MINISTRY OF THE ENVIRONMENT OF THE REPUBLIC OF ESTONIA

NATIONAL DEVELOPMENT PLAN FOR THE USE OF CONSTRUCTION MINERALS 2011-2020

Tallinn 2010

TABLE OF CONTENTS

Introduction

National Development Plan for the Use of Construction Minerals 2011 -2020 (hereinafter *Construction Minerals Development Plan)* is focused on the extraction and use of limestone, dolostone, crystalline building stone, sand, gravel and clay (hereinafter as *construction minerals), forming a whole, which comprises the entire territory of the Republic of Estonia, incl.* coastal waters and territorial sea.

The proposal of compiling a *Construction Minerals Development Plan* was approved with Order No. 276 of the Government of the Republic of 19 June 2008. The Development Plan is compiled based on § 10 section 2 of the State Budget Act and is consistent with Regulation No. 302 "Types of Strategic Development Plans and the Procedure for their Compilation, Supplementation, Implementation, Assessment and Reporting" of the Government of the Republic of 13 December 2005.

The process of compiling the *Construction Minerals Development Plan* is public; representatives of concerned state agencies and enterprises, local governments (hereinafter *LG), organisations and* non-profit organisations, as well as other persons interested in the process will be involved. The compilation of the *Construction Minerals Development Plan* is coordinated by the Ministry of the Environment. The *Development Plan will be developed in cooperation with the Ministry of Economic Affairs and Communications*, the Ministry of Finance, the Ministry of the Interior and the Ministry of Social Affairs. In addition, several experts and representatives of national local government associations will be involved in order to receive better know-how.

The *Construction Minerals Development Plan* is compiled on the basis of Estonian Environmental Strategy 2030 (hereinafter *Estonian Environmental Strategy)* [1], the implementation document of which is the National Environmental Action Plan of Estonia 2007-2013 (hereinafter *Environmental Action Plan of Estonia)* [2]. Based on the *Construction Minerals Development Plan, the part on construction minerals is supplemented in the Environmental Action Plan of Estonia* as well as the need to change the Estonian Environmental Strategy 2030. The draft legislation of the *Construction Minerals Development Plan* is submitted for approval to the Government of the Republic, and its implementation plan, Environmental Action Plan of Estonia, will be submitted for authorization to the Government of the Republic within three months of the approval of the Development Plan.

The environment in the *Construction Minerals Development Plan* denotes both the broader natural, economic and social environments, which are closely related. The *Construction Minerals Development Plan* describes the current situation of the use of construction minerals, establishes the strategic aims for developing the usage, and provides an estimate on the perspectives of use, taking into account nature protection and other necessary restrictions, incl. restrictions related to the location of the construction minerals. The need for compiling the *Construction Minerals Development Plan* is caused above all by the increased consumption of these mineral resources and related problems, the solution of which requires a national regulation. Examples could be the necessary quantity of developing technical infrastructure and the economically reasonable shipping distance in case of aggregates of necessary quality. The deficit of construction raw materials increases constantly; the lack of crushed stone for construction is particularly perceivable in Harju County, in the vicinity of Tallinn.

The research conducted by the engineering office OÜ Inseneribüroo Steiger in 2009 - "National Development Plan for the Use of Natural Construction Materials 2010-2020" - has been used for the compilation of the *Construction Minerals Development Plan* [3]. This work follows from the list of the deposits of the environmental register and the balance of mineral reserves, the data of Statistics Estonia, the results of the questionnaires of enterprises and organisations related to extraction, but also the comprehensive and thematic plans of counties, as well as resources data of the Geology Fund of the Geological Survey of Estonia. As a particularly complex situation concerns the supply of construction minerals in the region of Tallinn, the Ministry of the Environment ordered in the framework of the environmental programme of the Environmental Investment Centre the work titled "Compilation of the Development Plan of the Resources of Natural Construction Materials in the Vicinity of Tallinn and Explanation of Perspective Areas". The report on the work was compiled by the Mining Institute of Tallinn University of Technology (2005) [4]. The report focuses on the use of deposits of natural construction materials in the vicinity of Tallinn.

