Data Collection Survey on Logistics and Transport System in Southern Ukraine

Final Report

June 2017

JAPAN INTERNATIONAL COOPERATION AGENCY

PADECO Co., Ltd.
Pacific Consultants Co., Ltd.

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JR
17-014

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Abbreviations

AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
BSEC	Black Sea Economic Cooperation
CAGR	Compound Average Growth Rate
CAPEX	Capital Expenditure
CD	Chart Datum
CDM	Cement Deep Mixing
CIS	Commonwealth of Independent States
CMU	Cabinet Ministers of Ukraine
DG	Dry-state Galloping
DWT	Dead Weight Tonnage
EBRD	European Bank of Reconstruction and Development
ECS	Epoxy Coasted and Filled Strand
EE	Ecological Expertise
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIU	Economist Intelligence Unit
ERSS	Emergency Report Support System
ESIA	Environment and Social Impact Assessment
EU	European Union
EUR	European Euro
FAO	Food and Agriculture Organization of the United Nations
FIDIC	Fédération Internationale Des Ingénieurs-Conseils
F/S	Feasibility Study
FTA	Free Trade Agreements
FWD	Falling Weight Deflectometer
GDP	Gross Domestic Product
GIF	Global Infrastructure Facility

GIS	Geographic Information System
GUAM	Georgia, Ukraine, Azerbaijan, and Moldova
GVW	Gross Vehicle Weight
HDM-4	Highway Design and Maintenance Standards Model - 4
HV	Heavy Vehicles
IDP	Internally Displaced People
IFC	International Finance Corporation
IFI	International Financial Institutions
IMDG	International Maritime Dangerous Goods
IMF	International Monetary Fund
IMO	International Maritime Organization
IMSBC	International Maritime Solid Bulk Cargos
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
LCC	Life Cycle Cost
LP	Longitudinally Profiled
LOGMOS	Logistics Processes and Motorways of the Sea
MARPOL	Maritime Pollution
MENA	Middle East and North Africa
MOEDT	Ministry of Economic Development and Trade
MOI	Ministry of Infrastructure
OD	Origin-Destination
OECD	Organization for Economic Cooperation and Development
OHS	Occupational Health and Safety
PC	Prestressed Concrete
PCU	Passenger Car Unit
PCS	Port Community Systems
PETC	Pan-European Transport Corridor
PPP	Public-Private Partnership
P3DP	Public-Private Partnership Development Program

RWIV	Rain-Wind Induced Vibrations
SBHS	Steels for Bridge High Performance Structure
SEA	Strategic Environment Assessment
SOE	State Owned Enterprises
SPSP	Steel Pipe Sheet Piles
SWOT analysis	Strengths, Weaknesses, Opportunities, Threats analysis
TA	Technical Assistance
TBM	Tunnel Boring Machine
TEU	Twenty-foot Equivalent Unit
TOR	Terms of Reference
TEN-T / TEN	Trans-European Transport Network
TRACECA	Transport Corridor Europe Caucasus Asia
UAH	Ukrainian Hryvnia
UHS	Ukrainian Harmonized System
USAID	United States Agency for International Development
USD	United States Dollar
USPA	Ukrainian Sea Ports Authority
VAT	Value Added Tax
WB	World Bank

Executive Summary

E1. Introduction

Traditionally, transport systems in the Southern Region of Ukraine served as the gateway facing the Black Sea for the whole nation as well as the transit route to nations in the east and the north. However, the annexation of Crimea by Russia in 2014 and the on-going armed conflict in the eastern province of Ukraine have resulted in significant changes in the pattern of movements in the region. Some ports and linking road and rail connections became no longer available to Ukraine and east-west transit movements have been severely curtailed. Transport systems in the Southern Region must be reviewed under the changed circumstances.

Before the above changes took place, a request by the Government of Ukraine to the Government of Japan was made concerning the financial assistance for the construction of a bridge near the city of Mykolaiv, which was meant to strengthen the east-west transit corridor along the national highway M-14, and the "Preparatory Survey on the Project for Construction of Mykolaiv Bridge in Ukraine" was done by Japan International Cooperation Agency (hereinafter, JICA) in 2011. This project is also in need of review because of the changed circumstance. JICA thus decided to carry out a study to review the transport systems in the Southern Region of Ukraine.

E2. National Transport Policies and Plans

The Government of Ukraine formulated the Sustainable Development Strategy "Ukraine 2020" which defines the direction and priorities of Ukraine until 2020. Within, 62 reforms were identified, including "transport reform".

Moreover, in November 2016, the Ministry of Infrastructure of Ukraine held a national round table upon renewal of the National Strategy in the Transport Sector in Ukraine until 2030, to establish a conceptual basis for implementing the state policy in order to provide sustainable and efficient transport sector operation, to create conditions for social and economic development of the country, to improve competitiveness of the national economy and the wellbeing of its people. It had set 5 priorities for the transport sector, as follows:

Priority 1: Efficiency in Public Governance in the Transport Sector.
Priority 2: Provide Quality and Efficient Transport Services.
Priority 3: Achieve Sustainable Financing for Transport.
Priority 4: Improving Transport Safety and Security.
Priority 5: Improved Urban Mobility and Regional Integration.

E3. Analysis of Road Subsector

(1) Overview of the Road Subsector

The road network consists of four major international transport corridors, the Pan European Transport Corridors No. 3, 5, 9 and the Asian-European Highway. The total length of the public roads is 169,600 km, including, 8,080km of International (M-network) highways, 4,800 km of National (H-network) highways and 10,000km of Regional (P-network) highways. The quality of the road surface and the structures require improvement to meet the objectives of modern road transport in the country.

The Ministry of Infrastructure of Ukraine is in charge of managing and developing roads and the road sector. Ukravtodor, the State Road Agency, plans and manages the international corridors and Oblasts manage the road networks within the country. Due to the understanding that most of the networks have been created already, the oblast offices of Ukravtodor mainly focuses on the planning and implementation of repair, rehabilitation, and maintenance of roads.

In terms of the organizational capacity of Ukravtodor, there are 100+ employees currently employed at state level. Its functions are implemented through the 24 Ukravtodor oblast branches, which serve as ordering parties for construction works, reconstruction, capital and operating repairs, maintenance, and design-and-survey works for general usage roads of national and local significance. For the engineering works, Ukravtodor mainly outsources the works to the 12 state owned enterprises and acts as the managing and supervising body of their works. For the projects financed by the IFIs, the engineering works are outsourced as well and so far being conducted by international consulting firms, while the engineering capacity of Ukravtodor is obtained through the state enterprises.

The State Road Fund was active before the 2013/14 events, after 2014, it had been reorganized as general national revenue. In the recent months, the State Road Fund has been reestablished, with the parliament passing the bill on 16th November 2016. The fund is expected to enter into force from 2018.

In 2015, "The Strategic Plan for Development of Road Transport and Road Infrastructure of Ukraine up to 2020" was approved by the ordinance of Cabinet of Ministers. This Strategic Plan has been created in accordance with other strategies, such as "Ukraine 2020" and "Transport Strategy of Ukraine to 2020".

The donor assistance by the International Financial Institutions (IFIs), the World Bank, EIB, and EBRD are active and play an important role in the development of the road sector in Ukraine. Specifically, the World Bank is conducting a logistics study which will provide several concrete recommendations of each of the transport sectors, including roads. The World Bank is also conducting a grant TA which includes advisory services to the legislative process, drafting new laws, putting together feasibility studies, etc. EBRD has provided public loan assistance in the development of the PAN-European corridors 3 and 5 which connects Kiev and the EU border and the rehabilitation of roads in Kiev region. Moreover, EBRD is conducting a project to support the government in the legislation of the new concession law and policy. EIB is active mainly in the road rehabilitation for Highway M-06 and Highways M-01 and M-05 (part of the European Roads Ukraine II project) and is also conducting a nationwide TA on Road Safety Design to improve the road safety conditions.

In regards to the highways in the Southern Region, freight overloading is a significant issue for the bridge structures as well as pavement. Overloaded trucks often cause traffic safety hazards. Therefore, weight control of trucks is an urgent task to conduct in the Southern Region. In particular, in Mykolaiv, although the current regulation limits the loading volume to up to 24 tons, there are vulnerable bridges which the structural capacity hardly reaches the 24 ton regulatory level.

(2) Review of the Mykolaiv Bridge Construction Project

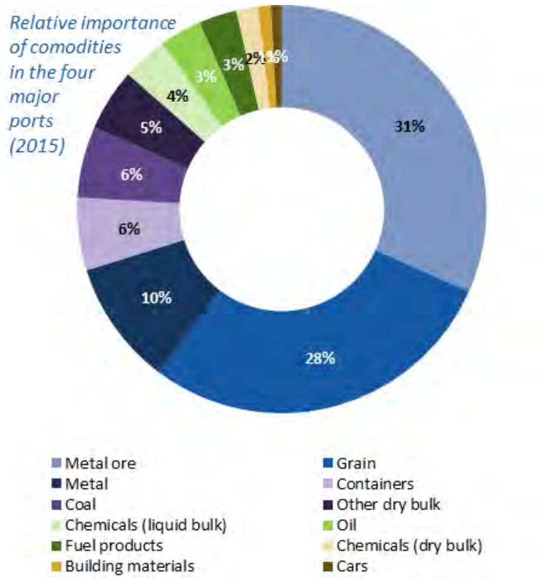
After The Preparatory Survey in 2011, the Ukrainian side conducted a feasibility study in accordance with Ukrainian standards. In July 2013, the Cabinet of Ministers approved the feasibility study. However, budget was not allocated to the project as it was before the commencement of the designing stage and the signing of the loan agreement.

In terms of the total cost of the project, in comparing the current situation to that of 2011, the Japanese Yen is much stronger to the Ukrainian Hryvnia and much weaker to the United States Dollar. Due to such big change in the currency value, the construction cost and the total project cost should be changed. The unit costs such as the labor cost, material costs and overhead cost had also fluctuated since 2011, with an average change of 232%, 224%, and 104% respectively.

E4. Analysis of Seaport Subsector

The Ukrainian seaport sector consists of 18 commercial seaports situated along the Black Sea and Azov coastline. The four main ports, which are included in the scope of this Study, have a market share of 78%, in terms of total throughput. These ports are Odessa, Illichivsk, Yuzhny and Mykolaiv. These ports are best located from both a nautical and from a hinterland perspective (close to industrial and consumer clusters), provide better services to port users and have a better nautical accessibility (in terms of draught).

The figure to the right presents the commodities which are handled in the four main Ukrainian ports. The two dry bulk commodities are the largest categories handled in the four main ports; metal ore (31%) and grain (28%). Metal, in break bulk (10%), is the third largest category. Container cargo has a market share of just 6%. Other commodities have a market share of 6% or less. The total volume handled in these four ports was almost 120 million tons in 2015.



Source: USPA statistics (2015)

Figure E.1 Relative Importance of Commodities

The Ukrainian ports are characterized by a hybrid port management model. There are both state-owned operating companies and privately-owned operators. The land and basic infrastructure is owned by the Government of Ukraine. The Government has the intention to transfer to the landlord port management model, according to the West-European standards. This means that operations should be privatized and that the right to operate will be concessioned to the private sector. The Government will not lose control, since the land and basic infrastructure will always be owned by the Government and the terminal will be transferred back at the end of the concession term. The private operator will only have a temporarily right to (develop, construct) operate and maintain the terminal.

E5. Road Traffic Characteristics and Forecast

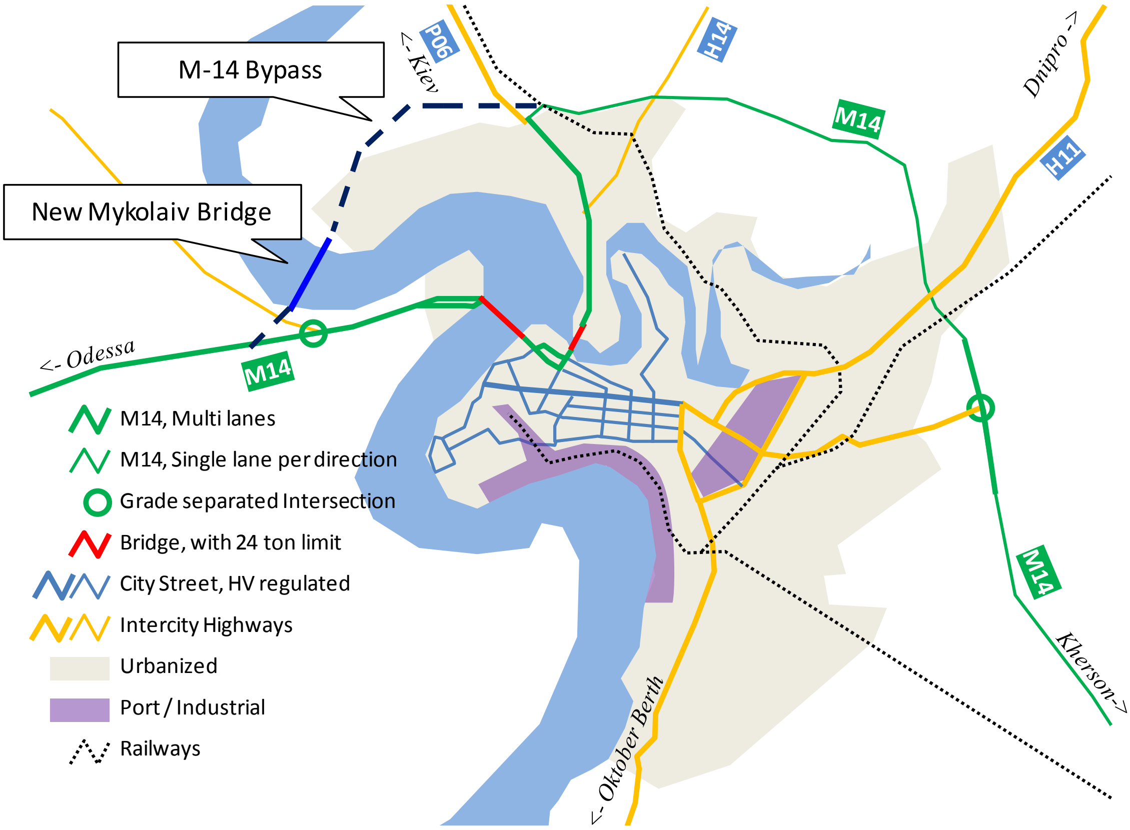
(1) Traffic Trends

The traffic and transport trends related to M-14 and the new Mykolaiv Bridge were reviewed and the findings are summarized as follows:

- The grain export is prioritized as a national economy booster, and the ports along M-14 will be the outlet of grains. Due to the population growth and economic growth in MENA, the grain export and its surface traffic will be increased in the Southern Region of Ukraine. During 1990's, grain export in Ukraine was less than 10 million tons per year, but it rapidly increased from late 2000's. Currently, grain export in Ukraine is more than 30 million tons and it is expected to grow by almost 40 million tons by 2023.
- The new Mykolaiv Bridge investment will realize the road transport network with a region-wide 40-ton capacity. The two bridges in Mykolaiv city are the barrier to the

regional road based logistics due to their small weight capacities. It can be said that the low efficiency of the road based logistics in the region is attributed to the barrier of the two bridges.

- Other than grain export, M-14 and ports contribute to the export of iron ore and steel products from the hinterland of Donetsk and Dnipro Oblasts.
- The origin of the grain products is distributed widely throughout Ukraine, except for the Western Region. The improvement of surface traffic efficiency in the Southern Region will directly benefit the majority of Ukraine.



Source: JICA Survey Team

Figure E.2 Highway Network Model and Land Use, Mykolaiv, 2016

(2) Traffic Forecast Review

In January 2017, the JICA Survey Team conducted its own counting survey at 6 locations around the Mykolaiv ring road and OD interview surveys at the west end of the Varvarovsky bridge and several port entry points, which showed growth in passenger car and trailers at the river crossing compared to the survey conducted in 2011.

The results of the traffic forecast in 2030 are shown in Table E.1 and Table E.2, where Case 1 is the base case assuming the total volume of export and import in the Southern Region at 157 million tons per year, while Case 2 assumes 15% higher demand covering other types of commodities[1]. In Case 1, for the case [with Bridge], over 40% of the traffic passing through Mykolaiv city is expected to cross the new Mykolaiv Bridge, which will alleviate the congestion and physical damages at the existing bridges. For the case [without Bridge], the estimated traffic

[1] For Case 1, it includes coal, metal ore, metal product, grains, and containers. For Case 2, other commodities include chemicals, petroleum products, building materials, etc.

on the Varvarovsky Bridge is assumed to be 1.6 times larger than the current situation, and 69,012 in PCU. The three lane bridge's saturation ratio in the peak hours would be 1.37, which suggests permanently paralyzed condition at the bridge, and the situation would be worse in the high season. Case 2 also shows a similar result, showing an even higher traffic crossing at the new bridge.

Table E.1 Traffic Forecast (AADT – Case 1)

	Passenger Cars	Buses	2axle trucks	Heavy Vehicles	Total	Total in PCU
2017 Present Situation	24,564	3,688	3,941	3,270	**35,463**	49,632
2030 Case 1 with Bridge;						
Crossing traffic at new bridge	14,890	963	1,792	2,878	**20,523**	29,035
Crossing traffic at existing bridge	21,189	3,965	2,550	0	**27,704**	34,219
2030 Case 1 without Bridge;						
Crossing traffic at existing bridge	36,079	4,928	4,342	4,797	**51,891**	69,012

PCU; 1.0 for passenger cars, 2.0 for buses, 2.0 for 2 axle trucks and 3.0 for heavy vehicles[2]
Source: JICA Survey Team

Table E.2 Traffic Forecast (AADT – Case 2)

	Passenger Cars	Buses	2axle trucks	Heavy Vehicles	Total	Total in PCU
2017 Present Situation	24,564	3,688	3,941	3,270	**35,463**	49,632
2030 Case 2 with Bridge;						
Crossing traffic at new bridge	14,890	963	1,792	3,520	**21,165**	30,960
Crossing traffic at existing bridge	21,189	3,965	2,550	0	**27,704**	34,219
2030 Case 2 without Bridge;						0
Crossing traffic at existing bridge	36,079	4,928	4,342	5,500	**50,850**	71,120

Source: JICA Survey Team

E6. Road and Seaport Development Scenarios for Southern Ukraine

(1) Road Sector

In regards to the development scenario of the road sector in Southern Ukraine, The first phase (2017-2025, short and mid-term) will be focused in strengthening the corridors through connecting the missing link of the Mykolaiv road and bridge section within the south Ukraine corridor. When the section is completed, the traffic congestion on the existing road going through the Mykolaiv City would be reduced. Further, the worries of damages to the two existing bridges of which the weight limit is 24 tons, will also be lifted.

The second phase (after 2025, long term) will be concentrated in the promotion of the development of the south Ukrainian corridor. Investments should be made in finding the bottlenecks of road sections within the linear corridor and in strengthening the capability of the corridor as a whole, by reducing the bottlenecks. The corridor would play a significant role for the movement of goods and passengers, and would provide efficient movement that only motorways can contribute.

[2] The Preparatory Survey in 2011 applied 2.0 for 2 axle trucks, 2.5 for 3+ axle trucks and 3.0 for trailers. There is no reference of PCU for buses in the said survey in 2011.

(2) Seaport Sector

The JICA Survey Team has taken the following steps for the selection of port projects considered for JICA's support:

1. Determination of the most promising cargo commodities in the Ukrainian ports. For this, the JICA Survey Team has carried out a detailed traffic forecast for the main commodities.
2. Determination of the current handling capacity for these main commodities in the various ports and the future capacity needs. Bottlenecks in potential capacity expansions have been taken into account as well.
3. Analysis of all the port development plans of the USPA for the four main Ukrainian ports.
4. Ranking of the port projects based on the following criteria: future growth potential of the commodity (= market share potential), potential for future development in the port, gap between current capacity and future demand and the status of the development plan.
5. Selection of 3 port projects based on the ranking, as described above.

The TOP-3 projects selected by the JICA Survey Team are as per below:

1. Reconstruction of the approach channel of the port of Yuzhny (Project 4);
2. Dredging of the water basin at the port of Yuzhny (Project 5); and
3. Construction of new Berths Number 10, 11, 12, and 12a at the Port of Yuzhny (Project 7).

With legal disputes on land title occurring for berths 10-12a at the Port of Yuzhny and the start of the procurement of the dredging works at the port, two alternative projects have been proposed by the Ministry of Infrastructure as follows:

- Reconstruction of berths number 5-8 in the Port of Yuzhny.
- Deepening and reconstruction of berths number 3-6 in the port of Illichivsk.

E7. Necessity and Priority of Potential Japanese ODA Projects

The JICA Survey Team had selected; i) Construction of the new Mykolaiv Bridge, ii) Development of the Port of Yuzhny through the three sub-projects described in Chapter 6, and iii) Technical Assistance on road transport operation and maintenance program for the Mykolaiv city government, as projects for potential Japanese assistance.

Large yield increase potential of grains, competitive price range of Ukrainian products, and the high population growth in emerging countries imply positive outlook on Ukrainian agribusiness. During 1990's, grain export in Ukraine was less than 10 million tons per year, but it rapidly increased from late 2000's. Currently, grain export in Ukraine is more than 30 million tons and it is expected to grow by almost 40 million tons by 2023. In such situation, the sea ports along M-14 are expected to enhance their roles as the outlet of the grain exports, and the delivery routes of these commodities are geographically distributed along M-14, from mainly the eastern and central Ukraine.

The eastern and central Ukraine exports 20.7 million tons of grain annually (56% of total grain export in Ukraine) and those grains are delivered to major sea ports in the southern Ukraine such as Yuzhny, Odessa, Illichivsk and Mykolaiv for exports to mainly MENA regions, India and China. Although Russian transit cargos have been drastically decreased during 2012–2015 by 55.0% (minus 19.5 million tons), the amount was compensated by growth of grain and iron ore exports. Especially agro products are essential for economic recovery of Ukraine since the products are the main sources to earn foreign currencies. However, Mykolaiv city, an important transit point of M-14, is facing difficulties to adapt to growing demand of road transport accelerated by increasing grain export and motorization of the country. The construction of the new Mykolaiv Bridge, which completes the route that bypasses the center of the city, would enhance the export traffic flow from eastern and central Ukraine to sea ports along the M-14 corridors and will contribute to the economic recovery of Ukraine.

Moreover, the Ministry of Infrastructure has listed the new Mykolaiv Bridge project as the highest in the top five missing link improvement projects, and with the Bridge located along the E-58 (EU Road Network) and International transport corridors of TRACECA and BSEC, such project is in line with the EU and international road network development policies.

In addition to the construction of the new Mykolaiv Bridge, the potential for providing Japanese assistance to the Port of Yuzhny has been identified through the study. With the economic recovery of the country becoming more dependent on the increase of bulk commodity exports such as iron ore and grain, obtaining enough port capacity for these products is critical. Moreover, deepening of the ports by the proposed dredging works will allow bigger vessels to be handled at these berths. Bigger vessels can carry more cargo in a voyage, hence the unit costs per ton of export cargo drop significantly. As such the commodity prices for example, Ukrainian iron ore, coal, metals and others will become lower and therefore more attractive for buyers. Especially, since these commodities are traded on the world market, a lower tariff means more sales volume, which will benefit the Ukrainian economy as a whole.

From the volume forecasts conducted for the major ports, it has been identified that (i) the trade pattern of coal has been shifted towards an import oriented trade focused on thermal coal; (ii) although export volumes of metal have decreased due to the geo-political issues, stable metal export volume for metal ore is expected; (iii) with the increase in the productivity in the grain sector, larger bulkers are targeted for and thus deeper ports are necessary; and (iv) although the container market is currently in overcapacity, the container volume is expected to increase significantly. In such circumstances, the potential of the Port of Yuzhny has been identified through not only by its geographical location, safe navigation and reliable cargo operations, but also with the port having an approach channel with a depth of -18.0 meters CD and a total load capacity of up to 200,000 tons.

In relation to the proposed new Mykolaiv bridge construction project, the Survey Team proposes the following road transport operation and maintenance program for the Mykolaiv city government, expecting integration with the new Mykolaiv bridge construction project and generation of regional synergy as a potential technical cooperation project. Mykolaiv city is a transit point in the road network connecting grainaries and major sea ports. Due to the absence of a bypass, currently passenger vehicles, buses, heavy trucks, and trailers are entering the city centre and severe damages on the road surface are observed. The purpose of this technical assistance is to implement sustainable road maintenance method in order to adapt to the increasing road traffic in the city.

E8. Japanese Technologies with Potential for the Sectors

This section describes the Japanese technologies that have potential of being utilized in Ukraine in the sectors for road, bridges and seaport.

For the road sector, Japanese technologies for road construction, tunnel construction, high performance asphaltic pavement, slope protection, road maintenance, skid resistance, and road safety are proposed. For the bridge sector, steel pipe sheet piles, corrosion resistance steel, steels for bridge high performance structure, longitudinally profiled steel plate, spiral-protuberance duct, and epoxy coated and filled pre-stressing strand are described. For the seaport sector, applicable Japanese technologies for dredging, new construction for a deeper berth, and for deepening existing berths are provided. Further, other applicable technologies such as the cement mixing method, sand drain, and maintenance are proposed.

1. Introduction

1.1 Study Background

Traditionally, transport systems in the Southern Region of Ukraine served as the gateway facing the Black Sea for the whole nation as well as the transit route to nations in the east and the north. However, the annexation of Crimea by Russia in 2014 and the on-going armed conflict in the eastern province of Ukraine have resulted in significant changes in the pattern of movements in the region. Some ports and linking road and rail connections became no longer available to Ukraine and east-west transit movements have been severely curtailed. Transport systems in the Southern Region must be reviewed under the changed circumstances.

Before the above changes took place, a request by the government of Ukraine to the government of Japan was made concerning the financial assistance for the construction of a bridge near the city of Mykolaiv, which was meant to strengthen the east-west transit corridor along the national highway M-14, and the “Preparatory Survey on the Project for Construction of Mykolaiv Bridge in Ukraine” was done by Japan International Cooperation Agency (JICA) in 2011. This project is also in need of review because of the changed circumstance. JICA thus decided to carry out a study to review the transport systems in the Southern Region of Ukraine.

1.2 Objectives

The objectives of the study are as per below:

- To examine the current situation/issues of logistics in the Southern Region of Ukraine after the 2014 political change
- To review the plan of the Mykolaiv bridge construction project
- To propose other potential projects that would contribute to improving the economic situation in Ukraine

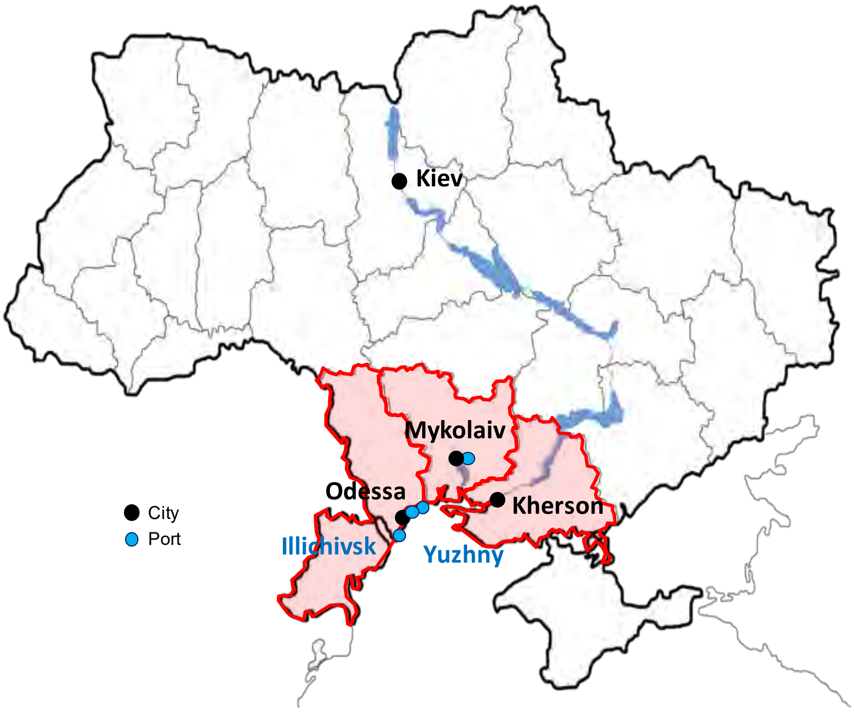
1.3 Study Area

The Study is being conducted in the Southern Region of Ukraine (Odessa Oblast, Mykolaiv Oblast, and Kherson Oblast).

The subject infrastructures for the study are as follows:

- Major highways and bridges in the Southern Region (Odessa, Mykolaiv, Kherson)
- Major ports in the Southern Region (Odessa, Yuzhny, Illichivsk[1], Mykolaiv)

[1] Port of Illichivsk is the former name of Port of Chronomorsk; Port of Illichivsk will be used within this report.



Source: JICA Survey Team

Figure 1.1 Map of Study Area

1.4 Study Tasks

- Prepare Inception Report (IC/R) by collecting and analyzing data and information available
- Review the current situation and analyze the issues of logistics
- Examine utilization of Japanese Technology
- Review national policies, plans, laws and regulations, and existing project plans
- Analyze current situation/Issues of the road/bridge and seaport sectors
- Review Mykolaiv bridge construction project
- Review the status of assistance from other donors in the transport sector in Ukraine
- Prepare scenarios for the road/seaport sectors
- Prepare Interim Report (IT/R)
- Discuss the potential and direction of JICA assistance with related organizations
- Propose the potential and direction of JICA assistance to related organizations
- Hold a seminar to introduce Japanese technology
- Prepare Draft Final Report (DF/R)
- Discuss with related organizations on the direction of JICA assistance and potential projects
- Prepare Final Report (F/R)

1.5 Study Schedule

The Study was officially launched by JICA in October 2016, and the first Survey Team members arrived in Ukraine on 7th November 2016, consisting of 8 members with various areas of expertise, namely the road, bridge and seaport sector. With the support from the Government of Ukraine and related stakeholders in Ukraine, the Survey Team conducted interviews and site visits in Kiev and the Southern Region of Ukraine.

In February 2017, the Survey Team submitted the Interim Report including the review of national policies, plans, laws/regulations, and institutional reforms; other donor assistances; preliminary traffic forecast; and priority projects in both the road and port sectors. The Interim Report was shared with the Government of Ukraine to further discuss the potential assistance by the Government of Japan to the road, bridge, seaport sector in Southern Ukraine.

The second field work by the Survey Team was conducted in February 2017, and on 21st February, "JICA Seminar on the Japanese Logistics and Transport Technologies" was held at the Ministry of Infrastructure in Kiev. At the seminar, Japanese corporations and the Survey Team presented Japanese technologies which could potentially be utilized in Ukraine in the field of road, bridge and seaport sector as well as the summary of the Interim Report to the Government of Ukraine. More than 70 participants from the Ministry of Infrastructure, USPA, Ukravtodor, regional administrations etc. as well as from Japanese corporations joined the seminar.

From late February to mid-April 2017, the Survey Team continued to hold discussions with JICA and Japanese corporations on the potential assistance by the Government of Japan and prepared the Draft Final Report with priority projects.

The third field work was conducted by the Survey Team from mid to end of April 2017 to discuss the potential priority projects with the Ministry of Infrastructure, Ukravtodor, USPA and stakeholders. This Final Report has been prepared incorporating the comments received.

2. National Transport Policies and Plans

2.1 National Transport Policies and Plans

2.1.1 National Development Plan

The Government of Ukraine formulated the Sustainable Development Strategy "Ukraine 2020" (signed in January 2015), which defines the direction and priorities of Ukraine until 2020. The Cabinet of Ministers is planned to approve the action plan for implementation of "Ukraine 2020" annually and be informed of the status of the implementation quarterly.

"Ukraine 2020" is being implemented, focusing on the goal of "European Standards and the Rightful place for Ukraine in the world" and four pillars, which are:

- Sustainable development of the country
- Security of the country, business and people
- Responsibility and social justice
- Pride for Ukraine in Europe and the world

"Ukraine 2020" includes a total of 62 reforms, where reforms are identified for each of the four pillars above. Within the development pillar, 26 reforms were specified as per below table, which includes the reform of the transport sector (No. 9).

Table 2.1 Ukraine 2020 – Reforms for Development

1. Deregulation and development of entrepreneurship	14. Program of Ukrainian export development
2. SME development program	15. Energy reform
3. Tax reform	16. Energy efficiency program
4. Reform of protection of competition and antitrust laws	17. Reform of agriculture and fisheries
5. Corporate law reform	18. Land reform
6. Financial sector reform	19. Housing reform
7. Capital markets reform	20. Reform of statistical institutions
8. Labor reform	21. Investment attraction program
9. Transport reform	22. Diplomatic relations and institutions reform
10. Telecommunication infrastructure reform	23. Public procurement reform
11. Trans-European networks participation reform	24. State financial control reform and stabilization of state budget
12. Customs reform and integration into the EU customs community	25. Civil service reform and reorganization of government agencies
13. The reform of economic and monetary policy	26. State property management reform

Source: Ukraine 2020 Strategy

Within the identified reforms, 8 priority reforms and 2 programs were defined as per below, along with 25 key indicators of successful development, such as improvement in sovereign credit rating from the current CCC to BBB by 2020 and increase in GDP per capita.

Table 2.2 Priority Reforms and State Programs

Priority Reforms	
1. Anti-corruption reform and lustration	5. Reform of law enforcement system
2. Judicial reform	6. Reform of the national security and defense system
3. De-centralization and state governance reform	7. Healthcare system reform
4. Deregulation and development of entrepreneurship	8. Tax reform
State Programs	
1. Energy independence program	2. Global promotion of Ukraine

2.1.2 National Transport Strategy and Its Priorities

In October 2010 the Cabinet of Ministers of Ukraine (Decree of the Cabinet of Ministers of Ukraine dated 20th October, 2010, No. 2174-p) approved the ***"National Transport Strategy of Ukraine for the period up to 2020"***. It states the necessity of reforming the railway, maritime and road transport and networks, indicating the main directions for:

- Development of transport infrastructure
- Improvement of the investment climate
- Ensuring the availability and quality of transport services
- Integration of the national transport system into European and International transport systems
- Improvement of the efficiency in the field of transport
- Transport security procedures
- Improvement of environmental performances and energy efficiency of transport vehicles

Moreover, as well as development strategies for each transport sector, which is stated further in Chapter 3 (Analysis of Road Subsector) and Chapter 4 (Analysis of Seaport Subsector).

Further, on 17th November, 2016, the Ministry of Infrastructure of Ukraine held a national round table upon renewal of the National Strategy in the Transport Sector in Ukraine until 2030. Such renewal is a logical and necessary step within the framework of implementation of the Association Agreement with EU and getting Ukrainian standards and policies in compliance with EU policies.

The purpose of the updated National Transport Strategy is to establish a conceptual basis for implementing the state policy in order to provide sustainable and efficient transport sector operation, to create conditions for social and economic development of the country, to improve competitiveness of the national economy and the wellbeing of its people.

It concludes with setting 5 priorities for the transport sector until 2030. These priorities will guide the development of appropriate and responsive strategies and the corresponding measures to achieve the set priorities. These priorities are as follows:

<u>PRIORITY 1: Efficiency in Public Governance in the Transport Sector</u>

- Improvement of governance and transparency in the transport sector as integral part of fighting corruption.
- Deregulation and liberalization to enhance attracting private operators alongside corporate governance for State Owned Enterprises (SOEs).

- Enhancing the policy making of the Ministry and non-biased regulatory role of the state agencies in line with the public administration reform.

PRIORITY 2: Provide Quality and Efficient Transport Services

- Apply approach for integrated transport systems serving the users' needs maximizing the economic benefits of current assets.
- Deploy new technologies to improve efficiency of transport operation and services, where maintenance will be prioritized over new investment.
- Enhance energy efficiency and respect environmental policies.
- Eliminate existing barriers to logistics and multi-modal solutions within the framework of national corridors, integration to TEN-T and improving terms of transit corridors.

PRIORITY 3: Achieve Sustainable Financing for Transport

- Adequate and reliable financing of transport investments is the corner stone for sustainable provision of transport services.
- Consider "user pays" principles and introduce mechanism for ear-marked funding for transport. The involvement of private capital with evident Value for Money shall be promoted. A continued dialogue with IFIs is crucial within the context of supporting transport sector development.
- Allocation of public funds will follow transparent prioritization mechanism and its administration shall safeguard cost efficiency and transparent public procurement rules. Establish open communication and Information disclosure on budget planning and spending.

PRIORITY 4: Improving Transport Safety and Security

- Reducing risk of transport to human lives particularly in urban areas and improves the security of transport users as a basic right.

PRIORITY 5: Improved Urban Mobility and Regional Integration

- Provide affordable, responsive and reliable public transport services with focus on regional connectivity to support the development of regional clusters and labor mobility.

2.2 Donor Assistance to the Transport Sector in Ukraine

Other than JICA, various International Financial Institutions (IFIs) is providing assistance to the Ukrainian transport sector. This section presents an overview of the main IFI donor programs related to the Ukrainian transport sector. Specific examples of IFI assistance for the road and seaport sector are described in Chapters 3 and 4, respectively.

2.2.1 USAID

USAID contributed to the improvement of the implementation of PPP-projects in Ukraine. According to the USAID Report on "Public-Private Partnership Development Program (P3DP) in Ukraine[1], the following background, objectives and results have been realized.

[1] USAID Cooperative Agreement # AID-121-A-00-10-00708

(1) Background

The public sector in Ukraine lags significantly behind European and Eurasian countries in providing reliable infrastructure and public services. Due to decades of economic inefficiencies and lack of maintenance, investment in excess of US$30 billion and growing is needed in public infrastructure. With an ongoing financial crisis, the government simply does not have the public funds to finance needed projects. One solution adopted in many parts of the world is the use of public-private partnerships – or PPPs – to attract private investment, management and technology. The Public-Private Partnership Development Program (P3DP) was launched in September 2010 by the United States Agency for International Development (USAID) to promote the use of PPPs in Ukraine. In 2010, the environment for PPPs was extremely poor. Ukraine's investment climate was one of the worst in the world. Awareness of PPP benefits and how to implement them was extremely low. The government was corrupt and unstable.

(2) Objectives

Within this context, the P3DP team pursued four interrelated objectives:

- Creating a legal and regulatory environment conducive to PPPs;
- Establishing a national PPP unit and working with other institutions to bridge related public and private interests;
- Developing public awareness and stakeholder capacity to implement PPPs; and
- Supporting municipal efforts to create pilot PPP projects in key public service sectors.

(3) Results

Despite this challenging environment, P3DP made progress in laying the foundation for PPPs. Legislation was improved, a PPP Unit was established within the Ministry of Economic Development and Trade (MOEDT), trainings and awareness raising activities were conducted, and work began on ten pilot PPP projects. Then in 2013, during the third year of the program, Ukraine experienced significant political, economic and social changes. A popular protest triggered by then President Yanukovich's rejection of the EU Association Agreement led to his abandoning the presidency and fleeing to Russia, which soon after occupied Crimea and initiated a conflict in the Donbas region in the East. Ukraine quickly formed a new government that initiated a reform program that significantly altered Ukraine's development objectives. P3DP responded to the changing needs and new requests of the national and local governments. This included showing how PPPs can be used to introduce e-Government services, help solve the long-term housing/health needs of internally displaced people (IDPs), and stimulate the economy by improving seaports or establishing industrial and technical parks. P3DP also supported Ukraine's efforts to improve State Owned Enterprises (SOEs) by improving management and governance, attracting private sector investment through privatization and PPPs.

2.2.2 European Investment Bank (EIB)

European Investment Bank The EU bank

In June 2005 a Framework Agreement was signed between European Investment Bank (EIB) and the Government of Ukraine. The agreement should facilitate the EIB to proceed with the financing of projects in the areas of environment, transport, telecommunications and energy infrastructure in Ukraine. This included priority Trans-European Network (TEN) projects connecting Ukraine and the European Union. EIB's activities were developed in close cooperation with the European Commission, the EBRD and other IFIs operating in the country.

Currently, EIB's portfolio of signed loans in the Ukraine has reached an overall value of EUR 4.35 billion, allocated to 38 different projects of which more than EUR 1.0 billion was allocated to transport infrastructure projects. In addition to the on-going/completed projects, future projects are defined as per below[2]:

Table 2.3 EIB's Committed Projects in the Future in the Transport Sector

Committed Projects	Budgeted Amount	Project description
2017	EUR 200 million	Urban Public Transport Project Frame Loan
2017	EUR 235 million	Railway rehabilitation of Dolinska–Mykolaiv line
2017	EUR 300 million	Kharkiv Metro Line extension with new rolling stock and new DEPOT
Projects in pipeline	**Under discussion**	**Project description**
2017–2020	EUR ? million	Urban road safety
2017–2020	EUR ?million	Rolling stocks (locomotives) and railway modernization
2017–2020	EUR ?million	Dnieper river locks rehabilitation / Port reconstruction
2017–2020	EUR ?million	Further road reconstruction and road safety

Source: EIB website

EIB utilizes the following conditions to all projects that might be supported by the bank:

- Project should support the Ukrainian transport infrastructure integration into the EU TEN-T network and increase the economic performance of the country and the life standards of the Ukrainian people
- Sovereign Financial Agreement;
- Maximum of 50% of total project cost;
- No VAT financing;
- Bankable project proposal;
- 20–25 years maturity;
- 5 years grace period with no payment;
- No administration and other fees.

2.2.3 The World Bank Group

World Bank (WB) is an international financial institution that provides loans to developing countries for capital programs. The World Bank's stated official goal is the reduction of poverty. However, according to its Articles of Agreement, all its decisions must be guided by a commitment to the promotion of foreign investment and international trade and to the facilitation of capital investment.

THE WORLD BANK

World Bank has committed to a total of 94 projects in Ukraine where 62 projects are closed, 13 projects are currently active, 2 as pipeline projects, and 17 have been dropped. In 2016, US$1.56 billion worth of projects were approved and as of October 2016, there are 8 loans active, where US$472 million has been disbursed, with an original principal amount at US$2.6 billion[3].

The current on-going and/or recently completed World Bank activities in the transport sector in Ukraine are shown in the following table.

2 EIB Website
3 World Bank Website http://data.worldbank.org/country/ukraine

Table 2.4 World Bank Projects in Ukraine in the Transport Sector

Sector	Project Description
Port	- Technical Assistance for the Lower Dnieper River Waterway and Port PPP
Railways	- Support to Railways Modernization: Technical assistance focusing on key reform components
Urban Transport	- Sustainable Urban Transport for Kiev - Sustainable Urban Transport for Odessa
Logistics	- Towards greener and more efficient logistics
Roads	- Road Safety Improvement Project: Road rehabilitation in Poltava region, road safety improvement along various corridors and institutional support and strengthening in the area of the reform of road sector - Road Sector Development Project: Road improvement Poltava to Kharkiv, maintenance of Core National Road Corridors, and institutional support - Prioritization of Road Corridors

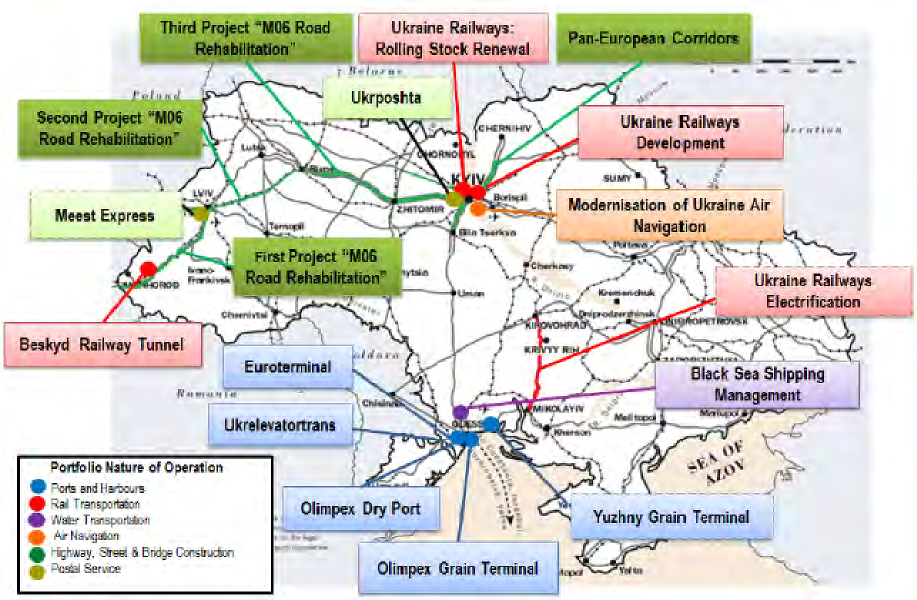
Source: World Bank website

2.2.4 European Bank of Reconstruction and Development (EBRD)

European Bank for Reconstruction and Development is an international financial institution promoting transition to market economies by investing mainly in private sector development and entrepreneurship in Eastern Europe, Central Asia and the Mediterranean. EBRD was established in 1991 and is headquartered in London. It is the largest investor in Eastern Europe.

EBRD has supported 24 projects in the Ukraine with a total value of EUR 1.3 billion in 25 years. Main sectors in which the EBRD is active are roads, railways, ports, shipping, logistics, intermodal, postal and aviation. It offers sovereign, sub-sovereign, and private funding structures.

The following figure presents the projects sponsored by the EBRD:



Source: EBRD website

Figure 2.1 EBRD Projects in Ukraine

Besides the projects in the figure above, EBRD supports the reforms in the Ukrainian infrastructure sector as well. More specifically, it supports below components:

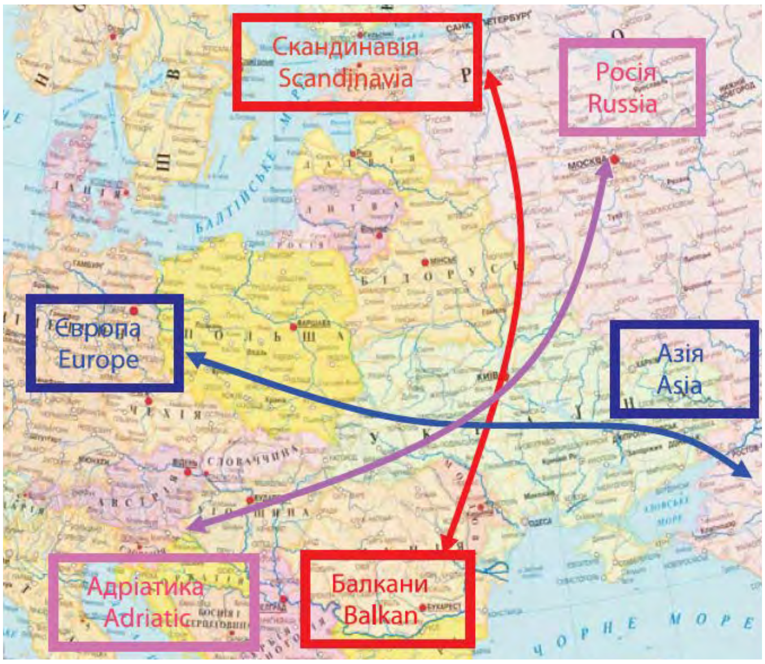
- Legal and policy framework for concessions;
- Preparation of the pilot concession project (port Olvia[4]);
- Corporatization of Ukrainian Railways and Ukrainian Post;
- Reform of the road sector financing and administration;
- Introduction of FIDIC contracts;
- Output performance based road maintenance contracts;
- International best practice in procurement.

[4] Former name: port Oktyabrsk

3. Analysis of Road Subsector

3.1 Overview of National Road Network

Ukraine is located at the center of East/West Europe-Asia Corridor and its position is advantageous as a main hub for transit of goods and passengers between Europe, Asia and Middle East. The importance of roads in Ukraine to international transportation is also confirmed by the fact that international transport corridors such as TRACECA Road Network, Pan-European Corridors and E-road Network pass through the existing motorways of Ukraine, such as Kiev–Chop and Kiev–Odessa. The total length of the road network of national and local importance is approximately 169,600 kilometers.



Source: Ukravtodor Presentation in 2013

Figure 3.1 Ukraine's Position in Europe

Across all transport modes, approximately 7 million passengers (including local and international transit) and more than 657 million tons of freight have been transported into, from, or through the territory of Ukraine in 2013. Most of the passengers (89%) has been transported by motor vehicles, while most of the freight (71.3%) has been transported by rail.

Ukraine's highway network is quite extensive; it covers the entire territory of the country. The government has invested in development of main roads, linking the country's major economic centers. However, the level of investment in the regional road network is rather low, which does not allow adequate financing for maintenance of the road network.

The international transport corridors including rail and road transport that pass through Ukraine include[1]:

- Pan-European Transport Corridor No. 3 (PETC III), with the route Berlin – Wroclaw – Lviv – Kiev and a length of 1,640 kilometers, of which 625 kilometers are highways across Ukraine

[1] Source: Infrastructure & PPP in Ukraine, Delloite

- Pan-European Transport Corridor No. 5 (PETC V), which links Trieste and Lviv via Ljubljana, Budapest and Uzhhorod with a total length of 1,595 kilometers, of which 319 kilometers of highways pass through Ukraine
- Pan European Transport Corridor No. 9 (PETC IX), with a total length of 3,400 kilometers and a route passing through Helsinki – St. Petersburg – Vitebsk – Kiev – Odessa – Plovdiv – Bucharest – Greece. In Ukraine, the length of the Pan European Transport Corridor IX is 1,027 kilometers
- Gdansk – Odessa International Transport Corridor, with a length of 1,816 kilometers, passes through Poland and Ukraine. In Ukraine, the length of this international transport corridor is 976 kilometers

Source: Ukravtodor

Figure 3.2 International Transport Corridors in Ukraine

3.2 Roads in Ukraine

3.2.1 Network

Roads in Ukraine consists of network of roads for public use, for official use, for private use, and streets with city roads. There are three types of roads: national, local, and streets. Each type of road is classified further. High-speed highways such as motorways or freeways are only available on selected segments of the major routes. The length of public roads is 169,600 kilometers, including:

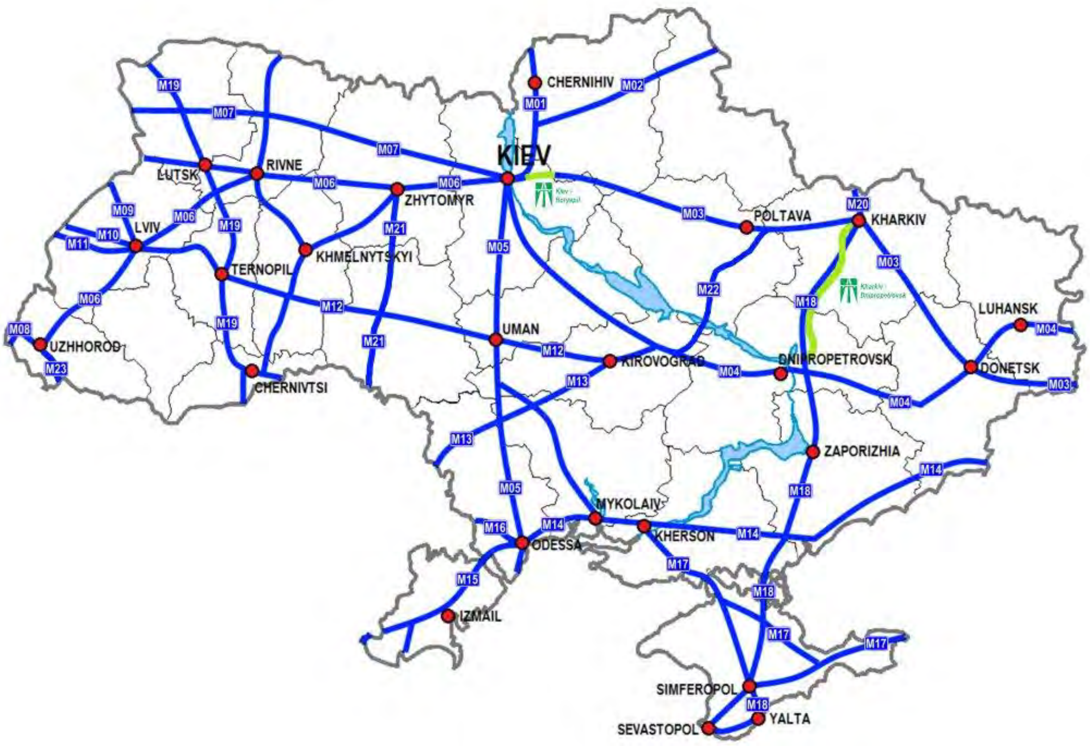
- State roads – 51,700 kilometers
- Local roads – 117,900 kilometers of which 80% of roads have not been repaired more than 30 years and have not met the current requirement level

The State Roads (Highways) are subdivided into four categories:

- International (M-network); 8,080 kilometers, with branches 8,600 kilometers
- National (H-network); 4,800 kilometers
- Regional (P-network); 10,000 kilometers
- Territorial state roads (T-network); 28,300 kilometers

The letter indexes are of their respective abbreviation in the Ukrainian language.

International Highways (Ukraine) are the roads in Ukraine on routes involving international transport corridors and/or highways that are part of the European network. The international highways in Ukraine are identified with letter **M** for the Ukrainian transliteration (Mizhnarodni), followed by a double digit of 01 through 23. Usually major routes of motorways detour in highly congested areas, such as cities. However, these highways may have branch roads with the same identification signs posted while going through such congested areas.



Source: Ukravtodor

Figure 3.3 International Highway (M Class) Network in Ukraine

There are 23 international highways of Ukraine, with the total length reaching 8,080 kilometers. Those highways cover 5% of all highways in the country. When branches (or exits) are mentioned and added to the length, the total length is then measured including the entire network, not as an alternative route.

The local roads are classified as follows:

- Regional local roads (O-Network) 50,000 kilometers
- District local roads (C-Network) 67,900 kilometers

3.2.2 Issues in Quality of Maintenance

Road infrastructure is the backbone of the transport system in Ukraine to provide trunk movements of goods and passengers as well as everyday life of people. However, the quality of the road surface and the structure for modern automobile traffic requires improvement to meet the objectives of the road transport in the country. The State Road Agency, Ukravtodor recently acknowledged that 80% of the road network suffers from shortage of maintenance and does not meet the modern quality requirements. This is particularly the case for local roads because the improvement of the trunk highways and motorways was emphasized.

Efficient planning, design, construction and maintenance of road infrastructure are one of the crucial elements for the development of transport networks for the growing mobility demands for passengers and goods. Creating and maintaining adequate road infrastructure requires both an effective national policy and coordinated actions at international level. Identification of investment needs and finding financial sources for improvement of the road infrastructure in non-satisfactory conditions has been a difficult task for the Government of Ukraine.

The following figure show present conditions of road pavement along the representative sections of the state highway network in the Southern Region.


Heavy Trucks in the city


Heavy Trucks near Mykolaiv port


Heavy Trucks on unpaved H-14


Heavy Trucks on M-15


Road Conditions of M-16


A Heavy Truck on M-16

Source: JICA Survey Team

Figure 3.4 Photos of Road Conditions and Traffic in the Southern Region

3.2.3 Institutional Framework of Road Administration

After the fall of the Soviet Union at the end of 1991, all state organizations for road service within Ukraine were reorganized. The Ministry of Infrastructure (hereinafter, MOI) of Ukraine is responsible for managing and developing the road sector. MOI is the implementing body of the state policy for road facilities, while the roads are managed by the State Road Agency, "Ukravtodor", which is the central executive body whose activities are directed and coordinated by the Cabinet of Ministers of Ukraine. The Cabinet of Ministers is led by the Prime Minister of Ukraine, joined by the Vice Prime Ministers and Ministers. In regards to the road management, Ukravtodor plans and manages the international corridors while Ukravtodor oblast branch manages the road networks within the country. Due to the understanding that most of the networks have been created already, the Ukravtodor oblast branch mainly focuses on the planning and implementation of repair, rehabilitation, and maintenance of roads. Cities manage the streets in the cities.

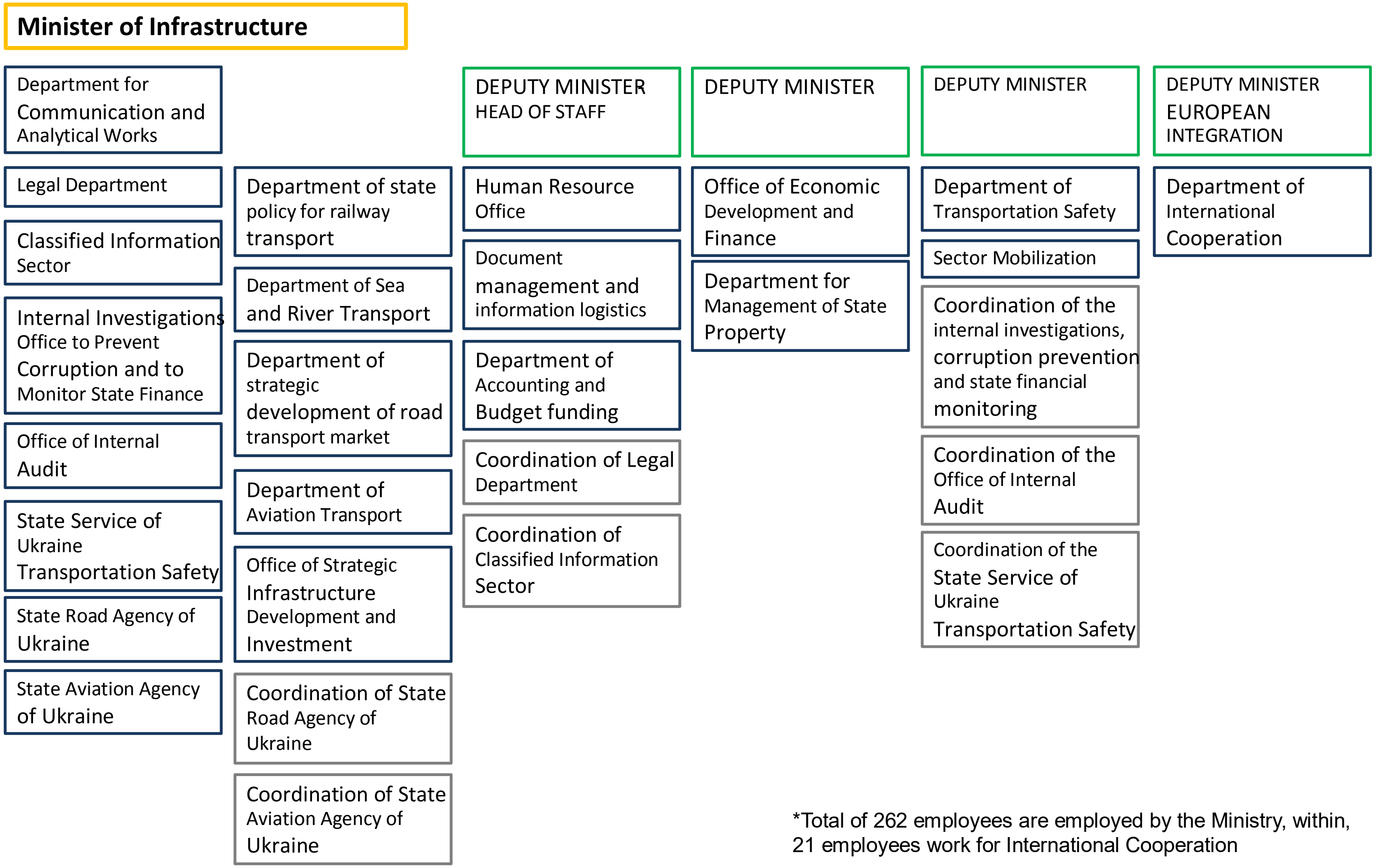
Other ministries within the government that is closely related to the transport sector development include; namely the Ministry of Economic Development and Trade of Ukraine and the Ministry of Agrarian Policy and Food of Ukraine. The Ministry of Economic Development and Trade mainly conducts strategic planning and restructuring of economy and creates the macroeconomic framework and national policies, including trade development. The Ministry of Agrarian Policy and Food of Ukrainian is responsible for the formulation and implementation of the national agricultural policy. Both ministries work closely with MOI in improvement of the roads and road networks in Ukraine.

<u>Budget Allocation for Road Construction and Maintenance</u>

The budget for management of roads is provided through the state. The Ministry of Finance of Ukraine is responsible for the budget system of Ukraine, which includes the state budget and local budget that will be allocated to each of the Ministries. While the Cabinet of Ministers of Ukraine assure the execution of the state budget of Ukraine, the Ministry of Finance organizes and administers the state budget execution process and coordinates activities of all participants of budget process concerning budget execution, including MOI.

The budget for the maintenance and repairs of the 169,600 kilometers of national roads responsible by the 24 Ukravtodor oblast branches is allocated by Ukravtodor. In order to secure the budget, each of the Ukravtodor oblast branches, coordinating with the oblast administrations, calculates the necessary budget and submits the budget request with detailed documents to Ukravtodor. Ukravtodor then examines the budget request utilizing its own calculation method and based on the total budget, priority, and hierarchy of roads, decides the allocation of budget. Road maintenances that have started and are conducted in multi-year phases are likely to be prioritized. These budget requests are usually provided at the end of the year, and amendments are made throughout the year after the initial budget allocation.

In recent years, due to the financial and economic difficulty, the state budget is not fulfilled for the large-scale projects to build roads and bridges. The funding of road works by the state including construction, development maintenance, and others for 2016 amounted to UAH 16.965 billion. For 2017, the planned state budget is UAH 22.379 billion (for breakdown, see Appendix 3-I).



Source: Ministry of Infrastructure

Figure 3.5 Organizational Structure of the Ministry of Infrastructure*

3.2.4 Organizational Structure of Ukravtodor

The organizational structure of the State Road Agency "Ukravtodor" is shown in Figure 3.6. As of March 2017, there are 108 employees that are employed within Ukravtodor; 21 employees in the Department of the Development of Road, 23 employees in the Department for Strategy and Coordination, 21 employees in the Planning and Finance, Accounting and Financial Reporting Department and others in various directorates.

Ukravtodor implements its functions via 24 Ukravtodor oblast branches (in the past, there were 26). These agencies serve as ordering parties for construction works, reconstruction, capital and operating repairs, maintenance, and design-and-survey works for general usage roads of national and local significance. The total number of employees for all 24 Ukravtodor oblast branches are 1,314 (as of March 2017).

Ukravtodor's main tasks are as follows:[2]

- Implementation of state policy in the field of road management and management of public roadways;
- Submission of proposals to MOI to ensure public policy in the road sector;
- Management of state property.

Ukravtodor consists of three key departments: i) Department for Strategy and Coordination ii) Department of the Development of Road, and iii) Planning and Finance, Accounting and Financial Reporting Department.[3]

The main tasks of the Department of Road Network Development are as follows:[4]

- Implementation of state policy and proposals for development (construction and renovation), planning for capital expenditures and repairs of public roads and engineering structures, scientific and technical research and pricing;
- Formation of plans and objectives for the construction, renovation, maintenance and repair of public roads, facilities, and implementation monitoring;
- Development of forecasts and future plans for the construction, renovation, maintenance and repair of public roads and facilities in accordance with the development and improvement strategies of the network of public roads, highway development programs and other decisions by the Government;
- Coordination and approval of project documentation for construction, renovation, maintenance and repair of public roads and facilities;
- Matching the variants of design for constructions and pavements as well as structural diagrams of bridges, overpasses and viaducts;
- Introduction of new advanced technologies and materials, software development and implementation of key scientific and technological development of the road sector to improve the quality of construction, renovation and repair of public roads and reducing the cost of execution of road works;
- Coordination of the activities of enterprises, institutions and organizations within the management of Ukravtodor in regards to construction, renovation, capital

[2] Source: Cabinet Ministers of Ukraine resolution (10th September,2014, No. 439)
[3] LOGMOS Master Plan-Annex 5, September 2013
[4] Source: Interview of MOI and Ukravtodor

expenditures and repair of public roads and engineering structures, scientific and technical research and pricing;

- Management, operation and development of streets and roads of cities and other settlements under local authorities in their respective areas of responsibilities.

Ukravtodor mainly outsources the engineering works to the 12 state owned enterprises, including "Ukrdiprodor" (Ukrainian State Enterprise of Road Facilities Design) and "Ukrdiprobudmist" (Ukrainian State Enterprise of Bridge Design), and acts as the managing and supervising body of their works. According to Ukravtodor, for the projects financed by the IFIs, the engineering works are outsourced as well, but so far are conducted by international consulting firms rather than the state enterprises or domestic private firms[5].

"Ukrdiprodor" is one of the largest state enterprises in the road sector with 421 employees as of March 2017. It provides road design service works to various road works done by Ukravtodor. Its scope of work includes[6]:

- Planning and designing of construction, reconstruction and capital repairs of motor roads and other facilities;
- Topographic, geodetic, cartographic surveys and works;
- Geophysical, hydro geological works;
- Planning of land-use, such as project design for land clearance operations and planning for rational utilization of land;
- Execution of engineering survey by classes (for buildings and constructions of I and II class roads);
- Execution of a complex projects works (under standard conditions, for new construction, for reconstruction and capital repairs of road facilities, for territories with rough engineering-geological conditions, sagging soils, slides, landfalls);
- Architectural and construction design;
- Designing of internal/external engineering networks, systems and facilities;
- Designing of means of fire prevention.
- Scientific, technical research and development in the area of designing and surveys of highways, custom-made facilities and road service facilities:
- Preparation of pre-project documentation to substantiate foreign and national investments;
- Preparation of tender documents to hold tenders;
- Authorship supervision over construction process, and also scientific support to construction-and-repair works.
- IT promotion and software development.
- Preparation of regulatory, metrological and policy documents for the design base, standards, typological project documentation and cost estimate standards in the area of road industry and distribution thereof.
- And others

"Ukrdiprobudmist" is a state enterprise specializing in bridge works, with 34 employees as of March 2017. It currently provides designing, construction supervision and other related services to the construction of the Zaporizhia Bridge. Ukrdiprobudmist's scope of acitivities include[7]:

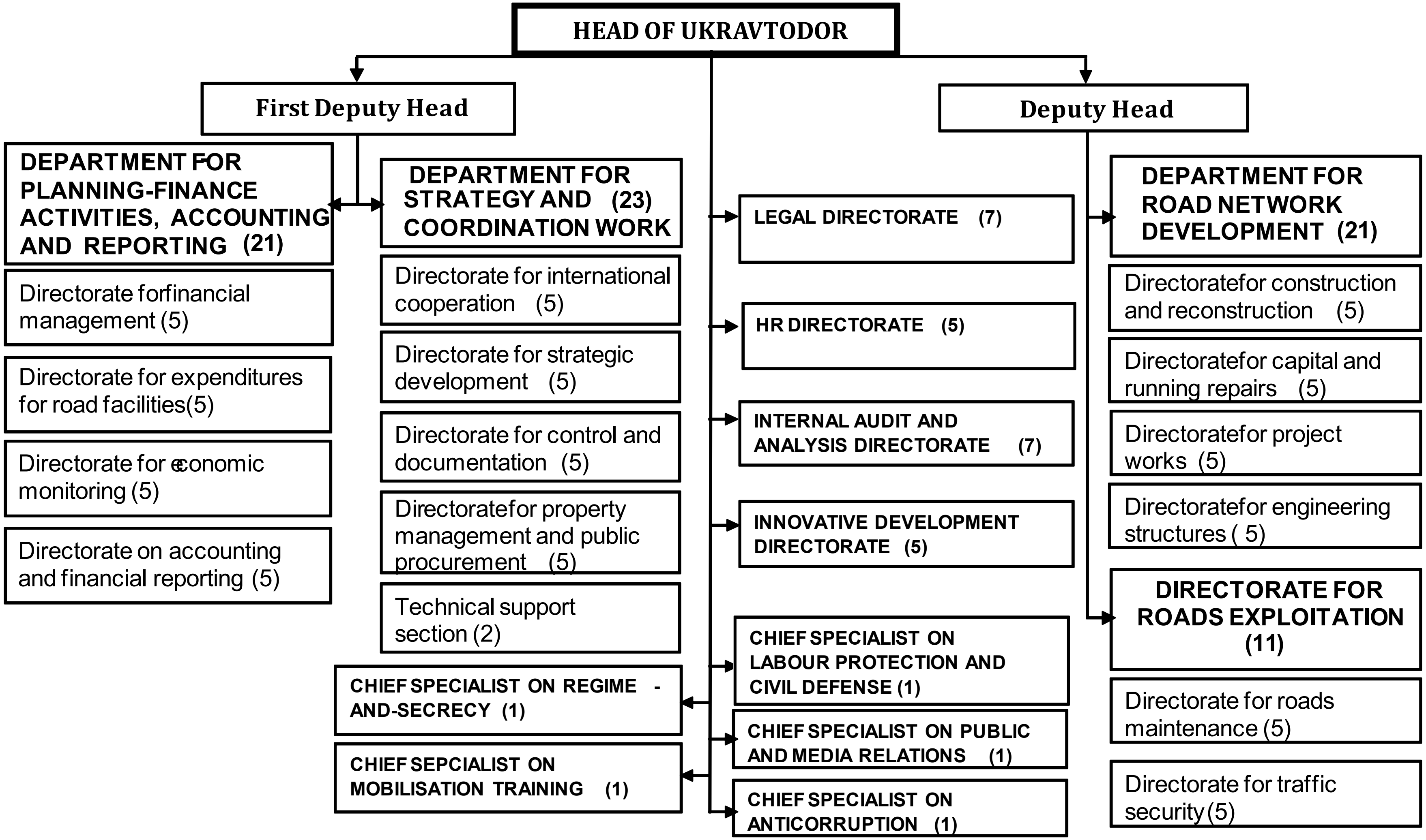
[5] Therefore, the engineering capacity of the Ukravtodor is obtained through the state enterprises for the IFI projects.
[6] Source: Charter "of State Enterprise – Ukrainian State Enterprise of Road Facilities Design" ID 05416892
[7] Source: Charter "of State Enterprise – Ukrainian State Enterprise of Bridge Design" ID 16290945

- Designing of bridges, custom-made constructions, building of bridge facilities;
- Designing and construction of bridge building equipment, machines and mechanisms, and production of civil structures;
- Project designing for expanding, reconstructing, technical re-equipping and capital repairs of factories manufacturing ferro-concrete and metal constructions, production facilities of bridge building organizations;
- Creating design documentation of bridges and its facilities;
- And others.

3.2.5 Capacity Improvement of Ukravtodor

In terms of the organizational capacity of Ukravtodor including availability of human resources, with only 100+ employees currently employed at state level, there seems to be not enough capacity to conduct all duties imposed to the authority. In such circumstances, increasing the authority and responsibilities of Oblasts has been started, which is in line with the policy in promoting further decentralization. However, there needs to be careful consideration of lack of personnel at the Oblast level as well. Moreover, it is necessary to efficiently utilize the private sector abilities, by demarcating public sector and private sector works in the road sector.

Moreover, Ukravtodor has stated the necessity of improvement of the complete information system in order to improve its capacity for managing the roads in the country. The enhancement of the E-road management tools, including Geographic Information System (GIS) is necessary, as currently, only fragmented information resources are available since the key elements of the system are missing. In order to obtain such complete information system, there is a need for sufficient fund allocation.



Source: Ukravtodor

(Number of employees)

Figure 3.6 Organizational Structure of Ukravtodor

3.2.6 Relevant Laws and Regulations on Roads

(1) Law of Ukraine "on Roads"

The law for the road sector is mainly governed by the Law of Ukraine "on Roads" (Supreme Council of Ukraine, 2005, No. 51, st. 556; Last amended dated. 11th October, 2015, No. 52, st. 482). The law stipulates the legal, economic, organizational and social principles of the roads as well as for its construction, repair and maintenance. In Article 5, the types of roads are classified into public roads, street and roads of cities and other inhabited localities, departmental roads which can only be used by representatives of certain agencies or sectors, and roads on private territories. Public roads are classified into state highways, national highways, regional roads, and local roads, as described earlier.

Sources of financing for construction, renovation, repair and maintenance of roads of general use, is stipulated that it shall be in accordance with the State Budget law for the relevant year, the Law of Ukraine "on the sources of financing of road sector of Ukraine" (Supreme Council of Ukraine, 1991, No. 47, st. 648; Last Amended 17th November, 2016, No. 1762-VIII), "on the tax from vehicle owners and other machineries" (Parliament of Ukraine, Act of dated 11th December, 1991, No. 1963-XII), "on concession for construction and operation of highways" (Supreme Council of Ukraine, 2000, No. 3, st. 21; Last amended dated 11th October, 2015, No. 52, st. 482) and other regulatory acts. Allocation of the funds shall be made according to the priorities set by the state policies and programs.

In regards to the protection of the environment, air, water resources, greenery during the construction, renovation, repair and maintenance, the law stipulates that it must be in accordance with the relevant environmental legislation, including the necessity of utilizing methods that ensures minimization of air pollution as well as preventing pollution of water bodies with harmful substances.

Although there has not been any implementation of toll roads in the past in Ukraine, the law stipulates the provisions of creating toll roads. It states that the toll roads, including bridges, shall be in accordance with the state strategy of development of the road network and is conditioned that it shall provide significant improvements and that an alternative road is available free of charge. In order for a public road to be classified as a toll road, a feasibility study and/or cost estimates shall be submitted to the Cabinet of Ministers of Ukraine, upon consultation with the local authorities where the road is located. The maximum amount of the fee and collection procedure must also be established by the Cabinet of Ministers. Moreover, the paid public roads must remain as state property but can be operated through concessions.

<u>Road Sector Reform</u>

Currently, the reform of the road sector in Ukraine is being undertaken through amendment of related laws as well as establishment of the state road fund. The major aim of the reform is to facilitate decentralization by providing greater functions, rights, and obligations to the local authorities and clarifying the responsible authorities in the road sector. The motivation of such road sector reform is explained by the "National Transport Strategy of Ukraine for the period up to 2020" and the Association Agreement with EU, which is described in Chapter 2.1.2. Detailed objectives of transfer of public roads of local importance to local level are summarized below[8]

- Effective management of roads of local importance by local authorities' operational decisions and effective solutions;
- Increase of responsibility by the local authorities;

[8] Source: Ministry of Infrastructure of Ukraine

- Enhancement of the local authorities and government's involvement in the development of additional sources of financing and maintenance of roads of local importance;
- Improvement of transport and operation of state highways, including the provision of bus services to rural areas;
- Improvement of socio-economic indicators associated with high levels of comfort and safety.

Through the decentralization process, the authority of 120,000 kilometer of regional/local roads is planned to be moved to the oblast administration and 50,000 kilometer of roads of national importance are planned to be retained by Ukravtodor. With the amendment of the budget code, 60% of the collected fund for roads is planned to be utilized for roads of national importance and payment of loan interest, 35% is planned to be utilized for the subventions to the oblasts, and 5% is planned to be spent on safety issues. The oblasts, in addition to its own local budget, shall be receiving such subventions from the central government and would be responsible in deciding the detailed usage of the budget. The allocation of subventions to oblasts are planned to be calculated using a simple formula, depending on network length.

As to the status of the amendments to the laws for enforcing decentralization, a plenary session of the Ukrainian Parliament took place on 17th November, 2016 and adopted several laws that set the legal background for the reform of the management system and financing of roads, namely:

- Amendments to the "Budget Code of Ukraine" (Supreme Council of Ukraine, 2010, No. 50–51, St. 572) in improving the mechanism for the financial backing of the road Sector
- Amendments to the Law of Ukraine "on the sources of financing roads of Ukraine" (Supreme Council of Ukraine, 1991, No. 47, st. 648; Last Amended 17th November, 2016, No. 1762-VIII), stipulating the establishment of the State Road Fund along with sources of budget and expenditure patterns
- Amendment to several laws of Ukraine in reforming the management system and financing the public highways, which foresees the following components:
  - Division of functions in managing highways and delegation of authority to Oblasts to manage roads of local usage;
  - To enforce long-term contracts for maintenance of roads;
  - To consider possibility for applying the FIDIC principles and requirements;
  - To conduct independent audit (appraisal) of the technical condition of roads and of the quality of roads works;
  - Operation and monitoring of toll roads

These laws were signed by the speaker of the parliament on 22nd November, 2017 and were ratified by the President of Ukraine on 8th December, 2017, and are expected to come into force on 1st January, 2018. In the course of 2017, necessary preparatory work, such as for the implementation of the State Road Fund as well as transfer of the authority of regional/local roads, shall be conducted.

Other amendments of related laws that are currently in discussion are shown in the table below.

Table 3.1 Summary of the Major Contents of Draft Amendments No. 0954

Article No.	Content of Amendment
The Law of Ukraine “on local state administrations”	
Article 20	*Rights in urban planning, housing, commercial services, transport and communications* Addition of clause; “manages public roads of local importance within the administrative territorial unit” to the list of the responsibilities of the local authorities.
The Law of Ukraine “on roads”	
Article 8	*Classification of Public Roads* In the current law, it only states that the list of the national roads is updated and approved by the Cabinet of Ministers of Ukraine every three years. In the amendment, the wording that the list will be created through proposals by the central executive authority that provides for the formulation of the state policy in the field of public roads and management of public-access roads is added.
Article 10	*Management of Public Roads* The demarcation of the roles of the central executive bodies are clarified, as follows: - Central executive authority that forms and implements the state policy in the field of the road economy. - Central executive authority that implements state policy in the field of road economy and management of public roads of national importance. - The Council of Ministers of the Autonomous Republic of Crimea and Sevastopol city state administrations.
Article 11	*The responsibilities of the central authorities in managing public roads* The new clause states the detailed responsibilities of the authorities listed in Article 10. - The central executive authority that forms and implements the state policy in the field of the road economy shall develop and ensure state policies and programs, develop measures for the integration of public roads into the international road network and harmonization of standards, approve budgets for construction, renovation and repair of public roads, and formulation and implementation of road safety measures. - The central executive authority that will implement the state policy in the field of public roads and management of roads of public-access roads, will develop proposals of public policy/strategy in the road sector management, implement construction, renovation, maintenance etc. of public roads, and keep statistical records and certification of public roads and others.
Article 27	*Classification of toll roads* The amendment states that submission to classify the public roads to toll roads to the Cabinet of Ministers shall be done through the central executive authority that provides for the formulation of the state policy in the field of public roads and management of public-access roads, in coordination with the Central executive authority that implements state policy in the field of public roads and management of roads of public-access roads as well as the Council of Ministers of the Autonomous Republic of Crimea and Sevastopol city state administrations, where the road runs through its territory.
Article 28	*Monitoring of the status of the toll roads* The responsible party for the monitoring is clarified. The amendment states that the monitoring of the toll roads of national importance shall be done through the central executive authority that that will implement the state policy in road sector management and public roadways.
Article 44	*Development and adoption of standards and norms* The clause will be amended so that the codes and standards of the construction, renovation, repair and maintenance of the public roads shall be conducted under the responsibility of the central executive authority that implements state policy in the field of public roads and management of roads of public-access roads, central executive authority that will implement the state policy in safety for land transport, the Council of Ministers of the Autonomous Republic of Crimea and Sevastopol city state administration, in coordination with the central executive authority that provides for the formulation of the state policy in the field of public roads and management of public-access roads and the Minister of Internal Affairs of Ukraine.

Source: Created by the JICA Survey Team using the amendment comparison table provided by Ukravtodor as of March 2017

State Road Fund

The Law of Ukraine "on sources of the funding of the road sector in Ukraine" (Supreme Council of Ukraine, 1991, No. 47, st. 648; Last Amended 17th November, 2016, No. 1762-VIII) first stipulated the State Road Fund in 1991. The fund was allocated to finance the construction, renovation, repair and maintenance of public roads of national importance, road facilities, as well as design and survey, research and implementation, development of capacities of road organizations and others. Although the State Road Fund was active before the 2013/14 events, after 2014, the State Road Fund was reorganized as a general state budget. Recently, as mentioned above, the State Road Fund has been reestablished with the parliament passing the bill on 17th November, 2016.

The fund is expected to enter into force from 2018 and the details of implementation are currently being discussed. It is planned that the allocation of budget into the State Road Fund is going to be gradually increased; in 2018, 50% of the collected fund, including fuel tax, custom duty for vehicles and oil products, and fees from the heavy vehicles (40 tons and above)[9], is planned to be allocated to the State Road Fund; in 2019 the amount shall be increased to 75%; and in 2020, it is planned to reach 100%.

(2) Concession Law for Roads

In Ukraine, the Law of Ukraine "on concessions" (Supreme Council of Ukraine, 1999, No. 41, st. 372; Last amended dated 24th November, 2015, No. 10, st. 97) defines the legal basis and regulation of concession of state and municipal property, as well as the conditions and procedure for its implementation.

Moreover, for the road sector, Law of Ukraine "on concession for construction and operation of highways" (Supreme Council of Ukraine, 2000, No. 3, st. 21; Last Amended dated 11th October, 2015, No. 52, st. 482) defines the terms for the concession of construction and/or operation of public roads, including the following:

- Determination and approval of concession will be made by the Cabinet of Ministers, on the basis of a feasibility study;
- Property of the state will be transferred to the concessionaire for use for the duration of the concession contract. The concession contract shall come into force from the date of acquiring the right to use the land;
- If the roads built/operated is a toll road, the calculation, subsidies, compensation and procedure of billing shall be determined by the Cabinet of Ministers;
- Concession fees must be made according to the concession contract, regardless of the results of the operating activities and income. Such fees will be part of the state budget.

As for the actual practice of road concessions[10], Ukravtodor conducted its first concession tender on the construction and operation of a new 84 kilometer highway Lviv–Krakovets for a period of up to 49 years. In May 2015 (as per the Minutes of Meeting by the Cabinet of Ministers, dated 31st March, 2015, No. 39), Ukravtodor, on behalf of the Cabinet of Ministers, announced the tender. 8 companies had shown interest to participate and 2 consortiums, Ukrainian Transport Highways consortium and the Bouygues Company (France) had submitted their bids. Upon evaluation, Ukrainian Transport Highways failed to pass as it did not meet the qualification requirement of the tender documentation. In the case of Bouygues Company,

[9] The fees described here which is planned to be implemented from 2018 include "fines" from vehicles of sizes and weight that exceed the set standard. However, at this moment, there are no such regulation.

[10] Source: Interview of Ukravtodor

although they have qualified the requirements, the submitted expected cost of the project was twice as large as the cost estimate of the government (EUR 800 million versus EUR 400 million) as the private sector's take on the risk was much larger. Therefore, the concession ended in a failure. Currently, this road has been taken off from the priority list.

(3) Law of Ukraine "on Public Procurement"

The public tendering is conducted under the new Law of Ukraine "on Public Procurement" (Supreme Council of Ukraine, dated 25th December, 2015, No. 9, st. 89; Last Amended dated 17th November, 2016, No. 1761-VIII). The new Public Procurement Law has facilitated the implementation of all procurement procedures to be conducted through the e-procurement system, by publishing the documents in the PROZORRO website, accredited by the Ministry of Economic Development and Trade. The new Public Procurement Law applies to procurements conducted by public sector entities, as well as by private sector entities from some industries (such as energy, oil and gas, etc.) with special or exclusive rights.

The major change that has been adopted by the new Public Procurement Law is that the public procurement procedures have been decreased to three types, i) open tender, ii) competitive dialogues and iii) negotiated contracts. Others changes include, increase of financial thresholds, increase of the submission deadline in medium-to-large tenders, less formalism in terms of evidence, exclusion of surety ships from security instruments, requirements on anti-corruption compliance of bidders, changes to framework ("long-term") procurement and others.

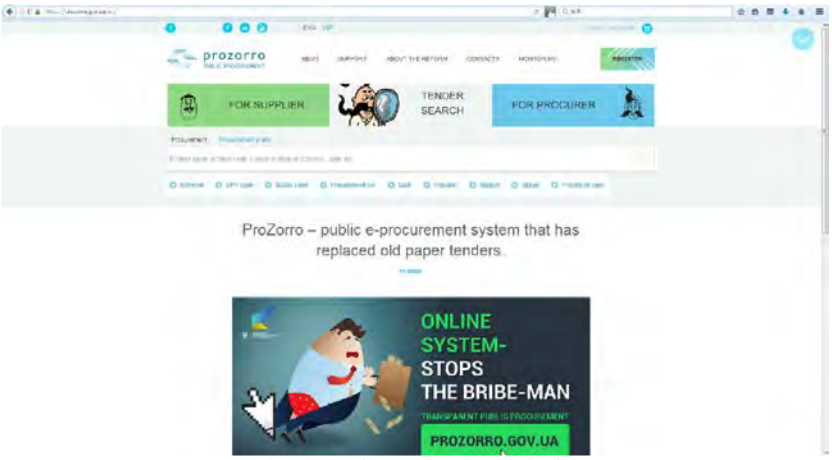
In Chapter I Article 6 of the new Public Procurement Law "International obligations in the field of procurement", it is stipulated that procurement of goods, works and services for cash loans and loans granted through international organizations shall be carried out in accordance with the rules and procedures established by the international organizations such as the European Bank of Reconstruction and Development, European Investment Bank and others. If such procedures are not set by these organizations, then the procurement is executed based on Ukraine's procurement law.

In terms of the procurement body, the current practice for the road sector is that, if funded by the state budget, the procurement is conducted by the oblasts and supervised by Ukravtodor. For procurement using loans from international organizations, it is directly implemented by Ukravtodor[11]. In the law, Chapter III Article 11 "tender committee and authorized personnel" stipulates the formulation of a tender committee that basically consists of at least 5 members, and shall be responsible for the preparation and approval of the annual procurement plans, selecting the procurement procedure, implementation, approval of procurement documents, and other activities stipulated in the Law.

In regards to the usage of Fédération Internationale des Ingénieurs-Conseils (FIDIC), it has only been utilized for procurements financed by international organizations so far. Moreover, 2017 is planned to be the first year where all projects by international organizations is planned to utilize FIDIC[12].

See Appendix 3-II for information on the public procurement procedures.

[11] According to Ukravtodor, the project implementing agency (that is, Ukravtodor) shall be stated in the loan agreement.
[12] According to Ukravtodor, they have only used the FIDIC Red Book (Conditions of Contract for Construction For Building and Engineering Works)) and have not used the Yellow Book (Conditions for Contract for Plant and Design Build For Electrical and Mechanical Plant, and For Building and Engineering Works).



Source: PROZORRO website (https://prozorro.gov.ua/en/)

Figure 3.7 Online System for Public Procurement "PROZORRO"

(4) Other Laws/Legislations Related to Roads

Other laws/legislations that relate to the road sector include the following:

- Law of Ukraine "on road traffic" (Supreme Council of Ukraine, 1993, No. 31, st. 338; Last Amended dated 23rd December, 2015, No. 4, st. 44) – the law regulates the traffic and safety and determines the rights, duties and responsibilities of the users, ministries and other central executive authorities, associations, enterprises, institutions and organizations.
- Law of Ukraine "on transport" (Supreme Council of Ukraine, 1994, No. 51, st. 446; Last Amended dated 23rd December, 2015, No. 4, st. 44) – the law defines the legal, economic, organizational and social principles of the overall transport sector, not only roads but also railway and maritime transport.
- Law of Ukraine "on road transport"(Supreme Council of Ukraine, 2001, No. 22, st. 105; Last Amended dated 23rd December, 2015, No. 4, st. 44) – the law defines the principles of organization and operation of road transport, regulating the road carriers, passengers, transport services, executive authorities and local authorities, vehicle owners.
- Law of Ukraine "on the sources of funding the road sector of Ukraine" (Supreme Council of Ukraine, 1991, No. 47, st. 648; Last Amended 17th November, 2016, No. 1762-VIII) – the law defines the legal basis for the financing costs associated with the construction, renovation, repair and maintenance of public roads and local roads Ukraine.
- Law of Ukraine "on local government in Ukraine" (Supreme Council of Ukraine, 1997, No. 24, st. 170; Last Amended dated 7th September, 2016 No. 43, st. 736) – the law determines the overall system of local government in Ukraine, as well as its organizational principles, activities, legal status and guarantees.
- Cabinet Ministers of Ukraine resolution (dated 10th September, 2014, No. 439) –The resolution states the responsibilities and rights of the State Road Agency, Ukravtodor.

See Appendix 3-III for further information on laws/regulations in Ukraine.

3.2.7 Engineering Standards[13]

(1) Design Standards

There are State building codes and national standards used for the design, construction and repairs of roads and engineering structures as follows:

- DBN V.2.3-4: 2015 "Highways: Part I. Design, Part II. Construction"
- DBN V. 2.3-22-2009 "Bridges and pipes, Basic design requirements"
- DBN A.2.2-3-2014 "Structure and content of the project documentation for construction"
- DBN A.3.1-5: 2009 "Organization of building production"
- CTU D.1.1-1 B: 2013 "Rules of construction costs"
- ISO BD.1.1-7: 2013 "Rules for determining the value of design and survey works and examination of project documentation for construction,
- DBN V. 2.3-6: 2016, "Bridges and pipes inspection and testing"
- ISO-H B V.2.3-23: 2009 Transport Facilities "Guidelines on assessment and forecasting technical condition of road bridges", etc.).

It should be noted that the Government of Ukraine is on the way to adjust the basic concept of the standard for road design fully in compliance with the European Standard.

(2) Classification of Roads

Among classifications of states roads, there are categories of roads according to the traffic volume as shown in the table below.

Table 3.2 Categories of Roads

Category of roads	The expected long-term traffic intensity, cars/day	
	in transport units	**in passenger car equivalent unit**
I -a	more than 10,000	more than 14,000
I-b	more than 10,000	more than 14,000
II	from 3,000 to 10,000	from 5,000 to 14,000
III	from 1,000 to 3,000	from 2,500 to 5,000
IV	from 150 to 1,000	from 300 to 2,500
V	to 150	to 300

Note: Under the same requirements of highways I-a and I-b, the roads are indicated as Category I roads.
1) The intensity of traffic shall be determined in total in both directions based on the results of the feasibility studies.
2) In determining the category of roads, the forecast period must be 20 years starting from the year of completion of the project elaboration.
3) Coefficients for bringing traffic intensity of various vehicles to a passenger car shall be adopted accordingly.

Source: Ukravtodor

(3) Design Speed

Design speed is applied for the calculation of the geometric elements of roads based on the identified category of the road and the terrain. For roads that are projected on the approach ways to large cities, as well as in locations where along the highway there are expensive capital buildings and forests, and in cases where roads intersect with valuable productive lands or lands occupied by longstanding valuable cultivated crops, gardens and vineyards, given that there is a corresponding feasibility study, it is allowed to take the values of estimated speeds listed in the table as acceptable for the hilly terrain. When developing design documentation for reconstruction of roads, the norms for categories I-b -III is allowed. If there is a respective

[13] Source: Ukravtodor Mykolaiv Region edited by JICA Survey Team

feasibility study, to keep elements of the plan and the longitudinal profile on individual parts of the existing roads, if they provide transport traffic in accordance with design speeds, the category 1 level or lower can be applied. For the areas with hilly and mountainous terrain, design speeds listed in the table below can be assigned, only based on a respective feasibility study for each specific section of the road.

Table 3.3 Design Speed

No.	Road category	Design speed, kilometer/hour		
			Permissible on the terrain	
		Speed on a flat terrain	Hilly	Mountainous
1	I-a	130	100	80
2	I-b	110	90	70
3	II	90	70	60
4	III	90	60	50
5	IV	90	50	30
6	V	90	40	30
Note 1. A hilly terrain is a terrain frequently cut by deep valleys with a difference in marks at the bottom of valleys and watersheds over 50 meters with a maximum distance of 0.5 kilometer, with roadsides located on deep ravines and unstable slopes of sub mountainous river valleys with side tributaries. **Note 2.** Mountainous terrain are mountain saddles (addition of one kilometer in each direction from the saddle) across mountain ranges and areas with difficult mountain canyons, heavily cut or unstable slopes, areas of distribution of plastic landslides and talus, valleys of mountain rivers with side tributaries.				

Source: Ukravtodor

In the locations where migration of wild animals takes place, it is needed to anticipate the bio-bypasses according to the requirements of the current legislation.

In the course of making necessary project-related decisions to solve problems that are not stipulated by regulations, the decision would usually be made based on the technical support of scientific and technical judgment following the national standards. The need for such kind of support is often confirmed at the stage of construction and operation of the road.

Scientific and technical support would be required in the following cases:

- The application of materials and technologies and the experience of its use in public roads in Ukraine is missing;
- Repeated use in structural layers of road materials from the dismantling of the existing road (cold and hot recycling, milling, vibro-resonating destruction, etc.);
- Application of anthropogenic soils;
- Other justified cases.

(4) Longitudinal Alignment and Cross Section

Basic parameters of the cross section of roads depending on their category must be assigned in accordance with below Table 3.4. The road with three lanes can be designed according to national standards, given there is a respective feasibility study that justifies that the parameters of roads to be enlarged.

Width of a divider strip should be sufficient for arranging the speed change lane for a left turn, surface pedestrian crossing, bridge supports, etc. If the distance between such places (sites) is less than 0.5 kilometer, the width of the divider strip will not be reduced to the parameters in Table 3.4. Given there is a respective feasibility study, the length of this strip may be increased.

The width of safety lanes (shoulder) on bridges (length up to 100 meters) from the roadside is assumed to be equal to the width of the stopping lane (if any) or if there is none, 1.0 meter or as specified in the relevant feasibility study. The width of the shoulder from the roadside on bridges with a length of more than 100 meters is assumed to be equal to 1.0 meter or as specified in the relevant feasibility study.

Table 3.4 Width of Each Road Classification

No.	Indicator	Unit	Roads Category					
			I-a	I-b	II	III	IV	V
1	Number of lanes	PCs.	4; 6; 8	4; 6	2	2	2	1
2	Lane width	Meter	3.75	3.75	3.75	3.50	3.00	4.50
3	Roadside width incl. shoulder	Meter	3.75	3.75	3.75	3.50	3.00	4.50
	Hard shoulder width	Meter	2.50	2.50	2.50	-	-	-
	Verge width	Meter	0.75	0.50	0.50	0.50	0.50	-
4	Median strip width	Meter	6.00	3.00	-	-	-	-
5	The width of a verge on a median strip	Meter	0.75	0.50	-	-	-	-

Note 1. During the reconstruction of existing roads of Category I, the width of the current divider strips may remain the same.
Note 2. On the roads of Category V with bus traffic, the width of the fortified roadsides shall be 0.75 meters.
Note 3. When arranging a 1st group type safety fence on a divider strip, the width of a divider strip may equal the width of a safety fence plus the width of the reinforced lane on a divider strip on each side of the fence.
Note 4. In residential settlements in which the speed limit is 60 kilometer/hour, it is allowed to narrow the width of the traffic lanes to 3.25 meters according to the established road signs, in accordance with national standards.

Source: Ukravtodor

The number of lanes of the Category I roads must be assigned depending on the average annual and daily traffic and terrain, as shown in the table below.

Table 3.5 Number of Lanes Depending on Traffic Intensity

Terrain	Intensity of traffic, unit/day equivalent	Number of lanes
Plain terrain and hilly terrain	up to 40,000	4
	from 40000 to 80,000	6
	more than 80,000	8
Mountainous terrain	up to 34,000	4
	from 34,000 to 70,000	6
	more than 70,000	8

Source: Ukravtodor

The road surface must be designed with a two-sloped (normal crown) straight-line sections of roads of all categories. In cases where Category I-b roads are being implemented on a stage-by-stage basis, with one driveway constructed in the first stage, the road surface must be equipped with a one-sloped (cross-fall) cross section. Given justification in the course of reconstruction of Category 1-b roads, it is allowed to retain a normal crown on the driveway with an obligatory provision for drainage from the road surface and divider strip.

The cross-fall of the driveway, except for sections where the steep turns are planned, must be designed depending on the material of the road surface. For cross-fall of the asphaltic-concrete and cement-concrete roads, the road surface must be 2.5%. The gravel and macadam surface, from 2.5% to 3.0%, and on the soil surfaces reinforced with binding and local materials, as well as on the cobblestoned roads from sledged stone and paving stone, from 3.0% to 4.0%.

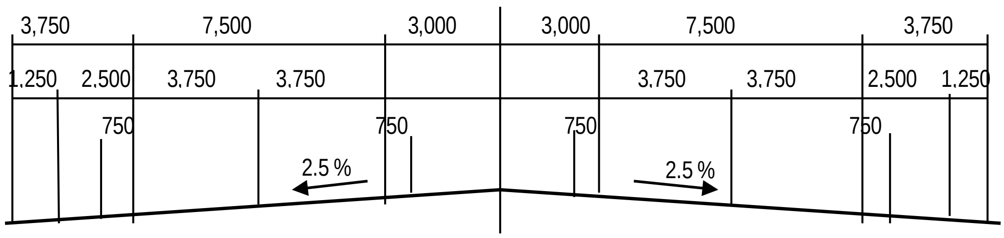
Under compressed conditions of settlements, given the appropriate substantiation, it is allowed for the roads of Categories III and IV to install a one-sloped lateral profile road surface with an obligatory drainage.

Slope gradient of roadsides must be bigger than the slope gradient of the road surface. Depending on the type of surface materials of the roadsides, its gradient must meet the following criteria:

- from 3.0% to 4.0% — reinforced by binding materials;
- from 4.0% to 6.0% — reinforced by gravel, macadam;
- from 5.0% to 6.0% — reinforced by planted grass or turfing

If the roadside is reinforced with asphalt-concrete or cement-concrete, the gradient of the roadside can be equal to the road surface gradient.

Super elevation will be applied on curves in the plan, depending on the radii of the curves and estimated speeds. Figure 3.8 indicates the cross section of roads of Category I-a, which would be applied to the ring road surrounding Mykolaiv City, including the new Mykolaiv Bridge.



Source: Ukravtodor edited by JICA Survey Team

Figure 3.8 Cross Section of Road: Category I-a

3.2.8 Strategy for the Road Sector

As stated in Chapter 2, in October 2010 the Cabinet of Ministers of Ukraine (Decree of the Cabinet of Ministers of Ukraine dated 20th October, 2010 No. 2174-p) approved the “National Transport Strategy of Ukraine for the period up to 2020”. The main principles and directions of implementation of the Strategy with regard to the road sector are:

- Approval and improvement of the State Program for road safety;
- Priority development of roads and highways of common use of state significance;
- Implementation of measures to improve the level of financial provision of road facilities;
- Ensuring access roads paved at all villages;
- Utilization of modern materials and the latest technology construction, reconstruction, repair and maintenance of roads;
- An optimal combination of centralized management of the network of roads and management of roads of local importance at the regional level;
- Ensuring adequate financing of construction, reconstruction and repair of roads of general use of state and local importance;
- Strengthening requirements for motor carriers and control over compliance with the requirements of legislation concerning traffic safety;
- Implementation of a unified system of training and certification of employees of road transport in accordance with European standards;
- Improving the mechanism of the use of alternative fuels;

- Implementation of international environmental standards "Euro3" – "Euro6" for vehicles and motor fuels;
- Adoption and implementation of the state target economic development program of road transport;
- Improving the technology of road transport, increasing the share of combined transport, development of optimal technological schemes for transport hubs;
- The use of environmentally friendly and energy-saving materials and new technologies and others.

Strategy on the Development of Roads

In 2015, "The Strategic Plan for Development of Road Transport and Road Infrastructure of Ukraine up to 2020" was approved by the ordinance of Cabinet of Ministers (Order by the Ministry of Infrastructure dated 21st December, 2015 No. 548). This Strategic Plan has been created in accordance with other strategies, such as "Ukraine 2020" and "Transport Strategy of Ukraine to 2020" explained above.

Within the Strategic Plan, 4 strategic areas are identified with necessary tasks for each area:

- Development of governmental policy in line with provisions of the Association Agreement[14], policies, strategies and best EU practices in the road transport sector in terms of regulatory policy, traffic safety, environment protection and energy efficiency.
- Accessibility and quality of transport services provided to all categories of passengers throughout the state, including people with limited mobility; improvement of quality and safety rate of passenger and freight transport services.
- Increase of subsector performance and competitiveness, creation of favorable business climate, support to improving performance of road transport operators, and vehicle fleet structure, applying advanced transport technologies, implementing transport system transit potential.
- Reform of road infrastructure subsector and development of road network and its maintenance in the proper condition.

In terms of the financing for implementation of such strategies, it is stated in the Strategic Plan that the tasks are to be carried out within budget allocations envisaged for the Ministry of Infrastructure of Ukraine by the State Budget of Ukraine for the year, local budgets, own funds of the transport market operators and other sources not prohibited by law.

Moreover, a state target economic program for 2013–2018 for roads has been approved by the Cabinet of Ministers of Ukraine dated 11th July, 2013, No. 696. However, due to lack of funding, implementation has not been satisfactory. Currently, a new development strategy for road facilities for 2017–2022 is being developed by Ukravtodor, with support from the World Bank.

3.2.9 Donor Assistance for Road Sector

Below are summaries of the donor assistance by the International Financial Institutions (IFIs) that play a role in the development of the road sector in Ukraine.

[14] Association Agreement is a treaty between the European Union and the European Atomic Energy Community and their 28 member states and Ukraine, ratified by the Parliament of Ukraine and the European Parliament on 16th September, 2014.

(1) The World Bank Group

The World Bank has recently commenced a logistics study which will provide several concrete recommendations of each of the transport sectors, including roads. Since the priority of the road sector has been changing, information gathering on the road, including its conditions, is first being conducted. The final report is expected to be drafted within the 1st half of 2017. World Bank is also conducting a Road and Safety Improvement project focused on roads M-03 and M-12's safety issues. There is possibility to focus more on the Southern Region as the Eastern border is closed.

In regards to Technical Assistance (TA), the World Bank is also conducting a grant TA which includes advisory services to the legislative process, drafting new laws, putting together feasibility studies etc.

Moreover, another new road investment project that is planned to start in 2018 is in its preparatory phase. It may involve road N-14 in bad condition but has potential for the grain industry. Within this project, concrete roads instead of asphalt are to be considered, especially for usage by heavy vehicles.

Table 3.6 World Bank Loan Projects for the Road Sector in Ukraine[15]

Project Start Year	Project Title	Details	Status
2015	Road Sector Development Project (Considered the Third Phase)	With a commitment amount of US$560 million, the project aims to improve transport connectivity, maintenance operations, and road safety for road users on selected sections of the national roads network and improve road network management in Ukraine.	Active
2012 2009	Roads and Safety Improvement Project	Loan provided to improve the condition and quality of sections of the M-03 road and increased safety on roads in Ukraine, including the execution of an extended international Road Assessment Program (iRAP). Commitment amount: First phase – US$400 million Second phase – US$450 million	Active (Phase 1 closed)
NA	Highway Project	NA Initial commitment amount was US$150 million	Dropped

Note that the financing amount in the table is the committed amount and may differ from the actual amount for implementation.
Source: World Bank website http://www.worldbank.org/en/country/ukraine/projects/all

(2) European Bank of Reconstruction and Development (EBRD)

In the road sector, EBRD has provided public loan assistance in the development of the PAN-European corridors 3 and 5 which connects Kiev and the EU border and the rehabilitation of roads in Kiev region (M-01, M-05, M-06, M-07, N-01, R-02).

