	Earthquakes in Ukraine	Bridges
DBN V 1.1- 4:2009	The system of Approval Planning Justification	-
DSTU B.V2.3-1:95	Navigation Clearance under Bridges	Bridges
DBN V 1.2-2:2006	System Reliability and Safety of construction Projects	Bridges
SNiP 2.2.01-83(2000)	Construction Standards and Rules/Foundations	Bridges
DBN D 2.2- 1: 99	Cost Estimate for Earth Work	Earth Work
DBN D 2.2-30: 99	Cost Estimate for Bridges	Bridges
-	SPECIFICATIONS OF HONSHU-SIKOKU EXPRESSWAY(HSBE SPECIFICATIONS)	Suspension Bridge including Superstructure and Substructure

Source: JICA Survey Team

CHAPTER 3

NATURAL CONDITION SURVEY AT THE PROJECT SITE

3. NATURAL CONDITION SURVEY AT THE PROJECT SITE

3.1 Topographical Survey

3.1.1 Outline of Topographic Survey

There is the Project area at the position of 80km from the Black Sea to the northern part and the area becomes the sedimentary plane due to the Southern Bug River mouth which is the main river of the Ukraine.

The topography in the project area faces about EL 60m in an interchange part with the international highway (M-23), it is a gentle down slope to Southern Bug River and EL 0m at the river left bank department. The right bank of the riverside is EL -1.27m and EL 55m in the interchange part with international highway (M-14).

The 450km section from the right bank of the riverside becomes in particular about 12.5% ascents and a landslide occurs.

3.1.2 Topographic Survey

The topographic survey was carried out from December, 2010 to the end of February, 2011. The survey divides it into the Bridge Section Survey at the river and Road Section Survey.

The contents of the Bridge Section Survey at the river are 1) River bed survey and Plane survey, 2) Center line and longitudinal survey on new bridge, 3) Cross section survey on new bridge, 4) Setting of benchmarks

The contents of Road Section Survey are 1) Plane survey, 2) Center line and longitudinal survey on new road, 3) Cross section survey on new road and 4) Setting of benchmarks.

It shows more detail item and quantity in Table 3.1.1 for the survey.

Table 3.1.1 Scope of the Topographic Survey

Bridge Section Survey	Unit	Quantity
River bed and Plane Survey	km^2	0.495
Center line and Longitudinal survey	m	2,475
Cross section survey	m	12,500
Road section survey	**Unit**	**Quantity**
Plane survey	km^2	2.000
Center line and Longitudinal survey	m	8,000
Cross section survey	m	40,100
Establish benchmarks	number	15

Source: JICA Survey Team

The results of the topographic survey are below the item and those result uses for the drawing of road and bridge design. The bench marks have established and the coordination shows in Table 3.1.2.

(1) Contour map based on total station: Scale 1/1000

(2) Longitudinal drawing of center line for the road and bridge : Scale V=1/200, H=1/1000

(3) Cross section drawing: Scale 1/200

Table 3.1.2 Coordination of bench mark

Bench mark	N	E	Level (m)
BM 2221	47 02' 37.8"	31 58' 00.6"	56.236
BM2222	47 02' 30.7"	31 58' 12.1"	52.919
BM2223	47 02' 41.5"	31 57' 52.6"	57.590
BM3500	47 02' 35.8"	31 56' 03.9"	45.498
BM3501	47 02' 30.8"	31 55' 56.0"	45.741
BM6700	47 01' 46.2"	31 54' 03.9"	35.727
BM322	47 01' 36.2"	31 54' 12.4"	38.030
BMC4	47 00' 23.2"	31 53' 31.5"	2.312
BMC3	47 00' 16.1"	31 53' 27.6"	2.664
BMC2	46 59' 16.6"	31 52' 54.9"	29.407
BMC1	46 59' 14.8"	31 52' 53.9"	36.559
BM1250	46 58' 52.4"	31 53' 00.8"	58.116
BM1251	46 58' 50.5"	31 52' 46.4"	56.916
BM1252	46 58' 47.4"	31 52' 26.2"	52.770
BM1253	46 58' 45.3"	31 52' 01.1"	53.067

Source: JICA Survey Team

3.2 Geological Survey

3.2.1 Outline of Geological Survey

There is Ukrainian shield which located southwest of Eurasian plate and East Europe Craton in Ukraine.

Ukrainian shield is old bedrock formed which area from the northwest of Ukraine to the southeast (Azov sea) on last Cambrian period (4,500 to 540 million years before) and as for about 1,000km length, about 250km width, total area about 256,600 km2, the greatest height is 347m from sea level.

It is formed by granite, gneiss, quartzite, sandstone and is divided into two plateaus of Dnieper plateau and the Azov plateau.

There is made up of a system of sedimentary terrigenous-carbonate deposits of Miocene of Sarmatian stage, loams of Niogene quaternary, alluvial quaternary deposits.

River bed of Southern Bug River at Bridge section are revealed solid and semisolid marl with inclusions of crushed-rock limestone and fine interlayer of limestone and sandstone.

3.2.2 Geological Survey

The geological survey divided it into the land section and river section for a road and a bridge design in a main position of road centre line and carried it out.

The survey on the land section carried out 6 places of 3 bore holes (right bank side) and 3 bore holes (left bank side) in total in February 2011 from December, 2010 . The surveys into left bank side point are an interchange, an abutment and the viaduct bridge position. The surveys into right bank side point are Anchorage of the suspension bridge plan, an abutment and an interchange position.

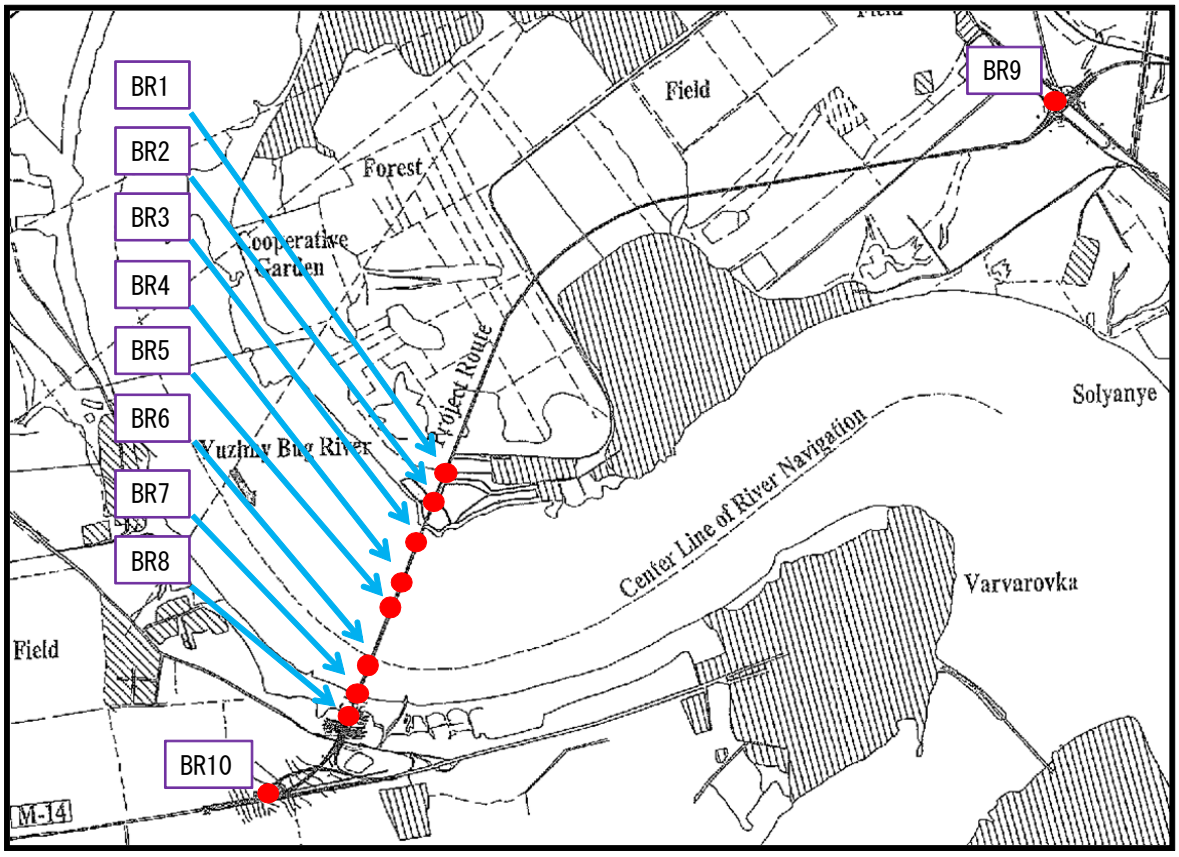
The survey on the river section carried out 4 places in July to August, 2011. The surveys points are a viaduct bridge, Anchorage of the suspension bridge plan (left bank) and both side of tower.

It shows coordination in Table 3.2.1 and a location map in Figure 3.2.1.

Table 3.2.1 Coordination of Survey

Number	Coordination		Assumed structure
BR1	31 53' 31.6"	47 00' 23.3"	Abutment
BR2	31 53' 27.6"	47 00' 16.1"	Viaduct bridge
BR3	31 53' 15.4"	46 59' 53.8"	Viaduct bridge
BR4	31 53' 09.9"	46 59' 43.9"	Anchorage
BR5	31 53' 07.6"	46 59' 39.8"	Tower
BR6	31 52' 59.2"	46 59' 24.4"	Tower
BR7	31 52' 57.2"	46 59' 20.2"	Anchorage
BR8	31 52' 55.4"	46 59' 16.3"	Abutment
BR9	31 58' 05.1"	47 02' 37.5"	Interchange(Left bank)
BR10	31 52' 15.2"	46 58' 47.9"	Interchange(Right bank)

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.2.1 Location Map

The main contents of the geological survey are 1) bore hole, 2) Cone penetration Test, 3) Material test, 4) Report and it shows more detail item and quantity in Table 3.2.2 for survey on Land and in Table 3.2.3 for survey on the river.

Table 3.2.2 Scope of the Geological Survey on Land

Boring Item	Unit	Quantity
Boring site	number	6
Boring on Land	m	231.6
Cone Penetration Test	m	118
Laboratory test	**Unit**	**Quantity**
Specific gravity	Sample	46
Natural moisture content	Sample	36
Sieve analysis	Sample	36
Liquid/Plasticity test	Sample	36
Tri-axial compression test	Sample	10
Unconfined compression test	Sample	13

Source: JICA Survey Team

Table 3.2.3 Scope of the Geological Survey on the River

Boring Item	Unit	Quantity
Boring site	number	4
Boring on the River	m	172
Cone Penetration Test	m	172
Laboratory test	**Unit**	**Quantity**
Specific gravity	Sample	32
Natural moisture content	Sample	20
Sieve analysis	Sample	20
Liquid/Plasticity test	Sample	20
Tri-axial compression test	Sample	4
Unconfined compression test	Sample	26

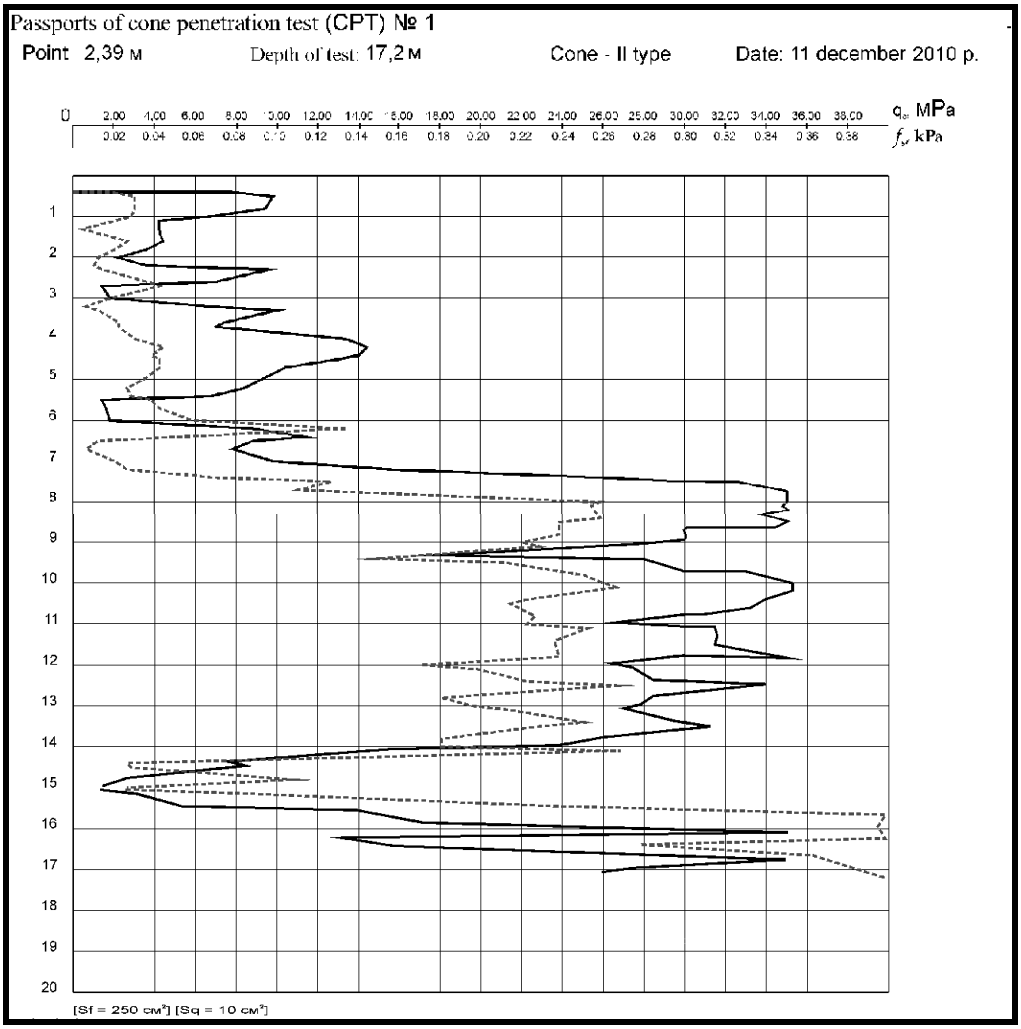
Source: JICA Survey Team

The result of the geological survey are 1) graph of cone penetration test, 2) material test, 3) boring log, 4) record of bore hole, 5) photo of core box and so on.

