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1. Oversize transport market analysis

1.1. Introduction

The oversize cargo is transported mostly by road, because it is treated as the cheapest way and the most flexible mean of transportation. Even though road transport encounters difficulties, arising from infrastructure and law limitations.

New technological approach and the globalization implies new technologies, like transport of the whole complete production lines, so called “projects” where the whole compact production line or its part is being transported in the assembled form. After road/rail/maritime/inland shipping transport, projects are installed readymade in previously designated places accessible to the means of transport. Choice of transport means and route is generally very limited by parameters of cargo. The transport availability of production and delivery places are crucial as well.

Furthermore, some huge elements as transformers, turbines generators are also being transported by all available means of transport. Construction of wind farms cannot be exercised without oversize transport, since most of components of one wind turbine exceed standard dimension.

Road transport of oversize units (constructions, machinery) produces considerable problems. This is due to the ongoing infrastructural expansion and renovations of roads, which result in the necessity to deviate from the assumed route. Another problem is connected with trees and shrubs that grow along the roads and hinder oversize movement.

There is not precise, and the only unique definition of the oversize cargo. This is due to the multiplicity of forms which that kind of cargo has, including heavy lifts, overwide, overhigh units and cargo, which exceeds axle load. Their parameters differ from each other, which effects in the multiplicity of means of transport engaged in the oversize transport. Sometimes even specially designed to transport a particular type of oversize cargo. There are also special handling installations (terminals, factory sites, ports and docks) for oversize transport.

It could be said, that in all cases “oversize” determinants are:

1) cargo dimensions,
2) cargo weight,
3) available cargo space on the vehicle,
4) permissible pressure and stress on the loading surface,
5) permissible stress on surface of road/rails.

Additional important element is the shape of the cargo, because its irregular geometry could negatively affect static and dynamic stability of the vehicle. In every case handling, stowage and securing of such cargo must be done under the supervision of the surveyors, proper calculations should be made prior, and necessary permits and certificates should be obtained. All appropriate rules, i.a. issued by the International Maritime Organization, the Road Administration or Rail Administration, should be strictly respected.

Below are oversize cargo definitions in the different modes of transport: road, rail, inland shipping, sea and air transport.

In road transport oversize cargo exceeds maximal permitted parameters of standard road vehicle or exceeds permissible axle load of the vehicle. In consequence, there are oversize
vehicles instead of oversize cargoes (Fig. 1 and 2).

Fig. 1. Tank unloading 1100 m³

Fig. 2. Silo transport

In rail transport oversize cargo exceeds standard loading gauge or exceeds permissible axle load of the railway. Such a situation is called extraordinary delivery, which means, such transport can cause difficulties in rail transport and it is necessary to take special technical and/or operating actions (Fig. 3 and 4).

Fig. 3. Transport of machine unit for refinery by company C.Hartwig – Katowice JSC.

Fig. 4. Unloading 330 ton generator from wagon type NORCA by company Metalchem Serwis Ltd.

In inland shipping oversize cargo is cargo, that overcomes the vessel’s length or/and width or which overcomes the standard air draft of the vessel (vertical clearness of bridges, gates etc.). It is taken under consideration the restricted visibility of the helmsman as well (Fig. 5).

Fig. 5. Transport of 2 pressure reactors with diameter 5,80m for Szczecin-Schwedt refinery

In the sea transport the oversize cargo is defined as: break bulk or general cargo unit, which overcome the parameters of standard cargo units. It means, it weights hundreds or even
thousands of tons and its dimensions is counted in tens or even hundreds of meters.

The example of such oversize cargo could be the oil rig, heavy crane, whole ship hull, ship’s sections, yachts, turbines, transformers, wind turbine blades, yachts, etc. (Fig. 6, 7).

![Fig.6. Transport of the oil rig](image1)

![Fig.7. Transport of the damaged warship](image2)

In air transport oversize cargo is such cargo, which cannot be located in air container or on special consolidation unit. The only way to transport it is to use the special transport airplane, e.g. Antonov An 225 or L382 Hercules type (Fig. 8).

![Fig.8. Antonov An-225 loading](image3)

In intermodal transport, oversize cargo is the cargo, that exceeds the average permissible parameters of means of transport in terms of size, shape, or/and permissible pressure and stress on the loading surface of minimum one mean of transport.

1.2. Polish oversize transport market

In Poland road transport is the most common mode for oversize cargo. It plays the important role in special deliveries on short and middle distances. The advantage of the road transport is relatively fast carriage and direct delivery to the buyer/receiver/contractor.

The following criteria are to be fulfilled for oversize cargo transported by road:

1) alternative means of transport, i.e. rail, ship or barge, cannot be used.
2) cargo is not dividable and cannot be transported by standard vehicles with standard axle load and dimensions, 
3) the permit for transit from the appropriate road administration was received, 
4) road traffic on the designated route enables the save oversize cargo transport, 
5) oversize transit will not difficult the standard road traffic on the long stretch of the route and do not compromise road safety, 
6) technical condition of the road infrastructure objects within the designated route, determined under the provisions of the building law, permits oversize transport, 
7) passage causes no danger to the technical condition of the other constructions located in the vicinity of the transit route, 
8) there is possibility to designate the transit route, that enable safety and road transport effectiveness. 

Worrisome is the fact, that increase of oversize transport in Poland is mostly connected with road transport. It brings fewer safety and more burdensome for society and natural environment. According to the data of the General Directorate for National Roads and Motorways, Division in Szczecin, there were about 1000 permits for transit issued in 2007, 1100 in 2008 and 1300 in 2009. In contrast, PKP Polish Railway Lines Company, Rail Traffic Management Branch in Szczecin, recorded only 28 deliveries in the last three years that widely exceeded gauge and axle load, needed special train and/or rail infrastructure components dismantling or rail traffic suspension.

1.2.1. Description of oversize cargo

1.2.1.1. Oversize cargo in road transport

In Poland, road transport law regulations don’t concern cargo, but so-called "non-normative" vehicles, it means vehicles, that exceed maximal accepted dimensions or weight. According to "Road traffic law", a non-normative vehicle is the vehicle or combination of vehicles, which axle load, with or without cargo, exceeds permissible limits. Polish regulations are consistent with European law in this regard, especially with Directive96/53:

1) maximum acceptable vehicle length: 
   – motor vehicle or trailer -12,00 m, 
   – articulated vehicle - 16,50 m, 
   – road train - 18,75 m. 
2) maximum acceptable vehicle width: 
   – all vehicles - 2,55 m, 
   – superstructure of refrigerated vehicles - 2,60 m. 
3) maximum acceptable vehicle height - 4,00 m. 
4) maximum acceptable vehicle mass: 
   – road trains or articulated vehicles – 40 t, 
   – articulated vehicles loaded with 40-feet containers– 44 t.

There is not any official statistic showing what sorts of cargo is transported by non-normative vehicles. According to carriers’ information the most common are: 

– wind turbines (windmills), 
– steel structures (building and for shipyard), 
– construction machinery, 
– agricultural machinery, 
– industrial equipment (generators, transformer, production lines components)
dutch houses,
tanks.

1.2.1.2. Oversize cargo in rail transport
In rail transport oversize cargo is treated as “extraordinary delivery”, which means, such transport can cause difficulties in rail transport. Therefore, it is necessary and to maintain special technical-operating conditions, taking into consideration:

1) cargo's shape, size and weight,
2) way of loading, stowing and securing it on the wagon,
3) transport means to be used,
4) transit route.

Extraordinary deliveries are divided into extraordinary deliveries in national and international transport directions.

1.2.1.3. Oversize cargo in inland shipping
In inland shipping oversize cargo is divided into two types.

1) 1st type of oversize cargo includes:
   Ships, which at least one parameter is inconsistent with requirements given in appropriate regulations on shipping on inland waterways, that means:
   – length, width, height of the highest indivisible part of a ship, draught, speed of a ship/combination of ships, are not corresponding with operating parameters of waterway, on which oversize transport is planned,
   – ships’ maximum dimensions, the highest number of ships lashed together and either pushed or pulled by tugs, the permissible draught in relation to the transit depth, the permissible speed on the waterway, are not corresponding with requirements described in local law regulations,

2) 2nd type of oversize cargo includes:
   – cargo protrudes from ships’ hold and exceed permissible height, taking into consideration the highest indivisible part of the ship, the infrastructural parameters of the waterway (bridge vertical clearance, lock gates) and helmsman’s limited visibility,
   – cargo protrudes beyond the horizontal outline of the ship.

1.2.1.4. Oversize cargo in maritime transport
Oversize cargoes, often described as “heavy lifts”, are those measured from tens to hundreds of meters and weight hundreds or even thousands of tons. Some of extra large oversize units are being transported on special, unique ships, built on purpose.

The example of such is the Semi Submersible ship (SEMI). The floating oversize cargo (on barge or by itself) is positioned on deck which is flooded and submerged underwater. When the ballast is pumped out, the deck comes up and oversize cargo remains on dry deck. Such system of loading is named Flo-Flo. Apart of the SEMI ships, to carry the oversize cargoes, there are also semisubmersible pontoons, standard pontoons and barges, or even classical ships.

The oversize cargo could be loaded by heavy crane (floating or shore ) with load capacity from 100 to 2000 tons and over. That system of loading is named Lo-Lo.

The shape of the oversize often exceeds the dimension of the carrier which must be carefully taken into account when passing narrows.
In every case, during loading and the sea passage, it should be taken into account following safety factors:
1) distribution of the mass of the cargo,
2) centre of gravity and centre of inertia of mass,
3) transverse moments,
4) torsion and vibration,
5) stability of the loaded ship.

1.2.1.5. Oversize cargo in air transport

In air transport oversize cargo can’t be transported by liner plane, in standard air container or air consolidation pallet, and that is the reason it has to be transported by airplane type Antonov An 225, L-382 Hercules. In air transport cargo dimensions are limited by the size of the hold.

1.2.2. Procedures for issuing oversize transport permits

1.2.2.1. Permits in road transport

General Directorate for National Roads and Motorways and Directors of Customs are responsible for issuing permits for carriers and forwarder transporting oversize cargo. The permits include:
1) permit for single transit of oversize vehicle in appointed time (no longer than 7 days) and route, issued by the General Directorate for National Roads and Motorways,
2) permit for single transit in appointed time (72 hours) for oversize vehicle crossing the Polish border, issued by the Customs Director, for vehicles satisfying minimum one of following conditions:
   – height, total mass are normative,
   – total width doesn’t exceed 3 m,
   – total length exceeds permissible value not more than 2 m,
   – axle loads exceed permissible value not more than 15 %.

