PKP Polskie Linie Kolejowe S.A.

Modernisation of the E 30/C-E 30 railway line at the section Opole – Kraków

Stage III

Task 15

Environmental impact report

Summary in non-specialist language

October 2007

Project No.	FS 2002/PL/16/P/PA/012
Copy No.	
Date	October 2007

Prepared by:	Lech Poprawski *et al.*
Checked by:	Jacek Jędrys
Approved by:	Christian Borst

1. Introduction

This report was compiled in preparation for the modernisation of the E 30/C-E 30 railway line at the section Opole – Kraków.

1.1 Basis for the report

This report was prepared based on the agreement with COWI A/S Parallelvej 2, 2800 Kongens Lyngby, Denmark – Leader of the Consortium responsible for the design of "Modernisation of the E 30/C-E 30 railway line at the section Opole–Kraków, project No. FS 2002/PL/16/P/PA/012 as commissioned by **PKP POLSKIE LINIE KOLEJOWE S.A.,** 74 Targowa Street: 03-734 Warsaw.

1.2 Objective and scope of the report

This report is to present environmental impacts of the planned project within the scope specified by Article 51, sections 1, 2 and 3 of the Act *Environmental Protection Law*. This report constitutes an enclosure to the Investor's applications concerning the issue of decisions on environmental considerations for implementation of the project submitted to Voivodes of the Opolskie, Silesian and Małopolskie Voivodeships.

1.3 Basic legislation

The report has been prepared in accordance with Polish laws that have been adapted in recent years to the effective legislation of the European Union. This section lists the applicable regulations broken down by acts and implementing regulations.

Legal regulations have been grouped according to topics: environmental impact assessment, air protection, noise protection, water and waste management, land and soil protection, nature protection, waste management, monitoring, protection of cultural objects, and other.

1.4 Input materials for the report

The basic material for the EIA report was the **Feasibility study for Modernisation of the E30/C-E30 Railway Line at the section Opole – Kraków, project No. FS 2002/PL/16/P/PA/012.** Input materials for the preparation of the report were individual topic-specific volumes of the "Study...", cartographic materials, content-related literature and unpublished materials on the subject, as well as own materials of author teams responsible for preparation of individual parts of the report.

2. Description of the investment project

The subject matter of the investment is modernisation of the E 30/C-E 30 railway line at the section Opole – Katowice – Kraków, within the limits of the Opolskie, Silesian and Małopolskie Voivodeships.
The railway line Opole – Katowice – Kraków is a part of Corridor III of the TEN. The line connects with transport corridor VI in Katowice and the E59 line (joining corridor III and II).

Fig. 1. Route diagram for the modernised line E 30/C-E 30

The modernisation of the E 30/C-E 30 railway line is aimed at meeting the requirements laid down in the 2004/50/EC directive of the European Parliament and Council on the interoperability of the trans-European conventional rail system (AGC and AGTC systems).

2.1 Location; current land use and development in the area of the expected impact; protected areas; mining damage

The Opole – Katowice – Kraków section of the E30/C-E 30 railway line that is planned for modernisation is located in the central part of southern Poland In geographical terms, it is located in several regions: the Silesian Lowland, Silesian Upland, Kraków-Częstochowa Upland, Sandomierz Basin and the Carpathian Foothills. The railway line that is to be modernised runs across a highly urbanised and industrialised area (meaning in particular the area between the Upper Silesian agglomeration and Kraków). The Upper Silesian conurbation is one of the most industrialised areas in Europe, which results from heavy accumulation and intensive exploitation of hard coal, zinc and lead ores and other mineral resources' deposits. It is also a location of numerous industrial plants involved in processing of raw materials.

Some parts of the area are legally protected due to their unique environmental values. They include the following: Ojców National Park and Jurassic Landscape Parks, Saint Anne Mt Landscape Park, Landscape Park of the Cistercian Landscape Compositions of Rudy Wielkie, Kraków Valleys Landscape Park, Tenczynek Landscape Park, Rudno Landscape Park, Bielany-Tyniec Landscape Park. Threats to protected areas are discussed in more detail in the volume devoted to nature protection and "NATURA 2000" sites.

Mining and mining damage

The largest area of mining works is located in the Upper Silesian agglomeration. In other parts of the studied area, we will mainly come across mineral extraction locations, particularly of Triassic and Jurassic limestones and dolomites, sands and gravels, silty materials, as well as porphyries and melaphyres near Kraków and Krzeszowice.

Mining leads to large-span qualitative and quantitative changes in the environment, including in the water. Mining activity converts the landscape, which manifests itself in the creation of sinkhole areas of different sizes that are later filled with water and the creation of artificial elevation forms, i.e. mining waste dumps.

The route of the E 30 line coincides with the area of vanishing mining operations in the northern part of the Upper Silesian Industrial Region (Polish abbreviation: GOP), whereas the C-E 30 line runs in the south, where mining activity is still intensive.

Deformations of the mining areas, especially the horizontal ravelling strains, result in a sustainable change of geotechnical parameters of the subsoil, as well the trackbed in the mining area itself (generally weakening its resistance and stability).

The number of failures of railroad surface within mining areas is 4–6 times higher compared to areas where mining activities do not occur and which display a similar traffic load and structure load parameters.

Provisions included in the applicable local area development plans

As part of the study, local area development plans were reviewed (for areas located along a strip of up to 250 m from the railway line) in terms of measures to protect residential development areas from negative impact of the E30/C-E30 line. Documentation of the review is attached to applications for an environmental decision. The review has shown that

- with a few exceptions, i.e. where a 120-metre zone was established with a ban on residential development, the existing and potential residential areas situated next to the E 30/C-E 30 railway line are not properly protected in the plans against line-related nuisance (noise in particular).
- Past errors in planning, i.e. locating residential development too close to the railway line persist in subsequent editions of local area development plans.
- We also observe some serious shortcomings in spatial planning for areas located in the vicinity of the E30/C-E 30 railway line.

2.2 Description of planned objectives

The feasibility study includes the following modernisation variants for the E 30/C-E 30 corridor:

- **Variant "0"** – reconstruction of the existing infrastructure within the scope necessary to fulfil the present needs, taking into account operating functions and traffic forecasts (recreation of the existing infrastructure).

- **Variant** "**1**"**–** infrastructure modernisation to meet AGC and AGTC standards for transport corridors (V=160 km/h in passenger traffic, V=120 km/h in cargo traffic, and the axle load of 221 kN). Utilisation of traditional rolling stock in passenger traffic is assumed.
- **Variant "2"** – modernisation and adjustment of the infrastructure to the speed of V=160 km/h for passenger trains and V=120 km/h for freight trains, and the axle load of 221 kN for conventional rolling stock (the same as Variant 1). This variant also includes modernisation of the infrastructure to support the maximum traffic speed (V_{max}) to 200 km/h, assuming the use of tilting passenger trains.
- **Variant "3" –** modernisation and adjustment of the E30 line infrastructure to V=200 km/h (for Opole – Zabrze section), V=160 km/h (for Zabrze – Kraków Podłęże section) and C-E30 to V=120 km/h.

2.3 Choosing the most environmentally-friendly variant

Environmental assessment included the impact analysis for all modernisation variants, including the no-action variant, and selection of the most environmentally-friendly variant. The analysis of each variant shows that all considered solutions and their parameters have a similar impact on both natural inanimate objects and the protection of Natura 2000 sites.