In regards to TAs, EBRD is conducting a project to support the government in the legislation of the new concession law and policy. EBRD is supporting in drafting the new concession law in order to amend the gaps and contradictions within the law (ex. tax and budget) due to different laws on concession and on PPP. The result of the drafting is planned to be available by the first quarter of 2017.

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15 The list is created by extracting road sector projects from the 94 projects listed in the World Bank website

Table 3.7 EBRD Loan Projects for the Road Sector in Ukraine[16]

Project Start Year	Project Title	Details	Status
2015	Ukraine Public Transport Framework	Municipal-guaranteed loans of EUR 100 million to public transport companies in Ukraine to facilitate critical improvements in public transport infrastructure in Odessa, Chernihiv, Chernivtsi and several other cities across Ukraine, with prime focus on transport renewal and associated efficiency gains.	Board Approved
2011	PAN-European Corridors	Co-financed with EIB, a loan of up to EUR 450 million to support the rehabilitation and upgrading of road approaches to Kiev – road sections on international and key national highways M-01, M-05, M-06, M-07, N-01 and R-02, and performance-based road maintenance contracts for M-06 road.	Repaying
2009	Lviv Road Rehabilitation and Modernization Project	Providing financing (EUR 38 million) to LvivElectroTrans Public Transport Company ("LET"), the public transport company of the city of Lviv, and LvivAvtodor, a road construction, maintenance and traffic management municipal enterprise to be created and owned by the City of Lviv	Repaying
2007	Kiev City Traffic Management	Providing a senior loan of EUR 30 million to the city of Kiev to finance the design and implementation of an Active Traffic Management System and Road Improvement Program in the city of Kiev, as part of the overall City Transport Development Strategy.	Completed
2006 2004 2000	"Kiev-Chop" M-06 Road Rehabilitation	Rehabilitation of M-06 Kiev-Chop Highway to European standards. The project has been divided into three phases. First Phase – Loan of EUR 75 million Second Phase – Loan of EUR 100 million Third Phase – Loan of EUR 200 million	Repaying (First phase – Completed)

Note that the financing amount in the table is the committed amount and may differ from the actual amount for implementation.
Source: EBRD website http://www.ebrd.com/ukraine.html

(3) European Investment Bank (EIB)

EIB is providing several loans to the road sector in Ukraine, as shown in the table below. EIB loans could be financed up to 50% in the transport sector[17] and is often co-financed with EBRD. EIB provides loans on a sovereign guarantee basis.

Currently, EIB is active mainly in the road rehabilitation for Highway M-06 and Highways M-01 and M-05 (part of the European Roads Ukraine II project). Since some projects have not started yet, the loan period will likely be extended until 2020, but it is unknown when the project will commence as there have been issues in the loan repayment.

In regards to TAs, EIB is conducting a nationwide TA on Road Safety Design to improve the road safety conditions. The TA includes support in the legislative level, where the consultant provides the law amendment drafts as well as design standards for highways and national roads. EIB will also be conducting a project dedicated in the 5 biggest cities in Ukraine for implementation of European urban traffic safety systems, such as creating bicycle lanes,

[16] The list consists of projects listed in EBRD website with Project Summary Documents
[17] Exception will be reconstruction of social infrastructures (100%) and energy efficient projects (75%)

installing camera monitoring system, speed limit, pedestrians crossing etc. The project will be worth EUR 250 million and is currently in the appraisal process.

Another TA planned is for the audit of the designing of the roads. It will involve review of the designs and providing recommendations to include a more sufficient design of the roads. This TA will include training of the auditors of the road safety and system establishment in Ukravtodor.

Table 3.8 EIB Loan Projects for the Road Sector in Ukraine[18]

Project Start Year	Project Title	Details	Status
2016	Ukraine Urban Public Transport	Framework loan of EUR 200 million to finance urban public transport investments in up to 20 municipalities in Ukraine	Signed
2015	Guarantee for Economic Development in Ukraine	Providing a guarantee of up to EUR 457 million (transport sector: EUR 151 million) to be issued by the EIB in favor of the IBRD. The guarantee will cover five IBRD loans supporting projects in the road transport, power and energy efficiency sectors against the risk of default by Ukraine.	Signed
2011	European Roads Ukraine II (PAN-European Corridors)	Co-financed with EBRD, providing EUR 450 million for the rehabilitation and quality improvement of roads in Ukraine, to improve 350 kilometers of five sections of highways branching out from Kiev, representing crucial European and national transport corridors largely on the extended Trans-European Transport Network (TEN-T).	Repaying
2007	European Roads Ukraine	With financing of EUR 150 million by EIB, rehabilitation of the final section of the M-06 highway between Kiev and Brody, with a length of 427 kilometers, on Pan-European Corridors III and V.	Repaying

Note that the financing amount in the table is the committed amount and may differ from the actual amount for implementation.
Source: EIB website http://www.eib.org/projects/loan/list/?region=4&country=UA

3.2.10 Ongoing and Planned Projects

There are three categories of road network improvement plan in this section, i) pipelined projects with possible financial sources, ii) national network projects waiting for investment, and iii) missing link improvements waiting for investment.

(1) Projects in Pipeline

Among the projects that are implemented in the current year, reconstruction and repair of public roads and bridges of national importance is of focus, including:

- Zhitomir – Mogilev – Podolsk in some areas along the route Zhitomir – Vinnytsia; Lions – Radekhiv – Luck; Ivano – Frankivsk – Chernivtsi;
- Tatar – Kamenets; Znamenka – Lugansk – Izvaryne the Znamianka – Alexandria; Lviv – Sambir – Uzhgorod, Brody – Chervonograd, Lviv – Ternopil; Dnipro – Mykolaiv; Odessa – Reni; Poltava – Alexandria; Chuhuiv – Melovoye and others;
- Reconstruction of 3 bridges in the Donetsk region, destroyed as a result of hostilities;

[18] The list consists of projects listed in EIB website as "Projects financed"

- Resumed construction of a highway through the Dnipro River in Zaporizhia, with a length of 9.1 kilometers. The project consists of the full development of 6 traffic interchanges, which include 26 engineering structures and extracurricular 2 large bridges, 17 overpasses and 7 underpasses;
- The bridge across the Dnipro River connecting the right bank of the island Khortytsya. This will be a steel girder bridge with a length of 340 meters;
- The bridge over the mainstream Dnipro River from the island Khortytsya to the left bank of the Dnipro — a cable-stayed bridge with a length of 660 meters of reinforced concrete pylon and a height of 152 meters from the top grillage (absolute marking the top 166 meters) and circuit cables along the facade in style "harp", which has a navigable length of 260 meters. The total cost of the project in 2009 was UAH 5.028 billion.

Table 3.9 Nationwide On-going Projects

No. of contract, section (km=kilometer)	**Subcontractor**	**Section length, kilometer / inception date**	**Contract implementation phase as of 1st November, 2016 / final completion**	**Final/anticipated contract cost as of 1st November, 2016**
First project of World Bank "Improvement of highways and road traffic safety"				
Capital renovation of the M-03 highway Kiev–Kharkiv–Dovsjanskyy				
Contract No. 1 (km 44+500 – km 90+000)	Road Construction Company "Altkom LLC"	45.5 / June 2010	Works completed	US$94 million
Contract No. 3 (km 126+700 – km 158+000, km 185+000 – km 191+400)	JSC "Pivdenzahidshliakhbud" /Road Construction Company "Altkom LLC"	37.7 /May 2010	Works completed	US$75 million
Contract No. 5 (km 239+317 – km 258+000, km 323+000 – km 329+050)	ONUR TaahhutTasimcilikveTicaret Limited Sirketi	24.78 / March 2012	Works completed	US$59 million
Contract No. 6 (km 196+600)	Road Construction Company "Altkom LLC"	Traffic interchange / June 2012	Works completed	US$4.2 million
Second project of World Bank "Improvement of highways and road traffic safety"				
Capital renovation of the M-03 highway Kiev-Kharkiv-Dovsjanskyy (section Lubny-Poltava)				
Contract No. 2.1 (km 210+ 275+000)	Todini Costruzioni Generali S.p.A	39.1 / April 2013	Contract rescinded 23rd August, 2016, Contract payments are being finalized	US$108 million
Contract No. 2.2 (km 282+ 333+250)	Todini Costruzioni Generali S.p.A	45.3 / April 2013	Contract rescinded 23rd August, 2016, Contract payments are being finalized	US$98 million
Contract No. 2.3 (km 220+782 – km 228+000, km 275+000 – km 282+000, km 333+800 – km 339+300)	ONURTaahhut Tasimacilikve Ticaret Limited Sirketi	20,8 / Signature date 4th October, 2016	-	US$134 million + UAH 2.6 million
A Joint EBRD/EIB Project "PAN-European Corridors - Upgrade of the Traffic Operation Condition of Highways Approaching the City of Kiev"				
Capital renovation of the M-06 highway Kiev–Chop				
Contract No.1 (km 128+000 – km 68+430)	Todini Costruzioni Generali S.p.A	59.57 / September 2011	Contract completed	EUR 279 million

No. of contract, section (km=kilometer)	Subcontractor	Section length, kilometer / inception date	Contract implementation phase as of 1st November, 2016 / final completion	Final/anticipated contract cost as of 1st November, 2016
Contract No.2 (km 68+430 – km 14+000)		54.43 / September 2011	Contract completed	
Capital renovation of the M-07 Highway Kiev–Kovel–Yagodyn				
Contract No.1 (km 30+600 – km 64+000)	Eurasian construction corporation «EVRASKON»	34.30 / October 2011	Contract Completed	EUR 36 million
Pilot project on maintenance of a section on the M-06 Highway Kiev–Chop				
Contract No.1 (km 434+230 – km 621+500)	ONUR Taahhut Tasimacilikve Ticaret Limited Sirketi	187.27 / September 2014	Contract is being implemented / tentative anticipated date – 15th August, 2021	EUR 63 million
Reconstruction of highway M-05 Kiev–Odessa				
Contract No.1 (km 17+740 – km 36+500, km 42+000 – km 87+000)	Road Construction Company "Altkom LLC"	63.76 / July 2013	Contract realized / projected pre-date – 24th December, /2017 (including the period of responsibility)	EUR 105 million
Capital renovation of the H-01 Highway Kiev–Znamyanka				
Contract No.1 (km 14+740 – km 43+345)	ONUR Taahhut Tasimacilikve Ticaret Limited Sirketi	28.605 / April 2015	Contract is being implemented / tentative anticipated date – 8th April, 2019 (incl. the indemnity period)	EUR 47 million

Source: Ukravtodor

(2) Projects for Network Development

The nationwide priority investment projects by the Ministry of Infrastructure is as follows. However, these projects are currently under consideration in the form of a new national transport sector strategy[19].

1. Construction and operation of the road Lviv–Brody of 78.8 kilometers, with an estimated construction cost of UAH 4.1 billion;
2. Construction and operation of the highway from the border with Russia to the road Kiev–Kharkiv–Dovzhanski of 49 kilometers, with an estimated construction cost of UAH 3.9 billion;
3. Construction and operation of Grate Ring Road around Kiev, including the first stage of GRR on the road Kiev–Znamianka to the road Kiev–Chernihiv–Novi Yarylovychi. The first stage is planned to include 78 kilometers out of 213 kilometers. The estimated construction cost of the first stage is UAH 20 billion;
4. Construction and operation of the road Ulianivka – Mykolaiv – Kherson – Krasnoperekopsk – Simferopol of 533 kilometers, with an estimated construction cost of UAH 24.2 billion;
5. Construction of the South Trans-European Road – Western border of Ukraine – Kiev on the section Vinnytsia–Kiev of 146 kilometers, with an estimated construction cost of UAH 5.1 billion;
6. Construction and operation of the road Odessa-Reni with the bridge over Dniester estuary on the section Odessa–Monashi of 81 kilometers, with an estimated construction cost of UAH 8.125 billion;

[19] Currently, the new national transport sector strategy which will include the road sector is being created with the support of the World Bank. Although the implementation timeline is unclear, the content of the strategy is planned to be finalized by the end of June 2017, and shall be presented for cabinet approval.

7. Construction and operation of the road Dnipro – Zaporizhia – Melitopol – Dzhankoi – Simferopol of 475 kilometers, with an estimated construction cost of UAH 21.4 billion.

The number of the project in the list above corresponds to the number of the road section in Figure 3.9.

Source: Ukravtodor

Figure 3.9 Locations of Priority Investment Projects

(3) Projects for Missing Link Improvement

Table 3.10 indicates the latest and authorized list of priority projects for missing link improvements presented by the Ministry of Infrastructure, which was considered through political and economic standpoints. All projects in the lists are either the construction of highway or bridges, including the new Mykolaiv Bridge. Within the list, the feasibility studies of the the first three projects have been conducted and approved by the Cabinet of Ministers, in the order of the Zaporizhia Bridge, new Mykolaiv Bridge, and bridge crossing the Dnipro River (H-16). The construction of the Zaporizhia Bridge has been commenced, and therefore currently, the highest priority project is the new Mykolaiv Bridge project, followed by the bridge crossing the Dnipro River (H-16).

Table 3.10 Priority Projects for Missing Link Improvement

Project Name (km=kilometer)	Total length (kilometer)	Including the bridge (meters)	Cost of construction, (million UAH)	Availability of project documentation
Construction of a bridge across the Southern Bug River in Mykolaiv on the international automotive road M-14 Odessa–Melitopol–Novoazovsk (E-58)	13.2	2,050	3,509.2	The feasibility study was approved by the Cabinet Decree dated 11th July, 2013 No. 511-r
Construction of a highway across the Dnipro in Zaporizhia	9.1	1,000	5,029	The project was approved by the Cabinet Decree dated 24th February, 2010 No. 286-p
Construction of a bridge crossing across the Dnipro at km 23 + 068 of the national Highway H-16 Zolotonosha – Cherkasy–Smila–Uman	2.8	1,160	1,946.4	The project was approved by the Cabinet Decree dated 18th October, 2013 No. 1012-r
Construction of a bridge crossing across the Dnipro on the international highway M-22 Poltava–Oleksandriya (E584)	2.56	860	4,500	Documentation is not available, the cost estimate is in the prices of 2006
Construction of a bridge crossing across the Desna River on the southern approach way to the city of Chernihiv on km 12 + 298 of the international highway M-01 Kiev–Chernihiv–Novi Yarilovichi (E-95)	1.8	577	1,500	Being developed

Source: Ministry of Infrastructure

3.3 Highways in the Southern Region

3.3.1 Road Network

(1) Physical Network

The road network length in the Odessa region is 318.0 kilometers; 93.8 kilometers are state roads. Within, there are 873 bridges and overpasses with a total length of 16,622 meters.

The network of public roads in the Mykolaiv region is 4,798.3 kilometers, of which 4,784.2 kilometers is paved (data as of 1st January, 2016). The length of the national roads is 1,591.8 kilometers, including 199.5 kilometers of international, 225.9 kilometers of national, 421.9 kilometers of regional and 744.5 kilometers territorial roads. The total length of local roads is 3,206.5 kilometers, where the length of the regional roads is 2,561.5 kilometers and district roads is 645.0 kilometers. Within, there are 103 bridges and overpasses, with a total length of 3,841 meters.

The networks of public roads in the Kherson region are 5,002 kilometers, out of which 4968.1 kilometers, or 99.3% is paved (data as of 1st January, 2016). The length of state roads is 1,467.4 kilometers, including 398.7 kilometers of international, 305.8 kilometers of national, and 762.9 kilometers of regional roads. The total length of local roads is 3,534.6 kilometers, where the length of regional roads is 3,054.5 kilometers and district roads is 480.1 kilometers. Within, there are 99 bridges and overpasses with a total length of 6,965 linear meters.

Further development of the network is planned to improve the capacity of certain roads, where in the recent years, significant increase in traffic and the completion of on-going projects are seen.

The main highways that pass through the Southern Region of Ukraine are M-14 and M-15, which provides connections with the Black Sea coastal area and is consistent with international transport corridors. Its development will significantly impact the economic and social development of the area, including increase in transit volume and road safety.

(2) Odessa

The geographic location of the Odessa region, with strong cargo and passenger ports in the Black Sea, attracts traffic, including a significant volume of international freight transport.

Odessa region is crossed by international transport corridors:

- National BSEC
- Baltic Sea–Black Sea
- Eurasian transport corridor

The greatest intensity of traffic is concentrated on highways Kiev–Odessa (over 25,000 vehicles/day), Odessa–Melitopol–Novoazovsk (over 20,000 vehicles/day, bypassing city. Odessa (35,000 vehicles/day).

(3) Mykolaiv

The Mykolaiv region is defined as the region of transit for the main areas of the North–South (Kiev–Simferopol) and West–East connections. In addition, the presence of powerful regional ports at the coast of the Dnipro–Bug estuary and the Black Sea resort areas also helps to attract traffic, including a significant volume of international traffic.

Mykolaiv region is crossed by the national automobile highways:

- Eurasian transport corridor
- BSEC

The largest volume of traffic can be found at the M-14 section of the city of Mykolaiv, over 20,000 vehicles per day. A significant growth in regional transit traffic is projected for this road.

(4) Kherson

The Kherson region in the Black Sea–Azov region holds cargo and passenger ports in Kherson, Skadovsk, Genichesk and an international ferry service Skadovsk–Zanhuldak (Turkey) and Skadovsk on the Black Sea. It promotes involvement in transport streams, including significant volume of international transport and transit transport in the neighboring the regions of Ukraine, Moldova, Western Europe and Russia.

Kherson region is crossed by two national corridors:

- BSEC
- Eurasian transport corridor

The largest amount of traffic is concentrated on highways M-14, M-17 Kherson–Dzhankoy–Feodosia–Kerch and P-57 Tsjurupinsk–Naked Pier–Skadovsk.

3.3.2 Major Issues

According to interviews based on Ukravtodor and Mykolaiv Oblast, the major issues of development of highways in the Southern Region at present are:

- Completion of construction of bypasses between Reni and Odessa (M-15);
- Reconstruction of Mykolaiv–Kherson section;
- Completion of the overhaul bridge across Khadzhibey Estuary on the road M-05 Kiev–Odessa 445+ 432 kilometers, length 531 p/m.;
- Repair of bridges across the strait of Dniester River to 40+640 kilometers and 52+789 kilometers of highway M-15, near the Palanca village (Moldova);
- Repairs that will be conducted on the most damaged sections of other highways.

<u>Over Loading and Pavement Deterioration</u>

Overloading of trucks is a serious issue for the bridge structures as well as pavement. Overloaded trucks often cause traffic safety hazards. Therefore, weight control of trucks is an urgent task to be conducted in the Southern Region. Especially in Mykolaiv, there are vulnerable bridges the structural capacity of which hardly reaches 24 tons, according to the local officials. However, so far, weight control of trucks is ineffective due to the lack of equipment and human resources. After the daytime enforcement period, the long queues of trucks rush on the major highways into the city, which weigh well over 40 tons.

	
Heavy Trucks on P-06	Weigh Station on P-06

Source: JICA Survey Team

Figure 3.10 Photos Related to Heavy Loading Trucks

<u>Shortage of Maintenance Budget</u>

The list below shows the allocated budget in 2017 for the planned works on public roads in Odessa, Kherson and Mykolaiv Oblasts, mainly for projects for roads M-15, M-14 and H-11[20]:

- Odessa Oblast UAH 1.3 billion (US$48 million) for 162.2 kilometers of roads,
- Kherson Oblast UAH 218.0 million (US$8 million) for 27.6 kilometers of roads,
- Mykolaiv Region UAH 352 million (US$13 milllion) for 37.5 kilometers of roads.

[20] Interview of Ukravtodor

However, the actual budget allocated is much smaller than the budget requested. The budget request and allocation of the Ukravtodor Mykolaiv Branch for 2017 and 2016 is summarized as follows:

Table 3.11 Budget Request and Allocation for Ukravtodor Mykolaiv Branch

	Daily Maintenance	Other Maintenance
Requested amount for 2017	US$35 million	US$300 million
Allocated amount for 2017	US$3.5 million by the state budget	US$9.5 million Including US$6.5 million by State and IFIs, US$ 2.0 million by Oblasts, and 1.0 million by local/Raion
Requested amount for 2016	US$35 million	unclear
Allocated amount for 2016	US$4 million	US$4 million
Contractor	Oblavtodor	Private companies

Source: Interview with Ukravtodor Mykolaiv Branch

As shown in the table above, the allocated amount for 2017 is tentative as of April 2017, however, only 10 percent of requested budget are allocated for the “daily maintenances” and less than 5 percent for the “other maintenances”. This table shows the shortage of maintenance budget.

The “daily maintenances” covers daily inspection, quick and minor maintenance work (patching, minor sealing), snow removals in winter period, etc.

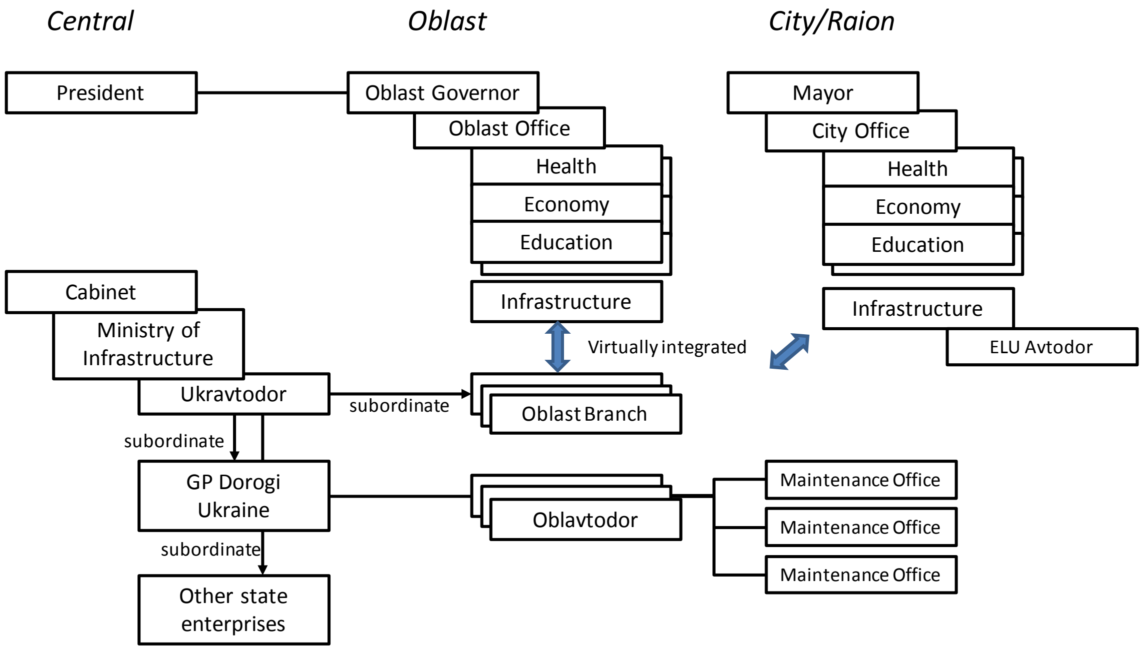
The “other maintenances” are major maintenance activities which would be subcontracted to private contractors through a tender process. The budget for the “other maintenances” consists of three sources, i) state and IFI budget, which is provided by Ukravtodor, ii) oblast budget to cover some road maintenance of oblast roads and iii) city/raion budget.

Reform Pressure in Maintenance Activities

The following describes in detail the framework of the road administration by oblasts and cities, starting with the explanation of the framework and structure of the overall road administration, including the regional governance aspects.

Figure 3.11 explains the relationship of how the Ukravtodor oblast branch co-works with the oblast for road administration. First, under the President, there are oblast governments headed by governors and led by oblast offices, which consists of several administrative functions including health, education, economy, etc. There is an Infrastructure Office in the oblast administration that is responsible for O-class road maintenances. Additionally, cities also have a similar structure with an Infrastructure Office for C-class roads.

On the other hand, as explained in 3.2.4, Ukravtodor is an exclusive administrator for road management, under the Ministry of Infrastructure. Ukravtodor has 24 oblast branches in each oblast. As Ukravtodor is a planning and an executive agency without an engineering resource, most direct work is undertaken by GP Dorogi Ukraine, a public entity for road maintenance with direct forces. GP Dorogi Ukraine has a large regional structure, consisting of Oblavtodors at the oblast level and several maintenance offices in each city and rural districts (Raion) within the oblast. The Mykolaiv Oblavtodor has 24 maintenance offices and 800 employees in total.



Source: JICA Survey Team

Figure 3.11 Overall Road Administration Structure

The actual road maintenance activities for M/H/P and T class roads are executed by the Ukravtodor oblast branches. The road maintenance activities are classified into two categories, i) "daily maintenances" and ii) "other maintenances". The former works are undertaken by the Oblavtodor and its maintenance offices directly, and the latter works are procured through open tender procedures.

As explained before, the budget for the "Other maintenance" are collected by the Ukravtodor oblast branch. In short, the Ukravtodor oblast branch shares the budget for road maintenance with the local government, and act as a virtual road agency[21] of the oblast office.

Within the City and Raion level, similarly to the Oblasts, an infrastructure office at city level shares the budget for road maintenance with the Uklavtodor oblast branch. The infrastructure office also consists of an ELUAvtodor (city company road maintenance office) that undertake daily maintenances at city level exclusively.

There are two issues in the regional road administration related to the reform and decentralization.

- It is expected that through the reform undertaken currently, the activities of the daily maintenances shall be undertaken by private companies, not by state enterprises like GP Dorogi. It is under arrangement by the EU that the daily maintenances for the M-06 road (Kiev–Lviv) would be open for public tender, as a 5-year-maintenance contract.
- The T-network (120,000 kilometers in total), which is under the ownership of state road agency (Ukravtodor), is planned to be handed over to the oblast infrastructure office in 2018. There is need for the oblast to expand its capacity for road maintenance.

[21] It should be noted that the appointed head of Ukravtodor oblast branch initially needs to be approved by the oblast governor.

3.4 Mykolaiv Bridge Construction Project

3.4.1 Status of the Project

The Government of Ukraine planned to build a new bridge across the Southern Bug River in Mykolaiv, as shown in Figure 3.12, in order to bypass the downtown area and ease serious traffic jams caused by heavy vehicles entering the city through M-14. The M-14 is an important trunk road in southern Ukraine, which is considered as a part of the international corridor connecting other European countries and Russia. However, the construction has not been started because of the lack of funding.

In 2005, the Government of Ukraine requested the Government of Japan to support the project through Japanese ODA loan. JICA carried out "Preparatory Survey on the Project for Construction of Mykolaiv Bridge in Ukraine" in 2011 (hereinafter, "The Preparatory Survey in 2011") as mentioned in "1. Introduction" of the Chapter 1. Preparatory Survey, which is one of JICA's inputs, is carried out to examine and analyze the relevance, effectiveness, and efficiency of the project, which is necessary to consider providing Japanese ODA loan. The Preparatory Survey in 2011 includes 1) the backgrounds and status of the project, 2) the natural conditions at the project site such as river bottom soils, water level, etc., 3) the traffic survey and traffic demand forecast, 4) the routes and types of bridges to be recommended for consideration, 5) a technical opinion on the environmental and social considerations, 6) the construction plan and the project cost estimation, and 7) the project evaluation and conclusion including justification of the project.

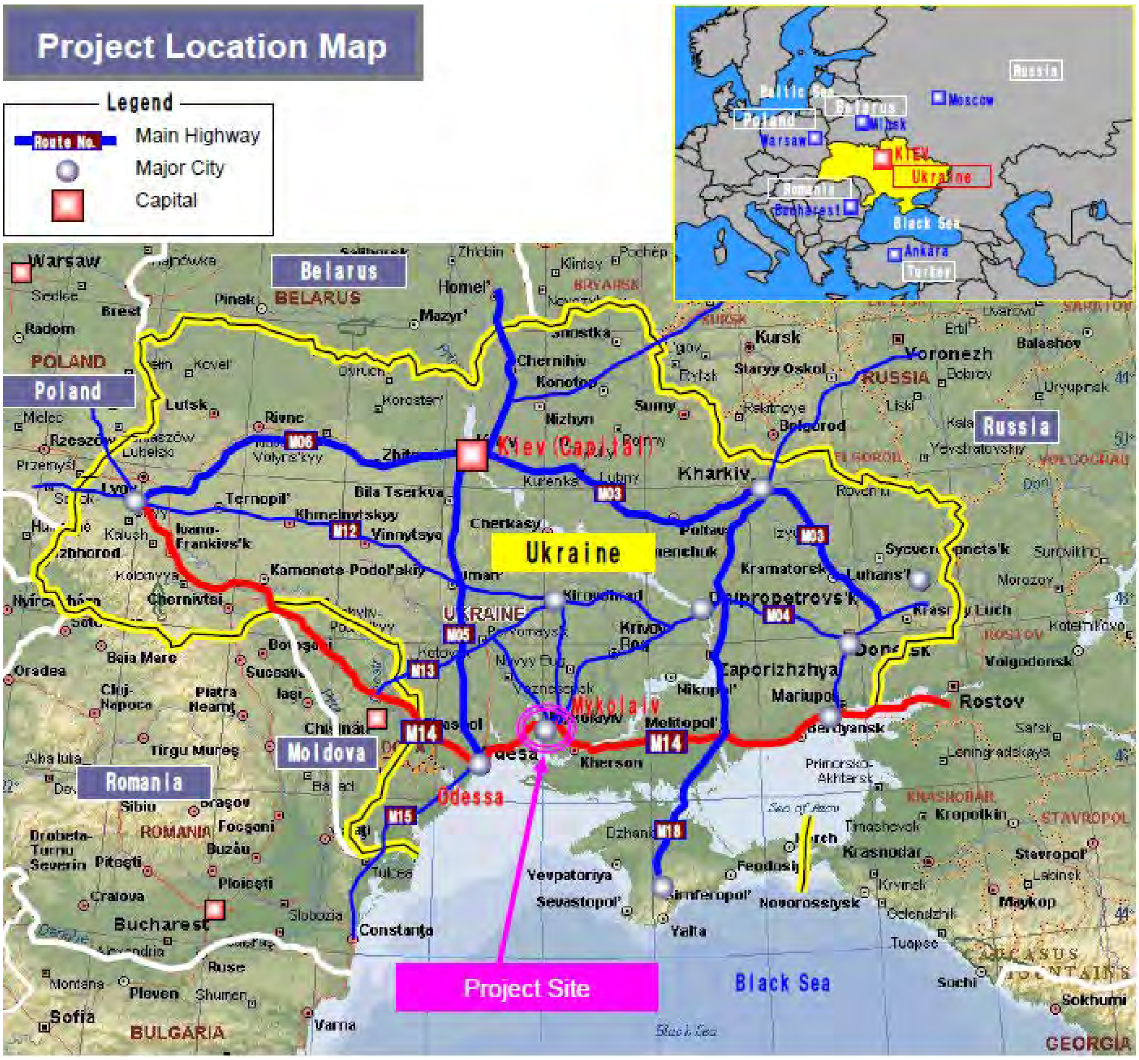
After completion of The Preparatory Survey in 2011, the Ukrainian side conducted a feasibility study in accordance with Ukrainian standards. In July 2013, the Cabinet of Ministers of Ukraine approved the feasibility study.

While the Government of Ukraine requested the Government of Japan to resume the consideration process of the project on various occasions, the necessity of the project should be re-examined due to the change in situation in Ukraine after 2014. Therefore, this survey collects and analyzes information of the logistics in southern Ukraine, including traffic demand in Mykolaiv.

If amendments to the feasibility study are made, such as changing the type of bridge, justifications within the Government of Ukraine is necessary as the feasibility study in 2013 has passed all levels of approval and the Government of Ukraine has already utilized its budget in reviewing the Project. The legal grounds for the justifications are as follows;

1) Cheaper cost (the cost in the feasibility study will be the upper limit)
2) Increase of the operational period of the bridge
3) Construction safety issues

Moreover, it is necessary for the feasibility study to be reconsidered if the location, purpose of the bridge and cost estimate will be changed. If the type of bridge is changed, the Project is going to be reconsidered from the start of the designing stage, which is the 2nd stage.



Source: The Preparatory Survey in 2011

Figure 3.12 Location of the New Mykolaiv Bridge

3.4.2 Specifications of the Mykolaiv Bridge as Planned in the Preparatory Survey in 2011

Below are the planned characteristics of the new Mykolaiv Bridge.

(1) Approach Bridge (Left Side)

Location	M-14 Bypass, PK 95+70 – PK 107+62.4
Length	1192.4 meters
Span	6×45 + 6×45 + 7×45 + 45 + 53.7 + 53.7 + 40 + 50 + 50 + 45 meters
Width	(1.0 m + Road carriage 2×3.75 meters + 2.0 meters + Walkways 1.5 meters) × 2 Total width 28.8 meters including median 3.0 meters
Completion	Under planning
Design Load	AK-loading (p = 14.7 kN/meters/Lane, P=147.15 kN) NK-loading (P = 245 kN) Pedestrian live load (q = 1.96 kN/square meters) on Walkways
Bridge type	Steel I-girder type with pre-stressed concrete slab;
Area	34,341 square meters
Remarks	Based on The Preparatory Survey in 2011

Superstructure

- The economic and rational bridge types for middle-scale girders are considered to have a span range from 30 meters to 60 meters, based on the past experiences
- For the approach bridge, the separated superstructures for each direction are planned to be adopted, in consideration of the constructability and cost.

Substructure

- The T-shaped pier is considered to be one of the most popular types of pier for the medium scale spans.
- The pier is planned to have separated columns made of reinforced concrete for each direction, however, its pile cap is to be unified due to required arrangement of piles.
- The exposed section of the pile cap above the water level is expected to be large. The rust protection for the steel pipes will be required for maintenance and aesthetics.
- Steel piles are environment friendly (small amount of construction waste, excavated soil & bentonite water).
- Multi-column foundation of which the pile cap is located above the water surface is planned to be adopted, so that the cofferdam and excavation of soft soil layer (Sapropel) during construction period is not required.
- Multi-column foundation would be an obstacle against the flow of the river.

(2) Main Bridge

Location	M-14 Bypass, PK 107+62.4 – PK 112+72.4, on the Southern Bug River
Length	510 meters
Span	510 meters
Width	(1.0 meter + Road carriage 2×3.75 meters + 2.0 meters + Walkways 1.5 meters) × 2 Total width 28.8 meters including median 3.0 meters
Completion	Under planning
Loading	AK-loading (p = 14.7 kN/meters/Lane, P=147.15kN) NK-loading (P = 245 kN) Pedestrian live load (q =1 .96 kN/square meters) on Walkways
Bridge type	Suspension Bridge with single span stiffened-girder;
Area	14,688 square meters
Remarks	Based on The Preparatory Survey in 2011

Superstructure

- The steel box girder with an orthotropic deck is planned to be adopted, for reducing the weight.
- The superstructure is planned to consist of 30 segments of 17 meters in length.
- From the aesthetic viewpoint, catenary carves of the main cables will contribute in becoming a symbolic landmark.
- Flat-hexagonal steel-box is planned to be adopted for improving the wind-resistance stability and maintenance workability.

Tower

- The tower is planned to have a rigid frame made of reinforced concrete with a portal shape.
- The shape of the tower is to be determined in consideration of aesthetics.
- Usage of slip forms for RC tower will enable the shortening of the construction period.

Substructure

- Steel Pipe Sheet Pile (SPSP) is planned to be adopted for anchorages and towers to overcome the soft and deep subsoil features of riverbed.

Others

- The dehumidification system that is the state-of-the-art technology is recommended to prevent deterioration of the main cable system.
- Periodical repainting is required for the stiffening girders.
- Maintenance manual must be prepared because there is no other suspension bridge in Ukraine

(3) Approach Bridge (Right Side)

Location	**M-14 Bypass, PK 112+72.4 – PK 116+20**
Length	347.6 meters
Span	45 + 50 + 50 + 40 + 56 + 56 + 50.6 meters
Width	(1.0 meter + Road carriage 2×3.75 meters + 2.0 meters + Walkways 1.5 meters) × 2 Total width 28.8 meters including median 3.0 meters
Completion	Under planning
Loading	AK-loading (p = 14.7 kN/meters/lane, P=147.15 kN) NK-loading (P = 245 kN) Pedestrian live load (q = 1.96 kN/square meters) on Walkways
Bridge type	Steel I-girder type with pre-stressed concrete slab;
Area	10,011 square meters
Remarks	Based on The Preparatory Survey in 2011

Superstructure

- Same as Approach Bridge (Left Side)

Substructure

- Same as Approach Bridge (Left Side)

Others

- Same as Approach Bridge (Left Side)

3.4.3 O&M Consideration of the Project

Since the new Mykolaiv Bridge will be a bypass road of the state highway M-14, it will be classified as a general road for public use, and Ukravtodor will be responsible for its maintenance. The maintenance approach varies according to the road category. Ukravtodor has a database which covers all the roads and bridges under its jurisdiction, and carries out a road asset management system and bridge management system. Its bridge management system is unique to Ukraine and is not HDM-4. In spite of carrying out those systems, the roads and bridges are in far from acceptable conditions due to budget shortfalls. From the viewpoint of reducing the cost of bridge maintenance, Japanese technologies for durable structures could be taken into consideration in the design stage of the new Mykolaiv Bridge.

3.4.4 Status of the Existing Bridges in the City

This section shows technical characteristics of the bridges on M-14 across the Southern Bug and Ingul Rivers, as well as observations by the JICA Survey Team.

(1) Varvarovsky Bridge

Location	M-14, 132 kilometers + 480, across the Southern Bug River
Length	751 meters
Span	18.4 + 2×27.62 + 4×65.4 + 2×64.14 + 65.4 meters
Width	Road carriage 10.40 meters + Walkways 2×1.85 meters (three lanes on the movable sections, two lanes with a median on others)
Completion	1964
Loading	Roadway, load limit 24 tons
Bridge type	Swing bridge, rotary girder 2×64.14 meters
Area	16.233 square meters
Remarks	The bridge horizontally rotates (90 degrees) at the central support. The nearest bridge over the Southern Bug River is near Prybuzhany village, Voznesensky district located 90 kilometers upstream of Mykolaiv City.

Superstructure

- Steel movable sections
  - The steel girders of the movable sections have several rusted areas due to deterioration of paint. Repainting work is necessary in the near future.
  - It is expected that a series of fatigue damage in the orthotropic deck area will be revealed. Detailed regular inspections are desired.
- PC sections
  - It can be observed that corrosion of the steel re-bars due to inadequate cover thickness is in progress. The rusting and corrosion in the re-bar and tendons are also expected due to the cracks and cover concrete deterioration in the girders. Immediate detailed inspection is necessary, to realize proper maintenance.

Substructure

- The honeycombs in the concrete due to improper construction are observed, which should be maintained. Some rusting and corrosion in the re-bar are also observed due to cover concrete deterioration, which should be improved.

Others

- Some water leakage can be observed at the bearings. It could be attributed to the damages of the expansion joint, and rusting in the bearing. Detailed inspections are desired.

(2) Ingul Bridge

Location	M-14, 135 kilometers + 120, across the Ingul River
Length	478 meters
Span	6×33.05 + 60.7 + 15.35 + 7×33.15 meters
Width	Road carriage 18.5 meters + walkways 2× 2.725 meters (four lanes)
Completion	1984
Loading	Roadway, load limit 24 tons
Bridge type	Bascule bridge (draw bridge), rotary lifting 1×60.7 meters
Area	8.843 square meters
Remarks	It allows only the passage of vessels to/from the shipyard, 61 Communards. It accommodates a trolley bus line (both ways). It used to be the biggest bascule bridge in Europe, but currently a bridge in Rotterdam is 6 meters longer than the Ingul Bridge.

Superstructure

- The deterioration of paint is severe, which influences rusting progress. Repainting work is necessary immediately.
- It is expected that a series of fatigue damage in the orthotropic deck area will be revealed. Detailed regular inspections are desired.

Substructure

- Cracks and spalling due to inadequate cover concrete thickness are observed, which need immediate maintenance work.

Other

- Some water leakage can be observed at the bearings. It could be attributed to damages of expansion joint, and rusting in the bearing. Detailed inspections are desired.

3.4.5 Price Changes for Bridge Construction Cost Estimates

(1) Exchange Rate Change

The exchange rates adopted in The Preparatory Survey in 2011 were:

- 1 US Dollar (US$) = 7.97 Ukrainian Hryvnia (UAH).
- 1 US Dollar (US$) = 79.5 Japanese Yen (JPY).

The exchange rates in 2016[22] are:

- 1 US Dollar (US$) = 4.164 Ukrainian Hryvnia (UAH).
- 1 US Dollar (US$) = 102.28 Japanese Yen (JPY).

Comparing the current situation to that of 2011, the Japanese Yen is much stronger to the Ukraine Hryvnia and much weaker to the United States Dollar. Due to such big change in the currency value, the construction cost and the total project cost should be changed.

(2) Unit Cost Change

The construction costs roughly consist of three categories: labor cost, material cost and overhead cost, including equipment and administration. The unit cost of those cost categories has fluctuated since 2011. Average of the change of the unit rates are 232%, 224%, and 104% respectively. The changes are summarized in Tables 3.12, 3.13, and 3.14 respectively.

On the other hand, unit costs in Japan in 2016 are assumed to almost the same as those in 2006.

[22] Source: exchange rates specified in the JICA proposal TOR

Table 3.12 Labor Cost Comparison

			as of	P/S in 2011	November, 2016	Febrauary, 2017
ID	Item	Standard	Unit	Rate (UAH)		
LA-001	Skilled Labor A		day	110	200	225
LA-002	Skilled Labor B		day	110	200	200
LA-003	Semi Skilled Labor		day	110	180	180
LA-004	Unskilled Labor		day	110	160	160
LA-005	Foreman/Ganger		day	110	400	400
LA-006	Rebar Worker		day	110	200	200
LA-007	Concrete Worker		day	110	200	200
LA-008	Scaffolder	Rigger	day	110	190	190
LA-009	Bricklayer		day	110	190	190
LA-010	Mason		day	110	190	190
LA-011	Carpenter		day	110	190	190
LA-012	Electrician		day	110	190	190
LA-013	Mechanic		day	110	190	200
LA-014	Welder		day	110	200	200
LA-015	Machine Operator		day	110	270	270
LA-016	Assistant Operator		day	110	270	270
LA-017	Driver		day	110	400	300
LA-018	Bridge Foreman		day	110	400	400
LA-019	Bridge Skilled Labor		day	110	350	350
LA-020	Bridge Unskilled Labor		day	110	200	200
LA-021	Engineer A	20 years	mth	2,400	12,000	12,000
LA-022	Engineer B	10 years	mth	2,400	9,600	9,600
LA-023	Engineer C	5 years	mth	2,400	7,200	7,200
LA-024	Survey Assistant		mth	2,400	7,200	7,200
LA-025	Laborer		mth	2,400	4,000	4,000
LA-031	Administrator		mth	2,400	6,000	6,000
LA-032	Draftsman (under suprvision)		mth	2,400	7,200	10,000
LA-033	Typist		mth	2,400	5,500	5,500
LA-034	Driver		mth	2,400	4,800	4,800
LA-035	Office Boy		mth	2,400	4,200	4,200
LA-036	Guard Man		mth	2,400	3,600	3,600
LA-037	House Keeper		mth	2,400	4,200	4,200
LA-051	Electrician (Special Grade)		day	110	200	200
LA-052	Senior Surveyor		mth	2,400	7,000	10,000
LA-053	Junior Surveyor		mth	2,400	5,000	6,000
LA-054	Bridge Carpenter		day	110	200	200

Table 3.13 Material Cost Comparison

ID	Item	Standard	as of	P/S in 2011	November, 2016	Febrauary, 2017
			Unit	Rate (UAH)		
MT-001	Cement (OPTC)		t	930	1,870	2,100
MT-002	High Yield Steel Bars	D13-D25, Grade 460	t	7,500	120,000	
MT-003	High Yield Steel Bars	D29-, Grade 460	t	7,500	120,000	
MT-004	Mild Steel Bars	D13-D25, Grade 350	t	6,800	6,800	
MT-005	Mild Steel Bars	D29-, Grade 350	t	6,800	6,800	
MT-007	Ready Mixed Concrete	Grade 50 (20)	cu.m.	700	636	750
MT-009	Ready Mixed Concrete	Grade 40 (20)	cu.m.	675	675	750
MT-010	Ready Mixed Concrete	Grade 35 (20)	cu.m.	625	675	770
MT-011	Ready Mixed Concrete	Grade 30 (20)	cu.m.	600	600	650
MT-012	Ready Mixed Concrete	Grade 25 (20)	cu.m.	575	560	600
MT-013	Ready Mixed Concrete	Grade 20 (20)	cu.m.	540	540	600
MT-014	Ready Mixed Concrete	Grade 15 (20)	cu.m.	515	515	600
MT-300	Rubble (for Soft Soil Replace)	max. 200mm	cu.m.	110	420	
MT-301	Rubble	150mm-225mm	cu.m.	110	360	
MT-302	Rubble	150mm-225mm	cu.m.	110	360	
MT-307	Aggregate	100mm	cu.m.	110	120	
MT-308	Aggregate	19mm	cu.m.	165	170	220
MT-309	Aggregate	12.5mm	cu.m.	165	170	220
MT-310	Aggregate	37.5mm	cu.m.	110	155	210
MT-311	Aggregate	50mm	cu.m.	110	155	195
MT-312	Crushed Fines	6.3mm downwards	cu.m.	165	80	80
MT-313	Graded	37.5mm (ABLE 1701.5 for ABC)	cu.m.	110	150	
MT-314	Aggregate	19mm for Seal Coat	cu.m.	165	180	215
MT-315	Aggregate	12.5mm Seal Coat	cu.m.	165	200	215
MT-316	Aggregate	9.5mm Seal Coat	cu.m.	165	200	215
MT-331	River Sand for Road Surface	SSCM Table 1701-9	cu.m.	45	87	160
MT-332	River Sand for Concrete and Masonry	SSCM Table 1701-2	cu.m.	45	87	160
MT-340	Building Bricks	Burnt Cray (SLS 39:1978)	1000n	1,380	4,000	4,000
MT-351	Bitumen	80/100 (Ex-Stock)	t	6,000	8,650	9,500
MT-352	Emulsion-C.S.S.1		t	6,000	9,000	12,600
MT-353	Emulsion-C.R.S.1	(Excl. Transport)	ltr.	6	6	
MT-354	Emulsion-C.R.S.2	(Excl. Transport)	ltr.	6	6	
MT-355	Bitumen	80/100 (Bulk, at Site)	kg	6		
MT-356	Bitumen	60/70 (Ex-Stock)	ltr.	6		
MT-361	Asphalt Concrete surfacing Material	Binder 60/70	m.t.	800	1,526	2,000
MT-362	Asphalt Concrete Bound Base Material	Binder 60/70	m.t.	800	1,597	1,800
MI-003	Steel Plate	9mm Thick	t	7,120	7,120	12,000
MI-015	H-Section Steel	H-300x300x10x15	t	6,980	17,650	18,400
MI-016	H-Section Steel	H-350x350x13x21	t	6,980	17,650	18,400
MI-017	C-Section Steel	C-380x100x13x20	t	6,780	14,550	14,400
MI-020	Equal Leg Angle	L-50x50x6	t	6,240	15,650	15,650
MI-021	Equal Leg Angle	L-120x120x12	t	6,240	20,130	20,130
MI-023	Steel Pipe		t	15,000	26,000	26,000
MI-141	Borrow Pit Soil		cu.m.	70	70	

Table 3.14 Equipment Cost Comparison

			as of	P/S in 2011			November, 2016	Febrauary, 2017
ID	Item	Standard	Unit	Foreign (JPY)	Local (UAH)	Combined (UAH)	Local (UAH)	Local (UAH)
EQ-01d	Bulldozer - D8	32t	day	632	2,045	8,608	9,600	9,600
EQ-02d	Bulldozer - D6	21t	day	510	1,741	7,033	7,000	7,000
EQ-05d	Motor Grader	3.7m	day	302	1,439	4,570	3,460	4,250
EQ-06d	Wheel Loader	1.5-1.7 cu.m.	day	238	977	3,452	1,620	2,500
EQ-07d	Wheel Loader	2.5-2.9 cu.m.	day	355	1,395	5,077	3,550	3,550
EQ-08d	Backhoe	1.4 cu.m.	day	459	1,292	6,060	4,950	4,950
EQ-09d	Backhoe	0.8 cu.m.	day	293	881	3,925	3,000	3,600
EQ-10d	Dump Truck	10t	day	197	792	2,838	1,120	1,200
EQ-11d	Dump Truck	20t	day	440	1,661	6,232	2,600	3,000
EQ-12d	Agitator Truck	4.4-4.5 cu.m.	day	205	678	2,806	1,360	1,400
EQ-13d	Concrete Pump	100 cu.m./hr	day	418	1,519	5,859	2,850	
EQ-14d	Vibration Roller	2.4-2.8t	day	101	574	1,622	1,500	1,500
EQ-15d	Macadam Roller	10-12t	day	159	870	2,516	5,600	5,600
EQ-16d	Tire Roller	8-20t	day	158	791	2,428	3,950	
EQ-17d	Tamping Roller	13.5-20.7t	day	481	2,837	7,833	6,100	
EQ-18d	Asphalt Sprayer	1000-1500 ltr.	day	30	253	563	2,600	
EQ-19d	Asphalt Paver	2.4-6 m	day	579	2,878	8,892	8,000	
EQ-20d	Crawler Crane	50t	day	459	2,289	7,054	5,260	
EQ-21d	Crawler Crane	100t	day	991	5,132	15,418		
EQ-22d	Track Crane	25t	day	264	1,300	4,043	4,400	
EQ-23d	Track Crane	50t	day	572	2,547	8,484	5,700	
EQ-24d	Track Crane	120t	day	1,456	7,441	22,554	6,290	
EQ-25d	Diesel Hammer	4.5t	day	555	1,641	7,404	2,920	
EQ-26d	Vibro-Hammer	60kw	day	331	1,093	4,533	660	
EQ-27d	Water Jet for Piling	325 l/min	day	406	1,472	5,682	490	
EQ-28d	Generator	100kVA	day	149	157	1,703	1,703	
EQ-29d	Generator	200kVA	day	304	311	3,466	3,446	
EQ-30d	Generator	300kVA	day	411	495	4,761	4,761	
EQ-31d	Air Compressor	7.5-7.8 cu.m.	day	122	214	1,482	1,200	
EQ-32d	Concrete Breaker	40 kg	day	3	10	45	45	
EQ-33d	Rammer	60-100 kg	day	12	126	248	248	
EQ-35d	Cargo Truck 10t w/Crane 2.9t	329hp	day	227	1,014	3,365	2,400	
EQ-36d	Lane Marker (hand guide type) 15cm	80-120 kg	day	12	156	280	1,100	
EQ-37d	Asphalt Plant	120 t/hr	day	2,757	13,651	42,267	126,750	136,000
EQ-38d	Asphalt Plant	180 t/hr	day	3,853	19,074	59,058	156,000	
EQ-39d	Concrete Batching Plant	45 cu.m./hr	day	748	2,825	10,591	6,830	
EQ-40d	Concrete Batching Plant	60 cu.m./hr	day	880	3,247	12,382	7,700	
EQ-41d	Crane with Dredge Bucket	60 cu.m./hr	day	522	2,694	8,108	8,970	
EQ-44d	Crawler Drill (Air Type)	80 kg	day	83	381	1,239	2,470	
EQ-45d	Crawler Drill (Hydraulic Type)	100 kg	day	582	2,084	8,121	5,960	
EQ-46d	Breaker (Air)	100 kg	day	60	165	788	788	
EQ-47d	Cruching Plant	500x750	day	230	944	3,335	3,335	
EQ-133d	Track Crane	160 t	day	1,918	9,808	29,709	13,480	
EQ-134d	Track Crane	200 t	day	2,274	11,741	35,340	19,530	
EQ-135d	Pickup Car	Double, 2WD	day	12	140	266	266	
EQ-136d	All Casing Drill		day	1,973	9,490	29,962	29,962	

3.4.6 Capabilities of Local Contractors in Bridge Construction

(1) Recent Market Activities in Road/Bridge Construction

Table 3.15 shows the list of long span road bridges in Ukraine. The Zaporizhia Bridge and the Kiev Podol Bridge are not completed and still under construction.

Table 3.15 Long Span Road Bridges in Ukraine

Name of the Bridge	Length of the Bridge	Main Span of the Bridge	Number of Lanes	Completion Year
1. Zaporizhia Bridge across the Dnipro River (Bridge No.10)	4,484 meters	260 meters (Cable Stayed Bridge)	6	Under Construction
2. Kiev Podol Bridge across the Dnipro River	7,100 meters	334 meters (Steel Arch Bridge)	6	Under Construction
3. Cable Bridge in the Odessa Port	150.5 meters	114.7 meters (Cable Stayed Bridge)	2	1998
4. Kiev Southern Bridge across the Dnipro River, Pivdennyi Bridge	1,228 meters	271 meters (Cable Stayed Bridge)	6	1992
5. Kiev Moscow Bridge across the Dnipro River, Moskovskyi Bridge	779 metesr	300 meters (Cable Stayed Bridge)	6	1976

Source: The Preparatory Survey in 2011, Table 8.2.2

(2) Zaporizhia Bridge Construction Project

Resuming construction of the 9.1 kilometers long highway over the Dnipro River in Zaporizhia, the project consists of 6 traffic interchanges, 26 engineering structures i.e. 2 large bridges, 17 overpasses and 7 underpasses, as shown in Figure 3.13. The total project cost as of 2009 was UAH 5.028 billion.

Source: Ukrdiprodor

Figure 3.13 Zaporizhia Bridge Construction Project across the Dnipro River

There are two large bridges in the scope of construction;

i) The bridge over the Dnipro Old River will span between the right bank and Khortytsya Island. This steel girder bridge has a length of 340 meters and is called "No. 4".
ii) The bridge over the main Dnipro River will span between Khortytsya Island and the left bank. This cable-stayed bridge has a length of 660 meters and is called "No. 10". It has a reinforced concrete pylon with a height of 152 meters from the road surface (166 meters from water level) with a harp-shape cable arrangement and has a navigable waterway with a length of 260 meters.

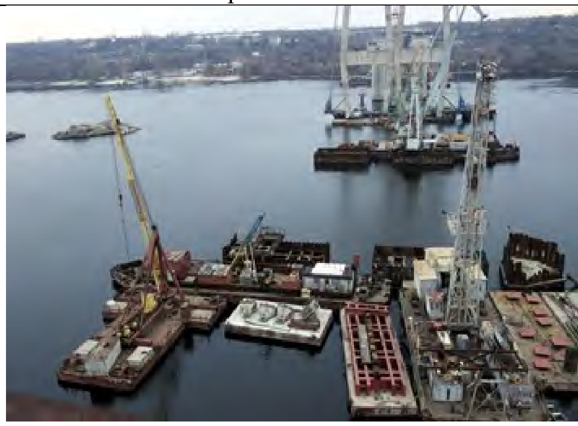
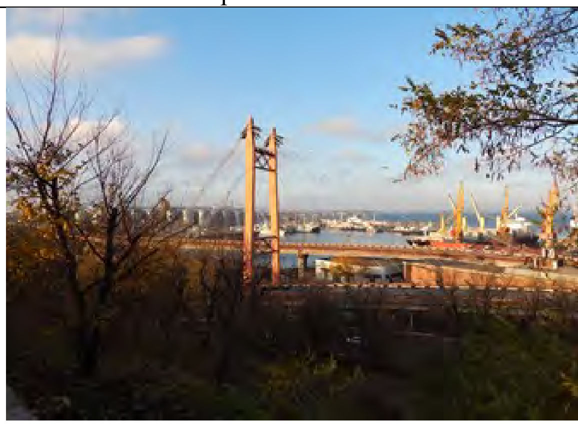
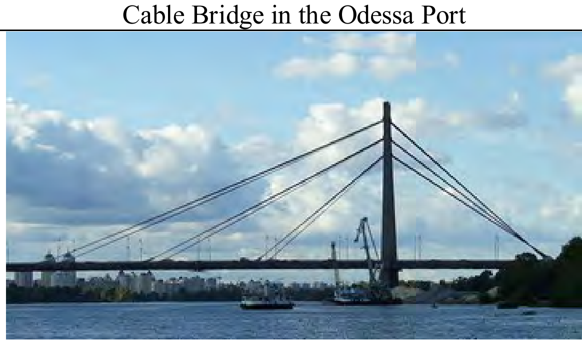
Details of construction scopes of the two bridges are explained below.

<u>No. 4 Bridge</u>

One pile has drilled and concreted in 40 bored piles (average depth of piling is 30 meters with at least 2 meters deep socketed into massive rock) for the 4 main piers at a height of 51 meters. The construction site received 3,388 tons of steel out of the required 3,393 tons. For the large-scale assembly of steel spans, the installation is by the launching erection method. A building berth with a length of 150 meters and a crane dock were built. A crane and 1,729 tons of steel elements and 72 meters long launching nose have already been assembled. The longitudinal sliding of the beam was launched with a length of 168 meters out of the total 342 meters required. The construction cost estimate of this bridge in prices of 2009 was UAH 420 million. Now this cost estimate seems to be adjusted upward.

<u>No. 10 Bridge</u>

The construction of 14 main piers on water (excluding pylons) was completed. The erection works at the two pylons are carried out at an altitude of 155–159 meters (total height of pylons 166 meters). 33 tiers of 36 are concreted. Reinforced steel is already assembled at tier 34 for concreting. The construction site received 2,383 tons of steel out of the required 5,482 tons. 96 cables - weighing 391 tons and at total length of 6,375 meters, ranging from 56.6 meters to 218.9 meters, were purchased and delivered from the "Brydon" company (Germany) in 2013. Out of 10 temporary mounting supports (MO) for the cable-stayed bridge, 6 are being built on the water and 4 on the ground of Khortytsya Island. From the required 48 bored piles used for the foundations of temporary supports on the water, 45 wells have been drilled, 41 of which have been concreted. The construction cost estimate of this bridge in prices of 2009 was UAH 870 million. This cost estimate seems to be adjusted upward.

 Zaporizhia No. 4	 Zaporizhia No. 4
 Zaporizhia No. 10	 Zaporizhia No. 10
 Kiev Podol Bridge	 Cable Bridge in the Odessa Port
 Pivdennyi Bridge	 Moskovskyi Bridge

Source: Strucure.net, Google

Figure 3.14 Photos of Major Bridges in Ukraine

(3) Bridge Contractors and Consultants

Due to the recent economic recession, the market situation in Ukraine has changed drastically. This chapter shows the situation of before and after year 2011, when The Preparatory Survey in 2011 was prepared.

Before 2011

According to the Preparatory Survey in 2011, availability of local design consultants and contractors for large bridges was stated in the Feasibility Study Report in 2004 for the Kievsojuzdo project, conducted by local consultants, as follows:

While the national bridge-building industry has certain experience in the design and construction of highway bridges with cable-stayed girder structures, suspension bridges with such large girders have never been built in the territory of CIS. An exception is a bridge across the river Irtysh (Kazakhstan) built in 2001 with the main girder being 750 meters long, but designed and constructed by Japanese specialists. It is also confirmed from the local consultant that this situation has not been changed since 2004.

Mostbud, a local contractor, is the only prime contractor for large scale bridge projects in the Ukraine. They have outstanding experience with bridges in Ukraine and other CIS countries, and still admit that they do not have any experience with suspension bridges. In addition, support by the consultant who has carried out the preliminary design will be necessary to the local consultant who is responsible in implementing the basic design (project documentation) to obtain approval from the concerned Ministries, followed by approval of the Cabinet of Ministers of Ukraine.

After 2011

During 2012 and 2013, there were more than 20 Ukrainian construction companies, including the largest private bridge building companies which participated in the construction of the Zaporizhia Project. However, after the domestic turbulence in 2014, some have gone bankrupt and have been out of the bridge construction field. Table 3.16 shows the status of the major bridge construction companies.

Table 3.16 Bridge Construction Companies in Ukraine

Company name	Situation
Enterprise Mast - Bud Ltd.	Under Operation, web-page updated
Volyn bridge building company	Under operation, currently not building any bridges but repairing.
Moststrojkom, Dnipro[23]	Under operation, doing a bridge in Dnipro Oblast
Transmost Chernivtsi	Under operation, but since the government stopped ordering bridges, the company now moved to other construction services, but is willing to return to bridges
Pivdentransbud LTD	Under operation, (interviewed)
Mostostroy	Under operation, (interviewed)
Pivdentransbud, PJSC	Bankrupt, used to be a big company
Mostobud, LLC	Bankrupt, used to be a big company
MSU ltd. - bridge building company	Bankrupt

Due to the long recession and the bankruptcy of many contractors and consultants, many engineers and workers in the bridge field have gone abroad or changed their jobs. Furthermore,

[23] Former "Dnipropetrovsk"

since Ukraine is recently intending to adopt EU standards and specifications, some of the Ukrainian companies may intend to obtain support from experienced foreign companies in the field of bridge planning, designing and supervision. .

Four (4) or five (5) construction companies in Ukraine seem to be able to take part in the bridge construction works and currently, there is not a severe competition in the bridge industry because of the shortage of funding for the bridge projects. Though these contractors have no experience in the suspension bridges, they have some competence in bridge construction, such as a cable-stayed bridge near Kiev achieved by the cooperation of those domestic companies with the conditions of having enough construction time. Also, cooperation with foreign companies is possible because they already have some relationship with foreign firms in the field of bridge engineering.

These bridge companies have capability of both steel and concrete bridges and even for extradosed bridges. However, even if they have experience with concrete box girders, their durability could improve. It appears that this is due to the temperature changes under the influence of freeze and thaw conditions.

4. Analysis of Seaport Subsector

4.1 Introduction

This chapter presents a comprehensive overview of the Ukrainian port sector. Section 4.2 starts with a general introduction of the Ukrainian port sector. All ports are described, categorized and the major changes in the Ukrainian port sector since the annexation of Crimea has been addressed. The port descriptions can be found in Section 4.5.1.

Section 4.3 provides the institutional framework for the Ukrainian port sector, elaborating on the applicable port management models and the most relevant legislation. Section 4.4 describes the volume dynamics in the Ukrainian port sector, and forecasts the demand for the four major ports in the Southern Region of Ukraine. Section 4.5 presents the four major ports and its developments. Furthermore, Section 4.6 presents the current status and challenges of the Ukrainian Seaport Authority (USPA). Finally, Section 4.7 provides an overview of the status of assistance from other donors to the seaport sector in Ukraine.

Source: USPA

Figure 4.1 Overview of Seaports

4.2 Overview of the Port Sector in Ukraine

4.2.1 General Introduction of Ukrainian Port Sector

Ukraine counts 18 commercial sea ports along the Ukrainian coasts of the Black- and Azov Seas. In Figure 4.1, these ports are presented, from West to East: Reni, Izmail, Ust-Dunaisk, Belgorod-Dnestrovskiy, Chornomorsk (previous name – Illichivsk), Odessa, Yuzhny, Mykolaiv, Olvia (previous name – Oktyabrsk), Kherson, Skadovsk, Yevpatoria, Sevastopol, Yalta, Theodosia, Kerch, Berdyansk and Mariupol. The main ports, however, are Illichivsk, Odessa, Yuzhny and Mykolaiv. These ports, which represent 78.3%[1] of the total volume of the Ukrainian sea ports, are the four ports that fall within the scope of this study. These ports offer also the best nautical accessibility for sea-going vessels (draught of vessels accommodated are 10.3–18.5 meters). The other ports in Ukraine can only accommodate ships with considerably less draught. Detailed information on the four ports is presented in Section 4.5.1.

[1] Source: USPA, based on the data on volume of cargo handling during the period from January till October 2016. In comparison with the data for the year 2015 the share of aforementioned sea ports increased slightly from 77.9 %).

The major container terminals in Ukraine are located in the ports of Odessa, Illichivsk and Yuzhny. At the mouths of the largest Ukrainian rivers, the Dnipro and Yuzhny Bug, there is another cluster of commercial seaports, namely Mykolaiv, Kherson, Olvia, which handle both bulk and general cargoes.

On the northern coast of the Sea of Azov, the Ukrainian commercial seaports of Berdyansk and Mariupo are located, whose distinguishing feature is their closeness to the industrially developed regions of Donbass and Pridneprovye. The export of metals and other commodities from these regions provides the main workload for these two ports. Disadvantage of these ports along the coast of the Azov Sea however is that they all face draught restrictions.

4.2.2 Categorization of Ukrainian Seaports

Various cargo sectors have been earmarked in the 25-years port development plan as provided in the "Strategy of development of sea ports of Ukraine until 2038", which was adopted in 2013. The sectors have been attributed to the following ports as follows:

- Crude oil and oil products → Odessa;
- Liquid chemicals in bulk → Yuzhny;
- Cargoes of metallurgical industry (iron ore, coal, steel) → Odessa, Mariupol, Illichivsk, Yuzhny;
- Grain cargoes → Odessa, Illichivsk, Mykolaiv and Kherson;
- Containerized cargoes → Odessa and Illichivsk.

Odessa is earmarked as the most all-round port, accommodating all cargo sectors. The rest of the ports are concentrated on a specific cargo sector or on a more limited amount of cargo sectors. In the next table the overview per port is presented.

Table 4.1 Specialization of Ports

Name of the sea port	Specialization
Odessa Sea Port	Bulk, general cargo, cruise liners, crude oil and oil products, steel products, containers
Illichivsk Sea Port	Terminalling by railway ferries and "ro-ro" vessels, steel products, containers, bulk grain
Yuzhny Sea Port	Bulk, general cargo, chemicals in bulk, steel products
Reni Sea Port	Bulk, general cargo, "ro-ro" vessels
Mariupol Sea Port	Bulk, general cargo, containers, heavy-lifts and oversized cargo, steel products
Izmail Sea Port	Bulk, general cargo
Mykolaiv Sea Port	Bulk, general cargo
Kherson Sea Port	Bulk, general cargo
Skadovsk Sea Port	Bulk, general cargo, "ro-ro" vessels, oil products
Olvia Sea Port	General cargo
Bilhorod-Dnistrovski Sea Port	Bulk, general cargo
Ust-Dunaisk Sea Port	Bulk, general cargo
Berdyansk Sea Port	Bulk, general cargo

Source: USPA

4.2.3 Changed Port Landscape

In March 2014, Russia annexed the Crimean peninsula. Since then, Russia is *de facto* administering the territory as two federal entities — the Republic of Crimea and the city of

Sevastopol — within the Crimean Federal District. As a result, the ports of Crimea (Yevpatoria, Sevastopol, Yalta, Theodosia, and Kerch) became in fact inaccessible for Ukraine.

On the 16th June, 2014, the Ministry of Infrastructure of Ukraine issued the Order No. 255 "On closing of sea ports". According to the order, Kerch, Sevastopol, Theodosia, Yalta and Yevpatoria ports shall be closed until the retrieval of the constitutional order of Ukraine on the temporary occupied territory of Crimea.

The list of sea ports opened for foreign vessels' calls is provided by the order of the Cabinet of Ministers of Ukraine "On the list of seaports of Ukraine opened for entry of foreign vessels" (with amendments) and is as follows:

- Reni
- Illichivsk
- Olvia
- Mariupol
- Izmail
- Odessa
- Kherson
- Ust-Dunaisk
- Yuzhny
- Skadovsk
- Bilhorod-Dnistrovski
- Mykolaiv
- Berdyansk

4.3 Institutional Framework

Ports can be categorized in the following port management models, which were originally defined as such by the World Bank. The distinctive factor is the allocation of responsibilities between public and private responsibilities.

Private sector involvement can be organized in various ways. The following table indicates the main applicable port management models and presents the allocation of responsibilities to the public sector or to the private party. More information on the port management models can also be found in Appendix 4-III.

Table 4.2 General Allocation of Responsibilities in Port Management Models

Port management model	Private participation	Regulation	Infra-structure	Super-structure	Equipment	Labor	Nautical services	Land ownership
Public service port*	Zero	Public	Public	Public	Public	Public	Public	Public
Tool port*	Very low	Public	Public	Public	Public	Private	Public or private	Public
Landlord port*	Medium	Public	Public	Private	Private	Private	Public or private	Public
DBFM in Landlord port*	High	Public	Public & Private[2)]	Private	Private	Private	Public or private	Public
Private port*	Maximum	Public or private	Private	Private	Private	Private	Private	Private

Note: *Standard port models according to the World Bank / PPIAF port reform toolkit
Source: JICA Survey Team

From the above presented models, the **public service port** and the **tool port** do not facilitate PPP arrangements. A terminal operator concession is the key agreement between a **landlord** port authority and an – often private – terminal operator. For **private ports,** a Build Operate

Transfer (BOT) concession agreement is the principle arrangement that allocates most of the responsibilities to a private party.

The Ukrainian port sector is currently characterized by its hybrid structure. The Ukrainian ports fit into several of these categories. In most ports, the land is owned by the State which also applies to other strategic assets such as approach channels, harbor basins and port channels. Ports in which the land and the other strategic assets is owned by the Government of Ukraine and where private operators are active are defined as **landlord ports** and ports with state-owned operators are defined as **public service ports**.

In some ports, however (such as Yuzhny), the private sector (e.g., TIS) has ownership over the land and other strategic assets like quay walls and access channels and therefore these ports are (full) **private ports**.

Private stevedoring companies can be found especially in the ports of Odessa and Mykolaiv. The majority of port facilities are disposed to the private sector. In the ports of Yuzhny and Illichivsk, state-owned stevedoring companies can be found which compete quite successfully with the private stevedoring companies.

It is the ambition of the Government of Ukraine to align the Ukrainian port sector with the European port sector from an institutional perspective. Therefore, it is the ambition to adjust the hybrid port management model towards a landlord model. This means that the following goals should be met in the near future:

- Privatization of state owned operating companies;
- Simplify the current legislation[2] in order to limit bureaucracy and enhance the investment climate;
- Harmonize various laws which are applicable for direct foreign investments;
- Introduce new procurement legislation which should enhance the participation of foreign companies, in line with European tender regulations.

In general, the strategy of the current Minister of the Ministry of Infrastructure and the Cabinet of Ministers is decentralization and privatization. The declared aim is to transparently privatize those assets which are not effectively managed. For those assets which cannot be privatized and are remaining as state property, the aim is to improve the quality of management and to attract new investors by some means, such as concessions.

4.3.1 Relevant Laws and Regulations on Seaports

Special attention is given to the Law of Ukraine “on Sea Ports” of May 2012 (hereinafter, the Law), which has a huge impact on all port stakeholders, including cargo terminals, stevedore companies, ship-owners and the public authorities.

The key goals and provisions of the Law include:

- Distribution of administrative functions in seaports;
- Promotion of investment in port infrastructure;
- Settlement of land disputes at sea ports;
- Adjustment of port economy management and planning; and
- Liberalization of rates on port services.

[2] In Appendix 4-I an overview is presented of the Ukrainian national legislation in sea transportation and sea port activities

This Law stipulates that port administrations are entitled to perform administrative functions only, while commercial services are delegated to private companies. Furthermore, the Law provides better opportunities and mechanisms for investments in port infrastructure, including strategic assets (dredging, berths and railways) and guarantees for investors. The list of possible investment mechanisms is not exhaustive; private investors and port administrations may establish relationships based on both traditional lease and joint venture agreements in addition to other legal mechanisms, such as concessions.

The incorporation of new joint stock companies based on integral economic complexes (usually on separate terminals) is also provided for in the Law. The concession agreement is given priority for new investment based on large port infrastructure and separate ports. Privatization of infrastructure (except strategic infrastructure) is allowed and infrastructure created with private investments will remain private property.

Land in ports may be held in any form of ownership permitted by the laws of Ukraine. The Law provides that land in ports may be state owned or privately owned, or even municipal property. This creates opportunities for financing the construction of new cargo terminals and ensuring a return on investments.

The most distinctive and liberal provision of the Law is on the direct determination of free port service rates, including those for loading and unloading operations and other commercial services. The provision applies to all services, except those deemed to be natural monopoly services and several specific services that are unrelated to the oil handling or transportation business. However, not all stevedore business participants are ready to de-regulate port rates.

The Law stipulates private-public partnership as basis for investment into sea port infrastructure development, mainly in the forms of lease and concession. The detailed issues of applying law institutions of lease and concession are set forth in the Laws of Ukraine “On concessions” and “On lease of state and public property”, while the Law of Ukraine “On sea ports” prescribes peculiarities of granting sea port property for lease or concession. Strategic assets which serve the interest of the nation (e.g. assets that impact the national security) cannot be privatized or concessioned. Berths may be leased not more than for 49 years.

Progress is being made with the implementation of the port reform and the implementation of the three laws. The World Bank assists for example with the establishment of the “Public-Private Partnership (PPP) Project Office” at the Ministry of Infrastructure of Ukraine. This Central Executive Body upon formation and state policy performance, inter alia, in sea transport, has the task to perform the provisions of the Law in practice. Concession based PPP projects will be implemented in Kherson and Olvia sea ports as pilot projects. Current status of these projects is that pre-project documentation is being drafted, supervised by the World Bank.

4.3.2 Findings on the Ukrainian Port Reform

Although many initiatives have been taken for a successful port reform, the implementation of the reform faces some important challenges. Challenges that have been experienced include:

- There is a lack of available funding for the financing of all types of works. This applies to both public funding and private funding. Current investment climate is rather challenging, which results in a lack of private interest to invest in Ukraine. This is caused by the unstable political situation in Ukraine, the deeply-rooted corruption in the country and the unpredictable and non-transparent domestic and external state policies.

- A second reason for the lack of funds lies in the fact that USPA has to transfer the majority of their income (approximately 75%) to the State to fill the gaps of the National Budget. This means that these resources cannot be used for the improvement of the Ukrainian port sector.
- There is a necessity to further improve the Ukrainian legislation governing maritime transport and concession policy;
- Political instability in Ukraine prevents continuous actions to realize the port reform. The people who are responsible for the legislation initiative (i.e. top management of the Ministry of Infrastructure) are changing periodically (once in 1–2 years). Each time different political forces gain control over the Ministry which hampers a proper implementation. Furthermore, in the current political setting, other matters are more prioritized than the port reform, such as the relationship with Russia and the visa-free regime with EU (highest priority task for current political establishment).
- Deeply-rooted bureaucracy and corruption in doing business still exists which distorts the valid legal system.
- State-owned operating companies cannot be privatized based on current legislation. In 1999 the Law of Ukraine "On the schedule of objects of state property which are not subject to privatization" established a list of state-owned enterprises which cannot be privatized. All current 13 Ukrainian sea ports are included in this list, and, therefore, are currently prohibited for privatization. To be privatized, the ports need to be excluded from this list. The opponents of privatization insist that in an unstable political situation, in particular, where a risky military conflict exists, the privatization will lead to the full loss of state control over the strategic port infrastructure.
- Currently, Ukraine lacks a state authority empowered and liable for control of an effective implementation of the international standards in the maritime field. International Maritime Organization (IMO) recommends establishing a Maritime Administration under the supervision of the Minister of Infrastructure, responsible for the effective implementation of international standards, maritime transport safety and security, sea environment protection, port formalities (administrative services), vessel- and seafarers certification and port state control.

4.3.3 Strategy for the Port Sector

As stated in Chapter 2, in October 2010, the Cabinet of Ministers of Ukraine approved the "National Transport Strategy of Ukraine for the period up to 2020" (Decree of the Cabinet of Ministers of Ukraine dated 20th October 2010, No.2174-p). The main principles and directions of implementation of the Strategy with regard to the port sector are:

- Construction and reconstruction of terminals (first and foremost, for containerized cargo) in the ports;
- Harmonization of national legislation with EU transport law;
- Elaboration of the key plans for the development of sea ports;
- Expansion of network of specialized terminals in ports;
- Improvement of the efficiency of logistics operations in ports;
- Modernization of the infrastructure of ports;
- Adoption of the Law of Ukraine "On sea ports" and making amendments to the Merchant Shipping Code of Ukraine;
- Elaboration and implementation of sectoral programs of development of sea ports;
- Reorganization of public enterprises (sea trade ports), establishment of State and Maritime administrations in the sea ports;

- Determination of the list of infrastructure facilities of the ports which may be transferred to the state administrations of ports;
- Determination of legal and institutional framework of activity of port operators;
- Determination of special conditions of development and operation of sea ports having a strategic importance for the State and located at the nodal points of international transport corridors, in accordance with international standards.

Certain goals stipulated in the Strategy (adoption of the Law on sea ports, determination of legal and institutional framework of activity of port operators etc.) are already accomplished; however, the majority of the tasks are not implemented yet.

(1) Strategy on the Development of Seaports

As part of this National Transport Strategy, the Cabinet of Ministers of Ukraine adopted the "Strategy of development of sea ports of Ukraine for the period up to 2038" in 2013. The Strategy has been developed in compliance with the Law of Ukraine "On the Sea Ports of Ukraine", with consideration of the main principles of implementation of State policy in the transport industry. It determines the forecasts of cargo flows, objectives, main directions and ways of development of sea ports and port industry in general, as well as other main parameters of development. The goals of the Strategy are the following:

- To provide port complex developments and to increase competitiveness of the port industry;
- To provide proper maintenance, effective management and use of strategic port infrastructure facilities;
- To involve private investments for the long-term period for development of port infrastructure;
- To create conditions for business activities at the sea port, equal access to the services rendered at the sea port;
- To provide material, technical and technological development of port industry and personnel training;
- To avoid environmental pollution, to observe requirements upon use and protection of water facilities within the territory and water area of the sea port;
- To provide ecological safety in compliance with international standards.

The Strategy is still in force at the moment, however, some of the current developments, such as the annexation of Crimea impacting the supply chain and transport corridors in Eastern Ukraine, are not reflected in the Strategy.

Ukrainian Port Reform

The key directions of the development of the port sector in general are provided in the draft **"Strategic plan for the development of maritime transport in the period up to 2020"**. The draft Strategic Plan has been prepared in the Ministry of Infrastructure in the end of 2015. It is not enacted at the moment, however, the contents of the document give an overview on the intentions of the Government of Ukraine with respect to the reform of port sector. The Draft Strategic Plan stipulates that for the proper development of the port/maritime sector during 2015–2020, the efforts must be focused on the following strategic areas:

1. Reform of the system of public management of the sector;
2. Implementation of effective forms of PPP in ports and development of strategic port infrastructure;
3. Development of e-community, simplification of control procedures, creation of favorable conditions for business;
4. Increase of the level of navigational safety, the development of Search and Rescue system,

environmental protection.

Direction 1 (Reform of public management of the sector), the main aims of this direction are:

- **Improvement of the regulatory framework of the industry** (easement of the regulatory pressure, implementation of the principles of non-discrimination and simplification of doing business),
- **Improvement of state management and fighting corruption** (creation of Maritime Administration, development of the industry potential);
- **Ensuring of sustainable use of marine resources** (development and implementation of state maritime policy).

Direction 2. Implementation of effective forms of PPP in ports and development of strategic port infrastructure:

- **Creation of favorable conditions for attracting investment in sea ports** (inventory of port facilities that can be transferred to the private sector; determination of the conditions and objectives of privatization, concessions, public private partnerships, lease or any other form of attracting investments to the ports);
- Ensuring of proper working conditions and development of strategic objects of infrastructure, within the sphere of responsibility of the State (maintenance of operational depths, creation of deep-water terminals; creation of a mechanism of compensation of funds to the investors in the port facilities which are the responsibility of the State.
- **Improvement of tariff policies, operation activities and simplification of regulatory procedures in ports** (introduction of new port tariffs complying with international best practice; improvement of intra-port logistics, including simplification of paperwork, reduction of forms of control applicable to cargoes; harmonization of national legislation on electronic documents and data protection in accordance with European requirements)

Direction 3. Development of e-community, simplification of control procedures, creation of favorable conditions for business:

- **Improvement of logistic links between the port and various types of transport** (integration with the inland water transport and railways; improvement of legal regulation of transshipment in Ukraine; simplification of the rules of inland transportation via Ukraine in coordination with Customs Service);
- **Implementation of a "single window" technology at the national level** (introduction of information technologies through the implementation of Information System of Port Community in all sea ports of Ukraine).

Direction 4. Increase of the level of navigational safety, the development of Search and Rescue systems and environmental protection:

- **The improvement of functionality of security management systems in Ukraine as a maritime state, and its compliance with international standards and EU regulations** (formation of the regulatory framework for the implementation of the concept of "single national maritime window" according to European regulations; creation of a national segment of SafeSeaNet system and introduction in sea ports of a "single national maritime window" on the basis of the current Information System of Port Community with its further integration into SafeSeaNet; implementation of directives of International Maritime Organization (IMO) and European regulations on maritime safety; compliance with the standards of safety in maritime transport and implementation of the requirements for control of Flag state and Port state).
- **Ensuring safety of navigation with regard to the risks of sea carriage** (implementation of IMDG Code and IMSBC Code).
- **Protection of the environment from the negative effects of the operation of sea transport** (rational use of infrastructure and optimization of transportation, handling and cargoes storage processes; reduction of emission in compliance with the MARPOL Convention and its Protocols and European regulations; creation of unified system of ecological security of European level in Ukrainian sea ports).

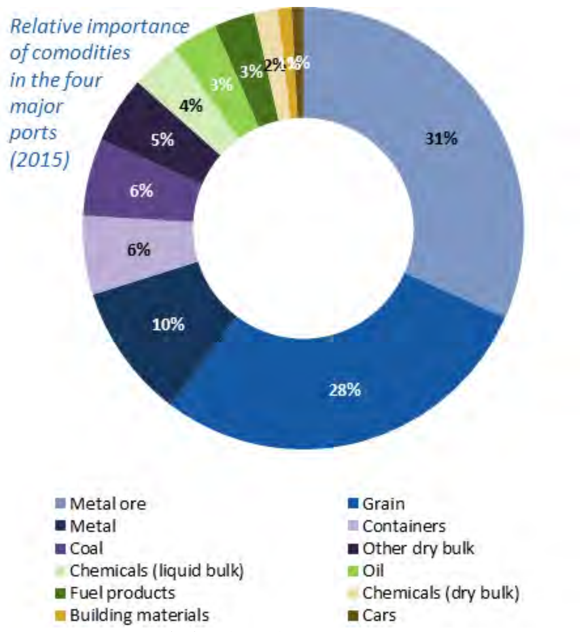
4.4 Handling Cargo Volume and Cargo Demand Forecast of Major Cargos at Major Ports

4.4.1 Methodology

The methodology for the traffic forecast exercise contains macro-, meso-, and micro-analysis. The macro-analysis entails the analysis of the major economic and social indicators, handled cargo volumes in the entire contestable region, and other relevant ratios. In the meso-analysis, we look into the competitive field of the cargo commodities which have an impact on the Ukrainian port volumes. In the micro-analysis, we use the market intelligence for the substantiation of our traffic forecasts; hereto interviews were conducted with major shippers (including producers, consignees), key forwarders, terminal operators, shipping companies, international integrated transport companies and port managers.

The approach to forecast cargo volumes in the major ports of the Southern Region consists of the following four main steps:

1. Identification of the historic handling cargo volume and cargo demand based on statistics and information provided by the USPA and third parties (mainly IMF and FAO statistics and outlook, which can be found in Appendix 4-V) (= macro-analyses);
2. Identification of the dynamics and value drivers nationally and internationally that determine the future demand for the cargo;
    a. by desk research for the corresponding markets, competing ports and industries (= meso market analyses)
    b. by conducting interviews with relevant market players such as shipping lines, cargo owners, freight forwarders, terminal operators and - if relevant – trade organizations (= micro-analysis)
3. Description of the method and preconditions for the forecast; and
4. Discussion of the forecast of the handling cargo volume and cargo demand.



Source: USPA statistics (2015)

Figure 4.2 Relative Importance of Commodities in the Four Major Ports in Ukraine

The forecast distinguishes import and export flows as both flows are determined by another set of factors. Furthermore, the forecast will focus only on the most important commodity types (> 5% of total volumes handled) which are handled in the four major ports:

- Dry bulk products:
  - Coal (6%);
  - Metal ore (31%); and
  - Grain (28%).
- General cargo products:
  - Non-unitized products, mainly finished metal products (10%); and
  - Containers (6%).

These commodities account for more than 80% of the total volume handled.

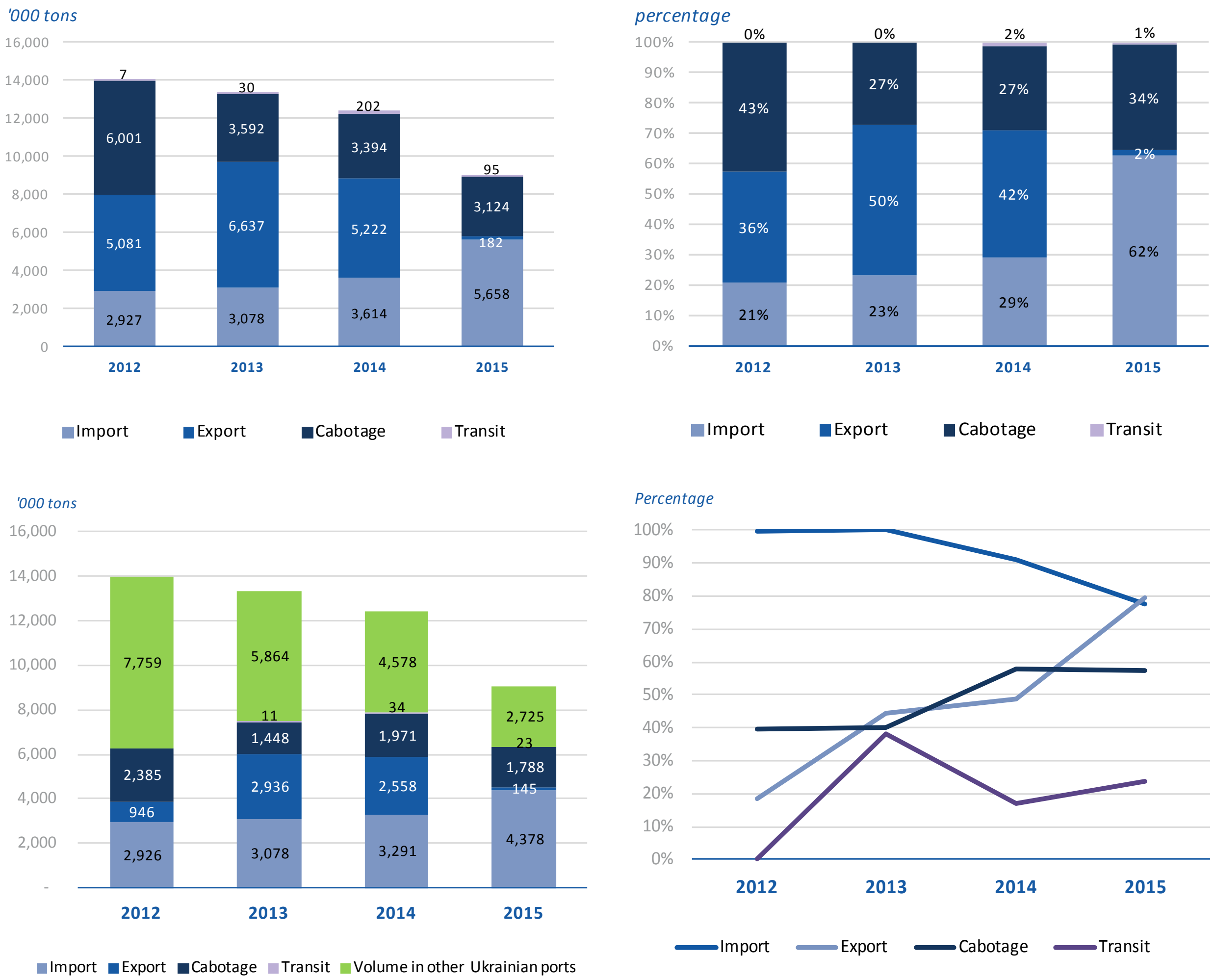
4.4.2 Demand Forecast Results

The forecast results are discussed per commodity type. For each of the commodities, a section is provided on the historics, the dynamics/value drivers, and the actual forecast. Appendix 4-V provides the historical and forecast data for the different commodity types.

(1) Coal

Historics

In Ukraine, the handling of coal decreased significantly with approximately 5 million tons from 14 million tons in 2012 to 9 million tons in 2015 (see Figure 4.3). Simultaneously, the distribution of the trade flows of coals altered significantly: from a transit/export-orientated trade (79% in 2012) towards an import-orientated trade (62%). Cabotage of coal is insignificant.

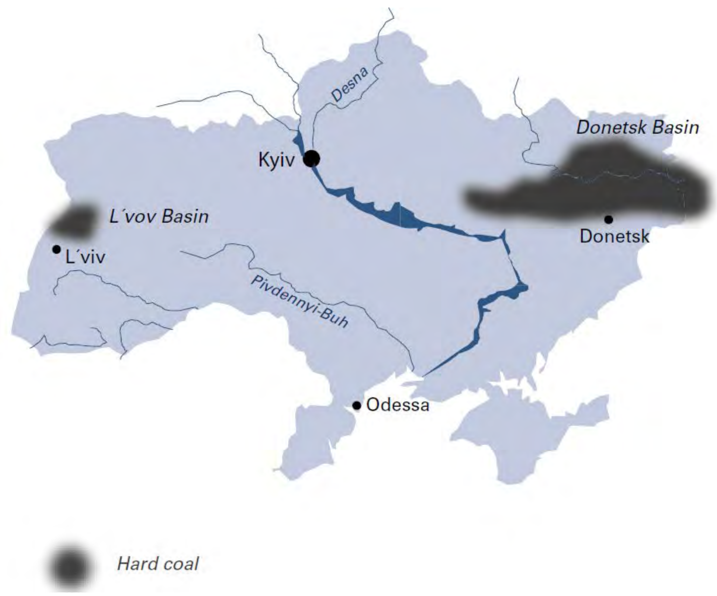


Source: USPA statistics

Figure 4.3 Handling of Coal in the Ukrainian Port System

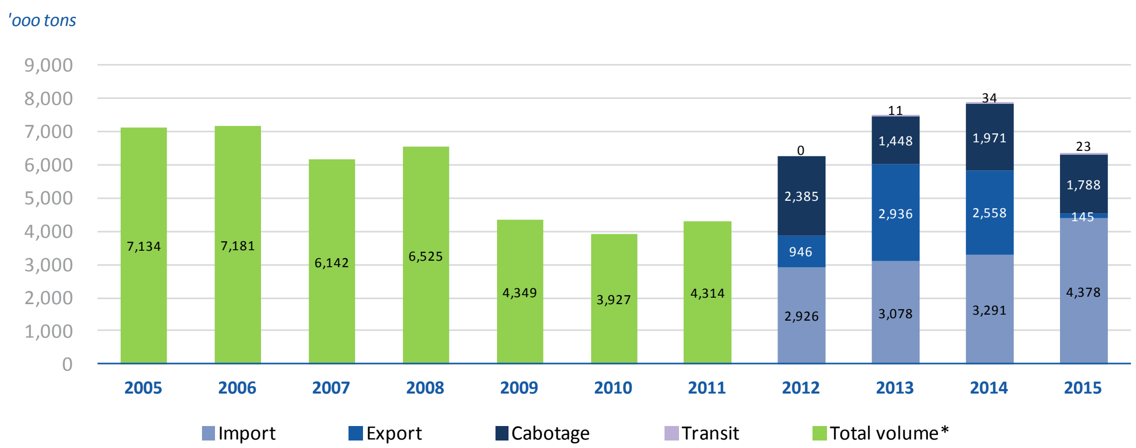
In contrast to the total volume of coal handled in Ukraine, the volume of coal in the four major ports remained stable (even increased slightly between 2012 and 2014). Furthermore, the importance of the four major ports in the handling of coal in the Ukrainian port system increased during the last four years. Nevertheless, the same trade pattern can be observed: a shift towards import of coal. This shift is caused by the geo-political instability in Ukraine:

- Export of coal is mainly metallurgical coal which is mined in the occupied territories in the East of Ukraine (see map in Figure 4.4);
- The majority of thermal coal is mined in the occupied territories. This creates a shortage for thermal coal. Thermal coal is stored to safeguard the energy supply;
- The energy sector is in a transition process from gas towards thermal coal; and
- Due to these happenings the total volume of coal handled fluctuated around 7 million tons as depicted in Figure 4.5.



Source: Euracoal

Figure 4.4 Coal Basin in Ukraine



Note: * no specific data on import, export, transit and cabotage available before 2012.
Source: Euracoal

Figure 4.5 Evolution of Coal Handled in the Four Major Ukrainian Ports

Dynamics – Value Drivers

The value drivers that determine the volume of coal differ per direction:

- The import of (thermal) coal is linked to the power generation in Ukraine. Hence the value drivers behind the growth rate of the volume imported are both the population growth in Ukraine and the growth rate of the Gross Domestic Product (GDP) in Ukraine. There is a correlation of 0.79 between the volume growth and the average growth of the population and the GDP (excluding years of crisis 2009 and 2010).
- The transit of coal remained stable over time, and there is no reason why this will change over time. A volume of 2 million tons of transit is expected.
- Coal is mainly exported to Bulgaria, Iran, Israel, Italy, Lebanon, Morocco, and Turkey. As for the import, the export of coal is determined by the population and GDP growth

of these countries. Nevertheless, due to the geopolitical turmoil, there is an export ban. There are no signals that the export ban will disappear in the nearby future. Hence, it is expected that the export volumes will remain low.

Given the large capacity for coal in the Southern Region of Ukraine, it is expected that the Southern Region becomes the main region for handling coal. More specific, it is expected that the Port of Yuzhny will remain the main entry for coal given its depth advantage over other ports.

Due to the shift in the trade pattern, a shift in the vessel size is expected as well as destination for coal will become mainly transatlantic (United States and Australia).

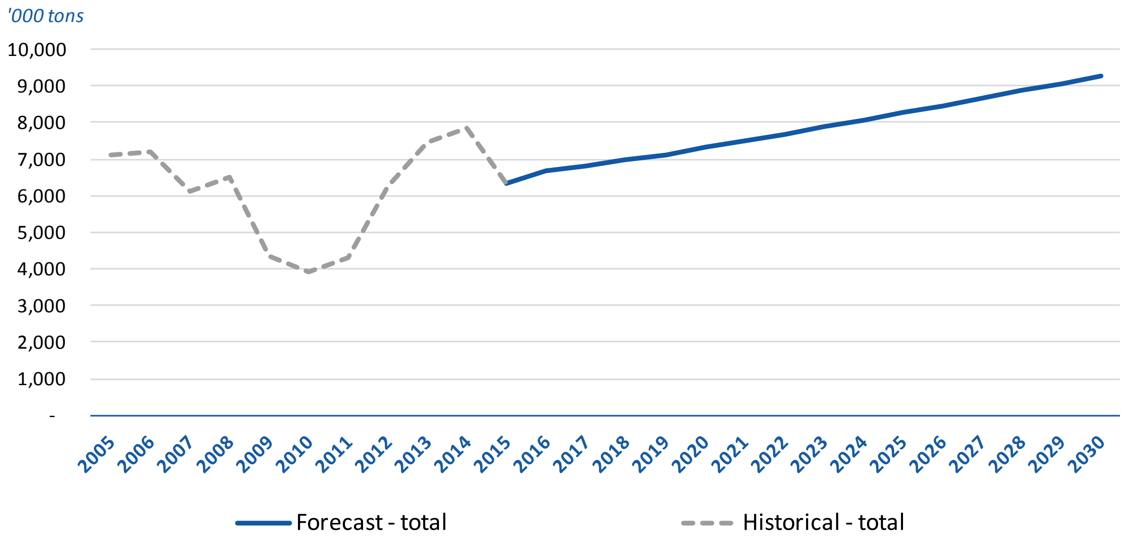
<u>Method and Preconditions</u>

The forecast of the volume of coal depends on the trade (see Appendix 4-V):

- The import of coal is mainly linked to thermal coal. Given the high correlation between the import volume growth, and GDP and population growth, these variables were used to forecast the import volume of coal. The precondition of the forecast is mainly driven by the IMF forecast for both variables.
- The export of coal is mainly driven by the demand for coal in Bulgaria, Iran, Israel, Italy, Lebanon, Morocco, and Turkey. The GDP and population growth in these regions are used as proxies for the forecast. The precondition of the forecast is mainly driven by the IMF forecast for both variables.
- The transit of coal is stable over time.

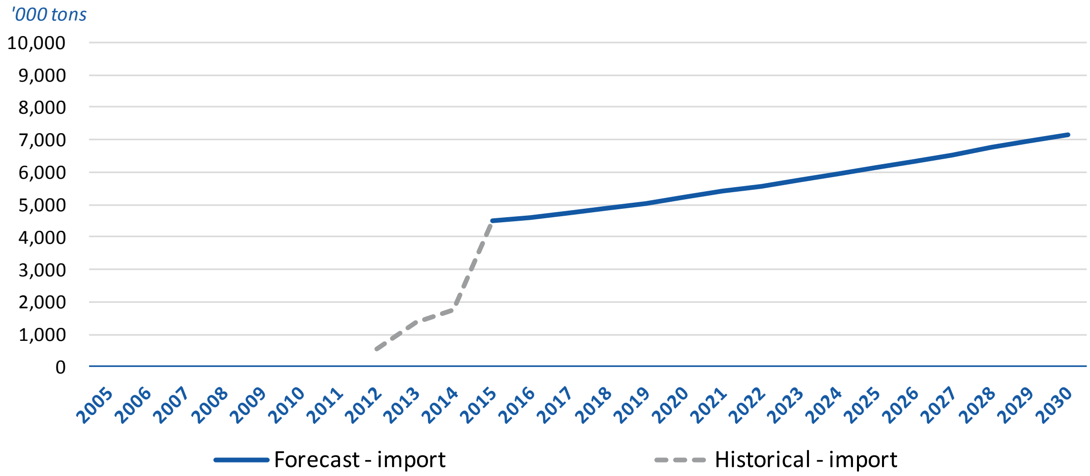
<u>Forecast</u>

Figure 4.6 provides the forecast for coal between 2016 and 2030. As illustrated in the previous section, it is expected that the total volume will increase from 6.3 million in 2015 to 9.3 million in 2030. This is an annual increase of 2.63% (CAGR 15 years).



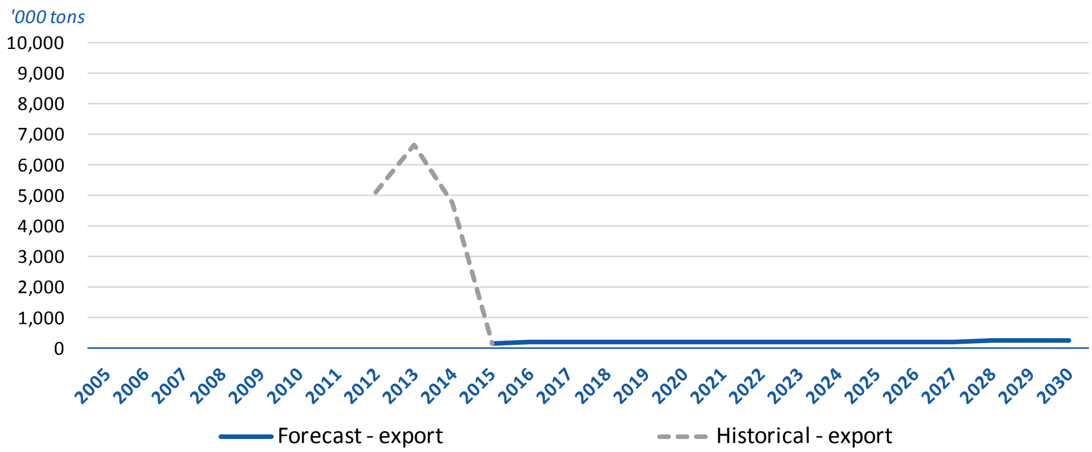
Source: JICA Survey Team

Figure 4.6 Forecast for Coal in the Four Main Ports in Ukraine



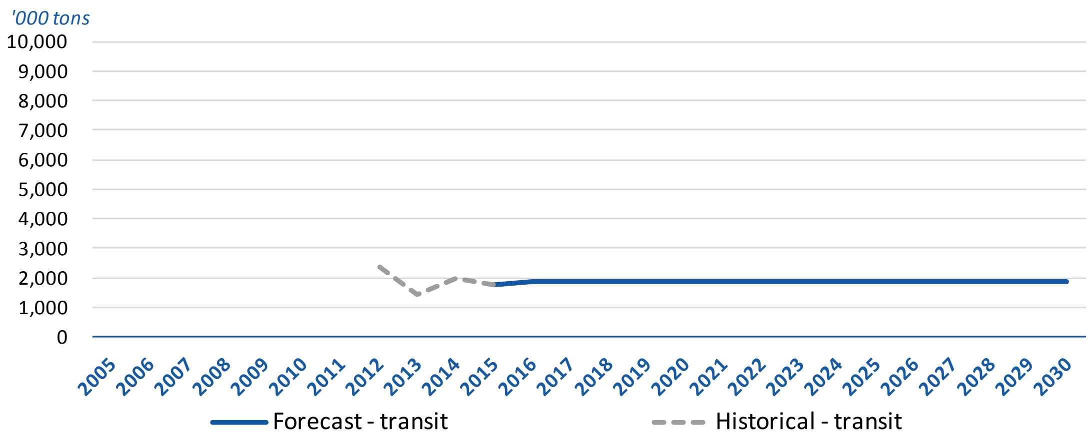
Source: JICA Survey Team

Figure 4.7 Forecast for Coal Import in the Four Main Ports in Ukraine



Source: JICA Survey Team

Figure 4.8 Forecast for Coal Export in the Four Main Ports in Ukraine



Source: JICA Survey Team

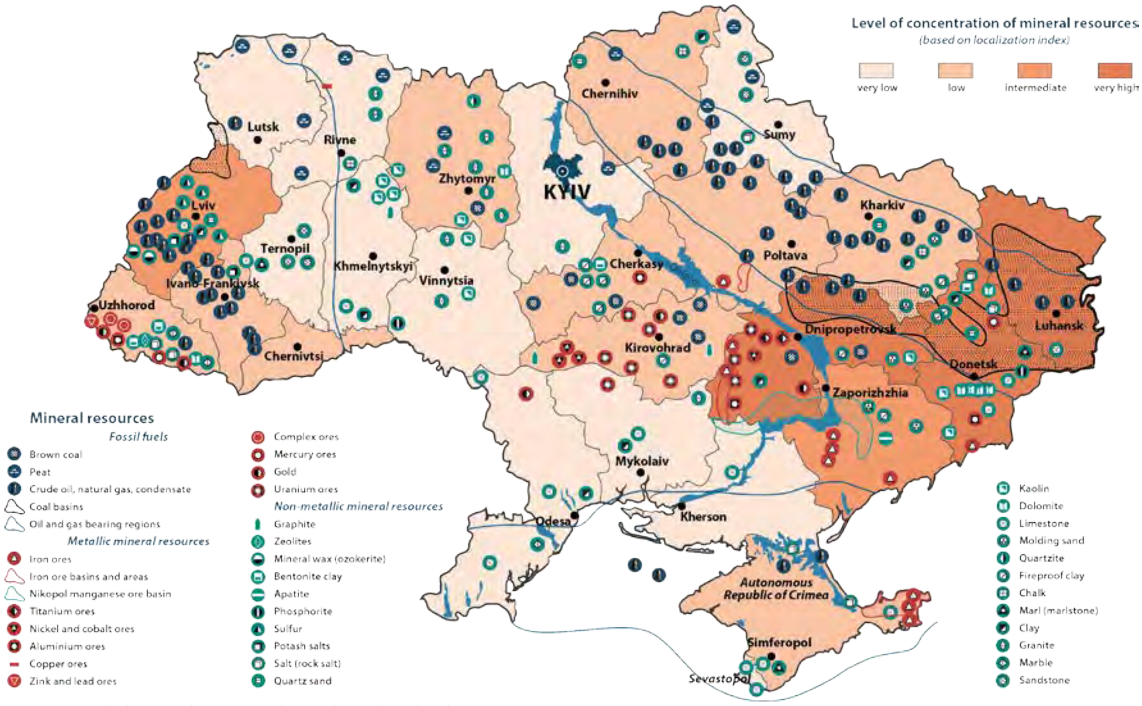
Figure 4.9 Forecast for Coal Transit in the Four Main Ports in Ukraine

(2) Metal Ore and Finished Metal Products

Historics

The key production input for ferrous metallurgy in Ukraine is the iron ore. For instance, combined iron ore and coke comprise around 50% of a steel billet cost. Apart from iron ore and coking coal, scrap and ferroalloys form around 17% of a steel billet cost. Ukraine is fully self-sufficient in iron ore supply, somewhat reliant on coking coal and significantly reliant on non-ferrous ores supply being a net importer of non-ferrous ores required for production of ferroalloys.