Carriers and forwarders contact authority, which is issuing the permit, by telephone, fax or e-mail. Application is usually available on the website. Fulfilled and signed application can be send by fax or e-mail and original paper can be delivered afterwards. There is application generator available on the internet website of the General Directorate for National Roads and Motorways, Central Department in Warsaw (www.gddkia.gov.pl), which is also available in German and English. Usually customers prefer to get the permit personally, because they are in a hurry, but there is possibility to send it by post at the expense of the applicant.

Application to get permit for oversize cargo transit has to include:
1) name and address of the entrepreneur and the person acting on behalf of him,
2) term and addresses of the beginning and the end of transit, and in case if transport starts or ends outside borders of the country - the place of border crossing,
3) type of cargo and its total weight.
4) unladen vehicle data: brand, registration number, weight, permissible cargo capacity, number of axles and number of wheels on every axle (in case of combined transport, this data is given separately for motor vehicle and trailer),
5) dimensions and total weight of single vehicle/road train with and without cargo,
6) wheel base and each axle load of laden vehicle,
7) scheme of cargo stowing on the vehicle/trailer.
There are no corridors dedicated for oversize vehicles and every time transit route is agreed with road directors of community, region, voivodship and divisions of GDDKiA. Transit route is appointed on the principle "the shortest way that fulfills requirements on width, accessible load per axel/axles". Most of the time, if it is possible, the applicant’s wishes are met. Sometimes the shortest distance between two waypoints is to be elongated due to the obstructions on the shortest planned route. If detour is enforced, not rarely, three times longer distance has to be worked out.

If road transport of one cargo unit is impossible, it is suggested to divide it or to change the mean of transport. Practically no refusal is observed, because applications are fulfilled after phone conference and customer knows beforehand if the transport operation could be done. Frequently, preplanning of the route is needed so the carries analyze the chances for the best passage. In some extreme cases, the additional expertise for permissible pressure on the road surface is to be done at the expense of an applicant.

According to the regulations, the maximum period for issuing the permit is 30 days, but practically the administration needs not more than two weeks. In some cases the permit is issued in 2 days. Issuance fee is established by a special computer program, which is used in the General Directorate for National Roads and Motorways. The longer route and the greater dimension excess the more expensive issuance fee is. Maximum price could be over 10.000 PLN.

1.2.2.2. Permits in rail transport

Decision on oversize transport, called extraordinary delivery, if there are technical and operational possibilities, is made by rail infrastructure managing institution, PKP Polish Railway Lines Company S.A. The decision is usually made within 30 days and is containing conditions given by all appropriate PKP Polish Railway Lines Company Local Departments.

1.2.2.3. Permits in inland water transport

In regulations for shipping on inland waterways is described, that oversize carriages in inland shipping are special deliveries, which can take place only on the base of permit. It is issued, upon request of shipowner, by the Inland Navigation Office appropriate for the place of the beginning of the route. For every special transport requirements for ship’s crew should be given. The crew members has to comply with the appropriate requirements of shipping regulations and requirements on professional qualification.

Special transit routes in inland shipping are identified in the application submitted to the Inland Navigation Office appropriate for the place of the beginning of the route. Before issuing the permit, the administration checks shipowner proposal taking into consideration shipping traffic safety. Eventually, if it is possible, route is optimally adapted to the operating parameters of the ship/combination of ships and to parameters of the waterway.

Documents needed to apply for the permit are enlisted below:
1) valid navigability certification,
2) ship’s dimensions,
3) cargo stowing and securing plan and information about ship’s stability,
4) the watertight test for the hulls transported from the shipyard.

The official period to obtain permit for inland shipping oversize transport is 2 weeks, in practice:
- the Inland Navigation Office in Wroclaw – 3-7 days,
the Inland Navigation Office in Szczecin – without delay if the permit requires an inspection of the vessel and the inspector cannot perform it on the day of application - then 2-3 days.

The period of validity of the permit - a permit is issued depending on the length of the route planned for the boat and the final date is given always in considerable extension. The weather conditions, the state of water, possible delay due to break downs of facilities are always taken into consideration.

1.2.3. Description of the relevant service providers

Organisation of oversize transport is practically done by specialized transport companies, forwarders and logistics companies. Many companies from TSL branch operate on the Polish market, but not everyone offers oversize transport service.

1.2.3.1. Road transport

State institutions engaged in road oversize transport include:

- General Directorate for National Roads and Motorways (Generalna Dyrekcja Dróg Krajowych i Autostrad - GDDKiA) – administration of main roads and highways, issuing permits for oversize vehicles; central division of the GDDKiA in Warsaw is responsible for servicing foreigners.
- Road Transport Inspection (Inspekcja Transportu Drogowego - ITD) - state authority, which started its activities in 2002 and is responsible for control of vehicles with a weight above 3.5 tonnes, as well as drivers and freight, and administration of any penalties.
- Police - is the central organ of government, competent in matters of protection of human security and the maintenance of public order and security; Police executes control, prosecution and punishment of both all vehicles and drivers; Additionally, the police offers escort for the oversize transport.

On the Polish market is a few dozen specialized companies offering oversize road transport appearing as a carrier and/or freight forwarder.

1.2.3.2. Rail transport

State institution engaged in rail oversize transport is PKP Polish Railway Lines Company S.A. (PKP Polskie Linie Kolejowe S.A. – PKP PLK), which is responsible for rail infrastructure, including administration and maintenance. PKP PLK issues permits for railway carriers transporting oversize cargoes. Among the rail carriers, should be mentioned:

- PKP CARGO S.A. continues the tradition of the former monopolist PKP and still has the largest share of oversize transport on the Polish market. The company has its own rolling stock meeting specific technical requirements of extraordinary cargoes.
- STK S.A. - is a licensed rail carrier in rail transport services, including transport of the extraordinary oversize and extremely heavy deliveries.

1.2.3.3. Inland waterway transport

State institution engaged in inland shipping oversize transport is the Inland Navigation Office (Urząd Żeglugi Śródlądowej - UŻŚ), which is administrating waterways and inland shipping traffic. The institution issues permits for shipowners transporting oversize cargoes/ships. The following companies are experienced in inland shipping transport of oversize cargo: ODRATRANS SA, Navigar Deneko Garbień Sp.j., Odra Lloyd Ltd.
1.2.3.4. Maritime transport

Polish owners do not operate any specialised ships for heavy lifts. However the oversize cargoes are incidentally carried on board, mostly as deck cargo. Polish forwarding companies as Morska Agencja Gdynia Sp. z o.o., C.Hartwig Szczecin, C.Hartwig Gdynia and Rhenus Port Logistic S.A cooperate with owners specialized in oversize cargoes transport.

The oversize cargo operations in Polish ports, are provided by the stevedore companies, i.a. DB Port Szczecin Sp. z o.o. and Port Gdański Eksplotacja.

1.2.3.5. Air transport

The biggest share in the air transport of all goods has Airlines Group LOT, which executes more than 50% of transport. The British company Chapman - Freeborn has a base located at the airport Szczecin-Goleniów. The company uses standard airplanes and AN-225 when extraordinary heavy cargoes are transported.

1.3. Infrastructure of oversize transport

1.3.1. Road transport

Road transport infrastructure, which is used by oversize cargo carriers, is divided into:

– linear infrastructure – roads,
– point infrastructure- road junctions, logistic centres, transhipment points, parking places, service stations, etc.

The main infrastructural obstacles in oversize transport aspect in road transport are:

– bridges,
– overpass,
– the small values of radius of curves and bends of the roads,
– the breadth of the roads,
– technical condition of the road surface,
– objects situated directly by the road or in the communication row,
– inadequate road standard against the axle load requirements (max. 11,5 t/axle),
– traction, power or telephone lanes crossing the road above,

Fig. 9. Road infrastructure of allowable axle load of 10 and 11,5 tonnes
In Poland, there are detailed regulations for transport on public roads, depending on technical conditions of roads and the permissible axle load, including propulsion, non-propulsion and component axle (Tab. 1).

Table 1. Permissible propulsion axle load on public roads

<table>
<thead>
<tr>
<th>Type of the road:</th>
<th>Permissible axle load [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>District and local road</td>
<td>80</td>
</tr>
<tr>
<td>Voivodeship road</td>
<td>100</td>
</tr>
<tr>
<td>Highway, express road, national roads</td>
<td>115</td>
</tr>
</tbody>
</table>

There are three types of tractors used for oversize road transport:

1) fifth wheel tractor- together with semitrailer make an articulated vehicles,
2) ballast tractor - slow-speed tractor used to tow trailers of a special construction,
3) semitrailer towing ballast tractor - highly specialized vehicles, which could haul six 40-ton trailers, so they can tow road train of total mass up to 250 tons.

The below mentioned trailers are used for oversize road transport:

1) standard trailer - mostly three-axle semitrailer of 13,6 m length and 1,35-1,40 m height of a platform, without curtain and sides; used for the transport of cargo units up to 25 tons, 15 m long, 7 m wide and 2,8 m high; there are semi-sliding trailers, which could be extended up to 21 m;
2) long trailers- with more axles, which could be extended even up to 45 m, with load capacity depending on the number of axles, up to 50 ton;
3) low platform trailer - often three-axles, used to carry loads up to 3,5 m thanks to platform height 0,75-1,05 m; there are also sliding options;
4) heavy low platform trailer - used for transport cargo up to 100 tons, the trailer has 4-8 axles and hydraulic or pneumatic suspension;
5) flush trailer – its platform is located at a height of 0.3-0.6 m above the road surface, there are also sliding options;
6) tank trailer - look like flush trailer, but instead of platform it has two external beams, between which the tanks can be located; it is equipped with pneumatic or hydraulic suspension and independent steering axles.
7) modular trailer - is made up of 2-4 axles modules, which can be assembled forming the multi-axle-road trailer distributing axle load; used for transport cargo up to 200 tons.
1.3.2. Rail transport

When planning a special delivery of rail transport, the following limitations of infrastructure have to be considered:

- loading gauge, building gauge,
- pressure per one meter of rail,
- radius of rail curves,
- permissible load on bridges and overpasses.

Safe transport of oversized cargo by rail requires to take into consideration: the permissible values of the wheels pressure on the rails, extreme curve arc, side inclination of rail track, load capacity of bridges and overpasses, dimensions of tunnels and other infrastructure facilities, and sometimes speed limitations. In Poland, the railway lines have been divided according to operational performance into 4 categories (Tab. 2). The most safe transport of the cargo exceeding the gauge is on the main railway lines, where the pressure on the axles have a maximum acceptable value and there is a good technical condition of rail infrastructure. However, on these railway lines there is the biggest traffic congestion, which is in conflict with low speed of oversize cargo trains.