The most significant difference concerns the risk of exposure to noise, reconstruction of hydraulic structures and the land occupation in the implementation Variants 1, 2 and 3 related to a change in the geometry of curves.

Measurements and the acoustic analysis show that in the current state of affairs, permissible noise levels are significantly exceeded in the area around the E 30 and C-E 30 line, both at day and night time (with the night time being critical here). The proposed modernisation of the E 30 and C-E 30 line will result in increased noise levels at most of the sections, regardless of the adopted variant.

At the moment, permissible noise levels at night for the residential setback (within 25 m from the railway line) are exceeded by more than 10 but less than 20 dB (Opolskie Voivodeship – ΔL_A = 10...19 dB, Silesian Voivodeship – ΔL_A = 8...14 dB, Małopolskie Voivodeship -ΔL_A= 12...13 dB). In potential modernisation variants, noise levels will increase by a few dB, whereas the difference between estimated noise levels for individual variants does not exceed 2 dB. The only exception here is the C-E 30 line within the limits of the Silesian Voivodeship, where by far the most advantageous option is the no-action (0) variant.

The estimated differences in noise levels for the proposed modernisation variants as compared with the current exceedance of permissible noise levels can be considered negligible, since they do not affect the assessment of the acoustic climate quality or the requirements for anti-noise solutions. For all modernisation variants, it is necessary to take all possible measures to reduce the noise level in the environment, including by the use of noise barriers in conjunction with such railway subgrade solutions that will limit the noise level at the same sections of the railway line. For this reason, the noise impact is not a critical parameter for the selection of a modernisation variant.

As regards hydrological conditions, it should be noted that the existing, heavily exploited bridges and culverts do not meet the formal requirements for flood protection.

Hydraulic calculations (included in the volume "Hydrological Study") indicate that numerous structures need to be rebuilt because of too small clearances and non-compliance with relevant new regulations.

Each of the solutions (except for the no-action variant) will generate large quantities of different types of waste. The smallest quantity of waste will be generated in the Variant "0", and the largest in Variant "2".

The project impact on all **ecological corridors** will be significant. Once the mitigation activities (rebuilding culverts and bridges, construction of wildlife crossings such as "green bridges", etc.) are implemented, the impact can be reduced to an insignificant level.

In relation to protected areas and nature reserves, the project impact is negligible.

Analysis of natural resources listed in the Habitats Directive and the Birds Directive outside the designated Natura 2000 sites has shown that in some cases the project may have an impact on the behaviour of some resources. However, if some proposed mitigants are employed, the project impact can be considered negligible. If such mitigating solutions are applied, modernisation of the railway line as planned will not have a significant negative impact on the Natura 2000 network.

In conclusion, it should be noted that in environmental terms, **the best option seems to be Variant 1.** The worst option, both for social and environmental reasons is the no-action variant, which is to maintain the existing infrastructure in its current state. Keeping the status quo has a negative impact on the acoustic climate, water environment, soil, and animal and plant protection. Final decisions as to the choice of one modernisation variant (option) should refer primarily to economic and technical considerations.

3. Environmental conditions

3.1 Geographical situation, landscape, landform features

In terms of physical and geographical regionalisation, the studied area belongs to Western Europe and consists of two mega-regions: Extra-Alpine Central Europe and the Carpathian Mountains, Subcarpathia and the Pannonia Lowlands. Smaller units of physical geographical division (meso-regions) located in the project area are: ***Wrocław Urstromtal, Racibórz Basin, Chełm, Katowice Upland, Jaworzno Knolls, Kraków-Częstochowa Upland, Olkusz Upland, Krzeszowice Trench, Kraków Gate and the Vistula Lowland***.

3.2 Climate

The analysed area stretches across two climatic regions: ***South of Lower Silesia and the Silesia and Kraków region***.

The South of Lower Silesia region covers the south-eastern part of the Silesian Lowland, Głubczyce and Rybnik Plateaux and the western part of the Silesian Upland. It is characterised by a small number of frosty weather days (about 14 days/year) and quite cold weather. It is often hot but cloudy (60 days/year on average).

The Silesia and Kraków Region (R-XXVI) includes the Silesian Foothills, Wieliczka Foothills, Silesian Upland, and the southern part of Kraków-Częstochowa Upland. The region is characterised by a large number of very warm days with precipitation (34 days/year) and the highest occurrence of moderately warm weather with a high cloud cover and precipitation (50 days). Frosty weather, moderately cold and without precipitation is relatively more frequent.

The majority of the studied area is characterised by high average annual air temperatures, reaching 8.5°C in the Silesian Lowland region. In the north-eastern upland areas, temperatures are slightly lower and fluctuate around 7.0–8.0°C.

Average annual precipitation in the area is typical for Polish upland regions and falls within the range of 650–700 mm. Only the southernmost strip of the area lies within the zone of higher rainfall of up to 800 mm, which is associated with the influence of the nearby Carpathian massif.

3.3 Geology

The analysed area stretches across three major geological structures: the Silesian-Moravian structure, Palaeozoic structures of the Central Polish Uplands, and the Silesia-Kraków Monocline. **The Silesian-Moravian Structure** is located between the Bohemian Massif and the Lower Silesian Block and the Carpathians. It is built from Precambrian and Palaeozoic rocks. It is divided into East-Sudetic metamorphic rocks, culm facies and the Upper Silesian basin.

Palaeozoic structures of the Central Polish Uplands form a strip of hills known as the Meta-Carpathian arch, formed during the Miocene. Tertiary upheaval movements and erosion processes have led to the exposure of Palaeozoic rocks, for instance in the vicinity of Kraków. The remainder of Palaeozoic rocks lie under a non-thick Mesozoic cover. A few geological units can be discerned here: the Krakowidy range, Lesser Poland massif, Świętokrzyskie mountains and Radom-Kraśnik elevation. These units now form a vast Palaeozoic anticlinorium lying between the Upper Silesian basin (in the west) and the Bug River basin (in the east), divided further into several zones.

Silesia-Kraków Monocline is a natural continuation of the pre-Sudetic monocline. Its south-eastern border is marked by the northern boundary of the Carpathian Mountains and the reach of the Carpathian Foredeep, whereas the Wieluń rift valley is considered to be its north-western border. The reach of the NW – SE monocline corresponds to the eastern reach of the Upper Jurassic rocks forming a cuesta of the Kraków-Częstochowa Upland. Mesozoic deposits slope by a few degrees, whereas locally the slope may be greater. In the monocline base, we can find Palaeozoic structures of the Kraków zone.

3.4 Soils

Soils that can be found in the study area are typical of the physical and geographical arrangement and geological structure. The diversity of soils results among others from the diversity of bed-rocks (mainly boulder clays and sands), which were subject to erosion, sorting and mixing as part of geological processes in the periglacial period.

The study area is dominated by brown surface soils, except for a small area in the south-western part, where luvisols and black earth are mainly found.

3.5 Surface water

The railway line Opole – Katowice – Kraków crosses portions of the upper parts of the Oder and Vistula River basins. Its central section cuts through the Silesian Upland that lies in the watershed zone of the two basins. As the Upper Silesian conurbation is strongly urbanised and the underground mines are widespread there, the river system course has been significantly modified.