Although the geological survey and extraction of mineral resources has not been defined on the level of the European Union (hereinafter *EÜ),* restrictions of nature protection shall be taken into account, the legal basis of which is the legislation and international agreements of the EU.

1. Relations to the strategies and development plans of other areas

The *Construction Minerals Development Plan is compiled in accordance with other concerned development plans and strategic documents, such as* Nature Conservation Development Plan until 2020 (draft legislation), Estonian Environmental Strategy, Environmental Action Plan of Estonia, Transport *Development Plan* 2006-2013, National Waste Management Plan 2008-2013 and water management plans of river basin districts.

Most important strategic documents related to the Development Plan are the following:

1) **Estonian Environmental Strategy 2030,** which describes the trends, main aims and strategies related to mineral resources. For mineral resources, intensive extraction technology, which has a short-term load on the environment and where the extracted area is set quickly into order, shall be preferred. Extensive extraction, however, is not entirely excluded; preference for this depends on the type of resources, conditions of the particular area, and the self-renewal ability of nature.

   According to the Estonian Environmental Strategy, the indicating meter to be developed is the annual rate of return of extracting permit areas (efficiency of deposit usage, cubic meters per hectare); formula: (the extraction capacity of resources): (the total area of extracting permit areas). Such an indicating meter would be wise to use for oil shale and peat, in case of which the useful layer is of a relatively even thickness. In case of construction minerals, the thickness of which differs even at the deposits of the same resource (for example, limestone), such an indicating meter does not provide the expected effect in different years for characterising and comparing the annual rate of return of extracting permit areas. It is more reasonable to use the organisational efficiency of extracted areas and the interrelation of extracted areas as the indicating meter.

   Another indicating meter for environmental strategy has been also proposed, that is, the area (in hectares) of groundwater and surface water, formed in artificial conditions on the extracted areas - this should characterise the impact of the extraction of resources on water resource. The extension of areas with open groundwater and the formation of bodies of surface water onto extracted areas indicate the hydrodynamic change of water, but it does not significantly influence water balance as a whole. Thus, the proposed indicating meter does not significantly characterise the quantitative and qualitative change of water as a result of extraction. This indicating meter does not characterise small quarries of construction minerals, where great impact on groundwater is not entailed. To some extent, the impact on groundwater in big quarries can be indicated with the help of this indicating meter, but there is no decrease in the quality of groundwater there either, as environmentally friendly extraction methods are used in the extraction and different water layers are usually not opened [1];

2) **Environmental Action Plan of Estonia 2007-2013.** Environmental Action Plan of Estonia is the implementation plan of the environmental strategy. Currently, the Environmental Action Plan of Estonia is valid for 2007-2013, following thereby from the aims and orientations of activity, established in Estonian Environmental Strategy 2030. The plan has been submitted as tables, which correspond to the measures (orientations of activity) established in the Environmental Strategy. The aim of the area of resources is environment-friendly extraction, which does not pollute water, landscapes and air, as well as the effective use of resources with minimal loss and waste. A separate orientation of activity the Implementation of the National Action Plan of the Use and Extraction of Construction Minerals has been pointed out as well. The Environmental Action Plan of Estonia plans to establish a rental system for the developers of deposits (extracting permit areas) (make granting of research and extraction permits business based), compile evaluation methodology for the business (monetary) value of deposits and deposit land depending on the reasonability of extraction (considering the value of land, infrastructure and environmental restrictions), and create a system of support and advantages for the use of environment-friendly technologies [2];

3) **Estonian National Strategy on Sustainable Development 'Sustainable Estonia 21' –** establishes the aim to use natural resources in a way and extent that ensures ecological balance. The use of natural resources shall occur on the principle that the use of renewable resources does not exceed their capacity for recharge and the use of the so-called fossil or non-renewable natural resources occurs on the principle that their exploitation shall be ensured by the time when they can be replaced with some other resource, for example, a renewable resource [5];

4) **Transport Development Plan 2006-2013** (hereinafter *Transport Development Plan)* is related to the Construction Minerals Development Plan above all through the construction and development of the infrastructure objects of national transport (Unfortunately, the necessary quantities of construction minerals have not been submitted in the Transport Development Plan for the construction of the objects; the data have been received from Estonian Road Administration in 2009, at the end of September 2009.) [6];