Table 2. Operation parameters of railway lines

<table>
<thead>
<tr>
<th>Railway lines category</th>
<th>Cargo trains max. speed $V_{\text{max}}$ [km/h]</th>
<th>Permissible axle load - $P$ [kN]</th>
<th>Carriage load $T$ [Tg/rok]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main (0)</td>
<td>$80 &lt; M_{\text{ax}} \leq 120$</td>
<td>$P \leq 221$</td>
<td>$T \geq 25$</td>
</tr>
<tr>
<td>First-class (1)</td>
<td>$60 &lt; M_{\text{ax}} \leq 80$</td>
<td>$210 \leq P &lt; 221$</td>
<td>$10 \leq T &lt; 25$</td>
</tr>
<tr>
<td>Second-class (2)</td>
<td>$50 &lt; V_{\text{max}} \leq 60$</td>
<td>$200 \leq P &lt; 210$</td>
<td>$3 \leq T &lt; 10$</td>
</tr>
<tr>
<td>Local importance (3)</td>
<td>$V_{\text{max}} \leq 50$</td>
<td>$P &lt; 200$</td>
<td>$T &lt; 3$</td>
</tr>
</tbody>
</table>
The network of PKP Polish Railway Lines SA is operating approximately 1600 stations. The sequence of railway lines in operation includes more than 14200 intersections with roads and pedestrian crossings. The number of 2700 of such crossings are guarded. PKP Polish Railway Lines SA maintains over 26000 engineering structures, including almost 7000 bridges and overpasses.

There are the railway lines important to the international East-West and North-South transit. These lines are covered by international agreements AGC and AGTC.

In northern and central part of Poland following point rail infrastructure should be exposed (Fig. 12):

1) 4 terminals PKP CARGO S.A. (Rzepin, Kobylica, Mława, Małaszewicze),
2) 3 terminals, in which hold PKP CARGO S. A. shares (Gadki, Pruszków, Warszawa Praga),
3) 7 private terminals with public access (Szczecin, Świnoujście, Poznań Garbary, Gdynia, Gdańsk, Łódź Olechów, Warszawa Gł. Tow.),
4) other important stations: Szczecin Port Centralny, Świnoujście, Gdynia Port, Gdańsk Port Północny, Gdańsk Nowy Port, Zajączkowo Tczewskie, Terespol Pomorski, Inowrocław, Poznań Garbary, Pruszków, Warszawa Praga.
Moreover, very important is existing and planned logistics infrastructure of PKP CARGO SA, especially in the field of intermodal transport, i.e. logistics centres, container terminals and centres of transhipment and logistics services (Fig. 13).

The popular types of special wagons for oversize transport are: UAI (for high units) and NORCA (for heavy pieces). The PKP CARGO and the private carriers operate usually type UAI. The Trade Trans Forwarding Company operates oversize cargo with its own rail wagons 25 meters long RBS.

Table 3. Rolling stock of cargo wagons (in pieces)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Kind of wagons</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2005</td>
</tr>
<tr>
<td>Poland</td>
<td>with tilt roof</td>
<td>984</td>
</tr>
<tr>
<td></td>
<td>special</td>
<td>5611</td>
</tr>
<tr>
<td>PKP group</td>
<td>with tilt roof</td>
<td>747</td>
</tr>
<tr>
<td></td>
<td>special</td>
<td>2642</td>
</tr>
<tr>
<td>Others</td>
<td>with tilt roof</td>
<td>237</td>
</tr>
<tr>
<td></td>
<td>special</td>
<td>2640</td>
</tr>
</tbody>
</table>
1.3.3. Inland waterway transport

The following types of vessels are used in the inland waterway transport of the oversize cargo:

– motor barges and barges without propulsion,
– tugboats and push boats with train of towed or pushed barges,
– pontoons.

In general, these are the standard vessels with reinforced bottoms and sides, suitable to carry different heavy lifts.

Inland waterways are divided into 7 classes, depending on the permissible parameters, including (Tab. 4):

– the air draft (minimum clearance under bridges, pipelines and other devices crossed the waterway overhead),
– the minimum draft (clearance of the water under keel).
### Table 4. Polish classification of inland waterways routes

<table>
<thead>
<tr>
<th>Inland waterway class</th>
<th>Minimum dimension of the channel</th>
<th>Minimum ground clearance under the bridges [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width of the navigable route[^1] [m]</td>
<td>Minimum water depth in the channel [m]</td>
</tr>
<tr>
<td>Ia</td>
<td>12</td>
<td>1,5</td>
</tr>
<tr>
<td>Ib</td>
<td>18</td>
<td>2,0</td>
</tr>
<tr>
<td>II</td>
<td>25</td>
<td>2,2</td>
</tr>
<tr>
<td>III</td>
<td>35</td>
<td>2,5</td>
</tr>
<tr>
<td>IV</td>
<td>40</td>
<td>3,5</td>
</tr>
<tr>
<td>Va</td>
<td>45</td>
<td>3,5</td>
</tr>
<tr>
<td>Vb</td>
<td>45</td>
<td>3,5</td>
</tr>
</tbody>
</table>

[^1]: navigable width of the trail at the bottom of the vessel with a maximum permissible load for a full immersion

The higher the class of the waterway, the better are conditions to carry oversized cargo. Class V offers better technical parameters, i.e. bigger permissible draft, easier manoeuvrability for watercrafts, larger clearances under bridges, allowing safer transport of oversize cargo than the lower classes.

The main inland waterway in Poland is the Oder Waterway, along with Gliwicki and Kędzierzyński Canal. However, there are foul navigational conditions, i.e. depth of the main transit, in the central section of the river from Brzeg Dolny to the estuary of the Warta river. Therefore, transport between the upper and lower section of the Oder is not possible during the most of the navigation season.

The most important Polish inland are:

1) on the Oder river and Gliwicki Canal: Gliwice, Kędzierzyn-Koźle, Wrocław, Głogów, Nowa Sól and Cigacice,
2) on the Wisła-Odra Waterway: Kostrzyn, Krzyż, Ujście, Czarnkowo and Bydgoszcz,
3) on the Wisła river: Chełmno, Grudziądz, Toruń and Tczew, 
4) on the Warta river: Poznań, 
5) on the Nogat river: Malbork.

Fig. 15. Classification of Polish inland waterways

1.3.4. Maritime transport

Transport of the oversize cargoes by the sea vessels, i.e. sea barges or ships, demands the specialized port infrastructure. This is the main factor defining the port’s capability to perform the oversize cargo handling operations. In Poland that kind of services could be provided in Port of Szczecin-Świnoujście, Port of Gdańsk and Port of Gdynia. All ports are easily accessible by the road and rail and, additionally, Port of Szczecin-Świnoujście is a river port.

In Szczecin, the oversize cargo is handled either by mobile crane „Gottwald” of 100 tons load or by floating crane of 200 tons load. Due to that, oversize cargoes could be handled at almost every quay, but most often such a cargo is handled at the Ewa Terminal or at the Duty Free Zone, where as a rule blocks of granite are loaded.
In Port of Gdańsk oversize cargoes are handled at the Port Free Zone by mobile Crane of 100 tons load. The other port operator owns floating crane of 63 tons load. Additionally, Gdańsk Shipyards “Remontowa” owns floating crane of 200 tons load, and Polish Ship Salvage Company (Polskie Ratownictwo Okrętowe –PRO) owns the biggest floating crane “Maja” of 300 tons capacity.

In Port of Gdynia oversize cargoes are handled by the Baltic General Cargo Terminal Gdynia Ltd. with the aid of the ship’s gear or mobile cranes and floating cranes chartered from outsiders.

1.3.5. Air transport

The following airports are located in Poland:

1) Airport im. Fryderyka Chopina w Warszawie - EPWA
2) Airport Gdańsk - Rębichowo im. Lecha Wałęsy - EPGD
3) Airport Kraków - Balice - EPKK
4) Airport Bydgoszcz - Szwederowo - EPBY
5) Airport Katowice - Pyrzowice - EPKT
6) Airport Łódź im. Władysława Reymonta - EPLL
7) Airport Poznań - Ławica - EPOO
8) Airport Rzeszów - Jasionka - EPRZ
9) Airport Szczecin - Goleniów - EPSC
10) Airport Wrocław - Strachowice - EPWR
11) Airport Zielona Góra - Babimost - EPZG.

Each of these airports has the infrastructure allowing handling large and heavy cargoes for transport by air.
For transport of cargo Polish air carriers operate airplanes: Saab 340A, L-410, An-26 and An-26B. While for transport of oversize cargo Il-76 and An-225 are used. The properties of the Saab 340 plane allow transport max. 3850 kg and 35,8 m$^3$ of cargo, depending on the route distance. Airplane L-410 is able to take on board the cargo weighing up to 1650 kg not exceeding 18 m$^3$ of volume.

1.4. The statistics of oversize transport permits

1.4.1. Road transport

In Poland there are no accurate statistics on the oversize transport by road, there is no central database to obtain that information. The only possible way to obtain data is the number of permits issued by the General Directorate for National Roads and Motorways (GDDKiA) (Fig. 17).
Fig. 17. The number of permits issued by GDDKiA

### 1.4.2. Rail transport

PKP Polish Railway Lines SA Rail Traffic Management Branch in Szczecin issued in 2009 387 permits for extraordinary transport, every for period of 3 months. Among them there was 28 permits for shipments with substantial exceed of the standard gauge and/or axle load. Analysing the permits, domination of transport directions to/from the Port of Szczecin, Port of Świnoujście and border station Gumieńce can easily be noticed. From the Pomeranian Region oversize cargoes are transport by rail, i.a. to Poznań, Kraków, Wrocław, Warszawa, Gdynia and Rzeszów.

The most often transported oversize cargoes are engines to the Power Plant „Dolna Odra”, paper in bales and rails and until recently ship’s machinery to Shipyard Stocznia Szczecińska Nowa. Moreover:

1) containers 40’ i 45’ High Cube type,
2) vehicles and military equipment,
3) transformers with weight over 90 tons,
4) steel in sheets of width of 3 m,

Below are shown quantities of special transport units carried out by one of the rail carriers (Tab. 6).
Table 6. Number of oversize cargoes transported by PKP CARGO S.A. in years 2007-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of deliveries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Together including:</td>
</tr>
<tr>
<td></td>
<td>other cargoes</td>
</tr>
<tr>
<td>2007</td>
<td>10013</td>
</tr>
<tr>
<td>2008</td>
<td>13453</td>
</tr>
<tr>
<td>2009</td>
<td>17164</td>
</tr>
</tbody>
</table>

1.4.3. Inland shipping transport

In years 2007-2009 the Inland Navigation Office in Szczecin issued 10 permits to carry large loads, and 21 permits associated with vessels of exceeded size:

1) Year 2007
   – 7 permits related to the exceeded dimensions of ship,
   – 8 permits related to oversize cargo,
2) Year 2008
   – 7 permits related to exceeded dimensions of ship,
3) Year 2009
   – 7 permits related to the exceeded dimensions of ship,
   – 2 permits related to oversize cargo.