The railway line whose route is analysed here is not only close to Poland's two major rivers, namely the Oder and the Vistula, but it also runs near or intersects with their main tributaries such as: Mała Panew, Kłodnica, Czarna and Biała Przemsza, Brynica, Prądnik and Rudawa. Their riverheads are found in the elevated parts of the Silesian Upland or Kraków-Częstochowa Upland. In the southern part of the area, the total run-off is formed in basins of the right-hand tributaries of the Vistula such as: Skawa, Soła and Raba. The latter are typical mountain rivers, starting in the Carpathians and characterised by a high variability of flows.

A detailed list of rivers together with the summaries of water levels and characteristic flows, regional water resources and water quality parameters are presented in the hydrological study, which forms a separate volume of the feasibility study.

3.6 Description of hydrogeological conditions

The complex geological structure that is found in the part of Poland discussed here translates into a large diversity of local hydrogeological structures. In accordance with A.S. Kleczkowski's classification of ordinary waters, hydrogeological regions discussed here are part of a large unit covering the southern part of Poland, known as the hydrogeological province of mountains and uplands. Groundwater is found in Cainozoic, Mesozoic, Palaeozoic and crystalline structures. Best explored are the hydrogeological levels from the Quaternary and the Tertiary, whereas in the Opole region, these are Cretaceous and Triassic levels.

Some hydrogeological structures characterised by high abundance and quality of groundwater have been classified as Main Groundwater Reservoirs (Polish abbreviation: GZWP). The special protection areas associated with the location of Main Groundwater Reservoirs are shown on the map attached to the report.

3.7 Acoustic climate

3.7.1 Quality standards of the acoustic environment

In line with the current national legislation on noise, a dual noise rating system has been introduced, which distinguishes between:

- implementing a long-term policy for the protection of the environment against noise pollution, especially for acoustic mapping purposes;
- identifying and monitoring of conditions for the use of the environment.

For both areas of activity, different noise indicators are employed.

For the purposes of environmental impact assessment, authors use the indicators that are applied in identifying and monitoring of conditions for the use of the environment. In order to identify and monitor conditions for the use of the environment, the following indicators are used:

- L_{AeqD} – equivalent noise level for day time (understood as the time interval between 6 a.m. and 10 p.m.),
- L_{AeqN}– equivalent noise level for night time (understood as the time interval between 10 p.m. and 6 a.m.).

Quality standards for the acoustic environment depend on the functions and intended use of the land, which should be specified in the local area development plan. In the absence of such plan, the land type is determined based on its de facto functions and uses.

3.7.2 Location and environment of the E 30/C-E 30 railway line

3.7.2.1 Opolskie Voivodeship

E30 line

The E 30 railway line within the limits of the Opolskie Voivodeship is approx. 56 km long. The E 30 line crosses 4 cities and towns: Opole, Gogolin, Zdzieszowice and Kędzierzyn Koźle. The following towns and villages are located in the direct vicinity of the E 30 line: Przywory Opolskie, Górażdże, Jasiona, Rozwadza and Raszowa.

C-E 30 line

The C-E 30 railway line within the limits of the Opolskie Voivodeship is approx. 44 km long. The C-E 30 line runs across 2 cities: Opole and Strzelce Opolskie. The following towns and villages are located in the direct vicinity of the C-E 30 line: Tarnów Opolski, Kamień Śląski, Szymiszów, Warmątowice and Błotnica Strzelecka.

3.7.2.2 Silesian Voivodeship

E 30 line

The E 30 railway line length within the borders of the Silesian Voivodeship is approx. 82 km long. The E-30 line runs across 9 cities: Gliwice, Zabrze, Ruda Śląska, Chorzów, Katowice, Świętochłowice, Mysłowice, Sosnowiec and Jaworzno. The following towns and villages are located in the direct vicinity of the E 30 line: Rudziniec Gliwicki, Taciszów and Rzeczyce Śląskie.

C-E 30 line

The C-E 30 railway line length within the borders of the Silesian Voivodeship is approx. 89 km. The C-E 30 line runs across 8 cities: Gliwice, Zabrze, Ruda Śląska, Chorzów, Katowice, Mysłowice, Sosnowiec and Jaworzno. The following towns and villages are located in the direct vicinity of the C-E 30 line: Kotulin, Ligota Toszecka, Toszek and Paczyna.

3.7.2.3 Małopolskie Voivodeship

E 30 line

The E 30 railway line length within the limits of the Małopolskie Voivodeship is approx. 64 km long. The line runs across the following cities and towns: Kraków, Trzebinia and Krzeszowice. The following towns and villages are located in the direct vicinity of the E 30 line: Balin, Trzebinia, Młoszowa, Dulowa, Wola Filipowska, Krzeszowice, Pisary, Rudawa, Niegoszowice, Zabierzów, Rząska, Zalesie, Kokotów, Węgrzce Wielkie, Rudzica and Podłęże.

C-E 30 line

The C-E 30 railway line within the limits of the Małopolskie Voivodeship is approx. 72 km. The C-E 30 line runs across the following cities and towns: Kraków, Trzebinia and Krzeszowice. The following towns and villages are located in the direct vicinity of the C-E 30 line: Balin, Trzebinia, Młoszowa, Dulowa, Wola Filipowska, Krzeszowice, Pisary, Rudawa, Niegoszowice, Zabierzów, Rząska and Podłęże.

3.7.3 Description of the railway line in terms of noise characteristics

The E30/C-E30 railway line is a priority trunk line. The E 30 line carries passenger and cargo traffic, whereas the C-E 30 line handles mainly freight trains, while local passenger trains run at some sections only. Passenger and cargo traffic is operated both at day and night time.

3.7.3.1 Traffic

The study specifies the number of trains per day, broken down into fast and mandatory reservation trains, stopping (local) trains and freight trains.

- Opolskie Voivodeship. Within the limits of the Opolskie Voivodeship, there are no significant changes in total traffic intensity along the entire length of the line. A sensitive section in terms of cargo traffic is that between Kędzierzyn Koźle and the voivodeship border, where freight trains account for approx. 50%.
- Silesian Voivodeship. A sensitive section along the E30 line is that between Gliwice Łabędy and Gliwice Sośnica (approx. length: 12 km), which runs through urbanised areas, and where daily traffic reaches approx. 200 trains, of which 64% are freight trains.
- Małopolskie Voivodeship. A sensitive section along the E30 line is that between Kraków Mydlniki and Kraków Main Cargo Station (approx. length: 20 km), where daily traffic reaches approx. 200 trains, of which 17% are freight trains. No freight trains run at the section between Kraków Main Cargo Station and Kraków Płaszów, which is favourable due to noise impact considerations.

3.7.3.2 Infrastructure and the rolling stock

Current state

At present, there are two types of track surface in a different state of repair at different sections of the E 30 and C-E 30 railway lines discussed here. Due to the condition of railway infrastructure, numerous speed limits apply to the line. The state of repair of railway subgrade and travel speed has a significant impact on varying noise emissions from trains.

Projected state

All modernisation variants assume the same surface design: contactless rails, resiliently mounted on wooden or concrete sleepers (**Variant** 1) with gravel ballast. Different variants vary in terms of the assumed maximum speed and changes in the infrastructure allowing for higher train speeds. **Variant** 3 is a mixed option: at the Opole West **–** Zabrze section, modernisation is to be carried out as in **Variant** 2, and at the Zabrze **–** Kraków section, modernisation corresponds to that in **Variant** 1.