5) **Nature Conservation Development Plan until 2020 (draft legislation),** with which the extraction activity of the Construction Minerals Development Plan shall be consistent. The mineral reserves in the list of the deposits of the environmental register, belonging under the category of nature conservation areas, has been generally indicated as passive, and quarrying is generally prohibited [7];

6) **National Waste Management Plan 2008-2013** and the Construction Minerals Development Plan highlight most important common indicators, such as possibilities for the use of mine waste, formed in extracting oil shale, and the so-called limestone screenings, as well as extending the re-use of construction waste [8];

7) **Water management plans of river basin districts** include also quarry lakes belonging under artificial water bodies, in case of which the development of a good ecological balance shall be aimed at. It is important to avoid the formation of steep-sloped shores, which are dangerous on water bodies intended for bathing and hinder the formation of normal shore flora. In an artificial water body, it is important to form an environment suitable (incl. areas of sufficient depth) for the formation of diverse biota (environmentally sound ecosystem) [9].

The bases for the sustainable use of natural environment and natural resources have been established in the Sustainable Development Act, which establishes the main aim of ensuring a living environment that is satisfactory for people as well as the resources necessary for the development of economy without causing significant harm to nature and preserving natural diversity [10]. The Sustainable Development Act, which is supplemented by several other acts, provides the general framework for the sustainable use of natural resources. Most important legislation in the extraction and use of construction minerals is the Earth's Crust Act [11] and the Mining Act [12].

The Earth's Crust Act establishes the order and principles for studying, protecting and using earth's crust with the aim to ensure an economically reasonable and environmentally sustainable use of the earth's crust. This act regulates general geological research, geological surveys, extraction of resources (except for the part which is regulated with the Mining Act), the rights of the owners of immovable properties in the limits of using the resources on their immovable properties, the maintenance of landscape changed with geological research, geological surveys, extraction of resources, the use of the earth's crust (except for the part which is regulated with the Mining Act and the Water Act) as well as the protection of the earth's crust.

The Mining Act establishes the requirements for ensuring the safety of people, properties and the environment as well as the sustainable use of deposits and the secondary utilisation of an underground working.

2. Overview of Estonian construction minerals

The need for construction minerals and the future vision of their use have changed drastically compared to the opinions ten years ago. The main reason for this is the accession of Estonia to the EU, which has entailed new requirements and restrictions on the extraction and use of resources, above all, in the area of environmental impact, but also new possibilities. The technology of extracting and using construction minerals has developed quickly. While until this time the planning of the use of construction minerals could have been called technology-centred, now the main aspect to be considered is natural environment.

Development of the information technology related to the extraction and use of resources has advanced significantly. The authorised processor of the list of environmental register deposits is the Estonian Land Board. The primary basis for systematising this information was provided by the Earth's Crust Act, valid until 1 April 2005 (RT I 1994, 86 / 87, 1488; 2004, 84, 572), based on which a cadastre of resources of the country started to be compiled in 1996 at the Geological Survey of Estonia; in 1999, it was renamed as the National Cadastre of Resources (it was the predecessor of the list of deposits of the environmental register).

Of particular importance is the acceptance of Environmental Impact Assessment and Environmental Management System Act (RT I 2005, 15, 87; 2007, 25, 131) at the Parliament of Estonia on 22 February 2005 and its entry into force on 3 April 2005. As the extraction and use of resources may cause significant environmental impact in some cases, assessment of environmental impact shall be organised to avoid irreversible changes in the environment (hereinafter *EEI).*

2.1. Main concepts related to the use of construction minerals

mine waste - the residue separated from the oil shale, extracted from a mine or quarry;

underground mineral extraction - a method of extraction for the winning of resources located deep in closed earth's crust, during which a network of earth's crust working is formed;

active reserves - mineral reserves are active if the technology and technique used for the extraction ensure the rational use of the earth's crust, the observation of environmental requirements and economically useful use of resources (Ca - active consumption reserve, Ra - active reserve);