The Inland Navigation Office in Szczecin in Wroclaw issued, in the years 2007-2009, in total 50 permits, primarily related to the exceeded dimensions of ships.

1.4.4. Air transport

Air transport of cargo is carried mostly in international transport directions. Most cargo is transported on the transatlantic routes to/from the United States and Canada. In Europe, the highest share of cargo is transported to Germany and Great Britain. In recent years, transport of cargo from Poland to Peking was initialized.

Table 7. Transport of cargo carried by Polish carriers in the years 1999-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Cargo [Thousand tons]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>1999</td>
<td>29,0</td>
</tr>
<tr>
<td>2000</td>
<td>27,8</td>
</tr>
<tr>
<td>2001</td>
<td>26,7</td>
</tr>
<tr>
<td>2002</td>
<td>28,8</td>
</tr>
<tr>
<td>2003</td>
<td>30,5</td>
</tr>
<tr>
<td>2004</td>
<td>30,0</td>
</tr>
<tr>
<td>2005</td>
<td>30,0</td>
</tr>
<tr>
<td>2006</td>
<td>40,0</td>
</tr>
<tr>
<td>2007</td>
<td>44,4</td>
</tr>
<tr>
<td>2008</td>
<td>46,1</td>
</tr>
</tbody>
</table>

Table 8. Cargo handled by Airport Goleniów in the years 1999–2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Cargo (t)</th>
<th>Air operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>152</td>
<td>6 415</td>
</tr>
<tr>
<td>2002</td>
<td>242</td>
<td>6 425</td>
</tr>
<tr>
<td>2003</td>
<td>335</td>
<td>7 687</td>
</tr>
<tr>
<td>2004</td>
<td>342</td>
<td>3 139</td>
</tr>
<tr>
<td>2005</td>
<td>673</td>
<td>3 002</td>
</tr>
</tbody>
</table>
Table 9. Cargo handled by Airport Gdańsk in the years 1999–2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Cargo (tony)</th>
<th>Air operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>1 472</td>
<td>10 512</td>
</tr>
<tr>
<td>2000</td>
<td>1 552</td>
<td>11 586</td>
</tr>
<tr>
<td>2001</td>
<td>1 953</td>
<td>14 052</td>
</tr>
<tr>
<td>2002</td>
<td>2 211</td>
<td>13 450</td>
</tr>
<tr>
<td>2003</td>
<td>2 686</td>
<td>14 346</td>
</tr>
<tr>
<td>2004</td>
<td>2 742</td>
<td>17 500</td>
</tr>
<tr>
<td>2005</td>
<td>3 433</td>
<td>19 000</td>
</tr>
<tr>
<td>2006</td>
<td>4 037</td>
<td>24 200</td>
</tr>
<tr>
<td>2007</td>
<td>4 757</td>
<td>28 200</td>
</tr>
<tr>
<td>2008</td>
<td>4 610</td>
<td>31 000</td>
</tr>
</tbody>
</table>

1.5. Regional perspective

The outlook of the oversize transport in Poland cannot be limited to the northern region of the country. In this region, the dominating types of area are agricultural lands and forests. These areas are not highly populated and the industry is undeveloped there. Industrial centres are concentrated only in big cities, mainly Szczecin, Gdańsk, Gdynia, Bydgoszcz and Toruń.

The majority of industrial activity takes place in southern Poland. Analysing the types of entrepreneurial activity, we can notice that most of companies that would be the potential recipient or sender of oversize cargoes are located in either central or southern Poland. There are north-south and west-east transport corridors and the condition of road and rail infrastructure is a bit better than in the northern part of the country. In conclusion, it can be stated that Polish West and East Pomeranian Regions would should be treated firstly as a transit region for oversize transport. Dominant transport directions are to/from sea ports and to/from several industrial areas (Fig. 18 and 20).
In upcoming years there are a few thousands of investments planned, in which oversize transport will be obligatory. Currently, due to the upcoming EURO 2012 event, quite new highways and expressways are under construction, as well as new route nodes, bypasses, overpasses and bridges are prepared. The old road and rail infrastructure is extensively modernized or reconstructed.

Taking into consideration oversize transport perspective, the most substantial investments which will take place in the upcoming 10 years in Poland are:

- biogas plants – dozens,
- power units in existing biogas plants – 4,
- gas blocks in existing cogeneration plants – 2,
- power units in existing cogeneration plants – 1,
- reconstruction and modernisation of airports, mainly in Łódź, Wrocław, Warszawa, Poznan, Goleniów, Białystok, Katowice,
- stadiums (11 stadiums being built for EURO 2012 purposes, more being planned),
- gas power plants, including one in West Pomeranian Region,
- biomass power plants, mainly in northern Poland,
- cogeneration plants, e.g. in Police,
- wind farms – 13,
- hydroelectric plants - 2,
- factories – 50,
- breakwater in Świnoujście,
- LNG terminal in Świnoujście,
- production and storage halls – 25,
- sports halls – approx. 50,
- entertainment and sports halls – 36,
- aluminium smelter in Nowa Sól,
- swimming pools,
- tramway lines,
- modernisation of railways,
- construction and modernisation of traction lines,
- wastewater treatment plants,
- Świnna Poręba water dam,
- thermal waste treatment plants –approx. 20,
- cement production line,
- underground gas storage depots.

One of the most important investments in Poland in upcoming years is construction of nuclear power plant in Żarnowiec, 35 km from Gdańsk. This decision was approved in early 2010. There is also another nuclear power plant in plans, either in Kopań or Klempicz, however this decision was not yet approved in any way.

Fig. 19. Underground gas storage depots

Another Polish very important investment is construction of gas power plants, gas blocks in existing power plants, biogas plants is strictly connected with necessity of diversification of natural gas sources, as well as the necessity of searching for sources of power other than
coal or gas. There are also underground gas storage depots constructions being planned, as an important part of national system of Poland serving a gas transmission country (Fig. 19).

Fig. 20. Special Economic Zones in Poland

Other enormous investments, which is strictly connected with oversize transport is planned modernisation of Polish waterways, which will allow to take advantage of inland shipping on a larger scale. Modernisation of border parts of Odra river is being planned with adapting the waterway from German port Schwedt up to Pomeranian Bay for sea-river ships. In purpose of making ports located in the estuary of Odra river more available for inland
shipping, reconstruction of a railway bridge, located on Regalica river (km 733,7), as a part of Szczecin-Wroclaw railway lines modernisation program, is being planned. On the Wisla river, there is planned a construction of water barrage in Nieszawa. Furthermore, there is a conception of modernisation E-70 waterway up to class II, including Wisla-Odra waterway. Other project which is very likely to succeed, is the construction of Odra–Dunabe–Elbe Canal.

There are several investments, connected with construction and modernisation of road and railway infrastructure, in purpose of improving accessibility of seaports Szczecin, Świnoujście, Gdańsk and Gdynia. In each of these seaports modernisation of old quays, as well as construction of new ones is being planned. In the Świnoujście seaport, a new LNG terminal is under construction.

Companies operating in Special Economic Zones, may also successfully serve as places of departure or destination of oversize cargoes (Fig. 20). Special Economic Zones work as isolated parts of country territory, where economic activity may work on preferential terms. That is, companies which operate in these areas are granted tax exemption, as a form of public assistance. Special Economic Zones were created for stimulating the economic development of some regions in Poland. For the oversize transport the most important Special Economic Zones are as follows: Kamiennogórska, Katowicka, Kostrzyńsko-Ślubicka, Krakowska, Słupska and Starachowicka (Tab. 10)

Table 10. Industrial branches in Special Economic Zones

<table>
<thead>
<tr>
<th>Special Economic Zone</th>
<th>Voivodeship</th>
<th>Top Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kamiennogórska</td>
<td>Lower Silesian Voivodeship, Wielkopolska Region</td>
<td>metal, paper, automotive</td>
</tr>
<tr>
<td>Katowicka</td>
<td>Silesian Voivodeship, Malopolska Region, Opole</td>
<td>automotive, metal, structural</td>
</tr>
<tr>
<td>Kostrzyńsko-Ślubicka</td>
<td>Lubuskie Voivodeship, Westpomeranian Region,</td>
<td>paper, metal, logistics</td>
</tr>
<tr>
<td></td>
<td>Wielkopolska Region</td>
<td></td>
</tr>
<tr>
<td>Krakowska</td>
<td>Malopolska Region, Subcarpathian Voivodeship</td>
<td>IT, modern services as BPO, SSC</td>
</tr>
<tr>
<td>Legnicka</td>
<td>Lower Silesian Voivodeship</td>
<td>automotive, metal, plastics</td>
</tr>
<tr>
<td>Łódzka</td>
<td>łódź Voivodeship, Wielkopolska Region, Mazovian</td>
<td>household articles, logistics, structural</td>
</tr>
<tr>
<td></td>
<td>Voivodeship</td>
<td></td>
</tr>
<tr>
<td>Mielecka</td>
<td>Subcarpathian Voivodeship, Malopolska Region,</td>
<td>no data</td>
</tr>
<tr>
<td></td>
<td>Lublin Region</td>
<td></td>
</tr>
<tr>
<td>Pomorska</td>
<td>Pomeranian Region, Kuyavian-Pomeranian Region,</td>
<td>electronic and electrical, metal, paper</td>
</tr>
<tr>
<td></td>
<td>Westpomeranian Region</td>
<td></td>
</tr>
<tr>
<td>Ślupská</td>
<td>Pomeranian Region, Westpomeranian Region,</td>
<td>metal, automotive, plastics</td>
</tr>
<tr>
<td></td>
<td>Wielkopolska Region</td>
<td></td>
</tr>
<tr>
<td>Starachowicka</td>
<td>świętokrzyskie, Mazovian Voivodeship, Opole</td>
<td>metal</td>
</tr>
<tr>
<td></td>
<td>Voivodeship, Łódź Voivodeship, Lublin Region</td>
<td></td>
</tr>
<tr>
<td>Suwalska</td>
<td>podlaskie, Voivod of Warmia and Mazury, Mazovian</td>
<td>wood</td>
</tr>
<tr>
<td></td>
<td>Voivodeship</td>
<td></td>
</tr>
<tr>
<td>Tarnobrzeska</td>
<td>Subcarpathian Voivodeship, Mazovian Voivodeship,</td>
<td>aluminiowa, elektroniczna, household articles,</td>
</tr>
<tr>
<td></td>
<td>świętokrzyskie, Lublin Region, Lower Silesian</td>
<td>building chemistry</td>
</tr>
<tr>
<td></td>
<td>Voivodeship</td>
<td></td>
</tr>
<tr>
<td>Wałbrzyska</td>
<td>Lower Silesian Voivodeship, Opole Voivodeship,</td>
<td>automotive, household articles, metal</td>
</tr>
<tr>
<td></td>
<td>Wielkopolska Region, Lubusz Voivodeship</td>
<td></td>
</tr>
<tr>
<td>Warmińsko-Mazurska</td>
<td>Voivod of Warmia and Mazury, Mazovian Voivodeship</td>
<td>wood</td>
</tr>
</tbody>
</table>
The location of wind farms, i.e. wind power plants, is mainly determined by meteorological conditions (Fig. 21). Investors are going to allocate wind turbines mainly in zones I and II. West Pomeranian Region is considered as the most attractive of all regions, where over 50% of investments will be allocated. On the second place stands, with 33% of investments, Pomeranian Region.