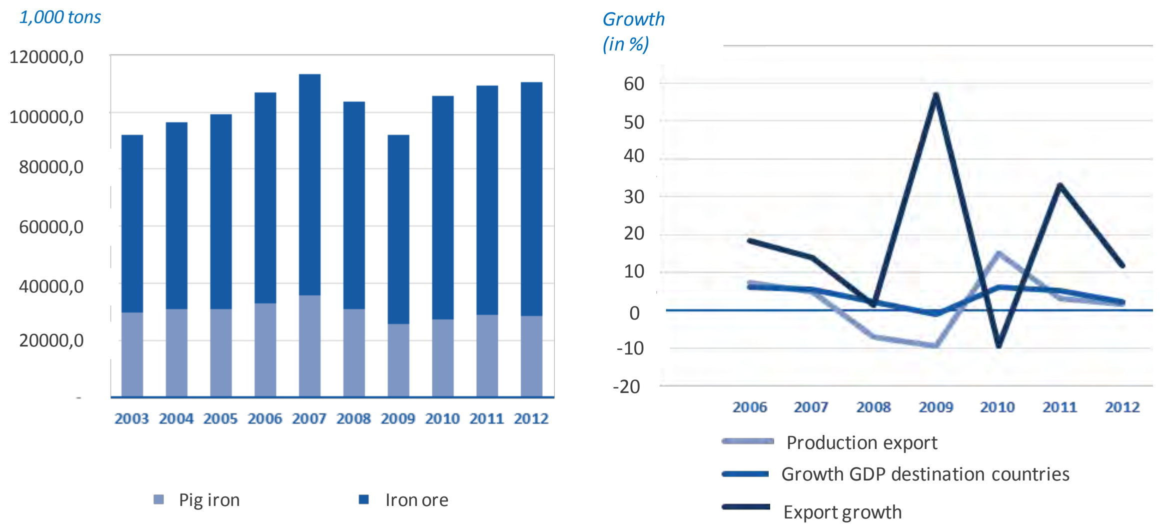
The Ukrainian iron and steel industry is concentrated in central (Dnipro, Kryvyi Rih, Nikopol), southern (Zaporizhia) and eastern (Donetsk Basin, Mariupol) regions of Ukraine (as visualized on the map in Figure 4.10).



Source: Ministry of Economic and trade Ukraine

Figure 4.10 Mining Locations in Ukraine

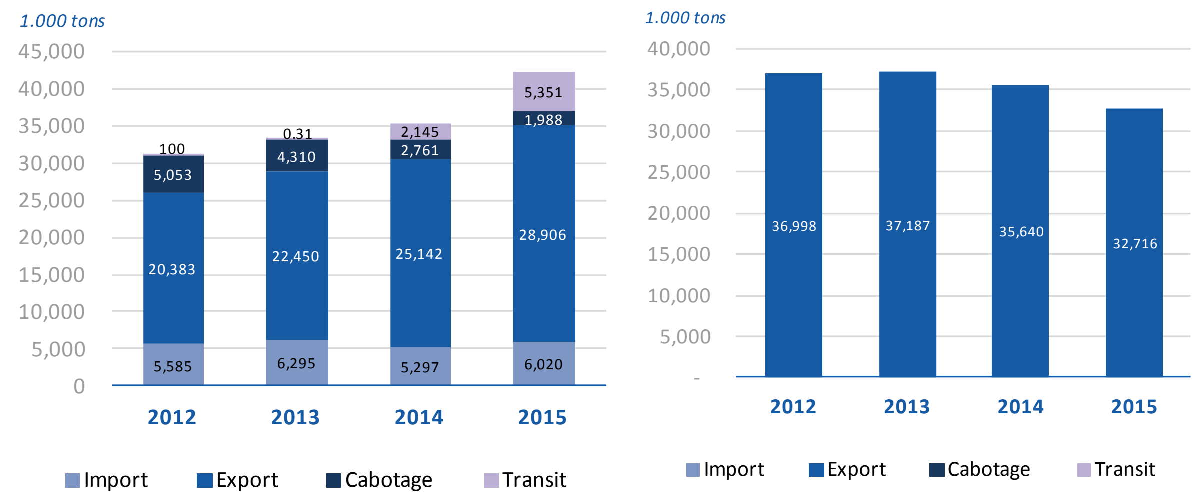
According to Indexmundi statistics, the production and export of metal ore follows the GDP growth in the main countries of destination for metal ore (see Figure 4.11).



Source: USPA statistics

Figure 4.11 Production Metal Ore, Export Metal Ore and GDP Growth

Parallel to the production of metal ore, the volume handled in ports increased with around 10 million tons per year. The export of steel products remained rather stable (around 35 million tons per year). The import of metal ore products remained rather stable (import of metal types that are not mined in Ukraine, for production of different metal products).



Source: USPA statistics

Figure 4.12 Handling of Metal Ore (left) and Metal Products (right) in the Ukrainian Port System

More than 95% of the metal products (in both dry bulk and as general cargo) are handled in the four major ports in the Southern Region in Ukraine. Cabotage and transit volumes are rather stable and account for 15% of the total volume. However, cabotage volume is limited in the Southern Region.

The volume in the Southern Region is structured as follows (in 2015):

- > 99% of total import volume, which accounts for 19% of the volume;
- > 94% of total export volume, which accounts for 75% of the volume;
- > 96% of total transit volume, which accounts for 5% of the volume; and
- 10% of total cabotage volume, which accounts for 1% of the total volume.

Metal products are for 60% handled in the Southern Region, mainly in Odessa (66%) and Mykolaiv (38%).

Dynamics – Value Drivers

The value drivers that determine the volume of metal differ per direction:

- Export: As visualized in the previous section he main driver for production and export of metal ore and metal products is the GDP growth (correlation >80%) in destination countries (China, Turkey, Italy, United States). The GDP outlook is based on the IMF forecasts for GDP.
- Import is mainly driven by the metal production sector. Hence the GDP growth is a good proxy to forecast, as it corresponds to more than 25% of the total GDP of Ukraine. The GDP outlook is based on the IMF forecasts for GDP.
- Transit and cabotage volume is insignificant compared to the total volume.

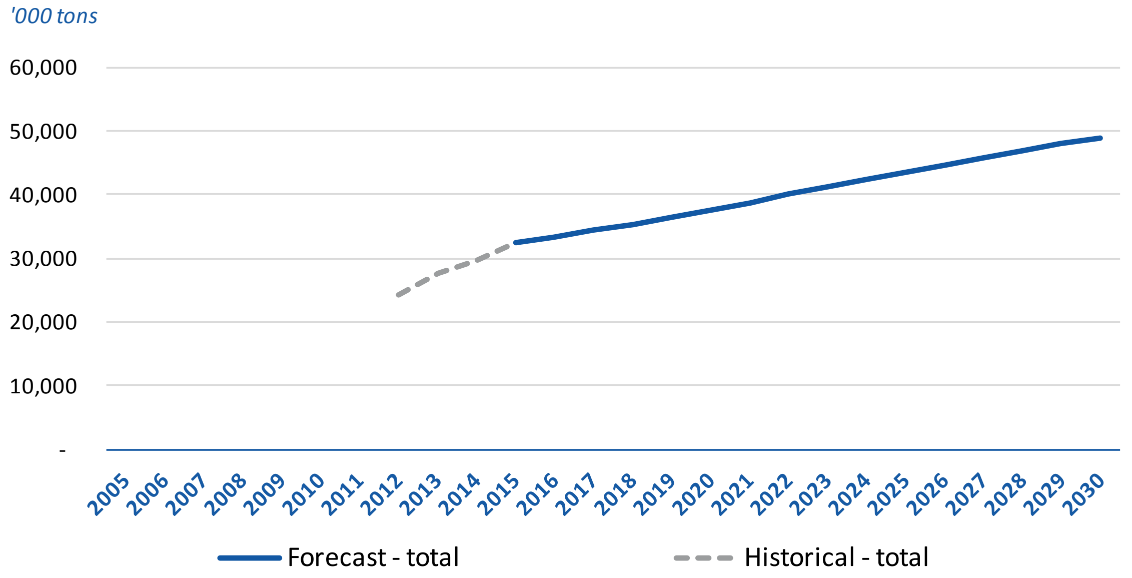
Method and Preconditions

The forecast of the volume of metal products depends on the trade (see Appendix 4-V):

- For the export side, the forecast is mainly driven by the demand for metal products in China, Turkey, Italy, and the United States. The demand for steel in these markets is mainly driven by the GDP evolution in these countries (correlation >80%). The GDP outlook is based on the IMF forecasts for GDP; and
- For the import side, the forecast is mainly driven by the metal production sector. Hence the GDP growth is a good proxy to forecast, as it corresponds to more than 25% of the total GDP of Ukraine. The GDP outlook is based on the IMF forecasts for GDP.

Forecast Metal Ore

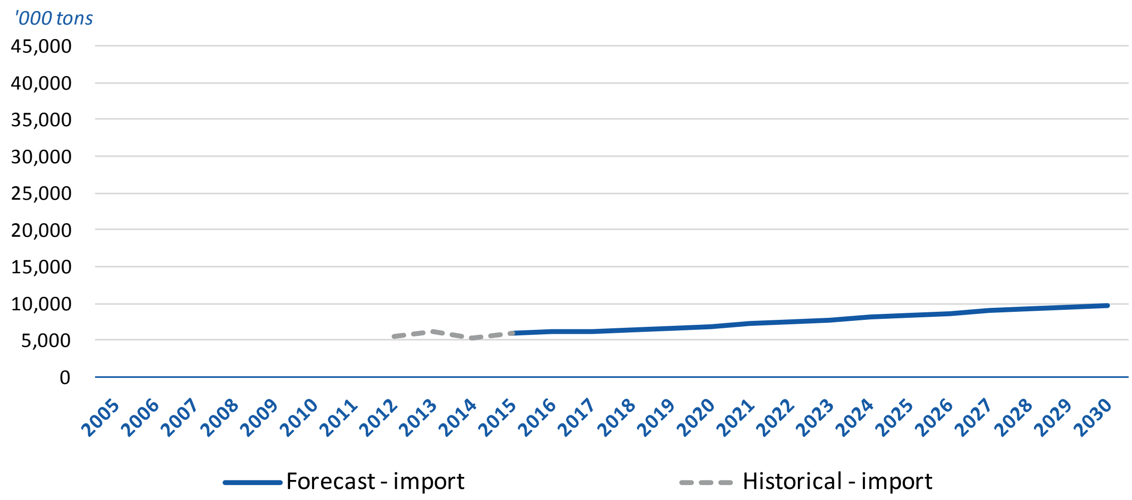
Figure 4.13 provides the forecast for metal ore between 2016 and 2030. It is expected that the total volume will increase from 32 million in 2015 to 49 million in 2030. This is an annual increase of 2.78% (CAGR 15 years).



Source: JICA Survey Team

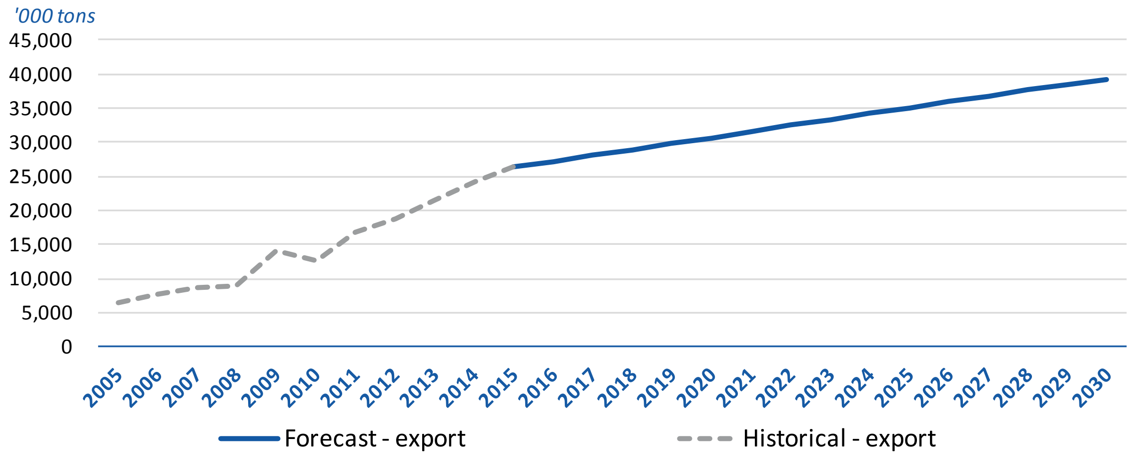
Figure 4.13 Forecast for Total Throughput Volume of Metal Ore

Given the large capacity for metal ore in the Southern Region of Ukraine, it is expected that the Southern Region becomes the main region for handling metal ore. More specific, it is expected that the Port of Yuzhny will be/remain the focal point for import and export of metal ore given its depth advantage over other ports.



Source: JICA Survey Team

Figure 4.14 Forecast for Total Import Volume of Metal Ore

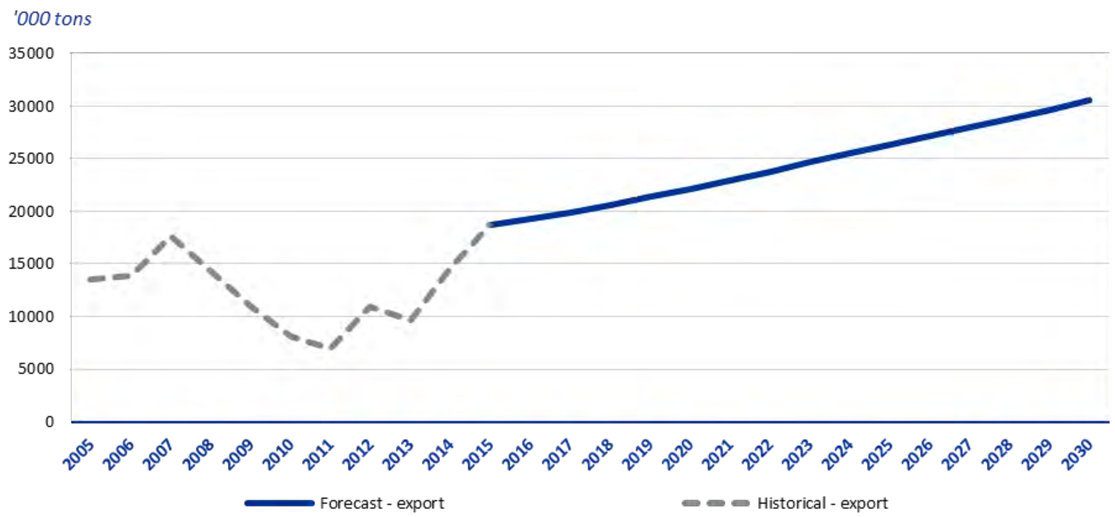


Source: JICA Survey Team

Figure 4.15 Forecast for Total Export Volume of Metal Ore

Metal Products

Figure 4.16 provides the forecast for metal products between 2016 and 2030. As illustrated in the previous section. The export volume equals the total volume, as import as break bulk is limited.



Source: JICA Survey Team

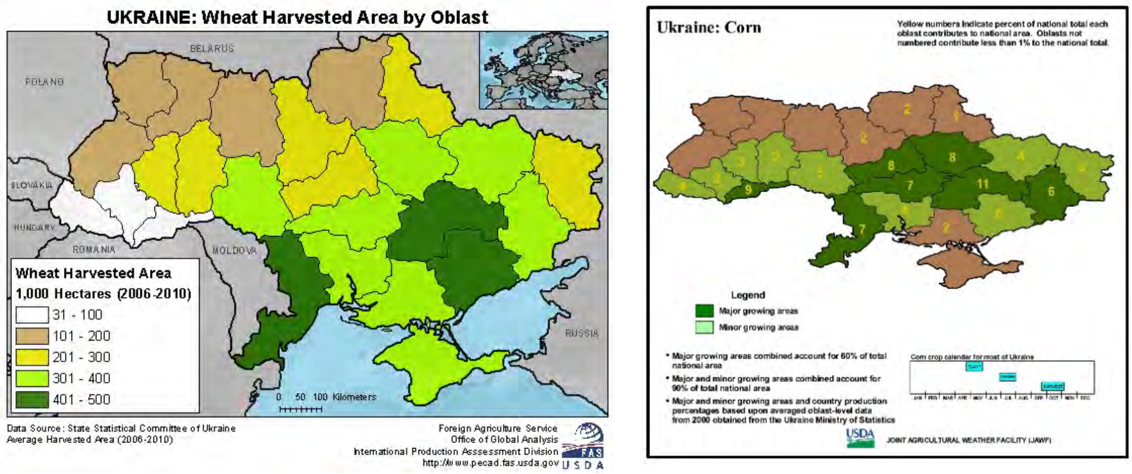
Figure 4.16 Forecast for Metal Products

(3) Grain Products

Historics

Ukraine is one of the largest grain suppliers worldwide. Import of grain is insignificant.

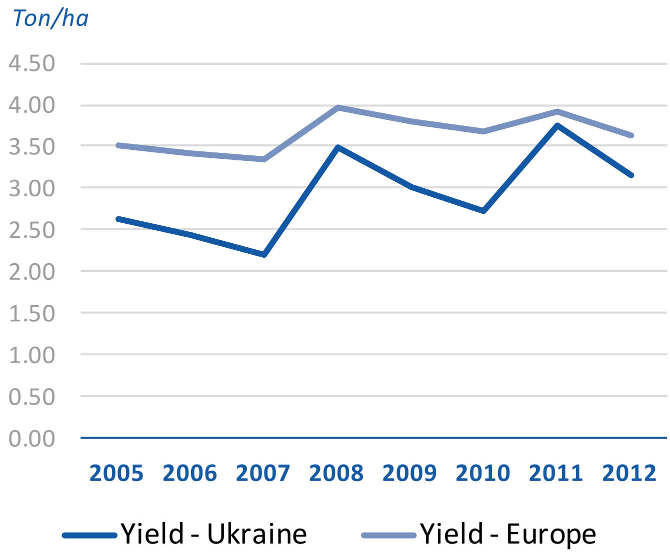
The production of grain products is particularly concentrated in the Southern, Central and Eastern part of Ukraine, as visualized in Figure 4.17.



Source: USDA

Figure 4.17 Production of Grain Products in Ukraine

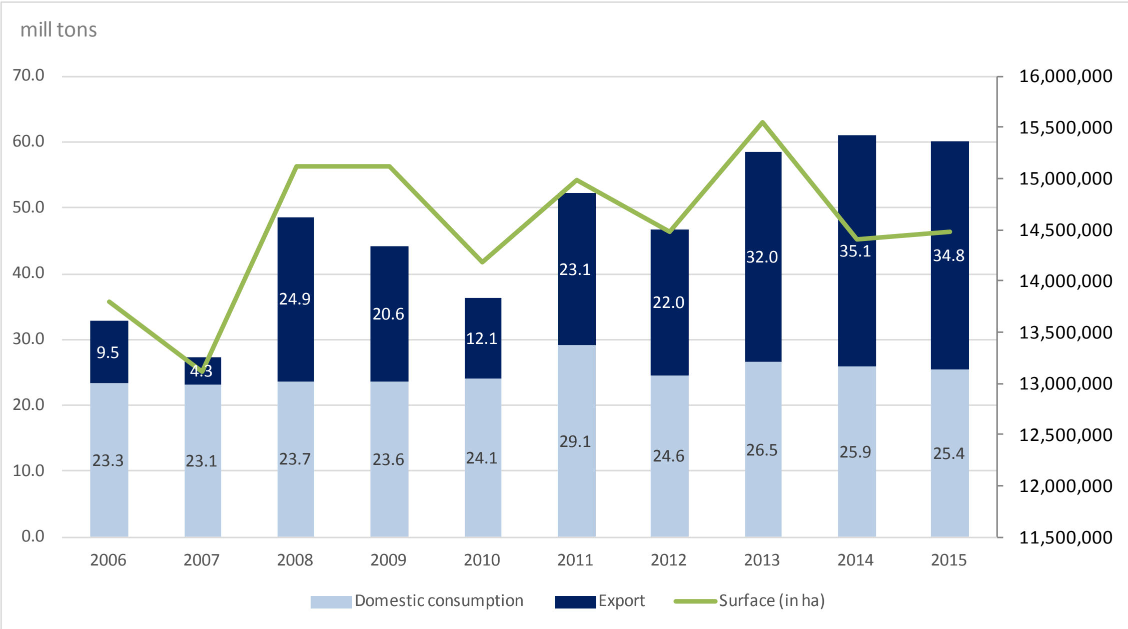
FAO statistics illustrate that the productivity in Ukraine increases (increase of 1 ton/hectare in 5 years). The yield is close to the average yield in Europe (3.5 ton/hectare).



Source: FAO statistics

Figure 4.18 Comparison of Yield between Europe and Ukraine

Furthermore, the surface used to harvest grain products fluctuates around 14.5 and 15.5 million hectares, which allows a yearly production of around 60 million tons. As visualized in Figure 4.19, the domestic consumption is rather stable and fluctuates around 26-28 million tons; the recent surplus of 32-35 million tons is for export.

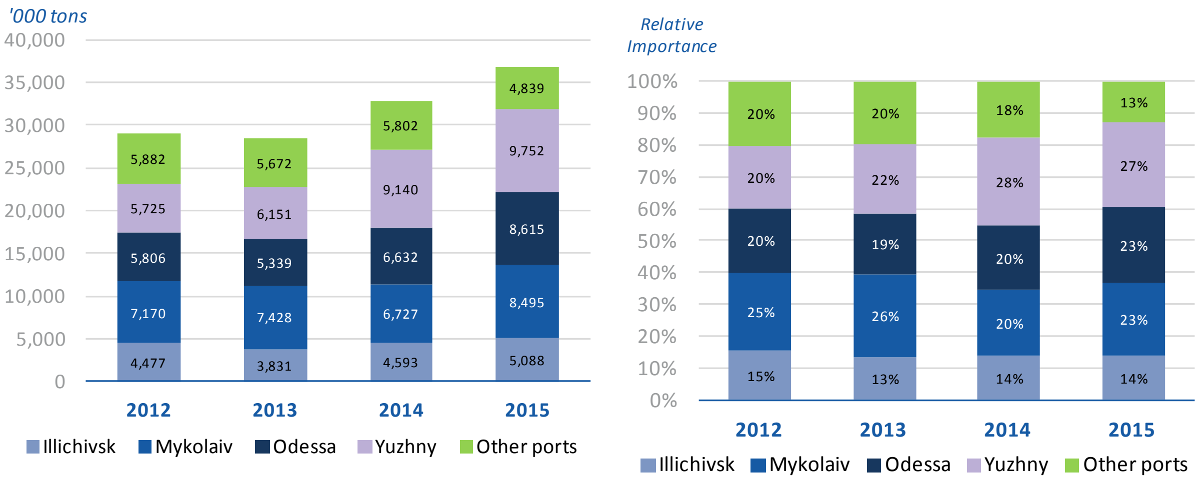


Source: JICA Survey Team, USDA GAIN Report UP1609

Figure 4.19 Production and Consumption of Grain Products in Ukraine[3]

Of these 35 million tons, most was exported through the Ukrainian seaport system (as visualized in Figure 4.20).

More than 85% of grain is handled in the four major ports in the Southern Region of Ukraine.



Source: USPA statistics

Figure 4.20 Handling of Grains in the Ukrainian Port System

3 The grain production volume in Figure 4.19 counts the volume in the crop fields in each harvest year. The grain export volume in Figure 4.20 and others count the volume in the seaports; therefore there is a small gap between the figures, due to the timing of the export. These figures do not include oilseeds production; therefore there is a small gap from Figure 5.4.

Dynamics – Value Drivers

As illustrated in the previous section, grain is used for domestic consumption and export by port or other ways of transport.

Production depends on:

- The surface used for crops: expected to be stable over time, i.e. 14.5 million hectares (10-year average); and
- The yield: expected to increase with 0.08 tons/hectare/year (historic regression of time series of yield in Ukraine, based on FAO statistics). Yield is capped to 8.5 tons/hectare which is the average Western-European yield.

The growth of domestic consumption depends on the Ukrainian population growth (based on IMF statistics).

The export is the difference between production and consumption (stocks are not taken into consideration in the forecast).

- The share of export through major ports in the Southern Region is estimated to slightly increase from 87% in 2015 to 90% in 2030 (as other ports will still be used for the export of grain).

Method and Preconditions

The forecast of the export volume of grain depends on the estimation of the internal production, consumption (see Appendix 4-V).

The internal production forecast exists of a yield forecast and a forecast of surface used for crops:

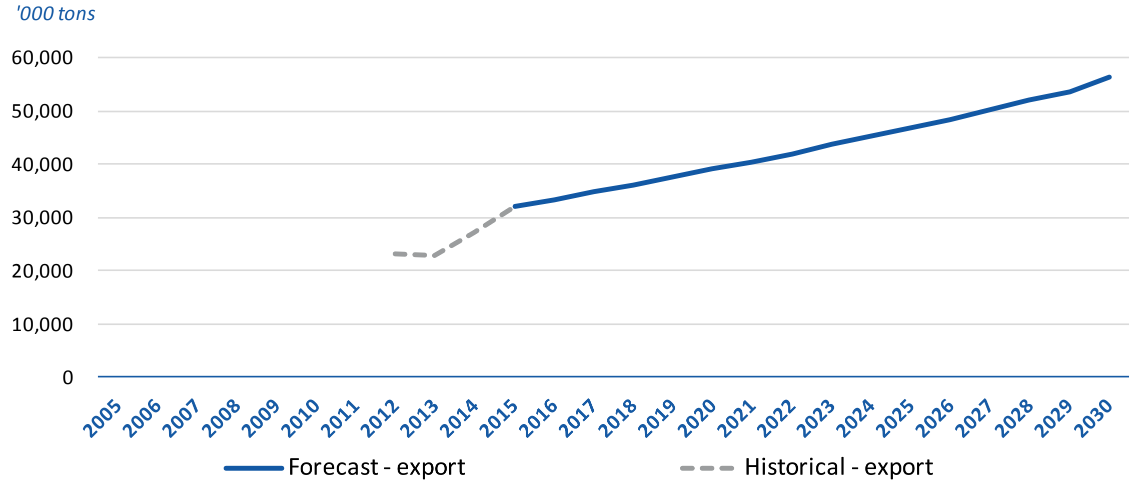
- It is expected that the yield will increase with 0.08 tons/hectare/year (historic regression of time series of yield in Ukraine, based on FAO statistics). Yield is capped to 8.5 tons/hectare which is the average Western-European yield; and
- It is expected that the surface for crops will remain stable over time, i.e. 14.5 million hectares (10-year average).

Population growth is used to estimate the consumption of grain in Ukraine (IMF forecast).

The export is the difference between production and internal consumption.

Forecast

Figure 4.21 provides the forecast for grain products between 2016 and 2030 in the major ports in the Southern Region of Ukraine. It is expected that the total volume will increase from 32 million tons in 2015 to 56 million tons in 2030. This is an annual increase of 3.84% (CAGR 15 years).



Source: JICA Survey Team

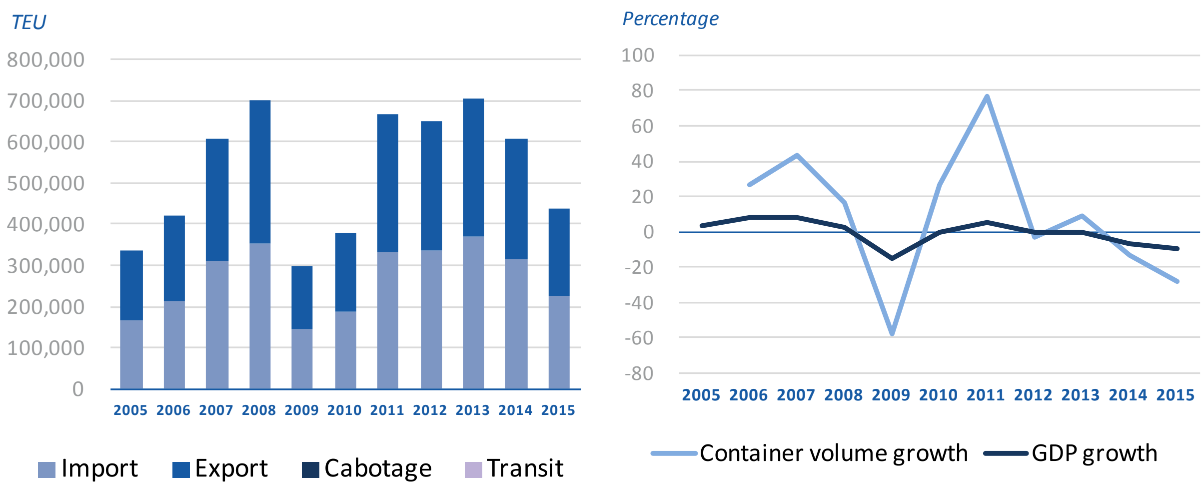
Figure 4.21 Forecast for Grain Products in Southern Ukraine

The market share development between the four ports depends on the capacity developments within the ports and constraints in the port access (both rail and road).

(4) Containers

Historics

The total throughput of containers in Ukraine fluctuated significantly between approximately 300,000 TEU[4] (in 2005 and 2009) and 700,000 TEU (in 2008 and 2013). The statistics illustrate a perfect relationship (correlation = 0.99) between the volume growth and the GDP growth during the last decade (with the exception of the years 2009, and 2011).

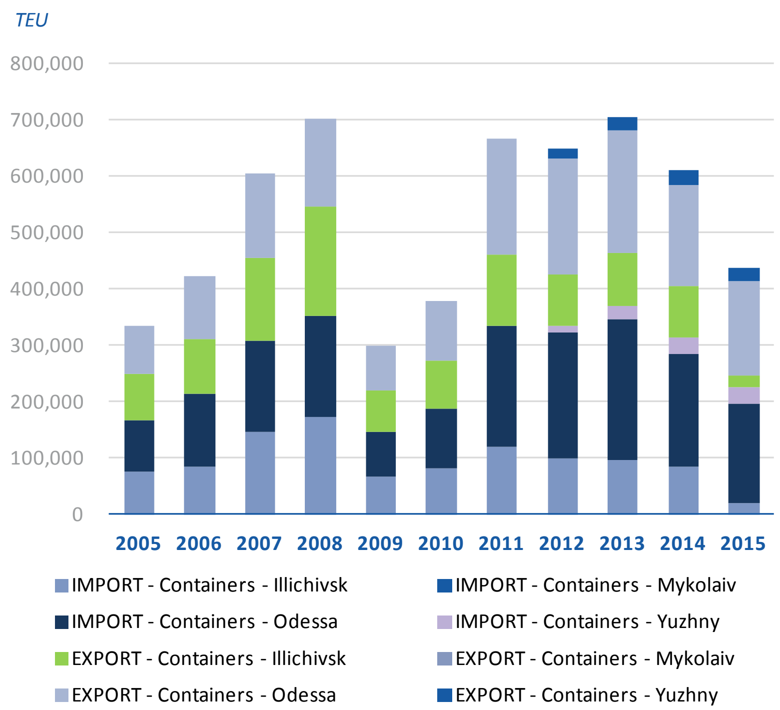


Source: USPA statistics

Figure 4.22 Container Volume in Ukraine (Major Ports)

Container volumes are concentrated in the ports of Odessa (80% in 2015), Illichivsk (10% in 2015) and Yuzhny (10% in 2015).

[4] Twnty-foot Equivalent Unit (hereinafter, TEU)



Source: USPA statistics

Figure 4.23 Container Volume in Ukraine per Port

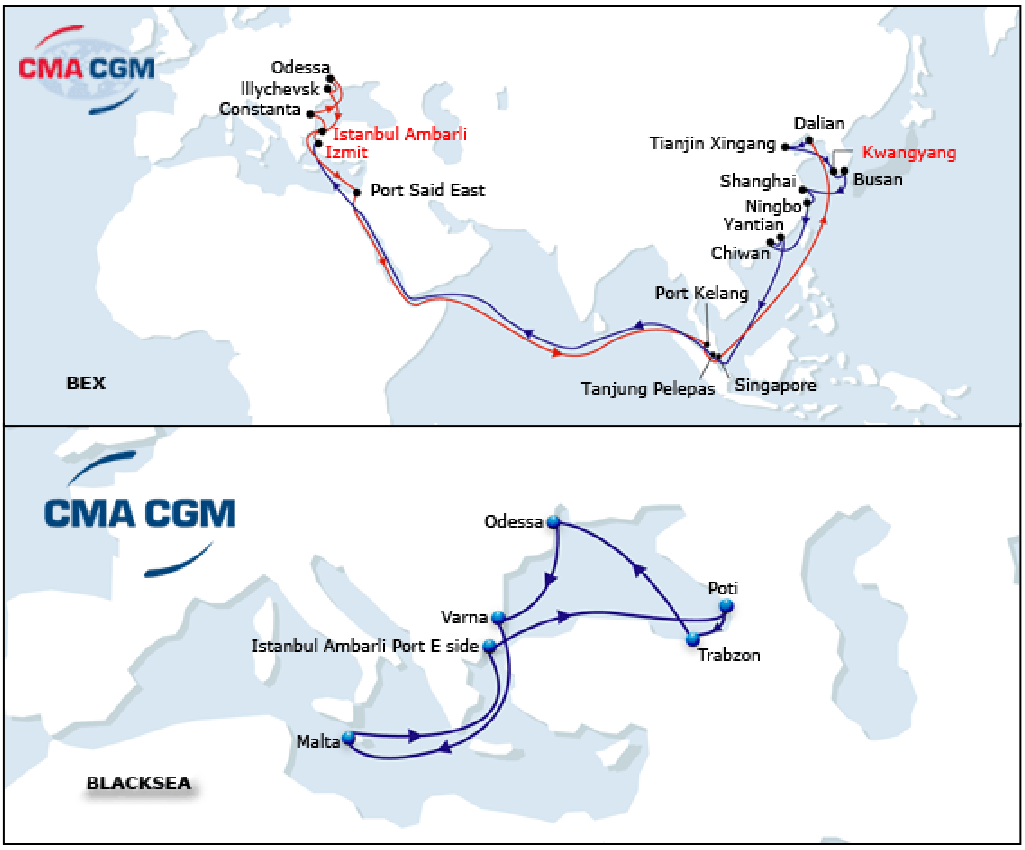
Shipping characteristics

The current shipping characteristics for the three main container ports in Ukraine are mostly based on feeder services from the major shipping lines. These services are largely carried out using 4,000 to 5,000 TEU vessels on a Black Sea route from Malta, Piraeus or one of the Turkish ports in the Sea of Marmara.

Prior to the 2008 economic crisis, large vessels (>8,000 TEU) on the East-West trade called at Illichivsk and Odessa, but due to the reduced container demand, the number of direct calls decreased after 2008. This was also caused by changing shipping characteristics on the main East-West routes: vessels of over 10,000 TEUs were introduced on many services and these vessels are unable to cross the Bosporus strait[5].

Recently, some of the lines have started to operate dedicated ‘Bosporus Max’ vessels, allowing for a direct service with larger vessels to the Black Sea. An example is CMA-CGM’s 9,400 TEU vessel Danube which made her maiden voyage from China in June 2014. This vessel class operates CMA’s Bosporus Express service, directly connecting Asia, Turkey and the Black Sea. Similar services are carried out by Maersk (AE3 & ECUMED), ZIM and OOCL (EMX). The following Figure provides an example of the two types of services that are calling in the Black Sea region: the dedicated direct lines and the feeder services from the East Mediterranean.

[5] “An Economic and Institutional Analysis of Multi-Port Gateway Regions in the Black Sea Basin”, Grushevska, K. and Notteboom, T., Journal of International Logistics and Trade, August 2014.



Source: CMA CGM

Figure 4.24 Dedicated Direct Lines and the Feeder Services from the East Mediterranean

<u>Dynamics – Value Drivers</u>

As illustrated in the previous section, the GDP growth is a good estimator for the container throughput in Ukraine. In 2015 the container volume multiplier was 2.9 (relationship between the annual growth rate of the container volume and the domestic GDP). Compared to well developed countries, 2.9 is rather high, but normal given the growth potential in Ukraine.

Based on these dynamics, the container volume depends on:

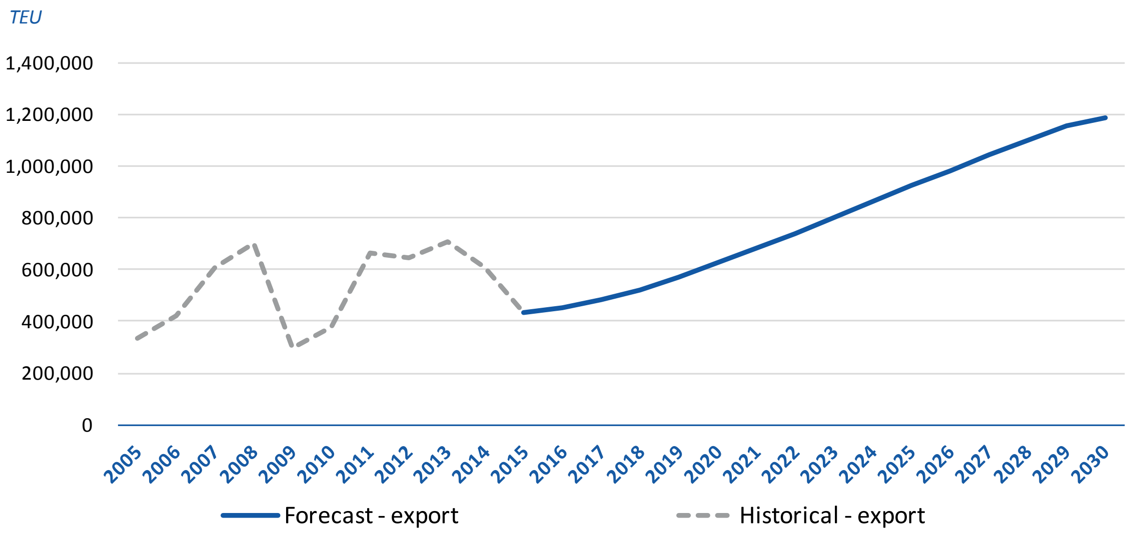
- The GDP growth in Ukraine (IMF forecast);
- The multiplier, which is expected to decrease over time from 2.9 in 2016 to 1.5 (average in developed countries) in 2030.

<u>Method and Preconditions</u>

The macro method is used to forecast the container volume in the Southern Region of Ukraine (see Appendix 4-V). This method is chosen over the micro method, as information/data on a commodity level is missing (cf. statistics of USPA).

<u>Forecast</u>

Figure 4.25 provides the forecast for container throughput between 2016 and 2030 in the major ports in the Southern Region of Ukraine. The increase in volume leads to an increase of container volume/capita from 0.01 TEU/capita to 0.03 TEU/capita.



Source: JICA Survey Team

Figure 4.25 Forecast for Container Throughput in the Southern Region of Ukraine

It is expected that the Port of Odessa will remain the incumbent for container throughput (80% of the volume).

4.4.3 Conclusions – Main Forecast Results

Following table lists the volume forecasts for the main commodity types.

Table 4.3 Volume Forecast at Major Ports

Commodity	Port	Volume 2015	Volume 2030	Difference	CAGR (15 years)
Coal (million tons/year)	Mainly Yuzhny (Mykolaiv for transit)	6.3	9.3	+3.0	+2.63%
Metal ore (million tons/year)	Mainly Yuzhny (small volumes (import) via Illichivsk and Mykolaiv)	32.4	48.9	+16.5	+2.78%
Metal products (million tons/year)	Odessa and Mykolaiv	18.7	30.6	+11.9	+3.34%
Grain (million tons/year)	All four ports	32.0	56.3	+24.3	+3.84%
Containers (in ’000 TEU/year)	Mainly Odessa (small volumes in Illichivsk and Yuzhny)	437	1,187	+750	+6.89%

Source: JICA Survey Team

Based on these forecast results, four patterns become visible:

1. **A shift in the trade pattern of coal**: a shift towards an import-oriented trade, and a focus on thermal coal (import) instead of metallurgical coal (export). This shift caused a shift in the origin/destination of coal from a nearby trade with Russia to a more transatlantic trade. This trade necessitates an increase of the berth capacity for coal and size/depth in the Ukrainian ports to attract large vessels (Capesize vessels) instead of the actual smaller vessels (inefficient).

2. **Stable export volumes for metal ore**. Due to the geo-political conflict in Ukraine the volume of metal products decreased significantly. Nevertheless, the world market for metal ore increases: an increase of the annual volume by 50% is expected in 15 years' time.
3. **A stable growth of the export volume of grain products**. In accordance with the changing markets in coal products, the grain market shifted as well (ban for export to Russia). Hence, for these grain products, deeper ports are needed to attract larger bulkers. Furthermore, due to an increase of the productivity in the Ukrainian grain sector combined with a preference to export by vessel instead of road/rail, it is expected that the grain volume will double in 15 years' time.
4. **The container market is defined by its rather unpredictable growth pattern**. This has led to an overcapacity in the market (e.g. container terminals in Illichivsk and Yuzhny are not operated). Nevertheless, following the IMF outlook for Ukraine, it is expected that the container volume will increase significantly from approximately 400,000 TEU/year in 2015 to 1.2 million TEU/year in 2030.

These results highlight two most urgent needs in the Ukrainian port sector:

1. The need to accommodate **larger bulk vessels** (deeper draught berths and deeper access channels):
    a. For coal, because of shift in trade (larger vessels, but lesser calls);
    b. For metal ore, because of the economies of scale; and
    c. For grain, because of the economies of scale.
2. The need for **larger storage facilities** for dry bulk products.

4.5 Capacity in Major Ports: Actual Capacity and Capacity Needs

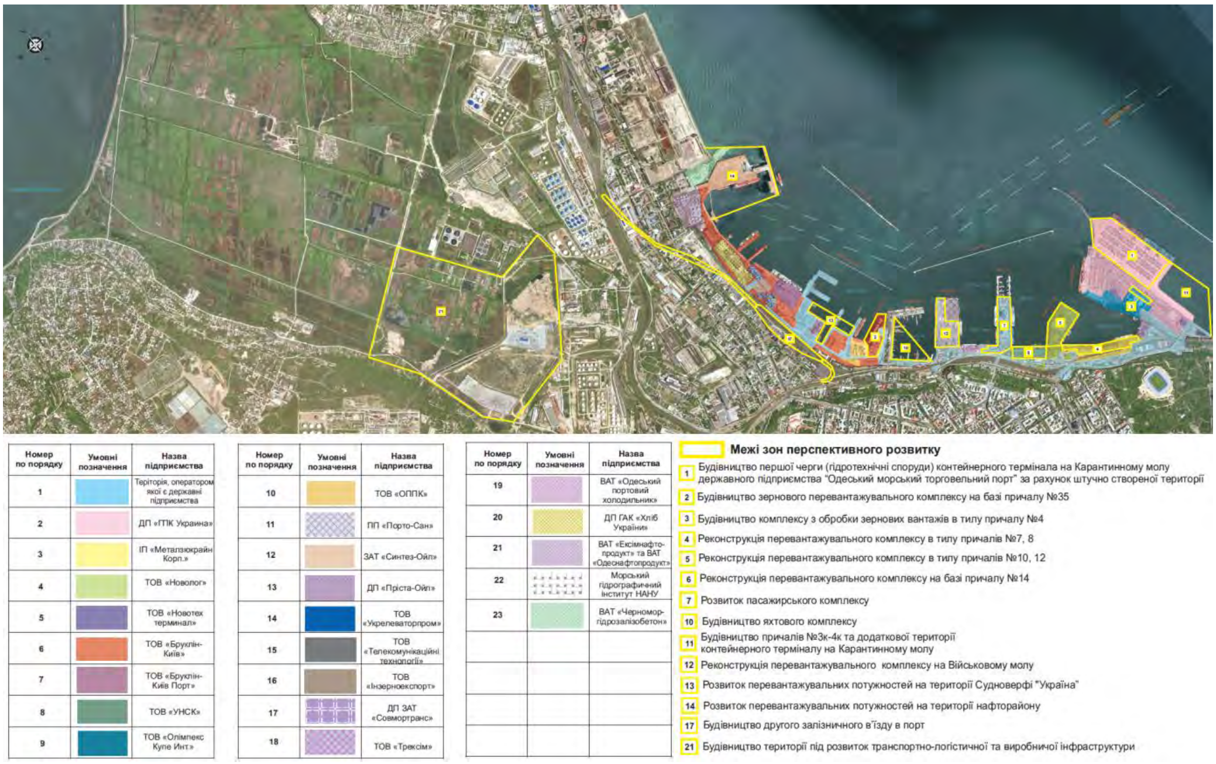
4.5.1 Current Capacity

This section discusses the capacity in the four major ports of Ukraine. The information provided in this section is based on desk research, presentations by the port authority (USPA) of all considered ports, and stakeholder interviews.

(1) Port of Odessa

The Port of Odessa is the main passenger and container port of the region. Furthermore, the port's technical capacities allow handling of more than **21 million tons of dry bulk** and **4 million tons of other bulk cargoes** annually. The port can handle **6 million tons of grain products per year**. The container terminals provide a handling capacity of over **900,000 TEU per year**. The passenger terminal is capable to serve up to 4 million tourists a year (USPA presentation).

Port of Odessa waters are bounded: in the south by parallel 46°25′N from the coastline to its intersection with meridian 30°54′E; in the east by meridian 30°54′E as far as the intersection with parallel 46°32′N and the coastline; in the west by the coastline and berth limits (USPA website).



Source: USPA website

Figure 4.26 Port of Odessa Plan

Ships enter and leave Port of Odessa via its Eastern, Western and Northern gates. The main canal of the Oil Harbor comprises the first and second canal's bends (width of first bends 100 meters, second – 140 meters, depths of the canal – 13.5 meters) (USPA website).

Technical dimensions of the port:

- Territory: 141 hectares;
- Number of berths: 55; and
- Extent of a berthing line: over 10,200 meters

Maximal vessel dimensions:

- Length - to 330 meters
- Width – to 40 meters, and
- Draught- to 13.0 meters

Port facilities
There are 55 protected berths with depths ranging from 6.2 up to 13.0 meters. The berthing line totals over 10 kilometers. The port has 8 terminals for handling dry cargoes, as well as passenger; oil and container vessels of 13.0 meter draft and 240 meter long are accommodated terminals, harbors and terminals to handle tropical and technical oils.

Port of Odessa Complexes:

- Oil Harbor;
- Grain Terminals;

- Production-handling terminal;
- Transit-Cargo Terminal;
- Passenger Terminal with exhibition center and hotel;
- Railway Service.

Storage Facilities
Port of Odessa's open storage area totals 425,070 square meter Sheltered warehouse area totals 6,042 square meters. There is the opportunity for simultaneous storage of more than 14,000 square meters.

Service of the port's facilities (USPA website):

- embarkation-disembarkation at the passenger terminal;
- rendering of services to freight and passenger vessels with own fleet;
- shipyard services;
- supplying with water at berths and at anchorage;
- stuffing and unstuffing of containers;
- taking off sewage, garbage etc.;
- granting of the passenger terminal exhibition hall for exhibitions, concerts and other events;
- other kinds of activities.

Operating system
The operating system in the port of Odessa depends on the type of cargo:

- Containers are mainly handled by a combination of gantry cranes (ship-shore), and rail or rubber tired gantry cranes on the terminal;
- Liquid bulk is handled in a conventional sheltered port system with storage areas (berths and jetties);
- Conventional cargo (mainly finished metal products) are handled by mobile harbor cranes (ship to shore and on shore); and
- Dry bulk is handled by self (un)loaders with hoppers directly on/from truck and/or rail or from/towards silos.

During the field interviews, two port projects were addressed (2038 Port Development Plan):

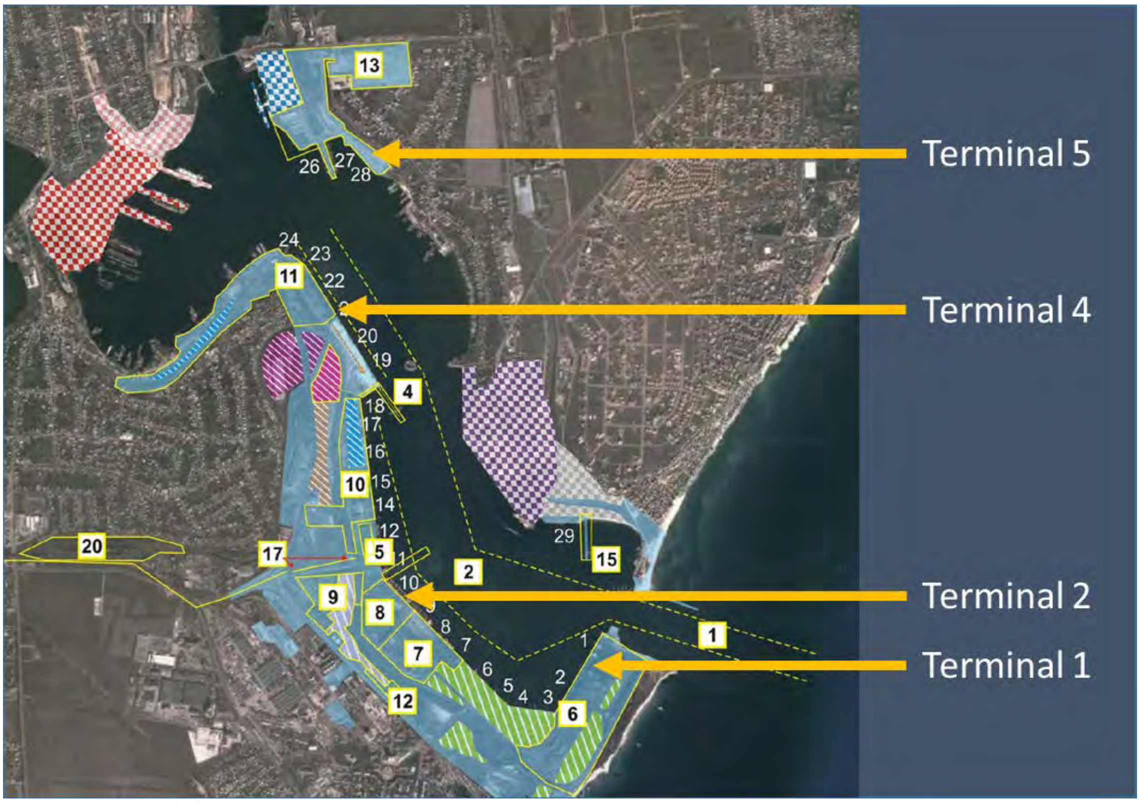
1. Container port development – reclamation of territory of 19 hectares; and
2. Berth of 650 meters and 15 meter depth, for an extra throughput capacity of 600,000 TEU/year.

The bottleneck for the Port of Odessa is that it is bounded by the city of Odessa. This hinders further developments of the port. The only possibility, to extend significantly the current port capacity is by the reclamation of land (cf. container terminals). Furthermore, extra volume will add traffic in to the city and rail network which are both already congested.

(2) Port of Illichivsk

The Port of Illichivsk includes 4 terminals. Port waters comprise inner and outer water areas. The maximum draft for the ships in the port is 12.0 meters[6].

[6] USPA Website



Source: USPA website

Figure 4.27 Port of Illichivsk Plan

The passage draught at the berths is announced by the Harbor Master and is reported to navigators and other interested persons. The port can accept vessels up to 275 meters in length (in some cases by permission of the Harbor Master of up to 300 meters). The length of the port's entrance canal is 1,400 meters, width of 160 meters and depth of 17.0 meters[7].

The port has facilities enabling to handle more than 32 million tons of cargo a year; about 6,000 meters of berths; storage areas that allow storage of 1.5 million tons for all kind of cargo; Outdoor storage of 575,000 square meters; Sheltered warehouses of 27,000 square meters; Railway infrastructure – 6 entrances to the port, more than 50 kilometers of railways in the port, handling of 1,300 wagons a day; Good road infrastructure with 5 gates to enter the port.

Specialized complexes and terminals:

- Multipurpose Terminals;
- Ample Container Capacities;
- Berths number 1–22;
- Multimodal Complex;
- Specialized Ore Complex;
- Socialized Complex for Sulfur Handling;
- Grain Handling Complex;
- Specialized Complex for Storage and Handling of Liquid Vegetable Oil;
- Fuel Terminal;
- Complex for Handling of Liquefied Gas (1st stage);

[7] USPA Website

- Plants Located Near CSP: Plant for Deep Proceeding of Agricultural Products, Chornomorsk Oil-and-Fat Integrated Plant (1st stage), Plant for Extraction of Vegetable Oil.

<u>Terminal 1 – Coal and Metal Ore, and Containers</u>

The first terminal is a universal cargo complex and has a wide range of cargo handling different nomenclature.

Source: USPA website

Figure 4.28 Photo of Port of Illichivsk (1)

Currently, the terminal is used for the handling of bulk cargo, iron, pellets, limestone, coal, and metal ore (sintering ore, manganese ore).

The terminal includes:

- Berth number 1 (length of 306 meters, with a design depth of 13.0 meter berth), which carried cargo operations of large vessels with deadweight of 125,000 tons or more, up to 14.0 meter draft; and
- Berth number 2 (length of 300 meters, with a design depth of 11.5 meter pier) where the processed bulk cargo, mainly in the export direction for vessels with deadweight of 50,000 tons of the final draft of 11.2 meters.

The maximum capacity of the terminal is between 4.8 million tons to 5.4 million tons per year.

Berthing front and warehouse space equipped with rail tracks number 36; 39; 40; 42; 43; 85; 86; 87; 88.

The total area of the terminal is 192,378 square meters, including warehouse space of 76,600 square meters.

Berths 3, 4 and 5 handle general cargo (unitized and non-unitized).

Terminal 2 – Metal Ore

The second terminal is connected by road, sea and rail transport modes. Given the location of the terminal - directly at the quay – allows the handling of containers, bulk and general cargo.

Source: USPA website

Figure 4.29 Photo of Port of Illichivsk (2)

Specifications Terminal 2

- Berth number 7: length of 220 meters and depth of 8.5 meters (projected depth 9.75 meters).
- The terminal can accept vessels tonnage to 25,000 tons. Length of 200 meters, a width of up to 32 meters. The capacity of the Berth number 7 is 1,100,000 tons/year.

Production features:

- Open areas with total area of 122,258.9 square meters;
- Developed network of railway sidings;
- Easy car access roads;
- The crane equipment of various capacities (10-20 tons);
- Loading machines and handling capacity from 1.5 to 16 tons;
- Automobile stationary scales g / p 30 tons;
- Mobile portable weight g / p 40 tons;
- Gage railway weight g / n 150 tons;
- Overload capacity is about 1.6 million. Tons of cargo a year.

The main production area is 12.2 hectares.

The volume of simultaneous storage warehouses are more than 350-400,000 tons.

Types of goods:
- Export - ore, coal, metal scrap, refractory clay, and grain; and
- Import - coal, coke energy, spar field, miscellaneous equipment.

Terminal 4 – General Cargo

The third terminal includes two berths: Berths number 21 and 22.

Source: USPA website

Figure 4.30 Photo of Port of Illichivsk (3)

Current operations are carried out by inefficient loading technology using bucket loaders and mobile harbor cranes on the berth.

Terminal 5

Terminal 5 is a rather unique terminal in the Ukrainian port sector: it specializes in RoRo vessels. The terminal has a surface of more than 36 hectares and includes a multimodal complex (Trucks and rail), and the AVTOPOROMNY complex.

Source: USPA website

Figure 4.31 Photo of Port of Illichivsk (4)

The multimodal complex is located at Berths number 26, 27, 28 which are equipped with two lifting bridges for railways wagons for loading and unloading ferries.

The capacity is:

- 1 million tons of cargo in wagons (rail);
- 150,000 loaded trucks; and
- 250,000 cars.

Operating system
The operating system in the Port of Illichivsk depends on the type of cargo:

- Containers are mainly handled by a combination of gantry cranes, or mobile harbor cranes (ship-shore), and rail or rubber tired gantry cranes on the terminal;
- Grain products is handled by self (un)loaders with hoppers directly on/from truck and/or rail or from/towards silos; and
- Other dry bulk is handled by revolving grab cranes.

(3) Port of Yuzhny

Today, the port is one of the most promising hubs of Ukraine, which is located on the banks of Ajalyk estuary in the north-west coast of the Black Sea. The port's capacity can handle more than 47.5 million tons of various cargoes per year.

The high competitiveness of the port to other ports of Ukraine is conditioned by its geographical location, year-round guarantee safe navigation and uninterrupted cargo operations. The depth (−18.0 meters CD) of the approach channel and at the berths allows acceptance of the larger fleet with a total load capacity of up to 200,000 tons.

Source: USPA Yuzhny presentation

Figure 4.32 Port of Yuzhny plan

Port facilities

Total length of berths is approximately 3 kilometers. The port has two cargo handling areas, three railway stations that are on Odessa Railway line, namely: Beregovaya, Chimicheskaya and Promyshlennaya. These stations are connected to the outer railway system through Chernomorskaya Station. The inner port roadways are connected to Odessa– Mykolaiv highway. Port berths are connected to the access railway lines and equipped with gantry cranes of rated lifting capacity up to 84 tons. Cargo handling operations may be performed 24 hours a day, Sundays and holidays included.

The port is open to navigation all year round.

Storage Facilities

There are 185,500 square meters of open storage areas in the port. The area of sheltered warehouse comprises 2,000 square meters.

Operating system

The operating system in the Port of Yuzhny depends on the type of cargo:

- Containers are mainly handled by a combination of gantry cranes (ship-shore), and rubber tired gantry cranes on the terminal;
- Grain products is handled by self (un)loaders with hoppers directly on/from truck and/or rail or from/towards silos; and
- Other dry bulk is handled by revolving grab cranes.

Stevedoring

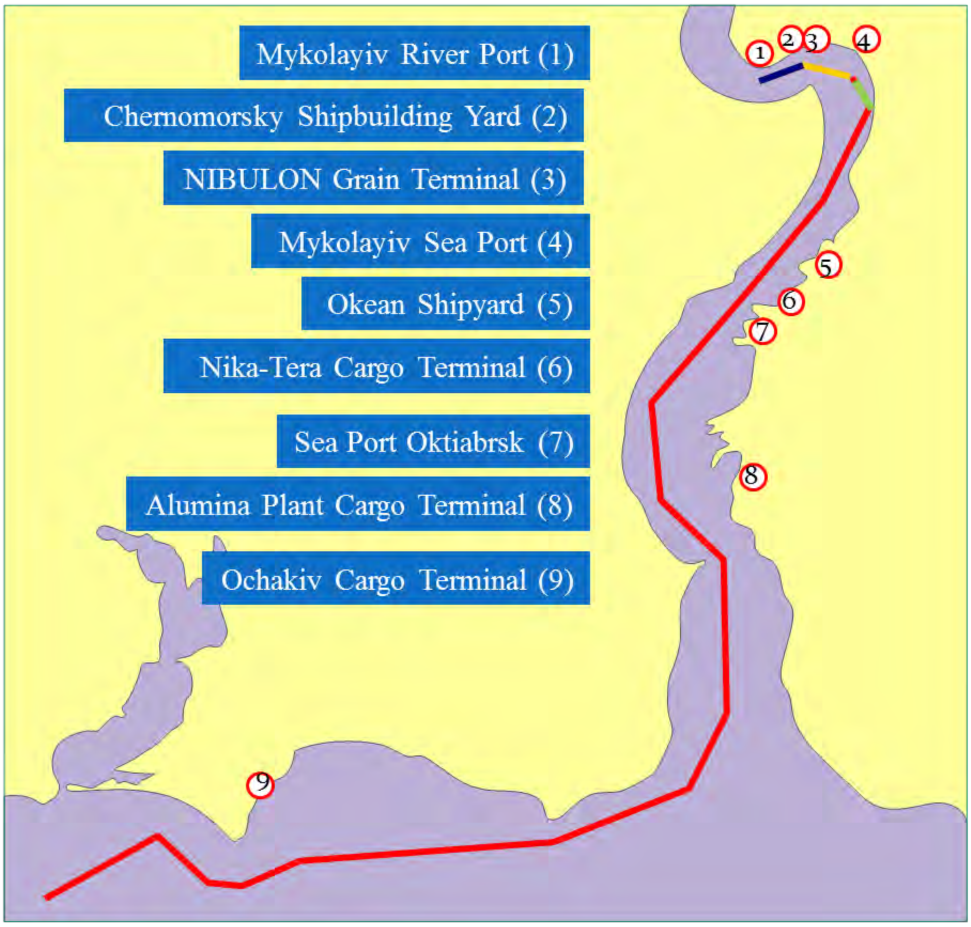
Port of Yuzhny has five transshipment complexes located at the opposite shores of Ajalykskiy Liman (estuary). The maritime terminals of different forms of ownership also operate in the port. An overview of terminal operators is presented in Appendix 4-II.

(4) Port of Mykolaiv

Ports and Terminals of the Mykolaiv Region are situated along the Bug-Dnieper Liman Canal (BDLC) with following characteristics:

- Length: 81.4 kilometers (between black sea and last terminal);
- Width: 100 meters;
- Depth: 11.2 meters (maximal); and
- Maximal draught for vessels: 10.3 meters.

The Port of Mykolaiv is situated at number 4 in the figure below.

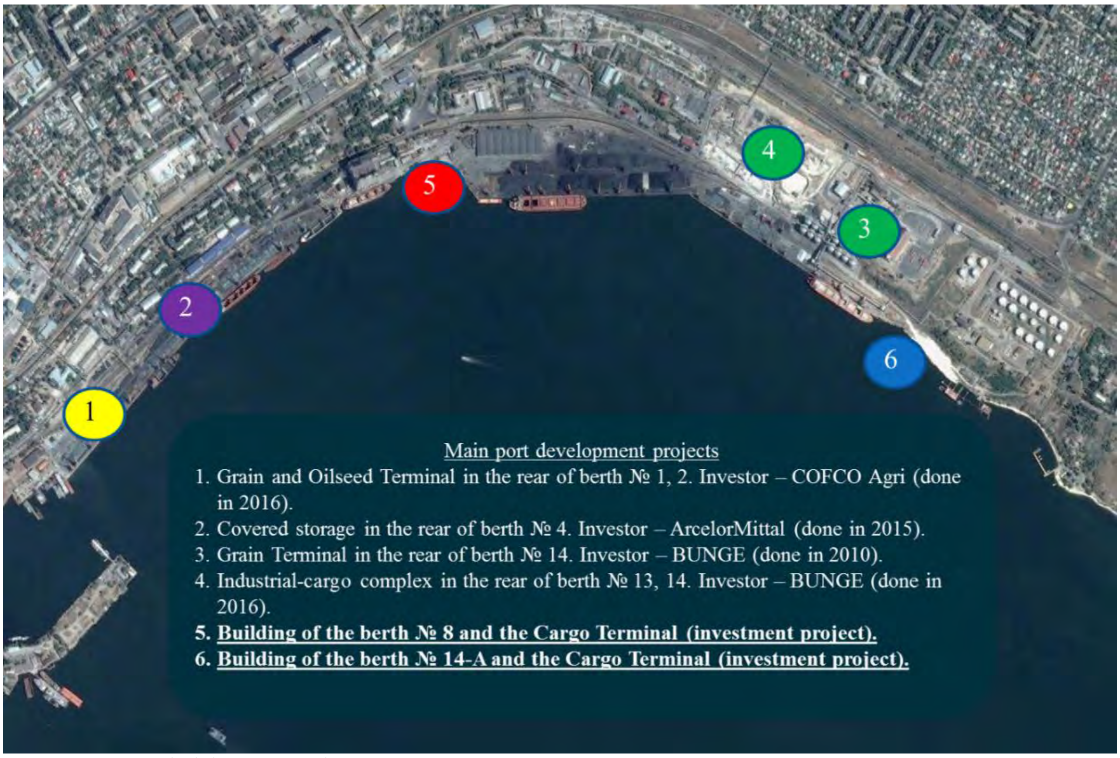


Source: USPA Mykolaiv presentation

Figure 4.33 Location of Port of Mykolaiv

The Port of Mykolaiv includes three main berth/terminal complexes:

1. Berths number 1 and 2: Grain silos with a total capacity of more than 120,000 tons/year. Throughput of the Terminal – about 2.5 million tons/year;
2. Berth number 4: Handling of metal products by Arcelor Mital (Warehouse space of 2,300 square meters, free height of up to 7 meters. Storage capacity of near 16,000 tons of metal products.) and refrigerated products; and
3. Berth number 14: Grain terminal with a capacity of 4 million tons/year.



Source: USPA Mykolaiv presentation

Figure 4.34 Port of Mykolaiv Plan

Port facilities
Territory of Port of Mykolaiv covers 69.3 hectares. Water area is 323 hectares. The length of the railroad is 24.6 kilometers. Total berthing line amounts to 2,920 meters.

Port of Mykolaiv Complexes.

- Cold-storage warehouse for storage of deep-frozen products;
- Complex for chipping of timber;
- Multipurpose handling complex;
- Grain handling complex;
- Oil terminal.

Operating system
The operating system in the Port of Mykolaiv depends on the type of cargo:

- Grain products are handled by self (un)loaders with hoppers directly on/from truck and/or rail or from/towards silos;
- Other dry bulk is handled by revolving grab cranes;
- Conventional cargo is handled with mobile harbor cranes.

Storage Facilities
The area of sheltered warehouses comprises 27,300 square meters; the total area of open yards is 181,500 square meters.

Aforementioned 13 Ukrainian seaports are able to process approximately 230 million tons of cargo per year (51 million tons for liquid bulk cargoes, 180 million tons for dry cargoes and 3 million tons TEU).

4.5.2 Hinterland Connection

The hinterland of the main seaports in the Southern Region is mainly connected by the rail network and the road network. Of the total freight, more than 70% is transported by rail in all four ports (based on interviews). More specific, in 2013, across all transport modes, approximately 7 million passengers (including local and international transit) and more than 657 million tons of freight have been transported into, from, or through the territory of Ukraine. Most of the passengers (89%) were transported by motor vehicles, while most of the freight (71.3%) was transported by rail.

The lack of origin-destination data, does not allow to connect regional statistics to port developments.

<u>Rail connection</u>

Rail connection in all four ports is available. Compared to international practice, the modal split for trains is very high (that is, 70% compared to below 20% in European ports). The state of the rail network is good, and in development. Figure 4.35 illustrates the rail connections in Ukraine.

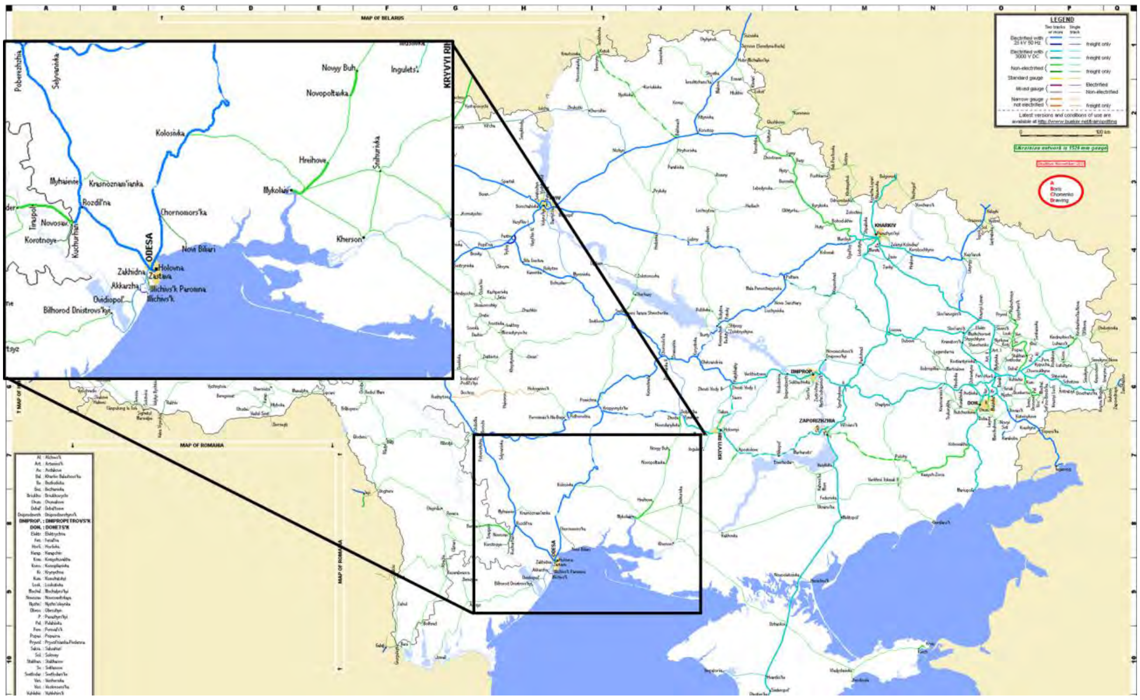


Figure 4.35 Hinterland Connections – Rail

Extra capacity is being developed in the short and medium term across all four ports:

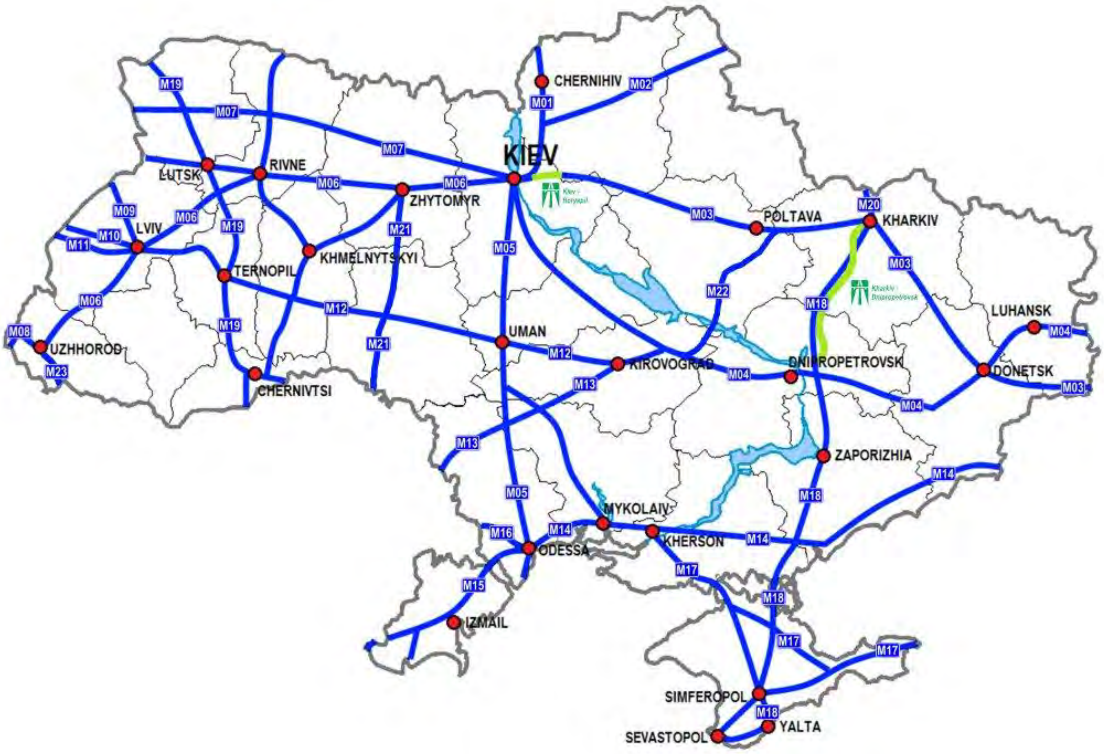
- Port of Odessa:
  - Construction of a second railroad entry; and
  - Construction of new rail road facilities.
- Port of Illichivsk:
  - Upgrade of the Illichivsk station; and
  - Construction of new rail road facilities.
- Port of Yuzhny (in development for the moment):
  - Development of station Chornomoroska (under construction);
  - Reconstruction of Berehova station;

- Construction of track connecting the port and Kimichna station & construction of railway yard B (TIS investment, under construction); and
- Construction of new rail road facilities.

- Port of Mykolaiv
  - Equipment of track switches with electric centralization; and
  - Construction of new rail road facilities.

Road Connection

The road connections are intensively discussed in Chapter 3. Figure 4.36 illustrates the road connections in Ukraine.



Source: Ukravtodor

Figure 4.36 Hinterland Connections - Road

These arterial roads are connected to the terminals by the access roads in the ports. The quality of these roads differs between the different terminals and ports but are in general – at least for the main terminals – in a fair condition. Part of this network requires an urgent rehabilitation. Details on these works can be found in Appendix 4-IV; Developments plans per port.

4.5.3 Conclusion – Current Capacity

The following Table confronts the current capacity of the four major ports in the Southern Region of Ukraine. The confrontation highlights that:

1. The Port of Odessa is limited by its location (bounded by the city);
2. The Port of Mykolaiv is limited by the limited depth of its access channel;
3. The Port of Illichivsk has a large potential to be developed, but is rather limited by its current depth of the water basin and depth of the terminals (bounded by the city);

4. The Port of Yuzhny has a large potential to be further developed, and has limited constraints.

Table 4.4 Current Capacity in Four Major Ports

	Odessa	Illichivsk	Yuzhny	Mykolaiv
Commodities handled:				
Coal			X	o
Metal ore		o	X	o
Metal products	X			X
Grain	X	X	X	X
Containers	X	o	o	
Dimensions:				
Maximum draught	-13.0 meters	-14.0 meters (channel)	-18.5 meters	-10.3 meters
LOA	330 meters	300 meters	350 meters	300 meters
Berth	8,000 meters	6,000 meters	3,000 meters	2920 meters
Terminal	141 hectares	346 hectares	NA	NA
Storage (indoor)	60,420 square meters	54,200 square meters	NA	27,300 square meters
State of infrastructure				
Infrastructure	Good	Good	Good	Good
Equipment	Good	Good	Good	Good
Capacity:				
Cargo	50 million tons/year	32 million tons/year	47.5 million tons/year	5.5 million tons/year
Containers	900.000 TEU/year	400.000 TEU/year*	200.000 TEU/year*	/
Hinterland connection:				
road	Congested	Not congested	Not congested	Congested
rail	Congested	Not congested	Not congested	Not congested
Development options:				
Quay	Very limited	Potential	Large potential	Limited (two small berths)
Terminal	Very limited	Potential	Potential	Limited

Note: X = main port; o = small volumes
* Estimation based on 2 gantry cranes per berth (2 berths in Illichivsk, and 1 berth in Yuzhny).
Source: JICA Survey Team

4.5.4 Capacity Needs

The four main ports in the Southern Region of Ukraine are specialized in three main commodities:

1. Dry bulk; mainly metal ore, grain and coal;
2. Break bulk, mainly metal products; and
3. Containers.

(1) Containers

The main port for containers is the Port of Odessa. The port has a capacity of over 900,000 TEU/year. Together with the container terminals of Illichivsk and Yuzhny, the total capacity in the major ports in the Southern Region is more than sufficient (i.e. more than 1.5 million TEU/year) to handle the forecasted demand for containers. Hence, there is no need for extra capacity in the medium term. Furthermore, in the Port of Yuzhny there is a potential to double the current capacity (only extension of quay needed, yard already available).

(2) Break Bulk – Finished Metal Products

The traffic forecast results have indicated a significant increase in the potential export volume of finished metal products. Nevertheless, the relative importance is rather limited compared to the other cargo types. Moreover, the handling facilities at both the Port of Odessa and Port of Mykolaiv are not fully utilized (less than 50%) and can accommodate the expected volume of 30 million tons/year. Hence there is no need for extra capacity in the short term.

(3) Dry Bulk

The demand forecast results have highlighted the need to increase the capacity (especially the depth at the berths and access channel) to accommodate larger dry bulk vessels for grain, coal and metal ore.

Grain

The demand forecast for grain demonstrates a significant increase in the growth of grain export due to the expected increase in the yield of grain products in the medium term. It is expected that the grain volumes will increase to a volume of approximately 55 million tons/year. The main bottlenecks to accommodate this volume are on the one side the hinterland connection (rail and road), and the storage facilities within the ports. The number of berths is of lesser importance given the large investments into grain facilities (cf. the Cargill project in Yuzhny, the TIS project in Yuzhny) and transformation of terminals (cf. chemical terminal of TIS in Yuzhny) in different ports.

Coal

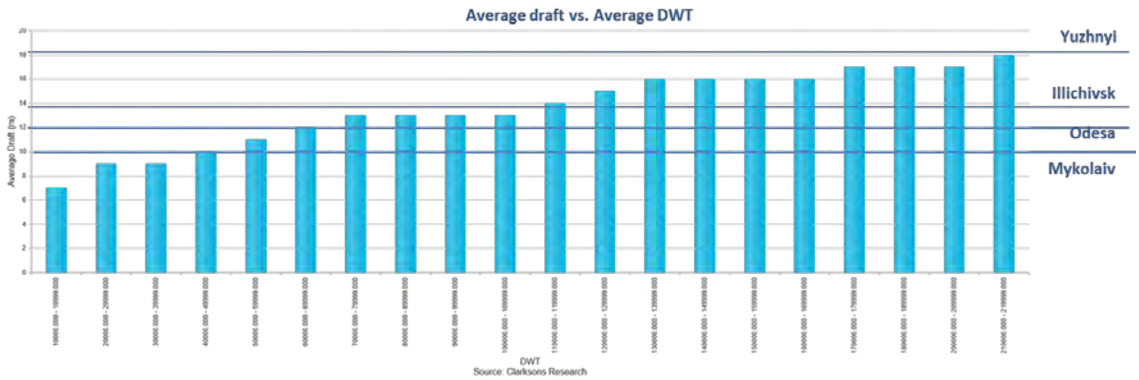
The demand forecast results highlight that the trade pattern of coal has shifted significantly from an export-oriented trade towards an import-oriented trade. This shift has had a significant effect on the capacity use of the terminals in the main ports in the Southern Region of Ukraine: coal terminals are not fully utilized (cf. coal terminals in Yuzhny and Mykolaiv). Nevertheless, this shift has consequences for the vessel types that will call the ports: that is, a move from Panama vessels towards capsize vessels (Dead Weight Ton (hereinafter, DWT) of more than 100,000 tons). To accommodate these vessels, dredging of the access channels and water basins is needed.

Metal Ore

The demand forecast demonstrate a significant increase in the volume of metal ore from approximately 30 million tons/year in 2015 towards approximately 50 million tons/year in 2030. To accommodate this increase, more depth is needed. More specific, to accommodate (see Figure 4.37)

- >100,000 DWT vessels (capesize vessels), a depth is needed of 15 meters; and
- >200,000 DWT vessels (capesize vessels), a depth is needed of 18 meters; and
- >250,000 DWT vessels (capesize vessels), a depth is needed of 21 meters.

Furthermore, an increase in the number of berths is needed as well.



Vessel type/market	Vessel size	Cargo type
VROC	200,000+ dwt	Iron ore
Capesize	100,000–199,999 dwt	Iron ore, coal
Panamax	60,000–99,999 dwt	Coal, grain, bauxite and larger minor bulk parcels
Supramax	54,000–59,999 dwt	Minor bulks and smaller parcels of major bulks such as grains, coal and bauxite
Handymax	34,000–53,999 dwt	>>
Handysize	10,000–33,999 dwt	>>

Minor bulks: Steel, steel products, cement, sugar, gypsum, non-ferrous metal ores, salt, sugar, Sulphur, forest products, wood chips and chemicals.

Source: Clarksons Research

Figure 4.37 Draft vs. DWT of Bulk Vessels

4.5.5 Conclusion

Table 4.5 highlights the main results of the capacity assessment for the four main ports per main commodity type. The results indicate that in the medium term additional berth and terminal capacity is needed for grain products and metal ore. Furthermore, the demand forecast highlight the need to deepen ports in order to accommodate larger bulk vessels for coal (transatlantic vessels) and metal ore (Capesize vessels).

Table 4.5 Capacity Assessment

Commodity	Port	Capacity need in the medium term	Bottleneck	Potential for extension
Containers	**Odessa**	No, there is sufficient capacity	Hinterland connection is congested and bounded by the city	Limited
	Illichivsk	No, there is sufficient capacity (terminals are currently used for the loading of grain)	Hinterland connection is congested and bounded by the city	Limited
	Yuzhny	No, there is sufficient capacity (terminal is empty)	No	Potential
Grain	**Odessa**	Yes (quay, terminal, and rail connection)	Bounded by the city	Limited
	Illichivsk	Yes (quay, terminal, and rail connection)	Bounded by the city for extension of terminal area	Potential
	Yuzhny	Yes (quay, terminal, and rail connection)	Rail capacity	Large potential
	Mykolaiv	Yes (quay, terminal, and rail connection)	Depth (transshipment at the beginning of the access channel)	Limited
Coal	**Yuzhny**	Yes (terminal, and quay)	None	Large potential
Metal ore	**Yuzhny**	Yes (terminal, and quay)	None	Large potential
Metal products	**Odessa**	No	Hinterland connection is congested and bounded by the city	Limited
	Mykolaiv	No	Hinterland connection is congested and bounded by the city	Potential

Source: JICA Survey Team

Furthermore, taken into account the bottlenecks in the ports, the assessment indicates the Port of Yuzhny has the largest potential for new projects. The success factors of the Port of Yuzhny is its large potential for further developments, the fact that it is not bounded by the city, its depth, and its connection to the hinterland. Besides the Port of Yuzhny, the Port of Mykolaiv and Port of Illichivsk have also a potential to increase their capacity for grain products. The Port of Odessa is limited by its location, and the sufficient capacity for containers.

4.6 Current Status and Challenges of the Sea Port Authority

4.6.1 The Ukrainian Sea Port Authority

The management/organization structure of ports has also seen revolutionary changes, effective from 2012. The ports became branches of a single "Ukrainian Seaport Authority" (USPA), which manages the ports from its headquarters in Kiev and local branches, and acquires the rights of a single legal entity. This reorganization formally ended the Soviet system of port economy management and brought the Ukrainian regime into the line with long-established international standards.

The state enterprise USPA is a state unitary enterprise established in accordance with the Law of Ukraine "On sea ports of Ukraine" dated 17th May, 2012, No. 4709-VI. It is included in the management of the Ministry of infrastructure of Ukraine in accordance with the decree of the Cabinet of Ministers of Ukraine, "On approval of proposals concerning the reorganization of state enterprises of Maritime transport" dated 4th March, 2013, No. 133-p and along with the Order of Ministry of Infrastructure "On measures for reorganization of state enterprises of Maritime transport" and the establishment of the state enterprise "Administration seaports of Ukraine", dated 19th March, 2013, No. 163.

The USPA consists of:

1. Central office in Kiev;
2. Chief of the representative office in Odessa[8];
3. 13 branches in the seaports of Ukraine:
4. Branch “Delta-Lotsman”

Mission of USPA

Promotion and development of maritime transport infrastructure of Ukraine and improve the competitiveness of state sea ports through administrative reform and creation of conditions and mechanisms for attracting investment.

Goals of USPA

- Providing proper functioning of seaports;
- Managing and ensuring the safety of navigation;
- Maintenance, efficient use and development of state property assigned to USPA.

The tasks of USPA

- Ensuring effective use of the state property transferred for economic management, as well as modernization, renovation, reconstruction and construction of hydro technical structures, and other port infrastructure;
- Ensuring all the entities (public, private and other forms) equitable access to the strategic ports’ infrastructure, which will form the basis of property of the Authority and its branches in each seaport;
- Provision with services for vessels during approach to the port and directly in each seaport for safe navigation, maneuvering and moorage;
- Organization and ensuring the safe operation of ports’ infrastructure, including hydraulic structures, navigation safety systems within the territory and water areas of the ports;
- Organization of navigation safety;
- Design and implementation of the plan of development of seaports as well as making proposals for its improvement;
- Rescue operations provision;
- Ensuring observance of the law on environment protection;
- Works on the elimination of the consequences of the accidents;
- Injured persons assistance;
- Delimitation of areas with mandatory use of tugs;
- Collection and proper use of port charges;
- Coordination of own activities and the activities of ports’ captains, pilot service, owners of marine terminals, port operators and other entities operating in the seaports in the event of natural disasters, accidents, and other emergencies requiring interaction;
- Provision of equal competitive conditions for business activities and services in the sea ports.

Organizational Structure of USPA

USPA is structured according to the current 13 branch offices of each port. In the table below, these branch offices are listed. The main difference between the current situation and the situation in 2013 and 2014 is the annexation of the Crimea by Russia. The Crimea ports are not under control of USPA anymore. In total, USPA employs 7,817 staffs as of 1st May, 2016.

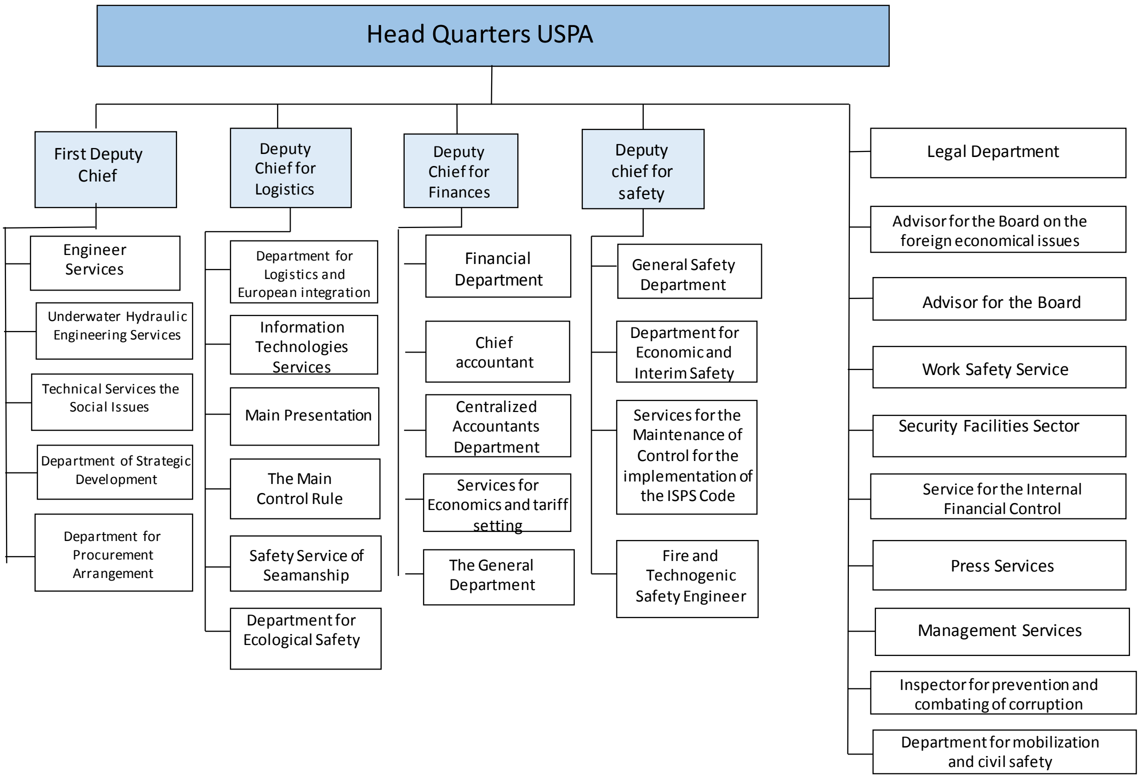
[8] The current Minister has announced to move the Main Representative Office from Odessa to Kiev

Table 4.6 USPA Offices

No.	Name	As of 12th June, 2013 USPA + others	As of 1st March, 2014 USPA	ports other	Together	As of 1st May, 2016 (USPA only)
1	Port of Berdyansk	1 447	319	916	1 235	321
2	Port of Bilhorod-Dnistrovski	817	191	630	821	192
3	Port of Evpatoriya	190	73	133	206	
4	Port of Izmail	2 014	409	1 403	1 812	383
5	Port of Illichivsk	5 981	1 271	4 281	5 552	1 286
6	Port of Kerch	1 592	1 140	306	1 446	
7	Kerch Ferry Line	232	0	229	229	
8	Port of Mariupol	4 119	515	2 932	3 447	515
9	Port of Mykolaiv	867	844	51	895	841
10	Port of Odessa	2 406	1 359	1 059	2 418	1354
11	Port Oktyabrsk	893	215	668	883	211
12	Port of Reni	818	512	444	956	494
13	Port of Sebastopol	557	346	257	603	
14	Port of Skadovsk	138	73	81	154	79
15	Port Ust-Dunaysk	87	22	64	86	21
16	Port of Feodosiya	860	409	464	873	
17	Port of Kherson	1 310	532	772	1 304	518
18	Port of Yuzhny	3 371	568	2 605	3 173	567
19	Port of Yalta	268	149	117	266	
20	Maritime rescue & recovery service	235	214	0	214	176
21	Agency for the maritime safety	26	0	0	0	
22	Information-analytical center	15	0	0	0	
23	Delta Lotsman	1 466	1 463	10	1 473	1 108
24	Administrative Staff of the USPA	0	162	0	162	163
Total:		**29 709**	**10 786**	**17 422**	**28 208**	**7,817**

Source: USPA

The organizational structure of USPA Headquarters is presented below:



Source: USPA

Figure 4.38 Organizational Structure of USPA Headquarters

As previously indicated in Section 4.3.3, the USPA is in some turbulent times. It is facing a national port reform, re-structuring of the organisation, a complete new management which was just recently appointed and the new Governance structure for the ports in the Crimea. It turned out to be that details regarding personnel capabilities and processes are unavailable. When the transition period is completed, detailed information could be collected and analysed.

4.6.2 Current Status of Port IT Systems, Customs and Other Regulatory Controls

Port Community Systems

Port Community Systems (PCS) are IT tools that enable efficient operations in ports. It should enable the users of this system through hardware and software to store, validate, process, exchange and transmit in electronic form the information and documents necessary for the implementation of border, customs and other types of control and clearance of persons, goods, cargoes, and vehicles. This system must comply with the legislation of Ukraine on electronic documents and has to take into account international (best) practice.

The PCS was implemented and being used in all seaports of Ukraine since the end of 2015. In particular, all ports use the module intended for clearance of arrival of ships. In Odessa, Illichivsk, and Yuzhny, the port clearance of arrival of the vessel is being made solely in electronic form. In other ports, the arrived ships are being cleared with the use of electronic system and papers in parallel.

However, the implementation of the PCS is surrounded by all kinds of disputes and allegations. First of all, no official tender has been organized for the procurement of such a system, while this is required by the legislation of Ukraine. Secondly, the PCS has been developed by a private company and this company is still the owner and manager of the system. This private company receives all relevant information from all related third parties (=users of the system) and has a full monopoly over these services. In the meantime, it has raised the tariffs two times without any visible improvements of the application. It goes without saying that it is better if these kinds of services are provided by a neutral and independent (State) Body.

Truck Weighing

Recently, the Ministry of Infrastructure arranged a campaign for weighing of all cargo trucks. It is said that this campaign aims to prevent overweight of trucks, and thus maintain the preservation of roads in the country. Measures have been introduced to restrict the entry and/or exit of trucks in the ports, the weight of which exceeds the normative parameters, to/from the territory of the state port operators, and also the monitoring of the same weight parameters by the private port terminal, located outside of the perimeter of the territory controlled by the sea port.

Quarantine Labs and Veterinarian Inspections

Before July 2016, the quarantine laboratories did not work on a 24/7 basis. Only after July 2016 these quarantine labs has started operation on a non-stop basis. As such, it procures the shortening of time necessary in obtaining of phytosanitary certificates, and reduces non-productive idle stay of vessels in berths. However, the establishment of 24/7 schedule does not solve all problems. This complex issue can only be solved by creating the number of private laboratories, which will be closely monitored by the State.

Veterinarian inspections are being held by the Ministry of Health. Currently, the main problem is the delays in the processing of feed wheat which is stored in ports for more than 1 month, which requires obtaining of fresh veterinary certificates.

Law of Ukraine “On veterinary medicine” stipulates that the validity term of the expert report of the State veterinary and sanitary survey certifying the safety of animal products, including feeding wheat, shall not exceed one month. Validity of veterinary certificates for export of feed grains is limited by the validity of expert report. In case of exporting of feeding stuff, if the period of transportation to the port and storage in port exceeds 1 month, there is a necessity for additional veterinary examination. USPA offered to the Ministry of Agriculture to initiate the amendments to the Law of Ukraine “On veterinary medicine” regarding the extension of the period of validity of expert report for feed grains up to three months. The issue is not resolved yet, up to now.

Vessel Arrival/Departure Control

Vessels which sail across the border of Ukraine are subject to border/customs control and customs clearance.

Custom control is to be performed in following forms:

- verification of documents and information;
- customs inspection;
- accounting of goods, vehicles for commercial use moved across the customs border of Ukraine;
- oral questioning;
- verification of accounting of goods carried through the customs border of Ukraine and/or are under the customs control;

- carrying out documentary inspections of observance of requirements of legislation of Ukraine on state customs affairs, including the timeliness, accuracy, completeness calculation and payment of customs fees;
- sending requests to other state bodies, institutions and organizations, authorized bodies of foreign States to establish the authenticity of documents submitted.

The vessels sailing under non-Ukrainian flags are under customs control during their entire duration of the stay in the port. The fiscal authority has the right during this period to carry out inspections and surveys of the vessel, sealing of individual holds and spaces where the goods are located if the grounds for importation to / exportation from the customs territory of Ukraine are unreliable. However, only the border control is mandatory to be carried out on board of a vessel. Other types of control generally are carried out in documentary in the premises of the controlling bodies before arrival (departure) of a vessel to (from) the port.

<u>Environmental Control</u>

Environmental control of a vessel is only carried out if the emitted substance contains visible floating particles or there are visible traces of oil or other contaminants in the area of the discharge, which led to the actual water quality deterioration.

According to the resolution of Cabinet of Ministers of Ukraine dated 7th July, 2015, No. 492, discharging of the segregated ballast waters in the territorial sea, inland waterways of Ukraine is allowed without restrictions and control by the state authorities on conditions that such ballast was taken in the Black or Azov Sea before entering the territorial waters.

Employees of State Ecological Inspection are entitled to verify the compliance of segregated ballast waters only in case if during the discharge from a vessel the segregated ballast water contains visible floating particles or there are visible traces of oil or oily liquids or other contaminants in the area of the discharge.

4.7 Donor Assistance for Seaport Sector

Below are summaries of the donor assistance by the International Financial Institutions (IFIs) in the seaport sector in Ukraine.

4.7.1 The World Bank Group

The most relevant port project that the World Bank is supporting at this moment is a grant to enable the feasibility study for the Lower Dnieper River Waterway and Port PPP Options in the Port of Kherson. According to the official tender information, the project can be described as follows:

Excerpt from Tender Information
The World Bank is providing comprehensive technical assistance to the Government of Ukraine (GoK) on the development of efficient and sustainable logistics. As part of this engagement, the World Bank is initiating a new Technical Assistance Project (Lower Dnieper River Waterway and Port PPP - P161153 or the Project), funded by the Global Infrastructure Facility (GIF). The objective of this Project is to evaluate the viability of a potential Public-Private Partnership (PPP) to upgrade, operate and maintain the lower Dnieper River waterway and Port of Kherson, located in the delta of the same river, to allow for efficient transport along this important transport corridor.

Objective:
Consulting services to evaluate Public-Private Partnership (PPP) options and scoping of a potential project for the upgrading, operation and maintenance of the lower Dnipro River waterway and the Port of Kherson.

The services will be developed in phases and include a pre-feasibility analysis and the identification of the additional analytical and advisory activities that would be required to structure a PPP project and take it to financial close. The contract would be structured in way such that subsequent phases of work will only be undertaken following the evaluation by the World Bank and the Government of Ukraine.

Other current port sector priorities include:

- Initiated by the Ministry of Infrastructure, discussion of conducting a Feasibility Study for Port of Mykolaiv development.
- Logistics study including the port sector. Focus will likely be on the Port of Odessa as there is the issue of territory constraint and river transport.
- A grant Technical Assistance for advisory to the legislative process, drafting new laws, conducting pre Feasibility Studies and Feasibility Studies.

4.7.2 European Bank of Reconstruction and Development (EBRD)

EBRD targets the private sector to enable new investments in the port industry. EBRD is supporting the financing of stevedore companies for agro logistics and currently, 3 projects are in implementation and 1 under preparation. All 4 projects are for investments to the private sectors, for new grain terminals.

A good example of this is the loan facility it provided to GN Terminal Enterprises Ltd. (Cypress). EBRD intends to allocate a long-term loan of up to US$40 million to this company to finance the expansion of the existing capacity of the grain terminal in the port of Odessa (Olimpex Grain Terminal).

As part of the program, EBRD at the end of February this year approved a loan of up to US$18.7 million to the Cypriot subsidiary GNT Olimpex Holding Ltd. for the construction of the Port of Odessa facilities for drying and cleaning of grain. The complex drying and cleaning of grain with annual capacity of 0.5 million tons is said to be integrated with visiting the same port transshipment terminal companies, through which last year were exported about 2.4 million tons of cereals.

Currently, EBRD is involved to fund a pilot project to install new concessions (BOT for 25–30 years) in the former port of Oktyabrsk, which is now renamed to “Olvia”.

Table 4.7 EBRD Projects for the Seaport Sector in Ukraine[9]

Project Start Year	Project Title	Details	Status
2015	Yuzhny Grain Terminal	Private sector project - Senior secured loan of up to US$ 37 million co-financed by IFC to MV Cargo Ltd (the "Company") to finance a greenfield development of a new state-of-the-art private grain terminal in the Port of Yuzhny.	Board Approved
2015	GNT Grain Terminal	Private sector project - a long-term loan of up to US$ 40 million to GNT Group of companies ("GNT") in order to finance the expansion of the throughput capacity of its existing grain terminal in the Port of Odessa.	Repaying
2015	Olimpex Dry Port	Private sector project - a senior secured loan of up to US$ 18.7 million to GNT Trade DMCC (the "Company") for the construction and development of a drying and cleaning facility in the Port of Odessa with annual design capacity of 0.5 million tons of grain located 6 kilometers away from the port and connected to it by a dedicated flyover.	Repaying
2013	Ukrelevatortrans	Private sector project - a senior loan facility of up to US$ 60 million to Brooklyn-Kiev LLC for the construction and development of a grain transshipment terminal in the Port of Odessa.	Signed
2009	Euroterminal Odessa Project	Private sector project - to finance (up to US$ 27 million co-financed with EIB) the construction of a logistics service centre on a 50-hectare land plot located north of Odessa in the city's industrial zone.	Repaying
2009	Odessa Terminal Holdco	Private sector project – financing of up to USD 37 million for the construction and development costs of a new container terminal in the Port of Odessa in two stages.	Completed
2006	Illichivsk Sea Commercial Port Infrastructure Dev. Project	Private sector project – loan of up to US$ 26 million to carry out its modernization program, including berth reconstruction, procurement of the cargo handling equipment and dredging works in order to increase operational reliability and efficiency of the Port's services.	Completed
2003	Ukrrichflot III	Private sector project - finance of up to US$ 31.26 million and guarantee of US$ 8 million for Ukrrichflot's acquisition of four dry cargo new building vessels as part of the company's fleet renewal program	Completed

Note that the financing amount in the table is the agreed amount and may differ from the actual amount for implementation.
Source: EBRD website http://www.ebrd.com/ukraine.html

4.7.3 European Investment Bank (EIB)

There is only one loan provided by EIB that is directly attributed to the port sector (Dnepr river locks and Port reconstruction). Rest of the loans are either provided to projects that indirectly contribute to the port sector (such as road- and railway improvements) or to public transportation projects. According to EIB, it has not been active on the seaport assistance because of the shared/division of labor between EBRD, as it is easier for EBRD to finance the

[9] The list consists of projects listed in EBRD website with Project Summary Documents

private sector. However, EIB acknowledges the importance of supporting the overall logistics sector in Ukraine.

4.7.4 The Netherlands

Ukraine and the Netherlands have agreed to enhance cooperation in the development of inland waterways and port infrastructure. The two countries have launched the "Dnipro Development Initiative".

Kingdom of the Netherlands

The Dutch Embassy in Kiev will cooperate with the Ukrainian Ministry of Infrastructure on the development of inland waterways and seaports. Main tasks will be to develop PPPs in the water sector, the ports of Oktyabrsk and Kherson, the management of the river Dnipro and the restoration of the locks in the river. Under this program, these and other projects in water management will be taken up. The Netherlands is not an exclusive partner to Ukraine under this initiative, but will seek to cooperate with other (EU)-countries and IFI's such as the World Bank, EIB and EBRD.

5. Road Traffic Characteristics and Forecast

In the preceding chapter, prospects of cargo traffic in and out of ports in Ukraine were examined and forecasts were made. This chapter will review the major traffic issues related to the road traffic, particularly in relation to the new Mykolaiv Bridge, its surroundings and the Southern Region. Initial thematic analysis related to recent trends will be discussed in order to substantiate macro trends in the recent past and future. Further, in consideration of the recent trend, the framework of the traffic forecast will be reviewed, and a revised approach will be proposed.