It describe a corn penetration test to evaluate a layer in support of the foundations of bridge structure in accordance with these test results, a geological feature ingredient and a boring log as follows.

(1) Cone Penetration Test

It shows a graph of depth and the ground resistance as a result of corn penetration test more (Figure 3.2.2). Resistance of the ground increased so that depth was deepened, and there was the class of hard clay which limestone got mixed with to depth 8m - around 14m, and resistance suddenly increased in this layer, and the hard clay was detected at depth after 17m by this graph. It becomes a hard layer having high density as the clay layer because limestone mixes in this layer and it is bearing stratum for supporting a pile foundation.



Source: JICA Survey Team

Figure 3.2.2 Result of Cone Penetration Test

(2) Material Test

We took the soil sample and performed materials examination of ingredient of soil, because it is prescribed by the geological survey of the Ukraine. As a result, relatively soil with much sulphate was detected around of viaduct bridge (BR-2) of the left bank part. It should be considered the concrete proportion and thicknesses of the concrete structure although there is weal sulphate.

Table 3.2.4 Result of Material Test

Place of Sampling	Depth of selection (m)	pH	CO_2 aggressive (mg/l)
BR-1	5.0	7.6	4.4
BR-2	10.0	6.9	17.6
BR-2	0.1	5.4	48.4
BR-3	0.5	7.1	6.6
BR-4	0.6	6.9	24.2
BR-5	0.5	7.5	11.0
BR-6	0.4	6.7	15.4
BR-7	4.0	7.5	6.6
BR-8	17.0	7.1	6.0
BR-9	5.6	7.2	8.8

Source: JICA Survey Team

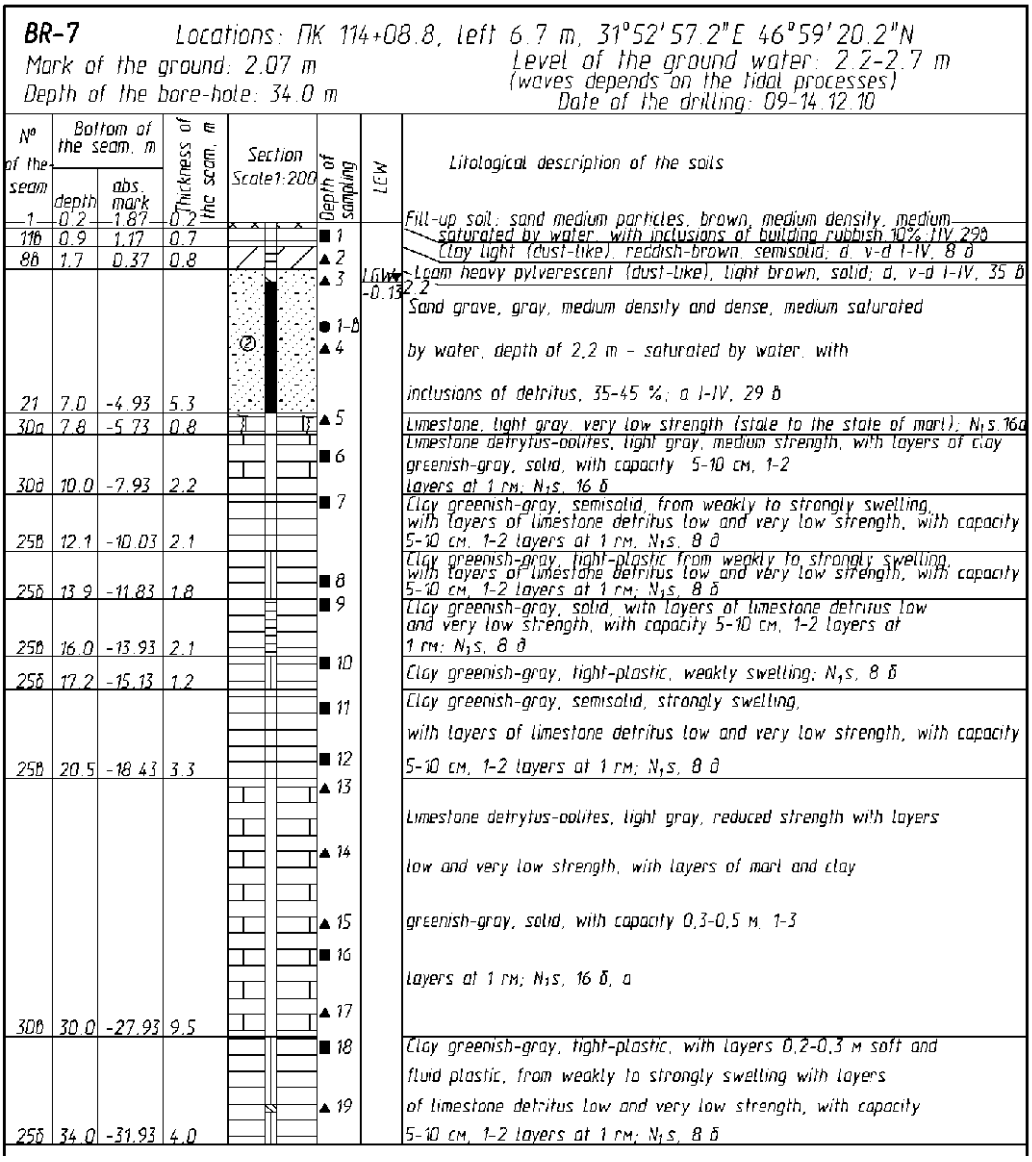
(3) Boring Log

Boring log shows the geological feature section of the digging point and the sectional depth is from the surface of the layer of an assumed bearing stratum. Information such as location, the water level in the bore hole, the stratum of each layer and a geological feature classification result, the boring length is illustrated in the columnar section.

It makes ten places of boring log in total by this project and shows a representative log in figure 3.3.3. In this boring log, it classifies in five layer and show stratum number in the left row. Stratum number 8 is loam, stratum number 11 is the surface layer including the clay soil and stratum number 21st becomes the gray colour of sand layer with density.

The stratum number 25th is greenish hard clay including the limestone, and the stratum number 30th is gray limestone. In this layer of the 25th and the 30th, a high resistance is provided, and it is with the layer where these layers support a pile foundation in accordance with the result of cone penetration test.

It was recognized that the silt layer deposited at the bottom of a river with the boring log of the river section. This silt layer becomes about 15m at BR3, about 23m at BR3, and the sedimentation layer thickens towards the right bank. This layer is disturbed and causes the river contamination when the substructure construct in the river due to the layer is very soft.



Source: JICA Survey Team

Figure 3.2.3 Boring log

3.2.3 Conclusions and Recommendations on Geology of Bridge Location

(1) In a geomorphologic context, the area under research is located in the valley of the Southern Bug River and primary-accumulative plain.

(2) Geological – litho logic cut of the explored depth of 35.6 m is made of quaternary anthropogenic diluvial, aeolian-diluvial, alluvial sediments and rocks of Sarmatian geologic stage of Neogene age.

(3) According to geological - genetic characteristics and physical -mechanical properties 22 engineer - geological elements are allocated, presented in Table normative and calculations of physics - mechanic characteristics of soils of engineering - geology passport.

(4) Groundwater met by wells in quaternary alluvial, diluvial, aeolian- diluvial sandy sediments and in Neogene thickness in limestone fracture on depth 1,7-13,0 m. (absolute marks from – 0,30 to 47,61 m). Aquifers have a close hydraulic connection with the water of Southern Bug River. Groundwater of this aquifer and water of Southern Bug River are non-aggressive or have low and medium carbonaceous and sulfate content

aggressive towards concrete grade W4 for water resistance for constructions, located in the ground with coefficient of filtration higher than 0,1 m/day, in open basin and for pressure constructions according to the SNIP2.03.11-85. Results of chemical analysis of water are presented in the table.

(5) Diluvial, aeolian- diluvial and neogene clay have swelling properties ranging from low to strong.

(6) Normative depth of freezing for loamy-clay soils is 0,65 m while it is 0,85 m for loam-sandy and sandy soils.

(7) On the right bank, the gully-ravine watersheds system is developed and there are preconditions for landslides. Potential Square for slides is the contact of quaternary and neogene sediments. The slope is in stage of unstable balance. General and local resistance of the slope should be verified by calculation. At the moment, the slide is in stable condition.

(8) Foundation of base for of the bridge through Southern Bug River is recommended on drilled piers with deepening on EGE-25 and 30.

(9) In boreholes BR1, BR2, BR7, BR8 indicated stratum "bearing stratum" EGE -25, and 30 for boreholes BR9, BR10 are EGE 11.

(10) There is very soft layer below the bottom of the river. This sedimentation layer becomes about 15m to 23m thickness around the river section. The layer is disturbed and causes the river contamination when the substructure construct in the river due to the layer is very soft. At the time of the construction of the bridge, measures to prevent contamination are necessary.

(11) The JICA Survey Team carried out the investigation of the minimum point with the equipment of the Ukrainian country because the geological survey of this project was a preliminary design stage. By the design of main bridge at the time of the detailed design, it should be increase the appropriate number of bore hole, and enforcement of standard penetration test (SPT) is required. We recommend the position of anchorage, the tower, each abutment and pier as an investigation point.

3.3 Results of Meteorological Survey

The proposed Mykolaiv Bridge will be northwest of Mykolaiv City which is close to the Black Sea; an area that is in the steppe zone of moderate continental climate.

3.3.1 Meteorological Data

Meteorological and hydrological data was assembled by Mykolaiv Regional Hydrometeorology Centre[1]. The meteorological station was at the head office of Regional Centre (E31°58′27″ N46°58′20″) until 1988 and then moved to Balovnoye Airport (E31°54′56″ N47°03′33″). Balovnoye Airport is about six (6) km north of the proposed bridge site. It's location is shown in Figure 3.3.1.

Meteorological data has been collected from 1876 to 2009, however, only data from 1876 to 2005 was available at this stage. Monthly meteorological data is summarized in Table 3.3.1.

[1] Ministry of Ukraine of Emergencies and Affairs of Population Protection from the Consequences of Chernobyl Catastrophe

Table 3.3.1 Monthly Meteorological Data in Mykolaiv City (1876-2009)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Yearly
Temperature(℃)													
Mean Max.	0.3	1.6	6.6	15.5	22.2	26.1	28.1	27.9	22.7	15.3	7.8	2.8	14.7
Mean Min.	-5.8	-4.6	-0.5	5.8	11.5	15.2	17.0	16.3	12.0	6.2	1.7	-2.6	6.0
Ave.	-3.3	-2.5	2.3	9.5	16.7	20.8	23.6	22.6	17.3	10.7	4.1	0.9	10.1
Max.	14.0	18.1	24.1	29.5	35.1	36.6	40.0	40.1	34.1	32.9	23.4	15.6	40.1
Min.	-29.7	-28.7	-20.8	-7.9	-1.2	4.2	9.0	7.5	-1.4	-13.7	-18.2	-24.6	-29.7
Relative Humidity (%)	85	82	77	69	64	64	61	60	68	75	84	86	73
Wind Speed(m/s)													
Max.	30	24	28	40	20	20	28	20	21	40	27	34	40
Mean	4.1	4.2	4.1	3.9	3.6	3.3	3.1	3.0	3.2	3.4	3.8	4.0	3.6
Days with Wind Speed over 15m/s	1.9	2.2	2.1	1.7	1.2	1.4	1.1	0.6	0.6	1.2	1.5	1.8	17.3
Rainfall (mm)													
Mean	26	27	25	27	44	51	39	36	46	32	32	31	416
Daily Max.	28	35	41	34	71	144	75	138	90	63	40	33	144
Rainy Days over 10mm/day	0.5	0.7	0.7	0.6	1.2	1.3	1.5	1.1	1.2	1.0	1.1	0.7	11.6

Source: Mykolaiv Regional Hydrometeorology Centre

Average annual rainfall is 447mm/year, while maximum and minimum annual rainfalls are 743 mm/year (1955) and 230 mm/year, respectively.