The plans of constructing enormous wind plant in the Baltic Sea are particularly noteworthy. Project, being implemented by Baltex-Energia company assumes construction of 260 wind turbines in the sea area approx. 90km north from Port of Ustka. The overall power of turbines is going to stand on 1560 MW level, which is approximately three times more than the power of all already implemented wind turbines in Poland (approx. 538 MW). Project developers are currently seeking for project approval in the Ministry of Infrastructure.

Fig. 21. Potential wind energy map
1.6. Examples of the oversize transport

1.6.1. Examples from road transport

It is estimated that 6-9% of the funds designed for investment in a wind turbine is spent for its transport and assembling. In some cases it is even up to 20% of the total investment costs. It should also be noted that, according to the German Wind Energy Institute, four of the five wind turbines produced in German in 2007, are exported to other countries. The wind turbines are being transported on more regular terms, than other oversize products, e.g. bridge elements, steel tanks, ships sections. Therefore, the importance of proper planning and executing the transport of wind turbines is crucial for that industry.

The below example shows the particulars of the wind power turbine of type Gamesa G90/100 power of 2,0 MW, transported from Spain to wind farm located in the city Margonin in Wielkopolska Region (Tab. 11).

Table 11. Description of wind turbine Gamesa G90/100 segments

<table>
<thead>
<tr>
<th>Lp.</th>
<th>Segments</th>
<th>Length [m]</th>
<th>Width [m]</th>
<th>Height [m]</th>
<th>Mass[t]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>fundament</td>
<td>4,44</td>
<td>4,44</td>
<td>3,20</td>
<td>16,00</td>
</tr>
<tr>
<td>2</td>
<td>section 1</td>
<td>15,60</td>
<td>4,10</td>
<td>3,90</td>
<td>65,00</td>
</tr>
<tr>
<td>3</td>
<td>section 2</td>
<td>17,00</td>
<td>3,90</td>
<td>3,90</td>
<td>65,00</td>
</tr>
<tr>
<td>4</td>
<td>section 3</td>
<td>17,00</td>
<td>3,90</td>
<td>3,50</td>
<td>58,00</td>
</tr>
<tr>
<td>5</td>
<td>section 4</td>
<td>23,90</td>
<td>3,50</td>
<td>2,80</td>
<td>56,00</td>
</tr>
<tr>
<td>6</td>
<td>section 5</td>
<td>24,40</td>
<td>2,80</td>
<td>2,80</td>
<td>52,00</td>
</tr>
<tr>
<td>7</td>
<td>gondola</td>
<td>10,10</td>
<td>3,30</td>
<td>4,35</td>
<td>75,00</td>
</tr>
<tr>
<td>8</td>
<td>hub</td>
<td>3,30</td>
<td>3,30</td>
<td>3,46</td>
<td>24,00</td>
</tr>
<tr>
<td>9</td>
<td>rotor blade</td>
<td>44,00</td>
<td>3,40</td>
<td>2,00</td>
<td>7,00</td>
</tr>
</tbody>
</table>

All of the elements listed in the table must be regarded as oversized cargo. The most convenient and most widespread technology of transport is by road. The transport of wind turbine segments is preplanned weeks before the date of travel, and all possible variants are analysed. Very important step is to request permit for oversize transfer. In the case of wind turbine components such requests must be submitted at least a month earlier, even though the statutory time for obtaining permit is 2 weeks. The issued permit designated the route and pointed out several mandatory preparatory works, including dismantling road signs, trimming branches of trees, raising the telecommunications cable, road works and small repairs etc.

The survey of access routes to the wind farm shall be made, with detailed photographs and drawings for each crossing, railroad crossing or other points that could produce problems. Survey is made by the pilot company or a road carrier itself. In the case of the wind farm in Margonin, the route chosen by road carrier proved to be identical to the route designated by the road administration issuing the permit. Sometimes, the route designated in the permit, turns out to be impossible for oversize transport. In such a situation, the carrier has to designate an alternative route himself, i.e. prepare detailed description of a detour and submit it to the road administration. Usually, the new route is accepted. However, this prolongs the waiting time for permits, and thus the time of the investment.

Elements of the farm were transported to Margonin from the following places of departure:
1) fundament from Schwerin in Germany,
2) tower segments from Fürstenwalde in Germany or from Chrudim in Czech Republic,  
3) gondola, hub and rotor blades from Spain (maritime transport).

The designated from the town of Schwerin in Germany to Margonin will be presented as example. Vehicles traveling from Germany (two vehicles in the convoy - the greater the number of vehicles is, the less convenient it is, because of the need to be escorted by the Police) have crossed the border in Świecko, and then passed through the Road No. 2 through Świebodzin and Nowy Tomyśl, where motorway A2 starts. Further, through Poznań and Oborniki to the Road No. 11, and then by voivodeship roads through Podstolice, Radwanki to destination Margonin. Transfer through the route Świecko-Margonin lasted approximately 5 hours. A detailed itinerary is included in the permit for oversize transit (Fig 22 and 23).

![Map of the oversize transport route](image_url)

Fig. 22. Map of the oversize transport route
Fig. 23. Permit for the oversize road transport with issuing fee calculations
Throughout the route oversize vehicles follow pilots. Due to the better knowledge of roads, the pilot companies are usually employed in the country of passage and the overtaking of the oversize vehicles is at the state border. For drivers, the detailed guide, that contains description of access routes to the wind farm, is prepared.

After about two weeks after the end of the journey the road administration sends by mail attachment to the permit, which specifies the number of kilometers traveled on different roads during the oversize transit, and charges arising from this. In above mentioned example example, the weight excess of 52.84 tonnes was charged a fee in the amount of 3.995,00 PLN (Fig. 22).

1.6.2. Rail transport

The parameters of the consignment, which may be accepted for carriage, are restricted primarily by rail gauge, e.g. low and narrow bridges, narrow space between tracks.

The practical examples of rail transport of oversize cargo in Szczecin Province are as follows:

1) The transport of military vehicles and equipment is carried on wagons serial Res, Rs, Samms, Smms from the railway stations, nearby the place of location of military unit to the railway station nearby the military exercise sites and back home.

2) The transport of transformers is carried on the wagons serial Uaais with 8 or 24 axles from Szczecin Port Central to many places in the country.
3) The transport of the steel sheets and plates is carried on the wagon serial Res, Rs from Szczecin Port Central to various receivers in the country.

1.6.3. Air transport

British company Chapman-Freeborn, which cooperates with the in Airport Szczecin-Goleniów, transported by air mechanical pumps from Goleniów to Madras in India. The cargo was loaded in the holds of airplane. The first loading operation organized by the Chapman-Freeborn in Airport Szczecin-Goleniów took place in October 2007.

Airport Szczecin-Goleniów enables air transport of oversize cargo by airplane An-225 and Ił 76. Among other things the following cargo was already handled there: dredging pumps, oversize elements of refinery, mobile elements weighing of the power plant of 16-25 tonnes, 28 ton component for the printing house. The contractors in Azerbaijan, Kuwait, Saudi Arabia, India, and Vietnam have waited for the above mentioned deliveries. Each transport was performed by airplane of a minimum mass of 190 tonnes.

Fig. 27. Handling operations at Airport Szczecin-Goleniów

1.7. Technical, organisational and law limitations of oversize transport

1.7.1. Road transport

1.7.1.1. Technical limitations in road transport

Basic technical limitations are associated with buildings and objects along the route and with bad condition of roads. The restrictions are including the following:

– bridges and flyovers limiting allowable pressure on axle/axles,
– too low and narrow bridges,
– too small width of the road,
– roundabout with too small turning radius, that unable to travel straight ahead,
– the poor state of roads, even not correspond to the values of the design for the road category (up to 11.5 tons per drive axle at national roads, 10 tons per drive axle for regional roads and 8 tons for other public roads),
– sharp turn in forests,
– stable objects in the urban area, such as lamps, road signs, advertising,
– electric traction, traction over the street,
traction, electrical, telephone nets placed over the carriageway,
carried out repairs of roads etc.

In accordance with the provisions, the road oversize transport may be safely performed if the road conditions allow such transport. This mean, transport will not endanger the construction of bridge, viaducts and other buildings located near the route, does not undermine the road, nor threaten its security.

In many cases, when planning a safe route of oversize cargo, tests should be made for resistance of buildings located along the route. Sometimes, tests confirming the maximum permissible load of the road are needed. If necessary, removal or upheaving power/telecommunication/traction lines should be arranged, road signs and others obstructions should be dismantled, roundabouts threatening the safety of transport should be disassembled. Currently there is no fast accessible information about the up-to-date technical parameters of roads, including bridges, flyovers, roundabouts etc. As a result, the unplanned prolongation and delay of the oversize transport operations is very often.

Very important issue is the need to take into account the oversize transport when designing, building and approving the road infrastructure. Especially road facilities, such as bridges, roundabouts, intersections, islands, signs, etc. On main roads roundabouts should be constructed in such a way, that makes possible to drive straight ahead, e.g. after opening a road barrier using a smart card. Following the example of Denmark, each opening of the roundabout could result in a fee (the amount of a specific issue to discuss). Use of the card would also leave trace on monitoring system, so that in case of any damage of labelling or other elements of the road, it would be much easier to find guilty oversize vehicle. The indicated company will cover the costs of the damage with the help of carrier's obligatory insurance. Another problem is the vertical road signs, which should be placed on the road in the way to avoid disassembling and re-assembly during transport of oversize cargo, as it is in some Western Europe countries. Moreover, the arms of hanging signs should be swinging to avoid disassembling and then assembling them for the passage of the oversize vehicle.

1.7.1.2. Organisational limits in road transport

The following inadequacies apply for the oversize road transport:

– Recently we observe some practices of illegal or unofficial oversize traffic, especially to/from the ports or directly abroad. In such cases, when the oversize transport is not reported and no evidence of such is registered, the carriers avoid the charges for the operation.

– Lack of the perception and awareness among road managers of the importance of the oversize transport for the local and national economy.

– In every from 16 divisions of GDDKiA responsible for issuing permits and agreeing the route is only one person.