5.1 Traffic Issues in the Southern Region and Its Surroundings

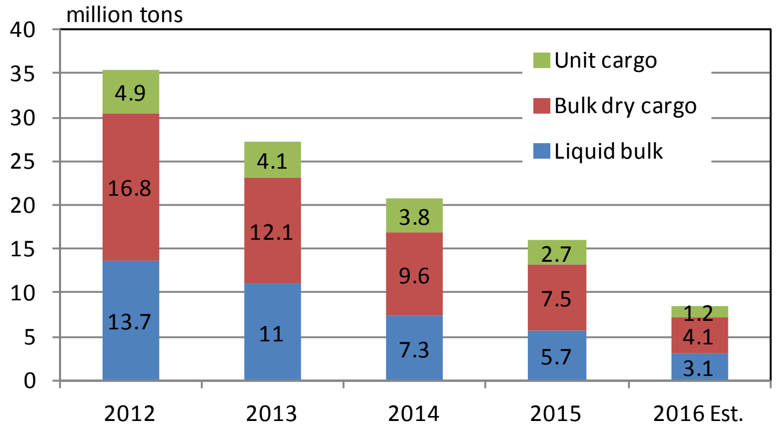
5.1.1 Russian Transit Decrease due to 2014[1] Event vs Export Products Growth

The major interest of the traffic trend in the Southern Region is the decrease of transit traffic demand from the major southern ports in Ukraine to Russia. The transit between Ukraine and Russia has been prohibited since 1st January, 2016[2]. EU and the United States are continuing their economic sanction against Russia since March 2014. The Preparatory Survey in 2011 assumed the traffic demand along the East–West corridor, including the transit demand to Russia, as the major contributor to future growth.

In this section, the significance of Russian transit demand in 2012 and 2015 in the Southern Region of Ukraine is reviewed, and the macroscopic flows of transit cargo demand to Russia are illustrated.

(1) Significance of Russian Transit

Figure 5.1 shows the trend of the Ukrainian port transit volume. The transit demand was 35 million tons in 2012. However, it decreased gradually and became 16 million tons in 2015. The volume of transit in 2016 can be extrapolated as 8.5 million tons. The decrease of transit traffic during 2012–2016 is distributed equally among different types of cargos. Accordingly, the net port transit demand bound to Russia is assumed at 27 million tons in 2012.

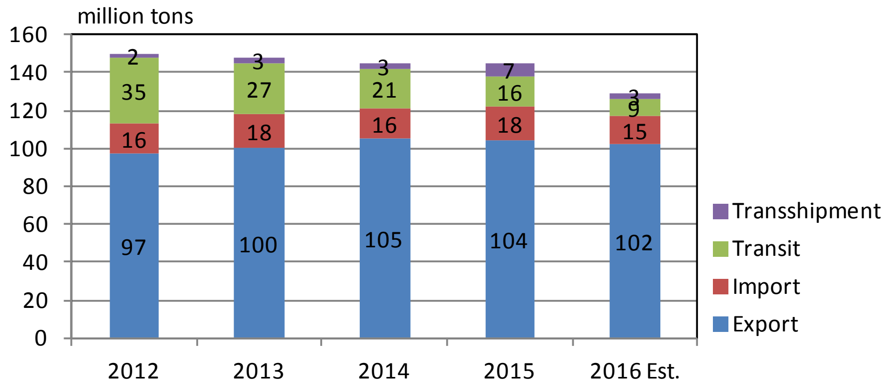


Source: USPA statistics. The 2016 volume is estimated based on the 1st half volume in 2015 and 2016.

Figure 5.1 Ukraine Port Transit Volume 2012–2016 (Million Tons)

[1] The civil unrest and Russian military intervention took place mainly in February 2014.
[2] Economic Monthly Report, February 2016, Embassy of Japan in Ukraine.

Figure 5.2 shows the total handling volume of Ukrainian ports, including an estimated volume for 2016. It should be noted that the total volume is stable during 2012–2015, due to the growth of export and transit demand. The total volume in 2016 is expected to be decreased due to the decrease of the transit bound to Russia. Assuming the transit volume bound to Russia in 2012 is 27 million tons and that 30% of the traffic were conveyed by road, it is estimated that 8.1 million tons of traffic has disappeared from the road in the Southern Region of Ukraine.



Source: USPA statistics. The 2016 volume is estimated based on the 1st half volume in 2015 and 2016.

Figure 5.2 Port Volume in Ukraine 2012–2016 (Million Tons)

It would be challenging to recover the transit demand bound to Russia in the future. Russia is developing major ports in Crimea and the Azov Sea and is also developing a permanent road connection at Kerch to directly utilize the port in Crimea. The major orientation of Russian trade is bounded to the Netherlands, Germany, via the Belarus transit corridor, which would absorb the once-existed transit volume via the Southern Region of Ukraine.

(2) Growth of Export Products and Geographical Distribution

Table 5.1 shows the detailed export demand in 2015 by major commodities, liquid bulk, dry bulk and cargos. In 2015, the share of dry bulk was 75%, including 28% of iron ore and 35% of grains, which shows more than 25%–40% growth during the period from 2012 to 2015. The share of metals (including steel products, casted iron, and scrap metal) was 16% in 2015, but its volume decreased slightly from 2012. The net growth of the iron ore and grain was 16.2 million tons during the three years.

Table 5.1 Ukrainian Export by Major Commodity in 2015 (Million Tons) and Growth Rate 2012–2015 (%)

	2015 Export Volume	Share	Growth Rate 2012–2015	Net Volume 2012–2015
TOTAL EXPORT	103.94		6.9%	6.7
Liquid Bulk	4.55	4%	−21.8%	−1.3
Bulk dry cargo	77.90	75%	14.6%	9.9
Iron ore, etc	28.91	28%	41.8%	8.5
Grain, etc	36.79	35%	26.6%	7.7
Packaged cargo	21.49	21%	−8.2%	−1.9
Metals	16.36	16%	−11.6%	−2.1

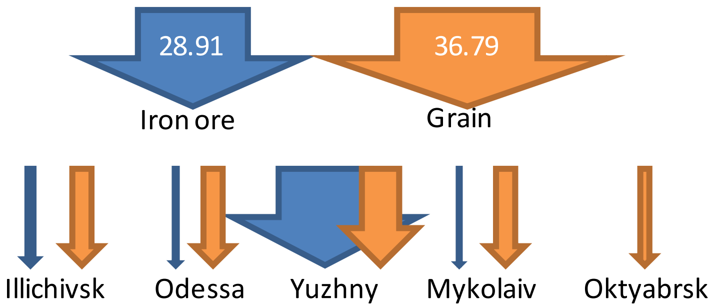
Source: USPA statistics.

Table 5.2 and Figure 5.3 show the export origin distribution for the commodities with major growth. Interestingly, the iron ore export is focused at the Port of Yuzhny, and the grain export is distributed among major ports, located along M-14. Applying the share of the road, 5.9 million tons of road traffic export was added.

Table 5.2 Export Origin and Share for Iron Ore and Grain in 2015

(million ton)	Iron Ore		Grain		Share of Road
Total of all ports	28.91		36.79		
Port of Illichivsk	1.47	5%	5.09	14%	30%
Port of Odessa	0.38	1%	8.62	23%	60%
Port of Yuzhny	24.34	84%	9.75	27%	25%
Port of Mykolaiv	0.23	1%	8.50	23%	25%
Port of Oktyabrsk[3]	0.00	0%	2.38	6%	25%
Total of the 5 ports	26.42	91%	34.33	93%	--

Source: USPA statistics. Share of road: interview with each port authority



Source: USPA statistics. The 2016 volume is estimated based on the 1st half volume in 2015 and 2016.

Figure 5.3 Export Origin and Share for Iron Ore and Grain

(3) Russian Transit Decrease vs Export Growth

The disappeared Russian road transit can be estimated at an approximated volume of 8.1 million tons per year, which does not have to pass M-14 to transit to Russia. However, the additional road traffic from the grains and iron ore can be estimated at 5.9 million tons per year, which has the potential to grow in the future. The delivery routes of these commodities are geographically distributed along M-14, including the new Mykolaiv Bridge section.

It is expected by the JICA Survey Team that the transit demand that has disappeared can be recovered by the growth of export. In the following sections, the logistic chains of major export commodities, that is, grains and iron ore will be reviewed, in order to substantiate the future growth potential.

5.1.2 Grain Product Policy and Logistic Chain Development by IFIs[4]

At the moment, agro products are likely the most promising for Ukraine to earn foreign currencies. Major donor agencies such as the World Bank, EBRD, and EIB are in the process of providing investments in the logistic chain development. This section will summarize the background of agro products in Ukraine and plans for the logistic chain development.

[3] Currently renamed to "Port of Olvia"

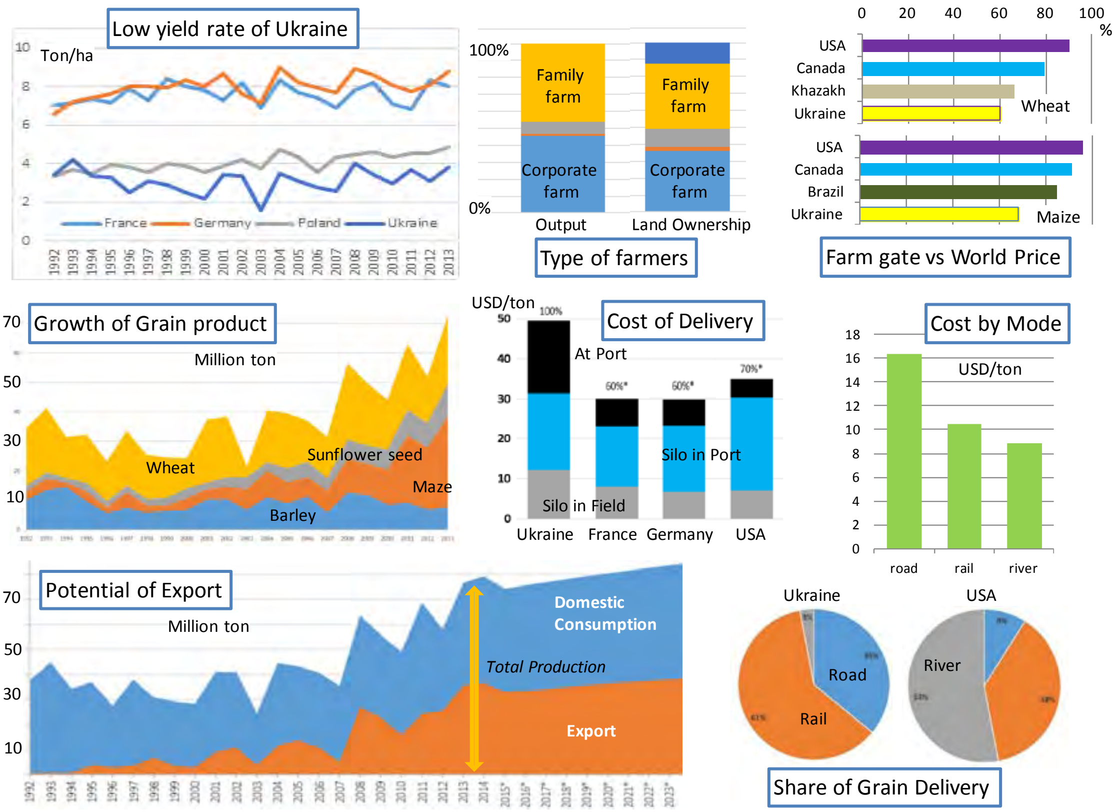
[4] IFIs: International Financial Institutions

(1) Agro Product Policy

The Government of Ukraine has issued a strategic paper[5] for agricultural and rural development in 2015–20, summarizing the characteristics of the agro industry, and the necessity of promoting agriculture and rural development. Moreover, the World Bank reviewed[6] the agro industry for creating a logistics chain development strategy. The analysis can be summarized as follows:

- The present low yield rate in Ukraine indicates a high growth potential
- Corporatization of farms is progressing, but the SME/family based famers still remain and are needed to be fortified.
- Agricultural development will provide livelihood to more than five million rural people and will generate an added value of 10% to Ukraine's GDP.
- Ukraine's key markets are in the Middle East and North Africa through the Black Sea, due to its low price range of Ukrainian products and growing population in MENA.
- Ukraine is the third largest global exporter of maize (17.6 million tons in 2014) and barley (4.2 million tons), and the sixth largest exporter of wheat (10.5 million tons)
- Ukraine's sunflower seeds and oil has a share of 23% and 26% respectively in 2012–16 in the global market.
- During 2000–15, the exports of grains, oilseeds and their processed products have grown by 250% and totaled 35 million tons in 2014.
- Despite significant recent growth, the grain sector in Ukraine continues to suffer from inefficiencies along the supply chain. Cost of delivery compared to other countries show the high price of Ukrainian delivery, particularly in port fees.
- As a result, farmers in Ukraine receive lower shares of world market prices and thus shoulder the costs of inefficiencies in logistics, estimated at US$20 per ton.
- The costs of logistics are affected by the underutilization of river transport, inefficiencies in rail transport, high share of road transport, deficient storage management and high port fees.

[5] Ministry of Agrarian Policy and Food of Ukraine, "Single and Comprehensive Strategy and Action Plan for Agriculture and Rural Development in Ukraine for 2015–2020", Draft, 26th October, 2015
[6] The World Bank, "Shifting into Higher Gear, Recommendations for Improved Grain Logistics in Ukraine", Report No: ACS15163, August 2015



Source: Ministry of Agrarian Policy and Food of Ukraine (2015), World Bank (2015), APK Inform (2015)

Figure 5.4 Summary of Agro Market and Logistics Conditions in Ukraine[7]

The World Bank report analyzes the physical development potential on the four sectors (rail, river, road, and storage), as well as strategies on removing institutional inefficiency, including the complex certification system, outdated documentation management, and perception of corruption. Table 5.3 summarizes the modal comparisons of the SWOT analysis on physical improvement.

Table 5.3 SWOT Analysis on Physical Logistics Development

	River	Rail	Road	Storage
Strengths	Low cost, traditional transport, eco-friendly	Low cost, good network, large share	Good network, good truck suppliers, simple investment	Network of 1200 storage, competitive service provision
Weaknesses	Unclear public/private demarcation, old infrastructure, frozen period	No competition, no flexibility in tariff, seasonal demand (low in summer,)	High cost in logistics, higher maintenance cost	Low storage capacity (half of annual production), less Silo facility, old structure
Opportunities	Potential of increase in efficiency	Potential of increase in efficiency	Potential of increase in efficiency	Production increase
Threads	Large investment	Large investment	Long term damage in pavement	Low rate of return, monopolized

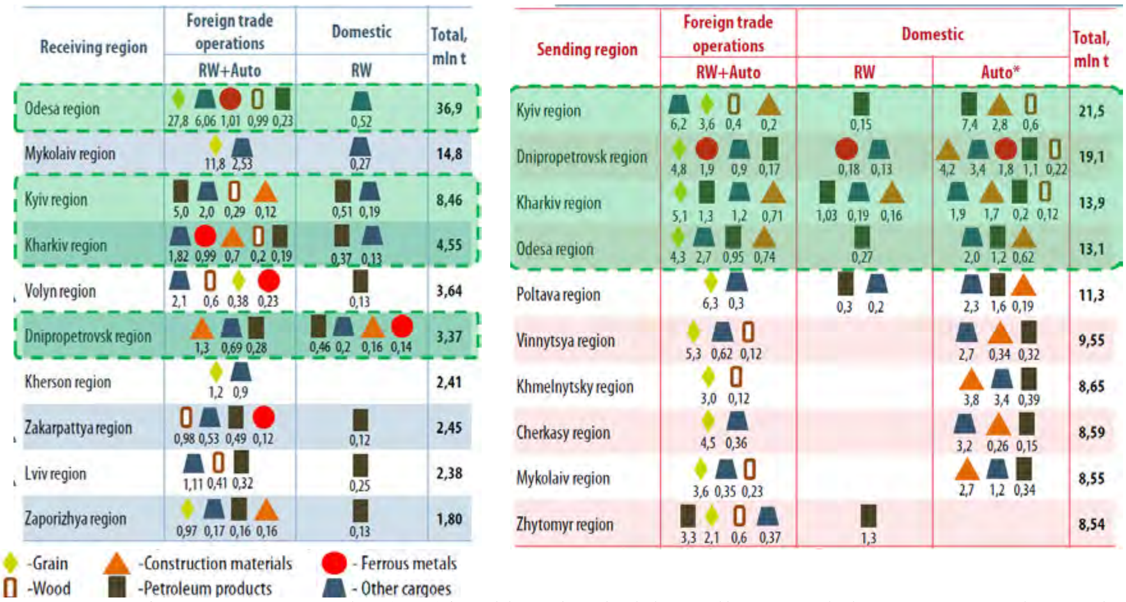
Source: cited from World Bank (2015), summarized by the JICA Survey Team

[7] The figures include oilseeds production, therefore there is a small difference from Figure 4.19 in Chapter 4.

Finally, the World Bank report proposes a preliminary investment package for the river transport infrastructure development, rail tariff optimization, and storage infrastructure development. The proposal by the Government of Ukraine's strategy paper for logistic development also focuses on the three sectors, with an exception of road development. Particularly, both reports put the stress on the river transport development.

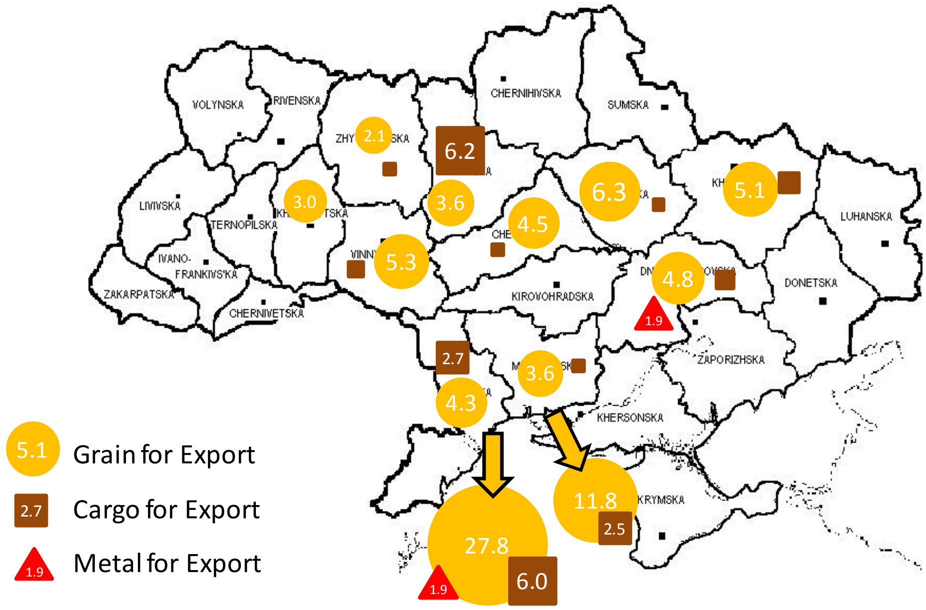
(2) Distribution of Agro Industry

Figure 5.5 shows the Origin and Destination (OD) of freight flows in the Southern Region of Ukraine. Odessa and Mykolaiv are the biggest regions of final freight delivery in the domestic network, particularly receiving export goods to be transported abroad, with the major commodity being grains. Odessa shows its variety in goods more than Mykolaiv. Kherson is also 7th largest destination in Ukraine.



Source: Center for Transport Strategies (CTS)/World Bank, Ukrainian Railways Logistics Strategy Scoping Study, 17th November, 2016.

Figure 5.5 Domestic OD for Freight (Left: Destination, Right: Origin)



Source: JICA Survey Team, based on Center for Transport Strategies (CTS)/World Bank, Ukrainian Railways Logistics Strategy Scoping Study, 17th November, 2016. Unit: Million ton

Figure 5.6 Freight OD for Major Exporting Commodities

Figure 5.6 explains the major origins of exporting freight delivery. This figure shows the major locations of grain produce for export, including Poltava, Vinnytsia, Kharkov, Dnipro and Cherkassy, which are located in the central and eastern regions in Ukraine.

Both figures show that the major domestic flows are grain from the central and eastern region to Odessa and Mykolaiv, and its total volume reaches 40 million tons per year, transport modes shared by rail and road.

(3) Rail and Road Share in Export Grain Products Delivery

The latest study[8] shows that the share of the rail in grain delivery in Ukraine is 60-65 percent, although over 90 percent for Iron ore, coal and cokes, and 75-85 percent for ferrous metal products. The reason why the rail shares in grain export are lower than other commodities can be summarized[9] as follows:

- The rail network was developed for traditional industries and does not geographically fit to the recent grain production, logistics chains of grain exports. (see Figure 4.35)
- The monopoly of the Ukrainian railway company does not provide attractive services to private agro producers and freight companies, because of lack of flexibility in tariff, high risk of corruption, less incentive of introducing a market business model.
- The grain hoppers in the rail network and grain hopper fleets are old and inefficient. It is expected that 82% of the existing fleet shall be disposed during 2014-2019, but the investment for fleet replacement is slow.

It should be noted that the annual turnover of the freight transport by rail is decreasing, 257 billion ton-km in 2008, 243 billion ton-kilometer in 2011 and 211 billion ton-kilometer in 2014.

[8] Center for Transport Strategies (CTS)/World Bank, Ukrainian Railways Logistics Strategy Scoping Study, 17th November, 2016.

[9] Mainly referred to the *Strategic Plan for Rail Transport Development up to 2020*, Approved by Order of Ministry of Infrastructure of Ukraine, No 547 dated 21st December 2015.

(4) Receiving Capacity at Port

Table 5.4 summarizes the receiving capacity of major silos (grain elevators and storages) at ports. It shows that the receiving capacity for road transport exceeds or is equal to rail transport.

Table 5.4 Grain Receiving Capacity at Ports

Ports	Truck	Rail	Ship	Barge
Kherson	6,800	4,980	800	1,900
PJSC “Kherson Bakery”	3,000	3,000	800	400
PJSC “Dnipro Terminal”	2,000	0	0	0
LLC “Agro-Tranzit-Invest”	1,000	480	0	1,500
LLC “Dnipro Tading Co.”	800	0	0	0
LLC Grain Terminal “UkrKazeksportastyk”	0	1,500	0	0
Mykolaiv	32,000	18,170	10,000	10,000
LLC “Nibulon”	19,000	7,500	10,000	10,000
LLC “Hrintur-Ex”	12,000	7,370	0	0
PJSC “State Food and Grain Coporation of Ukraine”	1,000	3,300	0	0
Yuzhny	26,250	28,200	0	0
LLC “TIS-grains”	18,750	21,000	0	0
LLC “Borivazh”	7,500	7,200	0	0
Odessa	15,200	18,700	12,000	7,000
PJSC “Ukrelevatorprom”	5,000	2,500	0	0
LLC “Olimpex Coupe International”	4,000	5,000	5,000	5,000
SE “Kulindorivskyy Bakery State Reserve Agency of Ukraine”	2,700	2,500	0	0
PJSC “State Food and Grain Coporation of Ukraine”	2,500	7,000	7,000	2,000
LLC “Graine Overloaded Complex Inzernoeksport”	1,000	1,700	0	0
Illichivsk	39,040	75,080	0	0
LLC “Illichivisk Graine Terminal”	33,600	57,600	0	0
Joint Venture - LLC “TransBulk Terminal”	3,000	16,640	0	0
LLC “ATS Success”	1,000	840	0	0
LLC “Transservice 2008”	1,440	0	0	0
TOTAL	119,290	145,130	22,800	18,900
	39%	47%	7%	6%

Source: http://agrex.gov.ua/elevators-map/#maptop, summarized by the JICA Survey Team

(5) Development Policy

The JICA Survey Team would like to point out the possibility on low return on investments concerning the planned agro logistics improvement packages, which was proposed the report by the Ministry of Agrarian Policy and Food of Ukraine[10], which focuses on waterways and rail, due to its large scale investment necessity and low efficiency of the existing operators. Such development strategy may fit the large scale agro operators that can secure regular transport with rail shipping. However, it may not be effective to small and medium scale agro producers, who hold major share within the Ukrainian export grain products. These small/medium scale farmers sell their products at dispersed locations with small consignments, which require a high flexibility in supply capacity, not like rail and water transport. Therefore, these farmers have the tendency to transport their products as much as possible by trucks. However, the existing two bridges in Mykolaiv have a GVW (Gross Vehicle Weight) limit of 24 tons, which keeps the capacity of road transport low.

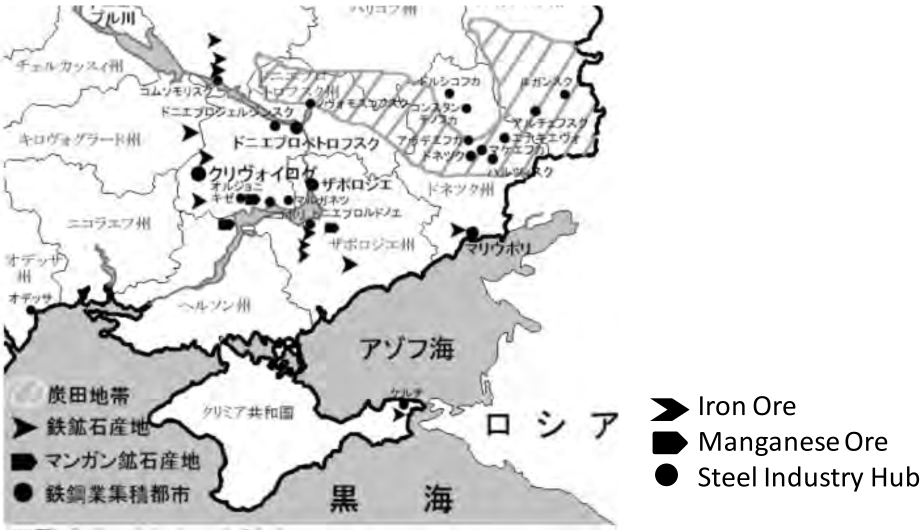
[10] Ministry of Agrarian Policy and Food of Ukraine, “Single and Comprehensive Strategy and Action Plan for Agriculture and Rural Development in Ukraine for 2015–2020”, Draft, 26th October, 2015

Further, the JICA Survey Team recognizes that road network development, including the new Mykolaiv Bridge in the Southern Region, has the following significances:

- In the agriculture sector in the Southern Region, the road network development particularly benefits small and medium-sized agriculture operators.
- Introducing railway and river water transport take time, with a long transition period necessary. Implementation of road improvement in the Southern Region should be considered as soon as possible as it is a quick fix.
- Road improvement reduces CO_2 emission by improving the average travel speed and travel flow with higher efficiency larger vehicles.

5.1.3 Iron Ore and Steel Products Export and Its Logistic Chain

Figure 5.7 shows the location of iron ore mines and steel related industry.



Source: Hattori, Ukrainian Steel Industry Outlook, Russia-NIS Report 2008.4, p. 39

Figure 5.7 Steel and Iron Ore Export Origins

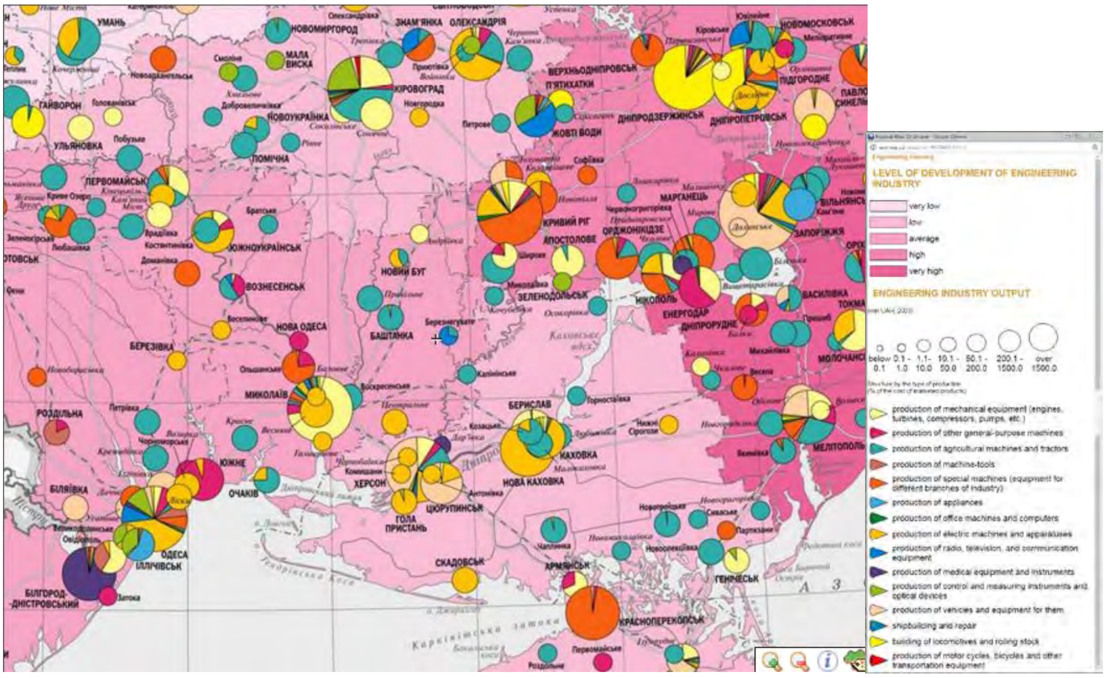
The major origins of the iron ore are distributed around the Dnipro Oblast. As shown in Table 5.2, 85% of iron ore are exported from the Yuznhy port, which has a good accessibility of railway network and larger vessels. Some iron ore are exported from Mariupol port, however, it would be influenced by the administration of Kerch Strait by Russia, which will increase the traffic demand between Donetsk/Dnipro to the Southern Region.

5.1.4 Industrial Development Potential in Mykolaiv and M-14

Figure 5.8 shows major industrial distribution in southern Ukraine, in 2000–2003. The cities along and behind M-14 have various characteristics as follows:

- Odessa has a variety of industrial categories, with electric machines (orange pie) being the major category. It also has a small conglomeration of industries in its surroundings, Illichivsk, Bilhorod–Dnistrovski, Yuzhny, and so forth.
- Mykolaiv is the center of mechanical equipment (yellow pie), with a vessel and turbine engine factory located in the city, based on historical military demand. Recently, a food and beverage factory "Sandora" was established by PepsiCo .
- Kherson holds the industry for vehicle parts (pink pie).

- Hinterlands of M-14 holds several small core industries for agricultural machines and tractors (dark blue pie), for its local agro services.
- Dnipro and Donetsk have the biggest industrial conglomeration within Ukraine, which needs an efficient transport services for export.



Source: Ministry of Natural Resource, *Ukraine Natural Resource Atlas*, http://wdc.org.ua/atlas/en/6070601.html

Figure 5.8 Industry Distribution in Southern Ukraine

5.1.5 Bottlenecks in Regional Transport and Urban Transport

(1) Incomplete Ring Road

Figure 5.9 shows the comparison of the urban road network structure in the major populated cities in Ukraine, with ring roads and intercity radial roads highlighted in orange. It can be said that only Mykolaiv and Dnipro do not have a proper ring road system in the industrialized cities in Ukraine.

Source: JICA Survey Team, not exactly in same scale

Figure 5.9 Radial and Circular Road Structure (Population in Millions)

(2) Bottleneck of the 24 ton Limit

The 24 ton-weight limit on the existing two bridges in Mykolaiv has continuously influenced the regional transport network, for example, the east-west directional traffic from Odessa to Kherson need to divert for more than 500 kilometers by taking M-05 and P-06.

The M-14 sections other than the two bridges in Mykolaiv are designed with a 40 ton limit compliance, and the surface has been maintained in good condition after the major pavement work done from 2013 to 2015. It can be said that M-14 is currently underutilized.

(3) Monitoring of Overloading

Ukrtransbezpeky[11] (State Service of Ukraine for Transport Safety), an affiliate body of the Cabinet Office and the Ministry of Infrastructure is responsible for the monitoring and control of overloading of trucks. Its monitoring activities are active, particularly in the Odessa and Mykolaiv region as shown in Table 5.5.

Table 5.5 Vehicle Overloading Monitoring Activities in the Top 6 Regions

Oblast	Number of checked vehicles	Number of vehicles overloaded
Total:	**199,747**	**5,996**
Odessa	83,022	1,307
Chornomorsk	15,461	660
Mykolaiv	12,909	175
Kiev	9,411	284
Rivnenske	9,206	151
Ternopil	8,782	190

Source: Ukravtodor Office of Mykolaiv Oblast

[11] State Service of Ukraine for Transport Safety website: http://dsbt.gov.ua/

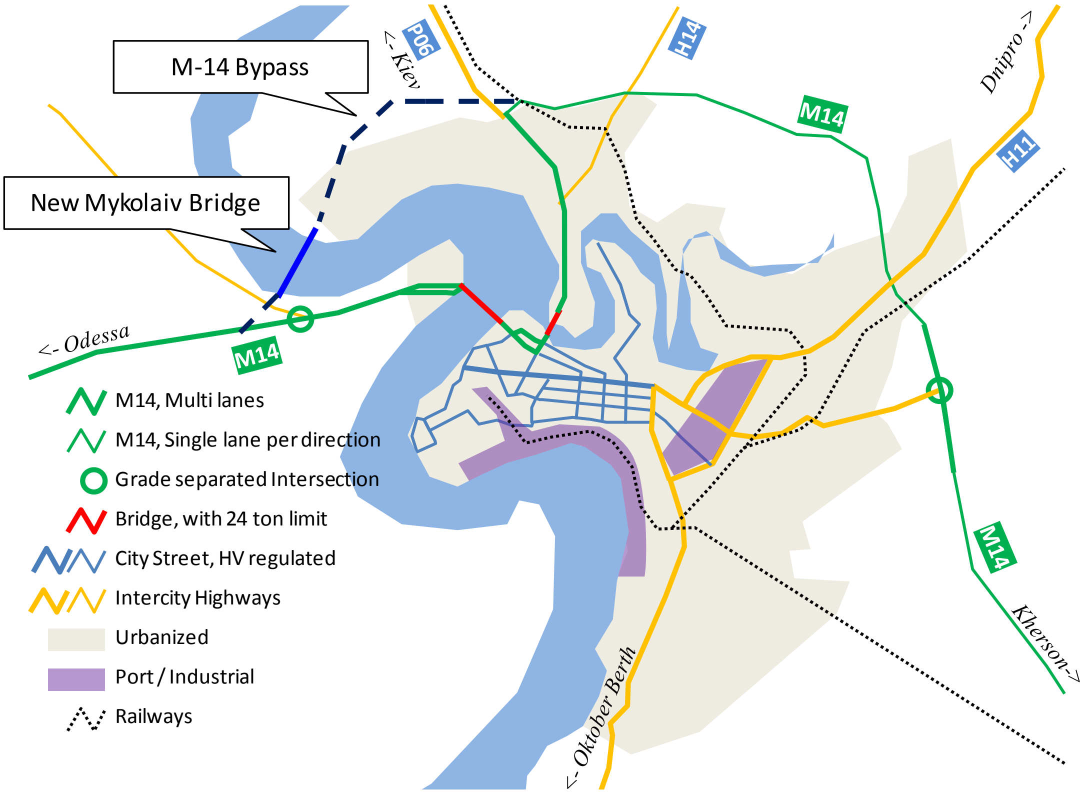
Source: JICA Survey Team

Figure 5.10 Overloading Monitoring at the P-06 Highway by Ukrtransbezpeky, on 17th November, 2016

Source: JICA Survey Team

Figure 5.11 The 24 ton Regulation at the Two Bridges in Mykolaiv City (Left: Ingul Bridge, Right: Varvarovsky Bridge)

(4) Micro-scope Observation and Influence



Source: JICA Survey Team

Figure 5.12 Highway Network Model and Land Use, Mykolaiv, 2016

Figure 5.12 depicts a simplified road network structure of Mykolaiv. M-14 highway runs through the outskirts of Mykolaiv city in the eastern area from Kherson. However, the alignment goes into the city from the northern area, passing through two bridges as well as the city center, and is directed to Odessa. The existing ring road section was constructed in 1980, and most are in two lanes. The two bridges on M-14 are highlighted in red within the network in Figure 5.12. Both bridges have a load limit of 24 tons and 7 tons per axle. The Varvarovsky Bridge on the South Bug River has three lanes. It has a few percent up-hill gradient headed to the city. The Ingul Bridge has 6 lanes.

The city streets drawn in blue lines are regulated for heavy vehicles, supervised by the municipal traffic police in a 24 hours, 7 days basis. Heavy vehicles destined to the port go into the city street from the east.

H-11 and P-06[12] are major industrial highways in Mykolaiv. H-11 is connected to Krivoi Rog[13], Dnipro and Kharkiv. The products from those industrial cities are connected to industrial areas and to the Port of Mykolaiv. PepsiCo invested a new beverage factory, Sandora that was built in 2013 and located at the intersection of M-14 and H-11. The Mykolaiv Oblast will open a logistics center adjacent to the intersection in 2017.

[12] The class of highway is specified as M (Intercity-1st), H (National-2nd), P (Regional-3rd), and T (Sub regional-4th). Letters of the M/H/P/T are capitals of Ukrainian words.
[13] The city has largest steel mill of Arcerol Mittal. Kryvyi Rih in Ukrainian language.

P-06 is a multi-lane capacity road and a shortcut highway connecting to M-05 heading to Kiev. Its design standard is as high as H-11, due to the importance of Mykolaiv as a naval base in the Soviet era.

H-14 is a national highway, but is of less quality than T class roads. It works as a collector of agro products in the hinterland. The World Bank has designated H-11 as a prioritized section for urgent upgrades.

As explained earlier, routes for heavy vehicles are regulated, but cause negative influences as per the following:

- Damages on cultural and social facilities located along M-14 in the city
  - Mykolaiv National Politechnique University, Shipbuilding museum, etc.
  - Difficulties in pavement management
- Slower speed and frequent stop-and-go operation of heavy vehicles in the city enhance deterioration of the pavement, particularly in summer. Deep rutting can be seen in all sections of M-14 in the city.
  - Although the JICA Survey Team was able to collect the municipal expenditure on pavement management, the data was insufficient to evaluate the significance of the expenditure.
- Traffic accidents: the JICA Survey Team could not collect the traffic accident data along M-14, however, the citizens call the M-14 section in the city as a "death road"
- Air pollution and Noise:
  - The Sustainable Development Strategy of the Mykolaiv City[14] identified the following as weaknesses in the community:
    - ✧ The increase of air pollution from vehicles
    - ✧ The overloading of heavy traffic resulting in pollution in the residential area, traffic jams in the city, damage in road pavement, and noise and vibration.
    - ✧ The share of pollutant emission in the city is 40% against the entire emission of the Oblast
- The same report suggests that bridges and bypass completion is essential for the city environment action plan (specified as Goal B5)

Traffic congestions in the city are attributed to traffic caused by the non-existence of a complete bypass. Some passenger cars pass through streets in the city although heavy vehicles are regulated for rat running in the city. The JICA Survey Team has not visited or observed the traffic situation during the summer leisure period.

5.1.6 Summary

In consideration of the surface traffic demand projection in the Southern Region of Ukraine, the following can be summarized as critical issues:

- Russian transit cargo traffic has decreased since 2014 and both governments prohibited direct transit through the borders from the beginning of 2016. It is estimated that 25% to 30% of surface traffic related to ports have decreased, comparing 2012 and 2016 figures. However, it can be said that the 2016 traffic level is at the lowest.
- The grain export is prioritized as a national economy booster, and the ports along M-14 will be the outlet of grains. Due to the population growth and economic growth in

[14] Proposals for Sustainable Development Strategy, 2012 Mykolaiv City

MENA, the grain export and its surface traffic will be increased in the Southern Region of Ukraine.

- The central government and IFIs are prioritizing their investment to rail and waterways for utilization by the grain export logistics, which will take a long time to justify. A large share of family based agro producers show their dependency on road based logistics with high frequency and overloading tendency.
- The two bridges in Mykolaiv city are the barrier to the regional road based logistics due to their small weight capacities. It can be said that the low efficiency of the road based logistics in the region is attributed to the barrier of the two bridges.
- Other than grain export, M-14 and ports contribute to the export of iron ore and steel products from the hinterland of Donetsk and Dnipro Oblasts.
- The origin of the grain products is distributed widely throughout Ukraine, except for the western region. The improvement of surface traffic efficiency in the Southern Region will directly benefit the majority of Ukraine.

The following can be summarized as recommendation for further consideration of improvement of M-14, including the new Mykolaiv Bridge:

- The transit demand to Russia has disappeared. Perhaps it would be necessary to revise the CAPEX of the new Mykolaiv Bridge in order to secure the economic benefit as projected in The Preparatory Survey in 2011.
- The new Mykolaiv Bridge investment will realize the road transport network with a region-wide 40-ton capacity. With such physical improvement, it will require social infrastructure for the overloading, including weigh-in-motion equipment, enforcement for family based agro farmers and local logistics companies, as well as major logistics companies.
  - Investing in the bridge construction could be justified by the economic benefit from saving travel time, decrease of vehicle operation cost, and reduction of automotive gas emission, due to traffic diversion. The detailed expectations of traffic diversion are discussed in Section 5.2.
- Other than the improvement of the bridge, road network improvement in the region can be programmed, in particular, including:
  - H-11 improvement, which has been prioritized by investment by the World Bank
  - M-14 Mykolaiv bypass ring road section improvement, which was built in the 1980s, and its longitudinal alignment are tight for heavy vehicles.
- The regional industrial improvement program, regional tourism development program, etc. can be implemented together with the physical improvements. Particularly, the regional industrial program and studies should cover the following:
  - Logistics industry development, in compliance with the 40 ton regulation
  - Regional industrial infrastructure development, in liaison with the regional industrial resources
  - Package loan to enhance modernization of truck and cargo fleets
- Tolling of the new Mykolaiv Bridge can be considered, however, detailed consideration is necessary. As the existing bridges shall be regulated strictly for heavy vehicles, there are no alternative roads nearby the new Mykolaiv Bridge that could accommodate the passing of heavy vehicles of up to 40 tons and such heavy vehicles would be forced to take a long detour if it chooses to avoid the toll. Therefore, tolling at the new Mykolaiv Bridge requires a detailed study of the optimized toll level for the regional economy, in consideration of the benefit of transport efficiency improvement and expenditure on regional maintenance. It should also be noted that Ukraine does not have experiences of toll roads.

5.2 Review of Traffic Forecast in The Preparatory Survey in 2011

5.2.1 Comparison of Traffic Counting

(1) Traffic counting in 2010

A two day traffic counting was conducted in December 2010 during The Preparatory Survey in 2011, as shown in Table 5.6. The Annual Average Daily Traffic (hereinafter, AADT) in 2010 was estimated by applying the results of the two day counting based on the monthly fluctuation in the region.

Table 5.6 24 Hours Traffic Counting Results in December 2010

	Motor	Passenger Cars	Buses	2 axle Trucks	3 Axle Trucks	Trailers	Total
Day1	0	10,610	3,608	1,129	486	1,397	17,230
Day2	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

Source: JICA Survey Team, based on The Preparatory Survey in 2011 (Final Report)

Table 5.7 Estimation of 2010 AADT with December 2010 Traffic Count

	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, based on The Preparatory Survey in 2011 (Final Report)

As shown in the monthly fluctuation above, the summer season generates higher traffic demands due to holiday and leisure purposes. After the closure of Crimea, it is said that Odessa and Mykolaiv are recognized as leisure destinations for the people of Ukraine, therefore, the fluctuation in the summer season is assumed to be larger than before.

In regards to the characteristics of grain harvests, the grains ripen in the summer and are delivered from the fields to ports from September to February. The fluctuation shown in the above data for freight may differ from the actual situation.

(2) Recent Traffic Counting Results

There are four data sources for traffic counting in the Southern Region in 2016. Related data is summarized in the subcontractor's final report, attached as Appendix 5-II to this report.

i) Ukravtodor's Automatic Counting System

Ukravtodor maintains an automatic loop coil traffic counting system with 209 counting locations all around Ukraine, which can provide 24 hours, 7 days counting with several vehicle classification. However, in 2016, only 15 locations were active and the quality of counting has not been secured due to the lack of maintenance. The JICA Survey Team could not obtain these data from Ukravtodor. Ukravtodor mentioned that the data collection had not been reliable due to the domestic political status since 2012.

ii) Ukravtodor and the World Bank

Ukravtodor and the World Bank are working on compiling a National Road Development Strategy, which covers the collection of traffic counting data in 2014 and 2016 for all the M/H/P/T class national roads with adequate length intervals and detailed vehicle classification. It should be noted, however, that the traffic counting results are estimations based on the sample counting with limited hours, which is expanded by coefficients for nation-wide counting results. Moreover, such set of traffic counting is not suitable to be used for the feasibility analysis for investments.

iii) Ukravtodor Office of Mykolaiv Oblast

Ukravtodor in Mykolaiv Oblast has conducted its own counting at the beginning of September 2016, for 24 hours at 7 locations with several vehicle classifications, as shown in Table 5.8 and Figure 5.13.

Table 5.8 Traffic Counting Data by Mykolaiv Oblast (September 2016)

Location (coded in the Map)	Passenger Cars	Buses	Trucks	Trailers	Total
1. M-14 км 125+500	9,058	957	4,031	2,430	16,476
2. M-14 км 143+000	1,358	62	2,091	1,975	5,486
3. M-14 км 147+000	1,908	62	2,606	2,098	6,674
4. M-14 км 159+000	2,476	62	2,394	2,312	7,244
5. City Entrance	3,364	399	2,321	1,773	7,857
6. H-11 км 319+000	7,219	538	2,674	1,329	11,760
7. P-06 км 225+000	5,402	404	2,218	2,151	10,175

KM=kilometer
Source: Ukravtodor Office of Mykolaiv Oblast

Source: Ukravtodor Office of Mykolaiv Oblast

Figure 5.13 Locations of Traffic Counting by Mykolaiv Oblast in September 2016

(3) JICA Survey Team's Traffic Counting

The JICA Survey Team carried out its own traffic counting on 24th and 25th January, 2017[15] at 6 locations around the Mykolaiv ring road and also conducted a road side Origin and Destination interview survey at the west end of the Varvarovsky bridge as well as several port entry points.

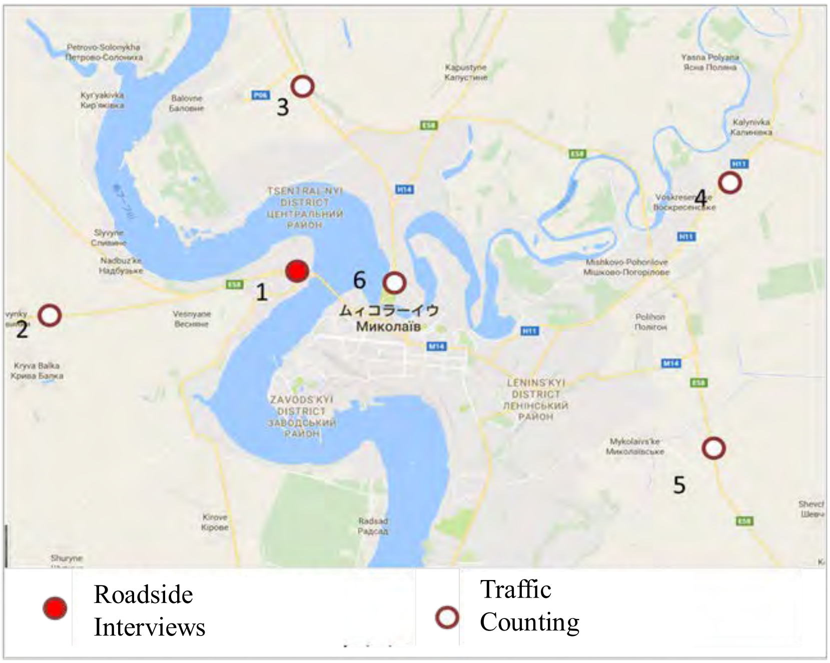
i) Traffic Counting

The counting was implemented utilizing the camera shooting method for 2 days (48 hours), applying the same vehicle classification as the 2010 survey. The details of the counting results are summarized in Appendix 5-I. Table 5.9 shows the summary of the counting results. Figure 5.14 shows the locations of the counting.

Table 5.9 Traffic Counting Data by the JICA Survey Team (January 2017)

		Passenger Cars	Buses	2 axle Trucks	3 Axle Trucks	Trailers	Total
1	Varvarovsky Bridge West	13,363	1,976	1,401	143	1,620	18,502
2	M-14 125 km post	4,703	550	1,049	123	1,365	7,780
3	P06	4,466	665	503	115	1,416	7,164
4	H11	3,202	473	686	77	468	4,905
5	M-14 167 km post	3,688	510	1,192	104	1,769	7,262
6	Ingul Bridge North	18,638	3,204	1,833	123	1,515	25,312

Source: JICA Survey Team.



Source: JICA Survey Team

Figure 5.14 Locations of Traffic Counting by JICA Survey Team in January 2017

15 Although a minor conflict occurred in Donetsk on 29th January, 2017, no influence was seen in the counting results.

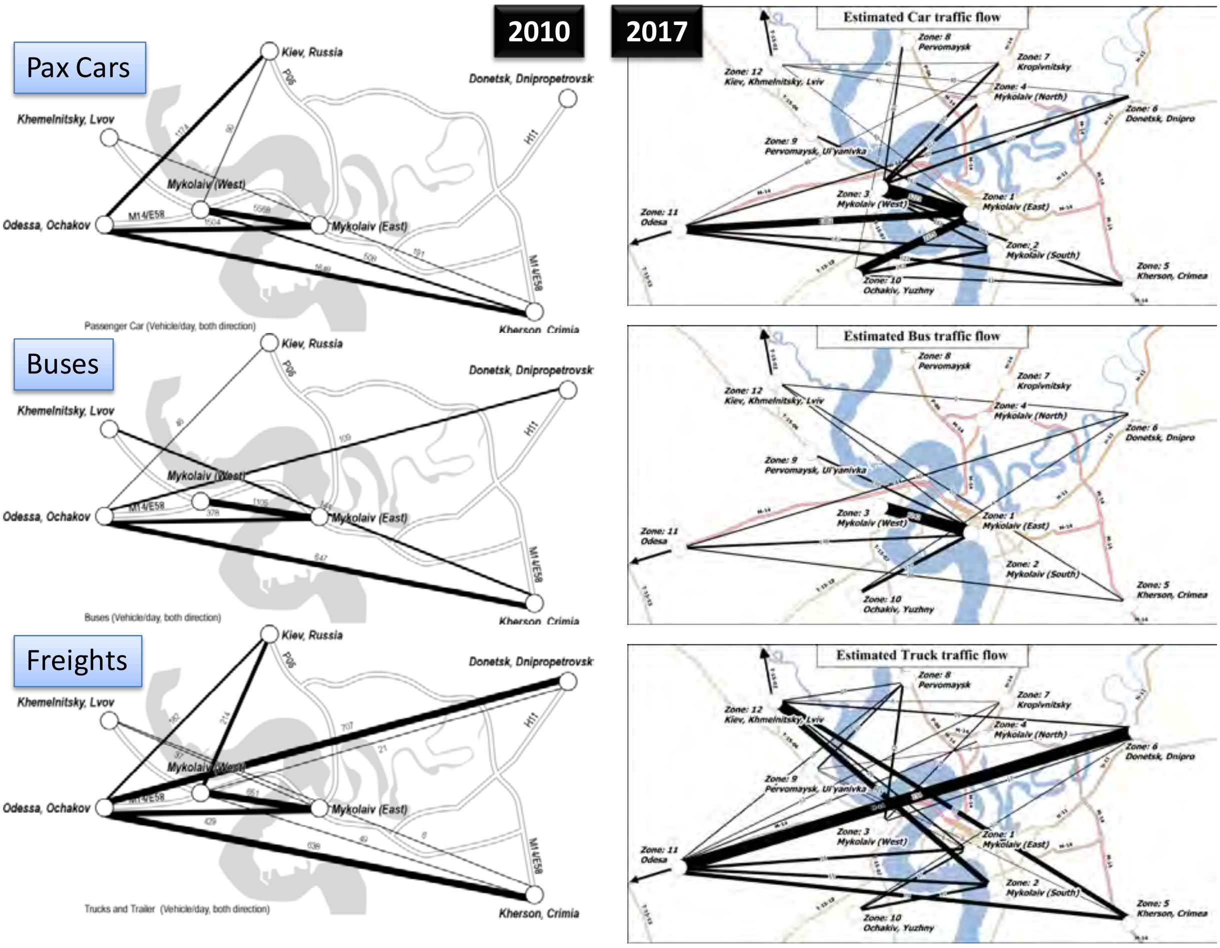
ii) Origin and Destination (OD) Surveys

Three kinds of OD surveys were conducted: i) for passenger cars, road side interviews were carried out from 8 a.m. to 4 p.m., and collected 332 answers, which was 5%–6% of the sampling rate during the hours, ii) for buses, information on all scheduled operation was collected from the regional and city bus operators and summarized, which shows 1,008 trips of scheduled buses for both directions, and covers 50% of bus traffic at the survey location, and iii) for trucks and trailers, the Survey Team collected the origin and destination date in the Southern Region from various sources, including: a) collected 176 raw data from the Transport Safety Agency (Ukrtransbezpeky), for sampled freight OD, b) inquired port operators in the Southern Region on the OD of the freight, but only a few samples with low reliability were collected. It should be noted that the road side survey for freight vehicles was not approved by the local traffic authorities, due to the present security circumstances in the region. The summary of the traffic surveys are attached in Appendix 5-I.

Figure 5.15 shows the OD results for passenger cars, buses and freight movement in the region, with comparison of OD surveys conducted in 2010. It should be noted that the OD zone designation of 2017 survey was amended from that of 2010, in order to clarify the regional circulation flows including ports in the Southern Region. The OD zone designation is depicted in Appendix 5-I.

For passenger OD patterns including cars and buses, the major trip movements are trips between Mykolaiv west bank and the main city. However, the regional movement between Kherson and Odessa, Kiev and Odessa and Dnipro and Odessa are the volumes that are assumed to be diverted to the new Mykolaiv Bridge. These results were utilized for analysis of diversion to the new Mykolaiv Bridge in the following section. The ODs for passenger cars and buses are summarized in Appendix 5-I.

Freight OD pattern was estimated by the OD taken by Ukrtransbezpeky, expanded by the rate of corridor traffic volume. The major freight movement in the region is between Odessa and Donetsk, which is planned to cross the new Mykolaiv Bridge in the future. The OD Desired Lines for passenger cars, buses and freight are also shown in Appendix 5-I.



PAX = Passenger, Unit: number of vehicle per day. See Appendix 5-II for details.
Source: JICA Survey Team.

Figure 5.15 OD Desired Line Comparison between 2010 and 2017 Surveys

(4) Review of Counting Results and Recommendations

The counting results have carefully been assessed, as it is the base of the traffic forecast and is utilized in analyzing the present situation of the transit demand decline. In this section, comparisons at two locations are summarized as follows:

i) West End of the Varvarovsky Bridge

Table 5.10 shows the comparison of traffic counting results in December 2010 and January 2017.

**Table 5.10 Comparison of Traffic Counting
(at the West End of the Varvarovsky Bridge)**

	Passenger Cars	Buses	2 Axle Trucks	3 Axle Trucks	Trailers	**Total**	Freight
2010 December, Preparatory Survey in 2011	10,645	3,016	1,152	498	1,302	**16,613**	17.8%
2017 January, This Survey in 2017	13,363	1,976	1,400	143	1,620	**18,502**	17.1%

Note: Freight ratio shows the share of the trucks and trailers in total.
Source: JICA Survey Team.

The influence of seasonal fluctuation is low in the comparison, and it can be said that the crossing traffic at the Varvarovsky Bridge has been increased, in spite of the regional turmoil at the border. The comparison shows trends in the traffic. The major change is the increase of passenger cars and decrease of buses, which substantiate the progress of motorization in the region. The number of trailers increased by 20%, while the number of 3-axles trucks decreased[16] and the number of 2-axles trucks increased. The total number of freight vehicles has increased; however, freight ratio has slightly decreased due to the increase of passenger cars.

ii) M-14 at 125 Kilometer Post

Table 5.11 summarizes the results of traffic counting in the summer of 2016 and winter of 2017.

Table 5.11 Comparison of Traffic Counting (at M-14, 125 Kilometer Post)

	Passenger Cars	Buses	Trucks	Trailers	**Total**	Freight
2016 September Mykolaiv Oblast	9,058	957	4,031	2,430	**16,476**	39.2%
2017 January This Survey in 2017	4,703	550	1,171	1,365	**7,789**	32.6%

Note: The number of trucks consists of the number of light, medium and heavy trucks. Trailers cover semi- and full-trailers. Freight ratio shows the share of the trucks and trailers in total.
Source: JICA Survey Team.

This actual counting can be used as the revision of seasonal fluctuation in this region, which was estimated in Table 5.7. Based on this survey result, monthly fluctuation coefficient can be revised as Table 5.12.

Table 5.12 AADT Coefficient Revision Based on 2016–2017

Monthly variation 2010 (based on Table 5.11)

	Pax	**Bus**	**2xT**	**3xT**	**Trail**
Jan.	1.00	1.00	1.00	1.00	1.00
Feb.	1.00	1.00	1.00	1.00	1.00
Mar.	1.30	1.97	1.85	1.79	1.76
Apr.	1.43	2.16	3.29	2.14	2.11
May	2.51	3.33	4.65	3.36	3.32
Jun.	4.25	4.49	6.02	4.61	4.54
Jul.	4.67	4.95	5.90	4.79	4.74
Aug.	4.25	4.49	6.02	4.61	4.54
Sep.	2.84	3.33	4.65	3.36	3.32
Oct.	1.43	2.16	3.29	2.14	2.11
Nov.	1.33	1.93	2.23	1.82	1.81
Dec.	1.30	1.97	1.86	1.78	1.76

Monthly variation 2016–17

	Pax	**Bus**	**2xT**	**3xT**	**Trail**
Jan.	1.00	1.00	1.00	1.00	1.00
Feb.	1.00	1.00	1.00	1.00	1.00
Mar.	1.21	1.51	1.63	1.42	1.41
Apr.	1.29	1.61	2.70	1.61	1.59
May	2.02	2.22	3.70	2.25	2.24
Jun.	3.20	2.83	4.72	2.91	2.90
Jul	3.49	3.07	4.63	3.01	3.00
Aug.	3.20	2.83	4.72	2.91	2.90
Sep.	1.93	1.74	3.44	1.78	1.78
Oct.	1.29	1.61	2.70	1.61	1.59
Nov.	1.22	1.49	1.91	1.44	1.43
Dec.	1.20	1.51	1.64	1.41	1.41

Note: Pax: Passenger cars, 2xT: 2-axles trucks, 3xT: 3-axles trucks, Trail: Trailers
Source: JICA Survey Team.

The AADT for 2017 based on the survey in Jan 2017 is estimated as shown in Table 5.13.

[16] This change could be assessed as: i) increase in demand for large volume delivery converted 3-axles trucks to trailers, and ii) trends of frequent small volume delivery increased delivery with smaller trucks.

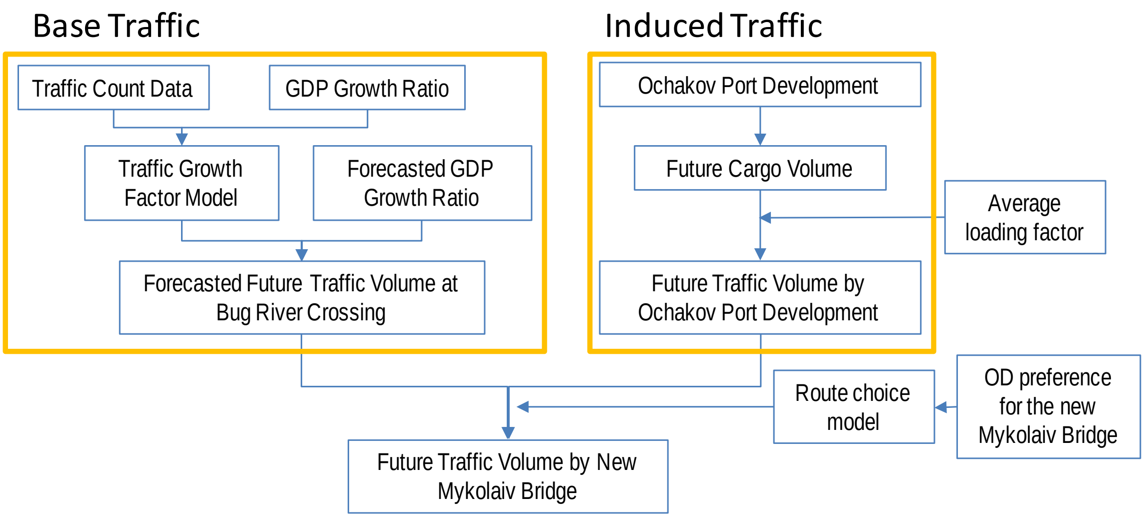
Table 5.13 Estimation of 2017 AADT

	Passenger Cars	Buses	2 axle Trucks	3 Axle Trucks	Trailers
Jan.	13,363	1,976	1,400	143	1,620
Feb.	13,363	1,976	1,400	143	1,620
Mar.	16,103	2,982	2,287	203	2,277
Apr.	17,234	3,178	3,776	230	2,581
May	27,029	4,381	5,182	322	3,636
Jun.	42,815	5,583	6,604	417	4,692
Jul.	46,620	6,063	6,487	430	4,867
Aug.	42,815	5,583	6,604	417	4,692
Sep.	25,736	3,438	4,819	255	2,884
Oct.	17,234	3,178	3,776	230	2,581
Nov.	16,358	2,942	2,672	205	2,323
Dec.	16,097	2,980	2,290	202	2,279
AADT	24,564	3,688	3,941	266	3,004

Source: JICA Survey Team

5.2.2 Review of the Forecast Model in The Preparatory Survey in 2011 and Proposed Revision

The traffic forecast methodology in The Preparatory Survey in 2011 is summarized in Figure 5.16.



Source: JICA Survey Team, based on The Preparatory Survey in 2011 (Final Report)

Figure 5.16 Traffic Demand Forecast Flow of The Preparatory Survey in 2011

There were two categories in the traffic forecast in The Preparatory Survey in 2011:

i) Base Traffic – coefficients estimated between recent traffic growth trends with GDP growth from 1999 to 2009, and extrapolated future traffic based on the GDP growth scenario. It assumed GDP growth as 4.5% in the first 5 years and 4.0% from 2015 to 2045.

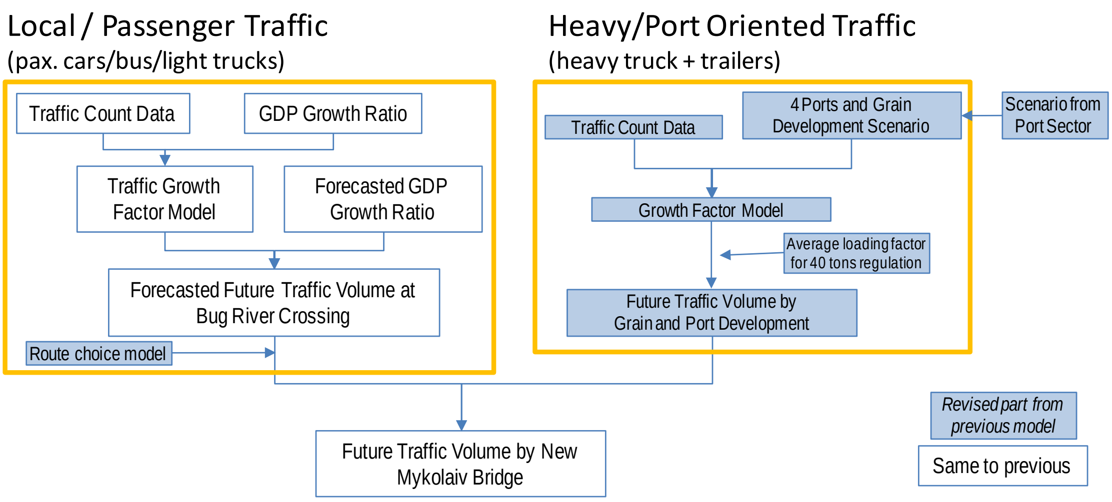
ii) Induced Traffic – additional traffic related to the Ochakov Port development scenario was estimated, and the expected cargo volume related to the scenario had been added. The scenario covers the demand on dry bulk and containers, including export, import and transit growth. The ratio of the induced traffic to the total volume was only 3% to 5%.

The JICA Survey Team's comments on the forecast framework are as follows:

- For the base traffic, the coefficients of traffic growth and the model structure of the model used in The Preparatory Survey in 2011 can be utilized. However, the assumptions of GDP growth should be modified to fit the current forecast.
- Referring to the r-square results of the model used in The Preparatory Survey in 2011, the r-square coefficient for the passenger car demand has enough explanatory power but the others were lower.
- For the induced traffic, the share of port development scenario based on Chapter 4 should be incorporated, including Illichivsk, Yuzhny, and Mykolaiv. The transit and container demand shall be revised from the original idea.

With above, the JICA Survey Team has revised the forecast framework as follows:

- Local traffic and heavy traffic in the model has been separated to incorporate the recent changes related to the ports.
- Local traffic model covers three categories: passenger cars, buses, and light trucks. It is assumed that the traffic demands for these categories are proportional to the GDP, and traffic models of The Preparatory Survey in 2011 are applied, though the explanatory power are not powerful, except for passenger cars.
- Port oriented traffic model covers two categories: heavy trucks and trailers. It is assumed that the traffic demands for these categories are proportional to the port handling volume, which is provided in the port development scenario.



Source: JICA Survey Team

Figure 5.17 Traffic Demand Forecast Flow for This Survey

(1) Local/Passenger Traffic Model (Passenger Cars, Buses, Light Trucks)

Similar to the model used in The Preparatory Survey in 2011, it is assumed that the local based traffic will grow proportionally with the GDP growth. There only is a few data source to estimate the coefficient for passenger car demand with GDP growth and recent economic situation of the country has been unstable and fluctuating. Therefore, the traffic growth factor model of the model used in The Preparatory Survey in 2011 for passenger car and bus shall be applied to this study. The forecasted GDP growths are assumed as 2.5% to 3.5%[17] during the forecast period, say:

$$TGR = a + b * GDPGR$$

Where:

TGR: Traffic volume growth ratio (% p.a.)
a,b: Parameters shown in the following table.
GDPGR: GDP growth ratio (% p.a.)

Table 5.14 Local/Passenger Traffic Forecast Model, Coefficient Settings

	coefficient a	coefficient b	R^2
Passenger Cars	−0.0124	1.259	0.846
Buses	0.080	−1.705	0.510
2 axle trucks	−0.023	0.905	0.567

Source: JICA Survey Team, based on The Preparatory Survey in 2011 (Final Report)

Table 5.15 GDP Growth Rate

2017	2.5%
2018	3.0%
2019	2.8%
2020	3.0%
2021-	3.5%

Source: EIU

Table 5.16 shows the crossing traffic demand forecast.

Table 5.16 Local/Passenger Crossing Traffic Forecast (AADT)

	Passenger Cars	Buses	2 axle trucks
2017	24,564	3,688	3,941
2020	26,416	4,030	3,983
2025	30,872	4,456	4,159
2030	36,079	4,928	4,342
2035	42,165	5,450	4,534
2040	49,277	6,026	4,734
2045	57,589	6,664	4,943

Source: JICA Survey Team

(2) OD Pattern and Route Choice

Regarding the route choice of the crossing traffic with the new Mykolaiv Bridge, the choice rate for the new Mykolaiv Bridge is estimated following the steps below:

1. The ODs are classified into two segments, i) captive to the new Mykolaiv Bridge, and ii) selective for both routes, based on the characteristics of the OD combination. The former segment covers the region wide OD pairs, which has a longer trip length and does not require entry into the Mykolaiv city. The latter segment covers the OD pairs to/from Mykolaiv city, which has a shorter trip length. Figure 5.18 shows the zone map and two segments of the OD pairs in the OD table.
2. The share of the segment is aggregated for the i) captive to the new Mykolaiv Bridge by vehicle types based on the OD pattern.

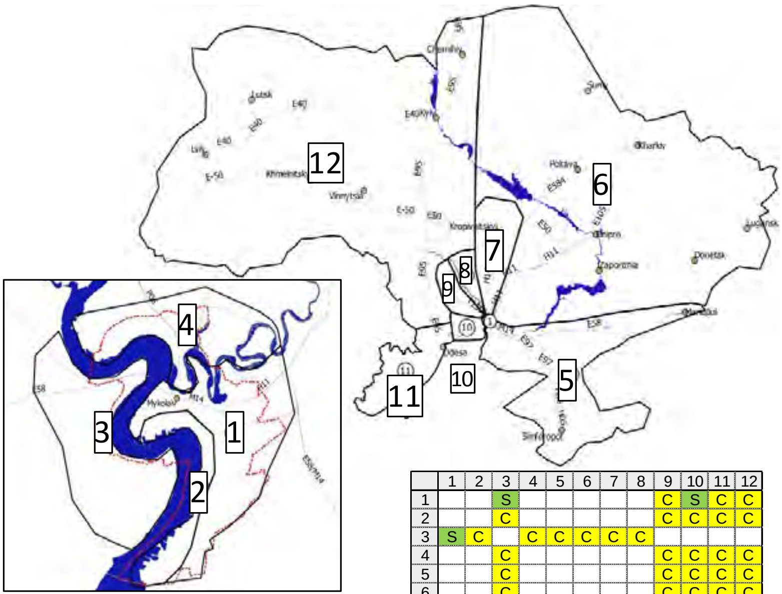
[17] The Preparatory Survey in 2011 assumed the GDP growth rate as 3.7% to 4.8%

3. The share of the segment is aggregated for the ii) selective for both routes by vehicle types based on the OD pattern.
4. The choice rate of the new Mykolaiv Bridge is assumed for the ii) selective for both routes by vehicle types. For passenger cars, it is assumed that 20% of the area of Mykolaiv city adjacent to the M-14 bypass would use the new route. For buses, it is assumed that 0% would be diverted from the selective segment, due to its fixed route services.
5. For the 2 axle trucks, the rate of the passenger cars has been applied, due to the lack of OD data for this category and similarity in vehicle characteristics.
6. The final route choice rate by vehicles is aggregated, as shown in Table 5.17.

Table 5.17 Local/Passenger Crossing Traffic Forecast (AADT)

	Passenger cars	Buses	2 axle trucks
Captive	29.82%	19.54%	29.82%
Selective	57.23%	76.59%	57.23%
Final	41.27%	19.54%	41.27%

Source: The Preparatory Survey in 2011 (Final Report)



	1	2	3	4	5	6	7	8	9	10	11	12
1			S						C	S	C	C
2			C						C	C	C	C
3	S	C		C	C	C	C	C				
4			C						C	C	C	C
5			C						C	C	C	C
6			C						C	C	C	C
7			C						C	C	C	C
8			C						S	C	C	C
9	C	C		C	C	C	C	S				
10	S	C		C	C	C	C	C				
11	C	C		C	C	C	C	C				
12	C	C		C	C	C	C	C				

C: Captive Segment to new bridge
S: Selective Segment to both routes

Source: JICA Survey Team

Figure 5.18 Zone Map and Designation of Captive and Selective OD Pairs

Consequently, the AADT on the new Mykolaiv Bridge for local and passenger traffic demand are estimated as shown in Table 5.18.

Table 5.18 Traffic Forecast for the New Mykolaiv Bridge (AADT)

	Passenger Cars	Buses	2 axle trucks
2017	*10,138*	*721*	*1,626*
2020	*10,902*	*787*	*1,644*
2025	12,741	871	1,716
2030	14,890	963	1,792
2035	17,402	1,065	1,871
2040	20,337	1,178	1,954
2045	23,767	1,302	2,040

Note: The figure in 2017 and 2020 are reference.
Source: JICA Survey Team

(3) Heavy Vehicles and Port Oriented Traffic Model Concept (Trucks and Trailers)

It is assumed that the freight traffic demand crossing the Bug River will be proportional to the total tonnage of export and import at the ports in the Southern oblasts (Odessa, Mykolaiv and Kherson).

Due to the closure of the Russian transit, it is assumed that the future transit demand from/to the ports will not generate traffic on M-14 and crossing the Bug River. Due to the very limited data sources in recent period, reliability and re-productivity of the model cannot be confirmed at the present stage. Heavy vehicles are regulated to pass through the new Mykolaiv Bridge; therefore, route choice model will not be applied to this category.

Table 5.19 shows the concept of the model, the relation between input and output. The input is the entire volume of the export and import in the Southern Region, at 93.7 million tons, with the major export being dry bulk, as shown in the table. The 5 variables to estimate the output would be assumed as shown in the table, 1) business day per year, 2) road transport share among the market, 3) average ton per vehicle, 4) round trip factor, and 5) crossing ratio at Mykolaiv. In the end, the output “HV (Heavy Vehicles) crossing per day” can be estimated.

Table 5.19 Heavy Vehicles and Port Oriented Traffic Model

	Present	Case 1 without bridge	Case 2 without bridge	Case 1 with bridge	Case 2 with bridge
[Input] Total volume of Export & Import in Southern Region (million tons)	93.77	157	180	157	180
Variables					
1) Business days per year	300	300	300	300	300
2) Road share	25%	25%	20%	25%	20%
3) Average ton per vehicle	12	12	12	24	24
4) roundtrip	2	2	2	2	2
5) crossing ratio at Mykolaiv	25%	25%	25%	30%	32%
[Output] Expected HV crossing per day (AADT of heavy vehicles)	3,256	4,797	5,500	2,878	3,520

Source: JICA Survey Team

The scenarios for the input are summarized in Table 5.20. The present demand is estimated for the 4 major commodities, with the volume of containers, which was explained in Chapter 4, Port Demand Scenario. The input is assumed to increase to 157 million tons per year in Case 1. Case 2 has been set to be 15% larger than Case 1, to cover demands of other commodities[18].

[18] For Case 1, it includes coal, metal ore, metal product, grains, and containers. For Case 2, other commodities include chemicals, petroleum products, building materials, etc.

Table 5.20 Scenario for Port Freight Demand

	2015 (Present)	2030 (Case 1)	2030 (Case 2)
Coal (million tons)	6.3	9.3	
Metal ore (million tons)	32.4	48.9	
Metal Product (million tons)	18.7	30.6	
Grain (million tons)	32	56.3	
Container (KTEU)	437	1187	
ton per container (ton/TEU)	10	10	
Container (million tons)	4.37	11.87	
Total volume in the Ports in Southern Region	93.77	156.97	180

Source: JICA Survey Team (See Table 4.3 for volume forecast at major ports)

The five variables were adjusted for the present situation and assumed for the future cases as follows:

1. The business days per year is assumed at 300 days in a year, for all cases.
2. The road transport share in the market varies by commodity, but heavy ore is dominant to rail, and 65% of grains are carried by rail. Consequently, the road transport share was assumed as 25% for all commodities in the current situation. In the future cases, promotion of rail and water transport is assumed to acquire the share of road transport in some part, and share of the road is expected to slightly decrease, until 22%.
3. The average freight ton per vehicle should be considered for delivery without cargo. Due to the regulation of the existing bridges and round trip, 12 tons was applied for the present case. For the future case with the new Mykolaiv Bridge, the average can be increased to 24 tons per vehicle because of the new Mykolaiv Bridge and with the network to be able to carry 40 ton vehicles. For the future case without the new Mykolaiv Bridge, the logistics efficiency is assumed not to improve and set as 12 tons.
4. The traffic is doubled for round trip.
5. The ratio of crossing at Mykolaiv[19] is adjusted to reproduce the present heavy vehicles crossing per day (AADT 3,256 in 2017). For future cases with the new Mykolaiv Bridge, the crossing rate is assumed to increase slightly due to its higher utility in the road network (30 to 32%). For the future case without the new Mykolaiv Bridge, the ratio is assumed to be the same as to the present case.

The output is assumed to vary from 2,870 to 5,500 heavy vehicles per day, with and without the new Mykolaiv Bridge. In the “without bridge” scenarios, the heavy vehicles are assumed to pass through the existing vulnerable bridges in Mykolaiv, generate economic externalities in the city road network, and cause delays. In the “with bridge” scenarios, the heavy vehicles are assumed to go through the bypass, save the economic externalities and shorten the travel time. The summation of the difference would be the base of the economic benefit.

(3) Flow Forecast of the New Mykolaiv Bridge

Table 5.21 summarizes the traffic forecasts for year 2030 with scenarios of Case 1. For the case with the new Mykolaiv Bridge, it is assumed that the new Mykolaiv Bridge will start its operation before 2030.

[19] The crossing ratio for heavy vehicles can be estimated by the freight OD patterns. The Survey Team collected 176 of OD raw data from Ukrtransbezpeky. The OD patterns show that 57.75% of the crossing trip is captive to the crossing. However, the Survey Team did not apply this rate due to i) low and unreliable sampling rate, and ii) low reproduction of the present traffic volume.

Table 5.21 Traffic Forecast (AADT – Case 1)

	Passenger Cars	Buses	2 Axle Trucks	Heavy Vehicles	Total	Total in PCU
2017 Present Situation	24,564	3,688	3,941	3,270	**35,463**	49,632
2030 Case 1 with Bridge						
Crossing traffic at new bridge	14,890	963	1,792	2,878	**20,523**	29,035
Crossing traffic at existing bridge	21,189	3,965	2,550	0	**27,704**	34,219
2030 Case 1 without Bridge						
Crossing traffic at existing bridge	36,079	4,928	4,342	4,797	**51,891**	69,012

PCU: 1.0 for passenger cars, 2.0 for buses, 2.0 for 2 axle trucks and 3.0 for heavy vehicles[20]
Source: JICA Survey Team

- For the case [with Bridge], the traffic is estimated for the two sections, that is, at the new Mykolaiv Bridge and at the existing bridges. Over 40% of the traffic passing through Mykolaiv city is expected to cross the new Mykolaiv Bridge, which will alleviate the congestion and physical damages at the existing bridges. This framework assumes the heavy traffic to the existing bridges to be zero, which is attributed to the assumption on traffic regulation. The number of the heavy vehicles is assumed to decrease, due to the deregulation of loading amount. The traffic on the Varvarovsky Bridge will be 27,704, and 34,219 in Passenger Car Unit (hereinafter, PCU), which could be handled with the present capacity of three lanes even at peak hours.
- For the case [without Bridge], the estimated traffic on the Varvarovsky Bridge is assumed to be 1.6 times larger than the current situation, and 69,012 in PCU. The three lane bridge's saturation ratio in the peak hours would be 1.37, which suggests permanently paralyzed condition at the bridge, and the situation would be worse in the high season.

Table 5.22 shows the result of Case 2. This Case is the scenario with higher traffic at the port:

Table 5.22 Traffic forecast (AADT – Case 2)

	Passenger Cars	Buses	2 Axle Trucks	Heavy Vehicles	Total	Total in PCU
2017 Present Situation	24,564	3,688	3,941	3,270	**35,463**	49,632
2030 Case 2 with Bridge						
Crossing traffic at new bridge	14,890	963	1,792	3,520	**21,165**	30,960
Crossing traffic at existing bridge	21,189	3,965	2,550	0	**27,704**	34,219
2030 Case 2 without Bridge						0
Crossing traffic at existing bridge	36,079	4,928	4,342	5,500	**50,850**	71,120

Source: JICA Survey Team

Table 5.23 shows the comparison of the new Mykolaiv Bridge crossing traffic with forecasts of The Preparatory Survey in 2011, in PCU. The traffic at the new Mykolaiv Bridge in the new estimations is slightly lower than that in the previous study. Table 5.24 shows how the assumptions of this Survey influenced the results of The Preparatory Survey in 2011.

[20] The Preparatory Survey in 2011 applied 2.0 for 2 axle trucks, 2.5 for 3+ axle trucks and 3.0 for trailers. There is no reference of PCU for buses in the said survey in 2011.

Table 5.23 Comparison with the 2030 Forecast of the Preparatory Survey in 2011, "with Bridge" Case

2030 The Preparatory Survey in 2011, toll-free condition, full induced traffic (PCU)	32,400
2030 Case 1 with Bridge (this study, PCU)	29,035
2030 Case 2 with Bridge (this study, PCU)	30,960

Source: JICA Survey Team

Table 5.24 Comparison of Positive and Negative Influences of the Assumptions

Positive influences	Negative influences
• AADT revision based in 2017 (AADT in 2017 is more than that in 2010)	• A more modest passenger car growth, due to revision of the GDP growth scenario • Difference in calculation period, though the target year is the same • A more modest monthly fluctuation

Source: JICA Survey Team

6. Road and Seaport Development Scenarios for the Southern Region of Ukraine

This chapter explains the development scenarios for the road and seaport sector. Basically, the construction of the new Mykolaiv Bridge is the priority project in the road sector, and the chapter further describes how other development needs could be integrated with the development of the Bridge. For the seaport sector, the JICA Survey Team suggests the prioritization of the 8 proposed projects.

6.1 Road Sector

6.1.1 Priority Projects in the Southern Region of Ukraine

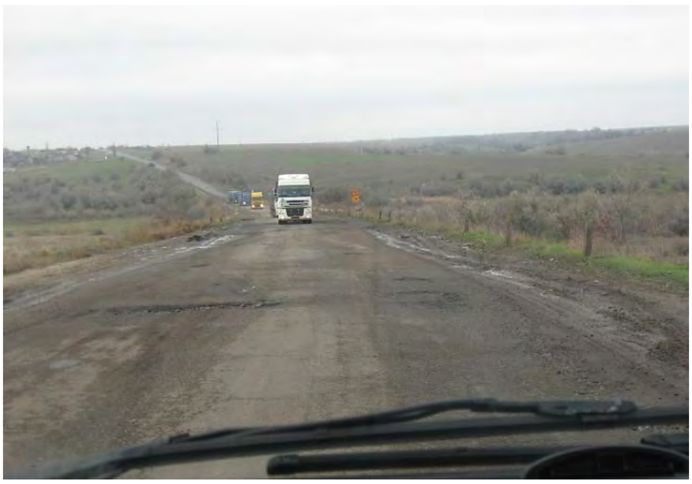
During the site visit by the JICA Survey Team and discussion with Ukravtodor in November 2016, it was mentioned by the Government of Ukraine that the construction of the new Mykolaiv Bridge is the highest priority project for the missing link development at national level, as well as in the Southern Region of Ukraine. Such selection of the priority project has also been supported by the Ministry of Infrastructure.

Other priority projects aside from the construction of the new Mykolaiv Bridge can be summarized as per below, in accordance with the priority projects stated in Chapter 3, Section 3.2.10 “Ongoing and Planned Projects” and through discussions with the local governments.

(1) H-14 in Oleksandrivka – Kropivnitskiy – Mykolaiv

As one of the radial highways from Mykolaiv, improvement of H-14 is necessary in the short term. Its feasibility study has been completed with the approval of the Cabinet of Ministers of Ukraine dated 17th June, 2015, No. 498. The World Bank has prioritized this project and is planning to source the fund for its improvement. The background of H-14 is explained in Chapter 5, Section 5.1, “Traffic Issues in the Southern Region and Its Surroundings”.

Presently, the conditions of H-14, especially the sections close to Mykolaiv requires significant improvement, namely in regards to pavement. However, there is significant traffic volume using this stretch as a radial road to the center of the city.



Source: JICA Survey Team

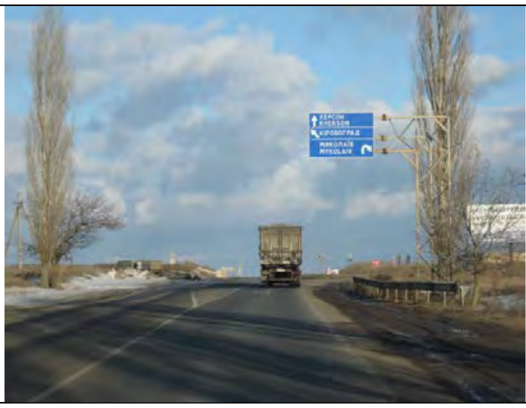
Figure 6.1 Photo of H-14 Near Mykolaiv

(2) M-14 in Kherson Oblast

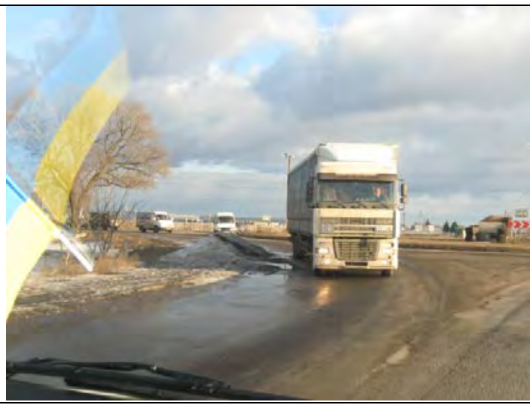
Investment to the remaining M-14 sections is necessary. Its feasibility study has been completed with the approval of the Cabinet of Ministers of Ukraine dated 17th June, 2015, No.498.

(3) Ring Road Improvement in Mykolaiv

The ring road bypass, a section of M-14 in Mykolaiv, has been completed in the 1980s. Major sections have been constructed in a 2 lane road for both directions without a center divider. Recently, the overpass interchange between the port access road to Mykolaiv Port and the ring road was completed; however, most sections need to be improved to multi-lanes in order to cope with the increasing number of heavy trucks and passenger cars during the construction of the new Mykolaiv Bridge.



Junction of Mykolaiv on M-14 to Kherson



Heavy Trucks on M-14 Ring Road

Source: JICA Survey Team

Figure 6.2 Photos of the M-14 Ring Road Near Mykolaiv

(4) M-15 in Odessa–Reni (Romanian Border)

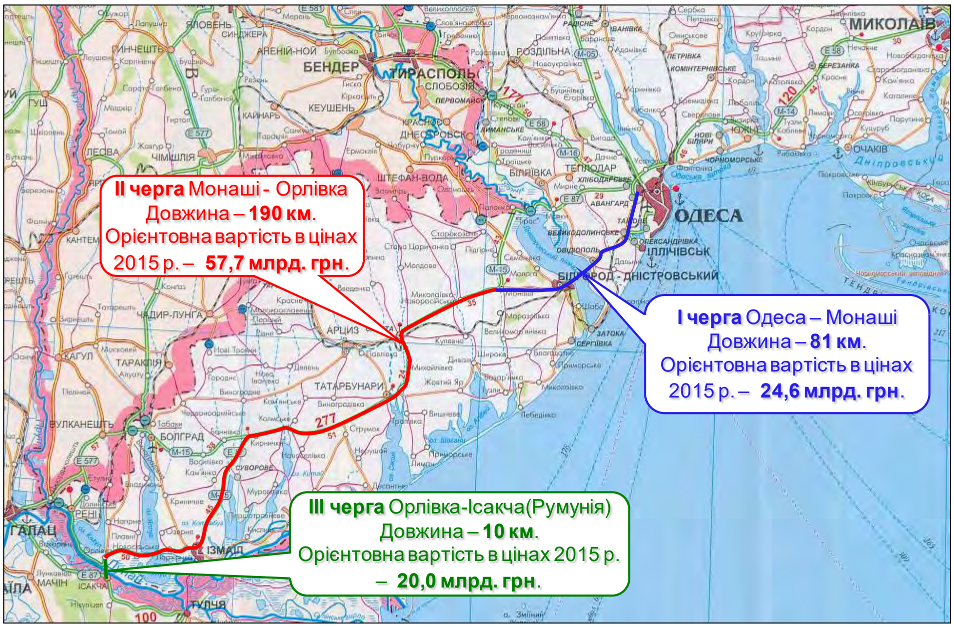
The international road M-15 Odessa - Reni (at the border to Romania), with a total length of 295.2 kilometers and classified as an E87 and BSEC corridor, is the main artery that provides traffic in the South-Western Region of the Odessa Oblast and Danube ports (Reni, Izmail, West-Danube). The surface condition is worse than the other M-class roads in the Southern Region. Particularly, the condition of the section 40-56 kilometers requires improvement, which is located in the swampy floodplain in the territory of Moldova. Thus, even if the road ownership is under Ukraine, it is difficult for Ukravtodor to maintain the road structure. There also is a small bridge with a 14 ton limit along the section.

Source: JICA Survey Team

Figure 6.3 Photo of M-15 West of Odessa

The agro productivity of southern Odessa is generally higher than the other areas; however, due to the limits to the logistics, there is difficulty for the agro products to reach the major markets.

In such circumstances, the Government of Ukraine has prepared and approved the feasibility study[1] in 2011, and Ukravtodor is currently preparing a proposal to improve the entire section of M-15. Figure 6.4 depicts the scope of the improvement. The scope is proposed in three phases, i) Odessa – Monastic (Belgorod-Dniester) with a length of 81 kilometers, including a bridge across the Dniester estuary with a length of 5.7 kilometers, and a project cost of UAH 24.6 billion, ii) Monastic (Belgorod-Dniester) – Orlovka with an estimated length of 190 kilometers, and a project cost of UAH 57.7 billion, and iii) construction of a bridge over Danube, Orlovka – Isaccea (Romania), with a length of 10 kilometers, including a bridge of 4.3 kilometers, at UAH 20 billion.

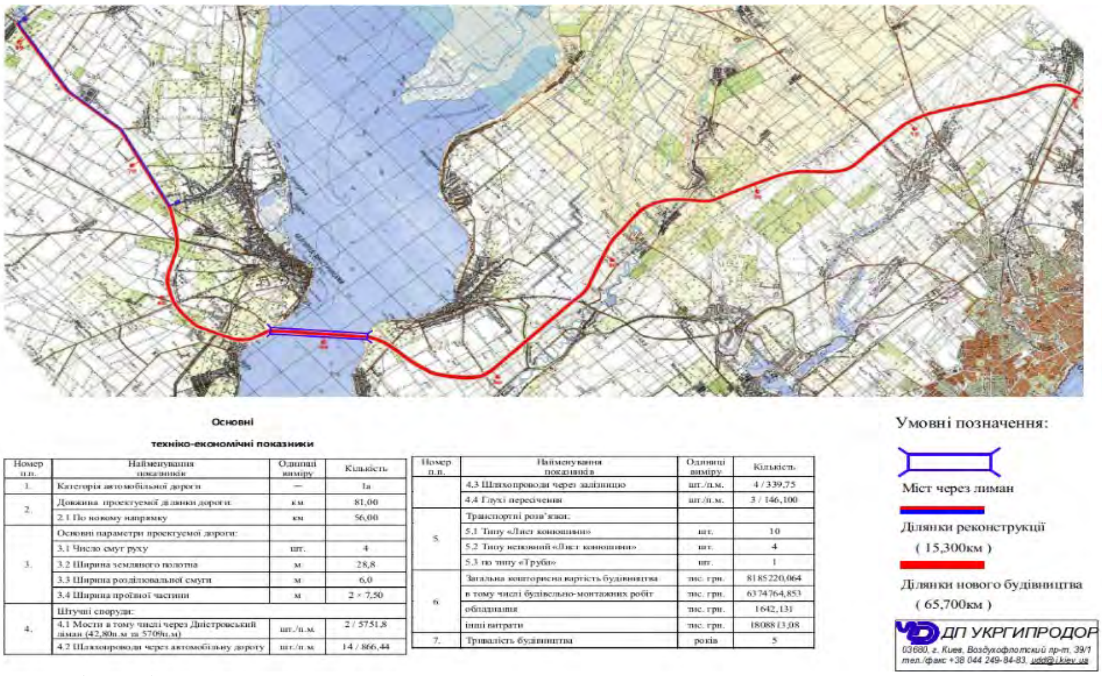


Source: Ukravtodor

Figure 6.4 Scope for Improvement of M-15

The details of the phase 1 scope are shown in Figure 6.5. It will be an alternative to the existing M-15 section passing through the Moldovian territory, proposing a new bridge crossing the Dniester estuary.

[1] 10th July, 2011, p. 690 "On approval of the feasibility of building area car roads of national importance Odessa –Reni (in Bucharest) for a new direction 'Odessa–Ovidiopol–Belgorod–Dniester–Monastic' with the bridge across the Dniester estuary, Odessa region"



Основні

техніко-економічні показники

Номер п.п.	Найменування показників	Одиниці виміру	Кількість
1.	Категорія автомобільної дороги	—	Ia
2.	Довжина проектуємої ділянки дороги:	км	81,00
	2.1 По новому напрямку	км	56,00
3.	Основні параметри проектуємої дороги:		
	3.1 Число смуг руху	шт.	4
	3.2 Ширина земляного полотна	м	28,8
	3.3 Ширина розділювальної смуги	м	6,0
	3.4 Ширина проїзної частини	м	2 × 7,50
4.	Штучні споруди:		
	4.1 Мости в тому числі через Дністровський лиман (42,80п.м та 5709п.м)	шт./п.м.	2 / 5751,8
	4.2 Шляхопроводи через автомобільну дорогу	шт./п.м	14 / 866,44
	4.3 Шляхопроводи через залізницю	шт./п.м.	4 / 339,75
	4.4 Глухі пересічення	шт./п.м.	3 / 146,100
5.	Транспортні розв'язки:		
	5.1 Типу «Лист конюшини»	шт.	10
	5.2 Типу неповний «Лист конюшини»	шт.	4
	5.3 по типу «Труба»	шт.	1
6.	Загальна кошторисна вартість будівництва	тис. грн.	8185220,064
	в тому числі будівельно-монтажних робіт	тис. грн.	6374764,853
	обладнання	тис. грн.	1642,131
	інші витрати	тис. грн.	1808813,08
7.	Тривалість будівництва	років	5

Source: Ukravtodor

Figure 6.5 Scope for Improvement of M-15 (Phase 1)

6.1.2 Development Scenarios of Roads for the Southern Region of Ukraine

In 2015, "The Strategic Plan for Development of Road Transport and Road Infrastructure of Ukraine up to 2020" was approved by the ordinance of Cabinet of Ministers (Order by the Ministry of Infrastructure dated 21st December, 2015 No. 548). This Strategic Plan has been created in accordance with other strategies, such as "Ukraine 2020" and "Transport Strategy of Ukraine to 2020".

Within the Strategic Plan, 4 strategic areas are identified as per below, with necessary tasks for each area:

- Development of governmental policy in line with provisions of the Association Agreement[2], policies, strategies and best EU practices in the road transport sector in terms of regulatory policy, traffic safety, environment protection and energy efficiency.
- Accessibility and quality of transport services provided to all categories of passengers throughout the state, including people with limited mobility; improvement of quality and safety rate of passenger and freight transport services.
- Increase of subsector performance and competitiveness, creation of favorable business climate, support to improving performance of road transport operators, and vehicle fleet structure, applying advanced transport technologies, implementing transport system transit potential.
- Reform of road infrastructure subsector and development of road network and its maintenance in the proper condition.

In terms of the financing for implementation of such strategies, it is stated in the Strategic Plan that the tasks are to be carried out within budget allocations envisaged for the Ministry of

[2] The Association Agreement is a treaty between the European Union and the European Atomic Energy Community and their 28 member states and Ukraine, ratified by Parliament in Ukraine and the European Parliament on 16th September 2014.

Infrastructure of Ukraine by the State Budget of Ukraine for the year, local budgets, own funds of the transport market operators and other sources not prohibited by law.

Moreover, a state target economic program for 2013–2018 for roads has been approved by the Cabinet of Ministers of Ukraine dated 11th July, 2013, No.696. However, due to lack of funding, implementation has not been satisfactory. Currently, a new development strategy for road facilities for 2017–2022 is being developed by Ukravtodor, with support from the World Bank.

The status of the road networks in the Southern Region of Ukraine is explained in Chapter 3, Section 3.1 "Overview of National Road Network". The importance of the road section for the east-west movement of goods and passengers via land, namely via Russia to the east countries and via sea, and various ports along the south coast of Black Sea has been emphasized. Although currently, there are issues in the connection via Russia, the demand of the sea traffic has become more important.

As can be seen from the figure below, the major east-west corridors connecting Asia and Europe passes through Ukraine. Especially the south Ukraine corridor plays an important role for not only the east-west movement via M-14, but also as a gateway to central Ukraine, which then finally reaches other European countries.

Source: Ukravtodor

Figure 6.6 International Transport Corridors in Ukraine

(1) Phased Development Scenarios for the Road Sector

The first phase (2017-2025, short and mid-term) will be focused in strengthening the corridors through connecting the missing link of the Mykolaiv road and bridge section within the south Ukraine corridor. When the section is completed, the traffic congestion on the existing road going through the Mykolaiv City would be reduced. Further, the worries of damages to the two existing bridges (Ingul and Varvarovsky Bridges) of which the weight limit is 24 tons, will also be lifted. One of the ways to raise the fund for the construction and maintenance of the project would be through adopting a toll road system from the beneficiary of the road. The collected toll could be utilized in the improvement of the existing two bridges in the city of Mykolaiv.

In this context, the ring road improvement in Mykolaiv could be combined with the construction of the new Mykolaiv Bridge. Further, the pipelined H-14 improvement enhances necessity of the first phase.

The second phase (after 2025, long term) will be concentrated in the promotion of the development of the south Ukrainian corridor. Investments should be made in finding the bottlenecks of road sections within the linear corridor and in strengthening the capability of the corridor as a whole, by reducing the bottlenecks. The corridor would play a significant role for the movement of goods and passengers, and would provide efficient movement that only motorways can contribute. Moreover, such linear corridor would connect the eastern regions and the Romanian border area, providing access to core ports along the Black Sea of which eventually reaches the inland areas. In this context, the improvement of M-14 to Kherson and M-15 improvement to Romania could be justified. The large investment for M-15 would require international co-financing, inclusive of the EU funds for convergence purposes.

Table 6.1 summarizes the development projects of the road sector in the Southern Region, in consideration of the development scope and implementation arrangement.

Table 6.1 Summary of the Development Projects in the Road Sector

	Mykolaiv Bridge	**(1) H-14 Road**	**(2) M-14 in Kherson Oblast**	**(3) Mykolaiv Ring Road**	**(4) M-15 Development**
Objectives	Complete the missing link in the Bypass road of Mykolaiv and mitigate the traffic concentration in Mykolaiv city, and enhance regional traffic flow and develop efficiency in the flows of heavy vehicles	Improve the pavement condition and enhance regional logistic circulation in the respective sections	Improve the pavement condition and enhance regional logistic circulation in the respective sections	Improve the capacity of the ring road function, and enhance regional logistic circulation in the respective sections	Provide alternative road link to southern Odessa region and improve accessibility. Enhance international connectivity to Romania and Bulgaria (EU markets)
Development Scope	Connect M-14, 125 kilometer post and P06-M14 junction with 10 kilometer multi-lanes M class road, including a 2 kilometer bridge section crossing the South Bug River. The bridge can be tolled to collect the maintenance expenditure of the bridges.	Upgrade the road structure and pavement from Mykolaiv to Oleksandrivka (total 238 kilometer) to H class standard[3]	Upgrade the road structure and pavement from Mykolaiv to Kherson (total 52 kilometer) to M-class standard, including widening to a 4 lane road	Widening the existing 2 lane sections into 4 lanes (18 kilometers), improve longitudinal alignment at the section of the Ingul river crossing by installation of viaducts and traffic control equipment	Improvement of 281 kilometer section, with 2 large bridges development crossing the Danube and the estuary of Dniester
Executing Agency	Ukravtodor[4]	Ukravtodor	Ukravtodor	Ukravtodor	Ukravtodor
Operational Agency	Ukravtodor and Mykolaiv Oblast Branch	Ukravtodor	Ukravtodor and Kherson Oblast Branch	Ukravtodor and Mykolaiv Oblast Branch	Ukravtodor and Odessa Oblast Branch
Phase	First Phase	First Phase	Second Phase	First Phase	Second Phase

[3] Already pipelined as a World Bank finance project

[4] According to Ukravtodor, as stipulated by Section II Article 10 and 11 of the Law of Ukraine "on Roads" (Supreme Council of Ukraine, 2005, No.51, st.556), Ukravtodor is the central exectuvie body for the realization and implementation of the state policy for the road works, directed by the Cabinet of Ministers through the Ministry of Infrastructure and Ukravtodor implements its functions through the 24 Oblast branches. With the project being part of the national network under Ukravtodor's responsibilities, the chief administrator shall be Ukravtodor, with specific works conducted by its Oblast branches.

6.2 Seaport Sector

6.2.1 Overview of Development Plans of the Government of Ukraine

During the field interviews, it became clear that for each port, the USPA has a Masterplan which exists of defined projects. The Masterplan bundles all projects identified by port operators and other stakeholders. Because of this practice, the Masterplan does not reflect the actual needed capacity in the port system. Therefore, the phasing is not initiated by the USPA but rather upon request by an operator which can guarantee a certain volume for a specific project.

Table 6.2 provides an overview of the projects.

The development plans include 89 projects:

- 22 projects in Odessa;
- 24 projects in Illichivsk;
- 25 projects in Yuzhny; and
- 19 project in Mykolaiv.

The projects are situated in different domains:

- 5 dredging projects;
- 52 quay and terminal projects;
- 6 road projects;
- 11 rail projects; and
- 10 other projects.

Table 6.2 Overview of Seaport Projects

	Odessa	Illichivsk	Yuzhny	Mykolaiv	Total
Infrastructure					
Dredging	/	2	2	1	**5**
Quay and terminal	15	13	14	10	**52**
Road	1	3	1	1	**6**
Rail	2	2	5	2	**11**
Other	3	2	2	3	**10**
Study					
Dredging	1	1	1	1	**4**
Quay and terminal	/	1	/	/	**1**
Road	/	/	/	/	**/**
Rail	/	/	/	/	**/**
Other	/	/	/	/	**/**
Total	**22**	**24**	**25**	**18**	**89**

Source: USPA, adjusted by JICA Survey Team

6.2.2 Development Priorities

Although the development plans list a wide variety of projects across all four ports, both the demand and capacity assessment have demonstrated that there is a specific priority for investments. More specific, the assessments have indicated that in the Southern Region, there is a need to **extend the handling capacity** (terminal and quay) **for grain, coal and metal ore products**. Furthermore, there is a need to **deepen at least one port to accommodate capesize vessels** for metal ore products.

Moreover, the project list distinguishes the type of investment. The list distinguishes public (USPA), private (Investor), and public-private (USPA/Investor) projects. In addition, projects linked to container and finished metal projects are not considered given the sufficient capacity in the Southern Region. Therefore, the projects in the port of Odessa are not selected. Further, as the focus is on port projects the focus is on investments in dredging and quay and terminal (re)construction.

Table 6.3 Development Priorities in the Seaport Sector

Action*	Type of infrastructure	Expected results	Implementation perspective	Project number
Port of Illichivsk				
1. Dredging of the approach channel up to 16 meters	Dredging	To increase competitiveness by means of creating conditions for accepting heavy-load vessels.	Short-, mid- and long-term	Project 1
2. Dredging of the water basin (1st and 2nd basins) up to 15 meters	Dredging		Short-, mid- and long-term	Project 2
14. Reconstruction of Berths Number1-6, 7-12, 14-17, 19-22, 26-29	Quay	Upgrade of cargo handling facilities	Short-, mid-, long-term	Project 3
Port of Yuzhny				
1. Dredging in order to reconstruct sea approach channel and internal approaches to deep-water berths.	Dredging	Dredging up to 21 meters, so as to enable 200 000 tons DWT vessels	Short-term	Project 4
2.Construction of the 1st and 2nd bends, as well as a new section of the 3rd bend of the approach channel	Dredging	Dredging up to 21 meters, so as to enable 200 000 tons DWT vessels	Short-term	Project 5
4. Reconstruction of Berths Number (5-7), 8 and 9, as well as of these berths` navigable operational waters	Quay	Dredging up to 17 meters, augmentation of cargo handling capacity	Short-term	Project 6
8. Construction of new Berths Number 10,11,12,12a, as well as a cargo handling facility	Quay	Creation of 1,495 meters berthing line, dredging up to 21 meters.	Short-, mid-term	Project 7
Port of Mykolaiv				
3. Construction of a universal cargo handling facility at the projected Berth Number 8	Quay	Dredging up to 10.5 meters, construction of a 190 meter long mooring line, new jobs	Short- and mid-term	Project 8*
4. Construction of a Berth Number 14a and a cargo handling facility	Quay	Dredging up to 10.5 meters, construction of a 240 meter long mooring line, new jobs	Short- and mid-term	Project 8*

Source: USPA Yuzhny presentation
Note: * Need for bundling of projects to pass the threshold of US$ 50 million.