Rainfall Intensity-Duration-Frequency curve/formula is unnecessary in bridge and/or road design in the Ukraine, therefore this information is not assembled by the Regional Hydrometeorology Centre.

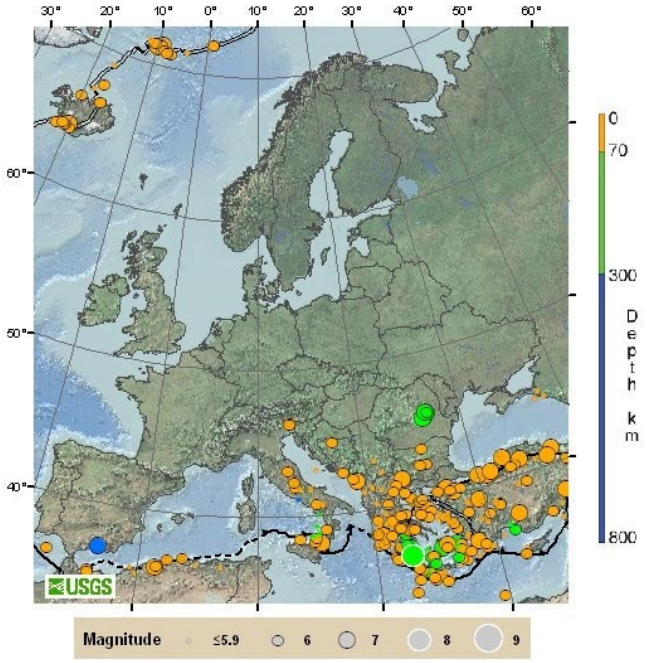
Source: JICA Survey Team

Figure 3.3.1 Location Map

3.3.2 Earthquake

Project area is located in a low-risk earthquake zone.

There hasn't been any remarkable earthquake event in/around the survey area since 1900, as gleaned from the USGS[2] web site.



Source: USGS Web Site

Figure 3.3.2 Epicenters in Europe (1900-2007)

3.3.3 Ice Regime[3]

Ice regime in region of Mykolaiv City is characterized with high variability and depends on the severity of a winter. Ice appears at slight decreasing of the water temperature below 0ºC. Ice formation is unstable. When soft air masses penetrate to the Southern Bug mouth area, then ice cover breaks; next lowering of temperature again causes freezing. During winter time, such situation happens a few times. Annually it is observed fast ice and drifting ice. As usual, in Mykolaiv there is no floating ice. In some years, ice ridge and ice piles on shore were observed.

Mean annual beginning date of ice phenomena (for 1956-2010) is 12th of December; mean annual end date of ice phenomena is 10th of March. At the average for the period from 1956 till 2010 74 days with all ice phenomena and 44 days with ice formation (including discontinuous ice) were observed.

[2] http://earthquake.usgs.gov/earthquakes/world/seismicity/europe.php

[3] Source: Ministry of Ukraine on Emergency and People Problem from Chernobilska Disaster Sequences/ State Hydrometeorological service Mes. L.M.Duranyk

Table 3.3.2 Ice regime and thickness of ice cover

Year	Beginning dates of ice phenomena	End dates of ice phenomena	Quantity of days with all phenomena	Quantity of days with complete freezing on the river	Maximum thickness of ice, cm
2000-2001	25.12	3.03	17	3	3
2001-2002	6.12	11.02	60	55	26
2002-2003	8.12	31.03	113	110	34
2003-2004	11.12	1.03	52	22	13
2004-2005	16.12	15.03	45	20	12
2005-2006	21.12	22.03	80	46	33
2006-2007	27.12	4.03	18	9	5
2007-2008	2.01	27.02	56	39	16
2008-2009	23.12	31.01	38	26	18
2009-2010	17.12	17.03	86	53	32
2010-2011	13.12	17.03	72	55	27
Average			58	40	20

Source: Ministry of Ukraine on Emergency and People Problem from Chernobilska Disaster Sequences/ State Hydrometeorological service Mes. L.M.Duranyk

3.4 Results of Hydrological Survey

The proposed bridge site is located upstream of the Varvarovsky Bridge: this stretch is tidal-prone. Varvarovsky Bridge forms the boundary between river and sea regime. The stretch upstream of Varvarovsky Bridge has fresh water while its downstream side has brackish water.

The Southern Bug River is nourished by melted snow in spring and rain during other seasons. Natural water level around the proposed bridge site is constantly affected by wind-setup from the Dnieper-Bug estuary.

3.4.1 Southern Bug River

Southern Bug River originates in Volyn-Podollya plateau near Kholodets Village (321 m BS[4]) and flows into Dnieper-Buh Estuary of the Black Sea. Catchment area of Southern Bug River is 63,700 km^2, channel length is 806 km and average channel slope is 0.00006 at the Varvarovsky Bridge.

Flood period is about two (2) months and flood peak lasts for about 3-6 hours. The river usually freezes for three (3) months in winter season from December to February.

The proposed bridge will cross a section of width of about 1,700 meters on Southern Bug River at about 9 km upstream of Varvarovsky Bridge (constructed in 1964). The river is 5-7 meters deep on the right and gradually becomes shallower to the left.

The river at the proposed bridge site is characterized by unstable freeze-up and observed maximum ice thickness of Southern Bug River is 0.59 m which corresponds to about 1% probability of exceedance.

[4] Baltic System (Mean Sea Level of Baltic Sea)

3.4.2 Hydrological Data

There are two hydrological gauging stations on Southern Bug River, one is in Oleksandrivka Village (E31°15′18″ N47°42′05″) and another is in Mykolaiv City (E31°58′13″ N46°59′00″). These two (2) stations belong to Mykolaiv Regional Centre of Hydrometeorology.

Oleksandrivka hydrometric station is about 132 km upstream of Varvarovsky Bridge and its discharge data has been measured since 1914.

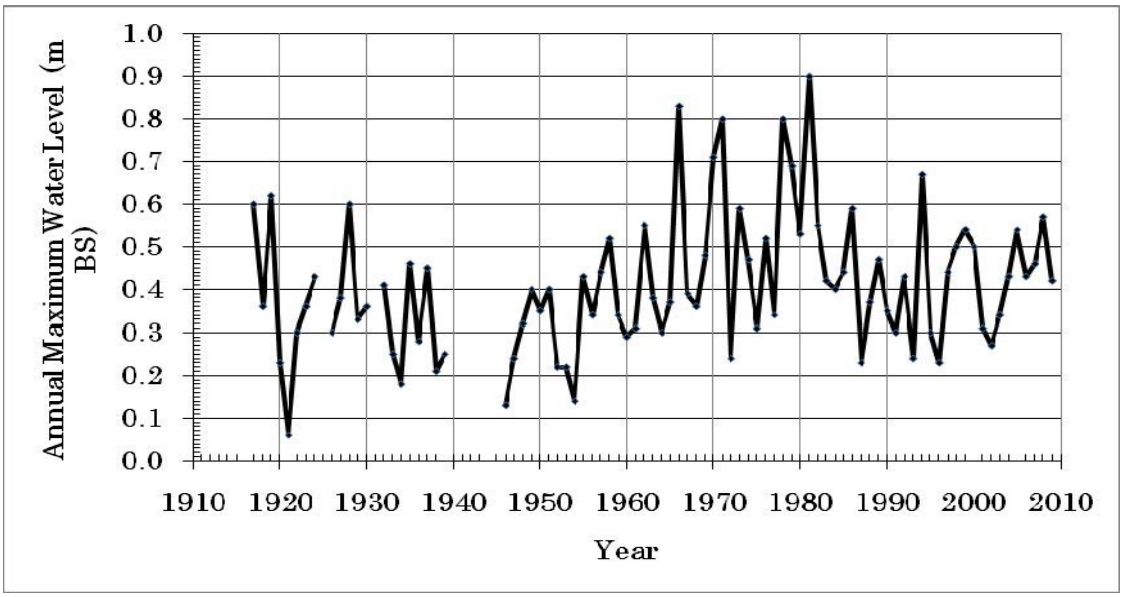
Mykolaiv hydrometric station is on the left bank immediately upstream of Varvarovsky Bridge, wherein water level data is measured. Varvarovsky Bridge is 11.4 km downstream of the proposed bridge site. Manual observation was started in 1956 while the automatic gauge was installed in 1973. Catchment area of Mykolaiv hydrometric station is 63,700 km^2 and location of Varvarovsky Station is shown in Figure 3.3.1

(1) Water Level at Mykolaiv Station

Available data period at Mykolaiv Station is from 1915 to 2009 and the datum used is the Baltic System (BS).

Maximum and minimum high water levels are 0.90 m BS (Nov.10, 1981) and 0.06 m BS (May.3, 1921), respectively. The average high water level for 53 years is 482 cm GL. High water level is mainly controlled by wind direction: rarely is discharge the dominant component. A SSW wind direction tends to increase the water level while northbound winds tend to decrease it.

Annual maximum high water level in 83 years is shown in Figure 3.4.1.



Source: JICA Survey Team (data from Hydrometeorological Centre)

Figure 3.4.1 Annual Maximum Water Level at Mykolaiv

Annual maximum flood levels vary from 0.06 to 0.90 m BS: the amplitude is 84 centimetres.

(2) Discharge at Oleksandrivka

Available data at Oleksandrivka Hydrometric Station is from 1914 to 2009. The annual average discharge is 89.1m^3/s.

Maximum flood discharge was estimated at 5,320m^3/s (April 8, 1932) and annual maximum flood discharge is observed in March and/or April.

3.4.3 Design Conditions

Catchment area of Proposed Bridge site is 53,800 km^2 and hydrological output data for bridge design was estimated in Feasibility Study in 2004. Updated observation data is mainly limited up to 2005, therefore the design data estimated in the Feasibility Study (2004) is used for this study.

(1) Water Level

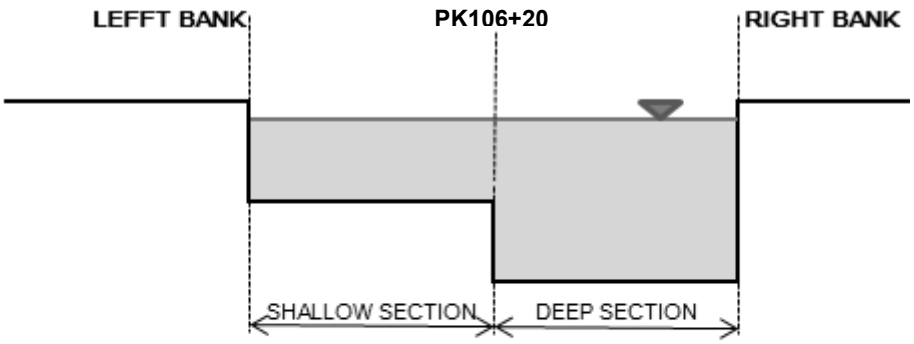
Water level of 1% exceedance probability considering wind-setup is 1.58 m BS while low water level is estimated at -0.17 m BS at the proposed bridge site.

(2) Discharge

Exceedance probability of 1% (corresponding to 100-year return period) discharge at the proposed bridge site is estimated at 4,500 m^3/s while those of 2% (50-year) and 10% (10-year) are estimated to be 3,710 and 2,118 m^3/s, respectively.

Annual mean discharge is estimated at 108m^3/s at the proposed bridge site.

There are two flow sections at the proposed bridge crossing, one is the shallow section (left bank to PK106+20) and the other is the deep section (PK106+20 to right bank). Hydrological factors of 1% exceedance probability for each section are shown in Figure 3.4.2.



Discharge Distribution (%)	21	79
Width of Section (m)	780	1,048
Discharge (m^3/s)	**930**	**3.570**
Flow Velocity (m/s)	**0.50**	**0.83**

Source: JICA Survey Team (data from 2004 F/S Report)

Figure 3.4.2 Hydrological Factors of 1% Exceedance Probability

(3) Navigation Issues

The proposed bridge level was designed considering the navigation clearance. The navigation clearance was estimated by adding vessel height to the navigation level.

The navigation level was estimated at 0.78 m BS in F/S (2004) and these results are available at this stage.

CHAPTER 4

TRAFFIC SURVEY AND TRAFFIC DEMAND FORECAST

4. TRAFFIC SURVEY AND TRAFFIC DEMAND FORECAST

4.1 Results of Traffic Survey

4.1.1 Outline of Traffic Survey

For understanding of the characteristics of the traffic on the existing Varvarovsky Bridge, a traffic survey was conducted on the 16th-17th and 20th-21st of December in 2010. The traffic survey consisted of continuous 24 hour traffic count survey for 2 days and roadside driver interview survey for 1 day. Survey location was west of the existing Varvarovsky Bridge.