– The Code of Administrative Procedures applies to the process of issuing permits and the persons who are doing all paperwork are government employee. Following strict procedures takes time and prolongs all the process.

– Numerous GDDKiA divisions have different application forms.

– Lack of updated maps with gauges and pressures for all national and provincial roads in Poland.

– There is always high anxiety on the positive settlement of the applications for permits. There is formal and informal pressing by the local governments for whom the supply of the oversize cargo is frequently associated with the investments, and labour market
boom. There is also anxiety of the carriers and shippers, who have already signed a contract of carriage, and must fulfil the terms.

- The lobby of the truckers is very influential. Organizations such as ZMPD (Association of International Road Carriers - Zrzeszenie Międzynarodowych Przewoźników Drogowych) and OZPTD (National Road Transport Employers’ Association- Ogólnopolski Związek Pracodawców Transportu Drogowego) have a very strong influence on politicians and on the execution of the law. They provide a large amount of voters.

1.7.1.3. Law obstacles in road transport

The following barriers and hindrances could be observed:

- The interpretational differences of existing provisions between the managers issuing road permits. The most common discrepancies concern excess of the permissible axle loads. There is no regulation in this respect and there are different practices for issuing licenses, e.g. the Szczecin Division of GDDKiA accepts axle load exceeded by 2 tonnes. There is theoretical possibility that the carrier, after receiving refusal issued by one division of GDDKiA, will obtain it in another division.
- The legal changes are necessary to enforce the highway concessionaire to accept the oversize vehicles on his road. Actually the highway operators could refuse the oversize vehicles on his road.
- There are no legal ways for enforcing forwarder and cargo operator to prefer rail or inland waterway as the medium of oversize transport instead of the road.
- The lack of Polish regulations of precise requirements on cargo securing. The Law on Road Traffic defines cargo securing in general terms and it is difficult to prove that the cargo is not properly fitted.
- The price list for the permit to carry oversized cargo is not published and the applicant does not know how much to pay before he applies.
- Existing regulations specify the permissible parameters: length, width, height limit of vehicles and permissible axle load, but there is no practical control for the turning radius of vehicles.
- Lack of licensing requirements (completed training, experience, insurance) for companies involved in the piloting.

1.7.2. Rail transport

In rail transport limitations are mainly related to the following factors:

- the loading gauge,
- construction gauge,
- pressure on one meter of the rail,
- the value of truck curves and side inclination of the tracks,
- permissible load of bridges and overpasses,
- dimensions of the tunnels and other infrastructure facilities,
- permissible transport speed.

Such elements as semaphores, signs, switches, towers, kiosks of the railway watchmen, train stations and platforms, the distance between platforms etc., should be also taken into consideration.

One of the technical obstacles of transport is the height of traction network wires. The standard suspension height is 5600 mm. Table below shows the examples of height deviations from the standard value in the West Pomeranian District (tab. 12).
### Table 12. Examples of traction wires reductions

<table>
<thead>
<tr>
<th>No.</th>
<th>Route or station</th>
<th>lines km</th>
<th>Height of reduction at place</th>
<th>Kind of object resulting in a reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Białogard - Czarnowęsy Pomorskie</td>
<td>224,818</td>
<td>4900</td>
<td>rail viaduct</td>
</tr>
<tr>
<td>2.</td>
<td>Station Krzyż</td>
<td>238,342</td>
<td>5140</td>
<td>road viaduct</td>
</tr>
<tr>
<td>3.</td>
<td>Station Krzyż</td>
<td>238,260</td>
<td>5100</td>
<td>nearby road viaduct</td>
</tr>
<tr>
<td>4.</td>
<td>Station Kostrzyń</td>
<td>255,550</td>
<td>4990</td>
<td>rail viaduct</td>
</tr>
<tr>
<td>5.</td>
<td>Station Szczecin Wzgórze Hetm.</td>
<td>2,092</td>
<td>4960</td>
<td>road viaduct at Milczańska Street</td>
</tr>
<tr>
<td>6.</td>
<td>Station Szczecin Wzgórze Hetm.</td>
<td>1,750</td>
<td>5170</td>
<td>pedestrian bridge</td>
</tr>
<tr>
<td>7.</td>
<td>Szczecin Port Centr. SPB</td>
<td>2,500</td>
<td>5050</td>
<td>rail viaduct by SPB 14</td>
</tr>
</tbody>
</table>

### 1.7.3. Inland transport

The following restrictions are specified in local law that is issued by the Inland Navigation Office in Szczecin. Limitations are related to the dimensions of the navigable routes, locks and clearance under bridges, pipelines and other devices crossing the waterway, the width of the bridges and the depth of the shipping route.

In the administration ordinances are given such particulars as the dimensions of vessels and towing trains permitted to navigate on specific sections of waterways.

![Figure 28. Maximal dimensions of ships on Odra river](image-url)
1.7.4. Air transport

The following hindrances are observed in oversize air transport:

– volume and capacity of freight plane,
– airport’s ability to take the plane (the length of runway),
– the possibility of transporting oversize cargo to the nearest airport fulfilling technical conditions,

The below mentioned weight restrictions refer to the airplanes Antonov:

– Antonov An-124 - 171 tons
– Antonov-225 Mriya "Cossack“ - 250 tons
– Airbus A300-608ST - 47 tons.
2. Theoretical basis for the South Baltic oversize strategy

For the oversize transport corridors investigations, Ollier method can be used which allows checking passenger or cargo flows at important fixed points and subsequently finding out requested parameters [4]. As such main fixed points can be taken ports on one side of the sea. For more detailed investigations multi criteria investigation methods can be applied [1, 6].

According to Ollier method, in fixed points quantities are checked by field formulas that can be shown as below [4]:

\[ Q_x = q_x(x, y, z, t), \]
\[ Q_y = q_y(x, y, z, t), \]
\[ Q_z = q_z(x, y, z, t). \]

Here:
- \( Q_x, Q_y, Q_z \) - investigated quantities in concrete fixed point on concrete directions;
- \( q_x, q_y, q_z \) - commodities in fixed points;
- \( x, y, z \) - fixed point coordinates;
- \( t \) - time.

Based on this method it is possible to find the investigated cargo flow parameters for the actual directions or concrete transport corridors. In order to check the development perspectives of the transport market for the forecast horizon, a forecast method based on the specific elasticity (multi criteria) method for each commodity groups can be used [1].

The basic elements for the multi criteria forecasts for oversize cargo are these [5]: GDP forecasts for the countries concerned; European export and import forecasts (values at constant prices) for the relevant countries; calculation of import and export for the different commodity groups for each country; projection of trade flows based on that calculated for all commodities and all countries (volumes), differentiated for exports and imports; technical possibilities on selected directions; geographical, hydro meteorological and other conditions on concrete directions.

Based on the existing cargo flow and dynamic of the development of different merchandise, especially those of importance to the oversize cargo transport corridors, it is possible to note tendencies and forecast regions which could be developed.

Run time of ships sailing between ports is very important for the sea transport in order to maintain proper compatibility with other transport corridors, like for instance in the Baltic region - with inland transport corridors via Poland. Full constant (liner) ship voyage time can be calculated as follows [4]:

\[ T = 2 \cdot T_r + T_{rez}, \]

Here:
- \( T_r \) - ship’s time for sailing and port operations, between leaving one quay wall to other quay wall;
- \( T_{rez} \) - reserve time that depends on the distance between ports.
Ship’s sailing and port operations times can be calculated as follows:

\[ T_s = \frac{S}{v} + T_p + T_l, \]

(5)

here:
\( S \) - distance between the ports;
\( v \) - average sailing speed in-between the ports;
\( T_p \) - time necessary for sailing within port and port formality arrangement;
\( T_l \) - time necessary for discharge and loading.

Time factor is very important for the transport regarding possibilities to operate optimal timetable based on weekly schedule with minimum number of ships, especially on first stage.

Safety factors in transport compared to other transport corridors play very important role because oversize cargo units are usually carried as expensive goods. Safety factor in transport can be calculated as follows [7]:

\[ P = \frac{1}{\eta^k}((1 - Q_1)(1 - Q_2)(1 - Q_3)(...)) \]

(6)

here:
\( P \) - positive probability;
\( Q_i \) - opposite probability;
\( \eta^k \) - correlation coefficient.

Safety is calculated as a positive probability.

For the comparison between transport corridors as well as between oversize transport corridors a complex evaluation method can be used that can be calculated for the concrete oversize transport direction as follows:

\[ E = \frac{1}{\eta^E} \sum (k_i \cdot M_i) \]

(7)

here:
\( M_i \) - factors like costs, time of delivery, safety, environmental impact, navigational conditions, ice conditions etc;
\( k_i \) - weight of the factors to depend on the type of cargo, transport possibilities etc that can be found on the basis of multi criteria analysis;
\( \eta^E \) - correlation coefficient that depends on number of factors used in evaluations.

On the basis of methodologies presented in this report it is possible to make evaluation of the concrete oversize transport corridor together with other parts of the whole transport corridor and find the difference between transport corridors as follows:
\[ \Delta = \frac{E_i}{E_0}, \]  

here:

- \( E_i \) - investigated transport corridor;
- \( E_0 \) - basic transport corridor, to be taken as standard.

On the complex evaluation basis, it is possible to establish more accurately all the advantages and disadvantages that would enable to take final decision and provide correct explanations for investors and other market players on an existing concrete transport corridor as well as oversize transport corridors potential possibilities.

For the transport corridors evaluation is taken Gauss distribution and there are three the main factors: costs of the transport, time of the delivery and cargo safety.

In case of Gauss distribution \([1, 2, 3]\), the main factors’ dependences can be expressed as follows:

\[
\sum P = \lim_{p \to \text{opt}} p_i, \]  

\[
\sum T = \lim_{t \to \text{min}} T_i, \]  

\[
\sum S = \lim_{s \to \text{max}} S_i, \]  

Where:

- \( P, T, S \) - main factors (cost, time, safety);
- \( p_i, t_i, s_i \) - costs, time and safety in separate transport corridor elements \( n \).

Unified evaluation on basis dependences (1) – (3) can be expressed as follow \([4, 7]\):

\[
G = k_P \sum P + k_T \sum T + k_S \sum S, \]  

Where:

- \( k_P, k_T, k_S \) - main factors weight coefficients.

Weight coefficients depend of the type of cargo (goods) and can be calculated as matrices (in case, if enough data) or can be found on basis of experts’ evaluation. For the typical inter modal cargo \([6, 7]\) cost factor weight coefficient could be \( 0.30 – 0.45 \), time factor weight coefficient could be \( 0.20 – 0.30 \), safety factor weight coefficient could be \( 0.10 – 0.20 \). In any cases sum of the weight coefficients must be equal to 1.
3. Forecast of the oversize transport flows

There are no official statistics on oversize transport in Poland. The only background for forecasting gives available data on issued permits. There are two possible sources of data: General Directorate for National Roads and Motorways and PKP Polish Railway Lines Company. Both institutions are responsible for issuing permits in road and rail oversize transport.