Precambrian - a period of time from the expected formation of the earth's crust and the rocks forming it until the beginning of the Cambrian (542 mn years ago);

construction waste - timber, glass, brick, metal, concrete and other construction materials waste, also extracted soil that forms during construction and repair works and that cannot be used during the works at the construction site;

East-European Platform - the flat terrain located between the mountain chain of Scandinavia, the Ural Mountains, the Caucasus, Crimea and the Carpathian Mountains;

infrastructure - ***econ. the system necessary for the functioning of society and economic development*** **(roads, communication, schools, hospitals, water and energy supply, etc.);**

intrusive rock - a rock type that has been formed of magma that has pressed itself from the magma source into the earth's crust in the process of magma retarding;

fee for mining right - the rate of fee for the extraction of national resources, deducing from the Environmental Charges Act;

ore - the solid component of any rock or deposit extracted from a natural state;

overburden - the surface layer located on the top of the layer of mineral resources;

environment - natural, economic and social environment;

environmental impact - the direct or indirect impact on human health and welfare, environment, cultural heritage or property, expectedly related to an activity;

environmental charge - the fee rates in the use of natural resources, deducing from the Environmental Charges Act;

complex deposit - a deposit which includes at least two or more resources (primary and secondary mineral resources), which can be extracted together or in case of the extraction of one resource, the others will be preserved in natural overburden; all will be studied of equal precision as required by the contracting entity or the granter of the exploration permit;

Quaternary - the youngest geological, currently continuing era (strata) of geological time, which began 1.806 mn years ago;

earth material - according to the Earth's Crust Act valid until 01.04.2005, the rock or deposit that has not been registered as a mineral resource;

earth's crust - the part of the earth's crust that is available for human activity on land, trans-boundary water bodies, territorial sea and inland sea as well as the exclusive economic zone;

mineral deposit - the layer of mineral resources or a part of the layer limited and studied during geological investigation or geological exploration and entered into the environmental register, whereas the entire layer or part of the layer which includes a mineral resource with intermediate layers will be registered as a mineral deposit;

mineral resource - a natural rock, deposit, liquid or gas, the traits or conditions of the layer of which correspond to the requirements established on the basis of § 9 section 1 of the Earth's Crust Act or the requirements established by the person who orders the survey, and the layer of which or its part has been entered into the environmental register;

extracting permit area - the part of the earth's crust established for the extraction of mineral resources with the extraction permit;

mining lease - a fee that is paid for the use of a mineral deposit, that is, for the extraction of mineral resources and the size of which depends above all on the size of the mining lease, location, the cost of land, but also the traits of resources, technology used, causing of environmental impact, etc.;

os, i.e., **esker** - a long narrow steeply sloped positive relief, which has been formed of the sediment transported by glacial pressured meltwater;

limestone - limestone and dolostone (carbonary rocks);

lime crushed stone - crushed stone formed of limestone and dolostone;

limestone screenings - the residue formed at the crushing and sorting of limestone (the diameter of the fraction particles 0-5 mm);

Paleozoic - an erathem as a chronostratigraphic unit and an era as a geochronological unit, which corresponds to the time period of 542-251 mn years ago;

passive reserves - reserves, the use of which is not possible due to environmental conservation or for which there is no relevant technology, but which could become usable in the future (Cp - passive consumption reserve, Rp - passive reserve);

quarrying - a method of mineral extraction in open earth's crust (also the open cast mine extraction of construction minerals);

subtlety module - a ratio that is determined according to particle size distribution;

Proterozoic - an erathem as a chronostratigraphic unit and an era as a geochronological unit, which corresponds to the time period of 2500-542 mn years ago (eon - the largest unit of geochronology);

production layer of oil shale - a productive oil shale layer, which is generally formed by 7 intermediate layers of kukersite and 6 layers of limestone;

oil shale ash - the residue formed during the burning of oil shale;

fragmenting - crushing of stone (loosening);

reserve supply - mineral reserve, the geological research level of which enables the necessary data for evaluating the perspectivity of mineral reserves and directing further geological exploration; the speed of resource exhaustion - the time for the entire extraction of mineral reserves on an extracting permit area;

outwash plane - a sand and gravel heap sloping on the top, which belongs among the edge formations of glaciers;

consumption supply - a mineral reserve, the extent of geological exploration of which provides the data necessary for the extraction and use of mineral reserves; efficiency **-** effectiveness;

filling material, that is, **filling soil** - area of application of resources, if the resource does not meet the established quality standards, but there is economic interest for the extraction of the resource (incl. **filling sand, filling gravel);**

security of supply - the indicator of the supply of quality construction minerals for the customers during a certain time period.