Vehicular traffic was categorized into 6 categories for the traffic survey, namely: motorcycles, passenger cars, buses, 2-axle trucks, 3 and more axle rigid trucks and semi/full trailers.

Roadside driver interviews included queries on number of passengers, trip purpose, origin and destination and preference for using the new Mykolaiv Bridge. In addition, for freight trucks including trailers, queries concerned with commodities/cargo being transported and loading weight were included in the interviews.

4.1.2 Results of Traffic Survey

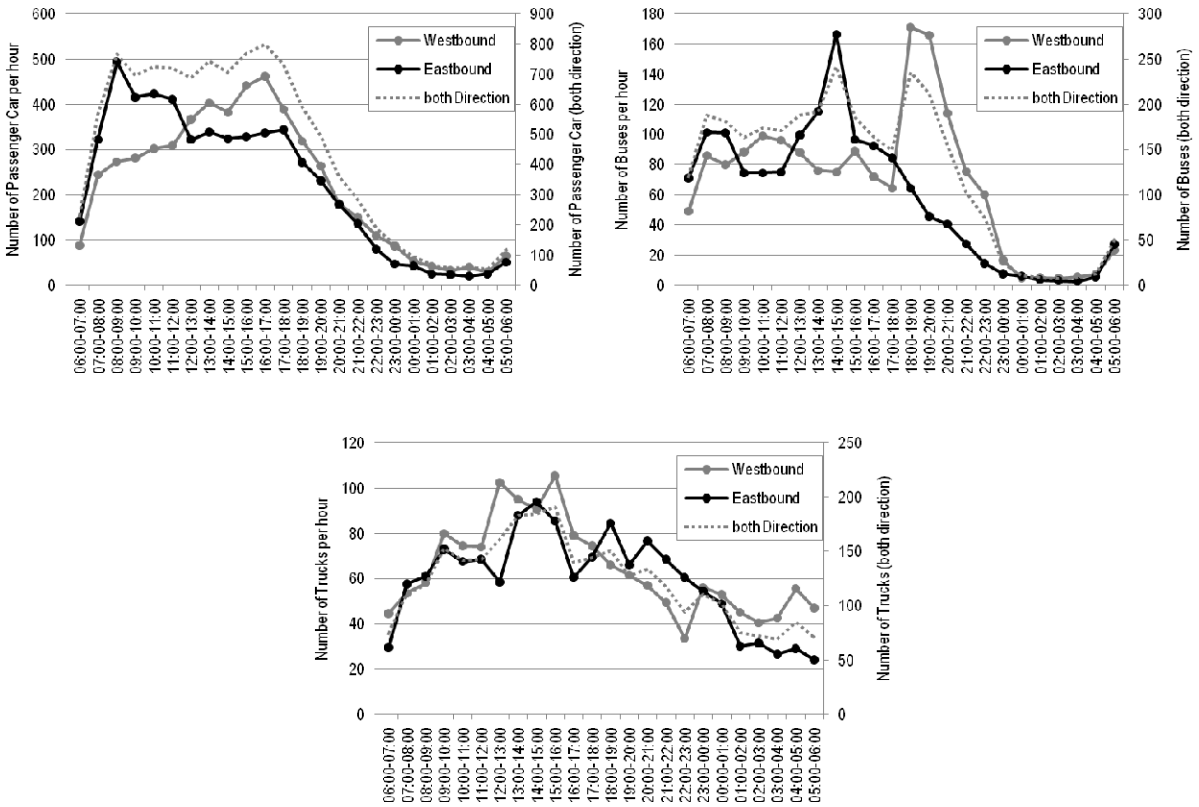
For the existing Varvarovsky Bridge, the observed 24 hour traffic volume is summarized in the following table. Average daily traffic volume is about 17,000 vehicles. Passenger cars account for 64% of total traffic volume while buses and trailers account for 18% and 8% respectively. Motorcycles were not observed in the survey period.

Table 4.1.1 24 Hour Traffic Volume (both directions)

	Motor-cycles	Passenger Cars	Buses	2 Axle Trucks	3+ Axle Trucks	Trailers	Total (veh/day)
Day 1	0	10,610	3,608	1,129	486	1,397	17,230
Day 2	0	10,680	2,423	1,175	510	1,207	15,995
Ave.	0	10,645	3,016	1,152	498	1,302	16,613
Share	0.0%	64.1%	18.2%	6.9%	3.0%	7.8%	100.0%

Source: JICA Survey Team

Figure 4.1.1 shows the hourly fluctuation of traffic volume on the existing Varvarovsky Bridge. As regards passenger cars, morning peaks (8:00 - 9:00 a.m.) were observed for eastbound traffic (to Mykolaiv city center) while evening peaks (16:00 - 17:00 p.m.) were observed for westbound traffic (to Odessa). The peak hour for buses was observed in the afternoon, at 14:00-15:00 p.m. for eastbound traffic and at 18:00-19:00 p.m. for westbound traffic. As regards trucks, no particular peaks were observed.



Source: JICA Survey Team

Figure 4.1.1 Hourly Fluctuation by Type of Vehicle (Average of 2 days)

Table 4.1.2 shows the sample ratio of the roadside interview survey by vehicle class and direction. For the detailed analysis, the results of the roadside interview survey were expanded by expansion factors based on the sample ratio. Expansion factors were calculated by direction, type of vehicle and observed period, namely, a.m. peak (6:00-10:00), daytime off-peak (10:00-16:00), p.m. peak (16:00-22:00) and night (22:00-5:00).

Table 4.1.2 Sample Rate of Roadside Interview Survey

Vehicle Type	Direction	Traffic Volume	Sample	Sample Rate
Passenger Cars	Eastbound	4,986	34	0.7%
	Westbound	5,694	13	0.2%
Buses	Eastbound	1,197	19	1.6%
	Westbound	1,226	14	1.1%
2 Axle Trucks	Eastbound	507	55	10.8%
	Westbound	668	15	2.2%
3+ Axle Trucks	Eastbound	232	36	15.5%
	Westbound	278	19	6.8%
Trailers	Eastbound	538	83	15.4%
	Westbound	669	26	3.9%

Source: JICA Survey Team

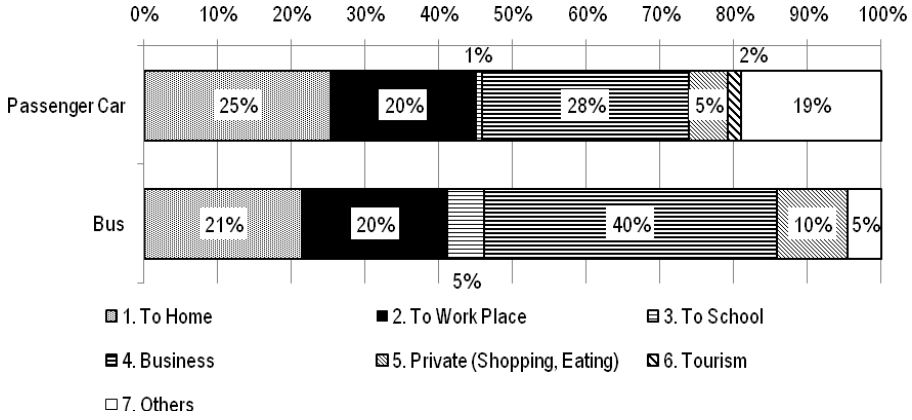
Average vehicle occupancy by vehicle class was calculated by traffic count volume and expanded number of passengers by roadside interview survey as shown in Table 4.1.3.

Table 4.1.3 Average Vehicle Occupancy Including Driver

Vehicle Type	Total Passenger Volume (Expanded)	Total Traffic Volume	Ave. Vehicle Occupancy
Motorcycles	-	-	-
Passenger Cars	22,693	10,680	2.12
Buses	14,878	2,423	6.14
2 Axle Trucks	1,623	1,175	1.38
3+ Axle Trucks	629	510	1.23
Trailers	1,806	1,207	1.50

Source: JICA Survey Team

Figure 4.1.2 shows the trip purpose composition by expansion to average daily passenger volume. The share of productive trips, namely, "home to working place" and "other business trips" of passenger car users are 20% and 28% respectively.

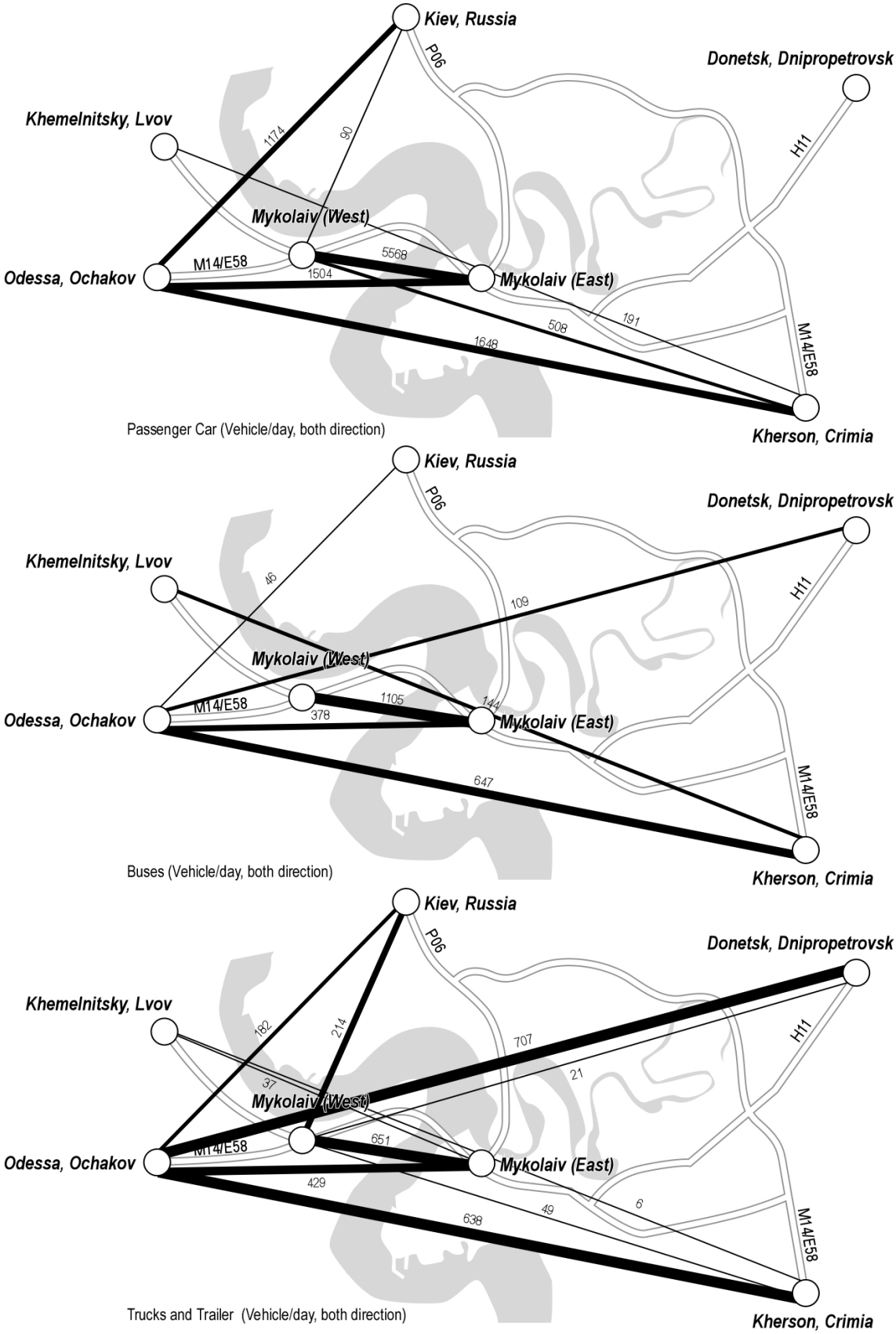


Source: JICA Survey Team

Figure 4.1.2 Trip Purpose of Passenger Car and Bus Passengers

Origin and destination of river crossing traffic is summarized in Figure 4.1.3. Almost half of passenger car and bus traffic observed at the existing Varvarobsky Bridge is dominated by internal trips within Mykolaiv region. Traffic volumes between Odessa (and other western regions and countries) and Mykolaiv (and western region) are also significant.

Donetsk is an industrial city, therefore, a considerable number of trucks and trailers come and go between Donetsk and Odessa.



Source: JICA Survey Team

Figure 4.1.3 Desire Lines by Vehicle Type

Table 4.1.4 shows the empty ratio of cargo trucks at the existing Varvarovsky Bridge. The empty ratio for eastbound trucks is slightly higher than that for westbound trucks.