3.8 Cultural heritage

The planned investment falls within the competence of the following Offices for Heritage Preservation: Opolskie Voivodeship Office for Heritage Preservation (section "A"), Voivodeship Office for Heritage Preservation in Katowice (section "B"), and Małopolskie Voivodeship Office for Heritage Preservation in Kraków (section "C").

Along the route of the planned investment project (in the adjacent zone of up to several hundred metres), several hundreds of structures and complexes have been identified in total. They represent the following categories of heritage objects (as specified in tabular and pictorial enclosures to the report, broken down by individual voivodeships):

- archaeological heritage;
- architectural monuments and historic architectural complexes;
- parks, cemeteries,
- historic railway infrastructure;
- historic items of engineering;
- historic urban structures and components of the cultural landscape.

4. Impact assessment at the project implementation stage

4.1 Land surface, soils, land use conditions

Earthworks and heap storage of materials, mainly aggregates and structural components during the project implementation stage will cause temporary local disruptions in the land surface and the landscape. Earthworks and transport with the use of heavy equipment can contribute to compaction of surface soil. Damaged systems should be restored as soon as possible.

4.2 Surface water

Modernisation work may also have an adverse effect on surface water. The impact should be considered in qualitative and quantitative terms.

The quantitative impact may consist in a disrupted flow at places where surface watercourses run under bridges or culverts.

A qualitative impact will consist in interference with the physical and chemical composition of water. Harmful substances (pollutants) may penetrate into surface water in several ways (either by means of a direct flow of substances into surface water or by leaching of substances from the work site). Negative factors will only apply during the project execution stage. Renovation and construction work combined with the temporary control of water relations (especially by means of drainage) may affect the water balance in natural habitats that are located in the vicinity of the railway line. Exposure might occur for habitats for which high groundwater levels are of primary importance, namely: alder forests, riparian forests, wet meadows, "młaka" meadows and old river beds.

4.3 Groundwater

Special attention should be paid at the project execution stage to the protection of groundwater, particularly where the railway line runs through the area of the Main Groundwater Reservoirs. As in the case of surface water, an impact of the project on groundwater must be considered in quantitative and qualitative terms.

A quantitative impact should be understood as the impact on the aquiferous layer resources. Such impact might occur at the work site and its immediate surroundings. It may be felt at shallower aquiferous layers. Such impact will be rather small and may occur in the areas in the immediate vicinity of surface water courses.

A qualitative impact of the project will result from any activities that may interfere with the physical and chemical composition of groundwater. A horizontal impact on groundwater will be similar to the extent of impact on surface water.

In order to protect groundwater, we should eliminate the possibility of contaminants penetrating into the ground and surface water. Prevention measures should include drainage (which is a must in the areas of Main Groundwater Reservoirs); attention should be paid as well to landfilling of waste, as well as storage of construction materials and oil-derived substances in the project areas.

4.4 Atmospheric air

4.4.1 Legal framework

Emissions at the construction stage and their impact on air quality are not subject to assessment according to the environmental quality criteria.

4.4.2 Determination of emission levels

No emission data is available for such a unique project as the modernisation of the railway line that is considered here. Measurement data is available, showing, among others, that in the area of large-scale construction sites, dust concentration increases. Such data, however, is not directly relevant for the project considered here. Main sources of atmospheric emissions are:

- operation of machinery with combustion engines;
- loading and unloading of vehicles;
- transport of bulk materials;
- wind erosion;
- road emissions from vehicle traffic;
- emissions in the storage locations of bulk materials.

4.4.3 Conclusions

Impact of the construction stage will be only temporary. Gaseous emissions (emissions from machinery and vehicle engines) will have little effect on air quality. Dust emissions caused by vehicle traffic on a dusty road will increase air dustiness near the road, whereas in a strip of several dozen metres along the road, dust concentrations may exceed the applicable quality standards for atmospheric air.

4.5 Noise

During the construction stage, sources of noise emissions into the environment will be plant and machinery used in the construction of track surface:

- heavy machinery for track-related work;
- construction machinery;
- specialised equipment;
- auxiliary devices.

The range of noise impacts associated with road work will depend on the type of machinery used, the number of concurrently operating machines and their working time. Generally, the sound power of modern construction machinery falls within the range of L_{WA}=105...115 dB.

At the Opole – Kraków section of the E 30/C-E 30 railway line that is discussed here, residential development areas lie within 20...50 m from the line, while some single buildings are directly adjacent to the railway land. An approximate analysis shows that the noise from construction activities may cause temporary nuisance to residents of buildings located at the distance of less than 100 m.

Noise from track-related work and noise from construction machinery is not subject to standardization, but it is recommended that the work is scheduled in such a way as to reduce the nuisance to residents, especially at night.

4.6 Waste and its management

4.6.1 Estimated waste balance

During modernisation and reconstruction of the E30 railway line at the Opole – Kraków section, waste will be produced during scheduled work related to site preliminaries, removal and rebuilding of the existing facilities, devices and installations, green area management, and the jobsite and machinery operation and clean-up/removal.

It is estimated that the above activities will generate, depending on the adopted variant, from approx. 3 to more than 4 million Mg of waste for the entire section between Opole and Kraków. The waste figure is smaller in the **Variant** "0", and higher for **Variants** 1, 2 and 3 (waste quantities in these variants are comparable).

4.6.2 Environmental impact

Environmental impacts of waste management at the project execution stage may be short- and long-term, direct and indirect. Their intensity depends primarily on the organisation of contractor work and waste management methods, especially as regards recyclable waste.

Implementation of an efficient waste management system at the stage of contractor work, including by means of establishment of suitable and legal waste facilities for the construction site and machinery fleet, as well as systematic waste removal at source will ensure that the waste management at individual work sections will be short-term, and only limited to the period when work is carried out. Involvement of the Investor, the Work Contractor and – ultimately – the entity that will operate lines, equipment and installations in the rational waste management plays a crucial role in reducing the environmental impact of waste management. It is estimated that if waste is properly managed, its environmental impact will be short-term and reversible at the temporary storage location.

4.7 Cultural heritage

Modernisation of the railway line may cause transformation of the environment by movement of large masses of soil (excavations, embankments), construction or reconstruction of engineering structures, rerouting of transport and the construction of all other associated facilities. All these activities constitute a potential threat to heritage objects (historic engineering structures and other items) that are located along the route of the investment project and in the neighbourhood.

All archaeological sites included in the heritage register and those protected by local regulations and included in voivodeship heritage registers fall obligatorily within the scope of the Act on Heritage Protection and Preservation. This means that all conflicts of work with heritage objects must be agreed with a Heritage Preservation Officer).

5. Environmental Impact Assessment including the analysis of possible post-investment threats, with a description of the forecasting methods

5.1 Surface of the earth (landscape)

Since nearly all variants for the proposed modernisation of the railway line (with few exceptions) remain within the area of the existing line and its associated infrastructure, it should be stated that project impact on the earth's surface and the landscape will remain unchanged. In fact, if **Variants** 1, 2 or 3 is chosen, railway landscape values can even be increased as the overall aesthetics will improve and the infrastructure will be renovated.

5.2 Soils (agriculture)

A negative impact of the railway line manifests itself by: vibration, stray currents, fire hazard, contamination of soils by herbicides or possible contamination as a result of chemical transport accidents.