2.2. A short overview of the geological composition and construction minerals of Estonia

Estonia is located on the East-European platform and is a classical Lower Paleozoic land.

Following from geological composition, the Estonian bedrock is divided into two parts in the structural sense: the deeper bedrock is formed by strongly ridged igneous and metamorphic rock (granite, gneiss, etc.) of the Precambrian, which is covered by the sedimentary rock with horizontal overburden. Basement is not exposed in Estonia; the closest outcrop is located on the Suursaar Island (in the eastern part of the Gulf of Finland).

The upper layer is formed by Upper Proterozoic and Lower and Middle Paleozoic rock, which has been formed approximately 360-540 mn years ago during the period of Vendian, Cambrian, Ordovician, Silurian and Devonian. The minimal thickness of the entire sedimental complex is 100-200 m in North Estonia on the southern coast of the Gulf of Finland and reaches up to 600 m in south-western Estonia (the thickest known in the borehole on the Ruhnu Island - 770 m). Thus, the upper layer rocks and related construction minerals of Estonian bedrock have been mainly formed in early Paleozoic. The rocks of the bedrock are covered by an overburden consisting of the loose sediments of the Quaternary layer. Many generations of geologists with their work have brought the research conducted on the Estonian bedrock, especially on the Ordovician and Silurian, on a very high level [13].

The distribution of construction minerals is determined by the specificity following from the geological composition: as Estonia is a part of the plateau formed in the geological past, the layer of the earth's crust, available to the industry, is dominated by sedimentary rock, i.e. the material accumulated in ancient seas. Therefore, Estonia is covered with a layer of sediments, of which the mineral reserve is determined of a quality established in the implementing provisions of the Earth's Crust Act as a result of geological exploration, and the outlined exploration area is registered in the list of mineral deposits. They are usually layered deposits in undamaged horizontal overburden of a layered composition, which do not contain notable metal ore.

The ridged bedrock beneath the sedimentary rock could soon also reach the sphere of human activity, above all in North Estonia, where the depth of the bedrock is 100-200 m. Maardu granite deposit, for example, has been included this way in the list of mineral deposits. A specificity of geological composition is the overburden, which has been mainly created by the last glacial epoch. Large quantities of meltwater entailed with the activity of land ice washed through and sorted the material brought along with glaciers. Sand and gravel sediments were formed this way, the geological exploration of which leads to the registration and use of more new mineral deposits. Clay sedimented in deeper water bodies related to glaciers. As the overburden was formed in continental conditions, horizontal resource layers did not form; instead, mineral deposits with lens-like layers were formed [14].

Estonia is sufficiently secured with construction minerals, but the location is uneven in terms of the varieties of mineral resources. The mineral deposits of carbonary rocks that provide industrial interest are mainly located northwards from the line of Pärnu and Lake Peipus. Sand deposits occur more or less evenly over Estonia, but their genesis is different. For example, the sand and gravel deposits related to the sediments of shore formations of the developmental stage of the Baltic Sea are located in West Estonia and the islands, while larger sand deposits, formed of the delta sediments well sorted by glaciofluvids are located in the Harju County; the kame related sand and gravel deposits of high quartz content may be mainly found in the Ida-Viru County, Viljandi and Võru County. There are also gravel deposits all over Estonia, but gravel is the most limited resource of construction minerals for its geological formation, and its supply has been mainly extracted in the Harju County. The most important gravel deposits related to eskers are located in West Estonia and Viljandi County [15].

In the Harju County, the supply of building limestone and building sand in the vicinity of Tallinn (in the radius of approximately 50 km) forms over 50% of the entire active reserves of Estonia. Thus, the use of building limestone and sand in the Harju County influences most of all the balance of these mineral resources in the entire Estonia.