Table 4.1.4 Empty and Loading Truck Ratio

Direction	Type of Truck	Empty	Loading
Eastbound	2 Axle Trucks	19.2%	80.8%
	3+ Axle Trucks	18.8%	81.2%
	Trailers	22.7%	77.3%
	Total	20.6%	79.4%
Westbound	2 Axle Trucks	10.4%	89.6%
	3+ Axle Trucks	35.4%	64.6%
	Trailers	11.9%	88.1%
	Total	15.2%	84.8%
Both Directions	2 Axle Trucks	14.3%	85.7%
	3+ Axle Trucks	27.8%	72.2%
	Trailers	16.8%	83.2%
	Total	17.6%	82.4%

Source: JICA Survey Team

The survey established that major commodities through the existing Varvarovsky Bridge are unprocessed agricultural products (25%), foodstuffs and beverages (24%), miscellaneous (18%) and construction materials (11%), as shown in Table 4.1.5. Westbound cargo volume is larger than eastbound cargo volume.

Table 4.1.5 Estimated Transported Commodities

Commodity being transported	Eastbound (ton / day)	Westbound (ton / day)	Both Directions	
			(ton / day)	Share
Unprocessed Agricultural Products	1,409	7,392	8,801	25%
Foodstuffs, Beverages	4,491	4,204	8,695	24%
Miscellaneous	1,162	5,379	6,540	18%
Construction Materials	1,462	2,642	4,104	11%
Steel and other Metal Products	1,179	1,405	2,584	7%
Chemicals Products	1,459	216	1,675	5%
Machinery and Parts	992	429	1,421	4%
Petroleum	1,079	204	1,283	4%
Fabric and Textile Goods	271	0	271	1%
Minerals (Ores)	270	0	270	1%
Pulp, Paper and Printed Matter	31	210	241	1%
Animal Feed or Fertilizers	24	0	24	0%
Total	13,827	22,081	35,908	100%

Source: JICA Survey Team

Table 4.1.6 shows transported cargo volume by trucks. In total, 66% of all commodities are carried by trailers, 18% by 3 and more axle trucks, rigid trucks and 16% by 2-axle trucks.

Table 4.1.6 Observed Cargo Tonnage by Type of Commodity and Truck

	2 Axle Trucks (ton/day)	3+ Axle Trucks (ton/day)	Trailers (ton/day)
1. Unprocessed Agricultural Products	747	335	7,719
2. Foodstuffs, Beverages	2,541	1,243	4,911
3. Animal Feeds or Fertilizers	24	-	-
4. Minerals (Ores)	204	-	66
5. Chemical Products	300	703	672
6. Steel and other Metal Products	177	725	1,682
7. Machinery and Parts	114	718	589
8. Construction Materials	100	218	3,786
9. Fabric and Textile Goods	158	63	50
10. Pulp, Paper and Printed Matter	241	-	-
11. Petroleum	-	659	624
12. Miscellaneous	1,159	1,774	3,608
Total loading tons/day	5,764	6,438	23,706
Share of trucks by cargo tonnage	16%	18%	66%
Share by cargo tonnage (excl. 2-axle truck)	-	21%	79%

Source: JICA Survey Team

Table 4.1.7 shows average cargo tonnage by type of commodity and truck. Some items have low reliability because of small sample size.

Table 4.1.7 Average Cargo Tonnage by Trucks

	2 Axle Trucks (ton / vehicle)	3+ Axle Trucks (ton / vehicle)	Trailers (ton / vehicle)
1. Unprocessed Agricultural Products	15.2	11.6	34.3
2. Foodstuffs, Beverages	7.0	15.2	21.6
3. Animal Feeds or Fertilizers	2.0	N/A	N/A
4. Minerals (Ores)	17.0	N/A	11.0
5. Chemical Products	2.6	20.7	17.7
6. Steel and other Metal Products	8.4	22.7	18.7
7. Machinery and Parts	5.2	18.4	12.5
8. Construction Materials	10.0	16.8	22.8
9. Fabric and Textile Goods	3.0	7.0	10.0
10. Pulp, Paper and Printed Matter	3.2	N/A	N/A
11. Petroleum	N/A	26.4	26.0
12. Miscellaneous	3.9	17.1	18.5
Total	5.6	17.5	23.2

Source: JICA Survey Team

4.2 Traffic Demand Forecast

4.2.1 Methodology

Future traffic demand for the new Mykolaiv Bridge was estimated by the following three steps.

- Forecasting of future traffic volume at the Southern Bug River Crossing based on existing traffic and economic data.
- Estimation of induced traffic by relevant development projects such as Ochakov Port development.
- Build and apply of route choice model estimated by the results of traffic survey.

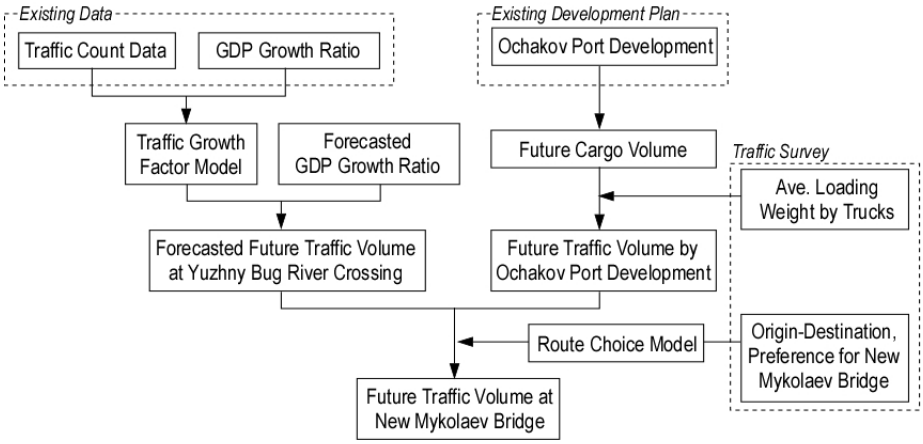


Figure 4.2.1 Traffic Demand Forecast Flow

4.2.2 Future Traffic Demand at Southern Bug River Crossing

Based on the monthly traffic volume fluctuation in 2007 measured by the automatic traffic count system as shown in 2.3.3 and results of the traffic count survey in December, monthly average traffic volumes and Annual Average Daily Traffic volume (AADT) in 2010 were estimated as shown in Table 4.2.1. The following analysis is based on the AADT in 2010.

Table 4.2.1 Estimated AADT and Daily Traffic Volume by Month in 2010 (vehicle/day)

	Passenger Cars	Buses	2 Axle Trucks	3 +Axle Trucks	Trailers
Jan	8,180	1,530	620	280	740
Feb	8,180	1,530	620	280	740
Mar	10,650	3,020	1,150	500	1,300
Apr	11,670	3,310	2,040	600	1,560
May	20,500	5,090	2,880	940	2,460
Jun	34,730	6,870	3,730	1,290	3,360
July	38,160	7,580	3,660	1,340	3,510
Aug	34,730	6,870	3,730	1,290	3,360
Sep	23,200	5,090	2,880	940	2,460
Oct	11,670	3,310	2,040	600	1,560
Nov	10,880	2,960	1,380	510	1,340
Dec	10,645	3,016	1,152	498	1,302
AADT	18,600	4,180	2,160	760	1,970

Source: JICA Survey Team

Table 4.2.2 AADT and GDP

	GDP Constant Price (billion UAH)	Passenger Car (veh/day)	Buses (veh/day)	Trucks (veh/day)	Trailers (veh/day)	Total (veh/day)
1999	406.0	8,682	2,398	1,415	428	12,923
2003	540.7	6,415	171	1,147	415	8,148
2006	668.0	9,052	280	1,613	1,162	12,107
2008	735.9	9,107	534	3,020	1,411	14,072
2009	624.8	7,308	695	3,739	1,173	12,915

Source: AADT in 1999 and 2003 are based on the previous F/S reports, 2006-2009 are based on the automatic traffic count report of SRA. GDP constant prices are based on the IMF report and base year 2007.

Based on existing AADT data and GDP of Ukraine as shown in Figure 4.2.2, traffic volume growth ratio at the Southern Bug River Crossing was estimated by the following linear regression model.

$$TGR = a + b \cdot GDPGR$$

where,

TGR : Traffic volume growth ratio (% p.a.)

a,b : Parameters shown in the following table.

GDPGR: GDP growth ratio (% p.a.)

Table 4.2.3 Traffic Forecast Model

	coefficient a	coefficient b	R^2
Passenger Cars	-0.0124	1.259	0.846
Buses	0.080	-1.705	0.510
Trucks & Trailers	-0.023	0.905	0.567

Source: JICA Survey Team

Future GDP growth rate shown in Table 4.2.4 is based on the projection by the IMF from 2010 to 2015. After 2015, GDP growth rate was assumed to be 4% p.a. Based on this assumption, per capita GDP of Ukraine will increase from 3,000 USD in 2009 to 11,800 USD in 2045 which is close to current per Capita GDP in Poland (11,500 USD in 2009).

Future traffic volume at the Southern Bug River Crossing was forecasted as shown in Table 4.2.4 using the aforementioned model and GDP growth rates. Forecasted average annual traffic growth rate from 2010 - 2045 of passenger cars is 3.88%, 0.82% for buses, 1.41% for trucks and 1.20% for trailers.

Table 4.2.4 Future Traffic Volume at Southern Bug River Crossing

Year	GDP Growth Rate (p.a.)	AADT (Vehicle / day)					
		Passenger Cars	Buses	2 Axle Trucks	3+ Axle Trucks	Trailers	Total
2010	3.7%	18,600	4,180	2,160	760	1,970	27,670
2011f	4.5%	19,400	4,200	2,200	800	2,000	28,600
2012f	4.8%	20,300	4,200	2,200	800	2,000	29,500
2013f	4.5%	21,200	4,200	2,200	800	2,000	30,400
2014f	4.3%	22,100	4,200	2,200	800	2,000	31,300
2015f	4.0%	22,900	4,200	2,200	800	2,000	32,100
2020f	4.0%	27,600	4,400	2,400	900	2,100	37,400
2025f	4.0%	33,300	4,700	2,600	1,000	2,200	43,800
2030f	4.0%	40,200	5,000	2,800	1,100	2,400	51,500
2035f	4.0%	48,500	5,300	3,000	1,200	2,600	60,600
2040f	4.0%	58,500	5,600	3,200	1,300	2,800	71,400
2045f	4.0%	70,600	5,900	3,400	1,400	3,000	84,300

Notes: GDP Growth rate (2010 - 2015) is based on IMF World Economic Outlook 2010.

Table 4.2.5 Average Growth Rate of Forecasted Traffic Volume 2010-2045

	Passenger Cars	Buses	Trucks	Trailers
Ave. Growth Rate	3.88%	0.82%	1.41%	1.20%

Source: JICA Survey Team

4.2.3 Ochakov Port Development

Currently, major sea ports for cargo transport in Ukraine are Odessa and Ilyichevsk ports. In 2007, the container volumes handled at Odessa and Ilyichevsk ports reached 523,000 and 456,000 TEU p.a. respectively. Both ports almost reached saturation in 2007 such that expansion of port capacity is being planned and implemented for both.