6.2.3 Evaluation of Projects

The JICA Survey Team has taken the following steps for the selection of port projects considered for JICA's assistance:

1. Determination of the most promising cargo commodities in the Ukrainian ports. For this, the JICA Survey Team has carried out a detailed traffic forecast for the main commodities.

2. Determination of the current handling capacity for these main commodities in the various ports and the future capacity needs. Bottlenecks in potential capacity expansions have been taken into account as well.
3. Analysis of all the port development plans of the USPA for the four main Ukrainian ports.
4. Ranking of the port projects based on the following criteria: future growth potential of the commodity (= market share potential), potential for future development in the port, gap between current capacity and future demand and the status of the development plan.

Table 6.4 summarizes the ranking of the projects with the three criteria.

Table 6.4 Ranking of Projects for the Seaport Sector

Ranking	Project #	Port	Type of infrastructure	Market share Potential	Potential for future development in the port	Gap capacity demand	Status
1	**Project 4**	**Yuzhny**	**Dredging**	H	H	H	H
1	**Project 5**	**Yuzhny**	**Dredging**	H	H	H	H
1	**Project 7**	**Yuzhny**	**Quay**	H	H	H	H
2	**Project 6**	**Yuzhny**	**Dredging + Quay**	M	H	H	M
3	**Project 1**	**Illichivsk**	**Dredging**	H	M	M	M
3	**Project 2**	**Illichivsk**	**Dredging**	H	M	M	M
4	**Project 8**	**Mykolaiv**	**Quay**	M	M	L	M
5	**Project 3**	**Illichivsk**	**Quay**	L	M	M	L

Source: JICA Survey Team

The TOP-3 projects selected are per below;

1. Reconstruction of the approach channel of the Port of Yuzhny (Project 4);
2. Dredging of the water basin at the Port of Yuzhny (Project 5); and
3. Construction of new Berths Number 10, 11, 12, and 12a at the Port of Yuzhny (Project 7).

6.2.4 Details of Prioritized Projects

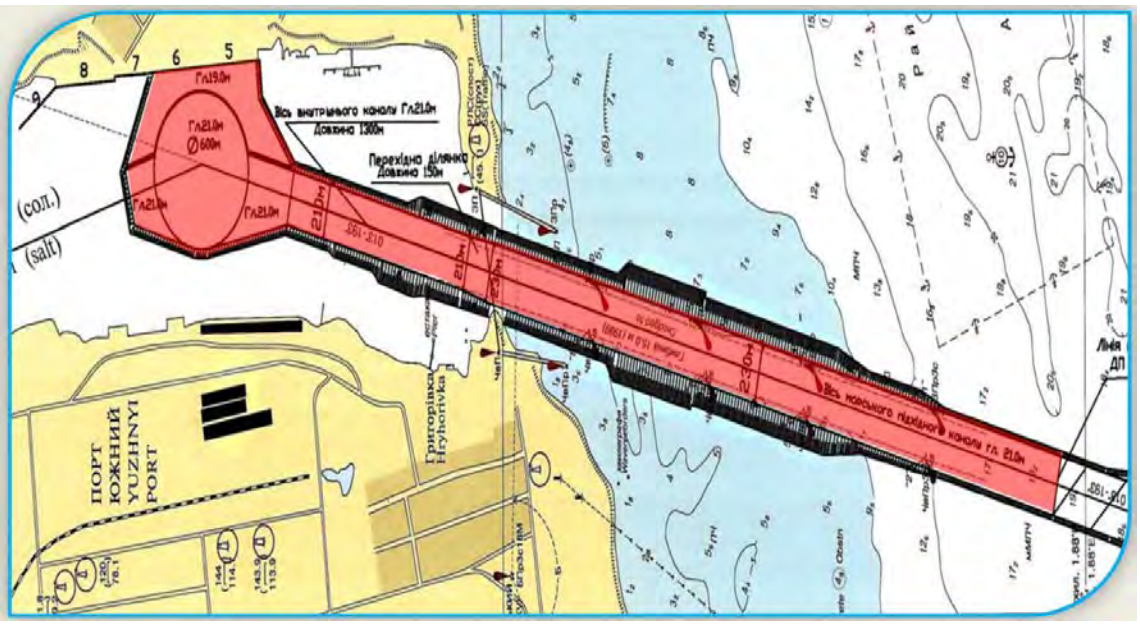
This section provides the detailed explanation of the three prioritized projects.

(1) Reconstruction of the Approach Channel of the Port of Yuzhny

This project includes the dredging of the approach channel from CD -18.0 meters to CD -21.0 meters of depth, and the dredging of Berths Number 5 and 6 to a depth of CD -21.0 meters. The deepening of the access channel and berth's depth will allow the port operator in the Port of Yuzhny to accommodate dry bulk vessels of over 200,000 DWT. More specific, it will facilitate the import of thermal coal and the export of metal ore products. Hence, this project can enhance the energy security position of Ukraine (import of coal for power plants and mining), and will increase the competitiveness of Ukraine in the metal market worldwide, as the transport cost will decrease (economics of scale).

The project has already been approved by the Cabinet Ministers of Ukraine, on 26th September, 2012 No. 711-p.

The development plan for this project can be found in Figure 6.7



Source: USPA Yuzhny presentation

Figure 6.7 Reconstruction of the Approach Channel of the Port of Yuzhny

The project includes three phases as depicted in following Table. The Table includes a cost-breakdown of the different phases. The project is estimated at UAH 1,894 million (US$ 87 million, exchange rate 1st October, 2015). Phase 1 is already performed in 2015, which leaves Phase 2 and Phase 3 for this project, with a total estimated CAPEX of UAH 1,008 million (US$ 46 million, exchange rate 1st October, 2015).

Table 6.5 Project Breakdown

Indicators	Units	Amount			
		Total	Including complexes		
			1-st	2-nd	3-rd
Type of construction – reconstruction					
Marine approach channel:					
- length	km	3,7	3,7	3,7	3,7
- width	m	230	140	230	230
- depth	m	21,0	19	20	21
Internal channel:					
- length	km	1,3	1,3	1,3	1,3
- width	m	210	140	210	210
- depth	m	21,0	19	20	21
Operating water area of moorings №№ 5,6:					
- area (up to a turn-round)	ha	14	14	-	-
- depth	m	19	19	-	-
Reversal in the area of moorings №№ 5, 6 with conjugation with an internal channel):					
- diameter	m	600	600	600	600
- depth	m	21	19	20	21
The total volume of dredging	ths. m3	13 803,50	10 360,50	1 765,00	1 678,00
The total estimated cost of construction at current prices on the date of 1/10/2015	ths. UAH	1894763,314	887235,170	508 586,075	498 942,069
Of the total estimated value on the date of 01.10.2015, was performed	ths. UAH.	887235,170	887235,170	-	-
The duration of the completion of the construction	months	29,5		15,5	14,0

Source: USPA Yuzhny presentation

(2) Dredging of the Water Basin at the Port of Yuzhny

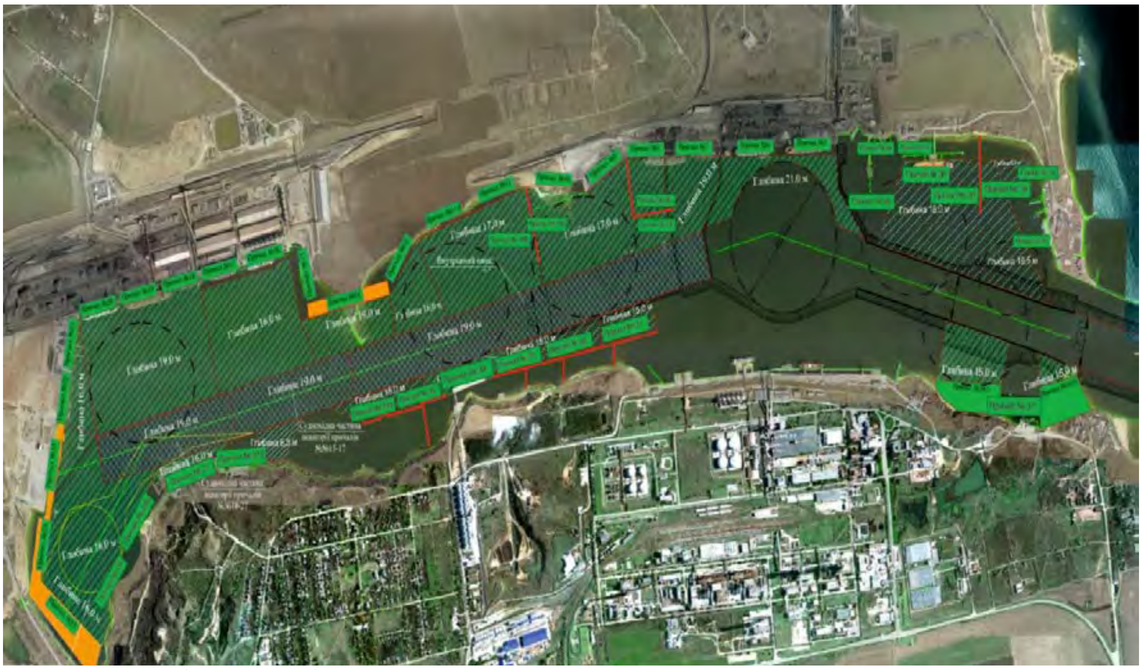
The project includes the dredging of the total basin (depth 21 meters) in 4 phases, including the dredging at 18 berths as depicted in Table 6.6. The project cost is estimated to be UAH 6,828 million (US$ 248 million). The project allows accommodating larger vessels with a DWT of 200,000 tons.

Table 6.6 Project Characteristics

Indicator	Amount				
	Full development	Including queues of construction			
		1st queue	2nd queue	3rd queue	4th queue
1. The number of complexes	18	5	2	2	9*
2. The total area of dredging sites, m ²	4135,79	1732,62	159,53	1357,64	886,00
3. The total volume of dredging, ths, m³	28 135,84	13 473,77	2 223,2	4 021,97	8416,9
4. The estimated cost of construction, ths. UAH. (with VAT)	6 828 459,485	3 503 677,933	541 365,543	815 113,832	1 968 302,177

Source: USPA Yuzhny presentation

The development plan for this project can be found in Figure 6.8



Source: USPA Yuzhny presentation

Figure 6.8 Dredging of the Water Basin of the Port of Yuzhny

(3) Construction of New Berths 10, 11, 12, and 12a at the Port of Yuzhny

This project compromises the construction of new berths for general and bulk cargo: that is, Berths Number 10, 11, 12, and 12a at the Port of Yuzhny. This project will add 1,495 meters of quay to the Port of Yuzhny with a depth of 21 meters. This length and depth will allow bulkers with metal ore to call the Port of Yuzhny.

The project is currently in the pre-project stage of geological engineering. As such no project cost estimates are already available.

The development plan for this project can be found in Figure 6.9

Source: USPA Yuzhny presentation

Figure 6.9 Construction of New Berths 10, 11, 12, and 12a at the Port of Yuzhny

During the visit to the port in February 2017, the JICA Survey Team found out that there is a legal dispute concerning the land title behind Berths Number 10, 11, 12, and 12a at the Port of Yuzhny. This dispute may endanger the implementation of the project. Procedures on how to cope with such dispute are identified and presented in the Box below.

If this dispute blocks this project, the JICA Survey Team proposes Project 6 (Reconstruction of berths 8 and 9, as well as of these berths` navigable operational waters), as a valuable alternative. Project 6 generates extra quay length and is close to the entrance of the port, which makes it suitable for handling dry bulk products (for example, metal ore, coal, or grain products).

It should be noted that the construction of new berths (10-12a) and reconstruction of berth (8-9) would be challenging from an engineering perspective, as it requires construction of deep berths in an area with a busy navigation channel and a small buffer. Chapter 9 provides suggestions for possible application of Japanese construction technology and experience for such challenges.

BOX: Procedures to Follow to Court Regarding the Land Title for Berths Number 10, 11, 12, and 12a at the Port of Yuzhny

This BOX provides explanation on the procedures the government and the court are to follow in the coming months and their likely schedule, and what the points are a possible investor must be aware of and how they are to be approached for a solution.

Every litigation in court has its own characteristics. Outcomes and timelines are quite unpredictable and therefore no definite indication of timelines or a typical stepwise structure can be given. A good example is the court case regarding a container terminal in the Port of Ilichivsk which has been unsettled for many years.

However, according to the data in the Register of court cases and judgments, the next hearing in the matter should have taken place in the Higher Economic Court of Ukraine on 3rd March, 2017. The outcome is not known so far – at least there is no information in the Register.

Generally, according to the procedure, the Higher Economic court have three main options. The court may either:

a) support the judgments of 1st and appeal instances (that is, to judge in favour of UkrLandFarming and Odessa Regional State Administration, and preserve the lease agreement in force), or
b) overrule the judgments of 1st and appeal instances and to render new decision (that is, to judge in favour of AllSeeds, and to order to cancel the lease agreement), or
c) to send the matter for a new consideration on merits in the court of 1st instance.

Options (a) and (b) will make everything clear very soon, in nearest days/weeks. Option (c) will most likely mean the new full circle of court battles, which will prolong the uncertainty for another 7-8 months.

A better solution to the dispute would be an amicable settlement of the dispute between the involved parties, however, considering the current state of the court matter, it is not understood what the attitude a winning party will have.

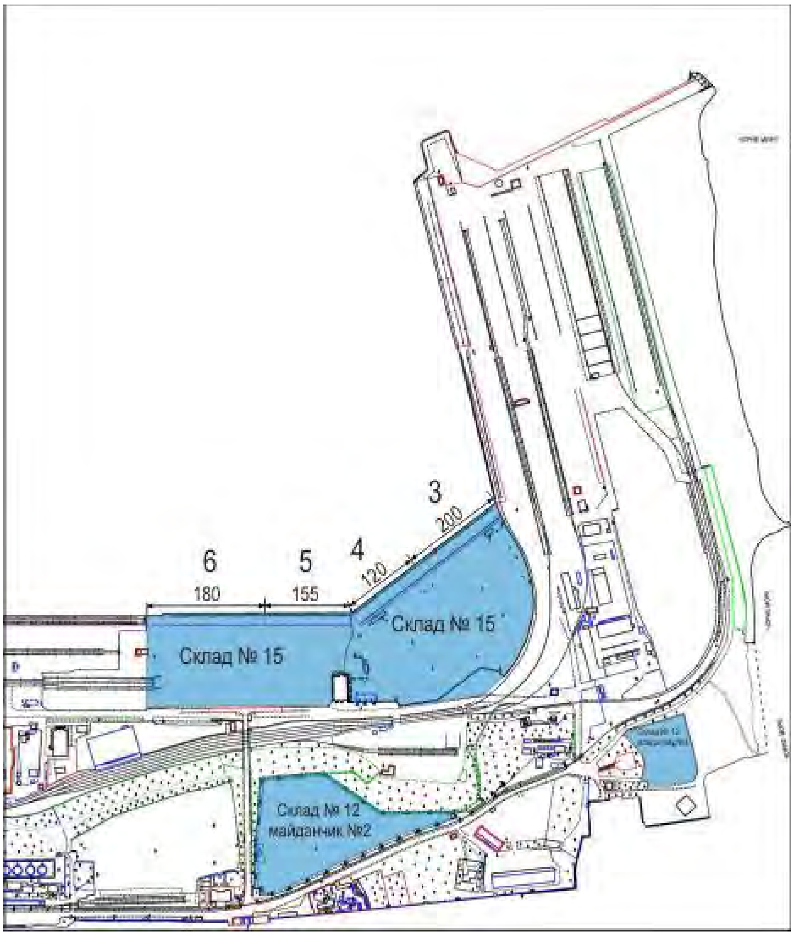
Obviously, in the event of option (a), the further developing of the investment project will be conducted by UkrLandFarming. In the event of option (b) AllSeeds will formally win, however the competitors – UkrLandFarming – may try to intervene somehow in the project.

Therefore, the Government of Ukraine and the current investor (AllSeeds Group) should sit together and determine based on the current market developments whether the investment is still applicable in Port of Yuzhny. In the event that this is not applicable anymore, new negotiations with a new investor could commence.

As a consequence of these procedures and disputes regarding berths 10-12a in the Port of Yuzhny and the start of the procurement of the dredging works in the port, two alternative projects have been proposed by the Minister of Infrastructure during the meeting with the JICA Survey Team (20^{th} April, 2017).

1. Reconstruction of berths number 5-8 in the Port of Yuzhny. This project was already presented by the JICA Survey Team as a suitable alternative for the construction of berths 10-12a. We refer to Table 6.3 and 6.4 for more information and ranking.

2. Deepening and reconstruction of berths number 3-6 in the port of Illichivsk. The Government of Ukraine is currently in discussion with the Chinese port operator Hutchison for concessioning the terminal. The current draft of the berths (CD -13.0 meters) needs to be enlarged to allow the handling of bigger vessels. Estimated investment amount is approximately US$ 50 million. In the figure below, berths number 3-6 with a total quay length of 755 meters in the port of Illichivsk are presented.



Source: USPA

Figure 6.10 Berths Number 3,4,5,6 at the Port of Illichivsk

The current status of the negotiations between the Government of Ukraine and Hutchison is not known. However, this project was also defined as one of the potential projects to be further analyzed (see Table 6.3, referred to as project #3). It scored not so well in the overall priority ranking as presented in Table 6.4.

6.2.5 Summary of the Development Projects in the Seaport Sector

The following table provides the summary of the development projects in the seaport sector, based on the information and analysis in the previous section.

Table 6.7 Summary of the Development Projects in the Seaport Sector

	(1) Reconstruction of the approach channel of the Port of Yuzhny	**(2) Dredging of the water basin of the Port of Yuzhny**	**(3) Construction of new berths 10, 11, 12, and 12a at the Port of Yuzhny**
Objectives	Deepen the access channel to CD -21 meters in the Port of Yuzhny.	Dredging of the water basin to CD -21 meters of the Port of Yuzhny.	Construction of 4 berths for dry bulk activities in the Port of Yuzhny.
Development Scope	This project includes the dredging of the approach channel from CD -18 meters to CD -21 meters of depth, and the dredging of berths 5 and 6 to a depth of CD -21 meters.	The project includes the dredging of the total basin (depth 21 meters) in 4 phases, including the dredging at 18 berths.	This project compromises the construction of new berths for general and bulk cargo at berths number 10, 11, 12, and 12a. This project will add 1,495 meters of quay to the Port of Yuzhny with a depth of 21 meters. This length and depth will allow bulkers with metal ore to call the Port of Yuzhny.
Executing Agency	USPA	USPA	USPA
Operational Agency	USPA	USPA	USPA

Source: JICA Survey Team

6.3 Integration of Road and Seaport Development Scenarios

6.3.1 SWOT Analysis and Development Strategy

This section explains how to synchronize the road and seaport development scenarios as an integrated transport sector development scenario for the Southern Region of Ukraine. The following table shows the basic analysis of the transport market in the Southern Region of Ukraine under a SWOT framework, which suggests a strategic transport sector development.

Table 6.8 SWOT in Transport Markets in the Southern Region of Ukraine

<u>Strengths</u> • High utilization of rail transport for heavy freight and extensive rail infrastructure • Variety of industrial resources of the coastal cities and strong connection with Donetsk/Dnipro hinterlands • 2 million population in the Southern Region • Accessibility to industrial materials (steel) • Stronger interest of the private sector in investing in the seaport sector	<u>Weaknesses</u> • Biased development scenario towards rail and water (river) transport • Poor road conditions and overloading • Several bottlenecks by physical weak links and weight limits in the road network • Large share of small-medium scale producers in the agro sector - Low stability in the local economy, low capacity in the private sector after 2012
<u>Opportunities</u> • Strong and stable trend in export business development, in ores and grains • Ukrainian's approach to EU and possibility of utilization of the EU convergence fund • Alternative tourism destination as an alternative of Crimea • GUAM relations, relation with the growing Turkish, Mediterranean and Middle East economies • Next off-shore destination of the EU manufacturing sector	<u>Threats</u> • Gap in development speeds in the seaport sector and other sectors (particularly in rail, river) • Relation with Russia • IMF control in investment with external funding • Motorization • Corruption

Source: JICA Survey Team

Examining the Strengths and Opportunities:

- The Southern Region of Ukraine has a large potential in industrial resources and extensive railway network. The robust investment interests in the seaport sector by the private sector can be an effective engine for the strengthening of logistics in the region. However, the gap in the development speed in rail and river transport[5] may become a bottleneck in the delivery of grain in the near future, and road development could fill the gap between the delay in rail and river transport development.
- The close relation with the EU and Mediterranean economies can provide a sufficient opportunity for fund raising in this region. Particularly, the large investment potential of the EU convergence fund could be useful to develop the international corridor to Romania and Bulgaria through the Southern Region of Ukraine. Demands of the next offshore destination of EU manufacturers may boost the opportunity of the Southern Region as well[6].
- The cities with industrial background and 2-million-population substantiate the service sector development in the region. Further, domestic tourism has been concentrated in the Southern Region after the closing of the Crimea market. Growth in domestic tourism market would create stability in the region.

Examining the Weaknesses and Threats:

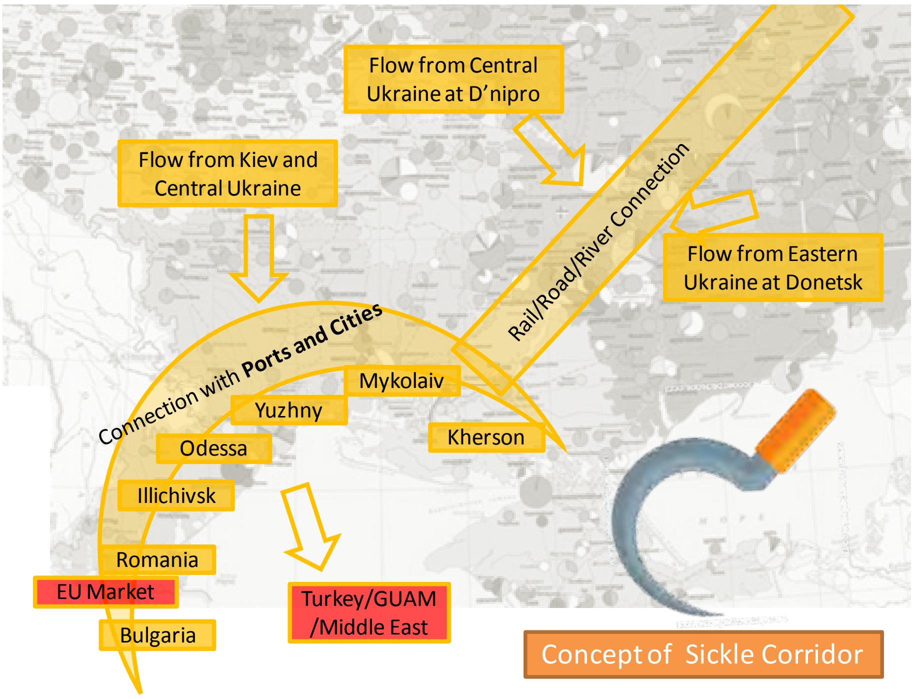
- The large share of SMEs in the agro production sector shows high dependency on road transport. The corporatization of the agro sector would take time and dependency in road transport will remain. The large investment in the river and rail transport sectors would take time to materialize and should be harmonized with the progress of corporatization of the agro sector.
- The low stability of the economy and geopolitical risks are significant. However, the stable grain demand in the Middle East and the Mediterranean markets are also strong.

Based on the SWOT analysis, the following 3 strategies are considered:

(1) Create a “New Southern Industrial Corridor”

The concept of a New Southern Industrial Corridor can be depicted as follows. The ports and cities facing the Black Sea and regional industrial cores (Donetsk and Dnipro) will be reorganized in a way to promote new industrial growth along the “New Southern Industrial Corridor”. The corridor will carry various industrial and agro products of the East and Central Ukraine and flow into the multiple efficient outlet of the Black Sea shore. This concept should overarch the multiple projects of seaport and road sectors as well as the rail and river transport in the region and integrate them into one corridor.

[5] It should be noted that the private company Nibulon is taking initiative in river transport investment along the South Bug River, not only for grain transport but also for the rejuvenation of construction material production in the region, which was a major industry in the South Bug in 1980s.
[6] The western Ukraine facing the Polish border is the present “next destination of EU offshore”, development of manufacturers, along with highway development investment by EU/EIB, are pipelined.



Source: JICA Survey Team

Figure 6.11 Concept of the "New Southern Industrial Corridor"

(2) Phased Development Scheme

The speed of the development of seaports can be quite fast, due to its affinity with the private sector as it is revenue-generating. On the other hand, the rail and river transport development would be slow because it requires large and lengthy investments. Further, the rail and river transport are often effective to large agro producers. However, SME farmers often face difficulties in securing their slots in rail and river transport and rely on road transport. In such circumstances, in the Southern Region of Ukraine, the three transport modes of seaport, road, and rail/river could be developed in a phased fashion.

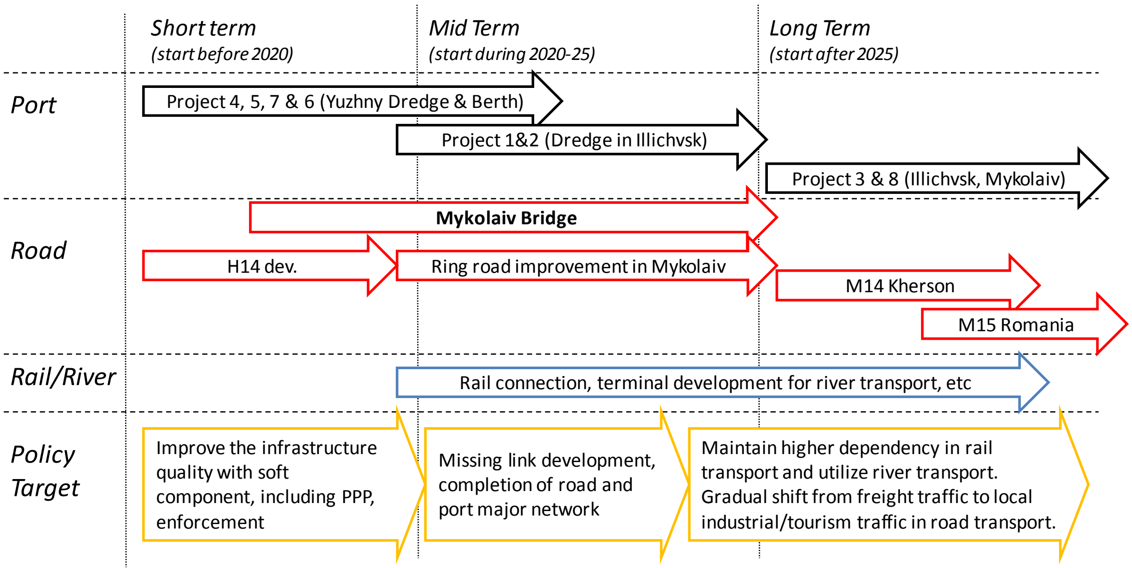
(3) Road Development with Multiple Effects

Due to its high network characteristics, the road sector development would bring about multiple effects:

- Tourism circulation in the region, particularly the seasonal fluctuation in the region is quite large and requires flexibility in operation and redundancy provided by the road sector;
- Industrial circulation in the region, particularly the cities along M-14 does not have a rail link and requires good communication by road; and
- Strengthened road structure would allow heavier and high capacity trucks, resulting in less traffic and higher efficiency.

6.3.2 Integrated Development Scenario

Based on the three strategies explained above, the following development scenario is proposed:



Source: JICA Survey Team

Figure 6.12 Integrated Development Scenario

The projects in the seaport sector, particularly the projects in the Port of Yuzhny will lead the large transport investments in the region. The construction of the new Mykolaiv Bridge and development of H-14 will also be facilitated in parallel, as short term projects.

The ring road improvement in Mykolaiv and the dredging projects in the Port of Illichivsk will be programmed as mid-term projects, which will be implemented from 2020 to 2025. By this period, the identified missing link should be completed with implementation of projects with physical improvement, and the major network to the port will be completed. The rail and river transport projects will also be initiated during this period, however, the development of rail and river based logistics will take time and will not cover the increase of export demand. The road transport will continue to keep a substantial role and share in the logistics in the Southern Region.

For the long term projects, port projects No. 3 and No. 8 (Berths in Port of Mykolaiv and Port of Illichivsk) and M-14 in Kherson and M-15 development connecting to Romania will be programmed. The share of rail transport should be maintained and river transport should be promoted to enhance the energy efficiency in the region. Eventually, if the rail and river transport system's capacity is developed successfully, the road transport could be gradually shifted to serve tourism and various local industrial needs instead of freight transport.

7. Necessity and Priority of Potential Japanese ODA Projects

This chapter explains the necessity and priority of the projects which have been selected by the JICA Survey Team for potential Japanese ODA Projects. The selected projects are as follows:

- Construction of the new Mykolaiv Bridge
- Development of the Port of Yuzhny
  - Reconstruction of the approach channel (Project 4)
  - Dredging of the water basin (Project 5)
  - Construction of new Berths Number 10, 11, 12, and 12a (Project 7).
- Technical Assistance on Road Transport Operation and Maintenance Program for the Mykolaiv City Government

7.1 Construction of the New Mykolaiv Bridge

As a priority project for potential Japanese assistance, the JICA Survey Team has selected the project for construction of the new Mykolaiv Bridge, which would connect the 125 kilometer post of M-14 and P-06-M-14 junction with 10 kilometer multi-lane M class road, including a 2 kilometer suspension bridge section crossing the South Bug River.

Large yield increase potential of grains, competitive price range of Ukrainian products, and the high population growth in emerging countries imply positive outlook on Ukrainian agribusiness. During 1990's, grain export in Ukraine was less than 10 million tons per year, but it rapidly increased from late 2000's. Currently, grain export in Ukraine is more than 30 million tons and it is expected to grow by almost 40 million tons by 2023, as shown in the Figure 5.4. In such situation, the sea ports along M-14 are expected to enhance their roles as the outlet of the grain exports, and the delivery routes of these commodities are geographically distributed along M-14, from mainly the eastern and central Ukraine.

The road transport (e.g. trailers and heavy trucks) in Ukraine is expected to play an important role on delivery of grains from graineries to major sea ports. Currently the World Bank is implementing a study on improvement of railway network in the western Ukraine in order to improve connectability to/from EU[1], but no investment is planned for the railway network between graineries and major sea ports. Although approximately 60-65% of total grain production is delivered by railway transport[2], its facilities are outdated, less flexible and geographically less connected to the recent grain production, logistics chains of grain exports. Among road network in the southern Ukraine, Mykolaiv city is a transit point in the network connecting major sea ports in the southern Ukraine and graineries in the eastern and central Ukraine.

The eastern and central Ukraine exports 20.7 million tons of grain annually (56% of total grain export in Ukraine)[3] and those grains are delivered to major sea ports in the southern Ukraine

[1] The study includes suggestions such as; to launch a Scheduled Direct Freight Rail Connection (SDRC) between major domestic oblasts (Kiev, Dnipropetrovsk, Odessa, Kharkiv) to regions bordered with Poland (Lviv, Zakarpattia and Volyn oblasts); to develop an intermodal logistics centers' network along with the improvement of customs clearance efficiency etc.; to implement these ideas utilizing the Liski terminals.
[2] Center for Transport Strategies (CTS)/World Bank, Ukrainian Railways Logistics Strategy Scoping Study, 17 Nov 2016
[3] Estimated from the exporting traffic of grain products from Dnipro, Kharkov, Poltava, and Cherkassy in 2015 in Figure 5.6, applying the share of small and medium sized agro enterprises in the Oblasts; where major freight export traffic may cross the new Mykolaiv Bridge section. The small and medium sized agro producers are defined as

such as Yuzhny, Odessa, Illichivsk and Mykolaiv for exports to mainly MENA regions, India and China. The analysis of "Chapter 5 Road Traffic Characteristics and Forecast" has revealed that although Russian transit cargos have been drastically decreased during 2012–2015 by 55.0% (minus 19.5 million tons), the amount was compensated by growth of grain and iron ore exports. Especially agro products are essential for economic recovery of Ukraine since the products are the main sources to earn foreign currencies. However, Mykolaiv city, an important transit point of M-14, is facing difficulties to adapt to growing demand of road transport accelerated by increasing grain export and motorization of the country. The construction of the new Mykolaiv Bridge, which completes the route that bypasses the center of the city, would enhance the export traffic flow from eastern and central Ukraine to sea ports along the M-14 corridors and will contribute to the economic recovery of Ukraine.

"The Strategic Plan for Development of Road Transport and Road Infrastructure of Ukraine up to 2020" specifies the overall competitiveness of the road transport development, in line with the EU-Ukraine Association Agreement. Currently, a development strategy for road facilities for 2017–2022 is under preparation, however, the Ministry of Infrastructure presents the five prioritized missing link improvement projects in Ukraine, and the new Mykolaiv Bridge project is listed highest of the top five missing link improvement projects. Other than the Zaporizhia Bridge Project which was approved by the Cabinet of Ministers in 2010 and started its construction in 2013, the new Mykolaiv Bridge project was the first to follow in obtaining approval by the Cabinet of Ministers. It should also be noted that the new Mykolaiv Bridge is located along the E-58 (EU Road Network) and International transport corridors of TRACECA and BSEC, in line with the EU and international road network development policy.

Currently, with M-14 passing through the central area of the Mykolaiv city without a proper bypass road system, severe traffic congestion in the city has been a serious problem. The situation is further worsened by the two existing bridges, Varvarovsky Bridge and Ingul Bridge which have 24 ton vehicle weight limit and 7 tons per axle load limits. In such circumstances, construction of the new Mykolaiv Bridge would be able to provide the region with a bypass road, which would significantly alleviate traffic congestion in the city and associated environmental hazards. This would result in significant savings in transport cost of export commodities originating in various parts of Ukraine, thus contributing to the enhancement of the Ukrainian economy.

During this survey, the JICA Survey Team conducted its own traffic count survey and OD survey and forecasted the traffic flow through the new Mykolaiv Bridge. The results show that in the case with the bridge, over 40% of the traffic passing Mykolaiv city is expected to cross the new Mykolaiv Bridge, alleviating the traffic congestion in the city and physical damages to the existing bridges. In the case without the bridges, results show that the traffic at the Varvarovsky Bridge would become 1.6 times than the current situation in 20 years, and the three lane bridge's saturation ratio in the peak hours to be 1.37, suggesting a permanently paralyzed condition at the bridge.

During the Preparatory Survey in 2011, it was concluded that the suspension bridge is suitable for the new Mykolaiv Bridge and its feasibility was confirmed by the Government of Ukraine. Japanese firms have the most advanced suspension bridge technologies and their experiences throughout the world will contribute to the technological improvement of the Ukrainian construction firms which may join the construction of the new Mykolaiv Bridge. Further technical study might be required before finalizing the bridge type.

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producers with a field area of less than 2,500 hectares. The figure does not include the grain products in the Southern Region.

For implementation of the project, further considerations from various perspectives are necessary, namely:

- Collection and review of the latest natural condition survey data such as topographic, geological, meteorological and hydrological data;
- Investigation of the landslide area on the west (right) bank by geotechnical specialists and study on the countermeasures;
- Confirmation of the latest design conditions for roads (including necessity of sidewalks), design standards & specifications, waterway, aviation, geological, vessel collision force, ice load, seismic load, live load, wind load, and temperature variation;
- Information collection and study of disasters such as landslide, flood, erosion, and earthquake;
- Study of the location of the substructure and scour protection such as revetments on the river bank and around the substructure, where careful consideration should be given to the potential effect of erosion by winding river flow to the future triggering of land slide;
- Study of the scouring, erosion and dredging of the river;
- Study on allocation of the pier and the cable anchorage in the twisted river flow;
- Study on river traffic, navigation safety and collision risk including anti-collision devices;
- Study on foundation types, construction space and waterway redundancies; and
- Study on willingness to pay for toll of the new Mykolaiv Bridge;
- Calculation of the project cost including procurement cost from foreign sources and Japan and fluctuation of currency exchange;
- Environmental and Social Considerations.

7.2 Development of the Port of Yuzhny

The JICA Survey Team has selected 3 projects in regards to the development of the Port of Yuzhny as priority projects for potential Japanese assistance.

Export of commodities through the ports of Ukraine is a vital source for earning foreign currencies. However, due to the political situation with Russia, several ports in the Eastern region are no longer within the USPA authority and cannot be used for Ukrainian exports, and therefore the capacity and efficiency of the existing accessible ports, namely the four major Ports of Illichivsk, Odessa, Yuzhny and Mykolaiv have become a crucial issue.

With the economic recovery of the country becoming more dependent on the increase of bulk commodity exports such as iron ore and grain, obtaining enough port capacity for these products is critical. Moreover, deepening of the ports by the proposed dredging works will allow bigger vessels to be handled at these berths. Bigger vessels can carry more cargo in a voyage, hence the unit costs per ton of export cargo drop significantly. As such the commodity prices for example, Ukrainian iron ore, coal, metals and others will become lower and therefore more attractive for buyers. Especially, since these commodities are traded on the world market, a lower tariff means more sales volume, which will benefit the Ukrainian economy as a whole.

From the volume forecasts conducted for the major ports, it has been identified that (i) the trade pattern of coal has been shifted towards an import oriented trade focused on thermal coal; (ii) although export volumes of metal have decreased due to the geo-political issues, stable metal export volume for metal ore is expected; (iii) with the increase in the productivity in the grain sector, larger bulkers are targeted for and thus deeper ports are necessary; and (iv) although the container market is currently in overcapacity, the container volume is expected to increase significantly.

The patterns identified above suggests that the two most urgent needs in the Ukrainian port sector are as follows.

- The need to accommodate larger bulk vessels (deeper draught berths and deeper access channels):
  a. For coal, because of shift in trade (larger vessels, but lesser calls);
  b. For metal ore, because of the economies of scale; and
  c. For grain, because of the economies of scale.
- The need for larger storage facilities for dry bulk products.

With such needs, the Port of Yuzhny has been identified as the most promising port for Japanese ODA. The port's potential is distinguished not only by its geographical location, safe navigation and reliable cargo operations, but also with the port having an approach channel with a depth of −18.0 meters CD and a total load capacity of up to 200,000 tons. Moreover, this port has a large potential for further developments, as it is not bounded by the city and has effective connection to the hinterlands. Specifically, in the medium term, the quay, terminal and rail connection for grains and terminal and quay development for coal and metal ores indicate large potential.

Moreover, building a new deep-draught and efficient terminal would result in lower unit costs for import and export due to the economies of scale, which could result in lower overall transportation costs for Japanese companies.

Brief descriptions of the benefits of the projects are described below.

(1) Reconstruction of the Approach Channel (Project 4)

This project includes the dredging of the approach channel from CD −18.0 meters to CD −21.0 meters of depth, and the dredging of Berths Number 5 and 6 to a depth of CD −21.0 meters.

The deepening of the access channel and berth's depth would allow:

- The port operator in the Port of Yuzhny to accommodate dry bulk vessels of over 200,000 DWT;
- Facilitation of the import of thermal coal and the export of metal ore products;
- Enhancement of the energy security position of Ukraine (import of coal for power plants and mining); and
- Increase of the competitiveness of Ukraine in the metal market worldwide, as the transport cost will decrease (economies of scale).

(2) Dredging of the Water Basin (Project 5)

The project includes the dredging of the total basin (depth 21 meters) in 4 phases, including the dredging at 18 berths. The project would allow increase in accommodating larger vessels with a DWT of 200,000 tons.

(3) Construction of New Berths Number 10, 11, 12, and 12a (Project 7).

This project implements the construction of new berths for general and bulk cargo. This project will add 1,495 meters of quay to the Port of Yuzhny with a depth of −21.0 meters. This length and depth will allow 200,000 DWT bulkers for metal ore to call the Port of Yuzhny.

From above reasons, the JICA Survey Team selected the 3 projects for the development of the Port of Yuzhny as priority projects with potential for Japanese assistance. It should be noted that for implementation of these port projects, not only the detailed technical aspects would need to be considered, but also the legal and regulatory framework, namely the awaited outcome of the new concession law. Furthermore, the court decision of the land title for Berths Number 10, 11, 12 and 12a at the Port of Yuzhny shall be followed and reviewed as well.

Lastly, the 3 projects identified as high priority projects for Japanese assistance are considered to provide synergy with one another, as well as with the construction of the new Mykolaiv Bridge. There is potential that these projects could be conducted in together, in phases, in order to increase its effectiveness, which shall be considered further in the next stage.

For implementation of the project, further considerations from various perspectives are necessary, namely:

- Review on outcome of the new concession law
- Review on court decision of the land title for Berths Number 10, 11, 12 and 12a
- Study of scheduling of the various projects for effective synergy
- Calculation of the project cost
- Environmental and Social Considerations
- And Others…

7.3 Potential Technical Assistance

The JICA Survey Team expects that the road transport sector is suitable for technical assistance under this survey for the logistics sector in southern Ukraine, because the authorities of the port and maritime sector have already established a self-sustainable structure with its own financial sources.

In relation to the proposed new Mykolaiv bridge construction project, the Survey Team proposes the following road transport operation and maintenance program for the Mykolaiv city government, expecting integration with the new Mykolaiv bridge construction project and generation of regional synergy as a potential technical cooperation project. As described above in 7.1, Mykolaiv city is a transit point in the road network connecting grainaries and major sea ports. Due to the absence of a bypass, currently passenger vehicles, buses, heavy trucks, and trailers are entering the city centre and severe damages on the road surface are observed. The purpose of this technical assistance is to implement sustainable road maintenance method in order to adapt to the increasing road traffic in the city. Details are described in the table below.

The Survey Team had comprehensive discussions with the Ukravtodor Mykolaiv branch, Infrastructure division of the Mykolaiv Oblast government, and Mykolaiv city government. The Ukravtodor Mykolaiv branch is the head of regional road administration, managing the road maintenance investments for M/H/P and T class roads. However, it does not hold its own engineering capacity and workforce for road maintenance, and the actual daily maintenance is implemented by the Oblavtodor (Oblast level road maintenance state enterprises). The Oblavtodor has 24 maintenance offices in each City and Raion in Mykolaiv and is a direct workforce that conducts road maintenance, including snow removal work in the winter period. According to the requirements of the national reform, such maintenance work is planned to be privatized gradually, and those Oblavtodors would also be privatized or reformed in the near future.

Mykolaiv Oblast government's infrastructure division is responsible in maintaining O-class road networks (4,831 kilometers in total). Due to the decentralization process, the Mykolaiv oblast will be handed over the T-class road from the central government in 2018 and is expected to maintain these roads by itself. However, these road networks are in rural areas which would not generate major economic relation with the new Mykolaiv Bridge construction project.

Mykolaiv city maintains the existing city's street network (C-class roads, 834.9 kilometers in the city, paved by bituminous concrete −65%, macadam −15%, and unpaved 20% per area wise), some of which are damaged by heavy traffic due to the missing link of the M-14 ring road. The construction project would take several years to complete, and such heavy traffic is expected to pass through the city until the completion. The city does not have a proper database for roads, and has no experience in analytical methodology of investment programming. Even if the bridge construction is completed and the heavy traffic is diverted from the streets, the city would not have a proper transport strategy on how to utilize the surplus capacity of the streets.

The city management has a clear will to maintain its direct workforce for road maintenance against the EU reform because i) there is no road maintenance workforce and suitable engineers in the Mykolaiv region, and ii) city government needs to present a proper management capacity to its citizen and mayor.

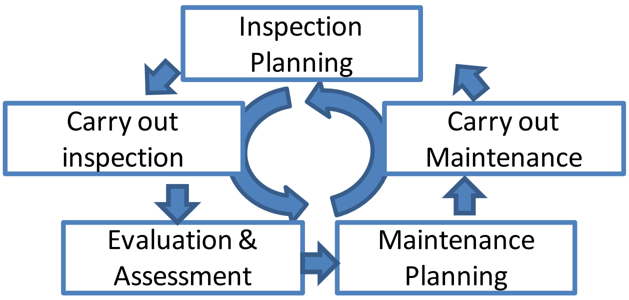
Moreover, the JICA Survey Team has suggested the city management the possibility of the bridge maintenance for the Varvarovsky and Ingul Bridges, however, it was explained that the city had materialized a proper database and periodic inspections and maintenances for the bridges, with qualified engineers from Kiev in the recent years. Instead, the city management mentioned that overloading control at the bridges should be considered to realize the sustainable operation of the bridges.

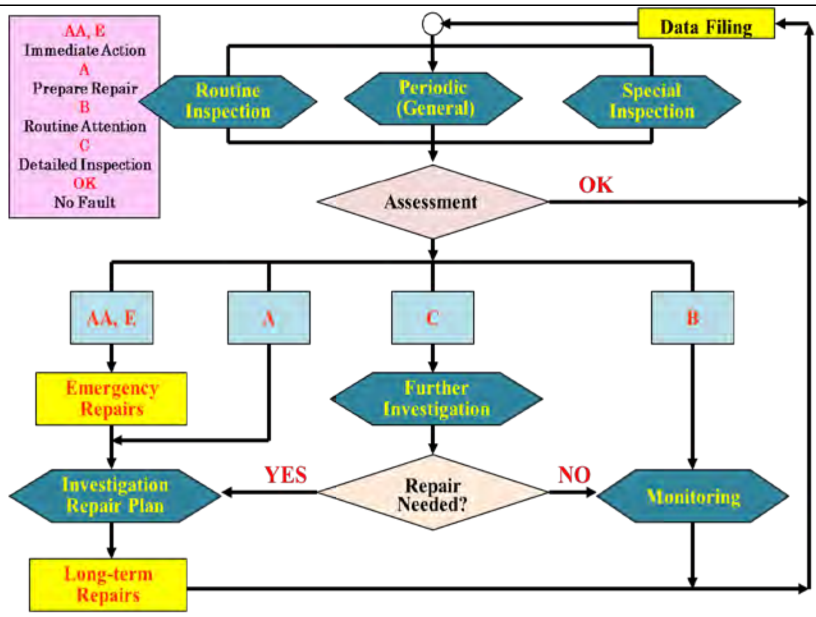
As stated in the previous chapters, the overall reform of the transport sector, including the road and maritime sectors, have been planned and are currently on-going, in compliance with the EU-Ukraine Association Agreement. Actual policy developments for the reform were initiated by the EU and have been implemented by the EU and related IFIs, including EIB, EBRD and the World Bank. The detail of expected technical assistance needs to be in compliance with the EU Ukraine Association Agreement.

However, although the EU and IFI's advisory services have started in 2014 after the exchange of the association agreement, the strategy paper for national transport is not fully completed yet. Some transport professionals in Ukraine are concerned about the delay in action for the transport and traffic reform, especially to small and medium class cities. The Swiss government did its transport advisory work to Vinnitsa city in Ukraine from 2015–2016, in coordination with the EU.

Therefore, the Survey Team suggests the following scope for technical assistance by the Government of Japan.

Table 7.1 Scope of the Potential Technical Assistance

Title	Road Operation and Maintenance in Mykolaiv City
Overall Goal	Realize the sustainable transport and traffic environment in the Mykolaiv city after completion of the expected new Mykolaiv bridge
Objective	The objective of the project is to strengthen the institutional and engineering ability of Mykolaiv city government to handle the operation and maintenance of roads in Mykolaiv city area.
Target Area	Streets in the Mykolaiv city (mainly C-class roads in Mykolaiv), including existing M-14 sections in the city
Counterpart	Mykolaiv City Government, Infrastructure office, road division in cooperation with Ukravtodor, Traffic Police and Ukrtransbezpeky (overloading enforcement agency, State Service of Ukraine for Transport Safety)
Background	Currently, with M-14 passing through the central area of the Mykolaiv city without a proper bypass road system, severe traffic congestion in the city has been a serious problem. The situation is further worsened by the two existing bridges, Varvarovsky Bridge and Ingul Bridge which have 24 ton vehicle weight limit and 7 tons per axle load limits. In such circumstances, construction of the new Mykolaiv Bridge would divert the heavy traffic, which would significantly alleviate traffic congestion in the city and associated environmental hazards. Thus proper operation of heavy vehicles is crucial after the completion of the new bridge. However due to lack of accumulated data, experiences, and technology to manage the overall system of roadways by Mykolaiv city, there is no proper maintenance and traffic operation. *The City Government requested Japanese technical and financial assistance to achieve a proper management of the road network.*
Component	The main component is to develop a road database and an analytical system to optimize maintenance investments under the responsibility of the city government. Capacity building will be conducted to the employees of the city corporation of infrastructure, road division, with 20 engineers and 80 foreman and workers. The expected design of the maintenance cycle could be depicted as follows. The technical assistance would supervise the development and operation of such cycle.  Subcomponents; **1. Road maintenance data base and management software:** the city government has a database in Microsoft excel format with basic data items (section name, length, width, pavement materials only). The new database would be designed to satisfy the requirement for proper maintenance. The scheme of maintenance planning should be in compliance with EU requirements, with the following algorithm for a proper maintenance program.

	 **2. Data collection methodology:** provision of a special vehicle for automatic data collection (IRI and video analysis) could be considered. On the other hand, the cloud based data collection system could be applied to maintain the latest data collection. Updates of road work histories should be undertaken by the city road division. **3. Road maintenance technology for preventive maintenance:** The actual daily maintenance activities and techniques should be instructed and transferred through an OJT basis, with provision of proper materials, tools and machines. For example, the city has several technical issues as follows; - the city does not own its laboratory to check quality of the materials - the engineers and workers are less qualified than expected for their position - the city has no experience in applying geo-textiles for road structures - ill drainage in snow season always damages the road structure - the city requires in finding a suitable asphalt material for all season, and for heavy traffic. **4. Traffic safety including overloading control and traffic safety auditing;** The city is considering the installation of a weighbridge with weigh-in-motion technology to sustain the life of the two bridges on M-14. The capacity of coordination with other agencies (Traffic police and Ukrtransbezpeky) would be developed through the technical cooperation scheme. **5. Traffic management strategy for traffic diversion;** The new traffic management scheme could be proposed, due to an expected heavy traffic diversion, including introduction of a traffic calming application into the present heavy traffic sections. The technical assistance program would provide necessary knowledge and experiences for traffic management. This program should be carefully planned to be in line with the progress of the new bridge construction project.
Required field of Specialties	➢ Road maintenance engineering ➢ IT specialist ➢ Traffic engineering specialist ➢ Material specialist for pavement ➢ Mechanical specialist for weighing equipment
Periods	➢ Three years (2018 to 2020)
Expected equipment	➢ Software for data base and operation and management. ➢ Trial installation of weigh in motion equipment and data system. ➢ Equipment for asphalt road maintenance, materials and small machines.

8. Japanese Technologies with Potential for the Sectors

This chapter describes the Japanese technologies with potential for the road, bridge and port sectors. These technologies have been shared with the Government of Ukraine and related stakeholders during the "Seminar on the Japanese Logistics and Transport Technologies" held in Kiev in February 2017. Details of the seminar is in Appendix 8-I.

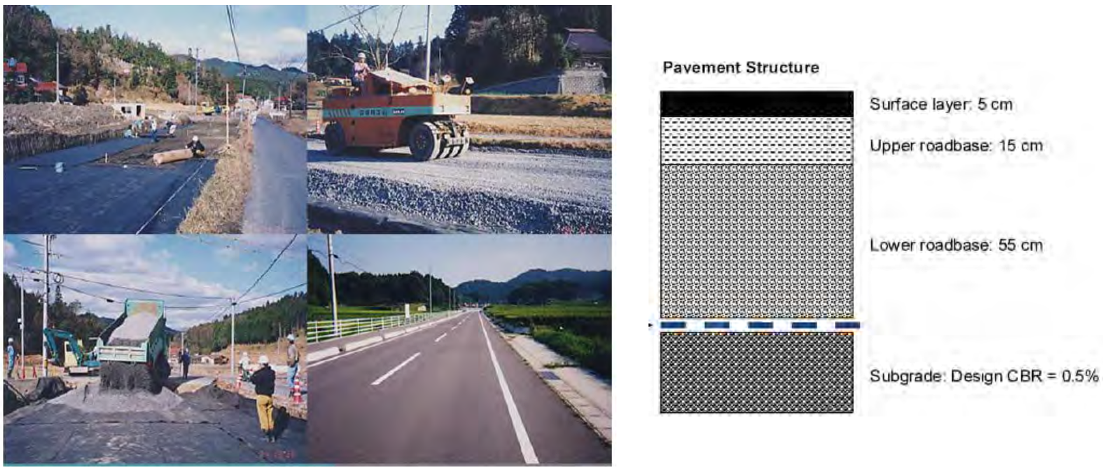
8.1 Road Sector

8.1.1 Road Sector

(1) Road Construction

<u>Soft Foundation</u>

There are various conventional measures for the construction of roads on the soft foundation, including; sand mat, sand pile, sand compaction pile, paper drain, cardboard drain and chemical/electrical methods. Using geo-textile for the soft foundation road construction is considered to be effective.



Source: JICA Survey Team

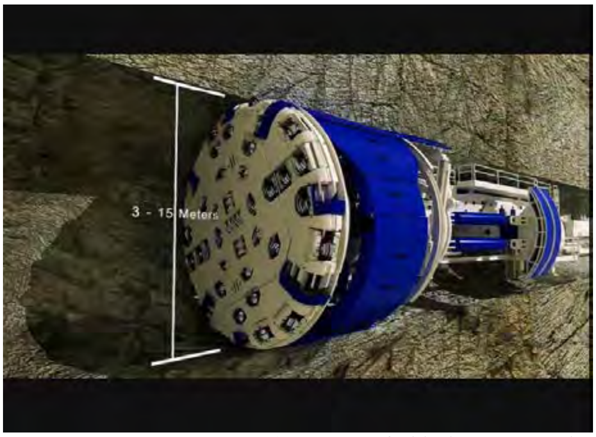
Figure 8.1 Image of Construction Using Geo-Textile

Source: JICA Survey Team

Figure 8.2 Photo of Laying of Geo-Textile on the Ground

(2) Tunnel Construction

Tunneling methods depend on the quality of soils/rocks to excavate. The conventional excavation methods involve drilling and blasting of rocks. Tunnel Boring Machine (TBM) is used for different types of rocks for road construction nowadays because of the improvement of the machines and system. The high performance TBM provides the possibility to dig tunnels efficiently and safely because of its high excavation power. Comparison of the conventional TBM and high performance TBM is shown in Table 8.1.



Source: JICA Survey Team (Courtesy of Shimizu Corporation)

Figure 8.3 High Performance TBM Machine

Table 8.1 Comparison of Conventional TBM and High Performance TBM

	Conventional TBM	High Performance TBM
Cutter-head Torque	Low power of cutter-head ➢ Difficult to rotate cutter-head for poor geology such as soil, clay or collapse in front of TBM	High power of cutter-head torque ➢ Able to rotate cutter-head for difficult geology.
Thrust Force	Low power of thrust force ➢ TBM stuck in squeezing rock ➢ Low cutter penetration for hard rock	High power of thrust force ➢ Able to cut through in squeezing rock ➢ High cutter penetration for hard rock
Disk Cutter	Low cutter penetration	High cutter penetration
TBM Data Monitoring	Monitor TBM data at TBM Operator Cabin only ➢ Unable to detect geology and TBM trouble quickly ➢ Unable to take quick action	Monitor real time TBM data virtually anywhere ➢ Able to detect geology and troubles of TBM immediately ➢ Able to take quick action
Tunnel Support	Late Tunnel Support	Early Tunnel Support

Source: JICA Survey Team

(3) High Performance Asphaltic Pavement

The pavement surface is the key factor for safety of traffic during rainfalls. Skid resistance of a wet surface decreases significantly compared with that of a dry surface. This is because of the existence of a water layer between the tire and the pavement surface. The high performance pavement provides quick drainage of water from the pavement surface, which then minimizes the water layer as much as possible. In addition, due to voids of the surface, the noise of tires could be absorbed resulting in a quieter pavement surface. The asphalt material used for such kind of pavement is a special type of bitumen that provides a strong bonding power.

Source: JICA Survey Team

Figure 8.4 Comparison of Two Types of Pavements

Source: JICA Survey Team

Figure 8.5 Magnified Image of the High Performance Pavement Surface

(4) Slope Protection

Various slope protection methods have been applied to slopes along roads in Japan, a disaster prone country, where disasters such as earthquakes, typhoons, floods, tsunami, slope failures, volcano eruptions, etc. occur quite frequently.

Among the disasters, slope failure is frequent and common in road construction and maintenance. Thus, there are a variety of counter measures, such as:

- Vegetation for surface failure;
- Slope covered by concrete or vegetation/concrete;
- Strengthening of slope by pile, anchor, and crib walls, concrete walls, masonry, stone walls etc.; and
- Regular installation of drainage such as; surface drain, side drain, sub-soil drain, drain pipe, etc..

The following photos are examples of actual application of the slope protection.

	
Bamboos For Stabilizing Slope	Slope Protection by Stones with Wire Netting

Source: JICA Survey Team

Figure 8.6 Slope Protection by Natural Materials

Concrete frames are used to protect slopes for the surface protection. Where environment is a major concern, the area inside of each frame is filled with vegetation, such as grass or shrubs. Where the slope is weak and slope stabilization is necessary, steel nails, piles or anchors are used to stabilize the weak slope.

	
Completed Crib Walls	Concrete Frames under Construction

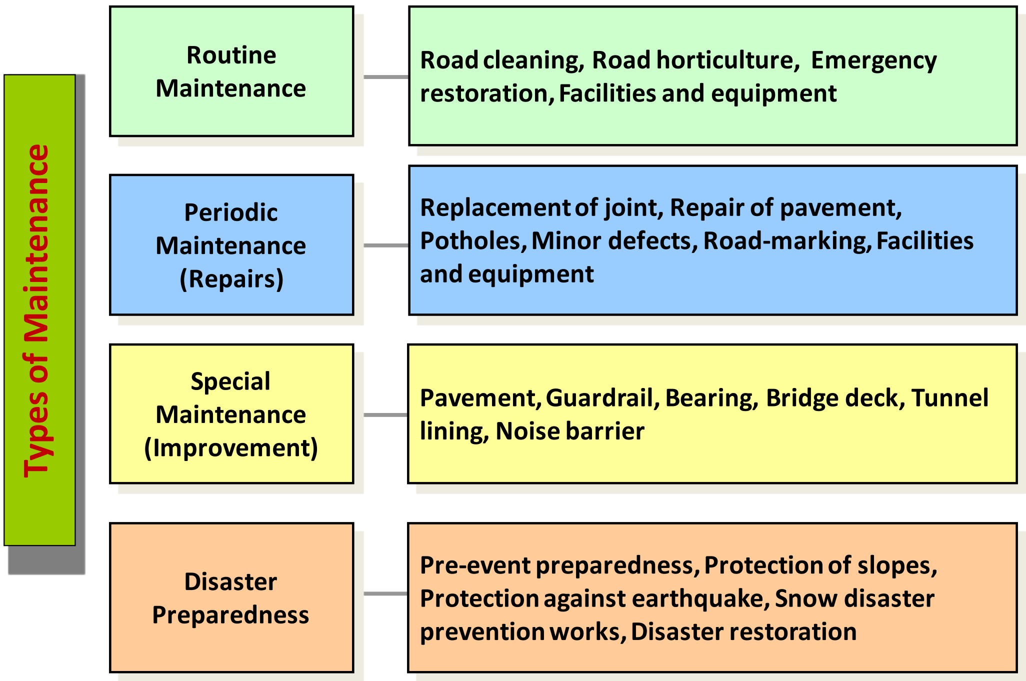
Source: JICA Survey Team

Figure 8.7 Slope Protections Using Concrete Frames

(5) Road Maintenance

There are different kinds of maintenance works starting from road cleaning, inspection and routine maintenance for minor repairs. The concept of road maintenance could be expressed in the following order and as per the schematic diagram.

- Maintenance Objectives
- Maintenance Planning
- Inspection
- Types of Maintenance
- Execution of Maintenance
- Special Maintenance Practices
- Disaster Prevention
- Highway Management Systems



Source: JICA Survey Team

Figure 8.8 Type of Maintenance

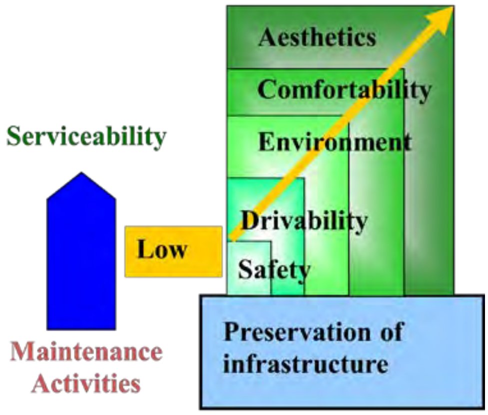
The objectives of the maintenance are expressed as follows:

- To provide comfort, convenience and safety to the public;
- To preserve investment in roads;
- To preserve environment; and
- To sustain economic resources.

In order to achieve the objectives, special care must be taken on the expressways, such as:

- Traffic control and safety during road works;
- Services for public travelling;
- Preventive maintenance (minimization of life cycle cost); and
- Utilization of advanced technologies.

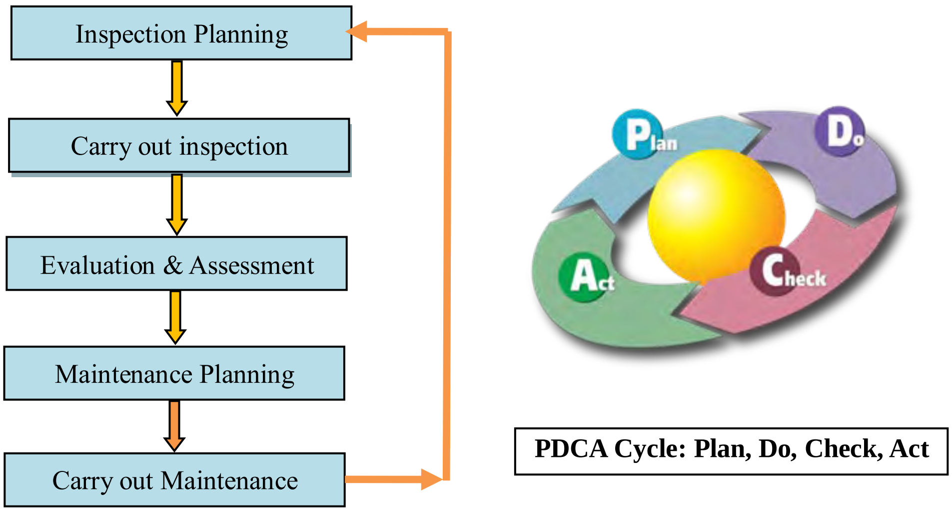
The concept of serviceability and maintenance work is expressed in the following figure. The serviceability ranges from minimum requirements to pleasure of driving. Expressways often require a higher level of serviceability than ordinary roads.



Source: JICA Survey Team

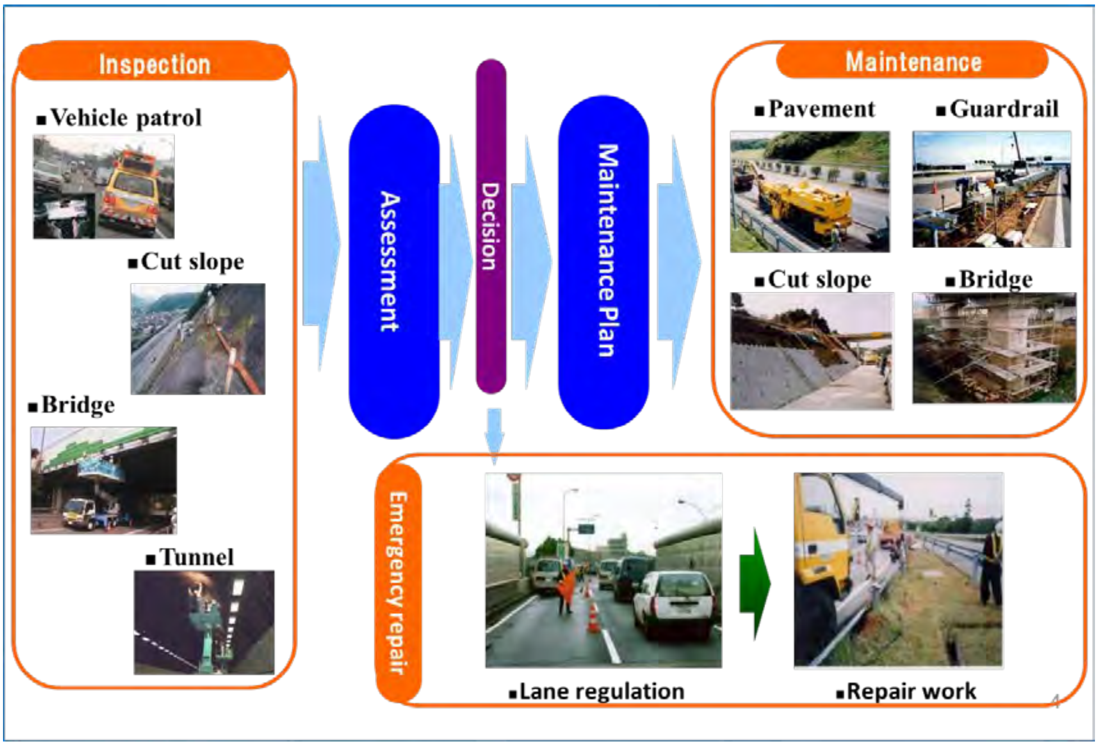
Figure 8.9 Concept of Maintenance and Serviceability

Maintenance is a never ending process of cycle. Figure 8.10 shows the flow from inspection to maintenance. The type of maintenance is also expressed in Figure 8.11.



Source: JICA Survey Team

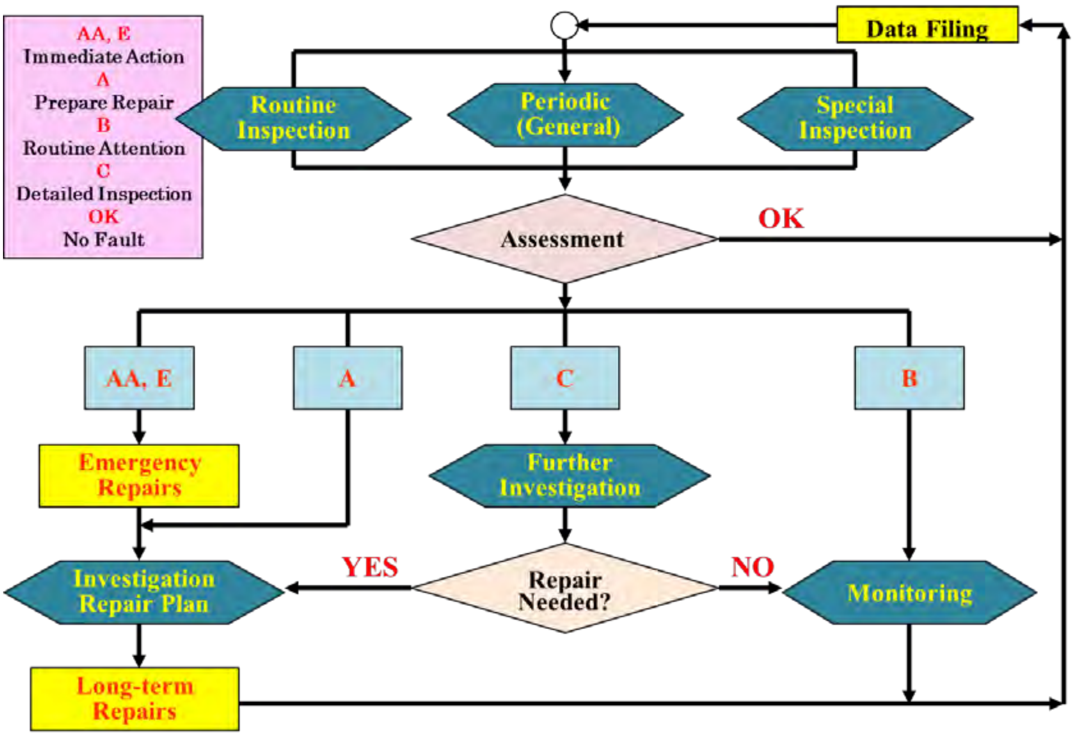
Figure 8.10 Maintenance Cycle



Source: JICA Survey Team

Figure 8.11 Flow from Inspection to Maintenance

These maintenance activities are inspected, recorded, processed, assessed, and implemented as shown in the flow diagram below.



Source: JICA Survey Team

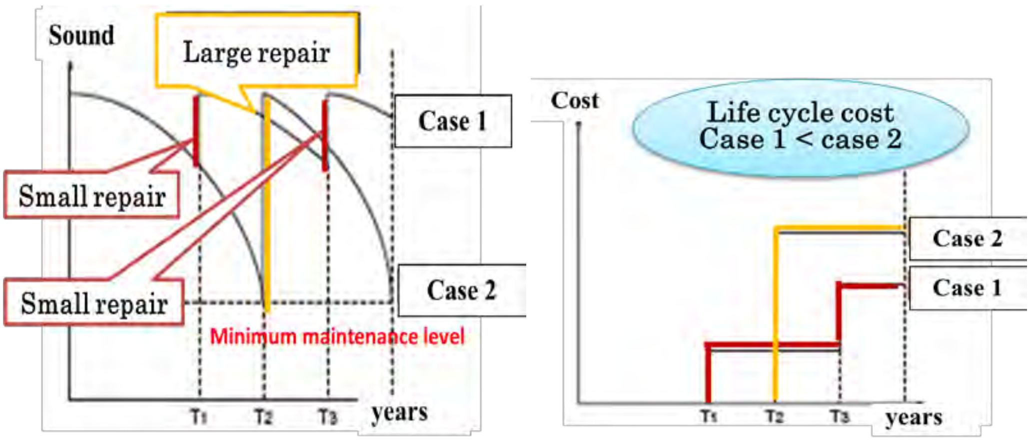
Figure 8.12 Process of Inspection, Assessment, and Repairs

The basic concept of advanced maintenance activities are supported by the idea of “preventive maintenance”. The key elements of the preventive maintenance are inspection activities. The targets of these activities are:

- Detecting early symptoms of deterioration;
- Checking the development pattern of deterioration;
- It is possible to find an optimal intervention level to slow the deterioration.

Benefits of preventive maintenances are:

- Pre-planned maintenance (maintenance period is known and optimal use of workforces and machines is possible)
- Optimal maintenance level (the most effective time and type of intervention and planning of integrated works is possible)



Source: JICA Survey Team

Figure 8.13 Concept of Preventive Maintenance

In order to fulfill above mentioned maintenance activities, various machines, equipment and technologies have been used, as shown in the following photos and figures.

	
Bridge inspection	Bridge and cut slope inspection

Source: JICA Survey Team

Figure 8.14 Bridge and Slope Inspection

Vehicle

Facilities

Source: JICA Survey Team

Figure 8.15 FWD Vehicle (Falling Weight Deflectometer)

The FWD (Falling Weight Deflectometer) is a non-destructive testing device that is used for assessing pavement properties. The collected information enables gathering of information on the bearing capacity and estimated expected life, as well as calculation of overlay requirements over a desired design life.

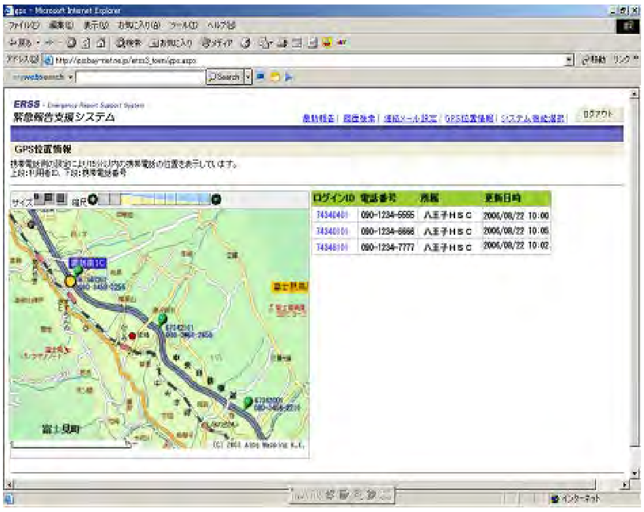
Field report by mobile phone

Situation report: simultaneous report

Source: JICA Survey Team

Figure 8.16 Emergency Report Support System (ERSS)

Such system aims to assist in reporting on simultaneous, real-time field conditions, to support sharing of information among the related people, and to produce a quick report in emergency situations on road defects, car accidents, natural disasters, etc.



Source: JICA Survey Team

Figure 8.17 Computer Display at the Office (ERSS)

Among the various maintenance and repair works, resurfacing works is considered large scale, where traffic control during maintenance works is necessary and important. The figure below shows the set of machines used for pavement repairing (resurfacing).

Source: JICA Survey Team

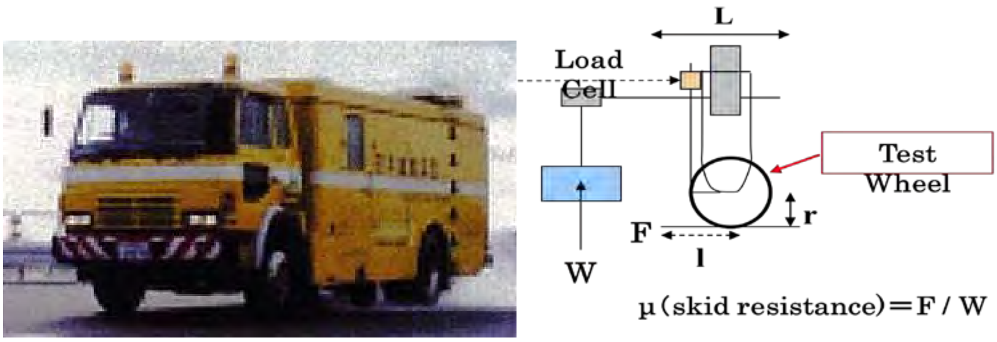
Source: JICA Survey Team

Figure 8.18 Convoy of Pavement Resurfacing Machines

(6) Skid Resistance

One of the pavement criteria especially for safety assurance is the skid resistance of the pavement surface. Skid resistance survey vehicle is used for continuous measuring of the skid resistance of the pavement. Purposes of the vehicle are as follows;

- Understanding of current status
- Comparison to maintenance goals
- Deciding the areas subject to repairs
- Implementation of repairs



Source: JICA Survey Team

Figure 8.19 Skid Resistance Survey Vehicle and Mechanism of Measurement

(7) Road Safety

Road safety is a high priority of road operation and maintenance. Severe accidents have occurred at the diversion, near structures, on bridges, under adverse weather conditions and during night. In order to minimize erroneous behavior of drivers on the expressways, various countermeasures have been taken. Guiding traffic and providing shock absorbing materials are commonly applied at the nose gore areas of the interchange diverting points. The photos below show examples of countermeasures utilizing sign boards, chevron marking to provide spaces, guardrails, and shock absorbing barrels.

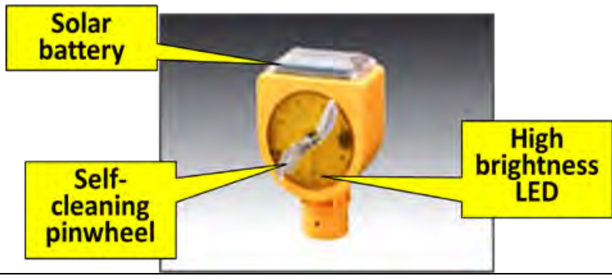
	
Nose Gore Area	Chevron Marking Provides Spaces at the Nose

Source: JICA Survey Team

Figure 8.20 Safety Measures at the Nose

Night driving poses difficult conditions to drivers. It becomes worse especially when it rains or snows or during foggy conditions. One of the measures to guide drivers during night and adverse weather conditions is to provide delineators alongside the road with self sustaining solar cells on top, shown in Figure 8.21 Another measure to guide drivers is to provide markings with sounds and vibrations if the car is driven on the marking.

Installed delineators at night

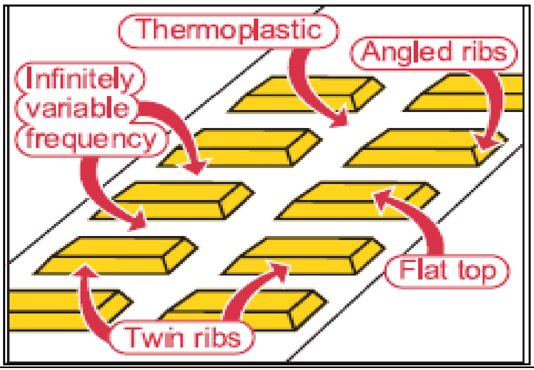


Structures of self sustaining delineator

Source: JICA Survey Team

Figure 8.21 Delineators at Night

View from the driver at night



Sound and vibration marking

Source: JICA Survey Team

Figure 8.22 Rumble Strip for Guiding Drivers at Night

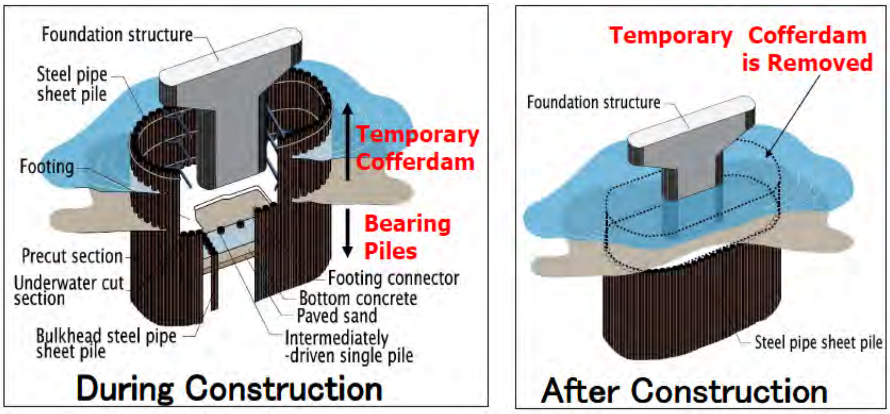
8.1.2 Bridge Sector

(1) Steel Pipe Sheet Piles (SPSP)[1]

Steel Pipe Sheet Piles (SPSP), in which steel pipe piles are provided with joints, are employed to construct high-rigidity walls. Widely used in bridges (steel pipe sheet pile foundations), harbor facilities (quay walls, revetments, breakwaters), and urban civil engineering (earth retaining and cofferdams). Large rigidity and excellent work efficiency allow for rational designing.

During the construction, SPSP work as a temporary cofferdam with the watertight joints and as a permanent rigid foundation (See Figure 8.23).

[1] In The Preparatory Survey in 2011, SPSP have been selected based on the study of the geological survey and water depth.



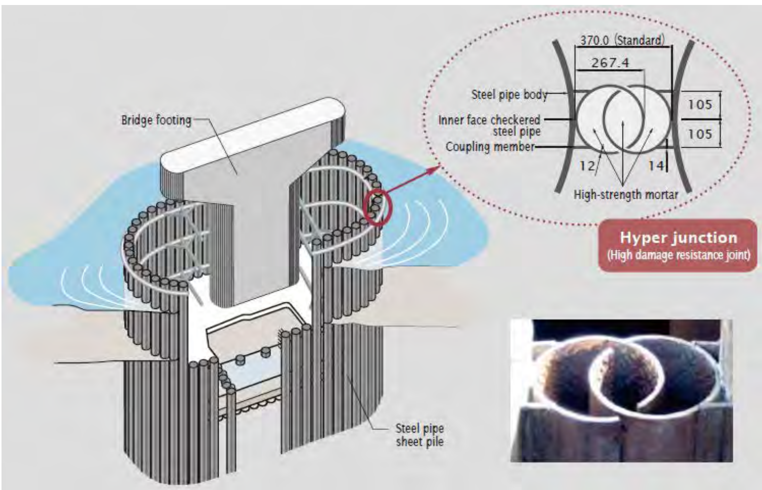
Source: JFE Steel

Figure 8.23 Steel Pipe Sheet Piles (SPSP)

A comparison with ordinary methods is summarized in Table 8.2 and Figure 8.27 Specific features of SPSP contain the following:

- Foundation can be used both for a temporary cofferdam and for a permanent foundation, which can contribute to the shortening of construction period and cost saving;
- When a group of SPSP are implemented together, it can provide high horizontal resistance and vertical bearing capacity;
- Minimum area is required for the works;
- Using the interlocks of high shear strength can further reduce the size of foundations. The foundation can also be used for the aesthetics of the bridge;
- High performance for scouring;
- Improves safety during construction.

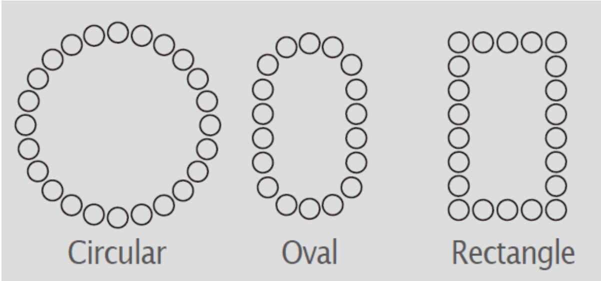
SPSP are effectively connected together with high damage resistance joints (hyper junctions), which are filled with mortar in order to make SPSP watertight and rigid (See Figure 8.24).



Source: JFE Steel

Figure 8.24 Joint between Steel Pipes

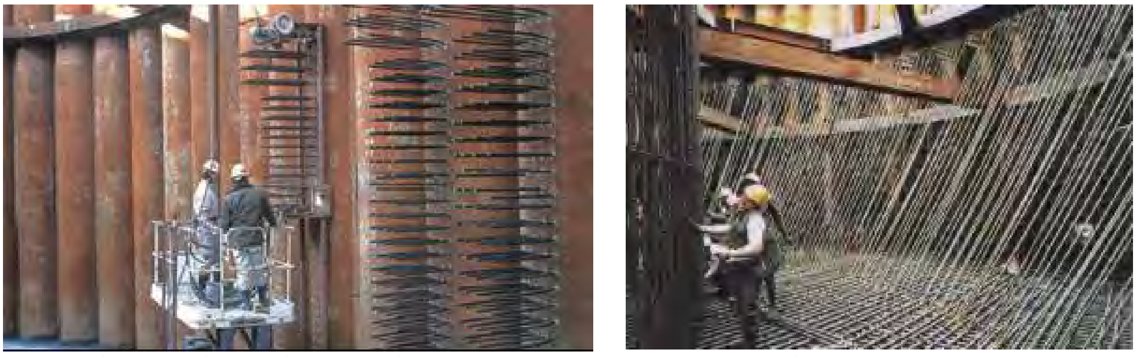
The steel pipe sheet piles can be variously arranged, according to the design requirements (See Figure 8.25).



Source: JFE Steel

Figure 8.25 Pile Arrangement

Studs on SPSP will connect footing concrete which is made of cast-in-place concrete in the dry up condition.

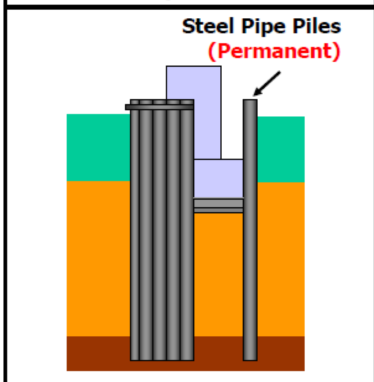
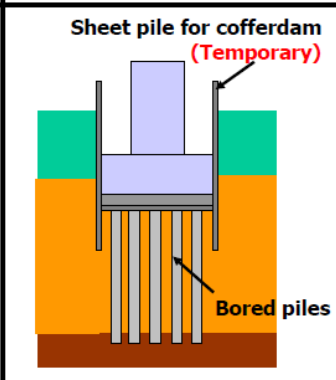
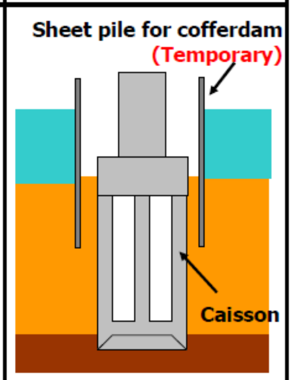


Source: Nippon Steel & Sumitomo Metal

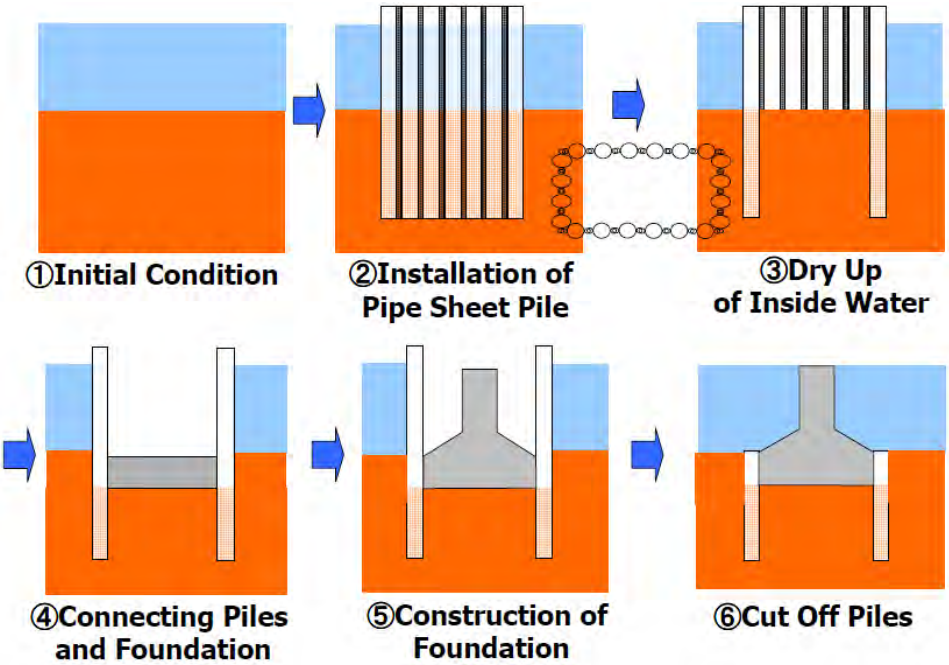
Source: JFE Steel

Figure 8.26 Connection between Footing and SPSP

Table 8.2 Comparison of Foundation Type

Steel Pipe Piled Well		Bored Concrete Pile	Concrete Caisson
			
Workability on Water	Good	Fair	Fair
Term of Works	Good	Fair	Fair
Bearing Capacity	Good	Fair	Good
Safety of Works	Good	Fair	Fair
Scouring	Good	Fair	Fair
cost	Fair	Good	Fair
Overall	Good	Fair	Fair

Source: JFE Steel



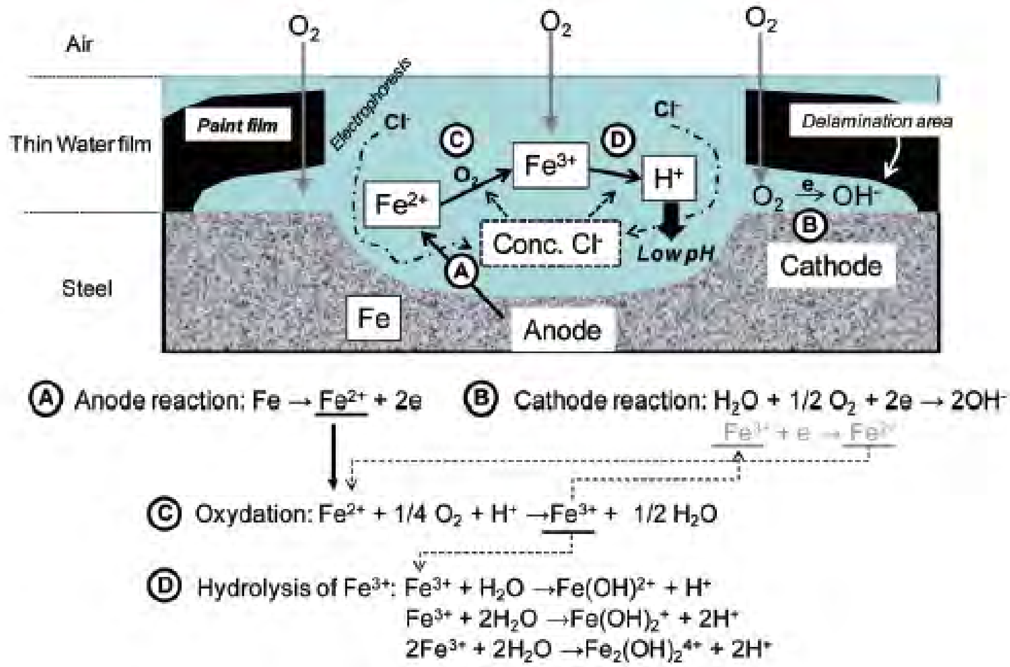
Source: JFE Steel

Figure 8.27 Construction Procedure

(2) Corrosion Resistance Steel for Painting Cycle Extension

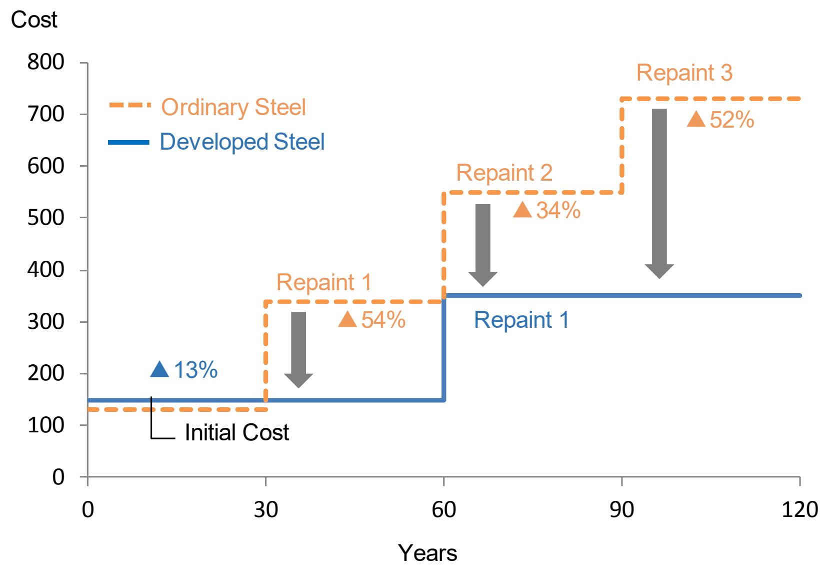
In general, the steel structure is coated to prevent corrosion. However, it is well known that corrosion starts to occur at invisible pin holes of paint film or a thinner paint film area at the edge or corner of the steel structure. Especially, the corrosion progresses rapidly under the condition containing high amounts of chlorides, such as in coastal areas. It is expected that the repairing and repainting cost of corroded steel structures will rise, and that maintenance of the steel structures would be more challenging due to the economic impact of the maintenance costs. Since a new technology to reduce the Life Cycle Cost (LCC) of social infrastructures is necessary, new anti-corrosion steel has been developed to reduce such LCC of the social infrastructures and to contribute to the sustainable development of society.

It was found that Tin (Sn) improves the corrosion resistance of steel dramatically under atmospheric conditions. The development of Sn-bearing steel exerting superior corrosion resistance at the paint defect, corrosion resistance steel for painting cycle extension is a significant step in reducing LCC.



Source: Nippon Steel & Sumitomo Metal

Figure 8.28 Schematic Model of Atmospheric Corrosion of Steel in Presence of Cl⁻



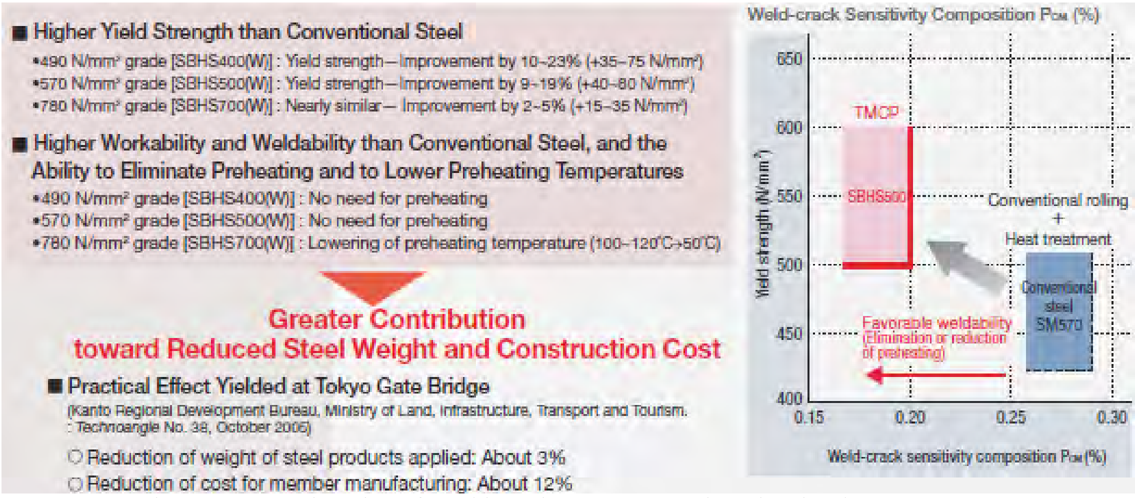
Source: JICA Survey Team, referring to "Development and Practical Application of Corrosion Resistance Steel for Painting Cycle Extension (CORSPACE™), Nippon Steel & Sumitomo Metal Technical Report No. 110, September 2015

Figure 8.29 Image of Life Cycle Cost for Painting

(3) Steels for Bridge High Performance Structure (SBHS)

Steels for Bridge High Performance Structures (SBHS) are high-performance steel plates (JIS G 3140) for use in bridge construction. These steels were developed as a result of a joint industry-academia research project and with the primary object of reducing the construction cost of steel bridges (See Figure 8.30 and Figure 8.31).

In terms of strength, toughness and weldability, the performance of SBHS exceeds that of 490 N/mm^2 (Newton/millimeter squared)-, 570 N/mm^2-conventional and 780 N/mm^2-grade conventional steel. A good understanding of the high performance offered by SBHS and their effective application will enable the user both to produce rational bridge designs and to conduct more streamlined member manufacturing.



Source: Research Group on Steel Products for Bridges, the Japan Iron and Steel Federation

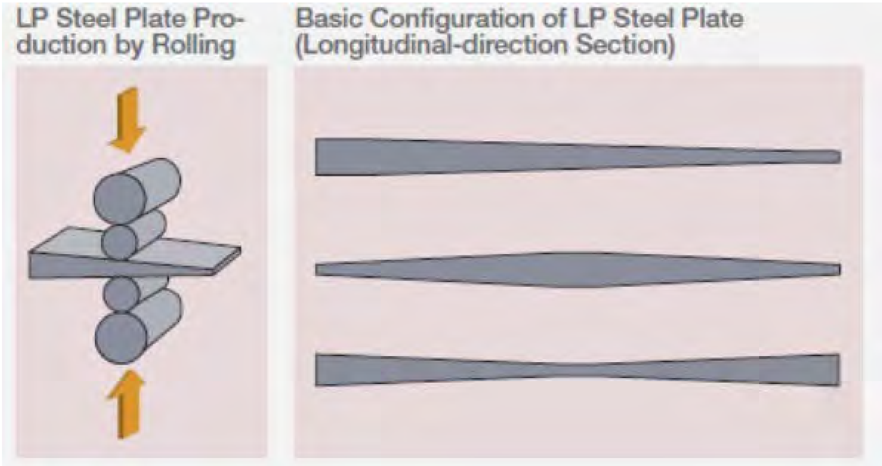
Figure 8.30 Features of SBHS

Source: Research Group on Steel Products for Bridges, the Japan Iron and Steel Federation

Figure 8.31 Tokyo Gate Bridge

(4) Longitudinally Profiled (LP) Steel Plate

LP steel plates are produced by changing the thickness in the longitudinal direction. Longitudinally profiled steel plates have become available due to recent developments in plate rolling technology. Application of LP steel plates allows cost reduction by eliminating welds and reducing structural weight. The figure below shows the production process of LP Steel Plates.

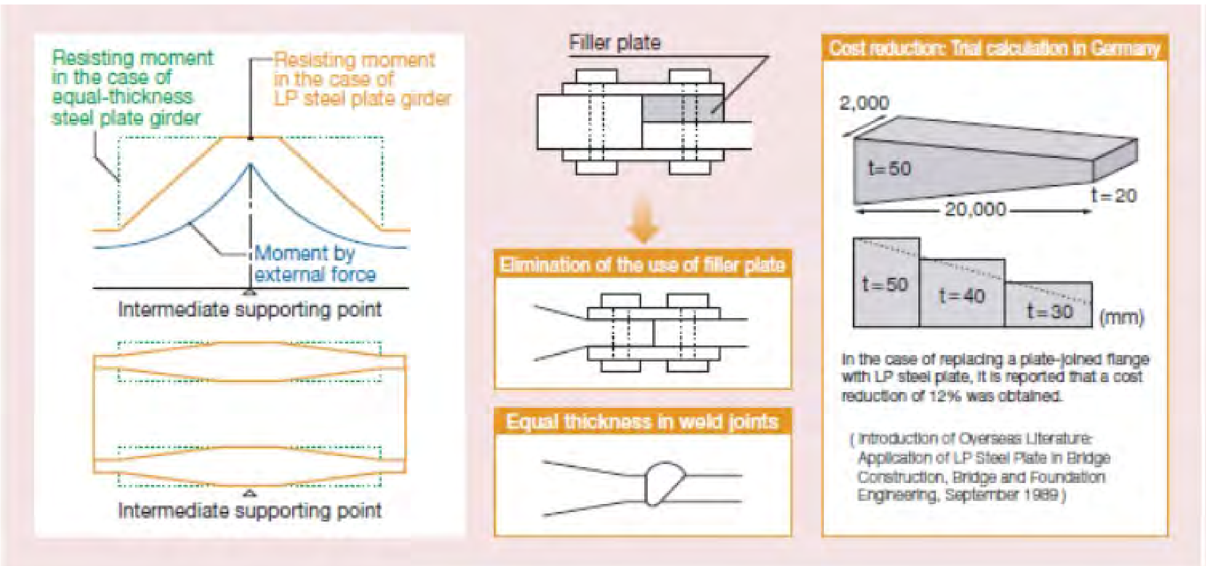


Source: Research Group on Steel Products for Bridges, the Japan Iron and Steel Federation

Figure 8.32 Production Process

Benefits of LP steel plates are summarized as follows (See Figure 8.33)

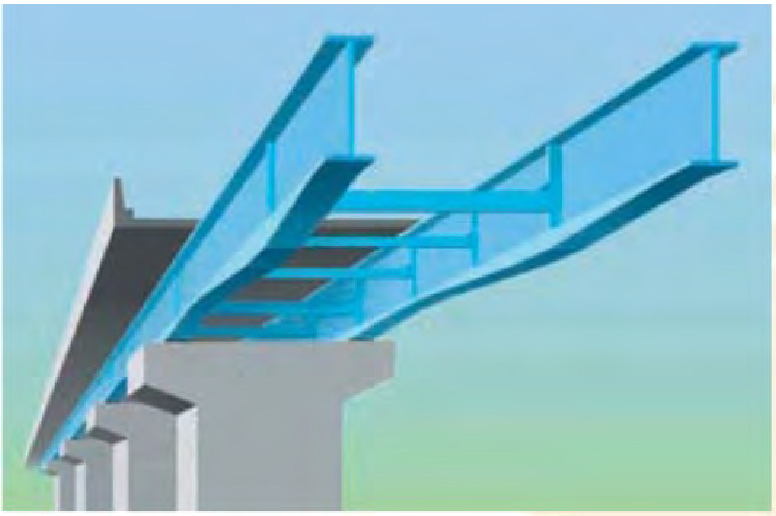
- Rationalized Thickness Composition in Compliance with the Section Force Required
  - Structural weight of LP steel plate girders can be reduced, compared to steel girders of equal thickness.
  - Application effect is greatly improved for a large-section twin-girder bridge.
- Equal Thickness in Joints
  - Use of filler plates can be eliminated in bolt joints.
  - Tapering process is not required for weld joints.



Source: Research Group on Steel Products for Bridges, the Japan Iron and Steel Federation

Figure 8.33 Application Benefits

An illustration of application of LP steel plates in girder flanges is shown below.



Source: Research Group on Steel Products for Bridges, the Japan Iron and Steel Federation

Figure 8.34 Application Example

(5) Spiral-Protuberance duct for Aerodynamic Stabilization

In terms of wind-resistant design of cable-stayed bridges and also for their maintenance, stabilization of wind-induced cable vibrations, such as rain-wind induced vibration (RWIV) and dry-state galloping (DG), have been one of the most significant engineering problems. Furthermore, for comparatively long stay-cables, the reduction of static wind forces is also required. In general, to mitigate the aerodynamic vibration of stay-cables, mechanical dampers, cross ties between stay-cables and aerodynamic treatments on cable surface have been applied to the real stay-cables. From a viewpoint of structural maintenance, the third method of aerodynamic countermeasure must be superior to the others. However, the vibration mechanisms have not been totally clarified yet, and then, the reliability of aerodynamic countermeasures are still under discussion.

The new surface treatment of spiral protuberance (Figure 8.26) has been developed and its capability for drag force reduction, aerodynamic stabilization, and aerodynamic performance has been confirmed by a series of the wind-tunnel tests.

Source: Shinko Wire Co., Ltd.

Figure 8.35 Spiral Protuberance

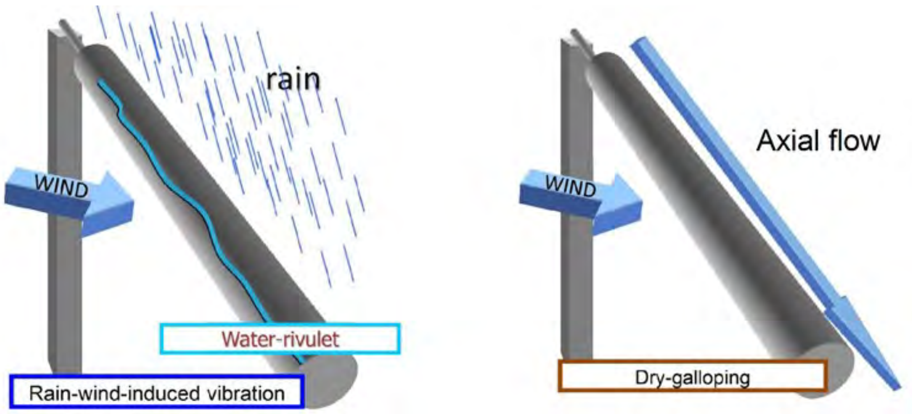
As shown in Figure 8.27, wind induced cable vibration is considered to be caused as follows.