The most prone to degradation are sandy soils with a small share of fine fractions. This category includes podzols. On the other hand, soils with a high content of organic matter, and dusty, silty and colloidal particles display considerable sorption and buffer properties that prevent abrupt changes in soil pH. This category includes fen soils and brown soils.

Because the line is fully electrified, its impact on soils is incomparably lower than in the case of regular roads that handle car traffic. The impact range is much smaller too. Therefore there is no need to limit the range of food crops in the vicinity of the line.

5.3 Surface water

It is expected that once the investment is put into operation, the use of railway traction will impact ground and surface water (“line source of pollution”). The volume of pollutants emitted by the railway into the environment is considerably lower than in the case of road transport, and almost 94% of PKP transport assignments these days are handled with the use of electric traction. Owing to all these factors, environmental interference of rail transport is relatively low. Threats may be expected in the areas when the railway line crosses poorly insulated aquifers.

Given the specific nature of pollutants emitted along the railway route, especially petroleum substances, attention should be paid to ensuring an appropriate system of water drainage ditches and drains along the route, and follow-up inspections of the system condition, as well as monitoring of the waterflow in the system, especially following emergency environmental hazards.

5.4 Groundwater

Available literature on hydrogeological conditions makes it possible to distinguish between the sections of the route that are more (or less) susceptible to contamination.

A typical example of insulation arrangement that provides for good insulation of groundwater is when the embankment is constructed of all-in aggregate, and its floor comprises low-permeability cohesive soils. In this way, the infiltrating water will easily run off along the slope towards the perimeter ditch. In this case, there is only a small risk that contaminants will penetrate into groundwater.

Unfavourable soil and water conditions (i.e. such that allow for easy penetration of contaminants) are found in high-permeability structures such as all-in aggregates, mixed-particle sands, or gravel admixtures with high filtration coefficients. In such profile, the rainwater (pollutants) can freely infiltrate deep into the embankment, directly into the surface of free-flowing groundwater. For such conditions, it is proposed to lay buried pipe drainage systems, at the depth that corresponds to the known level of the groundwater table.

5.5 Atmospheric air

Electrification of the railway line means no combustion gas, and thus no impact on atmospheric air quality. Other pollutants, such as dusts from wheel/rail friction, brake cladding, or wear and tear of other components in train sets are quite insignificant. Consequently, the issue of atmospheric air impact at the operational stage is negligible.

5.6 Noise

5.6.1 Objective and scope of the study

This section is to assess the noise impact resulting from operation of the E30 railway line at the section Opole West – Kędzierzyn Koźle – Katowice – Kraków (Podłęże) and the C-E 30 line at the section Opole Groszowice – Pyskowice – Gliwice – Katowice Muchowiec – Mysłowice – Kraków (Podłęże). The section in question runs across three voivodeships: Opolskie, Silesian and Małopolskie. The noise impact part of the study includes:

- noise impact assessment for the current state;
- noise impact assessment for the railway modernisation variants:
  - o **Variant** 0 – *Rehabilitation*, recreation of the existing infrastructure for V_{max}=120 km/h;
  - o **Variant** 1 – *Modernisation;* modernisation of infrastructure to adapt it to AGC and AGTC standards for transport corridors with V_{max}=160 km/h in passenger traffic and V=120 km/h in cargo traffic.
  - o **Variant**s 2 and 3 – *Modernisation and tilting trains;* modernisation of infrastructure for V_{max}=160km/h in passenger traffic and V_t= 120 km/h in cargo traffic for conventional rolling stock (as in **Variant** 1) and modernisation of infrastructure for V_{max}=200 km/h, assuming the use of tilting passenger trains.
  - o **Variant** 3: mixed variant for the E30:
    - ▪ at the section Opole – Zabrze – as in **Variant** 2, E30 – V_{max} = 200 km/h,
    - ▪ at the section Zabrze – Kraków (Podłęże) – as in **Variant** 1, E30 – V_{max} = 160 km/h.

Noise impact assessment for the current state and all modernisation variants includes:

- identification of noise levels for the setback (for day and night time);
- identification of noise impact ranges corresponding to permissible railway noise levels for day and night time;
- comparative analysis of modernisation variants;
- identification of sensitive areas;
- identification of noise protection requirements.

5.6.2 Basis for the study

This section presents the materials used in preparation of the relevant part of the report. The study is based on design documentation of the Feasibility Study: "Modernisation of the E 30/C-E 30 railway line (Corridor III) at Opole – Kraków section". The authors have also used study-specific noise measurements and computations in the surroundings of the railway line, as well as noise measurements and computations made for other purposes.

5.6.3 Testing and assessment methodology

In order to assess the noise impact of the railway line, a combination of measurements and computations was used. A main issue in the preparation of the railway line noise impact assessment is the fact that there is no national calculation method in Poland.

Based on the results of calculations, railway noise attenuation was determined versus the distance from the railway line.

Two basic types of environment were subject to testing, selected based on the analysis of land use in the vicinity of the railway line: a) open space or dispersed development, b) dense urban development (excluding ribbon development parallel to the line), and three locations of the railway line itself: at ground level or low embankment level, on a high embankment, in a trench. Railway noise changes were determined versus the distance from the railway line for individual sections of railway line with different traffic conditions and the type of environment. On this basis, the following were estimated: noise levels for the setback and average noise impact ranges corresponding to permissible noise levels.

The assessment passed over the impact of the land relief (land elevating or descending, regular hills, etc.).

Railway noise impact range calculations are subject to considerable uncertainty arising primarily from a considerable dispersion of the noise exposure level (L_{AE}) for different trains in the same category, uncertainty of input data for the calculations, as well as uncertainty related to the noise range estimates in the complex terrain conditions.

5.6.4 Noise calculation results: current traffic conditions

Calculations of noise parameters for day time (L_{AeqD}) and night time (L_{AeqN}) were performed for observation points at the height of h_0 = 4 m above ground level, taking into account the changes in traffic data for individual sections of the line and the type of development.

For each voivodeship, final assessment results were tabulated, including:

- Noise level at night time: L_{AeqN} within the distance of d = 25 m and d = 50 m from the E30 or C-E 30 line, which describe the noise exposure of the setback (vs. the railway line). For smaller distances (d = 10... 15 m), i.e. the buildings that are adjacent to the railway area, the noise level increases by 2...3 dB.
- Noise range at day time of L_{AeqD} = 60 dB and L_{AeqD} = 55 dB was determined for scattered development, typical of non-urban and peri-urban areas, and for the ribbon development areas.
- Noise range at night of L_{AeqN} = 55 dB and L_{AeqN} = 50 dB was determined for scattered and ribbon development areas.

5.6.5 Long-term impact: forecast of changes in 2025

Increase in traffic in 2025 is mainly due to the expected strong growth in mandatory reservation train traffic. It is assumed that in **Variant**s 1 and 2, mandatory reservation trains at the section Opole – Gliwice will travel along the C-E 30 (tilting trains), whereas in **Variant** 3, they will travel along the E 30 (traditional rolling stock).