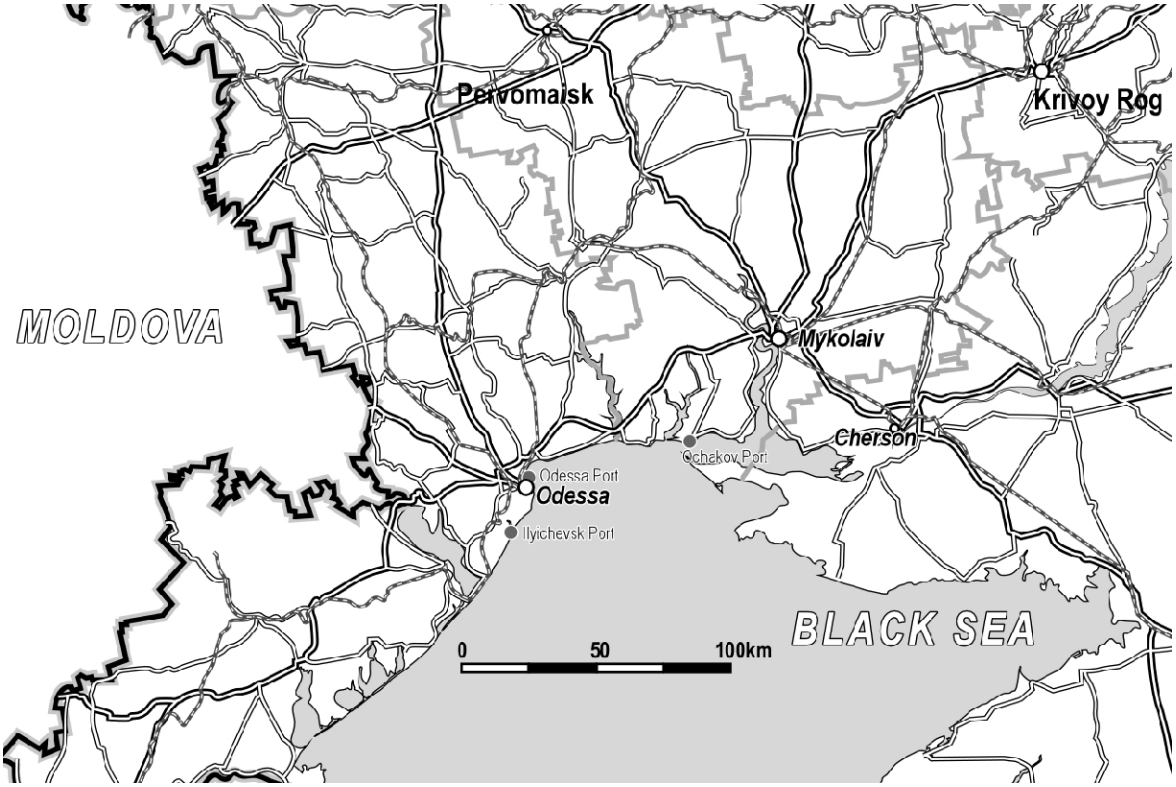
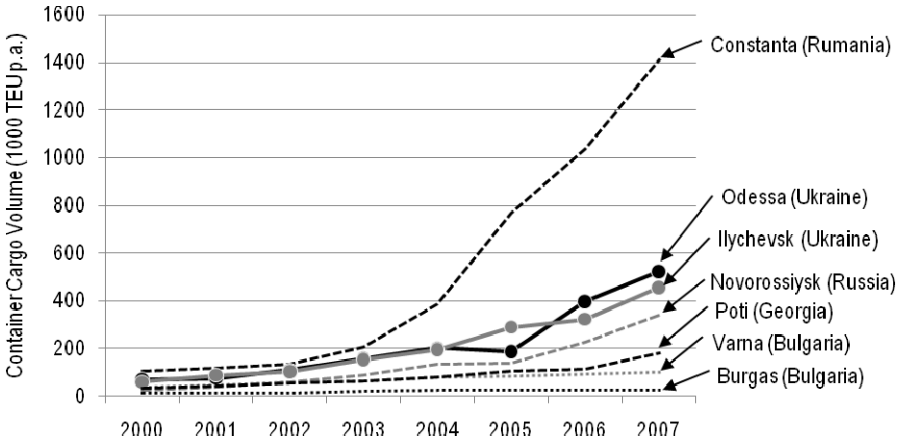


Figure 4.2.2 Location of Major Ports in Ukraine



Source: OCDI QUARTERLY 78, Ocean Shipping Consultants.

Figure 4.2.3 Container Cargo Volumes handled at Major Ports on the Black Sea

On the other hand, the development plan for Ochakov port, which is located on the right bank of the Dnieper-Bug River, was approved by the Minister of transport and communication in July 2008. The development plan includes;

- Transhipment complexes for coal and iron ore (49 hectares), containers (80 hectares) and grain (7.0 hectares),
- 8 principal and 1 auxiliary berth (total length 2700m, the depth at Stage I is 11.5m, at Stage II is 15.0m),
- Railway extension (75km) and access road repair, and

- Ochakov port will have a capacity almost equivalent to Odessa and Ilyichevsk ports under the development plan as shown below;

Table 4.2.6 Planned Capacity of Ochakov Port

	Dry Bulk Cargo	Container
Stage I (2012)	7 million tons p.a. - Coal : 1 million tons - Iron ore, raw material : 5 million tons - Grain : 1 million tons	0.5 million TEU p.a.
Stage II (2017)	21 million tons p.a. - Coal : 6 million tons - Iron ore, raw material : 13 million tons - Grain : 3 million tons	2 million TEU p.a.

Source: Presentation material prepared by Mykolaiv Region in 2010

According to the existing port development plan, major cargo to be handled at Ochakov port will be as follows:

- Export flows: steam and metallurgical coal, iron ore, grain and containers.
- Import flows: metallurgical coal, general cargo, containers and automobiles.

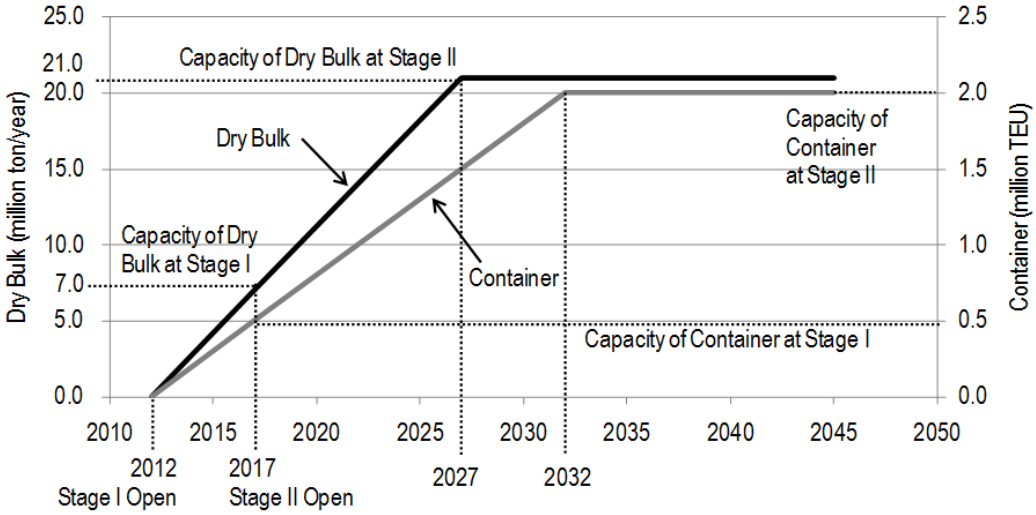
Future cargo volume at Ochakov port was estimated under the following assumptions.

- Coal: Share of exports to total handling weight is 14% which is calculated by 2008 UN trade data.
- 100% of heavy bulk cargo exported /imported at seaport such as coal and iron ore will be transported by railway.
- As regards grains and container cargo, modal share between the roads and railways is 77% and 23% respectively, based on data from the State Statistics Committee of Ukraine in 2009.
- As regards container cargo, share of exports to total handling weight is 42.8% which is calculated by 2008 UN trade data.
- In the case of 100% case, cargo volume handled at the opening of Stage II will reach capacity of Stage I.

Table 4.2.7 Estimated Future Cargo Volume of Ochakov Port

Cargo Type	Flow	Item	Unit	2017			2027 (Dry Bulk), 2032 (Container)		
					Road	Rail		Road	Rail
Dry Bulk	Export	Coal	million tons/year	0.14	-	0.14	0.84	-	0.84
		Iron Ore	million tons/year	5.00	-	5.00	13.00	-	13.00
		Grain	million tons/year	1.00	0.77	0.23	3.00	2.31	0.69
	Import	Coal	million tons/year	0.86	-	0.86	0.16	-	0.16
Container	Export		million TEU/year	0.21	0.16	0.05	0.86	0.66	0.20
	Import		million TEU/year	0.29	0.22	0.07	1.14	0.88	0.26

Source: JICA Survey Team



Source: JICA Survey Team

Figure 4.2.4 Forecasted Future Cargo Volumes at Ochakov Port

Future traffic volume generated at Ochakov port was forecasted by estimating future cargo volume under the following assumptions;

- Large vehicles, namely, 3 and more axle trucks, rigid trucks and trailers are used for cargo transport relevant to Ochakov port.
- Share of 3 axle and more rigid trucks and trailers are 21% and 79% respectively, based on current shares of cargo volume by weight based on the results of traffic survey as shown in Table 4.1.6.
- Average loading weight is 17.5 tons by 3 and more axle rigid trucks and 23.2 tons by semi/full trailers based on the results of traffic survey as shown in Table 4.1.7.
- Loading truck ratio is 72.2% for 3 axle and more trucks and 83.2% for trailers based on the results of traffic survey as shown in Table 4.1.4.

$$Veh_{rigid} = \frac{CargoVolume \times Share_{rigid}}{AverageLoadingWeight_{rigid}} \div LoadingRatio_{rigid}$$

where,

Veh_{rigid}: Number of rigid trucks of 3 and more axles relevant to Ochakov Port,

Cargo Volume: Forecasted cargo volume at Ochakov Port,

$Share_{rigid}$: Share of loading cargo volume by 3 and more axle rigid trucks (21%),

Average Loading $Weight_{rigid}$: Average loading ton per 3 and more axle trucks (17.5 ton/vehicle),

$LoadingRatio_{rigid}$: Loading truck ratio of 3 and more axles rigid truck (72.2%)

$$Veh_{trailer} = \frac{CargoVolume \times Share_{trailer}}{AverageLoadingWeight_{trailer}} \div LoadingRatio_{trailer}$$

where,

Vehtrailer: Number of trailer trucks relevant to Ochakov Port,

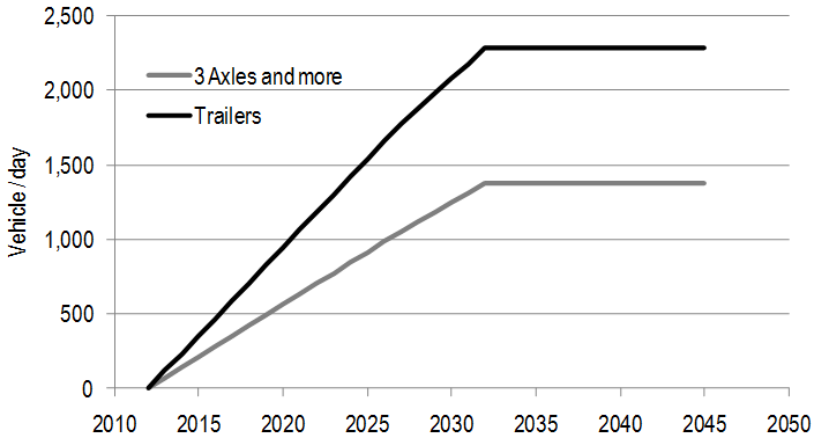
CargoVolume: Forecasted cargo volume at Ochakov Port,

Sharetrailer: Share of loading cargo volume by trailer trucks (79%),

AverageLoadingWeighttrailer: Average loading ton per trailer truck (23.2 ton/vehicle),

LoadingRatiotrailer: Loading truck ratio of trailer trucks (83.2%).

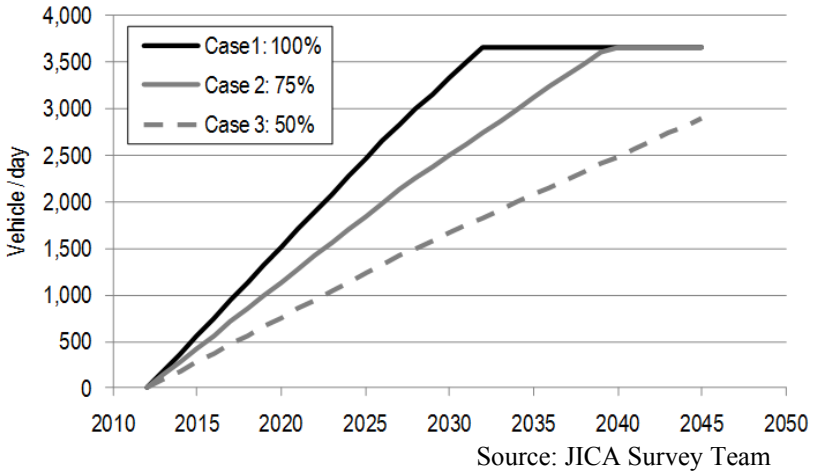
Future traffic volume which is the number of trucks including empty trucks, induced by Ochakov port development was estimated as shown in following figure.



Source: JICA Survey Team

Figure 4.2.5 Forecasted Future Traffic Volumes at Ochakov Port

For further analysis such as economic and financial analysis, another two cases for future traffic volume at Ochakov Port are defined, namely, 75% freight demand of port capacity case (case 2: 75% case) and 50% of port capacity case (case 3: 50% case). In addition, a case of all cargo demand at Ochakov Port is diverted from Odessa or Ilyichevsk Ports, namely, no induced traffic demand by Ochakov Port development is defined as Case 4.



Source: JICA Survey Team

Figure 4.2.6 Future Traffic Volume Cases at Ochakov Port

Table 4.2.8 Future Traffic Volume at Ochakov Port

	100% demand (vehicle/day)		75% demand (vehicle/day)		50% demand(vehicle/day)	
	3 Axles +	Trailer	3 Axles +	Trailer	3 Axles +	Trailer
2010	0	0	0	0	0	0
2011f	0	0	0	0	0	0
2012f	0	0	0	0	0	0
2013f	70	119	53	89	35	59
2014f	141	237	106	178	70	119
2015f	211	356	159	267	106	178
2020f	564	948	423	711	282	474
2025f	916	1,541	687	1,156	458	770
2030f	1,247	2,081	935	1,561	623	1,041
2035f	1,374	2,283	1,172	1,940	782	1,293
2040f	1,374	2,283	1,374	2,283	940	1,546
2045f	1,374	2,283	1,374	2,283	1,098	1,799

Source: JICA Survey Team

Future traffic volume crossing the Southern Bug River including traffic induced by Ochakov Port development is forecasted as shown in the following table.