Generally speaking, in Polish circumstances any oversize transport forecasting must be regarded as a highly imperfect, due to the large unregistered road market. Experts assume that from 10% up to 30% of all oversize transport operations are carried out without the required permits. The short transports, up to 100 km, which do not require the use of national roads and motorways, are very often illegal. The most difficult for unregistered market operators are international transports, which are almost 100% legal.

In road transport data shows ever sustained increase in the number of permits issued, on average, more than 10% yearly in 2001-2009. Therefore, the forecast shows future increase in permits number up to 2015. The registered road market will grow up over 40% compared to the best so far 2008 year (Fig. 29, Tab. 13)

In rail transport data available data concerning short period 2007-2009 shows dynamic growth of the permits issued, above 30% yearly. This number is the more significant that there was a significant decline in overall rail freight transport in that period. The forecast up to 2011 implies a high increase in oversize rail traffic (Fig. 30, Tab. 14)
### Table 13. Forecast of issued permits in road transport

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of permits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>12468</td>
</tr>
<tr>
<td>2002</td>
<td>18977</td>
</tr>
<tr>
<td>2003</td>
<td>22952</td>
</tr>
<tr>
<td>2004</td>
<td>21007</td>
</tr>
<tr>
<td>2005</td>
<td>19964</td>
</tr>
<tr>
<td>2006</td>
<td>22211</td>
</tr>
<tr>
<td>2007</td>
<td>23400</td>
</tr>
<tr>
<td>2008</td>
<td>30721</td>
</tr>
<tr>
<td>2009</td>
<td>24164</td>
</tr>
<tr>
<td>2010</td>
<td>progn.: 30111</td>
</tr>
<tr>
<td>2011</td>
<td>progn.: 32288</td>
</tr>
<tr>
<td>2012</td>
<td>progn.: 34622</td>
</tr>
<tr>
<td>2013</td>
<td>progn.: 37125</td>
</tr>
<tr>
<td>2014</td>
<td>progn.: 39809</td>
</tr>
<tr>
<td>2015</td>
<td>progn.: 42687</td>
</tr>
</tbody>
</table>

Fig. 30. Forecast of issued permits in rail transport

### Table 14. Forecast of issued permits in rail transport

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of permits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>10013</td>
</tr>
<tr>
<td>2008</td>
<td>13453</td>
</tr>
<tr>
<td>2009</td>
<td>17164</td>
</tr>
<tr>
<td>2010</td>
<td>progn.: 20694</td>
</tr>
<tr>
<td>2011</td>
<td>progn.: 24270</td>
</tr>
</tbody>
</table>
4. Oversize transport map

4.1. Oversize transport clients

Oversize transport clients are a very large group of companies, operators and state institutions. Location of the departure and destination places in oversize transport are not so much the location of these entities. Transportation operations take place mostly between the place of production and investment location. Numerous examples of the locations of various industrial areas and locations of existing and future investments are presented in chapter 1.5. “Regional perspective”. Figures below show the most important locations in terms of the South Baltic Oversize Strategy. The analysed area included the northern Poland, taking into account the transport corridor Berlin-Moscow. The presented locations include:
1) current and future locations of wind farms (Fig. 31),
2) current and future locations of special economic zones and power plants (Fig. 32),
3) current and future locations of main investments (Fig. 33).

4.2. Oversize transport corridors

In Poland, for transporting oversize cargo generally available public infrastructure is used. Permits of oversize transport, in the first place, indicate such routes, which run the main transit routes, i.e. east-west and north-south corridors. In the case of road permits, are motorways, expressways and national roads. In the case of railway permits, the preferred routes are main railway lines indicated in AGC and AGTC agreements.

Intermodal oversize transport, taking advantage of more than two modes of transport is very rarely used. However the standard transhipment points are seaports, river ports and airports. Oversize cargo is transhipped between ship and trailer/wagon or very rarely between plane and trailer. Practically, there are no transhipments between wagon and trailer. In other words, any change of transport mode is enforced by transport possibilities of origin-destination route and road transport acquires the vast majority of oversize cargo in the land transport directions. Rail transport is treated as less attractive alternative, which is used when road transport is impossible.

The South Baltic Oversize Strategy postulates greater use of sea transport, inland shipping and rail. Infrastructure of these modes of transport has been taken into account when creating the concept of oversize transport corridors. Hence, the corridors planning process began with the preparation of map of existing road, rail, and inland shipping infrastructure, including sea and river ports. The map reflects the future state of infrastructure, in 2020 perspective, which will be used for oversize transport (Fig. 34).

The oversize corridors should be based on the existing corridors of the TEN-T network (Trans-European Transport Network). Unfortunately, in the analysed area of Poland, their run mainly in North-South direction. Therefore, oversize transit around the Baltic Sea have to use the Berlin-Moscow corridor, which is about 200-300 km from the coastline (Fig. 35 and 36). The South Baltic Oversize Strategy postulates increasing the number of rail and road connections to enable efficient oversize transport around the Baltic Sea, i.e. using Berlin-Szczecin-Koszalin-Słupsk-Gdańsk corridor. Very important are connections to sea and river ports, which are treated as main transhipment points. Map of oversize transport corridors shows alternative possibilities of origin-destination transport services based on usage of two
or more modes of transport. The most important ports and railway nodes may play a role of oversize transport terminals (Fig. 37 and 38).
Fig. 31. Wind intensity areas and windmills
Fig. 32. Special economic zones and power plants
Powerplants
Inland ports
Gantry cranes
Rafinery
River shipyards
Machinery production
Power transformers
Ship’s engines

Fig. 33. Main investments
Fig. 34. Transport infrastructure
Fig. 35. Road TEN-T corridors
Fig. 36. Rail TEN-T corridors
Fig. 37. Oversize transport corridors
Fig. 38. Example location of oversize terminal
5. Oversize transport corridors economical aspects

A comprehensive economic analysis of the transport of oversize is practically impossible. Financial data related to operations are very difficult to obtain. In railway transport sector procedure for financial disclosure is long and quite complicated. In road transport sector the situation is a bit better but any request of transportation costs must be supported by detailed explanations for their usage. This follows the general fear of carriers and shippers of disclosure their data before the competition. Additionally, it is associated with a large share of illegal oversize road transport.

The following comments relate to compliance costs of road infrastructure, on the example. for the transport of cargo which is the turbine. Analysed oversize cargo is wind turbine that has been transported from the Port of Szczecin to the wind farm in Pobłocie Wielkie, in the West Pomeranian Region. Detailed description of oversize cargo and laden semitrailers shows following table. The biggest cargo unit is the rotor blade of a 45 m length, instead section 1 is the heaviest cargo unit (Tab. 15)

Table 15. Description of oversize cargo and laden vehicle

<table>
<thead>
<tr>
<th>No.</th>
<th>Sections</th>
<th>Description of cargo</th>
<th>Description of laden vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Section 1</td>
<td>15,809</td>
<td>4,220</td>
</tr>
<tr>
<td>2</td>
<td>Section 2</td>
<td>18,610</td>
<td>4,033</td>
</tr>
<tr>
<td>3</td>
<td>Section 3</td>
<td>19,980</td>
<td>3,803</td>
</tr>
<tr>
<td>4</td>
<td>Section 4</td>
<td>23,822</td>
<td>3,485</td>
</tr>
<tr>
<td>5</td>
<td>Section 5</td>
<td>24,367</td>
<td>2,771</td>
</tr>
<tr>
<td>6</td>
<td>Gondola</td>
<td>10,321</td>
<td>3,450</td>
</tr>
<tr>
<td>7</td>
<td>Hub</td>
<td>3,983</td>
<td>3,650</td>
</tr>
<tr>
<td>8</td>
<td>Rotor blade</td>
<td>44,157</td>
<td>4,219</td>
</tr>
</tbody>
</table>

Fig. 39. Route of the oversize road transport
The technical limitations of the road transport on above mentioned route was associated with:

- too small width of the road,
- roundabout with small turning radius, that unable to travel straight ahead,
- the poor state of roads,
- sharp turn in forests,
- several objects in the urban area, such as buildings, lamps, road signs,
- trees and bushes along the road,
- permissible axle load on local roads of 8 tons.

These last two limitations were most were the most difficult to overcome and were associated with additional costs for the carrier. Statement of compliance costs of road infrastructure to transport the oversize cargo is given in the table (Tab. 16).

Table 16. Compliance costs of road infrastructure to transport the oversize cargo

<table>
<thead>
<tr>
<th>No.</th>
<th>Description of operations</th>
<th>Location of operations</th>
<th>Costs [PLN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Survey of the route, preceding oversize transport</td>
<td>the whole route</td>
<td>3.500</td>
</tr>
<tr>
<td>2</td>
<td>Police escort (three convoys were needed for one wind turbine)</td>
<td>the whole route</td>
<td>3 times 3.000</td>
</tr>
<tr>
<td>3</td>
<td>Tree pruning</td>
<td>Several locations mainly on local roads (last 15 km)</td>
<td>4.500</td>
</tr>
<tr>
<td>4</td>
<td>Timber shielding performance of curbs on the road turns</td>
<td>3 locations</td>
<td>3 times 1.000</td>
</tr>
<tr>
<td>5</td>
<td>Lining the road with concrete slabs</td>
<td>last 2 kilometres (60 slabs)</td>
<td>28.000</td>
</tr>
</tbody>
</table>
|     | **Total**                                                    |                                        | **48.000 PLN**  | (c.a. 12.000 EUR)
6. Legal evaluation of the oversize transport corridors

6.1. Existing legal basis and its problems

6.1.1. Legal basis for oversize transport

Regulation describing oversize transport can be divided into two groups:

4) regulations concerning safety of vehicle’s construction, which result from technical-strength and stability documentation and law regulations, for example International Maritime Organization resolutions and codes,

5) acts of law and administration regulations of local authority concerning oversize transport, for example territorially proper Inland Waterway Transport Director orders.