Rain-wind induced vibration (RWIV)

The combination of rain and moderate wind speeds can cause high amplitude cable vibrations. This phenomenon has been observed on many cable-stayed bridges and has been researched in detail. The rivulets of water running down the cable surface in rainy weather were the essential component of this aerodynamic instability.

Dry-state galloping (DG)

Galloping of single dry, inclined cables is a theoretical possibility. It has been considered that there are two kinds of generation factors for the dry-state galloping, which are the axial flow formed in the weak side of cable, and the flow field at the critical Reynolds number range.



Source: Shinko Wire Co.,Ltd.[2]

Figure 8.36 Image of Wind-induced Cable Vibration

(6) Epoxy Coated and Filled Pre-Stressing Strand for Marine Environment

With the rising requirements for durability in pre-stressed concrete structures, the anticorrosive coated pre-stressing strand products focused though cement grouting systems are the most popular method for corrosion protection because of its high anticorrosive potential and economic efficiency. As requirements have grown for both long life concrete structures and short construction times, the anticorrosive coated PC steel is commonly used. With the concept of multi-layer protection system against corrosion, the use of Epoxy Coated and Filled Strand (ECS) for PC structures is prevalent to achieve the requirements.

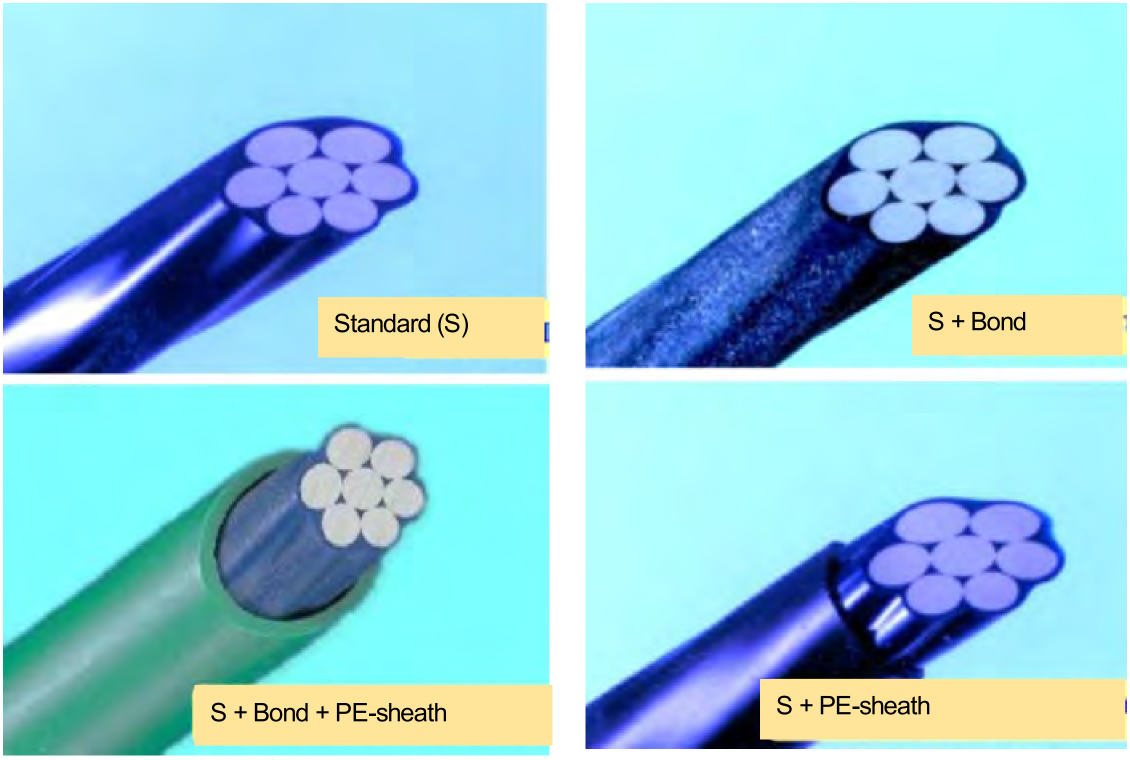
Currently in Japan, the use of ECS has spread. ECS is expected to be used not only for improving the durability of the structure but also shortening the construction time. For example, ECS is the first choice for external tendons inside box girders in Japan. Type of ECS is described and shown in the table and figure below.

[2] Reference: "Modification of surface configurations of stay cables for drag force reduction and aerodynamic stabilization," Tomomi Yagi, Kengo Okamoto, Ippei Sakaki, Hiroshi Koroyasu, Zifeng Liang, Shuhei Narita, and Hiromichi Shirato, ICWE.

Table 8.3 Types of ECS

	1st anticorrosive layer		2nd anticorrosive layer	
	Material	Surface Aspect	Material	Application
Standard (S)	Epoxy resin	Smooth	(None)	- External tendon for a box girder - Stay cable
S + Bond	Epoxy resin	Embedded sand for good adhesion with concrete	(None)	- Inner tendon - Pre-tensioning system - Stay cable
S+PE-sheath	Epoxy resin	Smooth	Polyethylene coating with close contact to 1st layer	- External tendon for a box girder (ex. For severe chloride attach area) - Stay cable
S + Bond + PE-sheath	Epoxy resin	Embedded sand for good adhesion with concrete	Polyethylene sheath (non-adhesion with 1st layer)	- Ground anchor

Source: Sumiden Wire Products Corporation



Source: Sumiden Wire Products Corporation

Figure 8.37 Types of ECS

8.2 Seaport Sector

Most of the port facilities in Japan were built in the 1960–1970's, and have already surpassed the design service period of 50 years. The major activities for port facilities range from new constructions to maintenance, reinforcement of existing facilities and prolongation of design lifetime of facilities.

To achieve issue of aging facilities, following technologies have been developed in Japan:

- Preparation and operation of the maintenance manual of port facilities
- Development of investigation techniques to detect deterioration of existing facilities
- Development of the structural repair method to keep existing facilities in good condition and to extend their service period
- Development of the method to reinforce the existing function
- Development of new types of structures (structural innovation)

8.2.1 Targeted Seaport Sector Projects

The targeted projects of the seaport sector are mainly for Port of Yuzhny, such as the dredging of the navigation channel and within the port as well as construction of 4 new deeper berths (−21 meters) (berths number 10, 11, 12, 12a). In addition, according to the interview of Port of Yuzhny, there are reconstruction plans to deepen the existing berths from −16 meters to −21 meters. However, for the reconstruction of the existing −16 meter berths, the maximum depth is only until −19 meters without reinforcement of the exiting berths.

8.2.2 Applicable Japanese Technologies

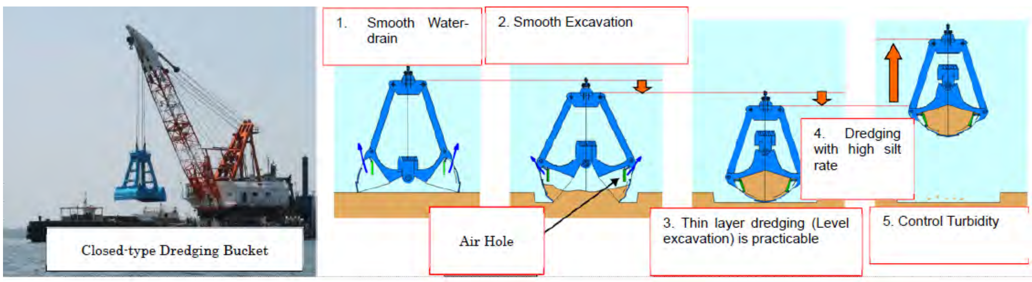
Applicable technologies to Port of Yuzhny are:

1. Dredging,
2. New construction for a deeper berth, and,
3. Technologies to deepen the existing berths.

(1) Dredging (Environmental Conservation Technology)

Since seawater disposal plant is easily influenced by waves, the construction work can progress after wastes are surely shut off with sea surface and problems of safety and environmental preservation are cleared. The dredging work is carried out by shutting off the pollution-prevented film in order to limit polluted water in the surrounding environment. Since most of the seawater disposals in Japan are founded on weak ground, soil improvement is also an important theme. Two methods for soil improvement, “Sand compaction pile method” and “Deep mixed disposal method” are carried out to ensure safety of revetment and to shut water off.

The use of the closed-type bucket is also effective for environmental conservation, shown in the figure below.



Source: Japan Dredging and Reclamation Engineering Association Catalogue

Figure 8.38 Closed-type Bucket

Source: Japan Dredging and Reclamation Engineering Association Catalogue

Figure 8.39 Dredging and Reclamation in Okinawa

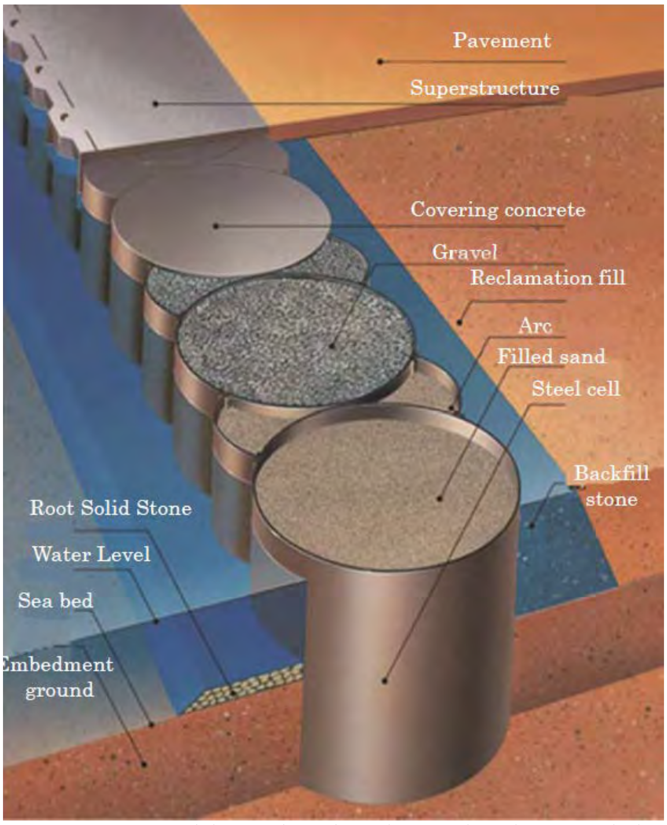
Since environmental concerns sometimes may be prioritized over economic concerns, dredging work in Japan often utilizes the "Silt Protector" in order to prevent sea water pollution by dredged materials. The dredging work taking into account environmental considerations could also be shared as one of the unique Japanese technologies.

(2) New Construction of a Deeper Berth

In Japan, technologies for construction of a deeper berth and rapid construction have been used for the improvement of the quay depth at Tokyo Port, Yokohama Port and Kobe Port, as it was necessary to accommodate the structures in a minimized construction period in order to accommodate large container ships. Adoption of technologies such as the improvement of soft seabed and installation of steel cell and steel jacket, lead to significant saving of construction period.

<u>Steel Cell Structure</u>

The Steel Cell structure is used in Minami-Honmoku C-3 & 4 Container berths in Yokohama Port, with a planned water depth of −18 meters (actually constructed with a depth of −20 meters). This structure is a kind of a Gravity Type structure. In order to construct such structure on soft subsoil, improvement of subsoil by CDM or Sand Compaction method is necessary. The schematic drawing of the Steel Cell structure is shown in the figures below.



Source: Japan Dredging and Reclamation Engineering Association Catalogue

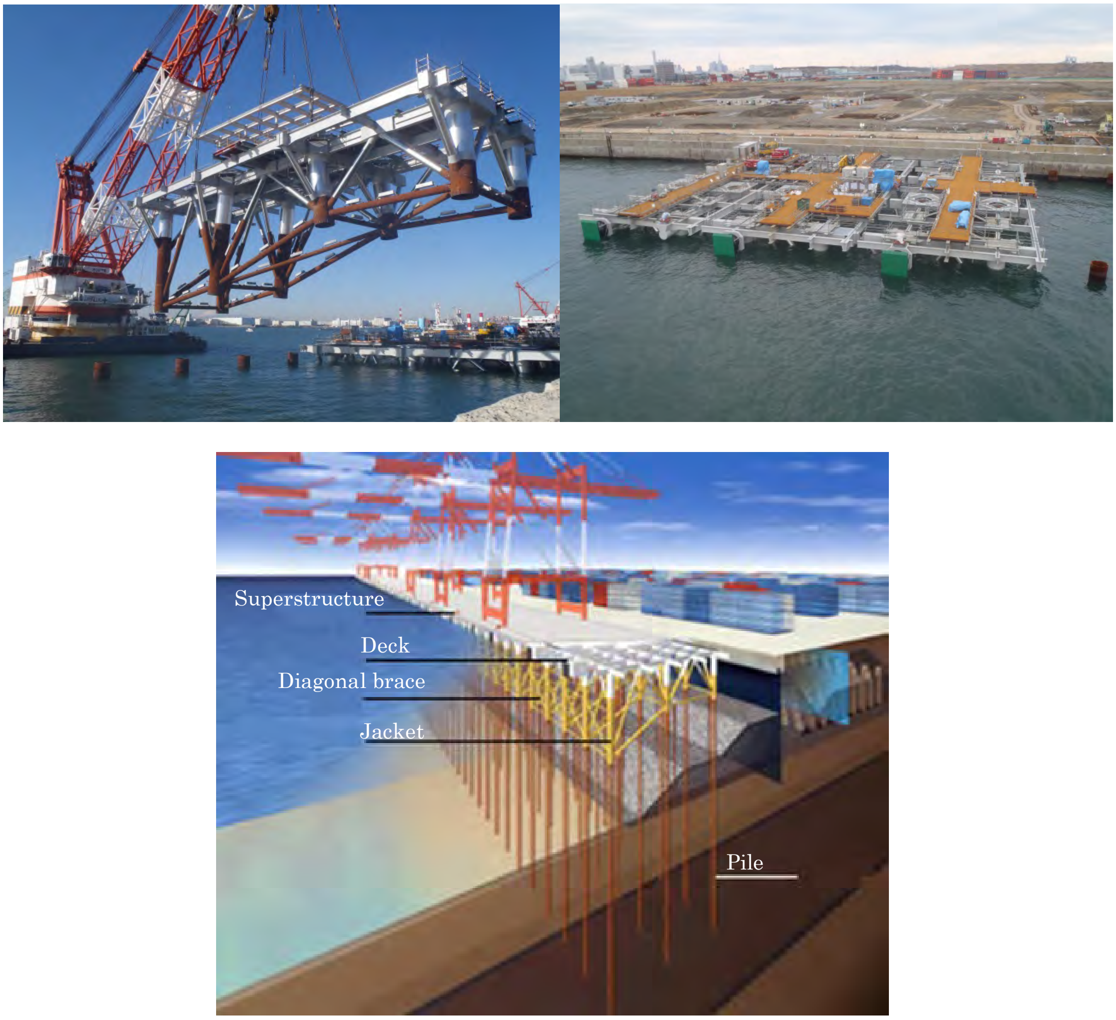
Figure 8.40 Schematic Drawing of Steel Cell Structure

Source: Japan Dredging and Reclamation Engineering Association Catalogue

Figure 8.41 Construction of Steel Cell Structure

<u>Jacket Structure</u>

The Jacket structure is used in Tobishima Container Terminal in Nagoya Port, with a depth of −16 meters. The Jacket structure is often used for off-shore oil leg. In Japan, it had been modified to a berth structure in the port. The continuous berth composed of the Jacket structure is only seen in Japan. The schematic drawing of the Jacket structure is shown in the figure below.



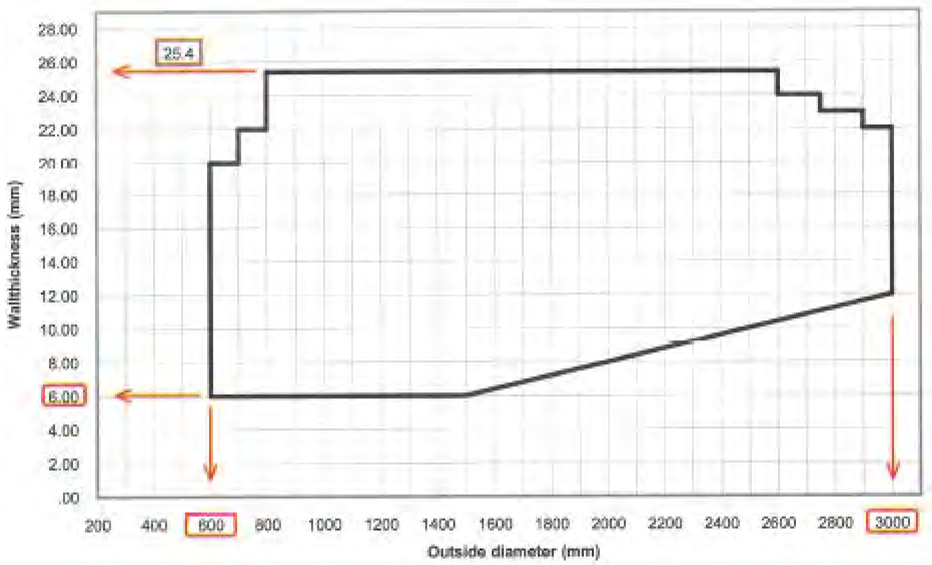
Source: Japan Dredging and Reclamation Engineering Association Catalogue

Figure 8.42 Schematic Drawing of Jacket Structure

Inland disposal of surplus soils from construction sites may be difficult, due to environmental issues and limited dumping sites. Therefore, effective utilization of surplus soils and dredging for reclamation work is useful, as it provides an alternative offshore disposal site with efficient containment and is environmental friendly.

<u>Large-Diameter and Long Steel Pile</u>

During the construction of deeper berths, such as, berths of −19.0 meters in depth, major materials of a pier or sheet pile structure require “Large-Diameter and Long Length Steel Pipe Piles”. One of the Japanese technologies that could be applied is the fabrication of the Spiral Steel Pipe Pilings with large-diameters and long lengths (the length of more than 50 meters).



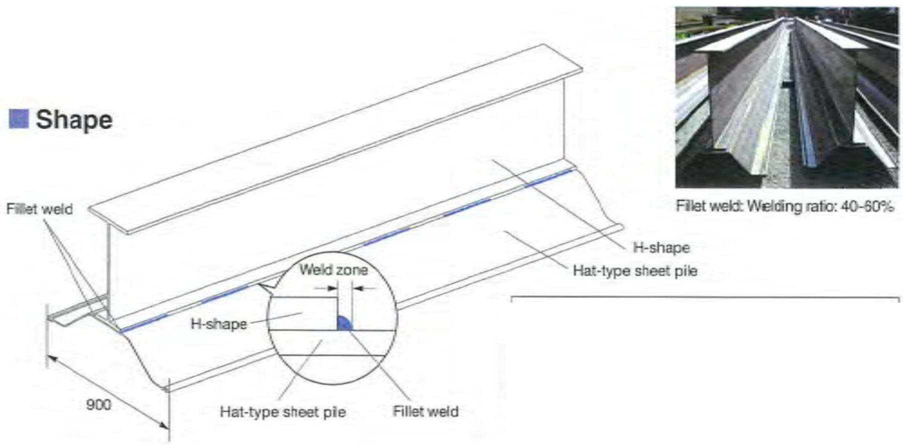
Source: Nippon Steel & Sumikin Pipe Vietnam Co., Ltd. Catalogue (Cat. No. 5 07.2015)

Figure 8.43 Available Size Range of Steel Pile

Specific Steel Sheet Pile Material

Hat-type and H-Shape combined high stiffness steel sheet piles are specific Japanese materials. The advantages of such materials are:

- Availability of numerous sectional properties;
- Ease of fabrication;
- Cost effectiveness; and
- Ease of Installation.



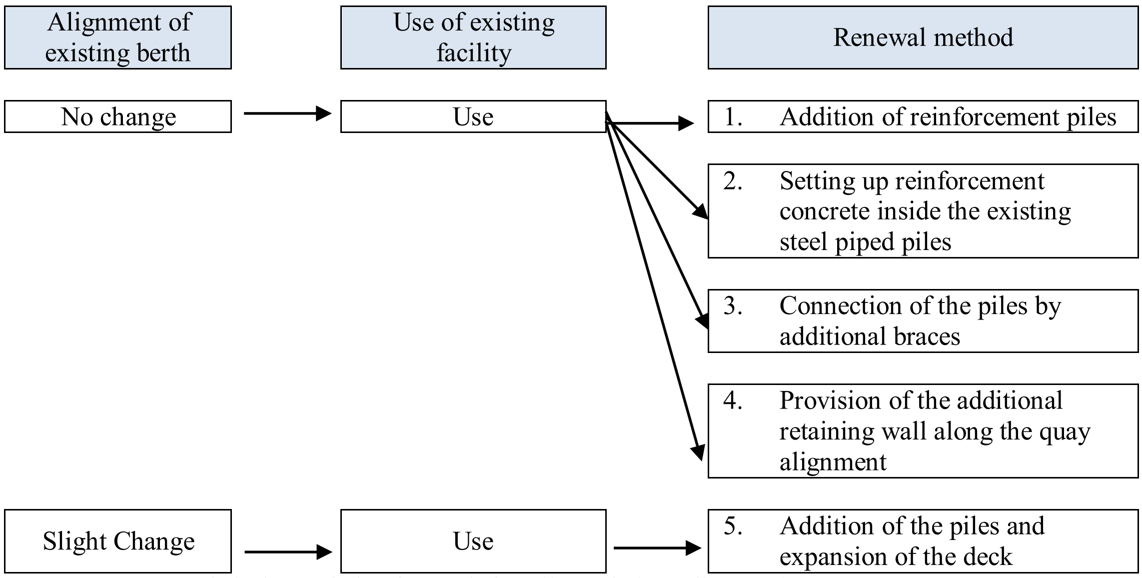
Source: Nippon Steel & Sumitomo Corporation Catalogue

Figure 8.44 Hat-type and H-Shape Combined High Stiffness Steel Sheet Pile

(3) Renewal Techniques of Port Facilities (Cases in Deepening the Existing Quay)

<u>Case of Piled Pier Structure</u>

In the case where the existing facility is a piled pier structure, the renewal concept of the structure is as follows:

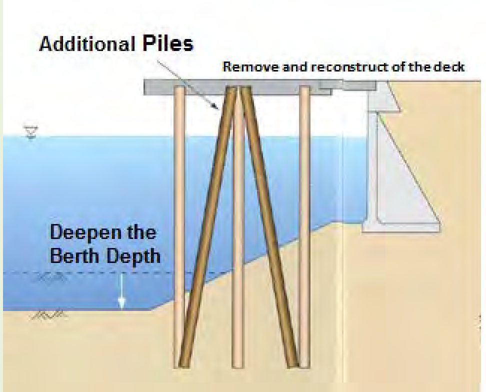


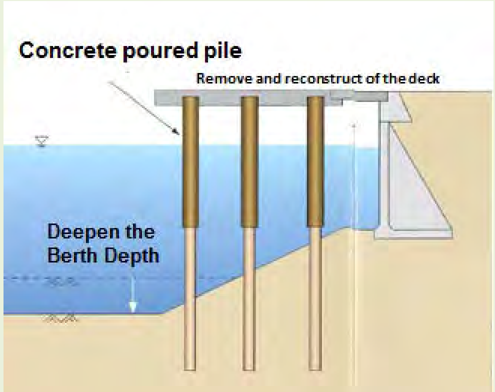
Source: Japanese Technical Association for Steel Pipe Piles and Sheet Piles Brochure

Figure 8.45 Conceptual Diagram of the Renewal Method for Existing Piled Pier Structure

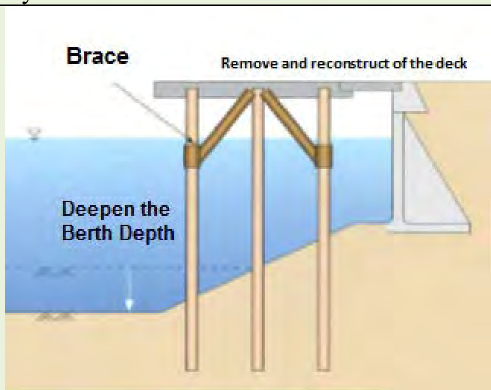
The renewal method is represented by the following schematic drawing:

1. Addition of reinforcement piles	2. Setting up reinforcement concrete inside the existing steel piped piles

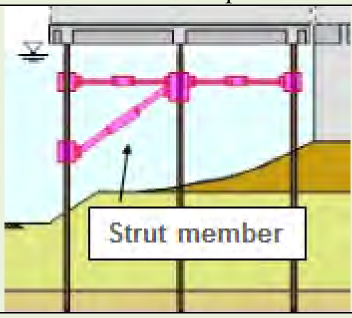


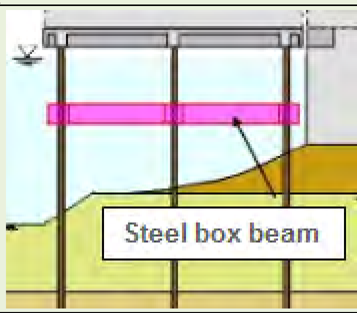


3. Connection of the piles by additional braces

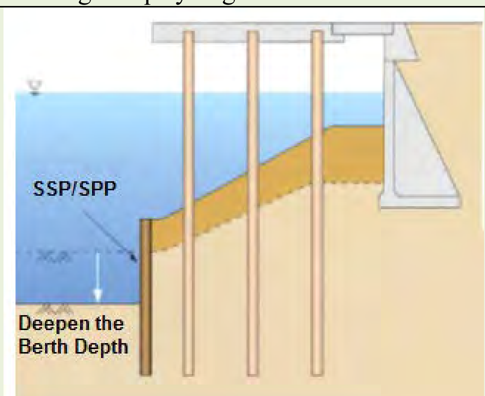


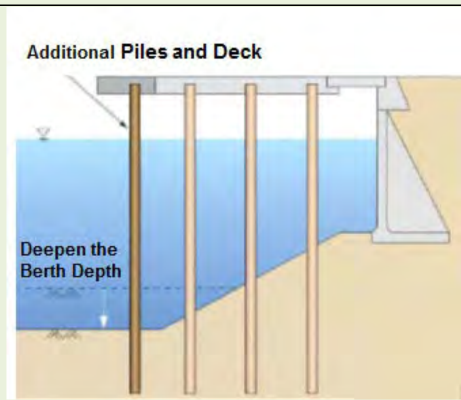
Variations:
Reinforcement of foundation piles without the removal of superstructure





4. Provision of the additional retaining wall along the quay alignment	5. Addition of the piles and expansion of the deck



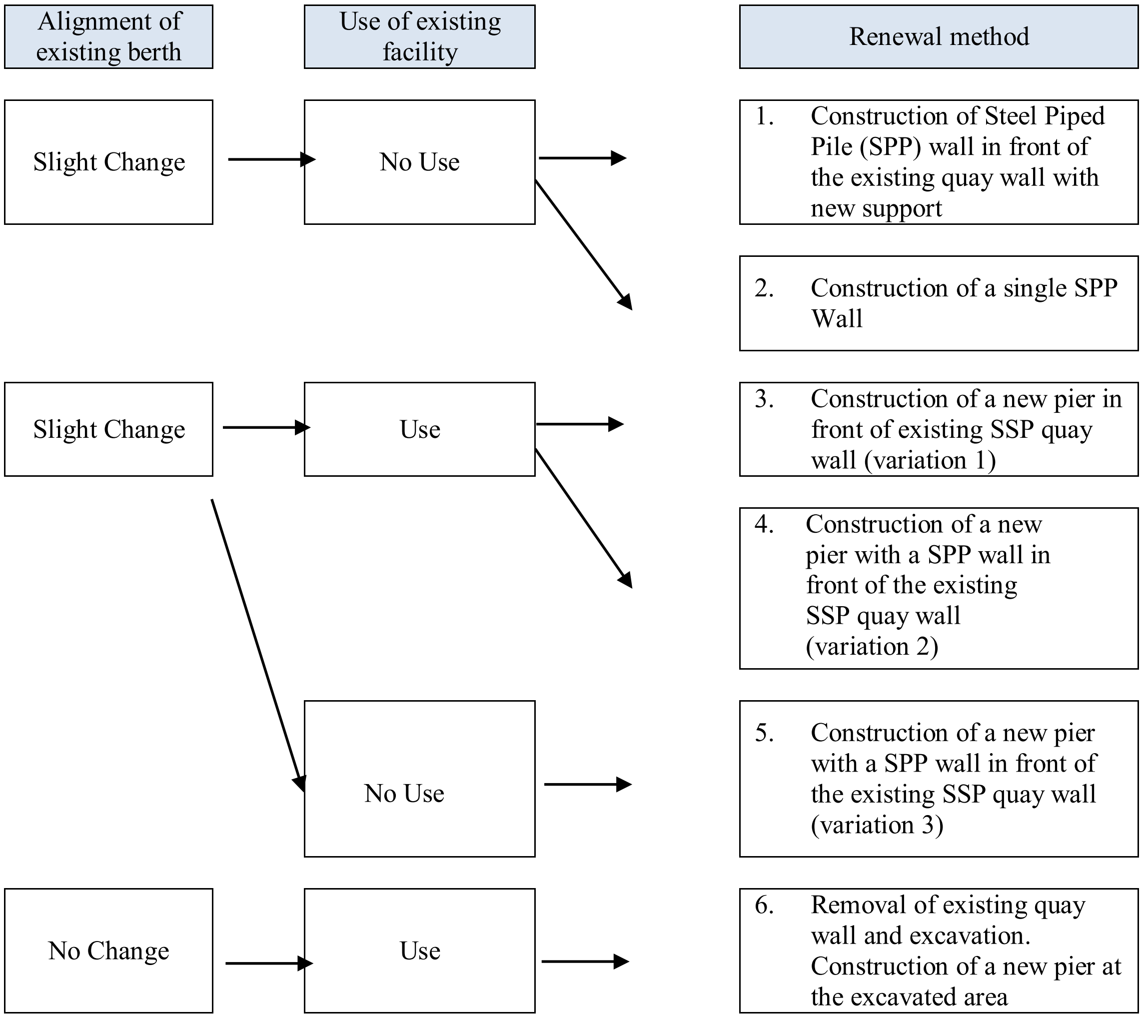


Source: Japanese Technical Association for Steel Pipe Piles and Sheet Piles Brochure

Figure 8.46 Schematic Drawing of the Renewal Method for Piled Pier Structure

Case of Steel Sheet Pile Berth Structure

In the case where the existing facility is a steel sheet pile berth structure, the renewal concept of the structure is as follows:

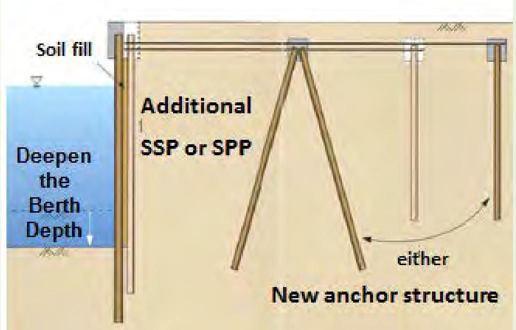


Source: Japanese Technical Association for Steel Pipe Piles and Sheet Piles Brochure

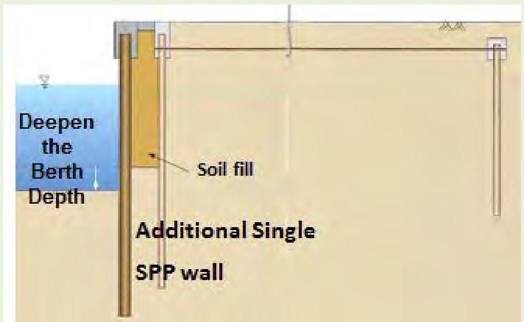
Figure 8.47 Conceptual Diagram of the Renewal Method for Existing Steel Sheet Pile Berth Structure

The renewal method is represented by the schematic drawings as follows:

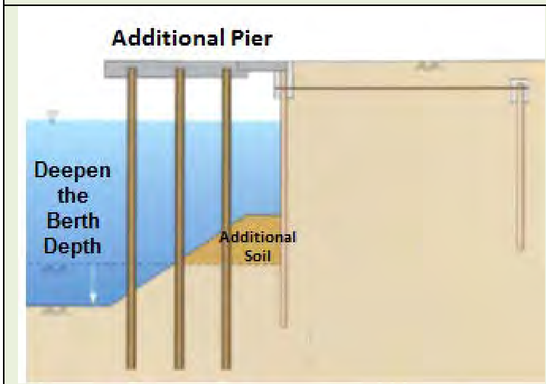
1. Construction of Steel Piped Pile (SPP) wall in front of the existing quay wall with new support



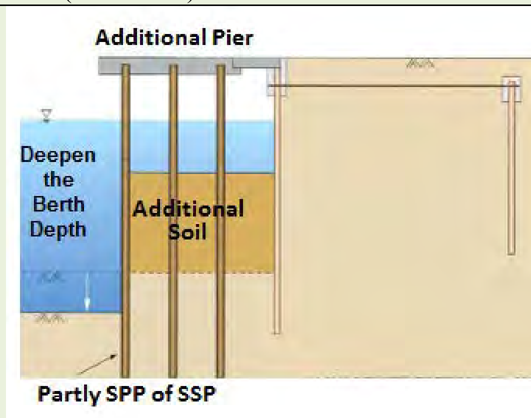
2. Construction of a single SPP Wall



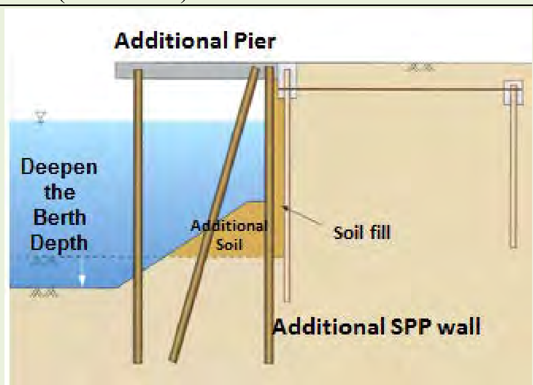
3. Construction of a new pier in front of the existing SSP quay wall (variation 1)



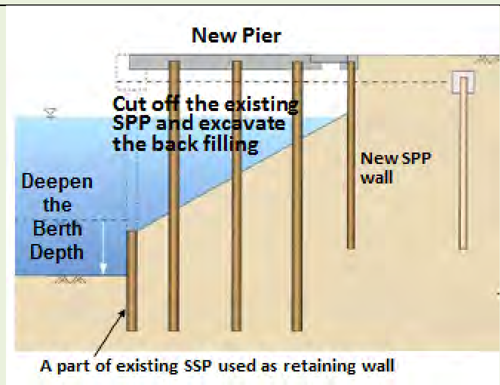
4. Construction of a new pier with a SPP wall in front of the existing SSP quay wall (variation 2)



5. Construction of a new pier with a SPP wall in front of the existing SSP quay wall (variation 3)



6. Removal of the existing quay wall and excavation. Construction of a new pier at the excavated area



Source: Japanese Technical Association for Steel Pipe Piles and Sheet Piles Brochure

Figure 8.48 Schematic Drawing of the Renewal Method for Steel Sheet Pile Berth Structure

Case of Gravity Berth Structure

In the case where the existing facility is a Gravity berth structure, the renewal concept of the structure is as follows:

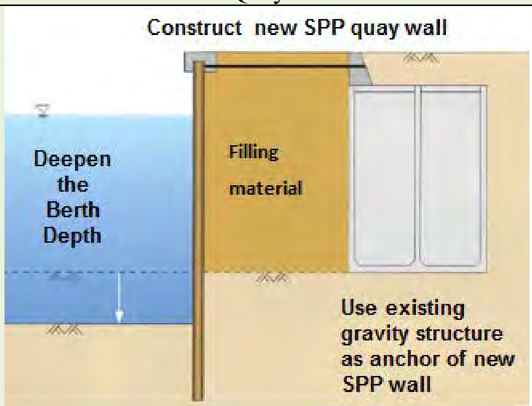
Alignment of existing berth	Use of existing facility	Renewal method
Large Change →	Use →	1. Additional SPP Quay Wall
		2. Additional Pier (Variation 1)
		3. Additional Pier (Variation 2)
Slight Change →	No Use →	4. Additional SPP Quay Wall

Source: Japanese Technical Association for Steel Pipe Piles and Sheet Piles Brochure

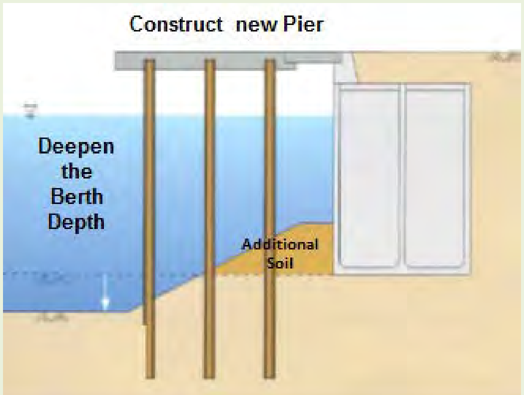
Figure 8.49 Conceptual Diagram of the Renewal Method for Existing Gravity Berth Structure

The renewal method is represented by the schematic drawings below:

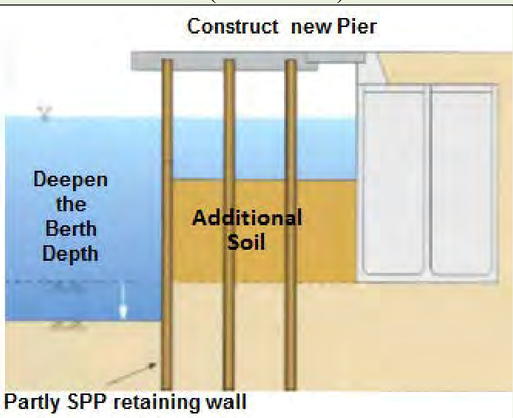
1. Additional SPP Quay Wall



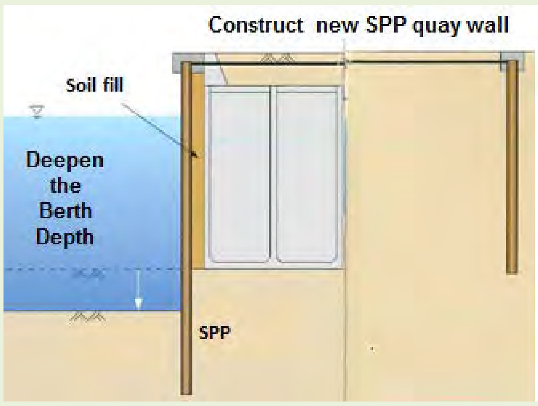
2. Additional Pier (Variation 1)



3. Additional Pier (Variation 2)



4. Additional SPP Quay Wall



Source: Japanese Technical Association for Steel Pipe Piles and Sheet Piles Brochure

Figure 8.50 Schematic Drawing of the Renewal Method for Gravity Berth Structure

Berth structures of Port of Yuzhny are mainly piled piers as shown in the following figures:

Source: JICA Survey Team (photo taken on 16th February, 2017)

Figure 8.51 Existing Berth of Port of Yuzhny

Source: JICA Survey Team (photo taken on 16th February, 2017)

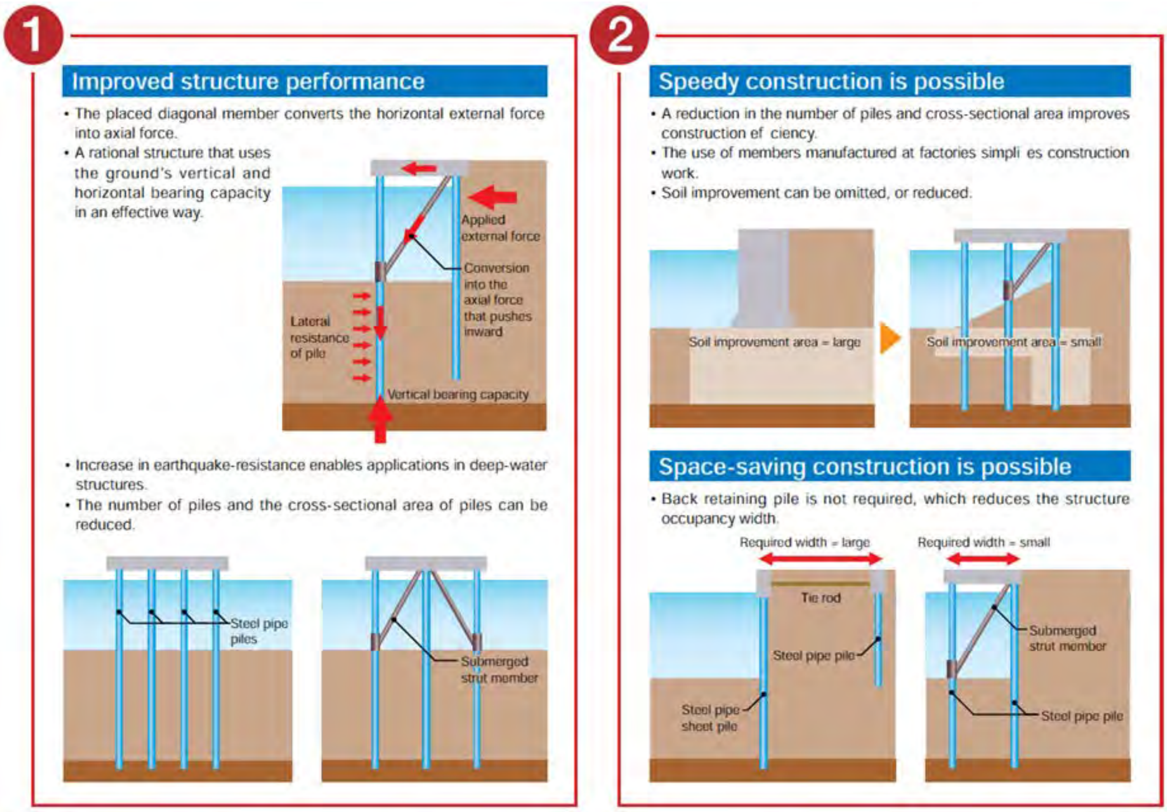
Figure 8.52 Existing Dolphin of Port of Yuzhny

The most applicable Japanese technology for the new deeper berths at Port of Yuzhny berths number 10, 11, 12, 12a will be the Jacket structure. The existing conditions of the planned area are shown in the figure below:

Source: JICA Survey Team (photo taken on 16th February, 2017)

Figure 8.53 Scheduled Area for New Deeper Berths in Port of Yuzhny

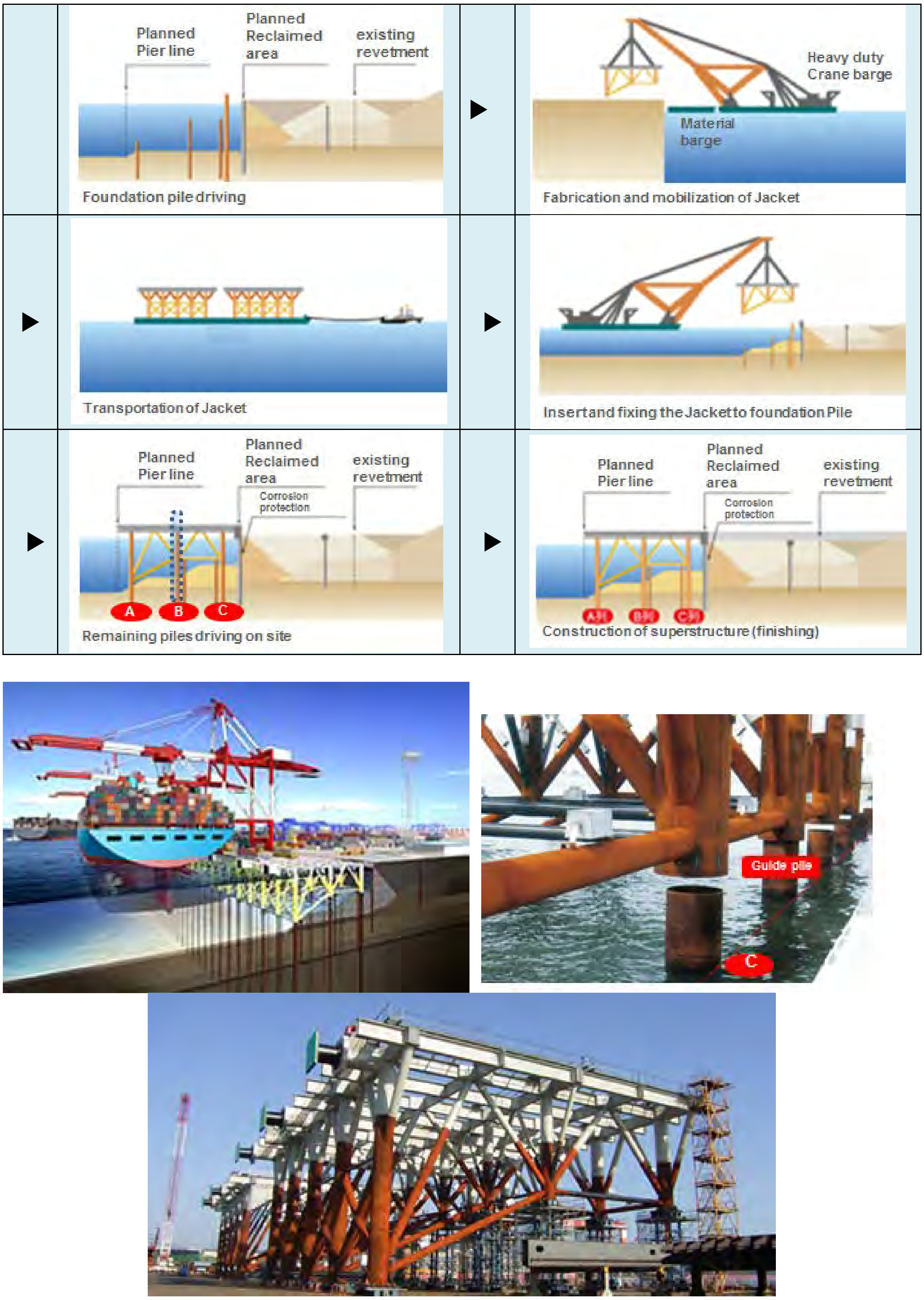
The benefits of using the Jacket structure are as follows:



Source: Nippon Steel & Sumitomo Corporation Catalogue

Figure 8.54 Benefits of Utilization of the Jacket Structure

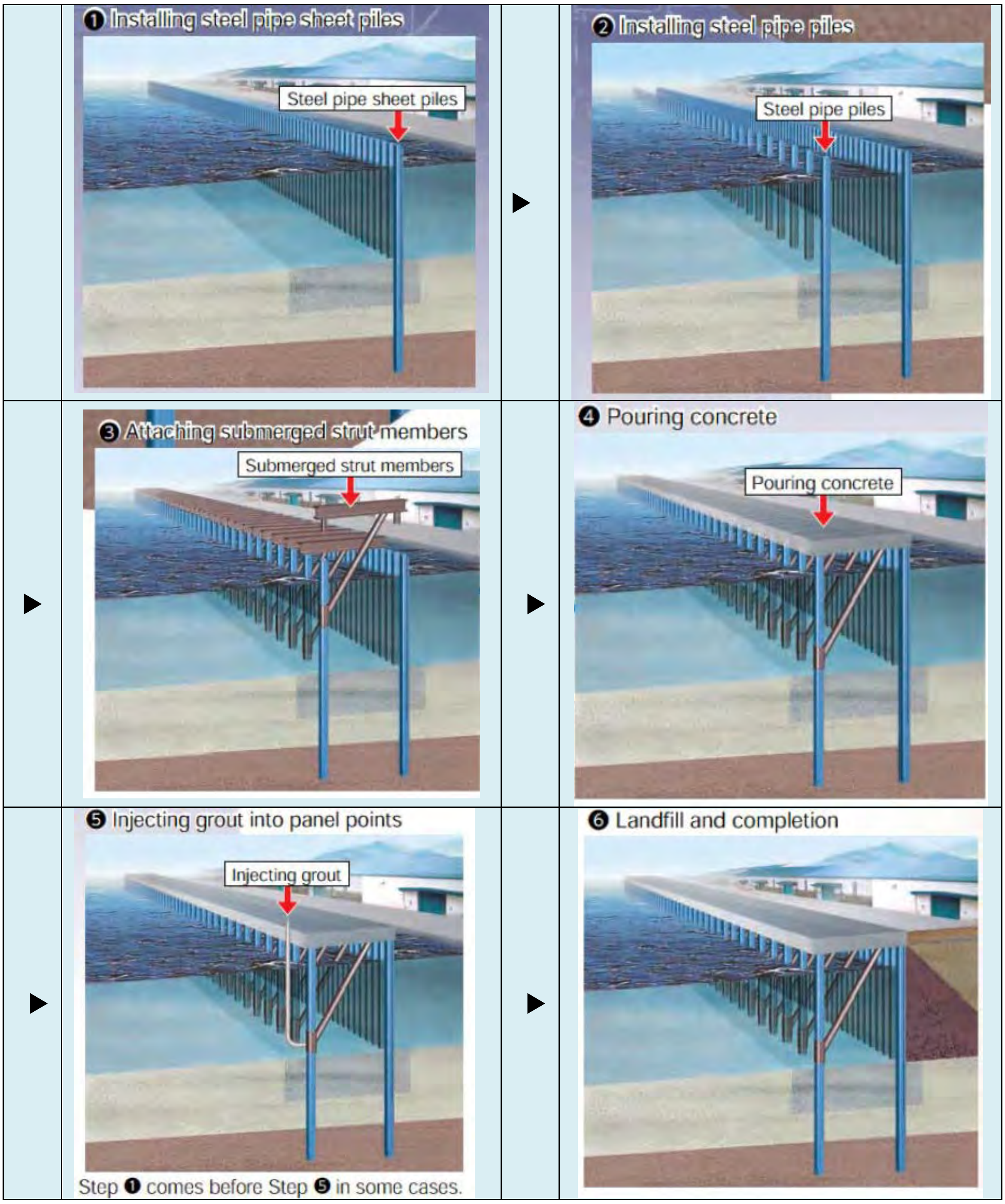
The most notable benefit is the rapid construction. The detailed construction procedure is as follows:



Source: Penta Ocean Construction Co., Ltd. website

Figure 8.55 Detailed Construction Procedure of the Jacket Structure

A similar structure with the Jacket structure is the Strut structure. The mechanism of the Strut structure is almost the same as the Jacket structure. The difference is that the strut structure intends for two pile lows whereas jacket structure unifies multi pile lows. The detailed construction procedure is as follows:

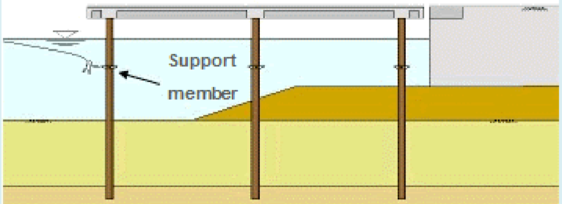
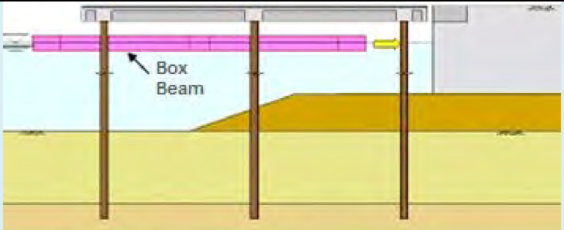
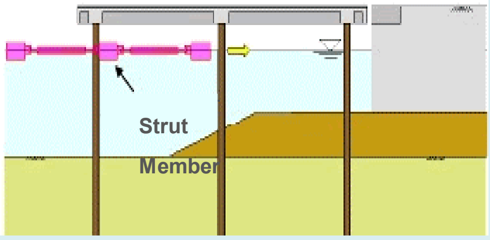
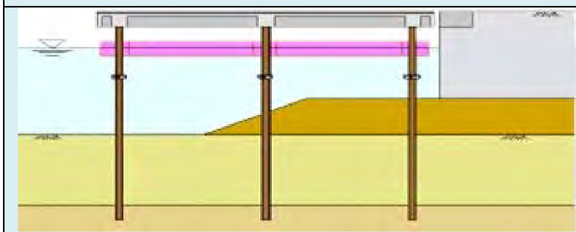
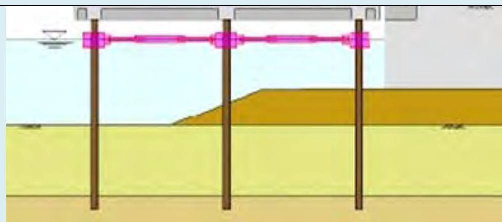
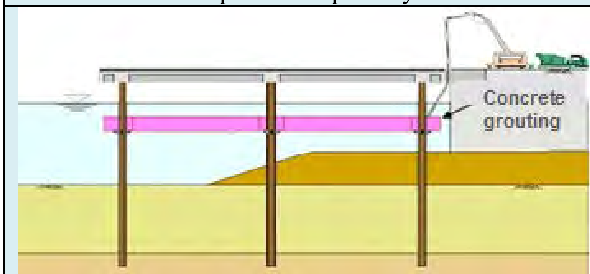
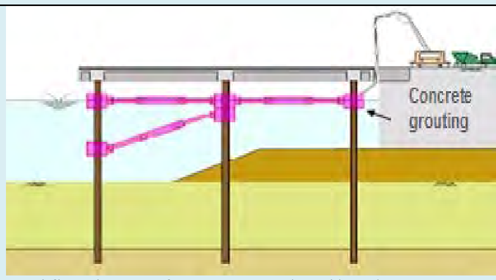


Source: Nippon Steel & Sumitomo Corporation Catalogue

Figure 8.56 Detailed Construction Procedure of the Strut Structure

The berths number 8 and 9 in Port of Yuzhny are scheduled to be reconstructed to deepen the depth of the berth from the existing −16 meters to −21 meters. According to the interview at the Port, these berths can be deepened until −19 meters without reinforcement of the existing structure according to the pre-study. An additional reinforcement is needed to deepen the berth to −21 meters. In order to deepen the existing piled pier, the renewal technologies for piled pier structures explained in 8.2.2 (3) Renewal techniques of port facilities (Cases in deepening the existing quay) could be utilized.

The method shown below is an application of the Strut structure to the existing facilities. The detailed construction procedure is as follows:

Deep Beam Structure	Strut Structure
 Installation of Support Members	
 Drawing of deep beam member by wire or rope. Beam itself float by buoyancy	 Drawing of strut member by wire or rope
 Fixation of the deep beam to piles by bolts	 Fixation of the strut member to piles by bolts
 Unification of beam and pile by concrete grouting	 Unification of strut and pile by concrete grouting

Source: JFE Engineering Corporation website

Figure 8.57 Detailed Construction Procedure of the Strut Structure for Renewal of the Existing Piled Pier Structure

The advantages of the Strut type structure include the following:

- Reinforcement of the existing structure
- Flexibility to the field conditions
- Rapid construction period (Minimization of the non-operation period)

These advantages are preferable for the reconstruction of berths number 8 and 9 in Port of Yuzhny.

8.2.3 Other Applicable Japanese Technologies

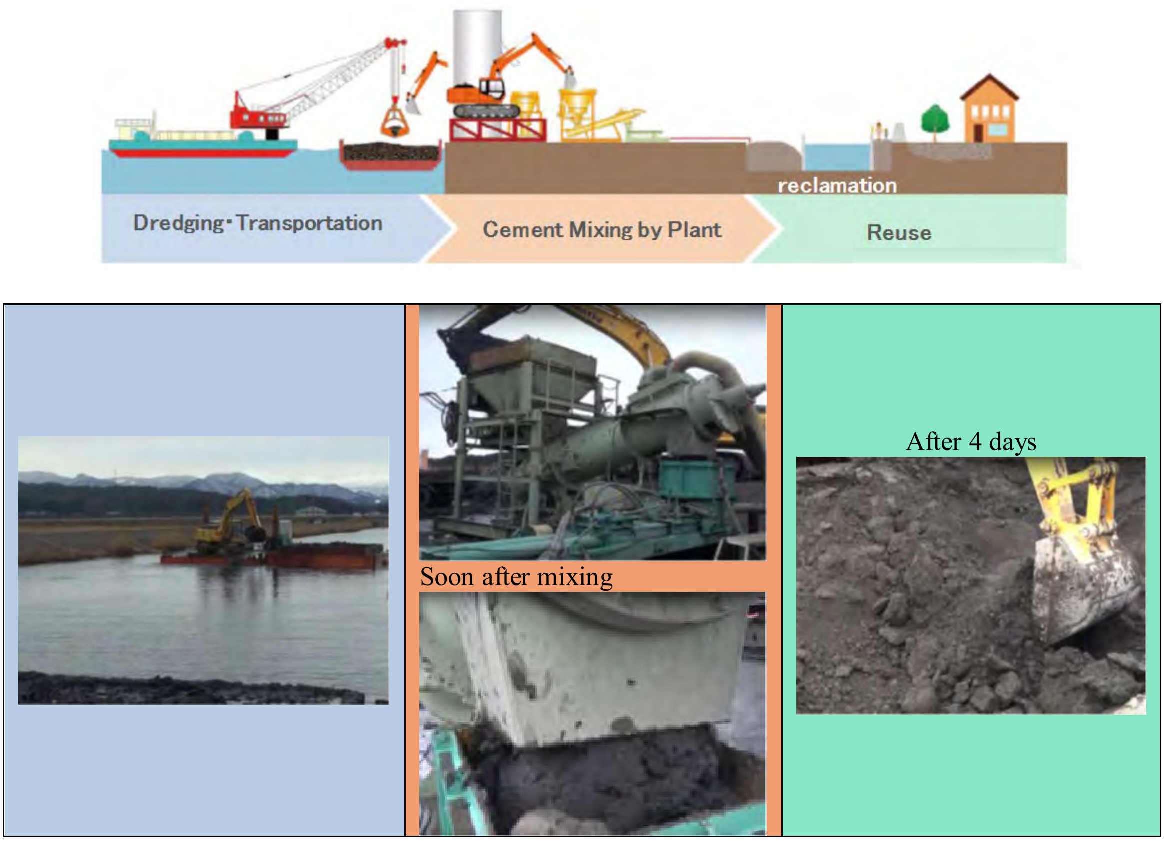
In section 8.2.2, Japanese technologies for the high priority projects in Port of Yuzhny were described. In Chapter 4, it is explained that the weak point of the Port of Odessa, which is the largest port in Ukraine, is that there is no space for development because of the close distance between the port area and the city proper. On the other hand, every port in Ukraine needs maintenance dredging, and the dredged material is dumped in the Black Sea, 26 kilometers away from the port.

If those dumped materials can be utilized as reclaimed materials at Odessa, one of the weak points of Port of Odessa can be solved. According to the interview at the Port of Yuzhny, the dredged materials are too soft to be used for reclamation. Although the dredged materials are also very soft in Japan, the following soil improvement technologies are utilized to change the very soft dredged soil and its high water content, to ordinary soil.

(1) Cement Mixing Method

The Cement mixing method is to mix the cement with the very soft and high water content soil to change the soil to ordinary soil. In order to decide the volume of cement to mix, sampling, testing and designing is necessary.

The procedure itself is very simple, as described below:



Source: Mud Treatment Research Association website

Figure 8.58 Detailed Construction Procedure of Cement Mixing Method

(2) Sand Drain

Moreover, at the Port of Odessa, uneven settlement is experienced and frequent maintenance is needed. To avoid the uneven settlement in the new reclamation area, the sand drain method is often used in Japan. This method is used to accelerate the settlement of soft clay layer by placing the sand piles in the soft clay and surcharge the land surface. The following is the sketch of the procedure of sand drain.

Source: http://www.kokusou.com/improvement/sand-drain/index.html

Figure 8.59 Sketch and Picture of Sand Drain

(3) Maintenance of Port Facilities

The “Port and Harbor Act” in Japan was revised in 2007 and the maintenance management for Port and Harbor structures is mentioned in the law. The manual was also revised reflecting the revision of the law.

The major contents of the manual are as follows:

- General provisions
- Methods of maintenance management
- Characteristics of the deformation of structures and points for maintenance management
- Methods of inspection and evaluation of Port & Harbor facilities
- Techniques of the inspection and survey of structures
- Forecasting of the progressive deterioration of structures
- Countermeasures and their selection
- Records

Most of Japanese port facilities have already aged 40–50 years, with its infrastructures becoming obsolete. Although the facilities are deteriorating, there is an increasing necessity to deepen the berths because of larger ships.

The budget to repair or reconstruct facilities is limited and it is difficult to reserve such budget for “scrap and build” process, which is a common practice for the renewal of port facilities. Thus, “preventive maintenance” is the major maintenance policy at present in Japan. This concept is to minimize the maintenance costs and keep the facilities operational or prolong its lifetime by continuous surveying and providing adequate maintenance work. In order to realize such state, the Government of Japan had prepared a manual to specify the standard procedure of maintenance work, including how to inspect, how to evaluate the deterioration of facilities and what kind of countermeasures must be applied to the damaged portions.

For the preventive maintenance, the maintenance work starts before the construction of new facilities because lots of important information is included in the design and initial construction phases. It is common that artificial structures become deteriorated by years of use. The important thing is not only the minimization of the initial construction costs, but also the minimization of the total lifetime costs including future maintenance costs.

Appendix

Appendix 3-I: State Budget 2017

Comparison of funding foreseen for 2017 against funding in 2016 (th UAH)*								
Code of budgetary expenditure	Name of the Budget Program	2016 adopted (with changes)		2016 factual (with changes)	2017 Foreseen by the adopted Law		Changes against the plan for 2016	Changes against the factual 2016
3111010	Management and administration in the field of construction, repairs and maintenance of roads	11,238.9	GF	11,182.0	45,872.1	GF	34,633.2	34,690.1
3111020	Development of the network and maintenance of rpads of general usage	12,815,734.0		9,376,057.0	10,390,345.6		-2,425,388.4	1,014,288.6
	from which at the cost of budget	8,065,909.0	GF	7,690,101.9	6,591,011.8	SF	-1,474,897.2	-1,099,090.1
	at the cost of remaining balances from loans contracted in previous years	4,749,825.0	loan	1,685,955.1	the remaining balance of 2016 will be used 3,799,333.8	loan	-950,491.2	2,113,378.7
3111030	Settlement of debt obligations related to sovereign loans borrowed for the development of a network of roads of general usage	5,600,165.2	GF	5,535,048.5	7,328,858.2	SF	1,728,693.0	1,793,809.7
3111040	Construction of the bridge crossing in the city of Zaporizhya				250,000.0	SF	250,000.0	250,000.0
3111600	Development of highways and reform of road sector (IFI loans)	4,374,626.2	IFI	1,874,923.8	3,717,400.0	IFI	-657,226.2	1,842,476.2
3111610	Development of the next-to-border road infrastructure at Ukraine-Poland border (part of the loan provided by the Polish Government)	6,800.0	IFI		47,083.2	IFI	40,283.2	47,083.2
3111800	Implementation of the state investment project "Improvement of the condition of roads in Lviv oblast»	232,077.9	GF	168,532.5	250,000.0	GF	17,922.1	81,467.5
3111820	Development of the -52 highway Dnipro-Tsarychanka-Kobelyaki-Reshetylivka				350,000.0	GF	350,000.0	350,000.0
	TOTAL	23,040,642.2		16,965,743.8	22,379,559.1		-661,083.0	5,413,815.3

*Foreseeing the start of the State Road Fund in 2018, a Special Fund has been created specifically to the road sector in addition to the General Fund to the budget for 2017. A General Fund is a public state fund that sources all kinds of expenditures. The Special Fund is a fund specific to the road sector, stipulated by the Law of Ukraine "on the State Budget of Ukraine" (Supreme Council of Ukraine, dated 21st April, 2017; Last Amended 2017, No. 13, st. 146), where Article 11-13 provides the details of the sources of the funds and Article 14 provides the contents of expenditures. Such fund would allow the road agency to forecast and plan the budgets and expenditures for road works.

Appendix 3-II: Procurement Procedure

Other Laws and Legislations relevant to the logistics and transport sector in Ukraine.

Procurement Procedure

The procurement procedures stipulated in the law for each type of tender are as follows:

Chapter IV "Open Tender"
The Law stipulates that when the open tender procedure is utilized, bidding shall be eligible to all interested parties and at least 2 proposals must be submitted. Furthermore, the Law indicates the following;

- Necessary information in the bidding announcement
- Necessary information in the tender document
- Procedures for clarifications of the tender documents and amendments
- Procedures for submissions of tenders (submitted electronically)
- Procedures for opening of the bids
- Procedures for Review and Evaluation of tenders
- Procedures for Rejection of bids or cancellations of the tender
- Procedures for Conclusion of the procurement contract and others

Chapter V "Competitive Dialogues"
The Law stipulates that competitive dialogues can be conducted if the necessity of negotiations for making optimal decisions on the technical and qualitative characteristics of the tender can be defined. The two stage procedure is as follows:

- First stage – all participants submit a tender providing information in compliance with the qualification criteria, without a price indication. The period for submitting tenders shall not be less than 30 days from the publication to the announcement of the competitive dialogue in accordance with Article 10[1]. All participants that pass are invited to negotiations, but cannot be less than 3 participants. Separate negotiations will be held with all stakeholders and all aspects of the procurement can be discussed. Tender documentation will be revised and the participants will be invited to proceed to the second stage.
- Second stage – participants must submit the final bids indicting the price. The winner will then be offered to enter into the procurement agreement.

Chapter VI "Negotiated Contracts"
The negotiated contracts are an exception in which a contract is signed after negotiations with one or more participants. The conditions of exceptions are the following;

- Purchase of works of art or for protection of intellectual property rights
- Absence of competition in the market
- Urgency in connection with emergence of special or social circumstances
- Lack of sufficient number of participants causing tender cancellations twice
- Additional purchase from the same supplier in the purpose of unifications etc.

[1] Chapter III Article 10, "Disclosure of Procurement Information" - The advertisement of the procurement and tender documentation shall be done no later than 15 days before the opening of tenders, if the procurement cost does not exceed the amount equivalent to EUR 133,000 for goods and services and EUR 5,150,000 for works. If the procurement cost exceeds such amount, no later than 30 days and the procurement shall be published on the website of the Authorized Agency in English. Any changes shall be made in one day from the date of the decision of the change.

- Additional construction work due to unforeseen circumstances to complete the project
- Procurement of legal services related to protection of rights and interest of Ukraine.

Other Laws and Orders related to the Law of Ukraine "on Public Procurement"

Ministry of Economic Development and Trade Order dated 25th March, 2016 No. 449/28579 "on approval of Documentation Templates for Public Procurement" – the order includes the templates necessary for the public procurement, such as form for the announcement for open tenders and competitive dialogues, notice of intention of signing contracts etc.

Ministry of Economic Development and Trade Order dated 25th March, 2016 No. 448/28578 (Last amended: dated 30th June, 2016 No. 1052) "on approval of Procedure of Determining the Object of Procurement" – the order states different objects and services for procurement and briefly its procedures.

Ministry of Economic Development and Trade Order dated 13th April, 2016 No. 680 "on approval of Sample Tender Documentation" – the order lists the general provisions for the tender documentations for open tenders and competitive dialogues, in accordance to the mandatory information specified in the Public Procurement Law Article 22 and others.

Ministry of Economic Development and Trade Order dated 30th March, 2016 No. 557 (Last amended: dated 12th April, 2016 No. 676) "on approval for Provision of the Tender Committee or Authorized Personnel" – the order includes the general provisions as well as principles and requirements of tender committee and authorized personnel.

Ministry of Economic Development and Trade Order dated 25th March, 2016 No. 447/28577 "on approval of the Procedure for Publishing Information on Public Procurement" – the order mainly defines the procedure for the electronic procurement system.

State Enterprise "Zovnishtorhvydav Ukraine" Order dated 13th April, 2016 No. 35 "on approval of the Procedure for Pre-Threshold Procurement"

Law of Ukraine "on Commercial Code of Ukraine" (Supreme Council of Ukraine, 2003, No. 18, No. 19–20, No. 21–22, st. 144; Last Amended dated 10th June, 2016, No. 28, st. 533) – the law describes the details for compliance with the Constitution of Ukraine's clauses for commercial activities. Such law applies during the signing of contracts.

Appendix 3-III: Other Laws/Regulations Related to the Road Sector

Tax System in Ukraine

The principal taxes applicable to companies in Ukraine are corporate income tax, Value Added Tax (VAT), property tax and customs duties. The standard corporate income tax rate is 18% and the standard VAT rate is 20% for domestic supplies and imported goods. Customs duties are imposed on the majority of goods imported into Ukraine and on certain limited categories of exported goods. For customs clearance purposes, goods are classified into 97 groups according to the Ukrainian Harmonized System (UHS) and import duty rates generally range between 0% and 10%[2].

The legislation in Ukraine generally does not restrict or limit the extent of foreign investment or equity participation of a foreign investor in a Ukrainian business. Further, it does not provide for any special tax regimes for enterprises with foreign investment. However, a foreign investor's contribution to the share capital of a Ukrainian enterprise with foreign investment made in the form of goods may be exempt from customs duties, provided the goods are not alienated for three years after the contribution.

Ukraine's tax treaty network mostly follows the OECD model. Treaties generally: (i) provide relief from double taxation on all types of income, (ii) limit the taxation by one state of companies with residency in the other, and (iii) protect companies with residence in one country from discriminatory taxation in the other. Further, Ukraine's treaties generally contain OECD compliant exchange of information provisions.

Tax incentives are provided for businesses operating in prioritized sectors, including sectors such as renewable and energy efficiency, agriculture, shipbuilding, mining, information technology, and other priority industries. For the renewable energy and energy efficiency sectors, VAT and customs duties are exempted from related imports and operations. Other priority industries, including the transport infrastructure industry, is provided with exemption from customs duties and postponing of VAT, subject to approval by the Cabinet of Ministers[3].

Moreover, according to Article 197 of the Tax Code of Ukraine (Supreme Council of Ukraine, 2011, No. 13–14, 15–16, 17, st. 112; Last Amended dated 21st December, 2016, No. 1797-VIII, st. 48), tax exemption apply for the following:

- The supply of goods and services in the customs territory of Ukraine and the import into the customs territory of Ukraine, goods financed by international technical assistance provided in accordance with the international agreements of Ukraine, consent to be bound by that given in the order established by the legislation;
- Import into the customs territory of Ukraine of the property as the humanitarian assistance.

[2] Ukraine has free trade agreements (FTA) with CIS countries, the European Free Trade Association (Iceland, Liechtenstein, Norway and Switzerland), Georgia, Macedonia and Montenegro. The deep and comprehensive free trade area (DCFTA) with EU became effective from 1st January, 2016, which reduces the customs duties applicable to goods originating from EU member states.

[3] In November 2016, the Cabinet of Ministers of Ukraine passed the resolution on the procedure of tax exemption for the Bortnychi Sewage Treatment Plant modernization project in the framework of the implementation of the project "Reconstruction of sewage treatment facilities and construction of a technological line for sludge processing and disposal at the Bortnychi Sewage Treatment Plant", signed on 6th June, 2015. The resolution was adopted to fulfill conditions of the international agreement (in the form of the exchange of notes) between the Government of Ukraine and the Government of Japan. The resolution envisages to temporarily, for the period of the implementation of the project, to set incentives in the taxation with personal income tax, value added tax, and profit tax.

Environmental and Social Legislations

The environmental impact assessment system (EIA) in Ukraine was developed in the 1990s, based on the former Soviet system. It was considerably changed in 2011, when several related laws such as the Law of Ukraine "on Ecological Expertise" (Supreme Council of Ukraine, 1995, No. 8, st. 54; Last amended: dated 2013, No. 46, st. 640), "on Environmental Protection" (Supreme Council of Ukraine, 1991, No. 41, st. 546; Last amended: dated 4th October, No. 46, st. 780), were amended and "on regulation of urban development" (Supreme Council of Ukraine, 2011, No. 34, st. 343; Last Amended: dated 22nd September, 2016, No. 51, st. 833) were adopted, which excluded pre-project and project materials from the list of objects subject to the state ecological expertise, and simplified legal requirements[4].

The environmental assessment in Ukraine utilizes a two-stage procedure as follows[5]:

- OVNS (Ukrainian acronym for Conducting Assessment of Environmental Impact): Preparation of the environmental impact assessment documentation, which includes an assessment of potential impacts on the natural, manufactured, and social environment, and designing prevention, mitigation, and compensation measures, by responsibility of the developer of the plan or project;
- Ecological Expertise (EE) – Review of the prepared document by authorized government agencies (state ecological expertise) and/or the public (public ecological expertise).

The Law of Ukraine "on Ecological Expertise" (Supreme Council of Ukraine, 1995, No. 8, st. 54; Last amended: dated 2013, No. 46, st. 640) specifies the types of EE (public or state), objects subject to EE, government authorities responsible for the EE and others. The procedure of EIA preparation is described in DBN A.2.2-1-2003, including the types of activities and objects of high environmental risk, which requires a full-scale OVNS. For projects that do not require OVNS, the set of design and construction norms and standards are defined in State Construction Norms DBN A.2.2-3-2014. These norms require a section on "environmental impacts, measures for their minimization, mitigation and compensation" in all types of design documentation, which will be approved by the State Civil Engineering Expertise.

Challenges within the current system is the lack of a system that monitors the implementation of mitigation measures set out in the design documents as well as the uncertainty of the responsible party, whether it is the central government or the oblast administration for carrying out State Environmental Expertise (SEE). Moreover, there is no regulatory document on the rules of submission of strategies, plans, master plans of cities and legislative acts to the SEE.

In regards to public participation, in 1999, Ukraine became a party to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice, as known as the Aarhus Convention. Several regulatory acts were developed that specify provisions of the Convention and certain norms for public participation are envisioned in DBN A.2.2-1-2003, which states the materials that should be included in the final EIA report to confirm public interests were taken into account, such as documentation of publication of the statement of intent in the mass media and organization of public hearings, appeals of citizens, public proposals etc. Organization of public hearings are generally the responsibility of the project proponent and the OVNS developer, but depending on the territorial communities, the local government may be responsible.

[4] "Environmental impact assessment in the EU as a roadmap for reforms in Ukraine", Institute for Economic Research and Policy Consulting, 2016
[5] "Ukraine Country Environmental Analysis", World Bank, 2016

However, in practice, full-scale well prepared public consultations are usually only organized for large projects with international financing, where the project information and/or ESIA are published on the web sites of the project developer and the international financial institution[6].

In such circumstances, in order to strengthen the EIA system and to harmonize with the EU directives, in October 2016, the Parliament passed two laws (draft law 2009a), Law of Ukraine "on Environmental Impact Assessment (EIA)" and "on Strategic Environmental Assessment (SEA)" including a more transparent procedure of the EIA system and its timeframe. Specifically, the law "On Environmental Impact Assessment" (EIA) provides for the implementation of the European approach for assessing the environmental impact of potentially harmful projects, with the objective to prevent damage to life and health of the Ukrainians and environmental degradation in general. The law "On Strategic Environmental Assessment" (SEA) provides for the creation of a mechanism of strategic environmental assessment to ensure the protection of the environment when making long-term strategic decisions. Currently, both laws have been vetoed by the President for revision in the area of economic and environmental impact assessments, security and defense concerns as well as public participation.

As to the social legislations, the Labor Code dated, 10th December, 1971 and the Act on Labor Protection, dated 14th October, 1992 are the main legislations that apply to occupational health and safety (OHS) issues. The legal framework of the resettlement policy framework of Ukraine include, but not limited to, the Constitution of Ukraine (article 13), Land Code of Ukraine (article 146), the resolution of the Cabinet of Ministers of Ukraine "on the Procedure of Determination of and Compensation for Losses to Owners of Land and Land Users", dated 19th April, 1993, No. 284 and the resolution of the Cabinet of Ministers of Ukraine "on Size and Procedure for Calculation of Agricultural and Forestry Losses Subject to Compensation" dated 17th November, 1997, No. 1279.

Loss Compensations

Generally, the issue of the compensation of losses/damages to third parties is still underdeveloped in Ukrainian law.

Firstly, all new projects must pass the state expert appraisement, which, among other factors, includes the assessment of negative influence of a new building on the environment. Further, all projects must comply with the State Sanitary Rules and Standards. Unless all Rules and Standards are compiled to, a positive conclusion of state expert appraisement is unlikely.

The following Ukrainian legislation regulates responsibility for violation of rules of urban development:

- Law of Ukraine "On the responsibility for violations in the field of urban development";
- Law of Ukraine "On the basis of urban development";
- Decree of Cabinet of Ministers of Ukraine "On Approving the Procedure of imposing penalties for violations in the field of urban development"

The above legislations provide the liability of legal persons and individuals for violation in the field of urban development. Entities and individuals engaged in urban development, which create objects designs, appraisement of construction projects and others, are responsible that the customer obtains project documentation developed in compliance with the law, construction standards, government standards and regulations. The sanction is a penalty (fine) payable to the State.

[6] "Ukraine Country Environmental Analysis", World Bank, 2016

However, the above legislation does not reveal any details of compensation to the third parties, except that it states the following: “The responsibility of the guilty subject of urban development is not exclusive of other remedies, that is, the compensation for damage due to violation”. Basically, the procedure of compensation for moral or pecuniary damage to individuals is governed by general provisions of civil legislation, which means that the aggrieved person may defend its right/claim compensation in usual claim, filing a lawsuit to the court and evidencing the amount of damages.

Appendix 4-I: Laws and Legislations Related to the Seaport Sector

The Ukrainian national legislation in sea transport and, inter alia, sea port activity includes quite a lot of regulatory acts, the principal of which are the following:

- The Law of Ukraine “On sea ports” dated 17th May, 2012, No. 4709-VI;
- The Law of Ukraine “On State-private partnership” dated 1st July, 2010, No. 2404-VI;
- The Law of Ukraine “On concessions” dated 16th July, 1999, No. 997-XIV;
- The Law of Ukraine “On lease of state and municipal property” dated 10th April, 1992, No. 2269-XII;
- The Law of Ukraine “On investment activity” dated 18th September, 1991, No. 1560-XII;
- The Merchant Shipping Code of Ukraine, dated 17th May, 2012, No. 4709-VI;
- The Water Code of Ukraine, 17th May, 2012, No. 4709-VI dated;
- The Land Code of Ukraine, dated 25th October, 2001, No. 2768-III;
- The Civil Code of Ukraine dated 16th January, 2003, No. 435-IV;
- The Commercial Code of Ukraine dated 16th January, 2003, No. 436-IV;
- The Decree of the Cabinet of Ministers of Ukraine “On some issues of sea port water areas” dated 3rd June, 2013, No. 406;
- The Order of the Ministry of Infrastructure of Ukraine “On port dues” dated 27th May, 2013, No. 316;
- The Order of the Ministry of Infrastructure of Ukraine “On approval of the Procedure of keeping the Register of hydro technical facilities in the Ukrainian sea ports” dated 18th February, 2013, No. 91;
- The Order of the Ministry of Infrastructure of Ukraine “On approval of the Regulation on the Harbor Master and the Harbor Master Service” dated 27th March, 2013, No. 190;
- The Order of the Ministry of Infrastructure of Ukraine “On approval of the Regulation on sea pilots” dated 8th May, 2013, No. 292;
- The Order of the Ministry of Infrastructure of Ukraine “On approval of the Rules of rendering services in the Ukrainian sea ports” dated 5th June, 2013, No. 348.

The aforesaid laws and bylaws govern the most important aspects of sea port activity, determining their legal status, peculiarities of business activity in sea ports, execution of state monitoring/control, rendering of special services in the sea ports, port industry development and many others.

The long-awaited Law on Sea Ports of May 2012 influenced all market participants, including cargo terminals, stevedore companies and ship-owners. The key goals and provisions of the law included:

- Distribution of administrative functions in seaports;
- Promotion of investment in port infrastructure;
- Settlement of land disputes at sea ports;
- Adjustment of port economy management and planning; and
- Liberalization of rates on port services.

Overview of Laws and Procedures in Regards to Land Ownership and Acquisition

There are several Laws of Ukraine that govern legal relations in the sphere of land ownership and acquisition, as follows:

- Code of Land Laws of Ukraine dated 25th October, 2001, No. 2768-III as amended and supplemented;
- Law of Ukraine "On sea ports of Ukraine" dated 17th May, 2012, No. 4709-VI as amended and supplemented;
- Merchant Shipping Code of Ukraine dated 23rd May, 1995, No. 176/95-BP as amended and supplemented;
- Code of Water Laws of Ukraine dated 6th June, 1995, No. 213/95-BP as amended and supplemented;
- Civil Code of Ukraine dated. 16th January, 2003, No. 435-IV as amended and supplemented;
- Law of Ukraine "On state registration of property rights on real estate and its encumbrances" dated 1st July, 2004, No. 1952-IV as amended and supplemented;

Descriptions of above are as per below:

1. Code of Land Laws of Ukraine serves as the principal Law of Ukraine in the sphere of land relations. Particularly it established types of rights on land plots, including in relation to a category of a land plot, determines volume of such rights, stipulates requirements to the persons, who are willing to acquire land plots depending on their category, established legal regime of the land plots.

2. Law of Ukraine "On sea ports of Ukraine" contains provisions as to the legal status of harbor lands.

3. Merchant Shipping Code of Ukraine contains provisions relating to the assignment of land plots for merchant shipping.

4. Code of Water Laws of Ukraine defines lands which belong to lands of water fund, competence of state authorities regarding management of lands of water fund.

5. Civil Code of Ukraine stipulates requirements to agreements in relation of land plots, necessary for recognition such agreements as valid; requirements to a legal status and capacity of persons engaged in land plots transactions.

6. Law of Ukraine "On state registration of property rights on real estate and its encumbrances" regulates relations arising in the sphere of state registration of real rights to immovable property, including land plots, and their encumbrances.

Overview of River Law and Permission System for Construction Work

1. The Order of Ministry of Transport of Ukraine "On Approval of Rules of technical exploitation of river port hydraulic structures"

   Rules of technical operation of river ports of hydraulic structures (hereinafter - the Rules) governing the operation, maintenance in working condition and repair of berths, barrage and shore protection structures and water areas of raids and approach channels of river ports of Ukraine. These rules apply to all river ports hydraulic structures, regardless of ownership.

   These rules provide grounded system of organizational and technical measures for accident-free exploitation, repair and maintenance port hydraulic structures in good condition.

2. Resolution of the Ministry of Health of Ukraine “On Approval of State sanitary rules and norms for sea and river ports”
   State sanitary rules and standards for sea and river ports of Ukraine are intended to guide in the work of employees of design institution, enterprises and making of designs, construction, repairing and operation of seaports and river ports. The rules are the guiding document for employees of sanitary and epidemiological institutions of the Ministry of Health Ukraine exercising state sanitary and epidemiological supervision on water transport. Compliance with these rules is obligatory for organizations and Transport companies of Ukraine, other organizations enterprises, institutions regardless of ownership and state accessories.

3. Merchant Shipping Code of Ukraine
   The central executive authority providing formation and implement state policy in the field of maritime and river transport, coordinates the allocation of land and water space for merchant shipping, as well as for construction or perform any work in the area of navigation equipment and sea routes in the presence conclusion central executive authority that ensures the implementation of state policy in the security sector at maritime and river transport.

4. Water code of Ukraine
   The objective of water legislation is to regulate legal relations to ensure the providing of security, scientific, rational use of water for population needs and branches of economic, restoration of water resources, water protection from pollution and depletion, prevention of harmful acts treatment and response, improvement of water facilities and protection of enterprises, institutions, organizations and citizens on the water.

   Citizens and their associations, other public formation in the prescribed manner may conduct public environmental review, publish the results and transmit them to the authority empowered to decide on the location, design and construction of new and reconstruction of existing enterprises, buildings and other facilities related to using of water, in the manner determined by law.

5. Law of Ukraine "On inland waterway transport" (currently only in progress)
   This Law governs relations in the sphere of inland water transport, the use of river and small ships, river waterways and their coastal shipping lanes, defines the legal regime of inland waterway infrastructure.

The List of Laws/Regulations on Sea Routes

- The Law of Ukraine “On sea ports of Ukraine” dated 17th May, 2012, No. 4709-VI;
- The merchant shipping Code of Ukraine dated. 23rd May, 1995, No. 176/95-BP;
- The Order of the Ministry of Transport and Communication of Ukraine dated 17th July, 2003, No. 545 “On approval of the Rules for the control of ships to ensure Maritime safety”;
- The Order of the Ministry of Transport and Communication of Ukraine dated 1st August, 2007, No. 655 “On approval of Rules of sailing and navigation in North-the Western part of the Black sea, Bugsko-Dneprovsko-Limanskiy and Kherson sea channels”;
- The Order of the Ministry of Transport and Communication of Ukraine dated 14th June, 2007, No. 498 “On approval of the regulation on navigation support of sailing in inland waterways of Ukraine”;
- Order of the Ministry of Transport and Communications of Ukraine dated 29th May, 2006, No. 514 “On approval of the Regulations on navigation and hydro graphic

maintenance of navigation in the inland sea waters, territorial sea and exclusive (Maritime) economic zone of Ukraine";

- The Order of the Ministry of Transport and Communication of Ukraine dated 26th November, 2004, No. 1048 "On approval of the Instruction about the procedure of control over performance of the shipping companies of Ukraine normative acts concerning safety of navigation";
- The Order of the Ministry of Transport and Communication of Ukraine from 20th October, 2003, No. 809 "On approval of Rules of passing of vessels through shipping locks of Ukraine".

1. The Law of Ukraine "On sea ports of Ukraine" defines the legal, economic and organizational basis of activities in sea ports of Ukraine. This Law regulates relations in the sphere of port operations and, in particular, establishes bases of state regulation of activities in seaports, the order of building, opening, expanding and closing seaports in Ukraine, the procedure for implementation on their territory of economic activity, defines the legal regime of port infrastructure facilities.

   Clause 14 of the law contains general order of organization of navigation in the sea port water area, and clause 74 ensures safety of navigation.

2. According to clause 23 of The merchant shipping code of Ukraine, a ship may be allowed to sail only after it is determined that it meets the requirements of safety of navigation, protection of human life and the natural environment. Classification society sets the requirements that must be met by inland vessels of Ukraine, put to the sea, and the border area of the sea voyage of these vessels.

3. The Order of the Ministry of Transport and Communication of Ukraine dated 17th July, 2003 No. 545 "On approval of the Rules for the control of ships to ensure Maritime safety" stipulates the rules drawn up to establish the procedure of state control of following the requirements of the International conventions of merchant shipping Code of Ukraine, legislative acts of Ukraine on safety of navigation and prevention of environmental pollution.

4. The Order of the Ministry of Transport and Communication of Ukraine dated 1st August, 2007, No. 655 "On approval of Rules of sailing and navigation in North-Western part of Black sea, Bugsko-Dneprovsko-Limanskiy and Kherson sea channels.

5. The Order of the Ministry of Transport and Communication of Ukraine dated 14th June, 2007, No. 498 "On approval of the regulation on navigation support of sailing in inland waterways of Ukraine" provides the rules that are drawn up for the purpose of creating a unified system for:
   - Navigation support of navigation within inland waterways, including travel (dredging, trawling, retention, removal and installation of navigation AIDS),
   - Providing safe pilotage, operation and maintenance of river information services, communications,
   - Providing daily hydrological and navigational and hydro graphic information, continuous crossing navigable hydro-technical facilities;
   - The maintenance of hydro technical constructions ports and bases-sites and timely opening and closing of navigation.

6. Order of the Ministry of Transport and Communications of Ukraine dated 29th May, 2006, No. 514 "On approval of the Regulations on navigation and hydro graphic maintenance of

navigation in the inland sea waters, territorial sea and exclusive (Maritime) economic zone of Ukraine”.

7. The Order of the Ministry of Transport and Communication of Ukraine dated 26th November, .2004, No. 1048 “On approval of the Instruction about the procedure of control over performance of the shipping companies of Ukraine normative acts concerning safety of navigation”. The instruction establishes the procedure of control over the implementation of the current legislation of Ukraine and international conventions related to safety of navigation by the shipping companies of Ukraine.

8. The Order of the Ministry of Transport and Communication of Ukraine from 20th October, 2003, No. 809 “On approval of Rules of passing of vessels through shipping locks of Ukraine”. These Rules define organizational, technical and technological means, rights and obligations of navigators and maintenance of personnel locks in order to provide uninterrupted and safe passing of the fleet.

Appendix 4-II: Key Players from Private Sector Operating in Main Sea Ports

(1) Odessa

The key players from private sector in the sea commercial port of Odessa are:

- Company branch “HPC-UKRAINE” of «Hamburg Port Consulting GmbH» – containers;
- LLC “Metalsukraine Corp. Ltd” – steel, bulk cargoes;
- LLC “Novolog” – steel, bulk cargoes;
- LLC “Novotech-Terminal” – steel, bulk cargoes, general cargoes;
- LLC “Brooklyn-Kiev” – steel, bulk cargoes, general cargoes;
- LLC “UNSC” – steel, cellulose;
- LLC “Olympex Coupe International” – steel, bulk cargoes, scrap metal;
- Subsidiary Enterprise “Prista-Oil Ukraine” – vegetable oils;
- LLC “Odessa Port Industrial-Transshipment Complex” – palm oil, vegetable oils, glycerin, molasses;
- LLC “Brooklyn-Kiev Port” - containers;
- PJSC with foreign investments “Sintez-Oil” – crude oil, dark oil products.

(2) Illichivsk

The key players from private sector in the sea commercial port Illichivsk are:

- LLC “Risoil Terminal” (group RISOIL) – vegetable oils;
- JV “Transbulkterminal” – grain cargoes;
- LLC “Black Sea Grain Terminal” – grain cargoes;
- LLC “Trans-Service” – grain cargoes;
- LLC “Olir Resources” – vegetable oils;
- LLC “Fram Shipping Agency” – grain cargoes.

(3) Yuzhny

The key players from private sector in the sea commercial port Yuzhny are:

- LLC “TIS-Fertilizers” (group TIS) – bulk chemicals (fertilizers);
- LLC “TIS-Grain” (group TIS) – bulk grain;
- LLC “TIS-Ore” (group TIS) – bulk cargo (ore, ore concentrate);
- LLC “TIS-Coal” (group TIS) – bulk cargo (coal);
- LLC “TIS Container Terminal” (group TIS) - general cargoes, oil, containers;
- “Borivage” Ltd - grain cargoes;
- “Delta Wilmar CIS” (group DELTA WILMAR) – vegetable oils;
- LLC “Risoil South” (group RISOIL) – vegetable oils;
- LLC “Allseeds Black Sea” (group ALLSEEDS) – vegetable oils;
- Subsidiary enterprise “Seaside Ukraine” – grain cargoes;
- “Terminal Stevedoring and K” – crude oil and oil products;
- PJSC “Ukrtransnafta” – dark and light oil products.

(4) Mykolaiv

The key players from private sector in the sea commercial port Mykolaiv are:

- LLC “Dnepro-Bugsky sea terminal”;
- LLC “Danube shipping and stevedoring company” (group COFCO) – grain cargoes;

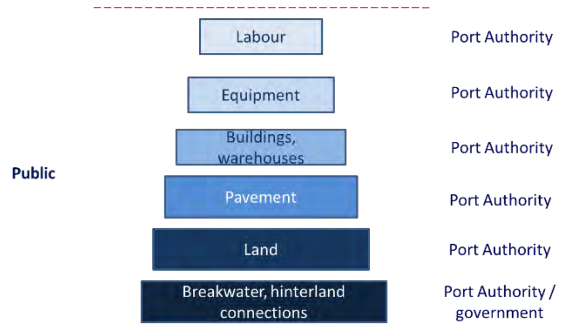
- LLC “Stevedoring Company Nikmet- Terminal” (group ARCELOR MITTAL) – steel;
- LLC “Nikmorservis Mykolaiv” – grain cargoes, steel, general cargoes;
- LLC “South Stevedoring Company Limited” (group OREXIM) – grain cargoes;
- LLC “Stevedoring Investment Company” (group OREXIM) – grain cargoes;
- LLC “European transport stevedoring company” (group BUNGE) – grain cargoes;
- LLC “New European Company” – bulk and general cargoes;
- LLC “Grintur-Ex” (group BUNGE) – grain cargoes;
- LLC “Trade House ‘Moreproduct’” – frozen products;
- LLC “Everi” (group OREXIM) – vegetable oils;
- LLC “Mikont” – oil products, mineral oil.

Appendix 4-III: Port Management Models

Public service port

In a public service port, all port functions are allocated to the public sector. Consequently, it does not entail PPP. Therefore in this report, it will only be considered as a potential starting point towards another port management model with private participation.

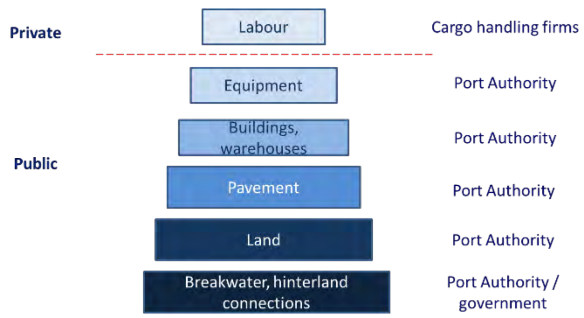
A strong performance of the port requires the availability of strong management skills as well as financing capabilities at the public sector to make the business driven investments. In many public service ports, the lack of these capabilities causes relative poor performance. Experiences in the port sector showed that an organizational split between public authority and public operator into two entities, working in the same environment and reporting to the same ministry has led to serious management challenges. The interests became better aligned, once the public operator and the public landlord were merged into one entity.



Various ports in Africa, including ports in South Africa, Kenya and Tanzania can still be classified as dominantly public service ports, but each of these ports is in transition towards a landlord port model.

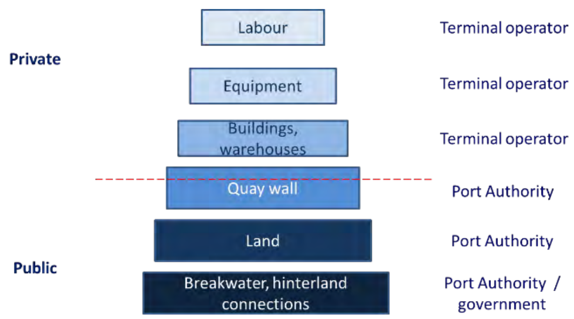
Tool port

In the tool port, the public port authority has virtually the same responsibilities as under the public service port. The one distinction concerns the labor. In this model, private stevedoring companies contracted by shipping agents execute the stevedoring activities. The frequent changes of the operators pose a burden on the utilization of the sophisticated terminal equipment. Examples are found in Portugal, Brazil and in France.



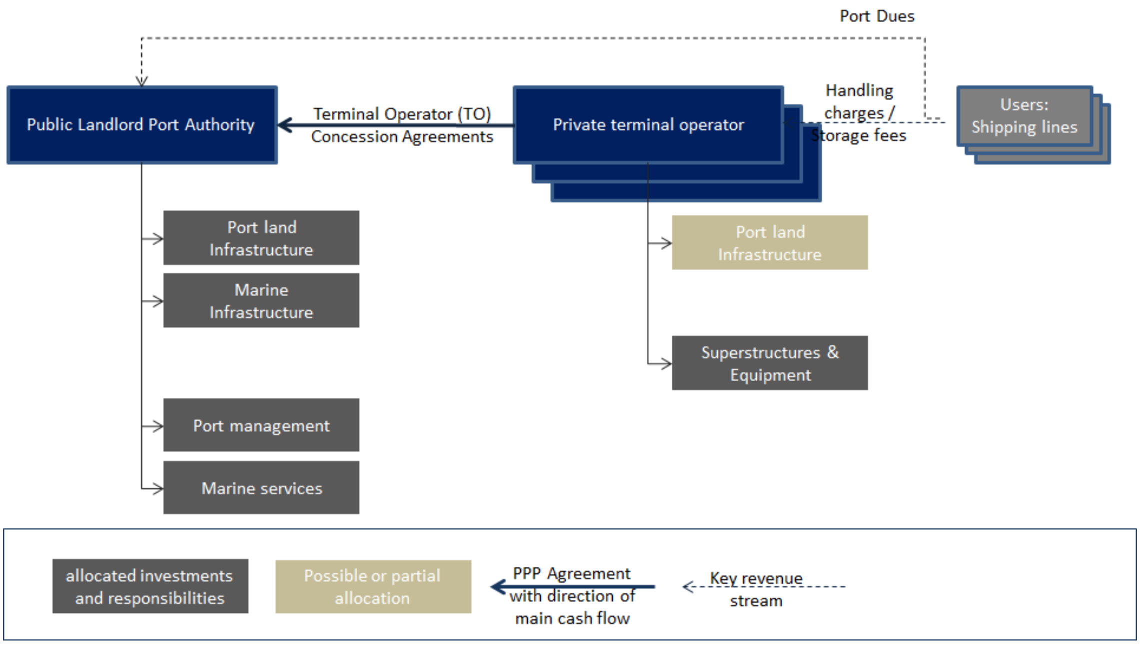
Landlord port - standard

Today's most popular port management model is the landlord port. In a landlord port model the private stevedoring companies provide and maintain their own superstructure and install their own equipment. The port authority provides port land and common-user port infrastructure. It concerns significant investments. The landlord's costs should be recovered by port dues received from vessels calling the port and from concession payments received from the various terminal operators. The landlord port authority retains responsibility for the nautical services, which could be concessioned to private service suppliers.



The PPP agreement linking the private investor and the terminal developer and operator is a concession agreement. The port authority grants herein a right for a certain period of time to develop and operate a terminal. As compensation, the terminal operator pays a concession fee to the port authority. The level of this fee is subject to the private business case including revenue projections, operational expenditures and the level of investments for the private investor. The following figure shows the landlord structure for one terminal. In most landlord ports, multiple terminal concessions are present.

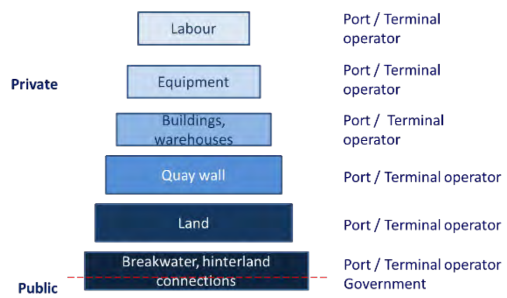
A few of the many examples include Antwerp, New York, Singapore, Hamburg, and Melbourne.



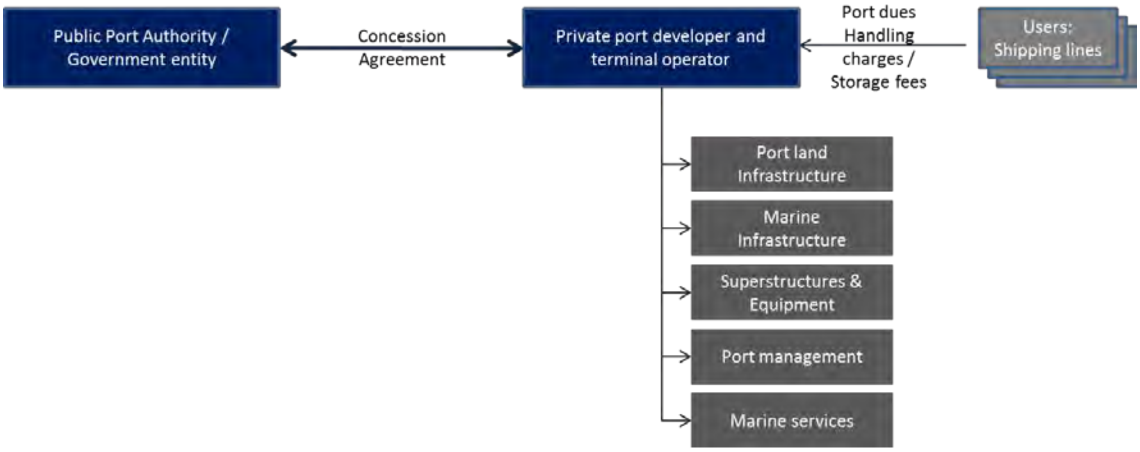
Principle Structure of a Standard Landlord Port

Private BOT model

The most private port management model concerns the private Build Operate Transfer (BOT) model. In the BOT concession agreement, all responsibilities are allocated to the private port investor, developer and operator. This model typically implies a significant investment obligation to the private party. On the other hand, as a result of the uneven allocation between public and private side, the private investor will require a long term right and other attractive commercial terms.



Fully privatized ports are found in developed areas as UK, Australia, New Zealand, Turkey, but also in deteriorated post-conflict areas, such as Liberia. In certain cases, such as London Gateway, a port is even managed under a Build Own Operate (BOO) model. In these models, the transfer back does not occur. In Melbourne, Australia, developments are underway to privatize the landlord port authority. This also could be considered as a BOO or BOT model of an entire port.