Table 4.2.9 Future Traffic Volume at Southern Bug River Crossing (Case1: 100% Port Demand)

Year	GDP Growth Rate (p.a.)	AADT (Vehicles / day)					
		Passenger Cars	Buses	2 Axle Trucks	3+ Axle Trucks	Trailers	Total
2010	3.7%	18,601	4,180	2,160	760	1,970	27,671
2011 f	4.5%	19,400	4,200	2,200	800	2,000	28,600
2012 f	4.8%	20,300	4,200	2,200	800	2,000	29,500
2013 f	4.5%	21,200	4,200	2,200	900	2,100	30,600
2014 f	4.3%	22,100	4,200	2,200	900	2,200	31,600
2015 f	4.0%	22,900	4,200	2,200	1,000	2,400	32,700
2020 f	4.0%	27,600	4,400	2,400	1,500	3,000	38,900
2025 f	4.0%	33,300	4,700	2,600	1,900	3,700	46,200
2030 f	4.0%	40,200	5,000	2,800	2,300	4,500	54,800
2035 f	4.0%	48,500	5,300	3,000	2,600	4,900	64,300
2040 f	4.0%	58,500	5,600	3,200	2,700	5,100	75,100
2045 f	4.0%	70,600	5,900	3,400	2,800	5,300	88,000

Source: JICA Survey Team

Table 4.2.10 Future Traffic Volume at Southern Bug River Crossing (Case 2: 75% Port Demand)

Year	GDP Growth Rate (p.a.)	AADT (Vehicles / day)					
		Passenger Cars	Buses	2 Axle Trucks	3+ Axle Trucks	Trailers	Total
2010	3.7%	18,601	4,180	2,160	760	1,970	27,671
2011 f	4.5%	19,400	4,200	2,200	800	2,000	28,600
2012 f	4.8%	20,300	4,200	2,200	800	2,000	29,500
2013 f	4.5%	21,200	4,200	2,200	900	2,100	30,600
2014 f	4.3%	22,100	4,200	2,200	900	2,200	31,600
2015 f	4.0%	22,900	4,200	2,200	1,000	2,300	32,600
2020 f	4.0%	27,600	4,400	2,400	1,300	2,800	38,500
2025 f	4.0%	33,300	4,700	2,600	1,700	3,400	45,700
2030 f	4.0%	40,200	5,000	2,800	2,000	4,000	54,000
2035 f	4.0%	48,500	5,300	3,000	2,400	4,500	63,700
2040 f	4.0%	58,500	5,600	3,200	2,700	5,100	75,100
2045 f	4.0%	70,600	5,900	3,400	2,800	5,300	88,000

Source: JICA Survey Team

Table 4.2.11 Future Traffic Volume at Southern Bug River Crossing (Case 3: 50% Port Demand)

Year	GDP Growth Rate (p.a.)	AADT (Vehicles / day)					
		Passenger Cars	Buses	2 Axle Trucks	3+ Axle Trucks	Trailers	Total
2010	3.7%	18,601	4,180	2,160	760	1,970	27,671
2011 f	4.5%	19,400	4,200	2,200	800	2,000	28,600
2012 f	4.8%	20,300	4,200	2,200	800	2,000	29,500
2013 f	4.5%	21,200	4,200	2,200	800	2,100	30,500
2014 f	4.3%	22,100	4,200	2,200	900	2,100	31,500
2015 f	4.0%	22,900	4,200	2,200	900	2,200	32,400
2020 f	4.0%	27,600	4,400	2,400	1,200	2,600	38,200
2025 f	4.0%	33,300	4,700	2,600	1,500	3,000	45,100
2030 f	4.0%	40,200	5,000	2,800	1,700	3,400	53,100
2035 f	4.0%	48,500	5,300	3,000	2,000	3,900	62,700
2040 f	4.0%	58,500	5,600	3,200	2,200	4,300	73,800
2045 f	4.0%	70,600	5,900	3,400	2,500	4,800	87,200

Source: JICA Survey Team

Table 4.2.12 Future Traffic Volume at Southern Bug River Crossing (Case 4: No Induced Traffic)

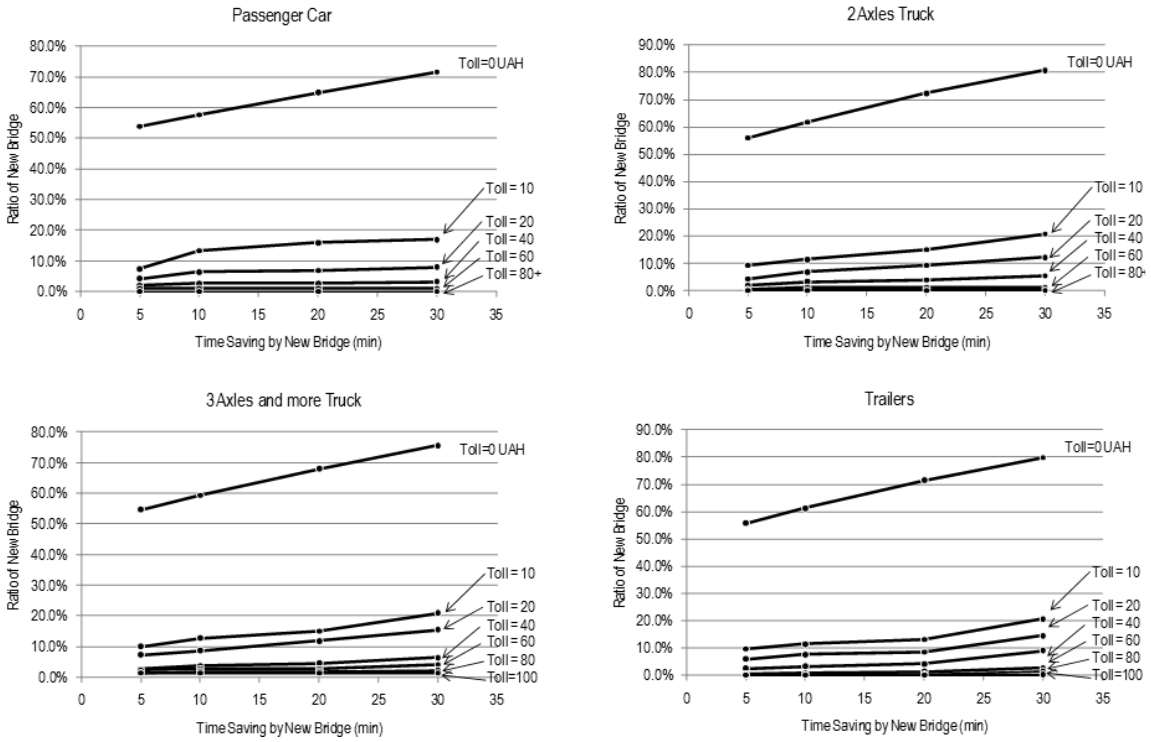
Year	GDP Growth Rate (p.a.)	AADT (Vehicles / day)					
		Passenger Cars	Buses	2 Axle Trucks	3+ Axle Trucks	Trailers	Total
2010	3.7%	18,601	4,180	2,160	760	1,970	18,601
2011 f	4.5%	19,400	4,200	2,200	800	2,000	19,400
2012 f	4.8%	20,300	4,200	2,200	800	2,000	20,300
2013 f	4.5%	21,200	4,200	2,200	800	2,000	21,200
2014 f	4.3%	22,100	4,200	2,200	800	2,000	22,100
2015 f	4.0%	22,900	4,200	2,200	800	2,000	22,900
2020 f	4.0%	27,600	4,400	2,400	900	2,100	27,600
2025 f	4.0%	33,300	4,700	2,600	1,000	2,200	33,300
2030 f	4.0%	40,200	5,000	2,800	1,100	2,400	40,200
2035 f	4.0%	48,500	5,300	3,000	1,200	2,600	48,500
2040 f	4.0%	58,500	5,600	3,200	1,300	2,800	58,500
2045 f	4.0%	70,600	5,900	3,400	1,400	3,000	70,600

Source: JICA Survey Team

4.2.4 Route Choice Model for New Mykolaiv Bridge

Based on the willingness to pay calculated by the results of the roadside interview survey, the diversion ratio in accordance with travel time savings and toll fees of the New Mykolaiv Bridge is estimated by logit regression model as shown in Figure 4.2.7.

The buses, including ordinary buses and inter-city long distance buses, are not considered in future traffic demand of the New Mykolaiv Bridge because they will pass through existing Varvarovsky Bridge to access the bus terminal in downtown Mykolaiv city.



Source: JICA Survey Team

Figure 4.2.7 Preference of New Mykolaiv Bridge by Driver

Route choice model was built by logit regression in following formula, based on the results of road interview survey data as shown in Figure 4.2.7. Table 4.2.13 shows the result of estimated parameters for the route choice model.

$$P_{new} = \frac{\exp(V_{new})}{\exp(V_{new}) + \exp(V_{old})}$$

where,

$V_{new} = \alpha \cdot (TravelTimeByNewBridge) + \beta \cdot (Toll)$

$V_{old} = \alpha \cdot (TravelTimeByExistingBridge)$

Pnew : Probability of New Mykolaiv Bridge chosen (diversion ratio).

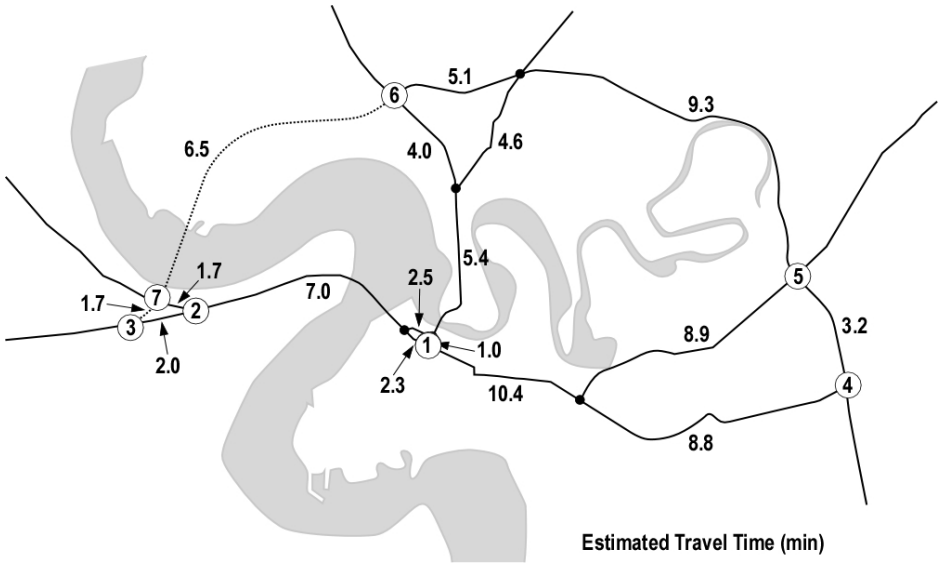
α , β : Parameters shown in the following table.

Table 4.2.13 Parameters for Diversion Model

	Variables	Coefficient	t-value	ρ2	Hit Ratio 1 (%)	Hit Ratio 2 (%)
Passenger Cars	α	-0.0308	-5.68	0.4938	81.53	76.82
	β	-0.0686	-14.40			
2 Axle Trucks	α	-0.0480	-10.26	0.4914	81.48	76.7
	β	-0.0708	-18.57			
3+ Axle Trucks	α	-0.0377	-8.26	0.3272	77.53	69.51
	β	-0.0427	-17.74			
Trailers	α	-0.0459	-12.82	0.445	79.85	74.53
	β	-0.0609	-24.36			

Source: JICA Survey Team

The following figure shows the estimated travel times on major sections based on the on-board GPS data at morning off-peak in November.



Source: JICA Survey Team

Figure 4.2.8 Estimated Travel Time at Off-peak

4.2.5 Future Traffic Volumes for New Mykolaiv Bridge

For the calculation of total traffic volume in the future, passenger car units (PCU) and three toll structures are defined as shown in Table 4.2.14.

Table 4.2.14 PCU and Assumed Toll Structure

	PCU	Toll Structure (UAH/vehicle)			
		Free	Toll-1	Toll-2	Toll-3
Passenger Cars	1.0	0	10	20	30
2 Axle Trucks	2.0	0	15	30	45
3+ Axle Trucks	2.5	0	20	40	60
Trailers	3.0	0	30	60	90

Source: JICA Survey Team

Based on the estimated travel times, the diversion ratio to the New Mykolaiv Bridge was calculated for each origin-destination pair. Table 4.2.15 shows the summary of the diversion ratio based for current traffic volumes in 2010.