The analysis of data shows that the largest increase in traffic intensity is assumed for freight trains on the C-E 30 line within the Silesian Voivodeship (3...9 times) and the Małopolskie Voivodeship (up to 8 times). Given the projected traffic conditions in 2025, the noise level at the sensitive section of the C-E 30 line in the Silesian Voivodeship is 3...7 dB. It is an enormous increase, given that the noise in the vicinity of the line is already a nuisance.

It should be noted that the estimated increase in the noise level in 2025 is solely due to the increase in the number of trains on the assumption that the same rolling stock will be used. However, as we speak here of a time horizon of almost 20 years (until 2025), we can assume that the rolling stock will be gradually replaced, regardless of which modernisation variant is selected, and newer trains emit less noise. As a result, the increase in the noise level may be smaller than assumed.

5.6.6 Noise exposure assessment

Noise exposure assessment is based on:

- noise levels occurring at the setback at day and night time,
- exceedance of the permissible noise level for the setback,
- noise range of L_{AeqN} = 50 dB at night time.

The land use analysis of the areas surrounding the E 30/C-E 30 line shows that residential areas are located on both sides of the railway line, whereas the setback is mostly found within 20...50 m from the railway line and individual buildings are located at the lesser distance of 10... 15 m. For this reason, in order to assess noise exposure in various modernisation variants, a representative distance of the setback of d = 25 m was adopted, for which L_{AeqN} noise levels were compiled for night time. For smaller distances of d = 10...15 m, the noise level is approx. 2 dB higher, and at the distance of d = 50 m approx. 3 dB lower.

For the purposes of noise assessment for each voivodeship, percentage shares of various types of land along the E 30 and C-E 30 lines were determined, broken down into:

- areas within cities with over 100,000 residents,
- areas within cities with over 10,000 residents,
- areas within villages and settlements,
- non-urbanised areas.

Results of such analyses and calculations have been presented in tables and on graphs, separately for each voivodeship.

5.6.7 Assessment of risk to health and life of residents

In assessing the impact of traffic noise on human health and activity, the following criteria values are applied:

- $L_{AeqD} \leq 55$ dB and $L_{AeqN} \leq 45$ dB – acoustic comfort conditions;
- $L_{AeqD} \leq 60$ dB and $L_{AeqN} \leq 50$ dB – appropriate acoustic comfort conditions, with subjective perception of noise as moderately onerous,
- $L_{AeqD} > 70$ dB and $L_{AeqN} > 60$ dB – health hazardous conditions.

In practice, the noise level along the entire length of the E-30/C-E 30 section discussed here (from Opole West to Kraków Podłęże) at the setback, i.e. within the distance of d = 25 m remains within the following ranges:

- day time: L_{AeqD} = 60.. .69 dB;
- night time: L_{AeqN} = 58...68 dB.

It can therefore be concluded that within the residential areas that are directly adjacent to the E30/C-E 30 railway line, acoustic conditions are hazardous to health.

The proposed modernisation of the line will not improve the quality of the acoustic environment in the vicinity of the railway line; quite the opposite, implementation of **Variant**s 1...3 will rather increase the noise.

5.6.8 Comparison of variants

The criteria for variant comparison are as follows:

1) noise emission – based on the comparison of L_{AeqN} noise indicators determined at the reference point and noise ranges of L_{AeqN} = 50 dB;
2) the population exposed to the noise of $L_{AeqN} > 50$ dB at night time.

The population exposed to noise levels greater than 50 dB at night time was estimated based on the known noise ranges and population density in cities/towns and communes through which the E 30/C-E 30 line runs.

Modernisation of the E 30/C-E 30 line at the section between Opole and Kraków, assuming the use of the same stock of freight, local and fast trains will increase the noise level in the vicinity of the line, with the exception of **Variant** 0 for the C-E 30 line in the Silesian Voivodeship.

The increase in noise levels is mainly due to the increase in train speeds, which is the lowest in **Variant** 0 and the highest in **Variant**s 2 and 3. As can be seen from the measurements taken for modernised and non-modernised sections of the E 30 and C-E 30 lines for the current rolling stock, improvement of the track quality fails to compensate for increased noise emissions due to the increased speed of traffic.

Estimated populations exposed to the noise greater than 50 dB at night time for **Variant**s 0–3:

- Opolskie Voivodeship: 5,000...6,000 people;
- Silesian Voivodeship: 26,000...40,000 people;
- Małopolskie Voivodeship: 12,000... 13,000 people;
- total: 43,000...60,000 people.

The largest population exposed to abnormal noise can be found in the Silesian Voivodeship, which is due to the high population density. In the case of the Silesian Voivodeship, the best modernisation variant in terms of noise impact is **Variant** 2 (if **Variant** 0 is not considered at all).

5.7 Waste

During normal operation of the railway line, two main types of waste are produced, namely

- municipal waste left behind by passengers at railway stations and on trains;
- waste resulting from the operation of trains, railway machinery and equipment, as well as clean maintenance of railway facilities.

Municipal waste

Its quantity changes with time and is difficult to estimate. In general it consists of mixed municipal waste (code: 20.03.01). Given that, it is primarily food packaging, and newspapers and books left behind, etc., so such waste could be segregated by the cleaning staff. Such waste should be selectively collected and transferred to recycling businesses. The remaining post-selection waste is useless and as such may be collected in containers and then taken to landfills.

Post-operation waste

This category of waste comprises a broad range of various waste types as catalogued in a regulation of the Minister of Environment (including dangerous waste).

A substantial proportion of such waste is dangerous waste, which requires special treatment. The basic rule is to selectively collect each type of waste, and then store it until collected by a specialised waste business in an environmentally acceptable way and without third-party access.

As it is expected that large quantities of waste will be produced (dangerous waste included), then pursuant to the Act *on Waste,* any contractor responsible for waste management must hold a waste generation permit. This requirement does not apply to municipal waste.

5.8 Electromagnetic fields

Due to the power supply parameters, new transformer stations are not likely to have a significant impact on the environment for which environmental impact reports are required (within the meaning of Article 51 section 1 of the *Environmental Protection Law*).

Modernisation work at the section: Opole – Katowice – Kraków includes the following sector-specific equipment and systems:

- railway traffic control;
- telecommunications;
- power engineering.

Such functional devices positioned at individual separate spots (containers, signal towers at stations) are not high-emission sources for electromagnetic fields during installation or use.

When it comes to systems, the technologies used these days, i.e. tele-transmission shielded cables, are provided with double protection in the form of an external shield that limits penetration of cable signals into the environment (and in the opposite direction).

Telecommunication fibre optic transmission cables replace the lines made of copper wires, which offer a lower transmission capacity.

Overhead traction lines are powered using direct current, and therefore are not a source of electromagnetic radiation within the meaning of the *Environmental Protection Law.*

So, it can be concluded that the line that is subject to the opinion poses no environmental hazards of electromagnetic radiation, neither related to work, nor related to the subsequent operation of equipment or installation of railway traffic control, telecommunications and power engineering systems.

From the point of view of the requirements imposed by the *Environmental Protection Law* in the field of protection against electromagnetic radiation, it should be ensured that the use of communication equipment by contractors remains within the permissible values of electromagnetic field emissions.

5.9 Oscillation and vibration

The railway line may be a source of vibration caused by train traffic. Oscillation and vibration may have a negative impact on building structures and the quality of life in the direct vicinity of the railway line. The amplitude of vibration and its harmfulness depend on several factors: train weight and speed, type and condition of railway subgrade and type of soil in the track base and in the vicinity of the track, as well as the distance from a source of vibration.