Public Port Authority / Government entity
Concession Agreement
Private port developer and terminal operator
Port dues Handling charges / Storage fees
Users: Shipping lines
Port land Infrastructure
Marine Infrastructure
Superstructures & Equipment
Port management
Marine services

Appendix 4-IV: Port Development Plans

Development Plans - Short-Term (until 2018), Mid-Term (until 2023) and Long-Term (until 2038)

(1) Port of Odessa

Domain	Action	Investor	Expected results	Implementation perspective
Dredging	Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project	USPA/investor		Short-, mid- and long-term
Development of the infrastructure of sea terminals	1. Construction of the first line (hydro technical facilities) of the container terminal at the Quarantine quay of the Public entity "Odessa Sea Commercial Port" at the expense of the artificially created territory	USPA/subsidiary company "HPC Ukraine"	Upgrade of cargo handling facilities by 6.6 million ton per year and creation of new jobs	Short-term
	2. Construction of a grain handling complex at Berth Number 35*	USPA/"Brooklyn Kiev" LLC	Upgrade of cargo handling facilities by 2.5 million ton per year and creation of new jobs	Short-term
	3. Construction of a complex to handle grain cargos in the rear of Berth Number 4	"Olimpeks Kupe International" LLC	Upgrade of cargo handling facilities by 1.0 million ton per year and creation of new jobs	Short- and mid-term
	4. Reconstruction of a cargo handling facility in the rear of Berths Number 7,8	Investor	Upgrade of cargo handling facilities by 0.4 million ton per year	Short- and mid-term
	5. Reconstruction of a cargo handling facility in the rear of Berths Number 10,12*	Investor	Upgrade of cargo handling facilities by 2.5 million ton per year	Short- and mid-term
	6. Reconstruction of a cargo handling facility in the rear of Berth Number 14	Investor	Upgrade of cargo handling facilities by 0.8 million ton per year	Short- and mid-term
	7. Development of a passenger complex	Investor	Improvement of services for passengers	Short- and mid-term
	8. Development and reconstruction of the port berths, birth facilities of the Zmiinyy Island and operational water basins	USPA/investor	Augmentation of cargo handling capacity	Short-, mid-, long-term
	9. Reconstruction and building of enclosing structures in the port	USPA	Enhancement of security at the sea port	Short-, mid-, long-term
	10. Construction of a yacht complex	Investor	Augmentation of capacities to service passengers and create new jobs	Short-, mid-, long-term

Domain	Action	Investor	Expected results	Implementation perspective
	11. Construction of births No. 3k-4k and additional territory for the container terminal at Quarantine quay	USPA/subsidiary company “HPC Ukraine”	Upgrade of cargo handling facilities by 6.6 million ton per year and creation of new jobs	Short-, mid-, long-term
	12. Reconstruction of the cargo handling complex at Viyskovyy quay	Investor	Upgrade of cargo handling facilities by 0.2 million ton per year	Short-, mid-, long-term
	13. Development of cargo handling capacities on the territory of the “Ukraine” shipyard	Investor	Upgrade of cargo handling facilities by 9.4 million ton per year and creation of new jobs	Short-, mid-, long-term
	14. Development of the cargo handling capacities on the territory of the called “oil district”	Investor	Augmentation of capacities for cargo handling	Short-, mid-, long-term
	15. Creation of cargo handling complexes; building and reconstruction of births and other hydro technical facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Augmentation of capacities for cargo handling	Short-, mid-, long-term
Development of the motor road infrastructure	16. Building new and reconstructing the existing motor road infrastructure facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Augmentation of capacities for cargo handling	Short-, mid-, long-term
Development of railroad infrastructure	17. Construction of the second railroad entry to the port	USPA/investor	Augmentation of capacities for cargo handling	Short-, and mid-term
	18. Building new and reconstructing the existing railroad facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Augmentation of capacities for cargo handling	Short-, mid-, long-term
Investments into other domains	19. Reconstruction (modernization) of power supply systems, introduction of energy saving technologies	USPA/investor	Increase performance of operations of the sea port and curtail operating costs	Short-term

Domain	Action	Investor	Expected results	Implementation perspective
	20. Introduction of the IT Port Community System*		Optimization of workflow at clearance and processing of cargos within the port, increasing safety of cargos and data protection, optimization of transport processes, decrease of human factor at clearance, curtail time of cargos processing	Short-term
	21. Building of a territory to be used for the development of the transport-logistics and production infrastructure	USPA/investor	Augmentation of capacities for cargo handling	Short-, mid-, long-term
* — These actions are supported by prefeasibility decisions (off-phase), feasibility studies, expert reports etc.				
Identification of specific and additional actions, investors, facilities, indicators and amount of investment in all domains is to be done based on the results of the pre-project decisions (off-phase), feasibility studies, expertise reports for respective projects, by means of amending and revising the development plan.				

Source: USPA Website

Номер по порядку	Умовні позначення	Назва підприємства
1		Територія, оператором якої є державні підприємства
2		ДП «ГПК Украина»
3		ІП «Металзюкрайн Корп.»
4		ТОВ «Новолог»
5		ТОВ «Новотех термінал»
6		ТОВ «Бруклін-Київ»
7		ТОВ «Бруклін-Київ Порт»
8		ТОВ «УНСК»
9		ТОВ «Олімпекс Купе Инт.»

Номер по порядку	Умовні позначення	Назва підприємства
10		ТОВ «ОППК»
11		ПП «Порто-Сан»
12		ЗАТ «Синтез-Ойл»
13		ДП «Пріста-Ойл»
14		ТОВ «Укрелеваторпром»
15		ТОВ «Телекомунікаційні технології»
16		ТОВ «Інзерноекспорт»
17		ДП ЗАТ «Совмортранс»
18		ТОВ «Трексім»

Номер по порядку	Умовні позначення	Назва підприємства
19		ВАТ «Одеський портовий холодильник»
20		ДП ГАК «Хліб України»
21		ВАТ «Ексімнафто-продукт» та ВАТ «Одеснафтопродукт»
22		Морський гідрографичний інститут НАНУ
23		ВАТ «Черномор-гідрозалізобетон»

Межі зон перспективного розвитку

1 Будівництво першої черги (гідротехнічні споруди) контейнерного термінала на Карантинному молу державного підприємства "Одеський морський торговельний порт" за рахунок штучно створеної території

2 Будівництво зернового перевантажувального комплексу на базі причалу №35

3 Будівництво комплексу з обробки зернових вантажів в тилу причалу №4

4 Реконструкція перевантажувального комплексу в тилу причалів №7, 8

5 Реконструкція перевантажувального комплексу в тилу причалів №10, 12

6 Реконструкція перевантажувального комплексу на базі причалу №14

7 Розвиток пасажирського комплексу

10 Будівництво яхтового комплексу

11 Будівництво причалів №3к-4к та додаткової території контейнерного терміналу на Карантинному молу

12 Реконструкція перевантажувального комплексу на Військовому молу

13 Розвиток перевантажувальних потужностей на території Судноверфі "Україна"

14 Розвиток перевантажувальних потужностей на території нафторайону

17 Будівництво другого залізничного в'їзду в порт

21 Будівництво території під розвиток транспортно-логістичної та виробничої інфраструктури

Source: USPA Website

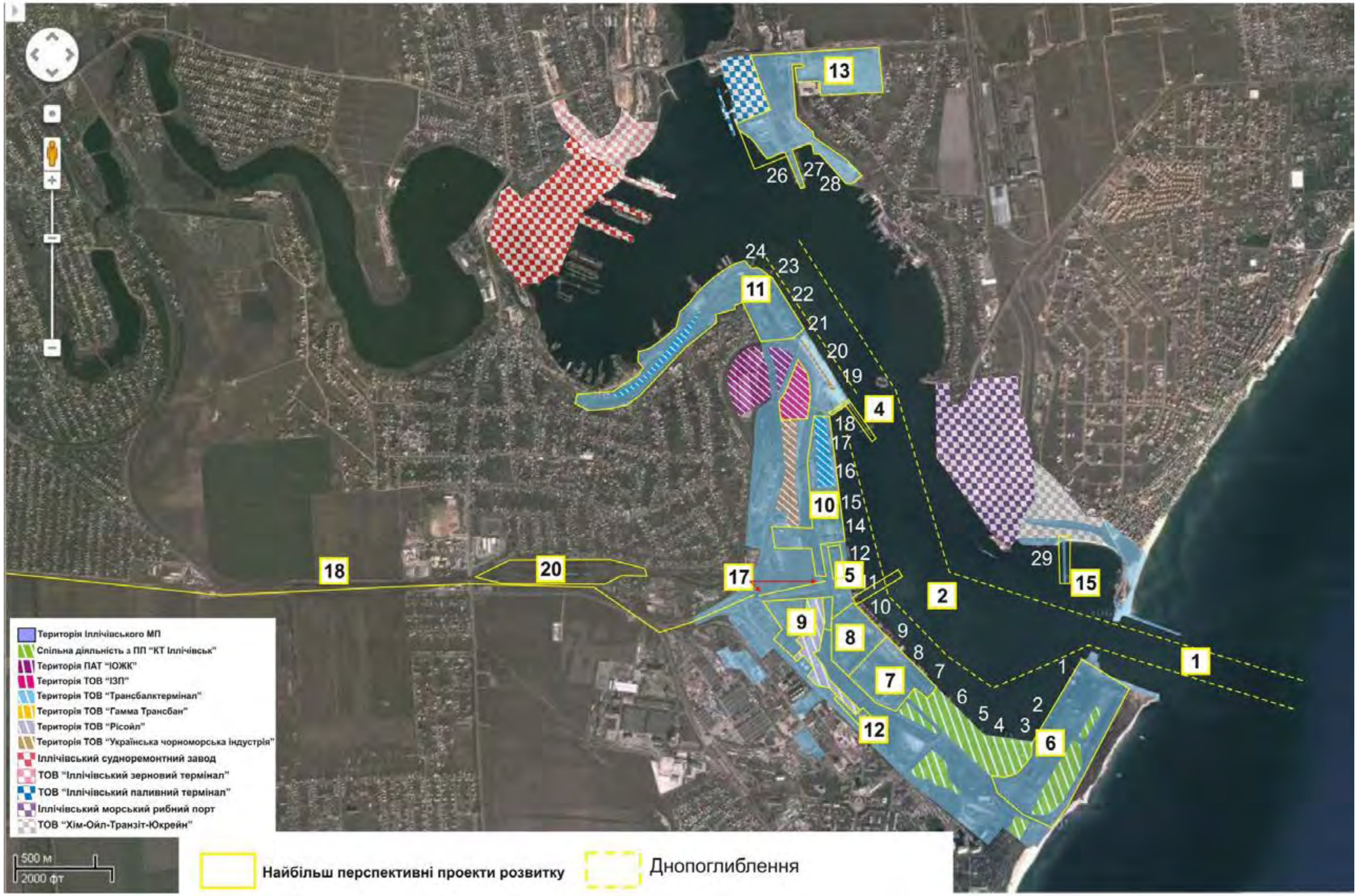
(2) Port of Illichivsk

Domain	Action	Investor	Expected results	Implementation perspective
Dredging	1. Dredging of the approach channel up to 16 meters	USPA/investor	To increase competitiveness of the port by means of creating conditions for accepting heavy-load vessels. To raise port dues.	Short-, mid- and long-term
	2. Dredging of the water basin (1st and 2nd basins) up to 15 meters			
	3. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.			
Development of the infrastructure of sea terminals	4. Construction at berths 18 and 19 of a two-sided quay with births 18a and 18b	"Illichivsk Grain Port" LLC	Upgrade of cargo handling facilities by 6.0 million ton per year	Short-term
	5. Re-equipment of an in-door storage number 8 located in the rear of the Berth Number 12 to handle the floor-storage grains	Investor	Upgrade of cargo handling facilities by 0.6 million ton per year	Short-term
	6. Upgrade of container facilities in the rear of Berths Number 1-6	Investor	Upgrade of cargo handling facilities by 1,400 TEU per year	Short- and mid-term
	7. Upgrade of the cargo handling facilities in the rear of Berths Number 7,8,9	Investor	Upgrade of cargo handling facilities by 1.4 million ton per year	Short- and mid-term
	8. Upgrade of a specialized cargo handling facility in the rear of the Berth Number 10 to handle import¥export bulk cargo	Investor	Upgrade of cargo handling facilities by 0.5 million ton per year	Short- and mid-term
	9. Upgrade of a facility for storing vegetable oil oilseeds derivative products at Berth Number 11 and construction of a quay at the at the junction of Berths Number 10 and 11	"Joint venture Risoil Terminal" LLC	Upgrade of liquid bulk handling facilities by 0.5 million ton per year; oil meal — by 1.0 million ton and grains — by 2.0 million ton	Short- and mid-term
	10. Upgrade of the Third Terminal in the rear of Berths Number 14,15, 16,17 and adjacent rear territories to upgrade grain and vegetable oil cargo handling facilities	Investor	Upgrade of grain cargo handling facilities by 5.0 million ton per year	Short- and mid-term
	11. Upgrade of the Fourth Terminal in the rear of Berths Number 21,22, reconstruction of the adjacent rear territories (incl. the "undeveloped coast") and warehouse Number 24 to upgrade facilities of grain, meal and vegetable oil cargo handling	Investor	Upgrade of cargo handling facilities by 0.7 million ton per year and new jobs	Short-, mid-term

Domain	Action	Investor	Expected results	Implementation perspective
	12. Upgrade of the filling-up base for vegetable oil	Investor	Upgrade of cargo handling facilities by 0.3 million ton per	Short-, mid-term
	13. Upgrade of the Fifth (multimodal) Terminal in the rear of Berths Number 26,27,28	Investor	Upgrade of cargo handling facilities by 1.7 million ton per	Short-, mid-term
	14. Reconstruction of Berths Number 1, 2, 7-12, 14-17, 19-22, 26-29	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
	15. Complete the construction of the quay with Berths Number 30,31	USPA/investor	Upgrade of cargo handling facilities and new jobs	Short-, mid-, long-term
	16. Setup of cargo handling facilities; construction and reconstruction of births and other hydro technical facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
Development of the motor road infrastructure	17. Upgrade of the inner port motor road infrastructure (incl. construction of elevated roads around the Second Gate and in the rear of Berths Number 10,11)	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
	18. Construction of a motor road from Gate Number 2, in parallel to Peremogy str. and highway H-04 (Velyka Dolyna – Zatoka) exiting to the Ovisiopolska highway T-1604	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
	19. Construction and reconstruction of the existing motor road infrastructure facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
Development of railroad infrastructure	20. Upgrade of the “Port of Illichivsk” station	USPA/investor	Upgrade of cargo handling facilities	Short-, and mid-term
	21. Building the new and reconstructing the existing railroad facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term

Domain	Action	Investor	Expected results	Implementation perspective
Investments into other domains	22. Introduction of the *[IT]* Port Community System*		Optimization of workflow at clearance and processing of cargos within the port, increasing safety of cargos and data protection, optimization of transport processes, decrease of human factor at clearance, curtail time of cargos processing	Short-term
	23. Reconstruction (modernization) of power supply systems, introduction of energy saving technologies	USPA/investor	Increase performance of operations of the sea port and curtail operating costs	Short-term
* — These actions are supported by prefeasibility decisions (off-phase), feasibility studies, expert reports etc.				
Identification of specific and additional actions, investors, facilities, indicators and amount of investment in all domains is to be done based on the results of the pre-project decisions (off-phase), feasibility studies, expertise reports for respective projects as well, by means of amending and revising the development plan.				

Source: USPA Website



Source: USPA Website

(3) Port of Yuzhny

Domain	Action	Investor	Expected results	Implementation perspective
Dredging	1. Dredging in order to reconstruct sea approach channel and internal approaches to deep-water berths.	USPA	Dredging up to 21 meters, so as to enable 200 000 tons DWT Capesize vessels to load to a full draft at berths and upgrade of cargo handling facilities	Short-term
	2.Construction of the first and the second bends, as well as a new section of the third bend of the sea approach channel of the state-owned enterprise Yuzhny Commercial Sea Port	USPA	Dredging up to 21 meters, so as to enable 200 000 tons DWT Capesize vessels to load to a full draft at berths and upgrade of cargo handling facilities	Short-term
	3. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project	USPA/investor		Short-, mid-, long-term
Development of the infrastructure of sea terminals	4. Reconstruction of Berths Number 8 and 9, as well as of these berths` navigable operational waters	USPA	Dredging up to 17 meters, augmentation of cargo handling capacity	Short-term
	5. Construction of specialized bulk cargo handling complex in the rear of Berths Number 8,9,10,11*	Investor	Upgrade of cargo handling facilities by 15.7 million tons per year and creation of new jobs	Short-term
	6. Development of berth facilities on the territory of Berth Number 4*	USPA/investor	Upgrade of cargo handling facilities by 1.7 million tons per year and creation of new jobs	Short-term
	7. Construction of Berths Number 33 and 33a, as well as a cargo handling facility	LLC “Torhodvyy Dim “Khlibna Havan””	Upgrade of cargo handling facilities by 3.3 million tons per year and creation of new jobs	Short-term
	8. Construction of new Berths Number 10,11,12,12a, as well as a cargo handling facility	USPA/investor	Creation of 1,495 meters berthing line, dredging up to 21 meters, augmentation of cargo handling capacity and creation of new jobs	Short-, mid-term
	9. Construction of Berths Number 14 and 15, as well as a bulk and general cargo handling facility	LLC “TIS-KT”	Upgrade of cargo handling facilities by 12.3 million tons per year and creation of new jobs	Short-, mid-term

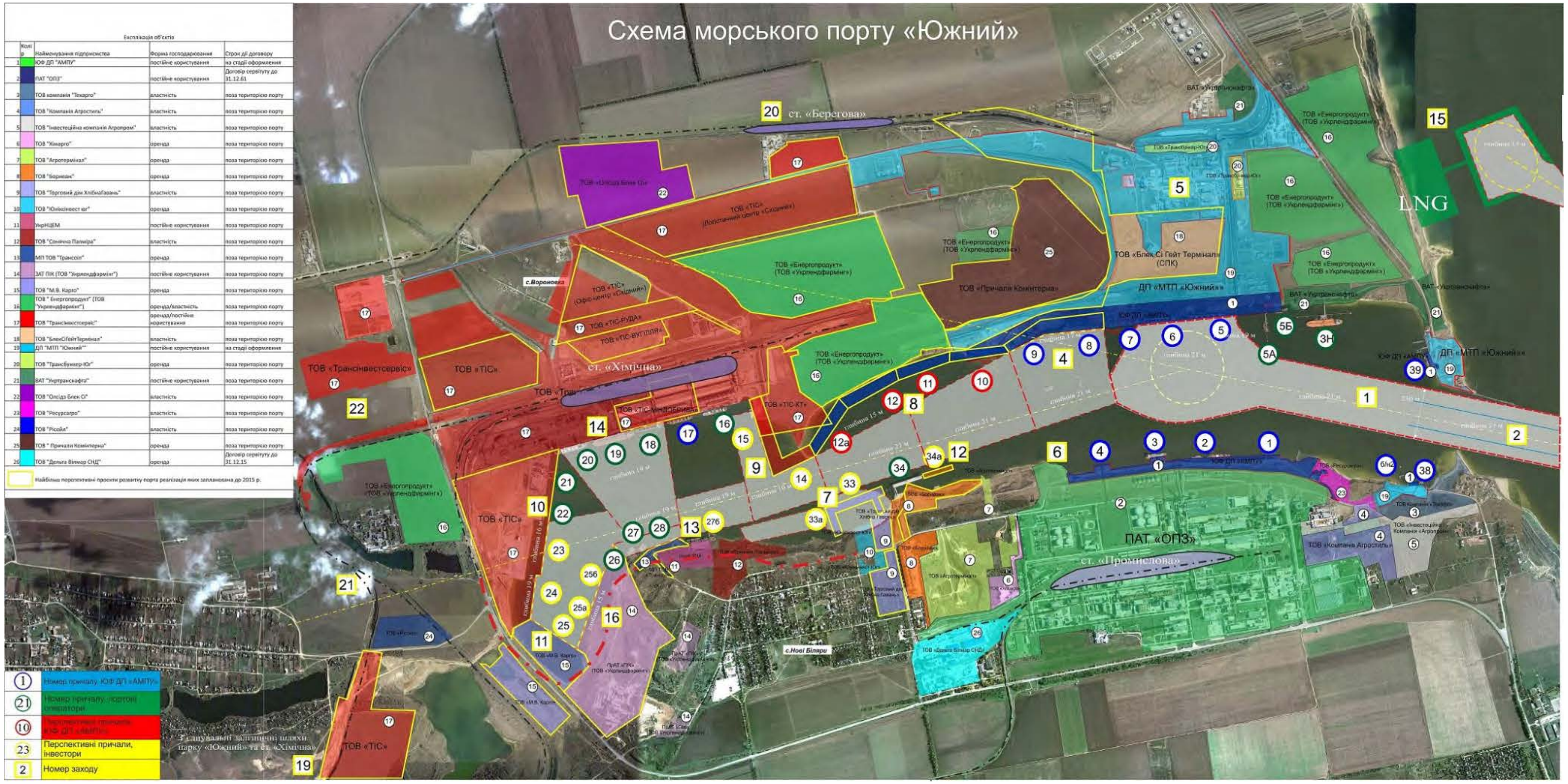
Domain	Action	Investor	Expected results	Implementation perspective
	10. Construction of a container terminal on the Berths Number 21,22, 23 (second priority) and construction of Berths Number 24*	LLC “TIS-KT”	Upgrade of cargo handling facilities by 350,000 TEU per year and creation of new jobs	Short-, mid-term
	11.Construction of Berth Number 25 and grain cargo handling complex*	USPA/ LLC “M.V.Kargo”	Upgrade of cargo handling facilities by 4.0 million ton per year and creation of new jobs	Short-, mid-term
	12. Construction of Berth Number 25 and seed-oil cargo handling complex*	LLC “Borivazh”	Upgrade of cargo handling facilities by 2.8 million ton per year and creation of new jobs	Short-, mid-term
	13. Construction of Berths Number 27 and 27b, as well as a universal sea cargo handling complex	LLC “Transoil”	Upgrade of cargo handling facilities by 24 million ton per year and creation of new jobs	Short-, mid-term
	14. Reconstruction of Berths Number 18,19,20 and dredging up to 19 m near the border	LLC “TIS-Ruda”, LLC “TIS-Vuhillya”	Augment of capacities for cargo handling	Short-, mid-term
	15. Construction of new berths and specialized cargo handling complex for liquefied natural gas*	Investor	Upgrade of cargo handling facilities by 10.0 billion cubic meters per year and creation of new jobs	Short-, mid-term
	16. Construction of berths and cargo handling complexes*	CJSC “PIK”	Upgrade of cargo handling facilities by 11.1 million ton per year and creation of new jobs	Short-, mid-term
	17. Creation of cargo handling complexes; building and reconstruction of births and other hydro technical facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Augment of capacities for cargo handling	Short-, mid-term
Development of the motor road infrastructure	18. Construction of new and reconstruction of existing motor road infrastructure. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Augment of capacities for cargo handling	Short-, mid-, long-term

Domain	Action	Investor	Expected results	Implementation perspective
Development of railroad infrastructure	19. Development of station Chornomorska – station Berehova railway junction:* 19.1 Construction of the second main track at 5 kilometers– 10 kilometers – 12 kilometers – 18 kilometers section. 19.2 Construction of the second main track at 24 kilometers – 27 kilometers section. 19.3 Construction of a level junction at 29 kilometers. 19.4 Construction of a Passing loop 29-30 kilometers and the second main track Passing loop 30 kilometers – Berehova station	Investor	Augment of capacities for cargo handling	Short-term
	20. Reconstruction of Berehova station	Investor		Short-term
	21. Construction of a track connecting “Yuzhny” park and Khimichna station	LLC “TIS”		Short-, mid-term
	22. Construction of railway-yard “B”, Khimichna station*	LLC “TIS”		Short-, mid-term
	23. Construction of new and reconstruction of existing railway infrastructure. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor		Short-, mid-, long-term
Investments into other domains	24. Reconstruction (modernization) of power supply systems, introduction of energy saving technologies	USPA/investor	Increase performance of operations of the sea port and curtail operating costs	Short-term
	25. Introduction of the *[IT]* Port Community System*	USPA/investor	Optimization of workflow at clearance and processing of cargos within the port, increasing safety of cargos and data protection, optimization of transport processes, decrease of human factor at clearance, curtail time of cargos processing	Short-term

* — These actions are supported by prefeasibility decisions (off-phase), feasibility studies, expert reports etc.

Identification of specific and additional actions, investors, facilities, indicators and amount of investment in all domains is to be done based on the results of the pre-project decisions (off-phase), feasibility studies, expertise reports for respective projects as well, by means of amending and revising the development plan.

Source: USPA Website



Source: USPA Website

(4) Port of Mykolaiv

Domain	Action	Investor	Expected results	Implementation perspective
Dredging	1. Reconstruction of the approach waterway to the “Port Ochakiv” LLC sea terminal	USPA	Increase depth up to 7.35 meters	Short-term
	2. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor		Short-, mid-, long-term
Development of the infrastructure of sea terminals	3. Construction of a universal cargo handling facility at the projected Berth Number 8 *	USPA/investor	Upgrade of cargo handling facilities by 1.0 million ton per year, dredging up to 10.5 meters, construction of a 190 meters long mooring line, new jobs	Short- and mid-term
	4. Construction of a Berth Number 14a and a cargo handling facility	USPA/investor	Upgrade of cargo handling facilities by 1.0 million ton per year, dredging up to 10.5 meters, construction of a 240 meters long mooring line, new jobs	Short- and mid-term
	5. Construction of Berths Number 16 and 17 universal cargo handling facility	USPA/investor	Upgrade of cargo handling facilities by 1.0 million ton per year, dredging up to 10.5 meters, construction of a 372.7 meters long mooring line, new jobs	Short-, mid-, long-term
	6. Construction of a production and cargo handling facility In the rear of Berths Number 13-14	Investor	Upgrade of cargo handling facilities by 1 million ton per year and new jobs	Short-, mid-, long-term
	7. Construction of grain cargo handling facility in the rear of Berth Number 9	Investor	Upgrade of cargo handling facilities by 0.5 million ton per year and new jobs	Short-, mid-, long-term
	8.Construction of a cargo handling facility for grains and oilseeds and their derivative products in the rear of Berths Number 1,2	Investor	Upgrade of cargo handling facilities by 2.5 million ton per year and new jobs	Short-, mid-, long-term
	9. Construction of an in-door storage in the rear of Berth Number 4	Investor	Upgrade of cargo handling facilities by 0.5 million ton per year and new jobs	Short-, mid-, long-term
	10. Reconstruction of warehouses Number 8, 9, Site Number 5. Construction of a boiler house. Construction of a liquid bulk terminal	Investor	Upgrade of cargo handling and new jobs	Short-, mid-, long-term
	11. A set of measures on modernization of a grain cargo handling facility in the rear of Berth Number 14	Investor	Upgrade of cargo handling facilities	Short-, mid-, long-term

Domain	Action	Investor	Expected results	Implementation perspective
	12. Setup of cargo handling facilities; construction and reconstruction of births and other hydro technical facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
Development of the motor road infrastructure	13. Building the new and reconstructing the existing motor road facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
Development of railroad infrastructure	14. Equipping track switches with electric centralization, reconstruction of tracks, manufacture, installation of a flat crossing for the Berth Number 3, construction of approach lines Number 21, 22, 59 *	USPA/investor	Upgrade of cargo handling facilities	Short-term
	15. Building the new and reconstructing the existing railroad facilities. Specific steps (objects) to be identified based on the prefeasibility decisions (off-phase) and feasibility study for a respective complex project.	USPA/investor	Upgrade of cargo handling facilities	Short-, mid-, long-term
Investments into other domains	16. Reconstruction (modernization) of power supply systems, introduction of energy saving technologies	USPA/investor	Increase performance of operations of the sea port and curtail operating costs	Short-term
	17. Introduction of the *[IT]* Port Community System*		Optimization of workflow at clearance and processing of cargos within the port, increasing safety of cargos and data protection, optimization of transport processes, decrease of human factor at clearance, curtail time of cargos processing	Short- and mid-term
	18. Construction of water treatment facilities in the rear of the birth № 13	Investor	Improving the environment	Short-, mid-, long-term
* — These actions are supported by prefeasibility decisions (off-phase), feasibility studies, expert reports etc.				
Identification of specific and additional actions, investors, facilities, indicators and amount of investment in all domains is to be done based on the results of the pre-project decisions (off-phase), feasibility studies, expertise reports for respective projects as well, by means of amending and revising the development plan.				

Source: USPA Website

Source: USPA Website

Appendix 4-V: Volume Statistics and Forecast

Volume statistics and forecast by commodity is as follows. (The data will also be provided in excel format)

(1) Coal

Value	Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Export - coal																											
Bulgaria - Gross domestic product, constant prices	$	7.236	6.753	7.675	5.647	-4.22	0.055	1.584	0.237	1.282	1.549	2.968	3	2.8	2.5	2.5	2.5	2.5									
Islamic Republic of Iran - Gross domestic product, constant	$	4.209	5.704	9.116	0.924	2.315	6.577	3.75	-6.609	-1.912	4.343	0.38	4.472	4.066	4.123	4.217	4.274	4.275									
Lebanon - Gross domestic product, constant prices	$	2.7	1.6	9.4	9.1	10.3	8	0.9	2.8	2.5	2	1	1	2	2.5	3	3	3									
Morocco - Gross domestic product, constant prices	$	3.292	7.575	3.532	5.923	4.244	3.816	5.246	3.01	4.535	2.551	4.508	1.846	4.785	4.198	4.545	4.698	4.876									
Turkey - Gross domestic product, constant prices	$	8.402	6.893	4.669	0.659	-4.826	9.157	8.773	2.127	4.193	3.02	3.985	3.281	2.977	3.215	3.315	3.462	3.506									
Israel - Gross domestic product, constant prices	$	4.152	5.707	6.214	3.006	1.392	5.656	5.062	2.382	4.376	3.163	2.508	2.782	2.962	2.915	2.952	2.892	2.924									
Italy - Gross domestic product, constant prices	$	0.95	2.007	1.474	-1.05	-5.482	1.687	0.577	-2.819	-1.748	-0.343	0.76	0.757	0.941	1.149	0.85	0.85	0.85									
Bulgaria - Population	$	-0.54	-0.52	-0.51	-0.43	-0.57	-0.78	-2.37	-0.61	-0.60	-0.50	-0.67	-0.56	-0.56	-0.57	-0.55	-0.56	-0.56									
Islamic Republic of Iran - Population	$	1.53	1.59	1.11	1.27	1.89	1.25	1.29	1.33	1.34	1.32	1.28	1.24	1.20	1.15	1.10	1.06	1.01									
Israel - Population	$	1.78	1.80	1.76	1.83	2.39	1.86	1.86	1.85	1.88	1.94	2.01	1.80	1.69	1.60	1.60	1.60	1.61									
Italy - Population	$	0.66	0.33	0.28	0.74	0.59	0.32	0.30	0.05	0.49	1.84	0.02	0.58	0.33	0.33	0.33	0.33	0.33									
Lebanon - Population	$	3.45	2.33	1.47	1.11	1.46	2.21	0.97	0.96	0.95	0.96	0.98	0.94	0.98	0.95	0.96	0.97	0.94									
Morocco - Population	$	1.11	1.11	1.10	1.09	1.08	1.07	1.05	1.04	1.02	0.99	0.98	0.97	0.95	0.95	0.93	0.92	0.90									
Turkey - Population	$	1.24	1.26	1.23	1.32	1.46	1.60	1.36	1.21	1.13	1.10	1.07	1.04	1.01	0.98	0.96	0.93	0.90									
Growth rate export basket	$	2.87	3.15	3.47	2.22	0.86	3.03	2.17	0.50	1.39	1.71	1.56	1.65	1.87	1.86	1.91	1.92	1.93	1.88	1.84	1.79	1.74	1.69	1.64	1.60	1.55	1.50
Export volume - historics	1000 tons								5081	6637	5222	182.2															
Export volume - forecast	1000 tons											182.2	185.2	188.7	192.2	195.8	199.6	203.5	207.3	211.1	214.9	218.6	222.3	226	229.6	233.1	236.6
MS - Four major ports - historics	$								100%	100%	91%	77%															
MS - Four major ports - forecast	$											77%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Export volume - historics	1000 tons								5080	6637	4754	141															
Export volume - forecast	1000 tons											141	185.2	188.7	192.2	195.8	199.6	203.5	207.3	211.1	214.9	218.6	222.3	226	229.6	233.1	236.6
Import - coal																											
Ukraine - Gross domestic product, constant prices	$	3.07	7.57	8.22	2.24	-15.14	0.26	5.47	0.24	-0.03	-6.55	-9.87	1.49	2.53	3.03	3.54	3.99	4.00									
Ukraine - Population	$	-0.75	-0.61	-0.59	-0.50	-0.39	-0.40	-0.32	-0.18	-0.28	-5.49	-0.40	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21									
Growth rate import basket	$	1.16	3.48	3.81	0.87	-7.76	-0.07	2.57	0.03	-0.15	-6.02	-5.13	0.64	1.16	1.41	1.66	1.89	1.89	1.845	1.797	1.749	1.701	1.653	1.605	1.557	1.509	1.5
Import volume - historics	1000 tons								2927	3078	3614	5658															
Import volume - forecast	1000 tons											5658	5694	5761	5842	5939	6051	6166	6280	6392	6504	6615	6724	6832	6939	7043	7149
MS - Four major ports - historics	$								0.19	0.44	0.49	0.79															
MS - Four major ports - forecast	$											0.79	0.81	0.82	0.83	0.85	0.86	0.88	0.89	0.90	0.92	0.93	0.94	0.96	0.97	0.99	1
Import volume - historics	1000 tons								544.9	1362	1770	4490															
Import volume - forecast	1000 tons											4490	4597	4730	4877	5040	5218	5402	5588	5777	5967	6160	6354	6550	6748	6946	7149
Transit - coal																											
Transit - historics	1000 tons								2385	1448	1971	1788															
Transit - forecast	1000 tons											1788	1898	1898	1898	1898	1898	1898	1898	1898	1898	1898	1898	1898	1898	1898	1898
Total volume - coal																											
Historics	1000 tons	7134	7181	6142	6525	4349	3927	4314	6257	7474	7854	6334															
Forecast	1000 tons											6334	6680	6816	6967	7133	7316	7503	7693	7885	8080	8276	8474	8674	8875	9077	9283

Source: JICA Survey Team

(2) Grains

Value	Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Production - grain	1000 tons	37258	33511.14	28937.8	52739.9	45406	38678.6	56255.9	45741.2	62679.45	63377.72			
Surface	ha	14204100	13803100	13112300	15123400	15114800	14184500	14985200	14484500	15550400	14408570	14497087	14497087	14497087
Yield - Ukraine	tons/ha	2.623045	2.4277981	2.2069202	3.4873044	3.0040755	2.7268215	3.7540974	3.1579412	4.0307291	4.3986128	4.4786128	4.5586128	4.6386128
Yield - Europe	tons/ha	3.516306	3.4071305	3.3396603	3.9652394	3.7993726	3.687893	3.9123419	3.6288527	4.0524947	4.3643283			
Production - grain	1000 tons	37258	33511.14	28937.8	52739.9	45406	38678.6	56255.9	45741.2	62679.45	63377.72	64926.839	66086.606	67246.373
Consumption - grain	1000 tons	13235	11572	11776	14964	10067	11422	13188	13188	13188	13188	12834.8	12834.8	12834.8
Export - grain	1000 tons	24023	21939.14	17161.8	37775.9	35339	27256.6	43067.9	32553.2	49491.45	50189.72	52092.039	53251.806	54411.573
Export (port) - grain	1000 tons								29059.20	28420.25	32894.40	36790.17		
port share	$								89%	57%	66%	71%	72%	73%
Port share	$								80%	80%	82%	87%	87%	87%
Export four major ports	1000 tons								23177.24	22747.98	27092.21	31951.34	33298.09	34675.12
Production - historics	1000 tons	37258	33511.14	28937.80	52739.90	45406.00	38678.60	56255.90	45741.20	62679.45	63377.72	64926.84		
Production - forecast	1000 tons											64926.84	66086.61	67246.37
Consumption - historics	1000 tons	13235	11572	11776	14964	10067	11422	13188	13188	13188	13188	12834.8		
Consumption - forecast	1000 tons											12834.8	12834.8	12834.8
Export - historics	1000 tons	24023	21939.14	17161.8	37775.9	35339	27256.6	43067.9	3255320%	4949145%	5018972%	5209204%		
Export - forecast	1000 tons											5209204%	5325181%	5441157%
Export - historics - port	1000 tons								23177.24	22747.98	27092.21	31951.34		
Export - forecast - port	1000 tons											31951.34	33298.094	34675.122

Value	Unit	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production - grain	1000 tons													
Surface	ha	14497087	14497087	14497087	14497087	14497087	14497087	14497087	14497087	14497087	14497087	14497087	14497087	14497087
Yield - Ukraine	tons/ha	4.718613	4.7986128	4.8786128	4.9586128	5.0386128	5.1186128	5.1986128	5.2786128	5.3586128	5.4386128	5.5186128	5.5986128	5.6786128
Yield - Europe	tons/ha													
Production - grain	1000 tons	68406.14	69565.907	70725.674	71885.441	73045.208	74204.975	75364.742	76524.509	77684.276	78844.042	80003.809	81163.576	82323.343
Consumption - grain	1000 tons	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8
Export - grain	1000 tons	55571.34	56731.107	57890.874	59050.641	60210.408	61370.175	62529.942	63689.709	64849.476	66009.242	67169.009	68328.776	69488.543
Export (port) - grain	1000 tons													
port share	$	74%	75%	77%	78%	79%	80%	82%	83%	84%	85%	86%	88%	90%
Port share	$	87%	88%	88%	88%	88%	88%	89%	89%	89%	89%	89%	90%	90%
Export four major ports	1000 tons	36082.59	37520.66	38989.50	40489.28	42020.16	43582.31	45175.90	46801.09	48458.04	50146.93	51867.92	53621.17	56285.72
Production - historics	1000 tons													
Production - forecast	1000 tons	68406.14	69565.91	70725.67	71885.44	73045.21	74204.97	75364.74	76524.51	77684.28	78844.04	80003.81	81163.58	82323.34
Consumption - historics	1000 tons													
Consumption - forecast	1000 tons	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8	12834.8
Export - historics	1000 tons													
Export - forecast	1000 tons	5557134%	5673111%	5789087%	5905064%	6021041%	6137017%	6252994%	6368971%	6484948%	6600924%	6716901%	6832878%	6948854%
Export - historics - port	1000 tons													
Export - forecast - port	1000 tons	36082.59	37520.659	38989.501	40489.28	42020.163	43582.314	45175.9	46801.087	48458.042	50146.929	51867.916	53621.168	56285.72

Source: JICA Survey Team

(3) Metal Products

Value	Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Bulgaria - Gross domestic product, constant prices	$	7.24	6.75	7.68	5.65	-4.22	0.06	1.58	0.24	1.28	1.55	2.97	3.00	2.80
Egypt - Gross domestic product, constant prices	$	4.47	6.84	7.09	7.16	4.67	5.15	1.77	2.23	2.10	2.24	4.20	3.83	3.95
Islamic Republic of Iran - Gross domestic product, constant prices	$	4.21	5.70	9.12	0.92	2.32	6.58	3.75	-6.61	-1.91	4.34	0.38	4.47	4.07
Italy - Gross domestic product, constant prices	$	0.95	2.01	1.47	-1.05	-5.48	1.69	0.58	-2.82	-1.75	-0.34	0.76	0.76	0.94
Pakistan - Gross domestic product, constant prices	$	8.96	5.82	5.54	4.99	0.36	2.58	3.62	3.84	3.68	4.05	4.04	4.71	5.00
Turkey - Gross domestic product, constant prices	$	8.40	6.89	4.67	0.66	-4.83	9.16	8.77	2.13	4.19	3.02	3.99	3.28	2.98
United Arab Emirates - Gross domestic product, constant prices	$	4.86	9.84	3.18	3.19	-5.24	1.64	4.89	7.12	4.73	3.08	3.97	2.26	2.50
Basket GDP	$	5.58	6.27	5.53	3.07	-1.77	3.83	3.57	0.87	1.76	2.56	2.90	3.19	3.18
Historics	1000 tons	13,467	13,905	17,652	14,326	10,928	8,079	6,973	10,934	9,672	14,578	18,705		
Forecast	1000 tons											18,705	19,302	19,915

Value	Unit	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bulgaria - Gross domestic product, constant prices	$	2.50	2.50	2.50	2.50									
Egypt - Gross domestic product, constant prices	$	4.83	5.54	5.83	6.00									
Islamic Republic of Iran - Gross domestic product, constant prices	$	4.12	4.22	4.27	4.28									
Italy - Gross domestic product, constant prices	$	1.15	0.85	0.85	0.85									
Pakistan - Gross domestic product, constant prices	$	5.20	5.50	5.50	5.50									
Turkey - Gross domestic product, constant prices	$	3.22	3.32	3.46	3.51									
United Arab Emirates - Gross domestic product, constant prices	$	3.05	3.41	3.70	3.43									
Basket GDP	$	3.44	3.62	3.73	3.72	3.62	3.51	3.41	3.30	3.20	3.09	2.99	2.88	3.00
Historics	1000 tons													
Forecast	1000 tons	20,599	21,345	22,141	22,965	23,796	24,632	25,472	26,313	27,154	27,994	28,831	29,662	30,552

Source: JICA Survey Team

(4) Metal Ore

Value	Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Export volume														
China - Gross domestic product, constant prices	$	11.3	12.7	14.2	9.6	9.2	10.606	9.5	7.9	7.8	7.3	6.9	6.588	6.171
Turkey - Gross domestic product, constant prices	$	8.402	6.893	4.669	0.659	-4.826	9.157	8.773	2.127	4.193	3.02	3.985	3.281	2.977
Italy - Gross domestic product, constant prices	$	0.95	2.007	1.474	-1.05	-5.482	1.687	0.577	-2.819	-1.748	-0.343	0.76	0.757	0.941
United States - Gross domestic product, constant prices	$	3.345	2.666	1.779	-0.292	-2.776	2.532	1.602	2.224	1.677	2.37	2.596	1.578	2.199
Basket GDP - growth rate	$	5.99925	6.0665	5.5305	2.22925	-0.971	5.9955	5.113	2.358	2.9805	3.08675	3.56025	3.051	3.072
EXPORT - metal ore - four major ports	1000 tons	6487.3	7688.2	8758.306	8885.283	13959.3	12659.1	16840	18811.41	21525.49	24276.42	26419.86		
EXPORT - metal ore - four major ports forecast	1000 tons											26419.86	27225.93	28062.31
Import volume														
Ukraine - Gross domestic product, constant prices	$	3.07	7.57	8.22	2.24	-15.14	0.26	5.47	0.24	-0.03	-6.55	-9.87	1.49	2.53
IMPORT - metal ore - four major ports	1000 tons								5515.43	6243.39	5246.15	6013.65		
Forecast	1000 tons											6013.65	6103.13	6257.60
Total volume														
Historics	1000 tons								24326.84	27768.88	29522.57	32433.51		
Forecast	1000 tons											32433.51	33329.06	34319.91

Value	Unit	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Export volume														
China - Gross domestic product, constant prices	$	6.03	6	5.9	5.8									
Turkey - Gross domestic product, constant prices	$	3.215	3.315	3.462	3.506									
Italy - Gross domestic product, constant prices	$	1.149	0.85	0.85	0.85									
United States - Gross domestic product, constant prices	$	2.081	1.924	1.737	1.625									
Basket GDP - growth rate	$	3.11875	3.02225	2.98725	2.94525	2.840222	2.735194	2.630167	2.525139	2.420111	2.315083	2.210056	2.105028	2
EXPORT - metal ore - four major ports	1000 tons													
EXPORT - metal ore - four major ports forecast	1000 tons	28937.5	29812.07	30702.63	31606.9	32504.6	33393.67	34271.98	35137.39	35987.76	36820.9	37634.66	38426.89	39195.42
Import volume														
Ukraine - Gross domestic product, constant prices	$	3.03	3.54	3.99	4.00	3.89	3.79	3.68	3.58	3.47	3.37	3.26	3.16	2.00
IMPORT - metal ore - four major ports	1000 tons													
Forecast	1000 tons	6447.33	6675.31	6941.52	7219.05	7500.08	7784.18	8070.86	8359.63	8649.95	8941.27	9233.00	9524.56	9715.05
Total volume														
Historics	1000 tons													
Forecast	1000 tons	35384.84	36487.38	37644.15	38825.94	40004.68	41177.85	42342.84	43497.02	44637.71	45762.17	46867.67	47951.44	48910.47

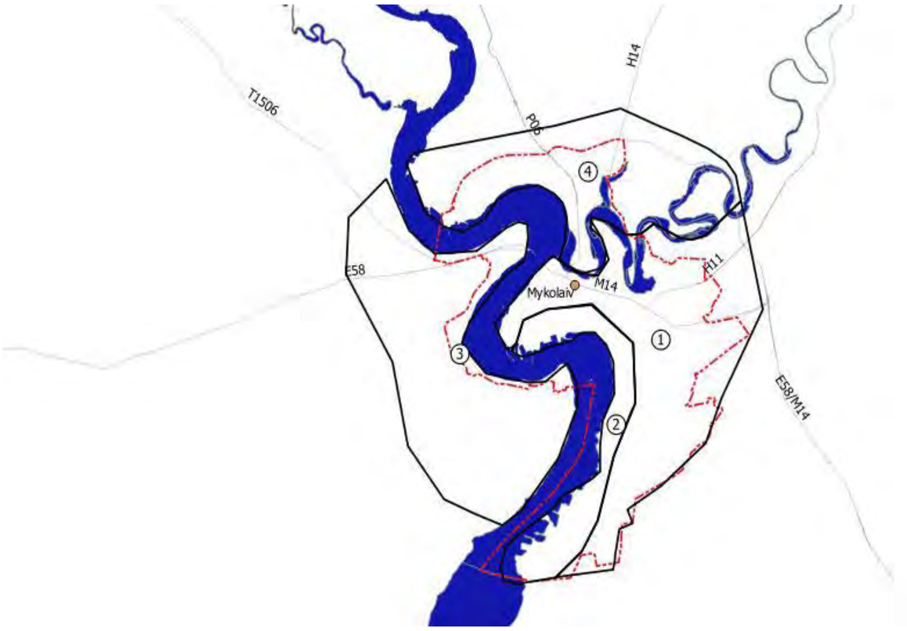
Source: JICA Survey Team

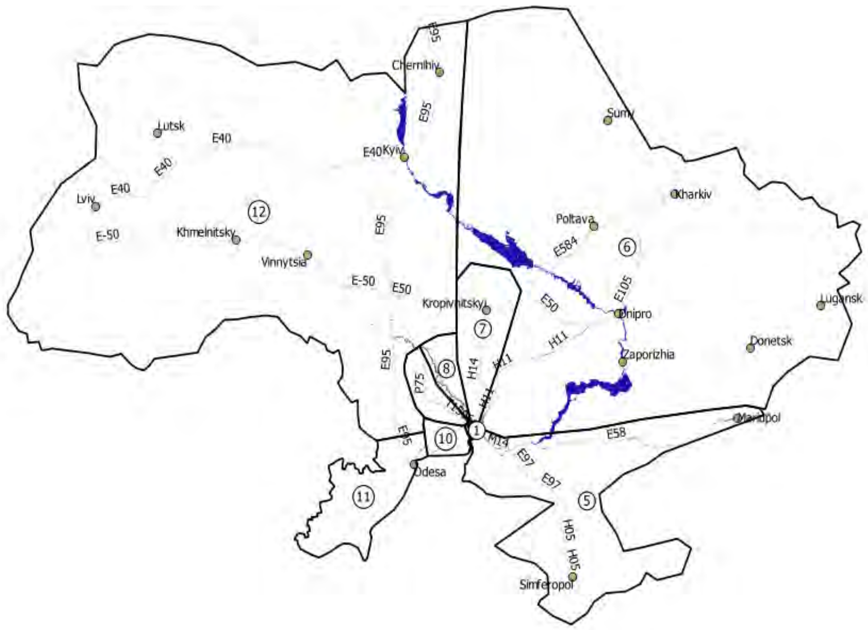
(5) Container

Value	Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
IMPORT - Containers - Total	1000 tons	166568	214878	308563	352002	145099	187395	333341	334047	368299	312885	224060		
EXPORT - Containers - Total	1000 tons	167757	207939	296719	350207	152638	190135	333586	314467	336391	295793	212768		
Total volume	1000 tons	334325	422817	605282	702209	297737	377530	666927	648514	704690	608678	436828		
Growth rate	$		26.4688552	43.1546035	16.0135276	-57.599945					-13.624714	-28.233319		
Ukraine - Gross domestic product, constant prices	$	3.071	7.571	8.216	2.243	-15.136					-6.553	-9.87	1.488	2.531
Multiplier	/		3.49608442	5.25250773	7.13933463	3.80549322					2.07915679	2.86051862	2.76981738	2.67911614
Forecast	1000 tons	334325	422817	605282	702209	297737	377530	666927	648514	704690	608678	436828	454831.815	485673.246
Value	Unit	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IMPORT - Containers - Total	1000 tons													
EXPORT - Containers - Total	1000 tons													
Total volume	1000 tons													
Growth rate	$													
Ukraine - Gross domestic product, constant prices	$	3.032	3.536	3.988	3.998	3.89297222	3.78794444	3.68291667	3.57788889	3.47286111	3.36783333	3.26280556	3.15777778	2
Multiplier	/	2.58841489	2.49771365	2.40701241	2.31631117	2.22560993	2.13490869	2.04420745	1.95350621	1.86280496	1.77210372	1.68140248	1.59070124	1.5
Forecast	1000 tons	523789.241	570049.864	624769.894	682627.41	741771.871	801758.336	862119.88	922377.13	982048.131	1040658.24	1097749.68	1152890.53	1187477.25

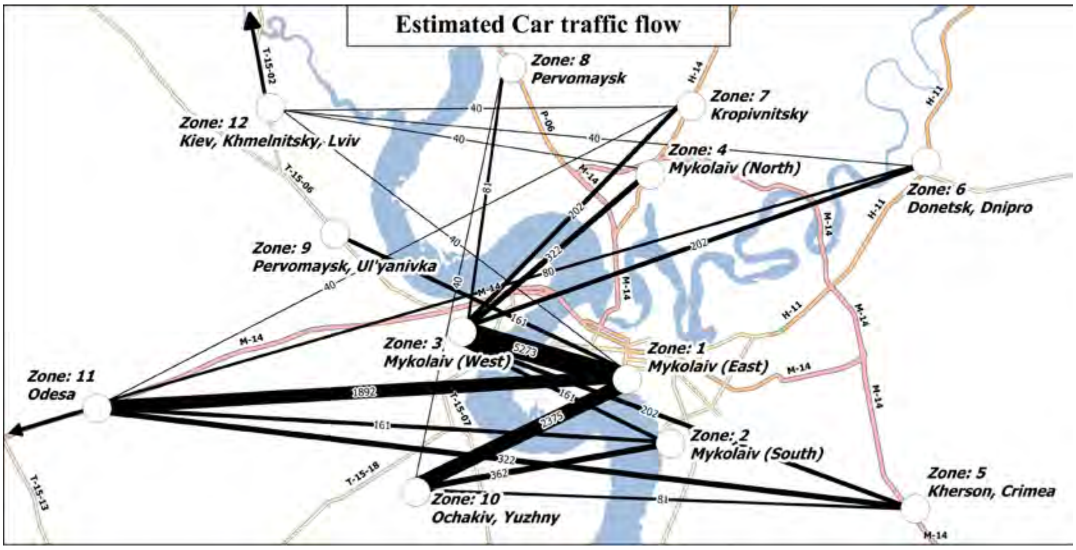
Source: JICA Survey Team

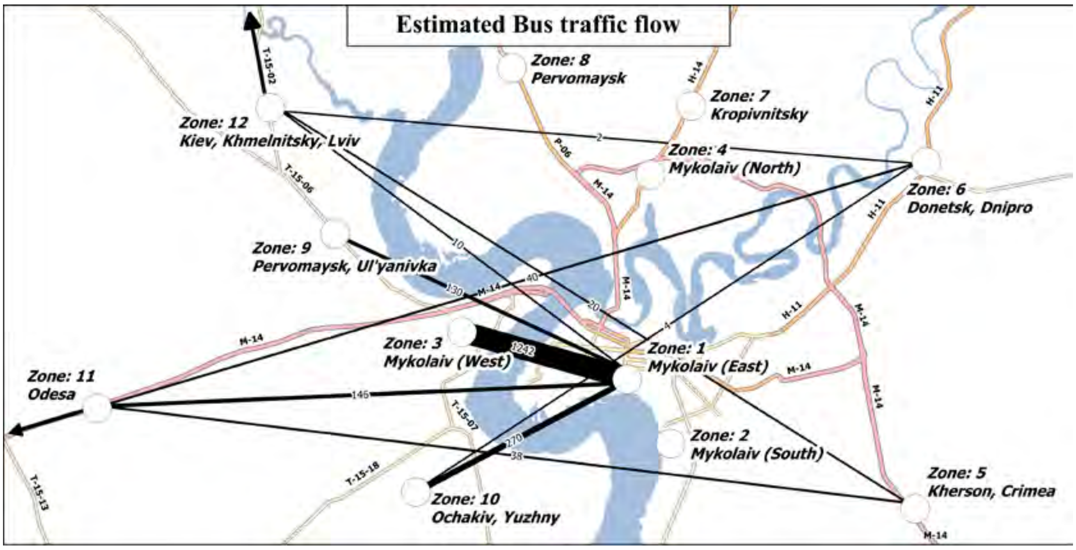
Appendix 5-I: Zoning Definition for OD Surveys

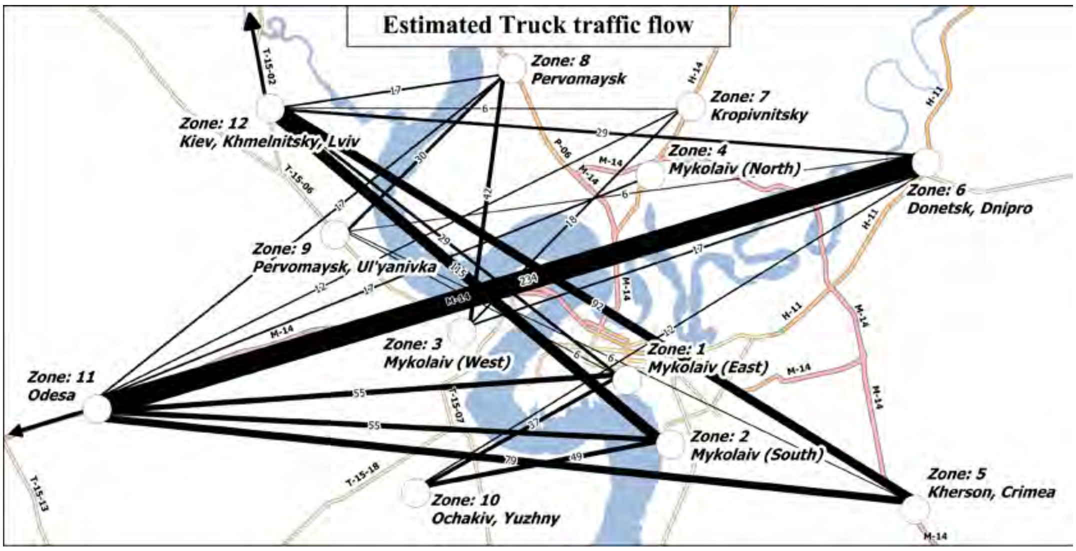




Estimated OD Desired Lines by the 2017 Survey (Figures on the lines are vehicles per day)







Appendix 5-II: Road Side OD Interviews and Traffic Volume Surveys on Highway M-14 in Mykolaiv City

Road side OD Interviews and Traffic Volume Surveys on Highway M14 in Mykolaiv City for Data Collection Survey on logistics in the Southern Region of Ukraine

Final report

March 2017

List of Acronyms

DCI – Dornier Consulting International

JICA – Japan International Cooperation Agency

OD – origin-destination

RSI – roadside interview

ToR – Terms of Reference

List of tables

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1 GENERAL TERMS AND CONDITIONS

The report presents the final results of the data collection survey in Mykolaiv region conducted by Dornier Consulting International GmbH as consultancy service for the project "Data Collection Survey on Logistics in the Southern Region of Ukraine" by Japan International Cooperation Agency (JICA) with a purpose to identify the current situation of logistics in the southern region of Ukraine after the 2014 political change and to review the plan of the Mykolaiv bridge construction project and other potential projects that will contribute to improving the region's logistics.

The survey consisted of Road side OD Interviews and Traffic Volume Surveys on Highway M14 in Mykolaiv City In order to clarify the traffic movement in and around city of Mykolaiv the data on traffic volumes and OD were collected and processed. For the purposes of the survey the DCI has completed following scope of work:

1. Survey Design and Planning. Consultant developed the methodology and detailed plan of survey procedures that was approved by the client and constantly reported on the progress of the survey, challenges, and solutions.
2. Conduct on-site survey. Consultant mobilised necessary local staff that was trained to conduct the survey and supervised the process constantly.
3. Processing of completed traffic count data and reporting. Consultant supervised the data processing of the survey and executed the quality control and necessary corrections of the survey data and prepared necessary reporting documentation.
4. Collection of miscellaneous data. Additional relevant to the survey data was collected when was identified as appropriate or requested by the client.
5. Conduct necessary arrangements and communication with stakeholders. Consultant communicated with city administration, police, road administration, transport safety administration and port authorities on behalf of the project.

The detailed review of data collection and processing and the results of the survey presented in following sections. Raw data submitted as separate files in previous reporting period.

2 DATA COLLECTION AND PROCESSING

2.1 TRAFFIC VOLUME SURVEY

The traffic volume survey was conducted for straight 48 hours on the 24th -25th of January 2017. The survey consisted of continuous 24-hour traffic count for 2 normal weekdays that are Tuesday and Wednesday. During the prior visit to Mykolaiv the survey sites were selected according to ToR (Figure 1), and to ensure unobstructed view of the traffic for both directions, e.g. north-south and south-north, east-west and west-east, and etc. as appropriate. To differentiate the sites, they were numbered as presented on Figure 1 and named as follows:

- Location 1 – "The West End of Varvarovsky bridge";
- Location 2 – "Road M14 towards Polovynky settlement";
- Location 3 – "Road P06 towards Mykolaiv airport";
- Location 4 – "Road H11 towards Voskresenske settlement";
- Location 5 – "Road M14 towards Mykolaivske settlement";
- Location 6 – "Road M14 along the city park Pobeda".

The survey was organized as traffic flow videotaping with further data processing. The specific geographic coordinates, camera coverage and dimensioning for each of the six locations are presented in Annex 1.

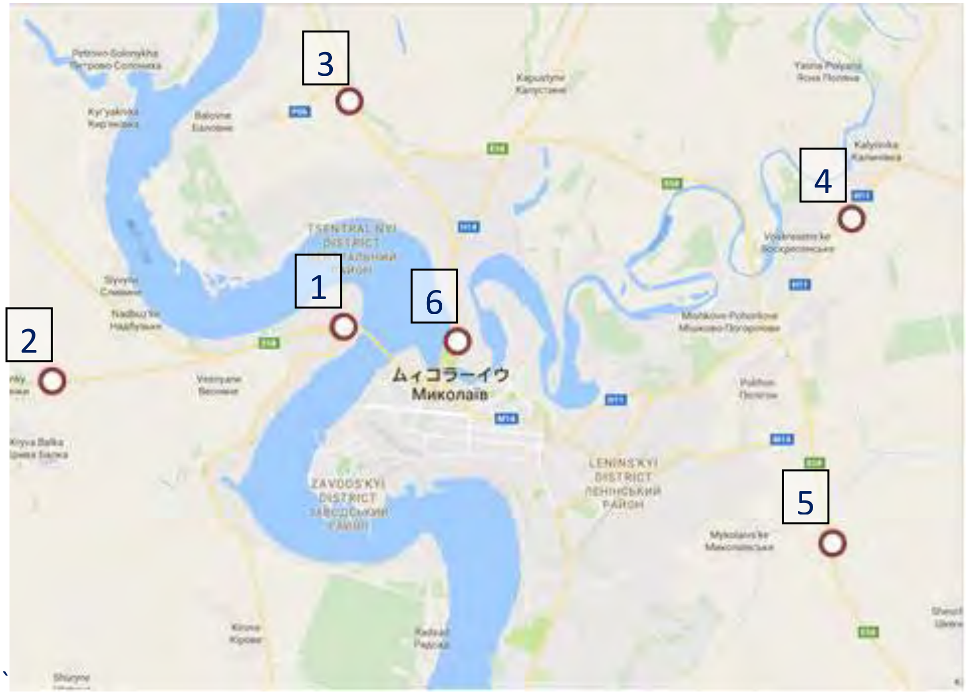


Figure 1 Locations of Traffic Count Survey

Each survey location was equipped with a video camera and two memory cards and supervised by a surveyor. Each surveyor was provided with 5 printed survey sheets split into 5 vehicle categories, namely: passenger cars, buses, 2-axle trucks, 3 and more axle rigid trucks, and semi/full trailers and by 15-minute intervals. The example of the survey sheet is presented in Annex 2. The survey sheets were provided in order: 1) to eliminate data loss as to continue manual data collection if any technical issues arise; 2) to process off-site 8 hours of traffic recorded during the shift; 3) to collect data manually during memory card replacement. Full memory cards were replaced with the free ones on each survey location every 8 hours.

The data processing occurred off-site within three weeks after survey. The data was processed by reviewing the videotape, continuous counting and recording data on a survey sheet. According to ToR the data was recorded every fifteen minutes under 5 vehicle categories, namely: passenger cars, buses, 2-axle trucks, 3 and more axle rigid trucks, and semi/full trailers.

2.2 Road side OD Interviews

To obtain OD information of traffic passing Varvarovskyi bridge, the RSI was conducted. The typical RSI methodology requires forced approach of passing traffic at the roadside which is conducted by authorised authority. Under the Article 35 of Law "On the National Police" vehicles can only be stopped by Traffic Police based on the list of causes, which do not include interview (see Annex 3 for details). The survey team with support of city's mayor has approached regional traffic police department and received a permission to conduct traffic counts and interviews without permission to stop vehicles. Due to these limitations, the alternative approach was used to conduct RSI.

The RSI survey was conducted for vehicle categories passenger cars, busses, and trucks (three and more axles) and assigned to the zones as presented on Figure 2.

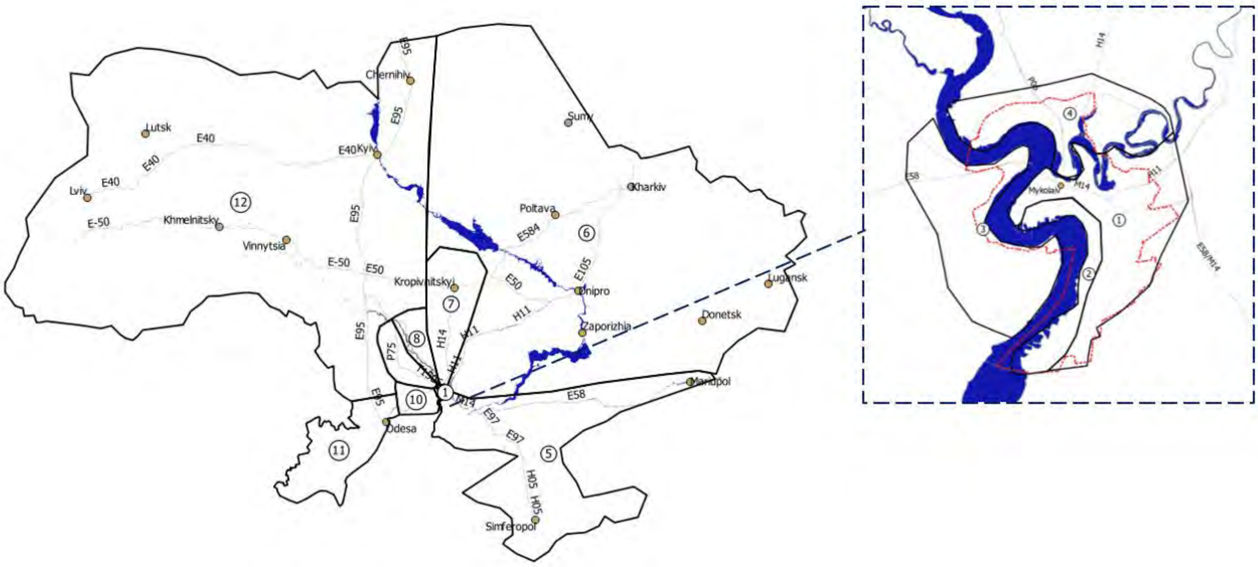


Figure 2 Traffic zones

2.2.1 RSI SURVEYS FOR PRIVATE PASSENGER VEHICLES

The RSI for cars was completed at two petrol stations for cars traveling in both directions on 25.01.17 from 8 am till 4 pm. The locations were approved by the client and the administration of the petrol stations (Figure 3).

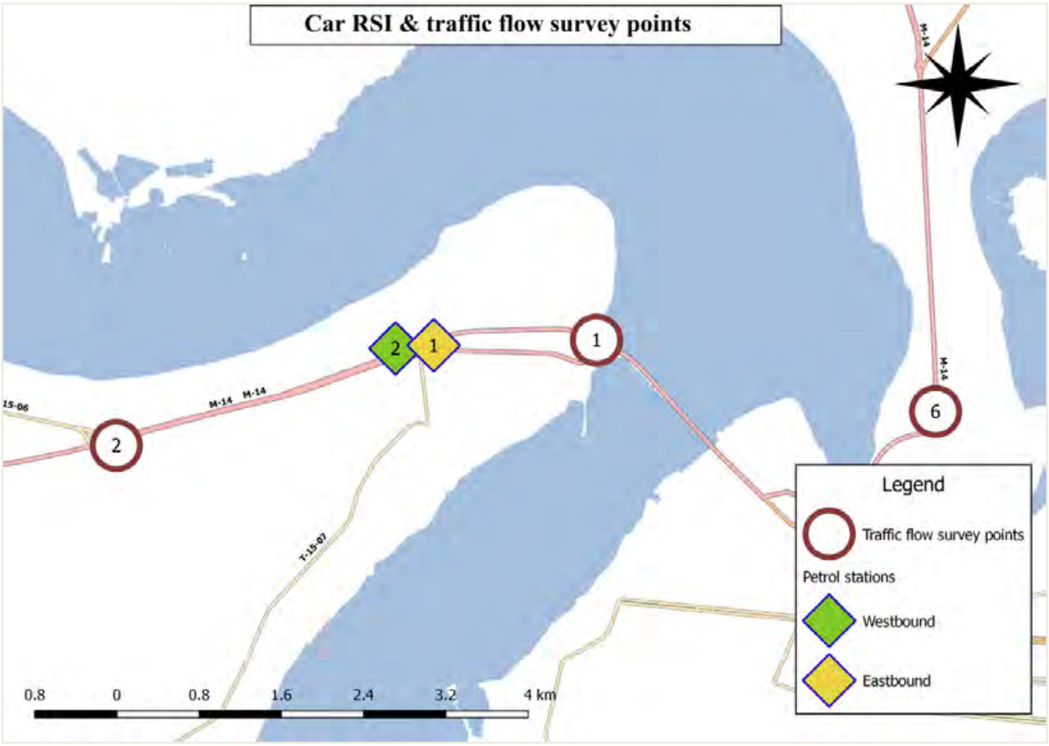


Figure 3 Locations of Car RSI

The surveyors were located inside and outside the petrol stations and were approaching a driver or passenger of every vehicle at the petrol station. The interview included questions on trip origin and destination and the interviewer was also recording time of interview, vehicle type (car, motorcycle, or taxi) and type of interviewee (driver or passenger). The sample form is in Annex 4.

Figure 4 Set up of the interview

2.2.2 RSI SURVEYS FOR TRUCKS

RSI data for trucks was collected through processing of the results gathered by Safety Control of Transport Safety Agency of Ukraine (UkrTransBezpeka). The data represents the inspection of oversized or overweighed vehicles that pass through Mykolaiv. The results of inspection are stored in “paper-and-pencil” Acts of Inspections. To collect the data for the analysis the surveyor processes all the papers into organized excel database.

The data collected includes:

- Act number;
- Date;
- Control point;
- Type of freight;
- Origin (name of the area and zone);
- Destination (name of the area and zone);
- Total weight of the loaded vehicle;
- Dimensions (if applicable).

In total 176 records were observed, assigned to the six control points around Mykolaiv and mapped (Figure 5, Figure 6). The locations and number of RSI are presented in Table 1.

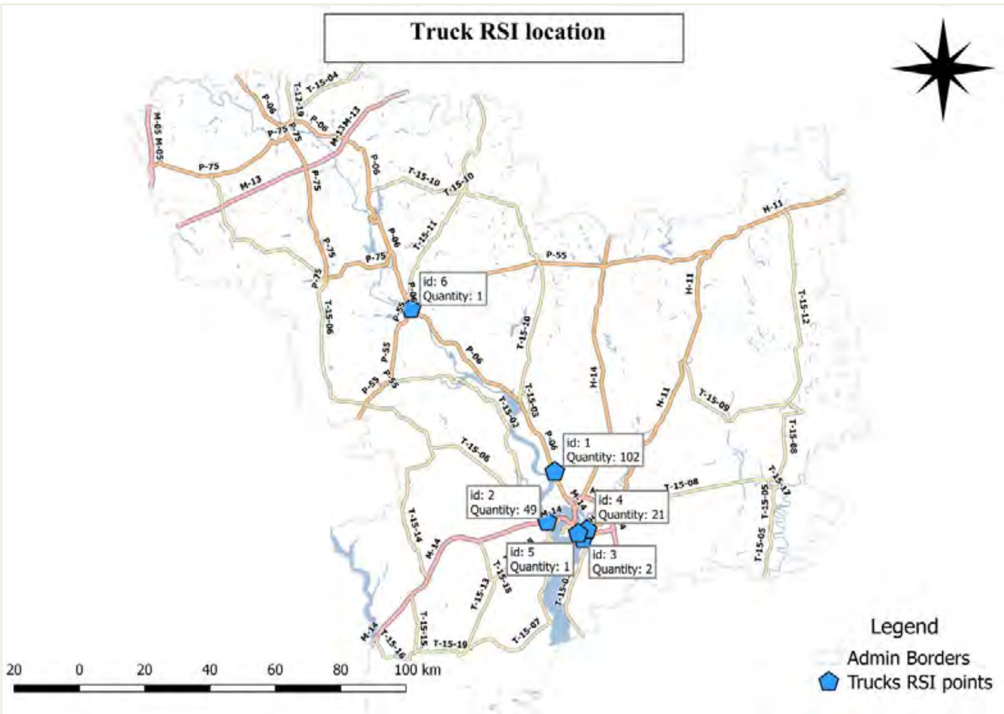


Figure 5 Truck RSI locations in Mykolaivska oblast

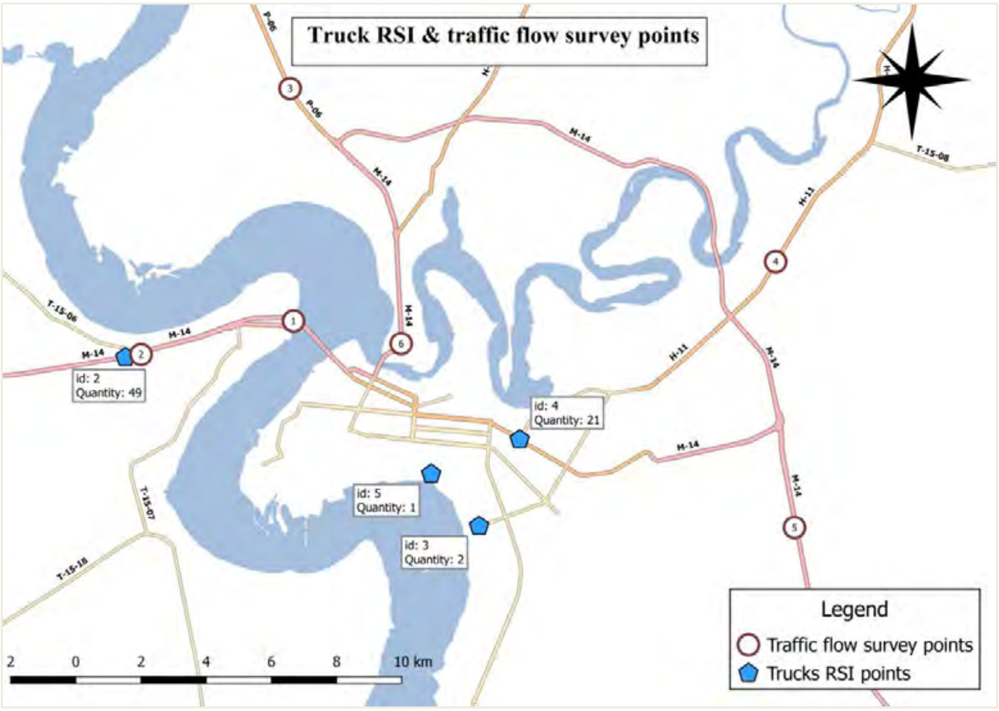


Figure 6 Truck RSI and traffic survey locations

Table 1 Location of Truck RSI

No	Location	Number of interviews
1	Ulyanivka-Mykolaiv P-06 212km	102
2	Odessa-Novoazovsk M-14 89km	49
3	Mykolaiv, 1 Kosmonavtov Str	2
4	Dnipro-Mykolaiv H-11 315km	21
5	Mykolaiv, 34 Zavodska Str	1
6	Voznesensk 123км from Kazanka	1

After data elaboration, the entries that have not contained information on origin and destination points we eliminated from further analysis, therefore, the total number of observations is 174.

Since the distribution of RSI is not homogenous between locations, the corrections were made to improve statistical representation. Points 3, 5, and 6 had little number of observations and were spatially joined with neighboring points that represent same geographical area. The methodology for corrections with detailed calculation of the OD matrixes is presented in Annex 5.

2.2.3 RSI SURVEY OF BUSES

RSI data for buses was received from observing route plates and verifying data with all formal and informal bus stations for all regular routes running through Mykolaiv 24 hours on Wednesday (as a day for survey).

When processing the bus station information only buses that cross the river through Varvarovskyi bridge were summarized.

The total number of buses ODs documented is 1008.

2.3 QUALITY CONTROL

A quality control of 5% of the survey data performed by peer-reviewing the video. The error was calculated as

$$\varepsilon = 1 - \frac{N_o}{N_c}$$

Where N_o – number of vehicles observed by the surveyor

N_c – number of vehicles observed by a reviewer.

The error was calculated for total number of vehicles in 15-minute interval. If the error exceeded 5% the reviewer was a candidate for suspension. Then the error of total number of vehicles per direction and by vehicle category was computed and the factual difference was reviewed. If the error of total number of vehicle exceeded 10% percent, then surveyor was automatically suspended and all results of the surveyor were reprocessed.

2.4 SAMPLE RATE

The sample ratio of RSI was calculated for the vehicle type and direction and presented in Table 2. The results of RSI were expanded to the number of total vehicle observed by traffic count for further analysis. The results of analysis are presented in the next section. The estimated OD matrices are presented in Annex 5 and Annex 6.

Table 2 Sample Rate of Roadside Interview Survey

Vehicle Type	Direction	Traffic Volume	Sample	Sample Rate
Passenger car	Eastbound	6729	140	2,08%
	Westbound	6631	192	2,90%
Trucks and trailers	Eastbound	886	122	13,77%
	Westbound	883	51	5,78%
Bus	Eastbound	1035	503	48,60%
	Westbound	894	505	56,49%

3 RESULTS

The results of survey were processed and integrated. The main characteristics of traffic volume survey were computed for each survey point and the RSI results were expanded to the results of traffic counts on the west side of Varvarovsky bridge.

3.1 RESULTS OF THE TRAFFIC VOLUME SURVEY

The results of Traffic Volume Survey for each location are presented below.

3.1.1 LOCATION 1 "THE WEST END OF VARVAROVSKY BRIDGE"

For the survey location 1 "The West End of Varvarovsky bridge" the observed 48-hour traffic volume is summarized in the Table 3. Average daily traffic volume is about 18,500 vehicles. Passenger cars account for 72 % of total traffic volume while buses and trailers account for 11 % and 9 % respectively. The detailed percentage of vehicles by categories is presented on Figure 7.

Table 3 Daily Traffic Volume for "The West End of Varvarovsky bridge" (both directions)

Day	Passenger cars	Buses	2-axle trucks	3+ axle rigid trucks	Semi/full trailers	Total (veh/day)
24.01.2017	13365	2023	1341	156	1600	18485
25.01.2017	13360	1929	1460	130	1640	18519
Ave.	13363	1976	1401	143	1620	18502
Share	72,2 %	10,7 %	7,6 %	0,8 %	8,8 %	100 %

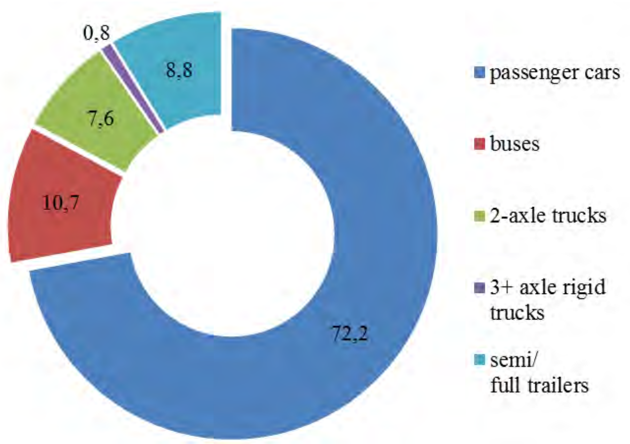


Figure 7 Percentage of vehicles by categories on "The West End of Varvarovsky bridge"

Hourly fluctuation of traffic volume on "The West End of Varvarovsky bridge" is shown on Figure 8.

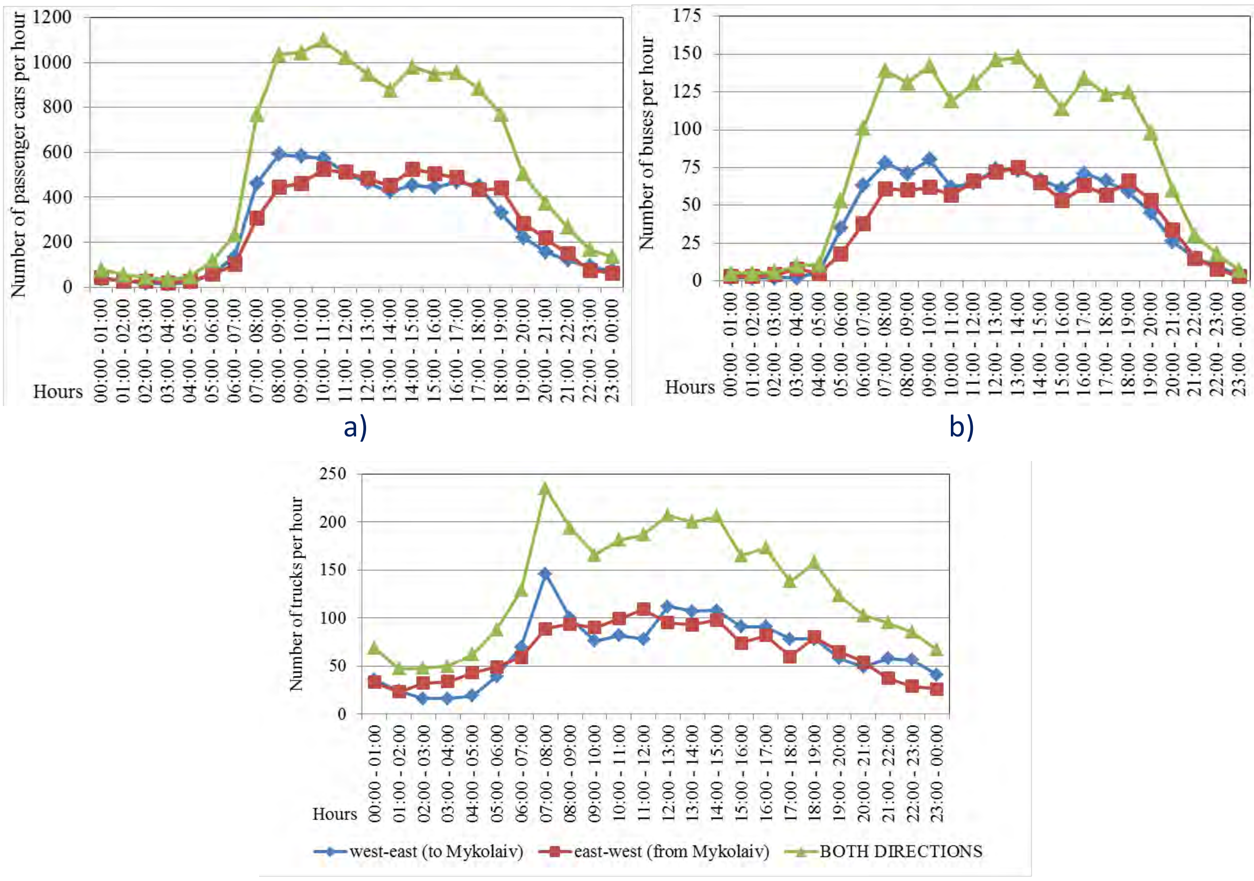


Figure 8 Hourly Fluctuation on "The West End of Varvarovsky bridge" by Type of Vehicle (average of 2 days): a) passenger cars; b) buses; c) trucks

As regards passenger cars, morning peaks (8:00 a.m. - 10:00 a.m.) were observed for eastbound traffic (to Mykolaiv city center) while slight evening peak (2:00 p.m.- 4:00 p.m.) was observed for westbound traffic (out of Mykolaiv city center). The peak hour for buses was observed in the morning, at 7:00 a.m. - 10:00 a.m. for eastbound traffic while peak for westbound traffic was observed at 1:00 p.m. - 2:00 p.m. Regarding truck flow, the peak was observed only for eastbound traffic at 7:00 a.m.- 8:00 a.m.

3.1.2 LOCATION 2 "ROAD M14 TOWARDS POLOVYNKY SETTLEMENT"

For the survey location 2 "Road M14 towards Polovynky settlement" the observed 48-hour traffic volume is summarized in the Table 4. Average daily traffic volume is about 8,000 vehicles. Passenger cars account for 60 % of total traffic volume while buses and trailers account for 7 % and 18 % respectively. The detailed percentage of vehicles by categories is presented on Figure 9.

Table 4 Daily Traffic Volume for the "Road M14 towards Polovynky settlement"

Day	Passenger cars	Buses	2-axle trucks	3+ axle rigid trucks	Semi/full trailers	Total (veh/day)
24.01.2017	4769	742	941	162	1292	7906
25.01.2017	4636	358	1156	83	1438	7671
Ave.	4703	550	1049	123	1365	7789
Share	60,4 %	7,1 %	13,5 %	1,6 %	17,5 %	100 %

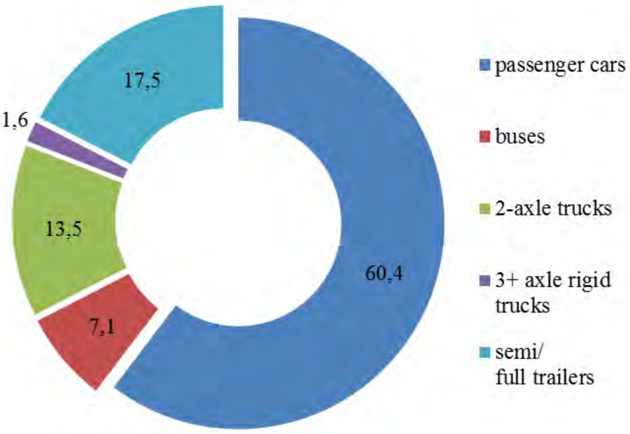


Figure 9 Percentage of vehicles by categories on the "Road M14 towards Polovynky settlement"

Hourly fluctuation of traffic volume on the "Road M14 towards Polovynky settlement" is shown on Figure 10.

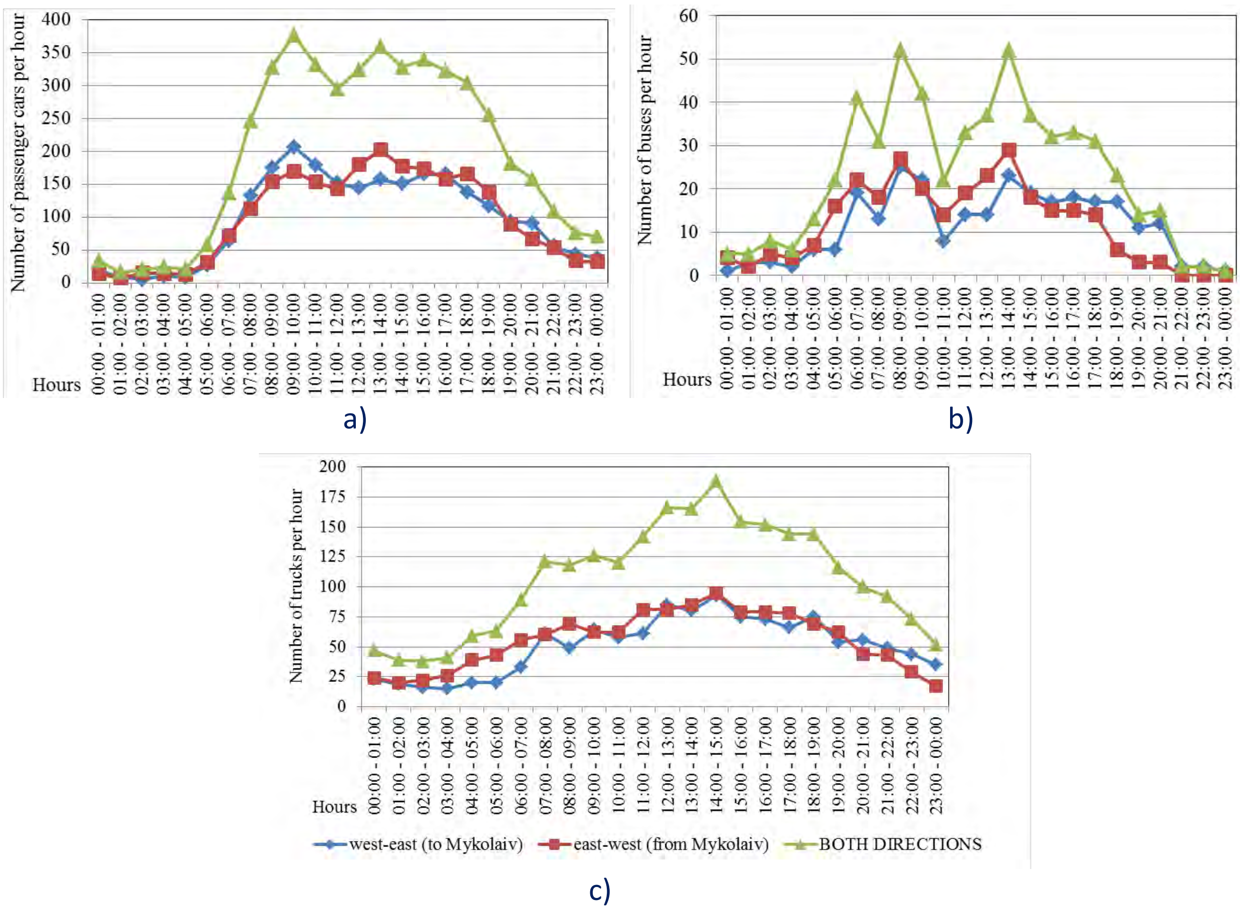


Figure 10 Hourly Fluctuation on the "Road M14 towards Polovynky settlement"

Regarding passenger cars, morning peak (9:00 a.m. - 10:00 a.m.) were observed for eastbound traffic (to Mykolaiv city center) while afternoon peak (1:00 p.m. - 2:00 p.m.) was observed for westbound traffic (out of Mykolaiv city center). The peak hour for buses was observed in the morning, at 8:00 a.m. - 9:00 a.m. for eastbound traffic while peak for westbound traffic was observed at 1:00 p.m.- 2:00 p.m. Regarding trucks, the peak was observed at 2:00 p.m. - 3:00 p.m. for both directions.

3.1.3 LOCATION 3 "ROAD P06 TOWARDS MYKOLAIV AIRPORT"

For the survey location 3 "Road P06 towards Mykolaiv airport" the observed 48-hour traffic volume is summarized in the Table 5. Average daily traffic volume is about 7,000 vehicles. Passenger cars account for 62 % of total traffic volume while buses and trailers account for 9 % and 20 % respectively. The detailed percentage of vehicles by categories is presented on Figure 11.

Table 5 Day Traffic Volume for the "Road P06 towards Mykolaiv airport" (24 hour, both directions)

Day	Passenger cars	Buses	2-axle trucks	3+ axle rigid trucks	Semi/full trailers	Total (veh/day)
24.01.2017	4552	685	504	112	1436	7289
25.01.2017	4379	645	502	117	1396	7039
Ave.	4466	665	503	115	1416	7164
Share	62,3 %	9,3 %	7 %	1,6 %	19,8 %	100 %

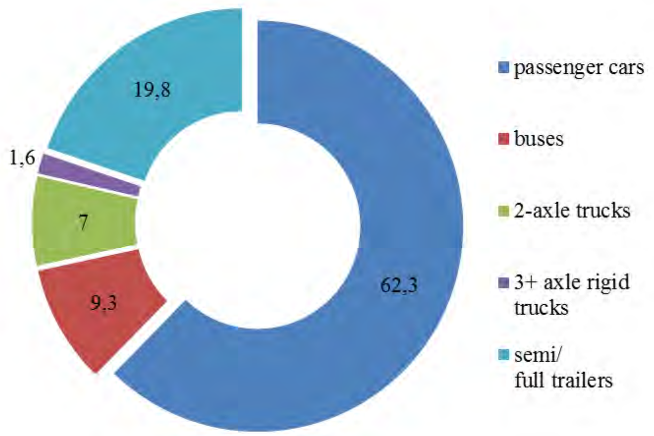
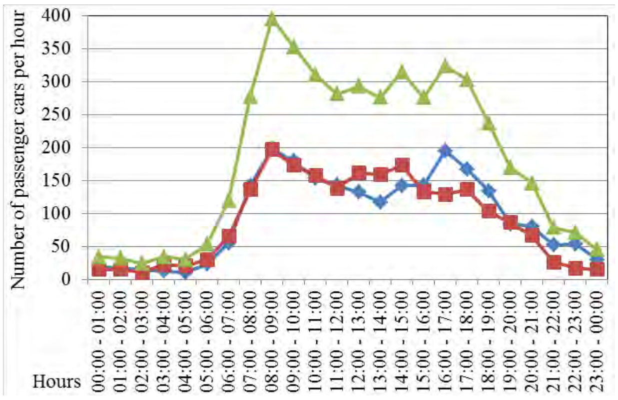
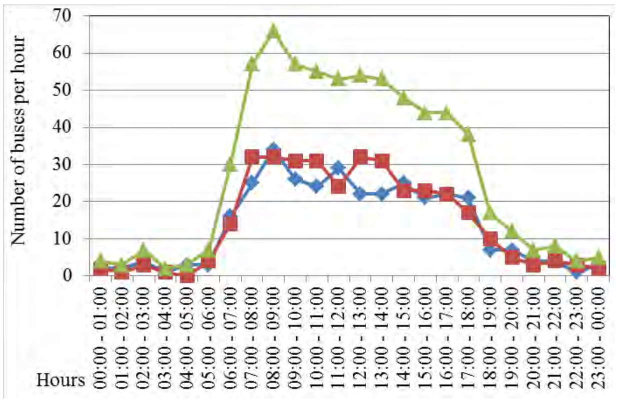


Figure 11 Percentage of vehicles by categories on the "Road P06 towards Mykolaiv airport"

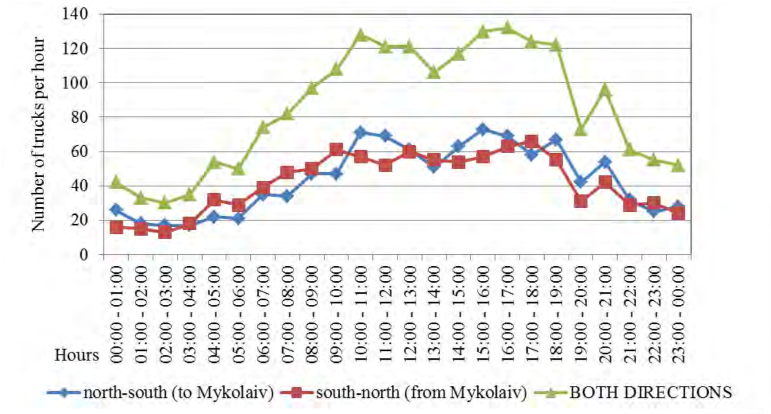
Hourly fluctuation of traffic volume on the "Road P06 towards Mykolaiv airport" is shown on Figure 12.



a)



b)



c)

Figure 12 Hourly Fluctuation on the "Road P06 towards Mykolaiv airport" by Type of Vehicle (average of 2 days): a) passenger cars; b) buses; c) trucks

Regarding passenger cars, morning (8:00 a.m.- 9:00 a.m.) and evening (4:00 p.m.- 5:00 p.m.) peaks were observed for southbound traffic (to Mykolaiv city center) while only morning peak (8:00 a.m.- 9:00 a.m.) was observed for northbound traffic (out of Mykolaiv city center). The peak hour for buses was observed in the morning, at 8:00 a.m. - 9:00 a.m. for southbound traffic while no peaks for northbound traffic were observed. Regarding trucks, no particular peaks were observed.

3.1.4 LOCATION 4 "ROAD H11 TOWARDS VOSKRESENSKE SETTLEMENT"

For the survey location 4 "Road H11 towards Voskresenske settlement" the observed 48-hour traffic volume is summarized in the Table 6. Average daily traffic volume is about 5,000 vehicles. Passenger cars account for 65 % of total traffic volume while buses and trailers account for practically 10 % each. The detailed percentage of vehicles by categories is presented on Figure 13.

Table 6 Day Traffic Volume for the "Road H11 towards Voskresenske settlement" (24 hour, both directions)

Day	Passenger cars	Buses	2-axle trucks	3+ axle rigid trucks	Semi/full trailers	Total (veh/day)
24.01.2017	3260	517	681	79	470	5007
25.01.2017	3144	428	690	74	466	4802
Ave.	3202	473	686	77	468	4905
Share	65,3 %	9,6 %	14 %	1,6 %	9,5 %	100 %

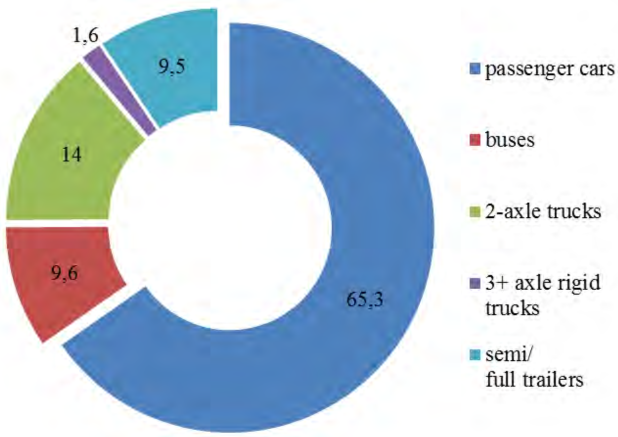
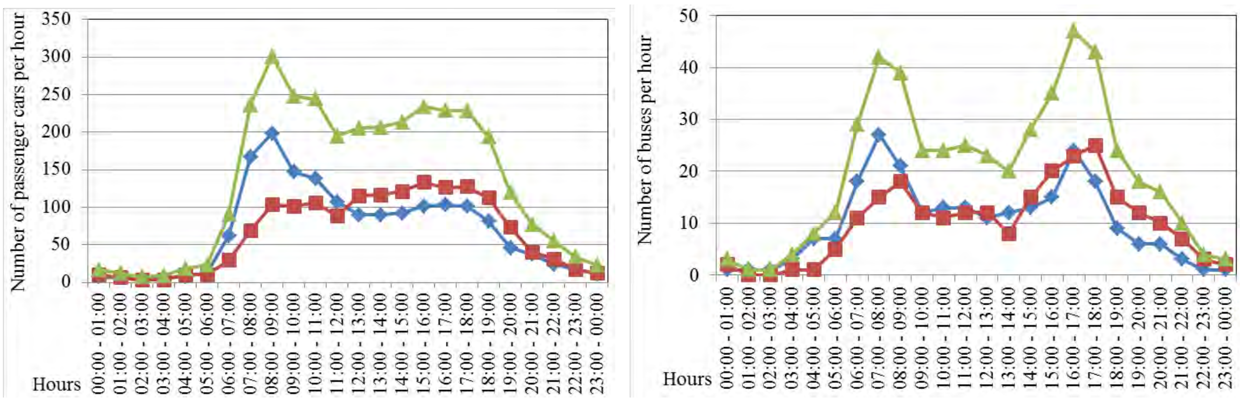
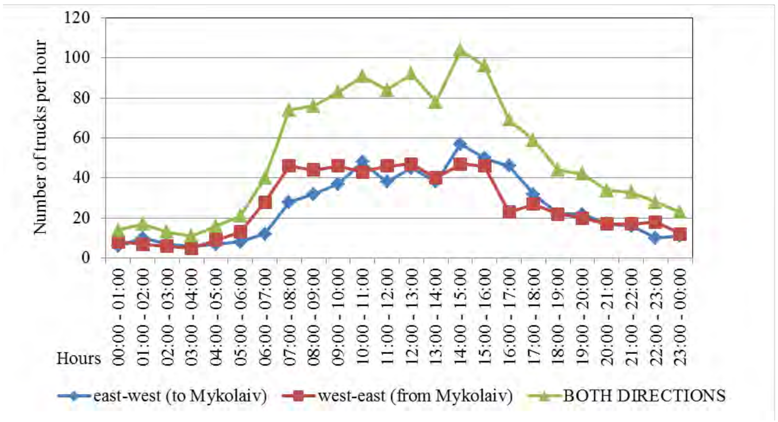


Figure 13 Percentage of vehicles by categories on the "Road H11 towards Voskresenske settlement"

Hourly fluctuation of traffic volume on the "Road H11 towards Voskresenske settlement" is shown on Figure 14.



a) b)



c)

Figure 14 Hourly Fluctuation on the "Road H11 towards Voskresenske settlement" by Type of Vehicle (average of 2 days): a) passenger cars; b) buses; c) trucks

As regards passenger cars, morning peak (8:00 a.m. - 9:00 a.m.) was observed for westbound traffic (to Mykolaiv city center) while no peaks were observed for eastbound traffic (out of Mykolaiv city center). The peaks for buses were observed at 7:00 a.m. - 9:00 a.m. and 4:00 p.m.- 6:00 p.m. for both directions. Regarding trucks, the peak volume was observed for westbound traffic (to Mykolaiv city center) at 2:00 p.m.- 3:00 p.m.

3.1.5 LOCATION 5 "ROAD M14 TOWARDS MYKOLAIVSKE SETTLEMENT"

For the survey location 5 "Road M14 towards Mykolaivske settlement" the observed 48-hour traffic volume is summarized in the Table 7. Average daily traffic volume is about 7,000 vehicles. Passenger cars account for 51 % of total traffic volume while buses and trailers account for 7 % and 24 % respectively. The detailed percentage of vehicles by categories is presented on Figure 15.

Table 7 Daily Traffic Volume for the "Road M14 towards Mykolaivske settlement" (24 hour, both directions)

Day	Passenger cars	Buses	2-axle trucks	3+ axle rigid trucks	Semi/full trailers	Total (veh/day)
24.01.2017	3693	592	1187	126	1719	7317
25.01.2017	3683	428	1196	82	1818	7207
Ave.	3688	510	1192	104	1769	7262
Share	50,8 %	7 %	16,4 %	1,4 %	24,4 %	100 %

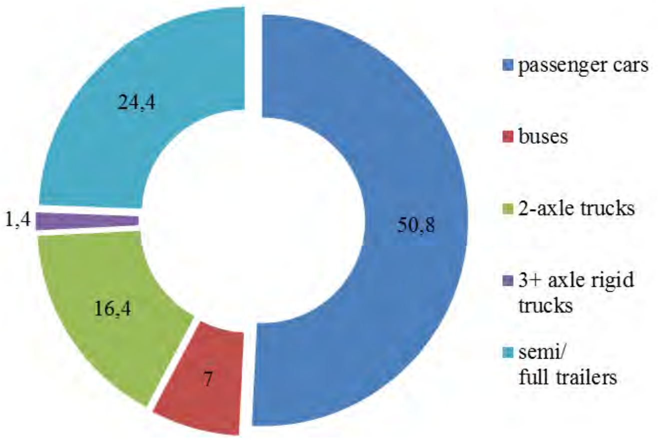


Figure 15 Percentage of vehicles by categories on the “Road M14 towards Mykolaivske settlement”

Hourly fluctuation of traffic volume on the “Road M14 towards Mykolaivske settlement” is shown on Figure 16.

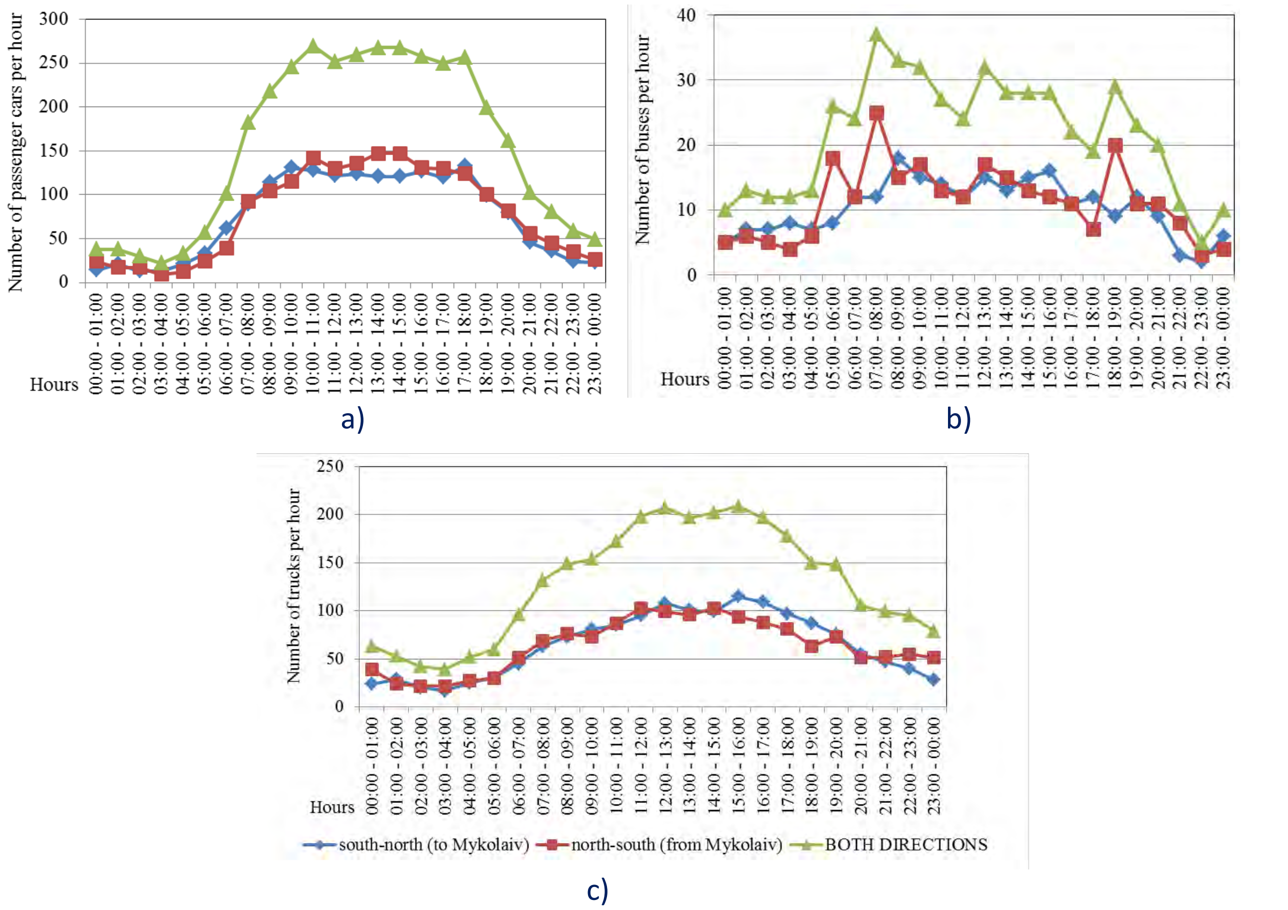


Figure 16 Hourly Fluctuation on the “Road M14 towards Mykolaivske settlement” by Type of Vehicle (average of 2 days): a) passenger cars; b) buses; c) trucks

As regards passenger cars and trucks, no particular peaks were observed for both directions. The peak hour for buses was observed in the morning, at 7:00 a.m.- 9:00 a.m. for both directions while evening peak was observed at 6:00 p.m. - 7:00 p.m. only for southbound traffic (out of Mykolaiv city center).