Table 4.2.15 Diversion Ratio to New Mykolaiv Bridge

Base Toll (UAH)	Passenger Cars	2 Axle Trucks	3+ Axle Trucks	Trailers
Free	47.4%	50.2%	53.1%	54.5%
Toll-1	31.5%	38.8%	49.3%	43.2%
Toll-2	18.9%	28.4%	45.6%	32.5%
Toll-3	10.6%	19.8%	41.9%	23.3%

Source: JICA Survey Team

The following tables show the forecasted traffic volume of Case 1 (100% demand at Ochakov Port capacity) at the New Mykolaiv Bridge.

Table 4.2.16 Future Traffic Demand at New Mykolaiv Bridge (Passenger Cars)

veh/day	Free	Toll-1	Toll-2	Toll-3
2015 f	10,900	7,200	4,300	2,400
2020 f	13,100	8,700	5,200	2,900
2025 f	15,800	10,500	6,300	3,500
2030 f	19,100	12,700	7,600	4,300
2035 f	23,000	15,300	9,200	5,100
2040 f	27,800	18,400	11,100	6,200
2045 f	33,500	22,200	13,400	7,500

Source: JICA Survey Team

Table 4.2.17 Future Traffic Demand at New Mykolaiv Bridge (2 Axle Trucks)

veh/day	Free	Toll-1	Toll-2	Toll-3
2015 f	1,100	900	600	400
2020 f	1,200	900	700	500
2025 f	1,300	1,000	700	500
2030 f	1,400	1,100	800	600
2035 f	1,500	1,200	900	600
2040 f	1,600	1,200	900	600
2045 f	1,700	1,300	1,000	700

Source: JICA Survey Team

Table 4.2.18 Future Traffic Demand at New Mykolaiv Bridge (3+ Axle Trucks)

veh/day	Free	Toll-1	Toll-2	Toll-3
2015 f	500	500	500	400
2020 f	800	700	700	600
2025 f	1,000	900	900	800
2030 f	1,200	1,100	1,000	1,000
2035 f	1,400	1,300	1,200	1,100
2040 f	1,400	1,300	1,200	1,100
2045 f	1,500	1,400	1,300	1,200

Source: JICA Survey Team

Table 4.2.19 Future Traffic Demand at New Mykolaiv Bridge (Trailers)

veh/day	Free	Toll-1	Toll-2	Toll-3
2015 f	1,300	1,000	800	600
2020 f	1,600	1,300	1,000	700
2025 f	2,000	1,600	1,200	900
2030 f	2,500	1,900	1,500	1,100
2035 f	2,700	2,100	1,600	1,100
2040 f	2,800	2,200	1,700	1,200
2045 f	2,900	2,300	1,700	1,200

Source: JICA Survey Team

Table 4.2.20 Future Traffic Demand at New Mykolaiv Bridge (Total)

veh/day	Free	Toll-1	Toll-2	Toll-3
2015 f	13,800	9,600	6,200	3,800
2020 f	16,700	11,600	7,600	4,700
2025 f	20,100	14,000	9,100	5,700
2030 f	24,200	16,800	10,900	7,000
2035 f	28,600	19,900	12,900	7,900
2040 f	33,600	23,100	14,900	9,100
2045 f	39,600	27,200	17,400	10,600

Source: JICA Survey Team

Table 4.2.21 Share of Future Traffic Demand at New Mykolaiv Bridge (Free Case)

	Passenger Car	2 Axles Truck	3+ Axle Trucks	Trailers
2015 f	79.0%	8.0%	3.6%	9.4%
2020 f	78.4%	7.2%	4.8%	9.6%
2025 f	78.6%	6.5%	5.0%	10.0%
2030 f	78.9%	5.8%	5.0%	10.3%
2035 f	80.4%	5.2%	4.9%	9.4%
2040 f	82.7%	4.8%	4.2%	8.3%
2045 f	84.6%	4.3%	3.8%	7.3%

Source: JICA Survey Team

Table 4.2.22 to Table 4.2.25 show the forecasted future traffic volume at the New Mykolaiv Bridge by toll structure.

Table 4.2.22 Future Traffic Volume at New Mykolaiv Bridge (Case 1: 100% Port Demand)

PCU/day	Free	Toll-1	Toll-2	Toll-3
2015	18,300	13,300	9,200	6,000
2020	22,300	16,200	11,400	7,500
2025	26,900	19,600	13,600	9,200
2030	32,400	23,400	16,200	11,300
2035	37,600	27,300	18,800	12,400
2040	42,900	30,700	21,000	13,800
2045	49,400	35,200	23,800	15,500

Source: JICA Survey Team

Table 4.2.23 Future Traffic Volume at New Mykolaiv Bridge (Case 2: 75% Port Demand)

PCU/day	Free	Toll-1	Toll-2	Toll-3
2015	18,300	13,300	8,900	5,700
2020	21,800	15,600	10,800	7,300
2025	26,400	19,000	13,000	8,700
2030	31,300	22,500	15,400	10,200
2035	36,800	26,400	18,300	12,100
2040	42,900	30,700	21,000	13,800
2045	49,400	35,200	23,800	15,500

Source: JICA Survey Team

Table 4.2.24 Future Traffic Volume at New Mykolaiv Bridge (Case 3: 50% Port Demand)

PCU/day	Free	Toll-1	Toll-2	Toll-3
2015	18,000	13,000	8,600	5,700
2020	21,200	15,300	10,300	7,000
2025	25,200	18,200	12,500	8,100
2030	29,900	21,400	14,500	9,700
2035	35,100	25,300	17,200	11,000
2040	40,900	29,300	19,600	12,700
2045	48,000	34,100	23,000	14,700

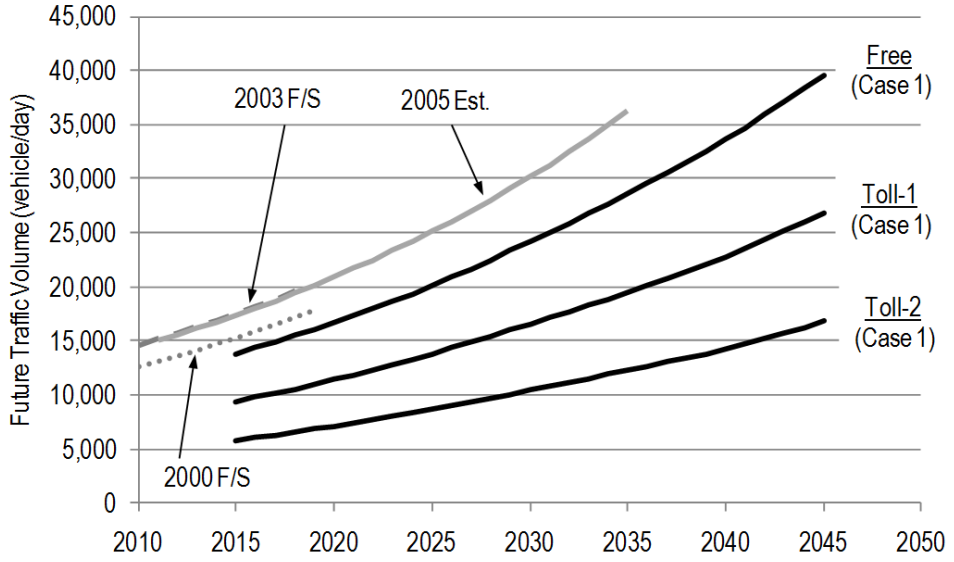
Source: JICA Survey Team

Table 4.2.25 Future Traffic Volume at New Mykolaiv Bridge (Case 4: No Induced Traffic)

PCU/day	Free	Toll-1	Toll-2	Toll-3
2015	17,400	12,700	8,600	5,500
2020	20,100	14,200	9,700	6,400
2025	23,300	16,800	11,100	7,000
2030	27,300	19,200	12,900	8,600
2035	31,700	22,500	14,700	9,400
2040	37,300	25,900	17,100	10,800
2045	43,500	30,500	19,900	12,500

Source: JICA Survey Team

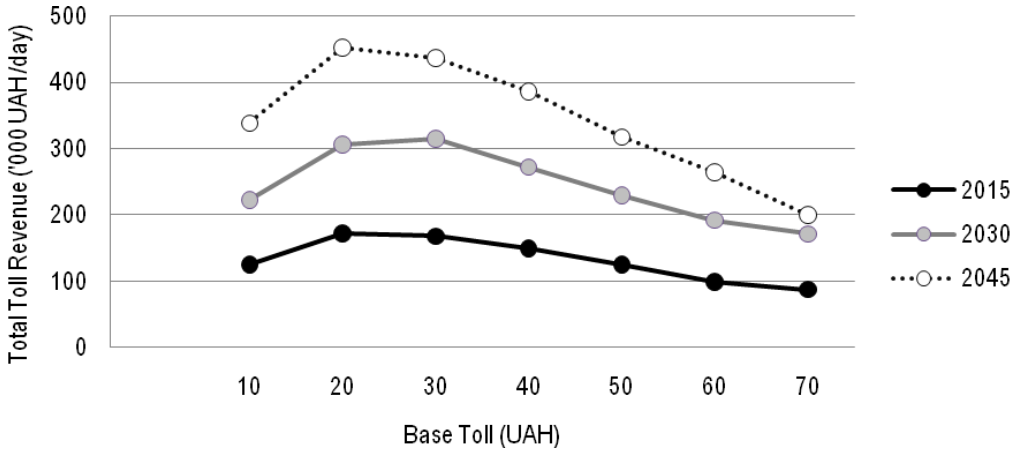
Figure 4.2.9 shows forecasted future traffic volume at the New Mykolaiv Bridge (Free, Toll-1 and Toll-2 at Case 1, namely 100% of port demand) and, forecasted traffic volumes by previous feasibility studies (Feasibility Studies in 2000 and 2003, and "Information Memorandum, Concerning technical-economic indexes of bridge pass construction over river Pivdenny Bug in Mykolaiv under financing by ODA program of Japanese Government, 2005). Future traffic volume estimated in this survey is lower than figures in previous studies.



Source: JICA Survey Team

Figure 4.2.9 Future Traffic Volume at New Mykolaiv Bridge by Previous F/S

Forecasted toll revenues based on the forecasted traffic volumes and toll structures are shown in Figure 4.2.10. Toll-2 (20 UAH for passenger cars) is optimum for maximization of toll revenue.



Source: JICA Survey Team

Figure 4.2.10 Total Toll Revenue by Toll Structure (Case 1: 100% Port Demand)

4.3 Traffic on the Southern Bug River

Numbers of ships passing the location of Mykolaiv Bridge are shown in the following table. Although these numbers are currently shrinking, it is expected that they will increase when the new barges are introduced by private enterprise in order to transport inland crops to Ochakov Port in the near future.

Table 4.3.1 Numbers of Ships at the Location of the Mykolaiv Bridge

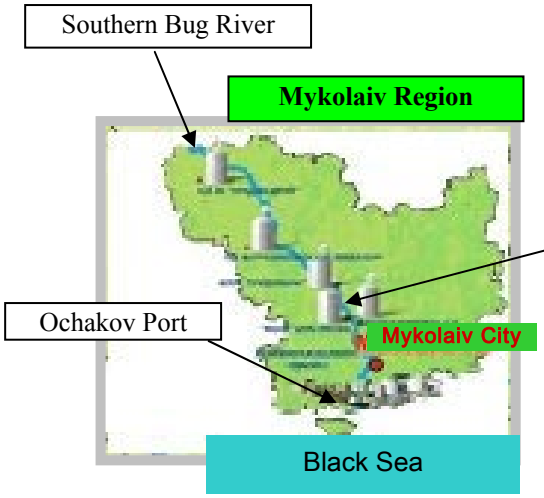
	Towed Type			Self-propelled Type		
Month Year	2008	2009	2010	2008	2009	2010
January	0	1	1	0	8	0
February	1	1	0	3	10	0
March	2	4	0	0	2	0
April	4	3	1	1	0	0
May	1	2	4	1	0	0
June	2	3	2	1	0	0
July	5	9	0	0	0	0
August	1	1	2	0	0	0
September	5	1	0	0	1	2
October	2	1	0	1	0	1
November	7	3	1	0	0	2
December	1	4	0	4	0	0
Total	31	33	11	11	21	5

The private enterprise, NIBURON, has following development plan utilizing the transportation capacity of the Southern Bug River according to their web site.

The Project of New Transhipment Terminal in Nova Odessa (Mykolaiv Region)

(Supported by the EBRD and the Danish Export Credit Fund)

- ✓ Target: The revival of the Southern Bug River as a transport water way of Ukraine:
- ✓ Grain Storage Capacity: 75,6000 tons
- ✓ Total Area: 5.87 ha
- ✓ Daily Capacity of Compiles: 4,000 tons/day
- ✓ Shipment Capacity on Water Transport: 10,000 ton/day
- ✓ The Expected Volume of Freight on the southern Bug River: 1,000,000 ton/year
- ✓ Beginning of Construction: October 20, 2010
- ✓ Current Situation: All main works are completed and euipment has been tested.



Nova Odessa Transhipment Terminal

A Tug Boat and Barges Passing through the Mykolaiv Bridge Site