A major problem in the assessment of potential impact of vibration caused by railway traffic is the lack of computational methods and requirements that would allow for an unambiguous analysis of vibration magnitude.

It is assumed that the nuisance related to transport vibration may occur within more than 10 to 30 m, depending on traffic and ground conditions.

Modernisation of the E 30 line will involve the replacement of the base and the railway subgrade. Contactless rails and elastic washers will be used, which eliminate vibration at joints (which occur in the case of older arrangements). Such structural solutions in the railway subgrade will reduce vibration induced by passing trains.

5.10 Extraordinary environmental risks (accidents, failures, fire hazard)

There are two reasons why the project can be considered as an investment posing the risk of serious failures. Firstly, because of dangerous substances transported by rail. Secondly, because of the fact that stationary railway facilities that will belong to the line are preliminary classified as hazardous facilities due to the presence of hazardous substances in excess of the threshold quantities specified by law.

Serious failures may occur along the section of the E 30 railway line that is considered here, at the construction site and site facilities or on the roads or in the facilities in the vicinity of the railway area that have an impact on such area.

However, the largest number of accidents involving hazardous substances occurs during reloading or transport.

PKP PLK S.A. applies some restrictions on such transport, by separating particularly dangerous goods (Polish abbreviation: MSN) from the entire cargo. This group includes: explosive and radioactive materials and 15 individual chemical products which pose the greatest risk of contamination, and nevertheless are part of the mainstream trade in chemicals. If such substances are transported, special rules for railway car checks are applied, reducing the likelihood of a major failure.

Most events that may result in serious failures are related to irregularities/defects by the fault of dispatchers (users) of railway cars, resulting from poor technical condition of the rolling stock and/or incorrect operation. Allowing transportation of hazardous materials by high-speed lines requires the inclusion of this type of transport activity by ISO 9002.

Major failures threaten the life and health of living organisms (fires, explosions, dustiness, or chemical, biological or radiological contamination) pollute various components of the environment (biological, chemical, radiological or thermal pollution), especially the air, soil and water.

Particularly dangerous substances that can contaminate soils during railway accidents are petroleum substances. Penetration of fuel deep into the ground can result in a significant threat to groundwater.

Basic security measures in the transport of dangerous substances by rail, i.e. solutions that can minimise the likelihood of accidents are:

- centralized control over the transport of dangerous substances;
- traffic information system;
- compliance with regulations governing the storage at depots and manoeuvring railway cars with

dangerous goods;
- periodic inspections of train sets;
- spot checks of compliance with basic regulations relating to the transport of hazardous materials.

Security measures affecting the magnitude of disasters:
- sewer systems in tunnels, at railway stations and along open-air routes;
- retention systems for liquids that may significantly affect the quality of water and the methods for evacuation and disposal of accumulated liquids;
- access routes for rescue teams;
- technical means available for rescue operations;
- alert and notification system.

Rail transportation of hazardous substances is hedged with a series of legislative acts providing for relevant prevention rules. These acts govern the following in particular:
- Carriage of dangerous goods by rail;
- Safety obligations of participants in the transport chain;
- Classifications of dangerous goods and the associated procedures for packaging, labelling and shipment;
- Conditions for carriage, loading and unloading of dangerous goods.

Fire hazards

Areas adjacent to the railway areas are exposed to the risk of fires.

Trees and shrubs within the area neighbouring the railway line may not be located closer than 15 m from the outermost track.

Two fire lanes should be designed parallel lanes to the railway line with a width of at least 2 m and a clearance from each other of 10 to 15 m (connected by transverse lanes at every 25 to 50 m).

5.11 The need to reroute the line in order to protect the environment, with particular emphasis on human health and life

There is no need to reroute the line in order to protect the environment or prevent risks to human health and life, so such rerouting is not planned.

5.12 Assumptions for the salvage of known heritage sites during the modernisation process

As the scope of modernisation work will be predominantly limited to the existing route (or remnants) of the railway line, it is expected that direct work will not have any impact on cultural monuments. However, due to a high density of heritage objects of different value in the intermediate investment zone, the following measures should be planned in advance so as to ensure the maximum protection of such objects:
- the need to conduct an inventory of all known heritage items, within a strictly defined direct and indirect impact zone with a width of 250 m.
- the need to apply to competent heritage preservation offices for preservation guidelines and conditions before preparation of the building permit design.
- ensuring archaeological supervision if new archaeological sites or objects are discovered during earthworks in the railway subgrade or its vicinity.

5.13 Protection of the existing heritage objects and cultural landscape

Identification of the scale of threats and necessary protection measures will be possible during the consultation and approval of a building permit design. As regards all archaeological objects as well as listed mobile and immobile heritage objects, including objects protected by local legislation and entered in voivodeship heritage registers, it must be ensured that the following legal rules and regulations are strictly observed: the Act on Heritage Protection and Preservation and the Regulation of the Minister of Culture regarding preservation and restoration work, construction work, preservation and architectural research and other activities related to heritage items included in the heritage register, as well as archaeological research, or the search for movable heritage items, hidden or abandoned.

6. Description of significant impacts on the environment

A. Direct, indirect, secondary and accumulated impacts

As all project variants are to be implemented within the limits of the existing railway lines, a direct impact of land occupation will be hardly significant.

Significant impacts will include primarily noise emissions. Impacts on the soil/land/water environment will be hardly significant, and the impact on atmospheric air quality virtually unnoticeable.

Among indirect or secondary impacts, we can mention a tendency to change the land use on the areas adjacent to the railway line.

B. Permanent, temporary, short-, medium- and long-term impacts

Permanent impacts associated with the operation of railway lines include:

- noise emissions;
- rainwater disposal from the railway subgrade into the environment;
- reduced migration of wild animals.

A temporary impact of varying intensity will occur in the case of railway collisions, which may result in penetration of transported substances or fuel into the environment.

Short- and medium-term impacts will be associated with the project execution stage, i.e. with the nuisance caused by equipment in operation and the use of local roads by transport vehicles.

C. Impact intensity

In order to illustrate the scale of impact of the modernised railway line, the report shows an environmental impact matrix, using the following scale:

0 – no impact;
1 – minimum impact;
2 – small impact;
3 – noticeable impact;
4 – significant impact;
5 – very large impact.

7. Mitigating and compensatory measures

7.1 Limitation of the noise nuisance

The E30 and C-E 30 railway line at the section Opole – Kraków/Podłęże generates noise above permissible values on the areas that are legally protected against noise in the status quo already, and the proposed modernisation can even aggravate the current situation. Therefore, at the design stage, all possible technical and organisational measures should be planned so as to limit the noise impact range.

Reduction of railway line noise can be achieved by:

1) reduction in noise levels by the use of attenuated subgrades, rail grinding, replacement of the existing rolling stock with the “quiet” ones;
2) limiting noise propagation in the areas that are subject to legal protection against noise through the construction of noise barriers.

At the post-modernisation stage in **Variant**s 1–3, the resultant noise level will be determined by the noise of trains:

in the Opolskie Voivodeship:

- at the section of the E 30 line: Opole West – Opole Groszowice: fast and stopping trains;
- at the C-E 30 line: freight trains;
- at the E 30 line: fast and freight trains.

in the Silesian Voivodeship:

- at the C-E 30 line: freight trains;
- at the E 30 line: fast and freight trains;
- at the section of the E 30 line: Gliwice Sośnica – Mysłowice: fast and stopping trains.

in the Małopolskie Voivodeship:

- at the C-E 30 line: freight trains;
- at the E 30 line: fast and freight trains;
- at the section of the E 30 line: Kraków Mydlniki – Gaj: fast and stopping trains.