3.1.6 LOCATION 6 "ROAD M14 ALONG THE CITY PARK POBEDA"

For the survey location 6 "Road M14 along the city park Pobeda" the observed 48-hour traffic volume is summarized in the Table 8. Average daily traffic volume is about 25,000 vehicles. Passenger cars account for 74 % of total traffic volume while buses and trailers account for 13 % and 6 % respectively. The detailed percentage of vehicles by categories is presented on Figure 17.

Table 8 Daily Traffic Volume for the "Road M14 along the city park Pobeda" (24 hour, both directions)

Day	Passenger cars	Buses	2-axle trucks	3+ axle rigid trucks	Semi/full trailers	Total (veh/day)
24.01.2017	18485	3109	2140	117	1515	25366
25.01.2017	18791	3298	1526	128	1514	25257
Ave.	18638	3204	1833	123	1515	25312
Share	73,6 %	12,7 %	7,2 %	0,5 %	6 %	100 %

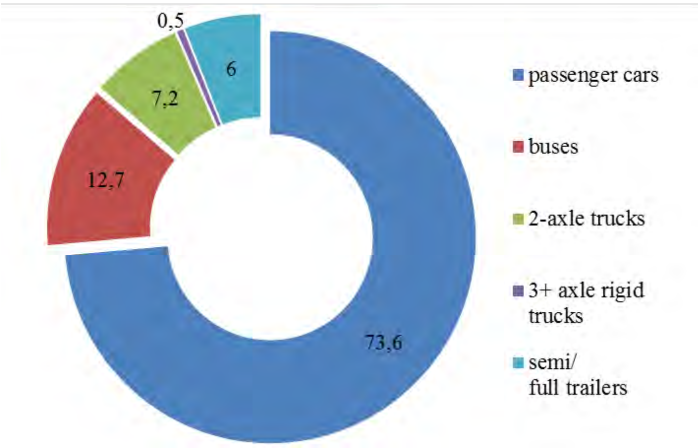
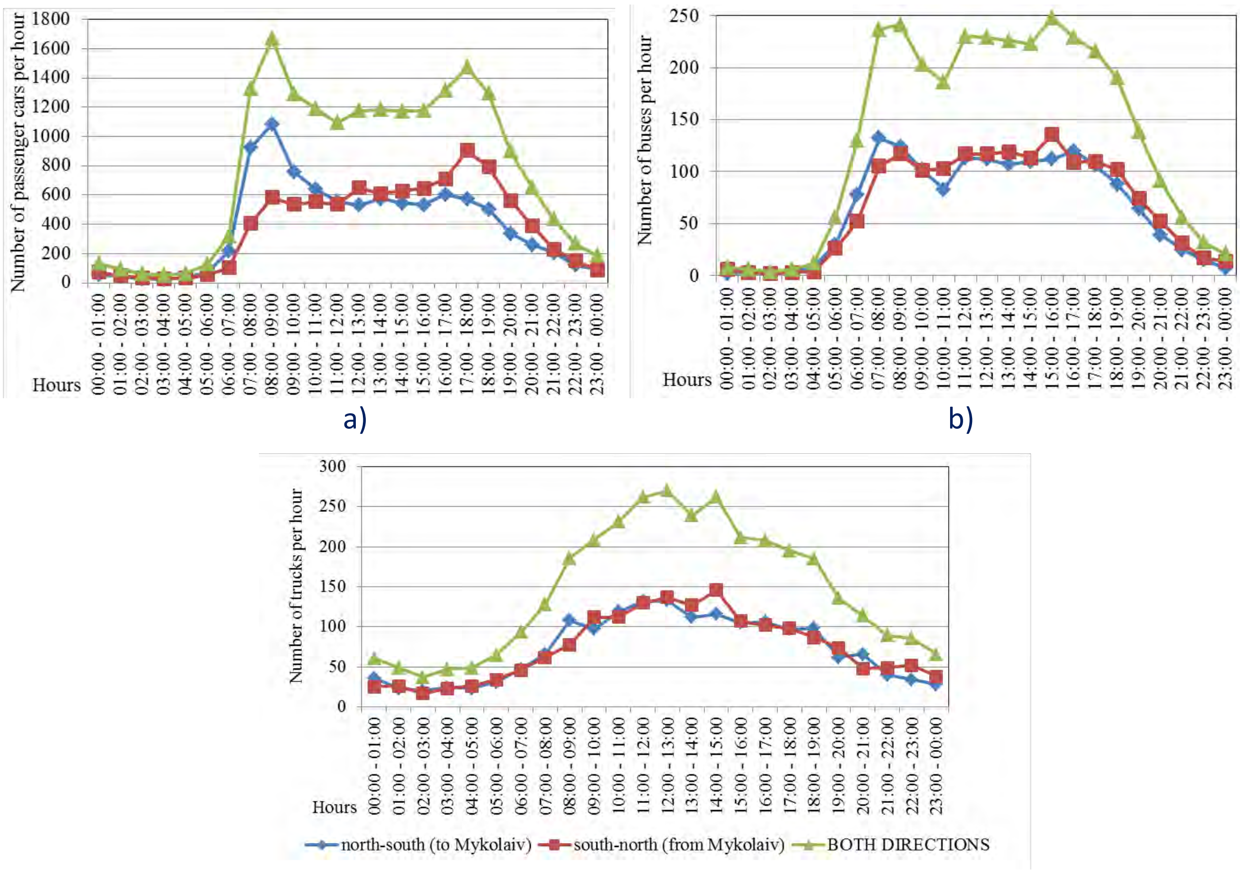


Figure 17 Percentage of vehicles by categories on the "Road M14 along the city park Pobeda"

Hourly fluctuation of traffic volume on the "Road M14 along the city park Pobeda" is shown on Figure 18.



a) b)

c)

Figure 18 Hourly Fluctuation on the "Road M14 along the city park Pobeda" by Type of Vehicle (average of 2 days): a) passenger cars; b) buses; c) trucks

As regards passenger cars, morning peaks (7:00 a.m. - 9:00 a.m.) were observed for southbound traffic (to Mykolaiv city center) while evening peaks (5:00 p.m. - 7:00 p.m.) were observed for northbound traffic (out of Mykolaiv city center). The morning peak hours for buses for southbound traffic were the same as for passenger cars while peak for northbound traffic was observed at 3:00 p.m.- 4:00 p.m. Regarding trucks, the peak was observed only for northbound traffic at 2:00 p.m. - 3:00 p.m.

3.2 OD ANALYSIS OF TRAFFIC PASSING VARVAROVSKYI BRIDGE

The results of RSI were processes and expanded to the number of observed vehicles by category at the point passing Varvarovsky bridge. The detailed matrices for passenger cars, buses, and trucks OD are presented in Annex 5, Annex 6 and Annex 7. The origins and destinations of river crossing traffic is summarized in Figure 19.

More than 40% of passenger car trips and 60% of bus trips occurred within the city of Mykolaiv. A significant passenger car traffic volumes also occur between Mykolaiv and zone 11 (Odessa region and further west) and zone 10 (Ochakov, Yuznyi and Mykolaiv suburb area). Regarding truck volumes the significant amount of traffic runs between zone 11 and zone 6. Zone 11 consists of two sea ports and largest city in the region - Odessa, and zone 6 includes industrial and commercial center Dnipro.

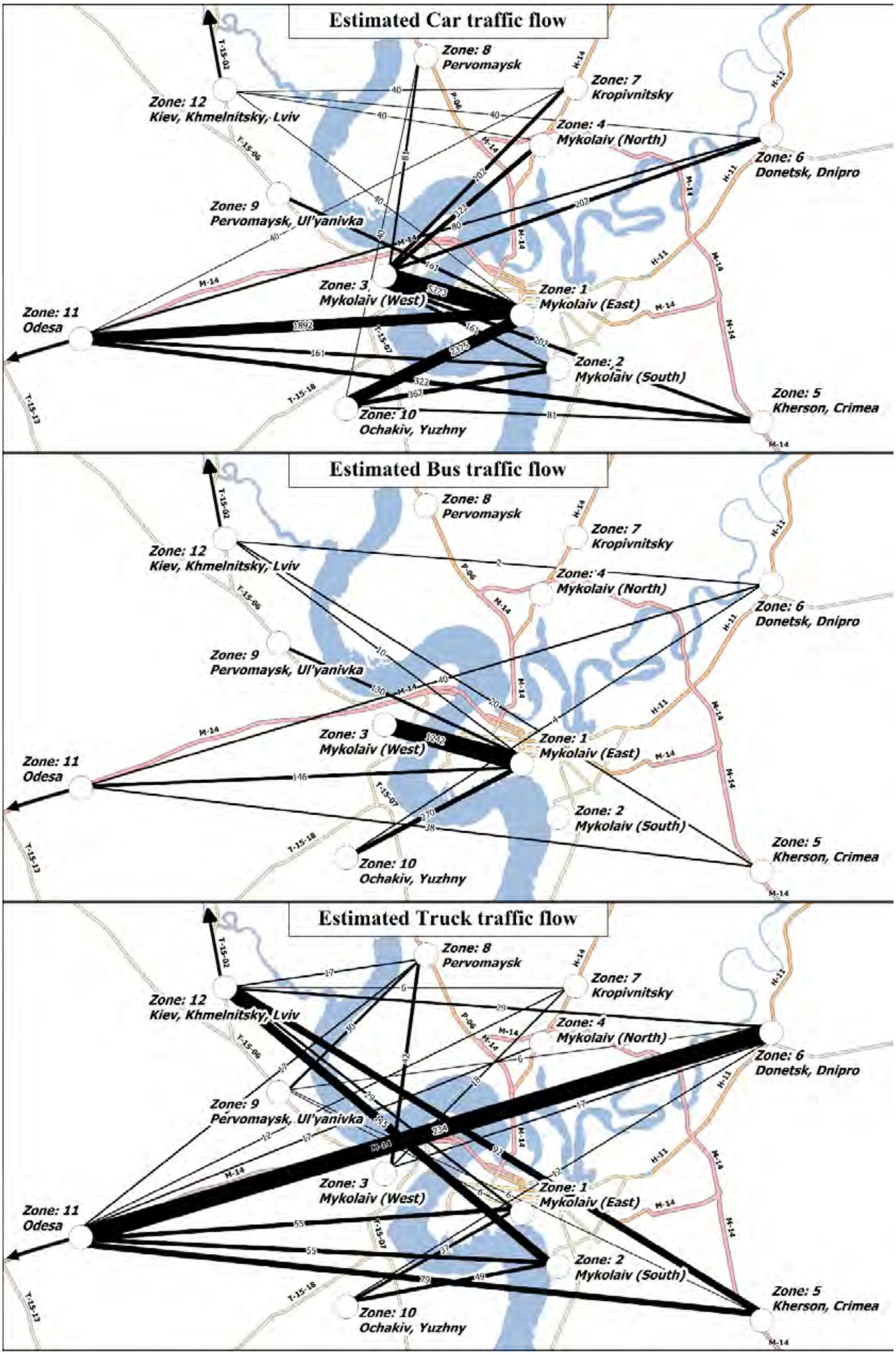


Figure 19 Desire lines by vehicle type

Due to the fact that only loaded vehicles were stopped for the inspection it is impossible to estimate empty and loading truck ratio. However, the number of vehicle stopped for the interview heading eastbound is almost 2.5 times higher than westbound, which corresponds with results of 2010 survey.

The results of survey have shown that as previously the main type of commodity transported through the Varvarovskyi bridge are Unprocessed Agricultural Products, accounting for 50%, Construction materials accounting for 13%, and foodstuff and beverages for 8% of total cargo transported. The westbound cargo volume is bigger for agricultural products. The results are shown in Table 9.

Table 9 Estimated Transported Commodities

	Eastbound	Westbound	Both Directions	Share
Unprocessed Agricultural Products	13999,53	21916,93	35916,46	49,8%
Foodstuffs, Beverages	4400,998	1497,568	5898,566	8,2%
Miscellaneous	2186,858	2629,378	4816,236	6,7%
Construction Materials	5422,934	4238,4	9661,334	13,4%
Steel and other Metal Products	381,41	671,08	1052,49	1,5%
Chemical Products	292,71	247,24	539,95	0,7%
Machinery and Parts	6158,314	3952,444	10110,76	14,0%
Petroleum and Fuels	403,585	0	403,585	0,6%
Minerals (Ores)	780,56	0	780,56	1,1%
Pulp, Paper, and Printed Material	709,6	0	709,6	1,0%
Wood and Timber	1149,552	0	1149,552	1,6%
Other	731,775	353,2	1084,975	1,5%
Total	36617,83	35506,24	72124,07	100,0%

It should be noted that the interviews occurred throughout the year, thus share of agricultural products supposedly is overestimated.

The methodology of estimation and assumptions are presented in Annex 8.

Since the largest amount of truck traffic in Mykolaiv region is carrying the agricultural products is expected that the traffic volumes would be significantly higher if the survey completed during the harvest period. Also, M-14 is an important connection for passenger traffic traveling to the sea area in Mykolaiv and Odessa region. It is expected that passenger car traffic is also significantly higher during summer months. These reasoning was also supported by the RSI conducted during survey.

3.2.1 MISCELLANEOUS DATA

During the miscellaneous data collection, the Avtodor traffic survey data for 2014 and 2016 were obtained. When reviewing the data, it was identified that results of traffic count are presented in the units that are the result of conversion of the real number of vehicles of different categories into the equivalent number of passenger cars. The conversion coefficients by vehicle types were taken from State Building Regulations B.2.3-4-2007 “Vehicular roads” and presented in Table 10.

Table 10 Conversion coefficient by vehicle types

Vehicle type	Conversion coefficient
Passenger car	1
The rigid freight vehicle (truck) with load-carrying capacity	
under 1 ton	1.0
1 - 2 tons	1.5
2 - 6 tons	2.0
6 - 8 tons	2.5
8 - 14 tons	3.0
over 14 tons	3.5
The semi/full trailer with load-carrying capacity	
under 12 tons	3.5
12 - 20 tons	4.0
20 - 30 tons	5.0
over 30 tons	6.0
Bus	3.0

Also, the Avtodor traffic survey data are converted using the conversion coefficients which allow moving from number of vehicles counted during certain day in certain month to number of vehicles during required day in required month or annual average number of vehicles per day. The coefficients which allow moving to the required day and month are based on “Definition of traffic volume on public road by rapid method” to the “Regulations on the road safety audit during operation of public roads” adopted by the order of The Ministry of Infrastructure of Ukraine in 2012. These coefficients are presented in Table 11 and Table 12.

Table 11 Week day coefficients of traffic volume

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Conversion coefficient	1.036	1.029	1.074	1.116	1.122	0.996	0.657

Table 12 Monthly coefficient of traffic volume

Month	1	2	3	4	5	6	7	8	9	10	11	12
Conversion coefficient	1.00	0.92	0.79	1.00	1.26	1.01	0.99	1.02	1.01	0.98	1.03	1.00

In addition to above mentioned the Avtodor traffic survey data are collected under vehicle categories that differ from those used during the survey. The categories used by Avtodor are as follows:

- Passenger vehicles:
  - passenger cars;
- Buses:
  - microbuses (under 20 passengers),
  - medium (20-30 passengers)
  - heavy (over 30 passengers) buses;

- Freight vehicles:
  - light trucks (load-carrying capacity under 2.5 ton);
  - medium trucks (load-carrying capacity 2.5 - 5.0 ton);
  - heavy trucks (load-carrying capacity over 5.0 ton) that are divided into 2-axle and 3 and more axle rigid trucks;
  - semi/full trailers that are differentiated by number of axles on tractor and trailer.

To be comparable to the survey results the traffic volumes for 2014 and 2016 have to be rearranged between vehicle categories and divided by proper conversion factor by vehicle type. The received numbers should be adjusted by week day and month conversion coefficients. The week day and month conversion multipliers were used according to the days and month of the survey. The list of the used coefficients is presented in **Error! Reference source not found.**.

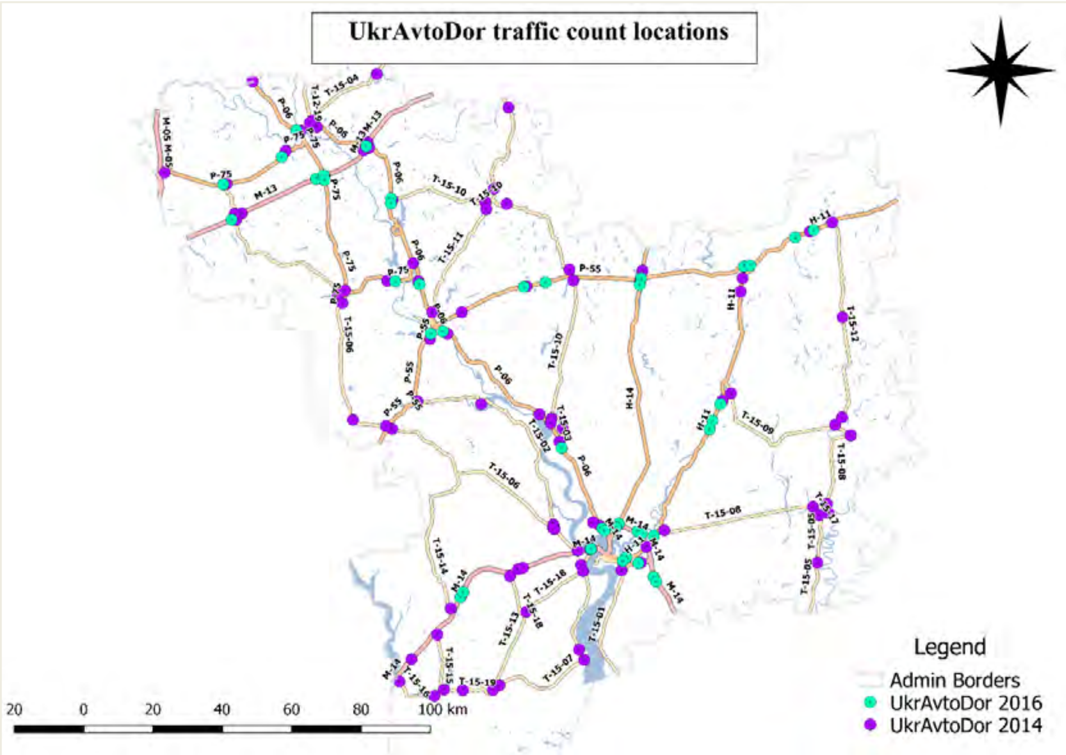


Figure 20 Location of Ukravtodor traffic counts

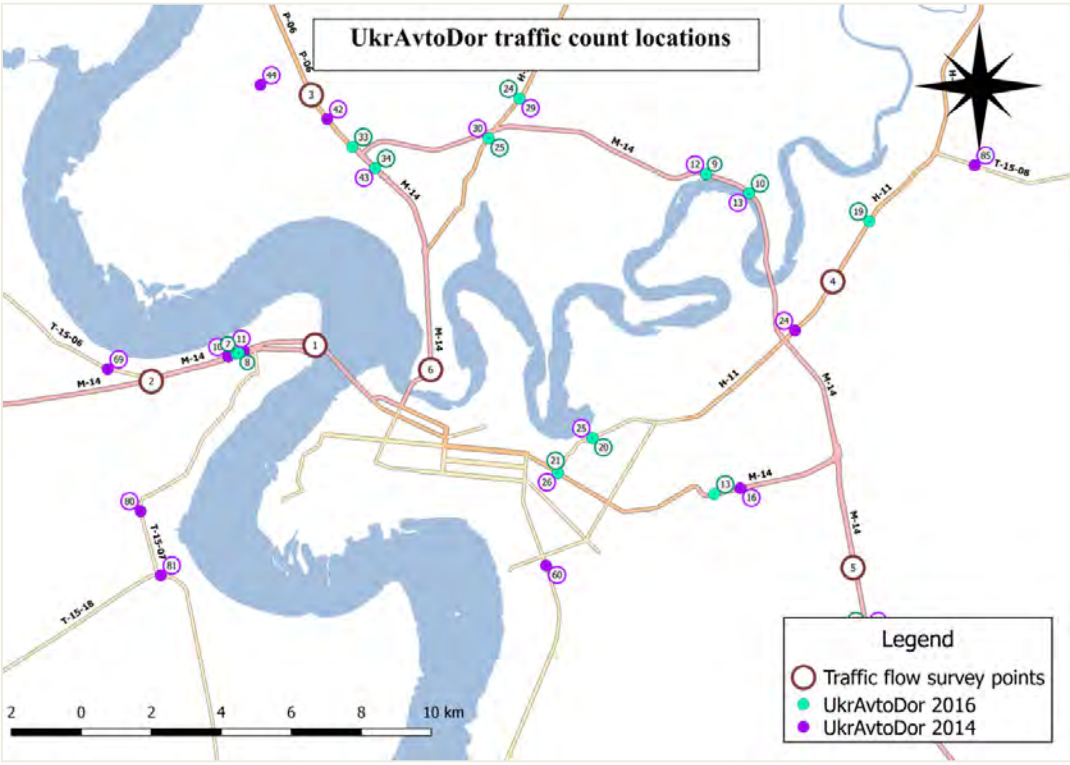
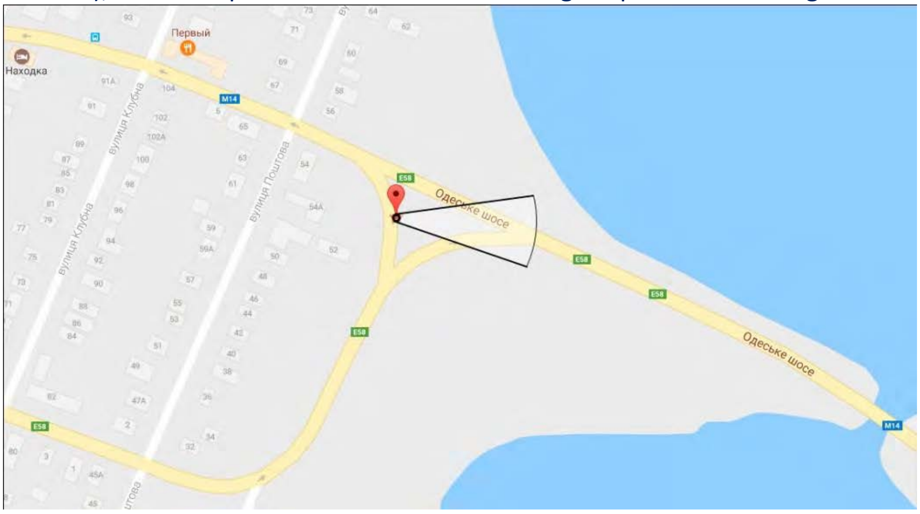


Figure 21 Location of Ukravtodor traffic counts

Annex 1. Documentation of the sites for Traffic Volume Survey

Location 1 – The West End of Varvarovsky bridge

The survey point near the west end of Varvarovsky bridge will be located on the link for changing driving direction between Veselynivska str. and Odesske highway at the coordinates 46°59'29.1"N 31°57'15.9"E (46.991408, 31.954431), see . The photo of the camera coverage is presented on Figure 23.



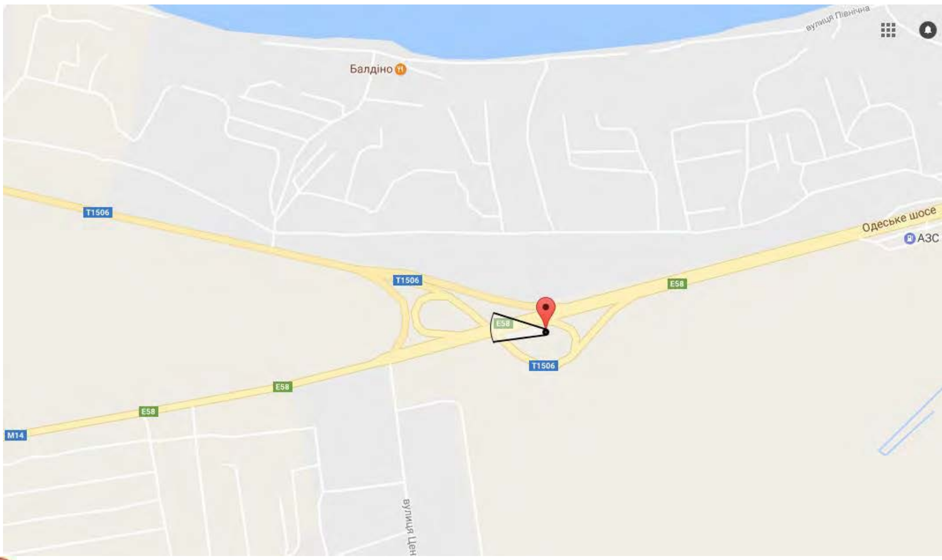
- The Traffic Volume Survey Location 1; - the camera coverage at the point

Figure 22 The Traffic Volume Survey Location 1 and camera coverage

Figure 23 The camera coverage at the Traffic Volume Location 1 (The West End of Varvarovsky bridge)

Location 2 – road M14 towards Polovynky settlement

The survey point on the road M14 towards Polovynky settlement was located at the coordinates 46°58'58.0"N 31°53'36.7"E (46.982770, 31.893523) after the turn on the road T1506, see Figure 24. The photo of the camera coverage is presented on Figure 25.



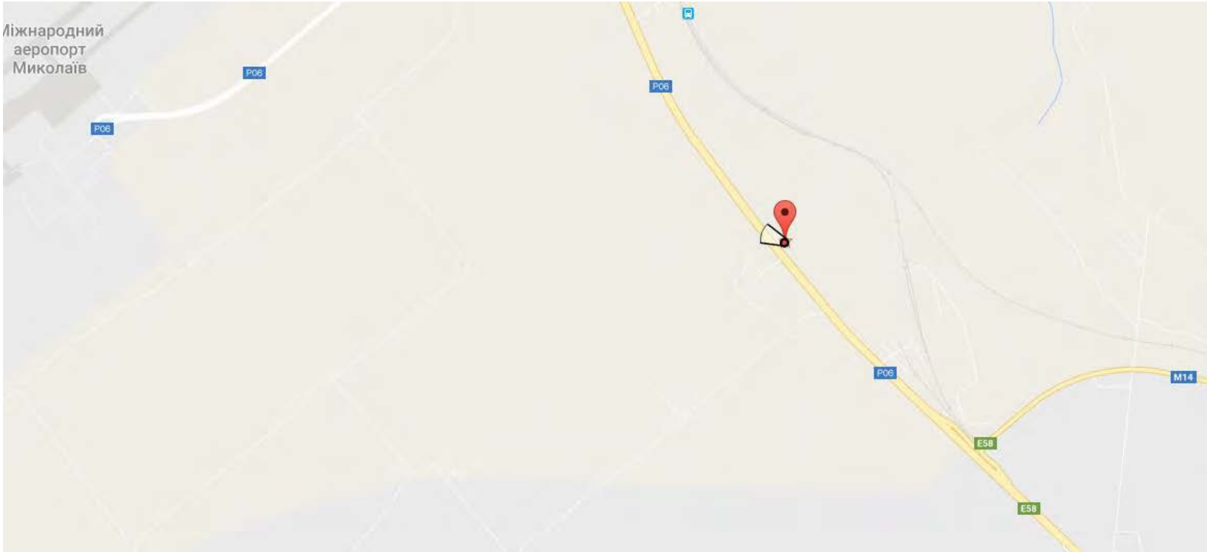
- The Traffic Volume Location 2; - the camera coverage at the point

Figure 24 The Traffic Volume Survey Location 2 and camera coverage

Figure 25 The camera coverage at Traffic Volume Survey Location 2 (road M14 towards Polovynky settlement)

Location 3 – road P06 towards Mykolaiv airport

The survey point on the road P06 towards Mykolaiv airport was located at the coordinates 47°02'55.8"N 31°57'39.5"E (47.048839, 31.960972), see Figure 26. The photo of the camera coverage is presented on Figure 27.



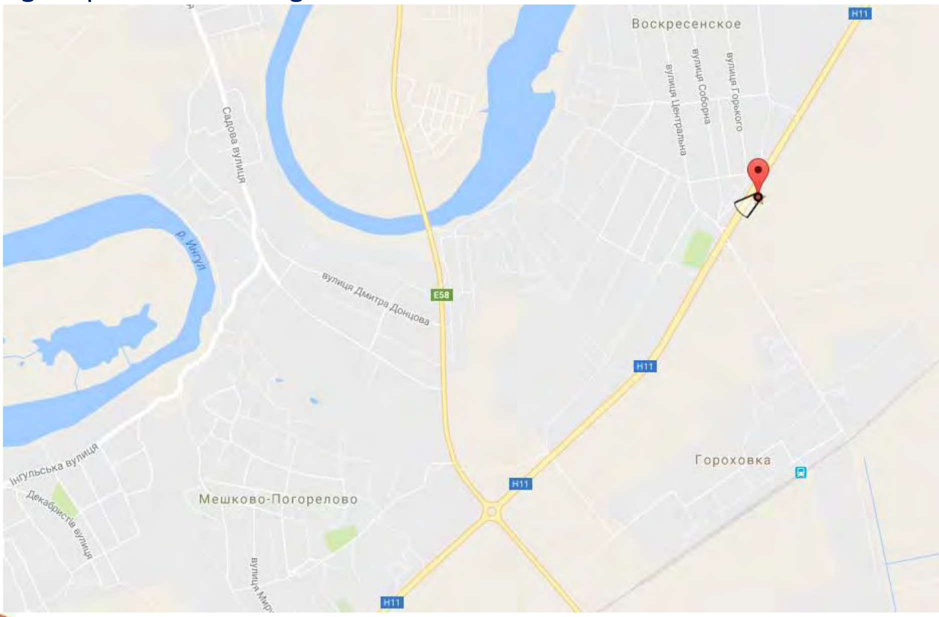
- The Traffic Volume Location 3; - the camera coverage at the point

Figure 26 The Traffic Volume Survey Location 3 and camera coverage

Figure 27 The camera coverage at Traffic Volume Survey Location 3 (road P06 towards Mykolaiv airport)

Location 4 – road H11 towards Voskresenske settlement

The survey point on the road H11 towards Voskresenske settlement was located at the coordinates 47°00'29.9"N 32°09'00.0"E (47.008317, 32.150008), see Figure 28. The photo of the camera coverage is presented on Figure 29.



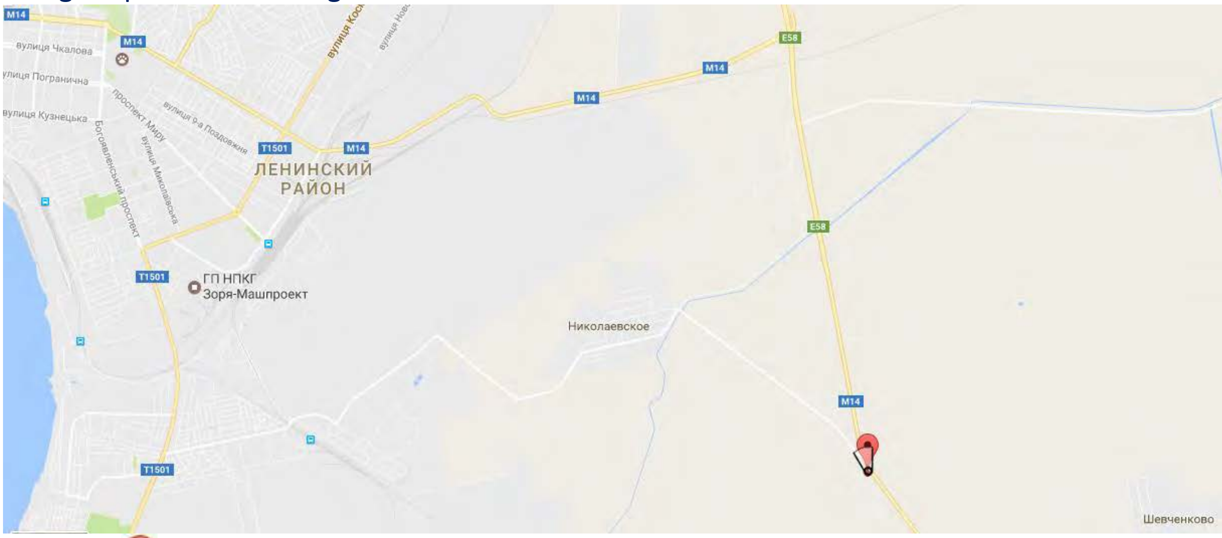
- The Traffic Volume Location 4; - the camera coverage at the point

Figure 28 The Traffic Volume Survey Location 4 and camera coverage

Figure 29 The camera coverage at Traffic Volume Survey Location 4 (road H11 towards Voskresenske settlement)

Location 5 – road M14 towards Mykolaivske settlement

The survey point on the road M14 towards Mykolaivske settlement was located at the coordinates 46°54'41.6"N 32°09'50.9"E (46.911550, 32.164133), see Figure 30. The photo of the camera coverage is presented on Figure 31.



- The Traffic Volume Location 5; - the camera coverage at the point

Figure 30 The Traffic Volume Survey Location 5 and camera coverage

Figure 31 The camera coverage at Traffic Volume Survey Location 5 (road M14 towards Mykolaivske settlement)

Location 6 – road M14 along the city park Pobeda

The survey point on the road M14 along the city park Pobeda was located at the coordinates 46°59'14.3"N 31°59'52.6"E (46.987317, 31.997933), see Figure 32. The photo of the camera coverage with dimensioning on the map is presented on Figure 33.

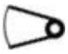
 - The Traffic Volume Location 6;  - the camera coverage at the point

Figure 32 The Traffic Volume Survey Location 6 and camera coverage

Figure 33 The camera coverage at Traffic Volume Survey Location 6 (road M14 along the city park Pobeda)

Annex 2. Traffic Volume Survey Sheet

TRAFFIC VOLUME SURVEY SHEET (КАРТКА ОБСТЕЖЕННЯ ІНТЕНСИВНОСТІ РУХУ ТРАНСПОРТУ)

Name and surname (ПІБ обліковця) ____________________ Date (Дата) __________ Start time (Час початку) _________ End Time (Час закінчення)__________

Survey location (Місце проведення обстеження) ____

Time interval (Період часу)		Traffic direction (Напрямок руху)									
		до Миколаєва (to Mykolaiv)					з Миколаєва (from Mykolaiv)				
		Кількість транспортних засобів за видами (Number of vehicles of each category)									
Start (початок)	End (закінчення)	легкові авто passenger cars	автобуси buses	двовісні вантажівки 2-axle trucks	тривісні вантажівки 3+ axle trucks (rigid)	вантажівки з причепом/напівпричепом semi/full trailers	легкові авто passenger cars	автобуси buses	двовісні вантажівки 2-axle trucks	тривісні вантажівки 3+ axle trucks (rigid)	вантажівки з причепом/напівпричепом semi/full trailers
1.											
2.											
3.											
4.											

Annex 3. A LETTER FROM TRAFFIC POLICE

DEPARTMENT OF TRAFFIC POLICE
TRAFFIC POLICE ADMINISTRATION OF MYKOLAIV OBLAST

04 January 2017 № 119/41/16/01-2017

To Oleksandr Senkevych
The mayor of Mykolayiv

Dear Mr. Senkevych!

Mykolaiv Traffic Police Department processed your letter regarding the possibility of involvement of Traffic Police representatives into and providing assistance for roadside surveys by Japan International Cooperation Agency (JICA).

We inform you, that involvement of Traffic Police to personal participation in roadside survey is "performing other (additional) duty and may be assigned to police only by law". Vehicles could only been stopped by Traffic Police only on the basis of requirements under the Article 35 of Law "On the National Police".

Therefore, Mykolaiv Traffic Police Department gives its consent to conduct traffic intensity survey by Agency as long as it complies with safety, public order and existing legislation requirements.

Best regards,
The Head Maksim Akhrameev

Annex 4. Car RSI survey sheets

Протокол / Survey Sheet

Дата/Date:
Ім'я інтерв'юера/Name of the interviewer:
Номер телефона/Cell number of interviewer:
Напрямок/Direction: ___ south(південь) ___north (північ)
Початок зміни/Survey starting time:

Ref. number	Time Час hh:mm	Тип ТЗ / Vehicle type			Опитуваний / Interviewee		З / Origin		ДО / Destination	
		Personal Car Легковий	Taxi Таксі	Motorcycle Мотоцикл	Driver Водій	Passenger Пасажир	City, Oblast Місто, обл.	Zone Зона	City, Oblast Місто, обл.	Zone Зона
1										
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19										
20										

Кінець зміни/Survey ending time:
Підпис інтерв'юера/Signature of surveyor___________

Annex 5. Estimation of Car OD Matrix

Table 13 Passenger car OD matrix based on RSI

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1			52	1	5	1	3	12	3	51	46		174
2			1							1	3		5
3	79	3		5	3	3	2	2	1	8		2	108
4			3									1	4
5	1		2							2	8		13
6	1		2		1						1		5
7	3										1	1	5
8													0
9	1												1
10	8		3					1					12
11	1		1			1							3
12	1					1							2
Total	95	3	64	6	9	6	5	15	4	62	59	4	332

Table 14 Percentage ratio for each passenger car OD pair

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1			15,7%	0,3%	1,5%	0,3%	0,9%	3,6%	0,9%	15,4%	13,9%		52,41%
2			0,3%							0,3%	0,9%		1,51%
3	23,8%	0,9%		1,5%	0,9%	0,9%	0,6%	0,6%	0,3%	2,4%		0,6%	32,53%
4			0,9%									0,3%	1,20%
5	0,3%		0,6%							0,6%	2,4%		3,92%
6	0,3%		0,6%		0,3%						0,3%		1,51%
7	0,9%										0,3%	0,3%	1,51%
8													0,00%
9	0,3%												0,30%
10	2,4%		0,9%					0,3%					3,61%
11	0,3%		0,3%			0,3%							0,90%
12	0,3%					0,3%							0,60%
Total	28,61%	0,90%	19,28%	1,81%	2,71%	1,81%	1,51%	4,52%	1,20%	18,67%	17,77%	1,20%	100,00%

Table 15 Estimated OD matrix for passenger cars crossing Varvarovskyi bridge

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1			2093	40	201	40	121	483	121	2053	1852		7004
2			40							40	121		201
3	3180	121		201	121	121	81	81	40	322		81	4349
4			121									40	161
5	40		81							81	322		524
6	40		81		40						40		201
7	121										40	40	201
8													0
9	40												40
10	322		121					40					483
11	40		40			40							120
12	40					40							80
Total	3823	121	2577	241	362	241	202	604	161	2496	2375	161	13364

Annex 6. Estimation of Truck OD Matrix

Table 16 OD matrix before adjustments

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	1	0	0	0	0	0	0	0	1	3	0	5
2	0	0	0	0	0	0	0	0	0	0	1	0	1
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	1
5	0	6	0	0	2	0	0	1	0	0	0	0	9
6	1	5	3	0	2	0	0	0	0	0	5	1	17
7	0	1	2	0	1	1	0	2	0	0	0	0	7
8	12	8	5	0	11	7	1	2	2	0	3	1	52
9	1	0	1	0	1	1	0	0	0	0	0	0	4
10	2	3	0	0	0	1	0	0	0	0	2	0	8
11	2	4	0	3	8	13	1	0	1	2	0	0	34
12	4	9	0	0	16	4	1	2	0	0	0	0	36
Total	23	37	11	3	41	27	3	7	3	3	14	2	174

To avoid statistical bias the points with negligible number of observations were joined with neighboring points

Table 17 Adjustment of spatial location

Location IDs before merger	Dummy point	Number of observations
6, 1	I	103
3, 4, 5	II	24
2	III	49

At the next step the correction coefficients were estimated based on equation:

$$A_i = \frac{P_i}{max\{P_j\}}$$

where A_i – correction coefficient for point i

P_i – number of observations in point i

$max\{P_j\}$– maximum number of observations among all points

The result of estimating the correction coefficients are as follows:

$$A_1 = 1.0$$
$$A_2 = 4.29$$
$$A_3 = 2.15$$

Table 18 Adjusted OD matrix

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	4,292	0	0	0	0	0	0	0	2,146	6,438	0	12,876
2	0	0	0	0	0	0	0	0	0	0	2,146	0	2,146
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	1
5	0	22,458	0	0	8,583	0	0	1	0	0	0	0	32,041
6	1	18,167	3	0	2	0	0	0	0	0	12,875	1	38,042
7	0	4,292	3,146	0	1	1	0	5,292	0	0	0	0	14,73
8	12	14,583	7,292	0	18,729	7	1	2	5,292	0	3	1	71,896
9	1	0	2,146	0	1	1	0	0	0	0	0	0	5,146
10	4,292	8,584	0	0	0	2,146	0	0	0	0	4,292	0	19,314
11	3,146	7,438	0	3	13,729	27,896	2,146	0	1	4,292	0	0	62,647
12	5,146	20,021	0	0	16	4	1	2	0	0	0	0	48,167
Total	27,584	99,835	15,584	3	61,041	43,042	4,146	10,292	6,292	6,438	28,751	2	308,005

Table 19 Percentage ratio for each truck OD pair

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0,00%	1,39%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,70%	2,09%	0,00%	4,18%
2	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,70%	0,00%	0,70%
3	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
4	0,32%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,32%
5	0,00%	7,29%	0,00%	0,00%	2,79%	0,00%	0,00%	0,32%	0,00%	0,00%	0,00%	0,00%	10,40%
6	0,32%	5,90%	0,97%	0,00%	0,65%	0,00%	0,00%	0,00%	0,00%	0,00%	4,18%	0,32%	12,35%
7	0,00%	1,39%	1,02%	0,00%	0,32%	0,32%	0,00%	1,72%	0,00%	0,00%	0,00%	0,00%	4,78%
8	3,90%	4,73%	2,37%	0,00%	6,08%	2,27%	0,32%	0,65%	1,72%	0,00%	0,97%	0,32%	23,34%
9	0,32%	0,00%	0,70%	0,00%	0,32%	0,32%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	1,67%
10	1,39%	2,79%	0,00%	0,00%	0,00%	0,70%	0,00%	0,00%	0,00%	0,00%	1,39%	0,00%	6,27%
11	1,02%	2,41%	0,00%	0,97%	4,46%	9,06%	0,70%	0,00%	0,32%	1,39%	0,00%	0,00%	20,34%
12	1,67%	6,50%	0,00%	0,00%	5,19%	1,30%	0,32%	0,65%	0,00%	0,00%	0,00%	0,00%	15,64%
Total	8,96%	32,41%	5,06%	0,97%	19,82%	13,97%	1,35%	3,34%	2,04%	2,09%	9,33%	0,65%	100,00%

Table 20 Estimated OD matrix for trucks crossing Varvarovskyi bridge

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	25	0	0	0	0	0	0	0	12	37	0	74
2	0	0	0	0	0	0	0	0	0	0	12	0	12
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	6	0	0	0	0	0	0	0	0	0	0	0	6
5	0	129	0	0	49	0	0	6	0	0	0	0	184
6	6	104	17	0	11	0	0	0	0	0	74	6	218
7	0	25	18	0	6	6	0	30	0	0	0	0	85
8	69	84	42	0	107	40	6	11	30	0	17	6	412
9	6	0	12	0	6	6	0	0	0	0	0	0	30
10	25	49	0	0	0	12	0	0	0	0	25	0	111
11	18	43	0	17	79	160	12	0	6	25	0	0	360
12	29	115	0	0	92	23	6	11	0	0	0	0	276
Total	159	574	89	17	350	247	24	58	36	37	165	12	1768

Annex 7. Estimation of Bus OD Matrix

Table 21 Bus OD matrix based on RSI

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1			317					19	33	69	37	3	478
2													0
3	317												317
4													0
5						1					9	6	16
6										1	10		11
7													0
8	19												19
9	33												33
10	69					1							70
11	37				10	10							57
12	2				4	1							7
Total	477	0	317	0	14	13	0	19	33	70	56	9	1008

Table 22 Percentage ratio for each bus OD pair

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1			31,45%					1,88%	3,27%	6,85%	3,67%	0,30%	47,42%
2													0,00%
3	31,45%												31,45%
4													0,00%
5						0,10%					0,89%	0,60%	1,59%
6										0,10%	0,99%		1,09%
7													0,00%
8	1,88%												1,88%
9	3,27%												3,27%
10	6,85%					0,10%							6,94%
11	3,67%				0,99%	0,99%							5,65%
12	0,20%				0,40%	0,10%							0,69%
Total	47,32%	0,00%	31,45%	0,00%	1,39%	1,29%	0,00%	1,88%	3,27%	6,94%	5,56%	0,89%	100,00%

Table 23 Estimated OD matrix for buses crossing Varvarovskyi bridge

	1	2	3	4	5	6	7	8	9	10	11	12	Total
1			621					37	65	135	73	6	937
2													0
3	621												621
4													0
5						2					18	12	32
6										2	20		22
7													0
8	37												37
9	65												65
10	135					2							137
11	73				20	20							113
12	4				8	2							14
Total	935	0	621	0	28	26	0	37	65	137	111	18	1978

Annex 8. Estimation of Transported Commodities

Table 24 Observed Transported Commodities

Commodity being transported	Number of vehicles carrying commodity*		Tons carried*		Share, vehicles	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
Unprocessed Agricultural Products	73	71	3032	2889	38,00%	61,00%
Foodstuffs, Beverages	24	5	916	212	13,00%	4,00%
Miscellaneous	11	9	452	335	6,00%	8,00%
Construction Materials	29	14	1182	560	15,00%	12,00%
Steel and other Metal Products	2	2	86	76	1,00%	2,00%
Chemical Products	1	1	33	28	1,00%	1,00%
Machinery and Parts	35	13	1350	529	18,00%	11,00%
Petroleum and Fuels	2	0	91	0	1,00%	0,00%
Minerals (Ores)	3	0	132	0	2,00%	0,00%
Pulp, Paper, and Printed Material	3	0	120	0	2,00%	0,00%
Wood and Timber	5	0	216	0	3,00%	0,00%
Other	4	1	165	40	2,00%	1,00%
Total	192	116	7775	4669	100,00%	100,00%

*The number of vehicles and tonnage was estimated with adjustments for survey locations as explained in Annex 6

The amount of tones carries by type of commodity is estimated as follows:

$$Q_{ij} = V_{ij} \cdot a_{ij} \cdot \gamma_{av}$$

Where V_{ij}= a total volume of commodity i per direction j, tons

a_{ij} = share of vehicles carrying commodity i per direction j, %

γ_{av}= average load, tons

$$\gamma_{av} = \frac{V_{ij}}{n_{ij}}$$

Where n_{ij}= number of vehicles carrying commodity i per direction j, vehicles.

The value estimate on the assumption that all vehicles in traffic are fully loaded, as interviewed ones.

Annex 9. Data Files

Location 1

TRAFFIC VOLUME on Survey location 1 - The West End of Varvarovsky bridge - **HOURLY**

Date	Time interval		Traffic direction									
			west-east (to Mykolaiv)					east-west (from Mykolaiv)				
			Number of vehicles of each category									
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
1/24/2017	0:00	1:00	25	1	7	0	21	35	1	5	1	24
1/24/2017	1:00	2:00	27	2	2	1	18	26	4	10	0	10
1/24/2017	2:00	3:00	20	3	1	0	19	20	5	13	0	10
1/24/2017	3:00	4:00	15	2	10	0	11	15	5	11	0	19
1/24/2017	4:00	5:00	20	5	10	3	7	22	7	25	2	18
1/24/2017	5:00	6:00	58	31	24	0	17	59	19	25	6	14
1/24/2017	6:00	7:00	128	64	49	3	17	110	41	46	3	23
1/24/2017	7:00	8:00	454	76	61	2	20	305	70	66	4	13
1/24/2017	8:00	9:00	646	78	85	2	31	463	72	65	3	32
1/24/2017	9:00	10:00	565	84	30	8	40	475	62	57	6	19
1/24/2017	10:00	11:00	598	59	38	8	36	530	57	48	5	33
1/24/2017	11:00	12:00	499	63	38	7	34	529	74	42	8	53
1/24/2017	12:00	13:00	464	87	47	3	44	434	75	53	4	44
1/24/2017	13:00	14:00	427	76	52	4	40	435	77	40	9	43
1/24/2017	14:00	15:00	450	61	43	9	58	520	62	46	11	55
1/24/2017	15:00	16:00	418	50	44	2	39	469	55	23	6	33
1/24/2017	16:00	17:00	472	70	33	6	58	500	60	40	4	47
1/24/2017	17:00	18:00	446	68	31	1	43	464	63	12	3	56
1/24/2017	18:00	19:00	350	53	19	0	60	445	77	4	1	82
1/24/2017	19:00	20:00	212	47	17	4	44	283	55	9	2	54
1/24/2017	20:00	21:00	150	25	11	2	38	218	28	5	1	41
1/24/2017	21:00	22:00	93	14	14	5	50	148	10	7	0	27
1/24/2017	22:00	23:00	93	8	11	4	41	81	10	5	1	21
1/24/2017	23:00	0:00	78	4	1	2	22	71	3	6	0	21

Total by vehicle category			6708	1031	678	76	808	6657	992	663	80	792
TOTAL per DAY					**9301**					**9184**		
1/25/2017	0:00	1:00	49	3	9	9	26	48	5	9	0	27
1/25/2017	1:00	2:00	32	1	4	1	21	21	2	8	1	16
1/25/2017	2:00	3:00	14	1	4	0	8	31	2	18	0	22
1/25/2017	3:00	4:00	14	1	4	0	7	20	10	20	0	18
1/25/2017	4:00	5:00	19	7	15	0	2	32	3	23	1	17
1/25/2017	5:00	6:00	59	38	21	0	15	53	16	33	0	19
1/25/2017	6:00	7:00	137	62	36	3	31	90	34	31	2	12
1/25/2017	7:00	8:00	469	80	181	2	25	307	52	73	4	18
1/25/2017	8:00	9:00	533	63	57	1	24	426	48	51	5	31
1/25/2017	9:00	10:00	601	75	30	4	39	446	62	55	8	34
1/25/2017	10:00	11:00	547	65	40	5	36	516	57	63	1	48
1/25/2017	11:00	12:00	524	66	38	3	36	492	58	61	6	48
1/25/2017	12:00	13:00	462	60	59	10	60	532	69	42	6	40
1/25/2017	13:00	14:00	420	70	53	5	60	471	73	38	10	46
1/25/2017	14:00	15:00	460	73	38	4	64	529	68	35	6	42
1/25/2017	15:00	16:00	469	72	59	6	31	541	50	31	3	51
1/25/2017	16:00	17:00	462	72	36	5	44	473	65	17	4	52
1/25/2017	17:00	18:00	455	63	29	2	49	402	50	3	0	45
1/25/2017	18:00	19:00	308	64	27	1	49	434	54	11	2	59
1/25/2017	19:00	20:00	229	43	13	1	36	282	51	9	0	55
1/25/2017	20:00	21:00	163	26	7	3	37	217	39	9	1	51
1/25/2017	21:00	22:00	145	16	10	3	34	147	19	8	1	31
1/25/2017	22:00	23:00	92	11	11	0	44	67	5	8	0	23
1/25/2017	23:00	0:00	66	3	15	0	41	54	2	8	1	16
Total by vehicle category			6729	1035	796	68	819	6631	894	664	62	821
TOTAL per DAY					**9447**					**9072**		
AVE Total by vehicle category			**6719**	**1033**	**737**	**72**	**814**	**6644**	**943**	**664**	**71**	**807**
AVERAGE TOTAL per DAY					**9374**					**9128**		

TRAFFIC VOLUME on Survey location 1 - The West End of Varvarovsky bridge – **HOURLY AVERAGE of 2 DAYS**

Date	Time interval	Traffic direction									
		west-east (to Mykolaiv)					east-west (from Mykolaiv)				
		Number of vehicles of each category									
		passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
2 days	00:00 - 01:00	37	2		36		42	3		33	
2 days	01:00 - 02:00	30	2		24		24	3		23	
2 days	02:00 - 03:00	17	2		16		26	4		32	
2 days	03:00 - 04:00	15	2		16		18	8		34	
2 days	04:00 - 05:00	20	6		19		27	5		43	
2 days	05:00 - 06:00	59	35		39		56	18		49	
2 days	06:00 - 07:00	133	63		70		100	38		59	
2 days	07:00 - 08:00	462	78		146		306	61		89	
2 days	08:00 - 09:00	590	71		100		445	60		94	
2 days	09:00 - 10:00	583	80		76		461	62		90	
2 days	10:00 - 11:00	573	62		82		523	57		99	
2 days	11:00 - 12:00	512	65		78		511	66		109	
2 days	12:00 - 13:00	463	74		112		483	72		95	
2 days	13:00 - 14:00	424	73		107		453	75		93	
2 days	14:00 - 15:00	455	67		108		525	65		98	
2 days	15:00 - 16:00	444	61		91		505	53		74	
2 days	16:00 - 17:00	467	71		91		487	63		82	
2 days	17:00 - 18:00	451	66		78		433	57		60	
2 days	18:00 - 19:00	329	59		78		440	66		80	
2 days	19:00 - 20:00	221	45		58		283	53		65	
2 days	20:00 - 21:00	157	26		49		218	34		54	
2 days	21:00 - 22:00	119	15		58		148	15		37	
2 days	22:00 - 23:00	93	10		56		74	8		29	
2 days	23:00 - 00:00	72	4		41		63	3		26	

TRAFFIC VOLUME on Survey location 1 - The West End of Varvarovsky bridge - **BOTH DIRECTIONS HOURLY AVERAGE of 2 DAYS**							
Date	Time interval		Traffic direction Number of vehicles of each category				
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
AVE of 2 days	0:00	1:00	79	5		69	
AVE of 2 days	1:00	2:00	54	5		47	
AVE of 2 days	2:00	3:00	43	6		48	
AVE of 2 days	3:00	4:00	33	10		50	
AVE of 2 days	4:00	5:00	47	11		62	
AVE of 2 days	5:00	6:00	115	53		88	
AVE of 2 days	6:00	7:00	233	101		129	
AVE of 2 days	7:00	8:00	768	139		235	
AVE of 2 days	8:00	9:00	1035	131		194	
AVE of 2 days	9:00	10:00	1044	142		166	
AVE of 2 days	10:00	11:00	1096	119		181	
AVE of 2 days	11:00	12:00	1023	131		187	
AVE of 2 days	12:00	13:00	946	146		207	
AVE of 2 days	13:00	14:00	877	148		200	
AVE of 2 days	14:00	15:00	980	132		206	
AVE of 2 days	15:00	16:00	949	114		165	
AVE of 2 days	16:00	17:00	954	134		173	
AVE of 2 days	17:00	18:00	884	123		138	
AVE of 2 days	18:00	19:00	769	125		158	
AVE of 2 days	19:00	20:00	504	98		123	
AVE of 2 days	20:00	21:00	375	60		103	
AVE of 2 days	21:00	22:00	267	30		95	
AVE of 2 days	22:00	23:00	167	18		85	
AVE of 2 days	23:00	0:00	135	7		67	

BOTH DIRECTIONS TOTAL						Total, veh/day
1/24/2017	13365	2023	1341	156	1600	18485
1/25/2017	13360	1929	1460	130	1640	18519
Ave.	13363	1976	1401	143	1620	18502
Share, %	72.2	10.7	7.6	0.8	8.8	100

LOCATION 2

TRAFFIC VOLUME on Survey location 2 - road M14 towards Polovynky settlement - **HOURLY**

Date	Time interval		Traffic direction: west-east (to Mykolaiv) — Number of vehicles of each category: passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	east-west (from Mykolaiv): passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
1/24/2017	0:00	1:00	11	2	3	1	20	12	7	4	2	23
1/24/2017	1:00	2:00	10	5	0	0	18	6	2	2	0	8
1/24/2017	2:00	3:00	5	6	2	1	21	14	9	4	0	10
1/24/2017	3:00	4:00	10	2	3	0	14	13	6	7	1	14
1/24/2017	4:00	5:00	6	9	5	0	10	13	10	6	4	23
1/24/2017	5:00	6:00	24	10	6	0	8	36	27	20	1	11
1/24/2017	6:00	7:00	63	26	24	4	11	84	30	21	3	24
1/24/2017	7:00	8:00	144	19	26	2	17	96	25	28	4	28
1/24/2017	8:00	9:00	186	41	12	1	22	157	45	27	1	37
1/24/2017	9:00	10:00	200	32	24	10	29	176	27	33	5	18
1/24/2017	10:00	11:00	178	9	23	4	27	161	14	38	4	27
1/24/2017	11:00	12:00	154	13	31	4	33	149	19	34	4	33
1/24/2017	12:00	13:00	147	17	36	6	26	212	32	41	5	41
1/24/2017	13:00	14:00	146	29	39	5	23	222	46	58	3	35
1/24/2017	14:00	15:00	126	23	36	7	51	169	22	56	4	54
1/24/2017	15:00	16:00	150	16	31	2	33	167	18	35	2	31
1/24/2017	16:00	17:00	157	22	27	3	35	165	13	40	1	43
1/24/2017	17:00	18:00	158	20	31	14	19	161	14	13	9	39
1/24/2017	18:00	19:00	121	23	13	14	30	152	7	10	11	36
1/24/2017	19:00	20:00	92	13	14	7	29	96	6	9	11	46
1/24/2017	20:00	21:00	80	18	9	0	35	66	5	11	0	28
1/24/2017	21:00	22:00	49	1	14	0	38	58	0	20	0	28
1/24/2017	22:00	23:00	53	1	7	2	37	36	0	2	0	32
1/24/2017	23:00	0:00	37	1	3	0	23	41	0	3	0	14

Total by vehicle category			2307	358	419	87	609	2462	384	522	75	683
TOTAL per DAY					**3780**					**4126**		
1/25/2017	0:00	1:00	26	0	6	0	15	16	0	5	0	13
1/25/2017	1:00	2:00	8	1	5	0	15	8	2	9	3	17
1/25/2017	2:00	3:00	4	0	4	0	4	15	1	11	0	18
1/25/2017	3:00	4:00	10	1	3	0	9	14	2	16	0	13
1/25/2017	4:00	5:00	10	2	15	1	9	13	3	28	0	16
1/25/2017	5:00	6:00	30	2	16	0	9	25	5	34	1	18
1/25/2017	6:00	7:00	64	11	16	3	8	60	14	44	4	16
1/25/2017	7:00	8:00	122	7	45	1	31	129	10	45	1	13
1/25/2017	8:00	9:00	163	9	44	1	17	148	8	40	1	31
1/25/2017	9:00	10:00	214	11	28	2	34	164	13	39	4	24
1/25/2017	10:00	11:00	180	7	27	3	31	145	13	25	1	28
1/25/2017	11:00	12:00	149	15	24	1	28	137	18	39	1	50
1/25/2017	12:00	13:00	140	11	47	7	48	148	14	34	6	35
1/25/2017	13:00	14:00	168	17	42	3	48	181	12	34	2	37
1/25/2017	14:00	15:00	175	14	49	0	43	185	14	29	3	44
1/25/2017	15:00	16:00	180	17	44	2	37	181	12	51	1	38
1/25/2017	16:00	17:00	172	14	34	7	40	151	16	25	1	48
1/25/2017	17:00	18:00	117	14	28	2	38	170	13	25	7	63
1/25/2017	18:00	19:00	113	11	29	8	55	124	4	16	5	59
1/25/2017	19:00	20:00	93	8	21	0	36	82	0	10	0	48
1/25/2017	20:00	21:00	102	6	20	0	48	67	1	7	0	42
1/25/2017	21:00	22:00	63	2	9	1	36	47	0	5	0	32
1/25/2017	22:00	23:00	33	2	5	0	36	29	0	7	0	17
1/25/2017	23:00	0:00	39	1	12	0	32	22	0	5	0	11
Total by vehicle category			2375	183	573	42	707	2261	175	583	41	731
TOTAL per DAY					**3880**					**3791**		
AVE Total by vehicle category			**2341**	**271**	**496**	**65**	**658**	**2362**	**280**	**553**	**58**	**707**
AVERAGE TOTAL per DAY					**3830**					**3959**		

TRAFFIC VOLUME on Survey location 2 - road M14 towards Polovynky settlement – **HOURLY AVERAGE of 2 DAYS**

Date	Time interval	Traffic direction									
		west-east (to Mykolaiv)					east-west (from Mykolaiv)				
		Number of vehicles of each category									
		passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
2 days	00:00 - 01:00	19	1		23		14	4		24	
2 days	01:00 - 02:00	9	3		19		7	2		20	
2 days	02:00 - 03:00	5	3		16		15	5		22	
2 days	03:00 - 04:00	10	2		15		14	4		26	
2 days	04:00 - 05:00	8	6		20		13	7		39	
2 days	05:00 - 06:00	27	6		20		31	16		43	
2 days	06:00 - 07:00	64	19		33		72	22		56	
2 days	07:00 - 08:00	133	13		61		113	18		60	
2 days	08:00 - 09:00	175	25		49		153	27		69	
2 days	09:00 - 10:00	207	22		64		170	20		62	
2 days	10:00 - 11:00	179	8		58		153	14		62	
2 days	11:00 - 12:00	152	14		61		143	19		81	
2 days	12:00 - 13:00	144	14		85		180	23		81	
2 days	13:00 - 14:00	157	23		80		202	29		85	
2 days	14:00 - 15:00	151	19		93		177	18		95	
2 days	15:00 - 16:00	165	17		75		174	15		79	
2 days	16:00 - 17:00	165	18		73		158	15		79	
2 days	17:00 - 18:00	138	17		66		166	14		78	
2 days	18:00 - 19:00	117	17		75		138	6		69	
2 days	19:00 - 20:00	93	11		54		89	3		62	
2 days	20:00 - 21:00	91	12		56		67	3		44	
2 days	21:00 - 22:00	56	2		49		53	0		43	
2 days	22:00 - 23:00	43	2		44		33	0		29	
2 days	23:00 - 00:00	38	1		35		32	0		17	

TRAFFIC VOLUME on Survey location 2 - road M14 towards Polovynky settlement - **BOTH DIRECTIONS HOURLY AVERAGE of 2 DAYS**							
Date	Time interval		Traffic direction				
			Number of vehicles of each category				
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
AVE of 2 days	0:00	1:00	33	5		47	
AVE of 2 days	1:00	2:00	16	5		39	
AVE of 2 days	2:00	3:00	20	8		38	
AVE of 2 days	3:00	4:00	24	6		41	
AVE of 2 days	4:00	5:00	21	13		59	
AVE of 2 days	5:00	6:00	58	22		63	
AVE of 2 days	6:00	7:00	136	41		89	
AVE of 2 days	7:00	8:00	246	31		121	
AVE of 2 days	8:00	9:00	328	52		118	
AVE of 2 days	9:00	10:00	377	42		126	
AVE of 2 days	10:00	11:00	332	22		120	
AVE of 2 days	11:00	12:00	295	33		142	
AVE of 2 days	12:00	13:00	324	37		166	
AVE of 2 days	13:00	14:00	359	52		165	
AVE of 2 days	14:00	15:00	328	37		188	
AVE of 2 days	15:00	16:00	339	32		154	
AVE of 2 days	16:00	17:00	323	33		152	
AVE of 2 days	17:00	18:00	304	31		144	
AVE of 2 days	18:00	19:00	255	23		144	
AVE of 2 days	19:00	20:00	182	14		116	
AVE of 2 days	20:00	21:00	158	15		100	
AVE of 2 days	21:00	22:00	109	2		92	
AVE of 2 days	22:00	23:00	76	2		73	
AVE of 2 days	23:00	0:00	70	1		52	

BOTH DIRECTIONS TOTAL						Total, veh/day
1/24/2017	4769	742	941	162	1292	7906
1/25/2017	4636	358	1156	83	1438	7671
Ave.	4703	550	1049	123	1365	7789
Share, %	60.4	7.1	13.5	1.6	17.5	100 %

LOCATION 3

TRAFFIC VOLUME on Survey location 3 - road P06 towards Mykolaiv airport - **HOURLY**

Date	Time interval		Traffic direction									
			west-east (to Mykolaiv)					east-west (from Mykolaiv)				
			Number of vehicles of each category									
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
1/24/2017	0:00	1:00	16	2	1	1	9	17	2	3	0	8
1/24/2017	1:00	2:00	19	2	2	0	12	13	1	1	3	12
1/24/2017	2:00	3:00	13	4	1	0	12	9	2	2	0	6
1/24/2017	3:00	4:00	12	1	0	2	11	21	0	8	1	15
1/24/2017	4:00	5:00	11	3	3	1	18	13	0	7	3	23
1/24/2017	5:00	6:00	23	0	12	6	6	29	2	22	5	10
1/24/2017	6:00	7:00	56	9	16	0	32	64	5	28	3	20
1/24/2017	7:00	8:00	154	27	10	3	22	132	28	25	3	27
1/24/2017	8:00	9:00	198	29	13	4	30	174	35	18	2	19
1/24/2017	9:00	10:00	188	29	14	5	27	173	34	17	6	53
1/24/2017	10:00	11:00	149	28	26	5	32	168	28	20	7	30
1/24/2017	11:00	12:00	145	35	20	5	50	154	26	14	4	34
1/24/2017	12:00	13:00	133	24	16	5	44	177	29	15	5	37
1/24/2017	13:00	14:00	119	25	11	0	47	162	32	11	5	37
1/24/2017	14:00	15:00	130	24	16	0	48	157	28	12	3	33
1/24/2017	15:00	16:00	123	25	17	3	35	128	24	15	2	27
1/24/2017	16:00	17:00	205	27	14	2	53	138	25	19	1	46
1/24/2017	17:00	18:00	184	26	11	2	50	135	12	12	0	59
1/24/2017	18:00	19:00	152	4	7	3	65	109	7	7	0	60
1/24/2017	19:00	20:00	99	5	4	3	33	105	5	3	0	28
1/24/2017	20:00	21:00	95	4	3	2	57	65	5	10	2	35
1/24/2017	21:00	22:00	40	5	3	1	21	26	4	0	2	25
1/24/2017	22:00	23:00	51	1	2	0	20	21	4	1	0	27
1/24/2017	23:00	0:00	34	5	5	0	17	13	3	7	2	14

Total by vehicle category			2349	344	227	53	751	2203	341	277	59	685
TOTAL per DAY					**3724**					**3565**		
1/25/2017	0:00	1:00	22	2	9	4	27	12	1	5	3	13
1/25/2017	1:00	2:00	15	1	5	2	15	17	0	2	0	12
1/25/2017	2:00	3:00	14	3	3	1	17	10	3	5	0	13
1/25/2017	3:00	4:00	11	0	8	4	9	22	1	6	0	5
1/25/2017	4:00	5:00	8	2	4	2	16	27	0	11	1	18
1/25/2017	5:00	6:00	23	5	8	2	7	30	5	12	4	5
1/25/2017	6:00	7:00	54	22	5	1	15	66	23	14	1	12
1/25/2017	7:00	8:00	130	23	11	0	21	139	36	11	1	29
1/25/2017	8:00	9:00	198	39	18	3	25	219	29	21	3	36
1/25/2017	9:00	10:00	171	23	13	2	32	172	27	10	10	26
1/25/2017	10:00	11:00	156	20	14	5	59	148	34	16	3	38
1/25/2017	11:00	12:00	140	23	17	9	36	121	22	15	5	32
1/25/2017	12:00	13:00	131	20	16	5	36	144	35	18	6	39
1/25/2017	13:00	14:00	115	19	12	3	29	155	30	15	4	38
1/25/2017	14:00	15:00	153	25	16	4	41	188	17	23	3	34
1/25/2017	15:00	16:00	162	16	38	4	49	138	21	28	5	37
1/25/2017	16:00	17:00	184	17	33	3	32	120	19	17	2	41
1/25/2017	17:00	18:00	149	16	7	1	44	136	21	8	3	49
1/25/2017	18:00	19:00	116	9	4	1	54	97	12	8	3	31
1/25/2017	19:00	20:00	69	8	1	1	42	67	4	0	0	31
1/25/2017	20:00	21:00	64	3	2	1	42	66	1	6	0	31
1/25/2017	21:00	22:00	64	3	0	0	39	25	3	2	1	28
1/25/2017	22:00	23:00	57	0	0	0	27	13	1	1	1	30
1/25/2017	23:00	0:00	25	0	2	0	32	16	1	2	0	22
Total by vehicle category			2231	299	246	58	746	2148	346	256	59	650
TOTAL per DAY					**3580**					**3459**		
AVE Total by vehicle category			**2290**	**322**	**237**	**56**	**749**	**2176**	**344**	**267**	**59**	**668**
AVERAGE TOTAL per DAY					**3652**					**3512**		

TRAFFIC VOLUME on Survey location 3 - road P06 towards Mykolaiv airport – **HOURLY AVERAGE of 2 DAYS**

Date	Time interval	Traffic direction									
		west-east (to Mykolaiv)					east-west (from Mykolaiv)				
		Number of vehicles of each category									
		passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
2 days	00:00 - 01:00	19	2		26		15	2		16	
2 days	01:00 - 02:00	17	2		18		15	1		15	
2 days	02:00 - 03:00	14	4		17		10	3		13	
2 days	03:00 - 04:00	12	1		17		22	1		18	
2 days	04:00 - 05:00	10	3		22		20	0		32	
2 days	05:00 - 06:00	23	3		21		30	4		29	
2 days	06:00 - 07:00	55	16		35		65	14		39	
2 days	07:00 - 08:00	142	25		34		136	32		48	
2 days	08:00 - 09:00	198	34		47		197	32		50	
2 days	09:00 - 10:00	180	26		47		173	31		61	
2 days	10:00 - 11:00	153	24		71		158	31		57	
2 days	11:00 - 12:00	143	29		69		138	24		52	
2 days	12:00 - 13:00	132	22		61		161	32		60	
2 days	13:00 - 14:00	117	22		51		159	31		55	
2 days	14:00 - 15:00	142	25		63		173	23		54	
2 days	15:00 - 16:00	143	21		73		133	23		57	
2 days	16:00 - 17:00	195	22		69		129	22		63	
2 days	17:00 - 18:00	167	21		58		136	17		66	
2 days	18:00 - 19:00	134	7		67		103	10		55	
2 days	19:00 - 20:00	84	7		42		86	5		31	
2 days	20:00 - 21:00	80	4		54		66	3		42	
2 days	21:00 - 22:00	52	4		32		26	4		29	
2 days	22:00 - 23:00	54	1		25		17	3		30	
2 days	23:00 - 00:00	30	3		28		15	2		24	

TRAFFIC VOLUME on Survey location 3 - road P06 towards Mykolaiv airport - **BOTH DIRECTIONS HOURLY AVERAGE of 2 DAYS**							
Date	Time interval		Traffic direction				
			Number of vehicles of each category				
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
AVE of 2 days	0:00	1:00	34	4		42	
AVE of 2 days	1:00	2:00	32	3		33	
AVE of 2 days	2:00	3:00	24	7		30	
AVE of 2 days	3:00	4:00	34	2		35	
AVE of 2 days	4:00	5:00	30	3		54	
AVE of 2 days	5:00	6:00	53	7		50	
AVE of 2 days	6:00	7:00	120	30		74	
AVE of 2 days	7:00	8:00	278	57		82	
AVE of 2 days	8:00	9:00	395	66		97	
AVE of 2 days	9:00	10:00	353	57		108	
AVE of 2 days	10:00	11:00	311	55		128	
AVE of 2 days	11:00	12:00	281	53		121	
AVE of 2 days	12:00	13:00	293	54		121	
AVE of 2 days	13:00	14:00	276	53		106	
AVE of 2 days	14:00	15:00	315	48		117	
AVE of 2 days	15:00	16:00	276	44		130	
AVE of 2 days	16:00	17:00	324	44		132	
AVE of 2 days	17:00	18:00	303	38		124	
AVE of 2 days	18:00	19:00	237	17		122	
AVE of 2 days	19:00	20:00	170	12		73	
AVE of 2 days	20:00	21:00	146	7		96	
AVE of 2 days	21:00	22:00	78	8		61	
AVE of 2 days	22:00	23:00	71	4		55	
AVE of 2 days	23:00	0:00	45	5		52	

BOTH DIRECTIONS TOTAL						Total, veh/day
1/24/2017	4552	685	504	112	1436	7289
1/25/2017	4379	645	502	117	1396	7039
Ave.	4466	665	503	115	1416	7164
Share, %	62.3	9.3	7	1.6	19.8	100

LOCATION 4

TRAFFIC VOLUME on Survey location 4 - road H11 towards Voskresenske settlement - **HOURLY**

Date	Time interval		Traffic direction									
			west-east (to Mykolaiv)					east-west (from Mykolaiv)				
			Number of vehicles of each category									
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
1/24/2017	0:00	1:00	8	0	1	0	3	9	2	0	2	7
1/24/2017	1:00	2:00	4	1	1	0	3	5	0	0	0	1
1/24/2017	2:00	3:00	3	0	0	0	5	3	0	2	0	3
1/24/2017	3:00	4:00	9	5	1	2	3	5	1	0	0	8
1/24/2017	4:00	5:00	9	9	3	1	4	10	1	1	0	7
1/24/2017	5:00	6:00	20	9	8	0	3	15	9	10	0	6
1/24/2017	6:00	7:00	66	19	10	0	5	27	10	18	0	14
1/24/2017	7:00	8:00	178	24	23	0	5	65	14	24	10	9
1/24/2017	8:00	9:00	197	20	30	1	10	104	18	28	5	10
1/24/2017	9:00	10:00	157	13	31	1	4	111	12	43	2	5
1/24/2017	10:00	11:00	132	16	32	1	18	113	13	27	2	18
1/24/2017	11:00	12:00	108	10	28	1	7	91	14	27	3	9
1/24/2017	12:00	13:00	81	12	30	5	18	113	17	38	1	11
1/24/2017	13:00	14:00	87	11	29	2	10	118	11	31	2	7
1/24/2017	14:00	15:00	95	14	35	7	25	115	15	39	2	13
1/24/2017	15:00	16:00	89	16	27	1	10	132	22	32	1	17
1/24/2017	16:00	17:00	109	30	22	1	10	131	26	4	0	14
1/24/2017	17:00	18:00	91	19	8	1	13	127	25	2	4	16
1/24/2017	18:00	19:00	81	10	6	1	11	126	12	3	8	14
1/24/2017	19:00	20:00	55	8	5	2	18	76	14	2	2	15
1/24/2017	20:00	21:00	34	5	4	1	6	40	11	2	3	10
1/24/2017	21:00	22:00	28	3	3	1	13	23	10	0	1	12
1/24/2017	22:00	23:00	17	0	3	0	8	19	3	4	0	15
1/24/2017	23:00	0:00	12	1	3	0	7	12	2	1	2	10

Total by vehicle category			1670	255	343	29	219	1590	262	338	50	251
TOTAL per DAY					**2516**					**2491**		
1/25/2017	0:00	1:00	5	1	0	0	7	10	2	1	0	6
1/25/2017	1:00	2:00	7	1	1	1	13	7	0	1	1	10
1/25/2017	2:00	3:00	4	2	1	1	7	3	0	1	0	5
1/25/2017	3:00	4:00	2	0	3	1	1	0	0	1	0	1
1/25/2017	4:00	5:00	7	4	6	0	0	10	1	4	0	6
1/25/2017	5:00	6:00	6	5	1	0	3	5	1	4	0	5
1/25/2017	6:00	7:00	58	17	6	1	2	30	12	16	0	8
1/25/2017	7:00	8:00	155	29	22	0	6	72	16	26	6	17
1/25/2017	8:00	9:00	198	21	14	0	9	101	17	28	3	14
1/25/2017	9:00	10:00	136	10	28	2	8	91	11	32	6	4
1/25/2017	10:00	11:00	143	10	30	1	13	98	9	23	3	12
1/25/2017	11:00	12:00	105	16	29	0	11	85	9	40	2	10
1/25/2017	12:00	13:00	99	9	21	5	11	116	7	30	0	13
1/25/2017	13:00	14:00	92	12	27	0	8	114	4	26	2	12
1/25/2017	14:00	15:00	88	11	27	1	19	126	15	26	1	12
1/25/2017	15:00	16:00	113	14	35	8	18	133	18	18	3	21
1/25/2017	16:00	17:00	96	17	40	3	16	120	19	14	1	12
1/25/2017	17:00	18:00	110	17	28	4	9	126	25	18	3	11
1/25/2017	18:00	19:00	81	8	8	2	15	98	17	6	1	11
1/25/2017	19:00	20:00	37	4	6	1	11	69	10	6	2	12
1/25/2017	20:00	21:00	39	7	5	2	15	39	9	7	1	11
1/25/2017	21:00	22:00	19	2	4	2	8	38	3	9	2	9
1/25/2017	22:00	23:00	17	1	2	1	6	14	2	5	1	11
1/25/2017	23:00	0:00	10	1	1	0	10	12	2	3	0	7
Total by vehicle category			1627	219	345	36	226	1517	209	345	38	240
TOTAL per DAY					**2453**					**2349**		
AVE Total by vehicle category			**1649**	**237**	**344**	**33**	**223**	**1554**	**236**	**342**	**44**	**246**
AVERAGE TOTAL per DAY					**2485**					**2420**		

TRAFFIC VOLUME on Survey location 4 - road H11 towards Voskresenske settlement – **HOURLY AVERAGE of 2 DAYS**

Date	Time interval	Traffic direction									
		west-east (to Mykolaiv)					east-west (from Mykolaiv)				
		Number of vehicles of each category									
		passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
2 days	00:00 - 01:00	7	1	6			10	2	8		
2 days	01:00 - 02:00	6	1	10			6	0	7		
2 days	02:00 - 03:00	4	1	7			3	0	6		
2 days	03:00 - 04:00	6	3	6			3	1	5		
2 days	04:00 - 05:00	8	7	7			10	1	9		
2 days	05:00 - 06:00	13	7	8			10	5	13		
2 days	06:00 - 07:00	62	18	12			29	11	28		
2 days	07:00 - 08:00	167	27	28			69	15	46		
2 days	08:00 - 09:00	198	21	32			103	18	44		
2 days	09:00 - 10:00	147	12	37			101	12	46		
2 days	10:00 - 11:00	138	13	48			106	11	43		
2 days	11:00 - 12:00	107	13	38			88	12	46		
2 days	12:00 - 13:00	90	11	45			115	12	47		
2 days	13:00 - 14:00	90	12	38			116	8	40		
2 days	14:00 - 15:00	92	13	57			121	15	47		
2 days	15:00 - 16:00	101	15	50			133	20	46		
2 days	16:00 - 17:00	103	24	46			126	23	23		
2 days	17:00 - 18:00	101	18	32			127	25	27		
2 days	18:00 - 19:00	81	9	22			112	15	22		
2 days	19:00 - 20:00	46	6	22			73	12	20		
2 days	20:00 - 21:00	37	6	17			40	10	17		
2 days	21:00 - 22:00	24	3	16			31	7	17		
2 days	22:00 - 23:00	17	1	10			17	3	18		
2 days	23:00 - 00:00	11	1	11			12	2	12		

TRAFFIC VOLUME on Survey location 4 - road H11 towards Voskresenske settlement - **BOTH DIRECTIONS HOURLY AVERAGE of 2 DAYS**							
Date	Time interval		Traffic direction				
			Number of vehicles of each category				
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
AVE of 2 days	0:00	1:00	17	3		14	
AVE of 2 days	1:00	2:00	12	1		17	
AVE of 2 days	2:00	3:00	7	1		13	
AVE of 2 days	3:00	4:00	9	4		11	
AVE of 2 days	4:00	5:00	18	8		16	
AVE of 2 days	5:00	6:00	23	12		21	
AVE of 2 days	6:00	7:00	91	29		40	
AVE of 2 days	7:00	8:00	236	42		74	
AVE of 2 days	8:00	9:00	301	39		76	
AVE of 2 days	9:00	10:00	248	24		83	
AVE of 2 days	10:00	11:00	244	24		91	
AVE of 2 days	11:00	12:00	195	25		84	
AVE of 2 days	12:00	13:00	205	23		92	
AVE of 2 days	13:00	14:00	206	20		78	
AVE of 2 days	14:00	15:00	213	28		104	
AVE of 2 days	15:00	16:00	234	35		96	
AVE of 2 days	16:00	17:00	229	47		69	
AVE of 2 days	17:00	18:00	228	43		59	
AVE of 2 days	18:00	19:00	193	24		44	
AVE of 2 days	19:00	20:00	119	18		42	
AVE of 2 days	20:00	21:00	77	16		34	
AVE of 2 days	21:00	22:00	55	10		33	
AVE of 2 days	22:00	23:00	34	4		28	
AVE of 2 days	23:00	0:00	23	3		23	

BOTH DIRECTIONS TOTAL						Total, veh/day
1/24/2017	3260	517	681	79	470	5007
1/25/2017	3144	428	690	74	466	4802
Ave.	3202	473	686	77	468	4905
Share, %	65.3	9.6	14	1.6	9.5	100 %

LOCATION 5

TRAFFIC VOLUME on Survey location 5 - road M14 towards Mykolaivske settlement - **HOURLY**

Date	Time interval		Traffic direction: west-east (to Mykolaiv) – Number of vehicles of each category: passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	east-west (from Mykolaiv): passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
1/24/2017	0:00	1:00	14	4	2	2	19	16	4	1	4	34
1/24/2017	1:00	2:00	18	7	2	1	13	13	8	2	5	19
1/24/2017	2:00	3:00	8	6	3	1	12	18	5	2	1	19
1/24/2017	3:00	4:00	9	8	2	3	13	6	6	3	0	20
1/24/2017	4:00	5:00	17	8	8	3	12	15	5	5	3	12
1/24/2017	5:00	6:00	34	12	7	4	12	22	26	7	2	18
1/24/2017	6:00	7:00	62	17	12	4	26	34	17	12	5	29
1/24/2017	7:00	8:00	99	18	23	7	25	98	37	21	2	42
1/24/2017	8:00	9:00	116	21	33	4	27	104	17	37	0	41
1/24/2017	9:00	10:00	153	14	49	0	35	129	21	54	2	27
1/24/2017	10:00	11:00	120	16	61	2	38	125	16	38	6	53
1/24/2017	11:00	12:00	147	15	56	1	39	133	19	55	7	51
1/24/2017	12:00	13:00	111	10	50	4	41	148	21	43	4	48
1/24/2017	13:00	14:00	113	12	48	6	55	149	23	36	3	44
1/24/2017	14:00	15:00	132	19	58	4	47	129	12	49	4	50
1/24/2017	15:00	16:00	125	13	66	4	46	113	12	32	4	51
1/24/2017	16:00	17:00	124	10	54	1	53	137	12	48	0	44
1/24/2017	17:00	18:00	125	11	33	2	68	125	7	34	4	46
1/24/2017	18:00	19:00	104	11	26	1	55	96	21	24	0	47
1/24/2017	19:00	20:00	72	12	23	2	49	77	9	14	1	48
1/24/2017	20:00	21:00	48	9	14	6	35	56	14	7	0	38
1/24/2017	21:00	22:00	36	3	10	0	33	53	10	2	2	45
1/24/2017	22:00	23:00	26	2	4	1	32	32	4	5	1	36
1/24/2017	23:00	0:00	26	5	6	1	30	26	3	6	2	42

Total by vehicle category			1839	263	650	64	815	1854	329	537	62	904
TOTAL per DAY					**3631**					**3686**		
1/25/2017	0:00	1:00	14	5	6	1	17	31	5	9	1	28
1/25/2017	1:00	2:00	24	7	6	0	36	20	3	1	1	20
1/25/2017	2:00	3:00	17	7	5	0	19	15	5	2	2	18
1/25/2017	3:00	4:00	16	7	4	1	10	11	2	3	0	17
1/25/2017	4:00	5:00	25	6	7	0	20	8	7	17	0	17
1/25/2017	5:00	6:00	31	3	21	2	14	26	10	17	2	14
1/25/2017	6:00	7:00	62	7	20	2	25	44	7	25	1	29
1/25/2017	7:00	8:00	81	6	45	0	26	86	12	43	0	30
1/25/2017	8:00	9:00	112	15	42	4	35	103	12	30	3	41
1/25/2017	9:00	10:00	108	16	41	4	32	100	12	30	1	31
1/25/2017	10:00	11:00	135	12	32	2	34	159	10	33	4	39
1/25/2017	11:00	12:00	97	9	55	4	35	126	4	34	1	58
1/25/2017	12:00	13:00	137	19	66	5	49	124	13	54	1	47
1/25/2017	13:00	14:00	128	13	42	4	47	145	7	51	4	53
1/25/2017	14:00	15:00	110	10	48	1	40	164	14	41	4	57
1/25/2017	15:00	16:00	129	19	49	3	62	148	12	46	6	49
1/25/2017	16:00	17:00	115	11	37	3	69	123	10	37	2	44
1/25/2017	17:00	18:00	141	13	28	1	61	122	7	29	1	47
1/25/2017	18:00	19:00	93	7	32	1	58	104	19	10	1	44
1/25/2017	19:00	20:00	87	12	24	2	50	86	13	15	2	65
1/25/2017	20:00	21:00	44	9	11	2	42	55	7	12	1	43
1/25/2017	21:00	22:00	36	3	6	0	44	37	5	9	0	45
1/25/2017	22:00	23:00	22	2	5	2	36	37	2	6	0	61
1/25/2017	23:00	0:00	19	7	6	0	13	26	5	4	0	47
Total by vehicle category			1783	225	638	44	874	1900	203	558	38	944
TOTAL per DAY					**3564**					**3643**		
AVE Total by vehicle category			**1811**	**244**	**644**	**54**	**845**	**1877**	**266**	**548**	**50**	**924**
AVERAGE TOTAL per DAY					**3598**					**3665**		

TRAFFIC VOLUME on Survey location 5 - road M14 towards Mykolaivske settlement – **HOURLY AVERAGE of 2 DAYS**

Date	Time interval	Traffic direction									
		west-east (to Mykolaiv)					east-west (from Mykolaiv)				
		Number of vehicles of each category									
		passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
2 days	00:00 - 01:00	14	5	24			24	5	39		
2 days	01:00 - 02:00	21	7	29			17	6	24		
2 days	02:00 - 03:00	13	7	20			17	5	22		
2 days	03:00 - 04:00	13	8	17			9	4	22		
2 days	04:00 - 05:00	21	7	25			12	6	27		
2 days	05:00 - 06:00	33	8	30			24	18	30		
2 days	06:00 - 07:00	62	12	45			39	12	51		
2 days	07:00 - 08:00	90	12	63			92	25	69		
2 days	08:00 - 09:00	114	18	73			104	15	76		
2 days	09:00 - 10:00	131	15	81			115	17	73		
2 days	10:00 - 11:00	128	14	85			142	13	87		
2 days	11:00 - 12:00	122	12	95			130	12	103		
2 days	12:00 - 13:00	124	15	108			136	17	99		
2 days	13:00 - 14:00	121	13	101			147	15	96		
2 days	14:00 - 15:00	121	15	99			147	13	103		
2 days	15:00 - 16:00	127	16	115			131	12	94		
2 days	16:00 - 17:00	120	11	109			130	11	88		
2 days	17:00 - 18:00	133	12	97			124	7	81		
2 days	18:00 - 19:00	99	9	87			100	20	63		
2 days	19:00 - 20:00	80	12	75			82	11	73		
2 days	20:00 - 21:00	46	9	55			56	11	51		
2 days	21:00 - 22:00	36	3	47			45	8	52		
2 days	22:00 - 23:00	24	2	40			35	3	55		
2 days	23:00 - 00:00	23	6	28			26	4	51		

TRAFFIC VOLUME on Survey location 5 - road M14 towards Mykolaivske settlement - **BOTH DIRECTIONS HOURLY AVERAGE of 2 DAYS**							
Date	Time interval		Traffic direction				
			Number of vehicles of each category				
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
AVE of 2 days	0:00	1:00	38	10		63	
AVE of 2 days	1:00	2:00	38	13		53	
AVE of 2 days	2:00	3:00	30	12		42	
AVE of 2 days	3:00	4:00	22	12		39	
AVE of 2 days	4:00	5:00	33	13		52	
AVE of 2 days	5:00	6:00	57	26		60	
AVE of 2 days	6:00	7:00	101	24		96	
AVE of 2 days	7:00	8:00	182	37		132	
AVE of 2 days	8:00	9:00	218	33		149	
AVE of 2 days	9:00	10:00	246	32		154	
AVE of 2 days	10:00	11:00	270	27		172	
AVE of 2 days	11:00	12:00	252	24		198	
AVE of 2 days	12:00	13:00	260	32		207	
AVE of 2 days	13:00	14:00	268	28		197	
AVE of 2 days	14:00	15:00	268	28		202	
AVE of 2 days	15:00	16:00	258	28		209	
AVE of 2 days	16:00	17:00	250	22		197	
AVE of 2 days	17:00	18:00	257	19		178	
AVE of 2 days	18:00	19:00	199	29		150	
AVE of 2 days	19:00	20:00	162	23		148	
AVE of 2 days	20:00	21:00	102	20		106	
AVE of 2 days	21:00	22:00	81	11		99	
AVE of 2 days	22:00	23:00	59	5		95	
AVE of 2 days	23:00	0:00	49	10		79	

BOTH DIRECTIONS TOTAL						Total, veh/day
1/24/2017	3693	592	1187	126	1719	7317
1/25/2017	3683	428	1196	82	1818	7207
Ave.	3688	510	1192	104	1769	7262
Share, %	50.8	7	16.4	1.4	24.4	100

LOCATION 6

TRAFFIC VOLUME on Survey location 6 - road M14 along the city park Pobeda - **HOURLY**

Date	Time interval		Traffic direction									
			west-east (to Mykolaiv)					east-west (from Mykolaiv)				
			Number of vehicles of each category									
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
1/24/2017	0:00	1:00	60	2	3	0	27	70	4	1	0	20
1/24/2017	1:00	2:00	41	1	4	0	8	49	2	2	0	21
1/24/2017	2:00	3:00	27	1	5	0	12	36	2	4	0	17
1/24/2017	3:00	4:00	20	1	10	1	18	28	3	5	0	26
1/24/2017	4:00	5:00	41	9	11	1	18	20	2	11	0	13
1/24/2017	5:00	6:00	69	30	22	0	10	61	28	17	0	16
1/24/2017	6:00	7:00	200	77	30	3	19	105	46	22	1	23
1/24/2017	7:00	8:00	947	130	73	1	21	408	108	55	5	18
1/24/2017	8:00	9:00	1061	118	110	10	32	511	119	67	2	25
1/24/2017	9:00	10:00	725	97	86	5	32	528	97	99	5	32
1/24/2017	10:00	11:00	608	73	99	5	38	530	97	107	6	43
1/24/2017	11:00	12:00	572	93	111	8	37	551	93	85	8	43
1/24/2017	12:00	13:00	531	81	108	3	53	644	90	120	2	31
1/24/2017	13:00	14:00	557	82	82	2	32	605	91	95	6	31
1/24/2017	14:00	15:00	551	89	78	4	51	619	95	106	6	41
1/24/2017	15:00	16:00	533	93	68	5	38	662	126	82	0	35
1/24/2017	16:00	17:00	612	142	49	5	45	685	130	41	2	56
1/24/2017	17:00	18:00	564	121	30	3	56	898	135	39	3	47
1/24/2017	18:00	19:00	511	99	30	0	76	809	113	26	5	48
1/24/2017	19:00	20:00	320	66	23	2	36	574	81	30	2	44
1/24/2017	20:00	21:00	264	54	19	0	45	386	64	14	2	27
1/24/2017	21:00	22:00	207	29	11	0	21	211	35	14	1	34
1/24/2017	22:00	23:00	128	17	7	0	24	165	20	12	2	45
1/24/2017	23:00	0:00	106	8	13	0	10	75	15	4	1	20

Total by vehicle category			9255	1513	1082	58	759	9230	1596	1058	59	756
TOTAL per DAY					**12667**					**12699**		
1/25/2017	0:00	1:00	53	2	10	0	32	78	7	6	0	22
1/25/2017	1:00	2:00	47	4	9	1	23	50	3	5	1	23
1/25/2017	2:00	3:00	28	2	6	0	17	31	2	4	0	8
1/25/2017	3:00	4:00	26	4	5	0	14	30	3	5	0	9
1/25/2017	4:00	5:00	24	6	6	1	9	39	6	10	1	16
1/25/2017	5:00	6:00	70	29	17	1	11	50	24	18	0	17
1/25/2017	6:00	7:00	227	78	25	1	15	100	58	26	0	19
1/25/2017	7:00	8:00	892	134	16	1	20	404	101	21	3	22
1/25/2017	8:00	9:00	1107	130	33	6	24	656	115	34	6	22
1/25/2017	9:00	10:00	788	106	30	5	36	543	104	41	4	43
1/25/2017	10:00	11:00	670	92	45	10	41	575	108	33	7	28
1/25/2017	11:00	12:00	540	132	63	4	40	523	141	77	6	41
1/25/2017	12:00	13:00	526	143	67	4	30	651	143	72	6	43
1/25/2017	13:00	14:00	590	131	63	6	39	613	147	79	4	39
1/25/2017	14:00	15:00	541	130	56	5	38	635	130	80	10	49
1/25/2017	15:00	16:00	535	131	51	6	42	626	145	61	2	34
1/25/2017	16:00	17:00	594	97	55	8	50	739	87	56	3	46
1/25/2017	17:00	18:00	576	91	54	0	50	907	84	56	1	49
1/25/2017	18:00	19:00	494	76	43	0	46	773	90	46	0	48
1/25/2017	19:00	20:00	354	61	21	1	41	550	66	33	0	39
1/25/2017	20:00	21:00	258	23	16	0	52	392	39	18	0	35
1/25/2017	21:00	22:00	205	21	13	1	34	246	27	7	2	39
1/25/2017	22:00	23:00	109	12	11	0	26	135	14	10	0	34
1/25/2017	23:00	0:00	88	6	6	1	26	103	13	7	10	33
Total by vehicle category			9342	1641	721	62	756	9449	1657	805	66	758
TOTAL per DAY					**12522**					**12735**		
AVE Total by vehicle category			**9299**	**1577**	**902**	**60**	**758**	**9340**	**1627**	**932**	**63**	**757**
AVERAGE TOTAL per DAY					**12595**					**12717**		

TRAFFIC VOLUME on Survey location 6 - road M14 along the city park Pobeda – **HOURLY AVERAGE of 2 DAYS**

Date	Time interval	Traffic direction									
		west-east (to Mykolaiv)					east-west (from Mykolaiv)				
		Number of vehicles of each category									
		passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers	passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
2 days	00:00 - 01:00	57	2	36			74	6	25		
2 days	01:00 - 02:00	44	3	23			50	3	26		
2 days	02:00 - 03:00	28	2	20			34	2	17		
2 days	03:00 - 04:00	23	3	24			29	3	23		
2 days	04:00 - 05:00	33	8	23			30	4	26		
2 days	05:00 - 06:00	70	30	31			56	26	34		
2 days	06:00 - 07:00	214	78	47			103	52	46		
2 days	07:00 - 08:00	920	132	66			406	105	62		
2 days	08:00 - 09:00	1084	124	108			584	117	78		
2 days	09:00 - 10:00	757	102	97			536	101	112		
2 days	10:00 - 11:00	639	83	119			553	103	112		
2 days	11:00 - 12:00	556	113	132			537	117	130		
2 days	12:00 - 13:00	529	112	133			648	117	137		
2 days	13:00 - 14:00	574	107	112			609	119	127		
2 days	14:00 - 15:00	546	110	116			627	113	146		
2 days	15:00 - 16:00	534	112	105			644	136	107		
2 days	16:00 - 17:00	603	120	106			712	109	102		
2 days	17:00 - 18:00	570	106	97			903	110	98		
2 days	18:00 - 19:00	503	88	98			791	102	87		
2 days	19:00 - 20:00	337	64	62			562	74	74		
2 days	20:00 - 21:00	261	39	66			389	52	48		
2 days	21:00 - 22:00	206	25	40			229	31	49		
2 days	22:00 - 23:00	119	15	34			150	17	52		
2 days	23:00 - 00:00	97	7	28			89	14	38		

TRAFFIC VOLUME on Survey location 6 - road M14 along the city park Pobeda - **BOTH DIRECTIONS HOURLY AVERAGE of 2 DAYS**							
Date	Time interval		Traffic direction				
			Number of vehicles of each category				
			passenger cars	buses	2-axle trucks	3+ axle rigid trucks	semi/ full trailers
AVE of 2 days	0:00	1:00	131	8		61	
AVE of 2 days	1:00	2:00	94	6		49	
AVE of 2 days	2:00	3:00	62	4		37	
AVE of 2 days	3:00	4:00	52	6		47	
AVE of 2 days	4:00	5:00	63	12		49	
AVE of 2 days	5:00	6:00	126	56		65	
AVE of 2 days	6:00	7:00	317	130		93	
AVE of 2 days	7:00	8:00	1326	237		128	
AVE of 2 days	8:00	9:00	1668	241		186	
AVE of 2 days	9:00	10:00	1293	203		209	
AVE of 2 days	10:00	11:00	1192	186		231	
AVE of 2 days	11:00	12:00	1093	230		262	
AVE of 2 days	12:00	13:00	1177	229		270	
AVE of 2 days	13:00	14:00	1183	226		239	
AVE of 2 days	14:00	15:00	1173	223		262	
AVE of 2 days	15:00	16:00	1178	248		212	
AVE of 2 days	16:00	17:00	1315	229		208	
AVE of 2 days	17:00	18:00	1473	216		195	
AVE of 2 days	18:00	19:00	1294	190		185	
AVE of 2 days	19:00	20:00	899	138		136	
AVE of 2 days	20:00	21:00	650	91		114	
AVE of 2 days	21:00	22:00	435	56		89	
AVE of 2 days	22:00	23:00	269	32		86	
AVE of 2 days	23:00	0:00	186	21		66	

BOTH DIRECTIONS TOTAL						Total, veh/day
1/24/2017	18485	3109	2140	117	1515	25366
1/25/2017	18791	3298	1526	128	1514	25257
Ave.	18638	3204	1833	123	1515	25312
Share, %	73.6	12.7	7.2	0.5	6	100

Appendix 8-I: Seminar on the Japanese Logistics and Transport Technologies

The "JICA Seminar on the Japanese Logistics and Transport Technologies" was held on 21st February, 2017 at the Ministry of Infrastructure of Ukraine in Kiev. The program for the seminar is as shown below.

Time	Presentation	Presenter
9:30–10:00	Start of Reception (Morning Coffee)	
10:00–10:10 (3 min × 3)	Opening Remarks	Japan International Cooperation Agency Embassy of Japan in Ukraine Ministry of Infrastructure of Ukraine
10:10–10:20	Keynote Speech "Transport Sector Policy"	Ministry of Infrastructure of Ukraine
10:20–10:40	Presentation of Interim Report (Road & Bridge) Q&A	JICA Survey Team
10:40–11:00	Presentation on Japanese Technology (Road) Q&A	JICA Survey Team
11:00–11:10	Coffee Break	
11:10–12:00	Presentation on Japanese Technology (Bridge) Company Presentation Q&A	JICA Survey Team IHI Infrastructure Systems
12:00–13:00	Lunch Break	
13:00–13:20	Presentation of Interim Report (Seaport) Q&A	JICA Survey Team
13:20–14:00	Presentation on Japanese Technology (Seaport) Q&A	JICA Survey Team
14:00–15:00	Presentation on Japanese Technology (IT Application on Transport Infrastructure) Company Presentations Q&A	JICA Survey Team NEC, Panasonic
15:00–16:00	Q&A / Discussion / Afternoon Coffee	

Participants from the Ukrainian side include:

- Ministry of Infrastructure of Ukraine
  - Deputy Minister for European Integration
  - Deputy Director, Head of the Division of European Integration and Technical Assistance, Department for International Cooperation
  - Chief Specialist of Programs and Project Managements, Department of Strategic Development of Road Transport Market
  - Director, Department of Sea and River Transport
  - Chief Specialist, Department of Sea and River Transport
  - Head of Infrastructure Development and Investment
- Ministry of Regional Development, Construction and Housing Communal Services of Ukraine
  - Chief Specialist of the Department for Cooperation with Authorities and Analytical Work
  - Chief Specialist of European Integration of Department on International Cooperation and Cooperation with International Financial Organizations

- Chief Specialist of International Projects of Department on International Cooperation and Cooperation with International Financial Organizations

- Ministry of Economic Development and Trade
  - Chief Specialist of Cooperation with International Financial Institutions
  - Representative
- Ministry of Agrarian Policy and Food of Ukraine
  - Head of Marketing Department
- Ukravtodor
  - Acting Deputy Chairman
  - Director of the Department of the Development of Road
  - Head of Department of Artificial Structures on Road Network Development
  - Deputy Head of Investment Policy and International Relations
- Ukrainian Sea Ports Authority
  - Head of Department of Strategic Development
- Port of Yuzhny
  - Acting Director
  - Head of Department of Infrastructure and Development
- Port of Odessa
  - Deputy Director
- Port of Kherson
  - Acting Director
- Port of Olvia
- Mykolaiv City Council
  - Director, Mykolaiv Development Agency
  - Project Coordinator, Mykolaiv Development Agency
- Mykolaiv Road Agency
  - Deputy Head of Economic and Administrative Affairs
  - Acting Road Service Chief in the Mykolaiv Region
- Yuzhny City Council
  - Advisor to the Mayor
- Marine Search and Rescue Service
  - Deputy Director - Secretary of the State Coordinating Committee
  - Head of Communication Service
  - Head of Cooperation with Institutions on Issues of the Enterprise Activity
  - Specialist of International Department
- State Hydrographic Service of Ukraine
  - Chief specialist of the International Department
- State Enterprise Ukrvodshlyakh
  - Head
  - Deputy Head
- State Enterprise ChornomorNDIproekt
  - Deputy Head of Technical Department
- State Enterprise DerzhdorNDI
  - Director
  - Head of Department Rationing of Road Networks

- Institute Kyivdniprotrans
  - Deputy Director – Chief Engineer Institute
  - Head of Technical Department
  - Head of Production Planning Department
- Institute Ukrdorproekt
  - Director
  - General Director
- Interproekt Ltd.
  - Director
  - Chief Engineer
- Yevrodorinzhproekt Ltd
  - Director
- Soyuztransproekt Ltd.
  - General Director
- Mostoproekt LLC
  - Director

Participants from the Japanese side include:

- Embassy of Japan in Ukraine;
- Japan International Cooperation Agency (Europe Division, Middle East and Europe Department);
- JICA Survey Team;
- IHI Infrastructure Systems;
- Panasonic;
- NEC; and
- Other Japanese firms.