6.1.1.1. Law regulations in road transport

Oversize cargo transport is regulated by many acts of law issued by the Ministry. The most important are:

- Act of June 20th 1997 - Road traffic law (section II - Road traffic; chapter 5: Order and traffic safety on roads; chapter 4: Conditions for use of vehicles on the road - Art. 61 – 64, Dz. U. z 2003 r. Nr 58, poz. 515);
- Act of March 21th 1985, about public roads (Dz. U. z 2007 r. Nr 19, poz. 115);
- Act of September 6th 2001 r. about road transport (Dz. U. 2004 r. Nr 204 poz. 2088);
- Decree of the Minister of December 31st 2002 on vehicles technical conditions and range of their necessary equipment (Dz. U. z 2003 r. Nr 32, poz. 262 ze zm.)
- Decree of the Minister of December 16th 2004 r. on special conditions and permits issuing procedure for oversize vehicles transit (Dz. U. Nr 267, poz. 2660);
- Decree of the Infrastructural of July 26th 2004 about costs connected with transit route defining (Dz. U. Nr 170, poz. 1792);
- Decree of the Home Affairs and Administration of December 30th 2002, about road traffic control (Dz. U. z 2003 r. Nr 14, poz. 144 ze zm.);
- Decree of the Infrastructural Minister of April 26th 2004 about vehicles which make pilotage (Dz. U. Nr 110, poz. 1165).

Abundance of documents don’t foster easiness and coherence of law applied to carriers, forwarders and institutions that operate oversize vehicle transport. Currently there could be observed some effort to change and simplify existing Road Traffic Law and other acts with the aim to reorganize existing legal order in discussed area. New act is being widely discussed and opened for public consultation.

6.1.1.2. Law regulations in rail transport

Conditions of cargo transport by rail are identified in:

- Decree of June, the 7th 2006 (with later changes) on kind and conditions on transporting cargo, that can cause transport difficulties in rail transport (Dz. U. nr 108, poz. 746).
- Cargo delivery regulation (RPT) PKP Cargo S.A. (text codified with changes from the 1st of January 2010)
- Ch5 Instruction how to transport extraordinary delivery PKP Cargo S.A.

6.1.1.3. Law regulation in inland water transport

In inland water transport oversize cargo transport is regulated by:

1) Ordinance of Infrastructure Minister of April, 28th 2003 on regulations for shipping on inland waterways,
2) Local law regulations published by appropriate territorial Inland Navigation Office Directors. For example for lower section of the Odra river there are:
   – Ordinance of Inland Navigation Office Director in Szczecin from June, 7th 2004 regarding local law on inland waterways.
   – Ordinance of Inland Navigation Office Director in Szczecin from December 4th 2009 regarding shipping on the border waters of Oder, West Oder and the river Lusatioan Neisse.

6.1.1.4. Law regulations in maritime transport

In Poland the Law defining the sea transport taken as the whole, is The Polish Maritime Code issued on 18 of September 2001. There is not any particular law regarding oversize cargoes, therefore carrying such type of cargo, apart from the ship’s Loading and Stability Instructions, one must follow the standards of Safe Practice for cargo Stowage and Securing, and other safety procedures enforced by the IMO Conventions. The institution of Maritime Code, however in different forms, is enforced in all Maritime Countries.

The following International Regulations will be observed when carrying the oversize cargoes:

– International Convention for the Safety of Life at Sea (SOLAS), 1974
– International Convention for Safe Containers, 1972 (CSC))
– International Regulations for Preventing Collisions at Sea, 1972 (COLREGs)
– Code of safe practice to cargo stowage and securing (CSS IMO Code)
– Regulation of the local Maritime Administrations

Regarding the oversize transport, the local law imposes on the Administration the duty to monitor and supervise the movement of such cargoes. In practice it is limited to one time permit given to the water crafts carrying oversize cargoes, for entering the port and to navigate on the waters under jurisdiction of the said administration. It applies however to all ships deferring from the standard parameters for draft, dimensions and maneuverability.

Due to the variability of the oversize cargoes, apart from General Regulations originated from the Port Regulations, the regulations referring the oversize cargoes alone are not defined, and the permit for movement is given for one passage only. It should be emphasized that in every case the additional tugboat assistance should be given and frequently, second pilot. The terms of the additional insurance coverage for the carrier will be produced.

In case of the Polish ports such Port Regulations origin from the Directives, Announcements and Orders of the Director of the Maritime Office.
6.1.1.5. Law regulations in air transport


6.2. Optimization procedures of oversize transport corridors and network

To optimize the oversize road transport in Poland, changes mainly in the regulatory framework are proposed:

- to standardise and simplify procedures for issuing permits for oversize transport,
- to define the standard for oversize cargo not only the standard oversize vehicle,
- to introduce uniform permit application,
- to shorten time needed for issuing permit to several days, which would reduce the illegal transport without permits,
- to introduce a clear system of license fees,
- to increase the penalties for transport without permits, and carriage of goods not complying with the authorization, including ban for oversize transport operations for the specified period,
- to create standards for securing cargo and to force carriers to use them,
- to create a database containing constraints on cargo routes,
- to introduce licensing of pilot companies,
- the change of rules for the design and construction of roads, which move oversize vehicles.

To simplify the procedure for obtaining a permit for oversize transport, it should be possible to submit applications electronically. The form should be in Polish, English and German. After its completion, the program should automatically guide the application to the appropriate office issuing the permit. It also should include the option to automatically check and inform the applicant whether it is possible to obtain a permit for the proposed journey, and how much will it cost.

To restrict the road transit of oversize and redirect it to the other modes of transport, it would be advantageous:

- to promote water transport as safer, energy sparing and environment friendly,
- to promote water transport as the alternative for oversize transport, where the limits, at least the weight limits, are easier to follow,
- to award the carriers shifting their cargo from the road to the water, e.g. with tax deductions (for CO₂ reduction, environment protection, etc.).

6.3. Regional experience for “one-stop shop” approach

In Poland, there were not used the solution of "one-stop-shop" for issuing permits, so far. The only step in the right direction, is the website of state road administration GDDKiA (www.gddkia.gov.pl), where one can find the web based tool for preparing an application for oversize transport permit. It is prepared in Polish, German and English.
After completion of based application it should printed and sent to GDDKiA in Warsaw (Fig. 40).

Fig. 40. Web based generator of oversize permit application
7. Barriers and possible solutions

7.1. Main barriers of oversize transport development in Poland

The problem of barriers in oversize transport should be analysed in each mode separately. Looking for possibilities of ensuring safety for all transport users and reducing losses resulting from oversize transportation, one can easily find that the most difficult situation is in road transport. The rest of transport modes has natural features to facilitating surveillance of the oversize traffic:

1) in sea transport - the regulations and principles related to the oversize cargoes on board the ships are strictly controlled by the IMO (International Maritime Organisation) and the Class Societies (Lloyd, GL, GL .PRS etc); no ship could receive the insurance coverage without appropriate certificates and positive results of inspections;

2) in inland shipping – the most important limitation is associated with waterway parameters (draft, air draft, breadth of canals and bridges, etc.); so the physical limits of the ship and waterway are playing effective role in ensuring the security of oversize transport;

3) in the rail transport – rail administration is very vigilant and will not easy permit any overweight knowing the size and capacity of the wagon and train; it is not possible to exceed railway gauge because the wagon will not come through;

4) in air transport - the oversize transportation is extremely limited by the capacity of an air plane; nothing could come on board without the precise cargo list complying with the technical data of plane;

The road transportation is quite different and not easy to control. Although the operators are obliged to report any oversize cargo to be transported, some of them escape this duty.

The penalties on carriers for the exceeded dimensions are not imposed and executed. The general practice is to stop a vehicle on the parking lot and wait for authorization. Much worst problem make over weighted vehicles. We could observe two situations:

- truck is overloaded against its own capacity
- truck is overloaded against the permissible capacity of the particular road.

Polish law does not permit any excess over the permissible gross vehicle weight or permissible axle load. In both cases efficient check points on the road to control such illegal traffic are needed. Another need is continuity and thus the inevitability of punishment. Current situation that state inspectors are limited with working hours, because they work only by days 8 hours daily. Therefore by night much of the overweighed vehicles are being transported.

From time to time some inspectors catch the carriers overcoming the limits, but the penalties re not too much tiresome for them. In effect, it could be profitable to break the rules. Simply: it is cheaper to risk low penalty then to lose the freight.

The problems associated with illegal oversize road transport can be named as follows:

- The central database of the issued permits is not exercised and remains at the stage of the project and conception only.
– Road administration officials issuing permits do not inspect cargoes and the information stated by the applicants are accepted in bona fide.
– Information on permits issued is not being supplied to the Police and the Road Transport Inspection ITD. Administrators and GDDKiA are not informed about criminal records of the carriers by the ITD and the Police.
– The ITD has limited ability to control vehicle at night, and most transport takes place just by night. Because the ITD is a civil service and must observe the Labor Code, and its employees have restrictions to work at night, while doing inspections. With too many hours worked at night, the Labor Inspectorate may impose a penalty on the ITD. The only situations permitting to make inspections at night are "night actions" or denunciation of illegal transport.
– Financial penalties are not much tiresome for the carriers. The maximum penalty is currently 60 thousand PLN and seems not to be big enough to enforce the change the behavior of certain carriers.
– The ITD does not have access to data from the Central Register of Vehicle and Drivers. The ITD can only provide data, and then has not access to them.
– The ITD can only work on public roads. Anyone stopped on a private field or property cannot be controlled there without the permit of the owner. Positive example of cooperation on such areas ports where managers always welcome the inspectors.
– There is no direct cooperation between Police and ITD.
– Only 577 ITD inspectors in 2010 were employed in Poland.

7.2. Effective inspections and penalties

To achieve increase of the controls efficiency and to eliminate 100% carriers breaking the law frequently, the following solutions should be implemented:

the simple system of the execution of the penalties,
1) to increase the frequency of the control,
2) to introduce the controls by night,
3) to implement strict penalties for carriers who frequently overcome do not obey the law,
4) high number of the check points.
5) to allow to penalize the carriers following the measurements from the dynamic weights (WiM systems),

The last possible solution is worth of farther explanation. Automatic control devices type WiM (Weight in Motion) allows to weight the vehicle moving with the velocity up to 140 km/h. It is very useful because it does not disturb the standard road traffic. Information of the weight and axle load is transmitted to the road administrator.

Currently, the execution of the penalty based on the data from that system is not possible. The measurement is too much influenced by the external circumstances, such as rain, temperature, wind, car speed and acceleration. Producers declare maximum accuracy of 10%, while in Poland the law permits only error of less than 2%.

In Poland the WiM system in road transport is at the initial state of construction. All said above made WiM systems useful only to preselect the vehicles and to stop those supposed to be overweighed for further static weighting. Now, we can only say about
limited number of preselecting posts. Such system installed in Wrocław prevents the city roads from overloaded vehicles.

The system could be easily extended by the modems for measuring the external dimensions of the vehicles (length and height). Such extended pre selection system consists of the following elements (Fig. 41):
1) the camera to measure the length and height,
2) induction loops to switch off/on the weighting sensors,
3) over-view camera,
4) camera to identify the plates number,
5) weighting sensors,
6) the boards with the information for driver.

Fig 41. The system of pre selection the vehicles in motion

When the state control institution will have effective tools, like WiM systems, the situation on Polish roads will improve.