Replacement of the current rolling stock with a quieter one could bring the noise reduction of several dB.

Selection of noise protection measures should be preceded by a detailed analysis of the noise reduction required against the technical viability of individual solutions, and the expected outcomes vs. financial outlays.

The report states:

- location of noise barriers that must be constructed given the existing exceedance of noise levels in areas that are legally protected against noise.
- sections of the line where it is recommended to limit noise emissions by means of railway subgrade solutions, i.e. at locations where requirements concerning noise reduction are so strict that it would be difficult to achieve it solely through the use of noise barriers.

At the stage of working design/building permit design for the selected modernisation variant, it should be analysed whether the construction of noise barriers is technically viable, taking into account local terrain conditions and economic feasibility.

7.1.1 Noise barriers

Locations of noise barriers that must be constructed to reduce the noise level in the areas that are legally protected against noise have been established. In determining screen locations, the following issues have been taken into account: obligatory noise reduction, distance and type of development. Total lengths of the proposed barriers are as follows:

- Opolskie Voivodeship: 44.9 km;
- Silesian Voivodeship: 72.3 km;
- Małopolskie Voivodeship: 65.4 km.

Noise barriers should be custom designed for each area, taking into account the local urban planning conditions.

Technical viability of the required noise barriers has not been analysed at the current stage. The preliminary analysis suggests that their construction may be faced with some technical limitations, such as:

- in the vicinity of train stops and stations – due to the width of railway subgrades and turnouts of incoming and outgoing lines;
- in the case of high buildings (with more than four storeys) located near the railway subgrade – very high barriers required to reduce noise at higher storeys;
- in the case of buildings that are located higher than the railway line – as above;
- collisions with the railway infrastructure;
- collisions with the road infrastructure.

Noise barrier locations stated in the report are preliminary and as such must be reviewed at the building permit design stage, in accordance with the limitations set forth above.

7.1.2 Silent track: track vibration isolation

In the area of train stops and stations, where the possibility to construct effective noise barriers is limited, it is recommended that noise emissions be reduced by trackbed solutions. The following solutions are possible:

- under-rail spacers;
- vibration insulating washers;
- elastic inserts to be used in sleeper cladding;
- elastic supports for sleepers;
- sub-ballast-mats;
- supports for the mass-spring systems.

7.2 Reducing soil and water pollution

Railway investment projects do not have a significant impact on the soil and water environment. If the project work items are carried out in an appropriate way, materials are correctly stored, and waste is managed in an orderly manner, then the adverse impact of the project on the soil and water environment will be limited. In the areas of Main Groundwater Reservoirs, especially not insulated from the surface, drainage water should be pre-treated so as to remove petroleum substances.

8. Restricted use zone

At the present stage, no restricted use zone is planned or recommended. If the as-built analysis confirms that in the surroundings of the E30 railway line section that is discussed here, quality standards for the acoustic environment are not fulfilled (despite the available technical and organisational measures), then it will become necessary to establish a restricted use zone.

9. Cross-border impacts

Modernisation of the railway line, both during the project execution stage and thereafter will not bring about any lasting and significant changes to the environment in the border area. Since the railway line is located at a considerable distance from the State borders, no cross-border impacts are expected that would require international agreements.

10. Environmental monitoring

The proposed modernisation of the railway line according to **Variant**s 1, 2 and 3 can substantially alter the operating conditions related to noise emission levels; therefore, as-built measurements of noise levels in the environment must be performed. This section indicates locations where as-built noise measurements must be performed. It also specifies locations for follow-up measurements.

11. Social conflicts

Social conflicts will be triggered primarily by the noise resulting from the operation of the E 30/C-E 30 line, which is a nuisance for residents of the estates located nearby. Residents complain about the noise nuisance and request noise mitigation measures, primarily in the form of noise barriers. So far, complaints about the noise nuisance have been lodged by residents of large cities: Opole, Gliwice, Katowice, Świętochłowice and Kraków. Submissions were most numerous in the Silesian Voivodeship.

It is expected that the on-going work, particularly in the areas where the railway line interests with roads, may cause periodic traffic problems that will lead to residents' discontent. Individual conflicts may also arise in connection with the transportation of materials and the temporary occupation of land. Such situations should be avoided through a good work schedule, appropriate information policy and cooperation with the local government.

12. Difficulties encountered in the preparation of the report

Difficulties encountered in the preparation of the report are not related to technical shortcomings or gaps in the current knowledge, but rather from the broad scope of the topic itself, and the lack of detailed information at the moment, e.g. the information necessary to state the exact quantity of waste to be generated during the project execution, or to evaluate the method for waste management.

13. Impact on Natura 2000 sites and other forms of nature protection

The E 30/C-E 30 railway line passes through the following legally protected areas: Tenczynek Landscape Park and Kraków Valleys Landscape Park (Małopolskie Voivodeship). Other national and landscape parks and nature reserves are located at a considerable distance from the railway line. Within the limits of: the Opolskie, Silesian and Małopolskie Voivodeships, the E 30/C-E 30 railway line Opole – Katowice – Kraków does not cross any Natura 2000 sites. The sites that are closest to the line in question are located in the Opolskie Voivodeship, and these are: Kamień Śląski and the Oder River Valley in the Opolskie Voivodeship (Nature 2000).

On the other hand, the line intersects with ecological corridors of international importance within the limits of 3 voivodeships.

Beyond the boundaries of protected areas, the occurrence of valuable natural habitats, habitats of amphibians and reptiles, and protected plant localities have been acknowledged.

The existing E30 and C-E30 railway lines are barriers to wildlife migration, primarily within the limits of ecological corridors. Field observations and data collected from forest district offices show that animals frequently cross the railway line within the limits of the Małopolskie Voivodeship, in the ecological corridor of the Puszcza Dulowska Forest, at the border between Białka forest administration region (Krzeszowice Forest District, Regional Directorate of the State Forests in Kraków) and Dulowa forest administration region (Chrzanów Forest District, Regional Directorate of the State Forests in Katowice). Observations confirm that the local incidence of animal collisions with trains is also significant. A similar situation occurs within the limits of the other two voivodeships, but with less dramatic adverse effects.

In order to reduce the barrier effect of the railway line resulting from modernisation, it is proposed that culverts and bridges along the railway line are redeveloped so that they could also serve as wildlife crossings. On the other hand, in the Puszcza Dulowska Forest it is proposed to construct a “green bridge” at the spot where animals cross the railway line. If such a crossing is constructed, animals will be able to migrate across the railway line. However, the solution should be integrated with other solutions implemented for the nearby A4 motorway, which is another local structure impeding animal migration.

In order to protect the inventoried natural habitats, habitats of amphibians and localities of valuable plant species, including the locality of the protected stemless carline thistle (Małopolskie Voivodeship), modernisation work should be carried out in such a way as to avoid interference with such valuable habitats and species.

Threats to protected areas are discussed in more detail in Volume II concerning the protection of nature and “NATURA 2000” sites.