Basis for the compilation of the *Construction Minerals Development Plan is the data of the list of* deposits of the environmental register on the research level, quality, amount of reserves of construction minerals, the construction of mineral deposits, etc., but also the balance of mineral resources. A mineral deposit may be of national or local importance. Of national importance is such a mineral deposit that is located in a trans-boundary water body, territorial or inland sea, or an exclusive economic zone as well as a mineral deposit, the quality or quantity of mineral resources of which is particularly important for the state, following from economic development; also, the products made from the mineral resources have potential for export or the important environmental impact related to the extraction reaches several counties or crosses the state border. The list of deposits with national importance is established by the Government of the Republic (in addition, the mineral deposits registered in territorial or internal sea). As at 1 January 2009, the following deposits of construction minerals are of national importance:

- Aavere, Harku, Karinu, Kunda, Nabala, Metsla, Vasalemma, Võhmuta and Väo limestone mineral deposit;
- Anelema, Hellamaa, Kaarma, Koonga, Kurevere and Orgita-Haimre dolostone deposit;
- Maardu granite deposit;
- Arumetsa, Aseri, Joosu, Kallavere, Kunda and Küllatova clay deposit;
- Hiiumadala, Kaku, Pannjärve, Piusa, Prangli, Ihasalu, Kuradimuna, Kopu, Naissaare, Tallinna-Saku sand deposit.

The mineral deposits not registered in the above list are of local importance. The construction minerals of these deposits belong to the state if it is a bedrock mineral resource (geological formation from Precambrian to Devonian: granite, limestone and dolostone, partly clay and sand) or if they are mineral resources formed in the Quaternary (gravel, partly clay and sand), whereas the land on the top of deposits belongs to the state.

According to the Earth's Crust Act, construction minerals are divided according to their area of application:

- limestone: building, technological and cement limestone as well as filling material;
- dolostone: building, technological and finishing limestone as well as filling material;
- crystalline building stone (i.e. granite, is not divided);
- sand: building, technological sand and filling material (hereinafter *filling sand);*
- gravel: building gravel and filling material (hereinafter *filling gravel);*
- clay: cement, not readily melting, ceramic and lightweight clay.

Depending on the area of application, construction minerals shall comply with specific quality criteria; thus, widely used limestone, for example, is not usable as a construction mineral everywhere.

Table 1. The reserve of construction minerals, registered in the list of mineral deposits, according to areas of application, as at 31 December 2008, thousand m^3 [16].

Construction mineral	Active consumption reserve Ca	Active reserve supply Ra	Passive reserve
Building limestone	160,994	271,345	236,576
Technological limestone	13,912	40,061	73,492
Cement limestone	8426	87,946	51,286
Building dolostone	43,160	99,882	82,027
Technological dolostone	12,967	82,530	—
Finishing dolostone	2911	21,464	1400
Crystalline building stone	1,245,062	1,723,932	—
Building sand	208,285	444,895	168,845
Technological sand	3911	3231	2128
Filling sand	35,739	1422	1289
Building gravel	40,727	73,018	16,053
Filling gravel	1644	—	14
Cement clay	15,276	11,213	489
Not readily melting clay	—	—	341
Ceramic clay	10,479	235,886	13,664
Lightweight clay	8,124	2248	228

According to the data presented in Table 1, the total active reserve of limestone and dolostone is 845,6 mn m^3, the active reserve of crystalline building stone about 3 billion m^3, the active reserve of sand and gravel the total of 115,4 mn m^3, and the active reserve of clay 283,2 mn m^3. As at 31 December 2008, 531 deposits of construction minerals were included in the list of mineral deposits, of which 32 are of national importance.

An overview of the reserves of construction minerals has been provided by counties, mineral resources and mineral deposits in Annex 1 of the *Construction Minerals Development Plan* [3].

The Earth's Crust Act also establishes the concept of possible reserve (i.e. mineral reserve, the research quantity of which is determined by geological investigation and which is separated on an area surrounded by a mineral deposit outside the contour of consumption and reserve supply or in an area where the existence of new deposits may be supposed, based on the existence of indications of mineral resources). Currently, however, the registration of possible reserve in the list of mineral deposits is not required according to legislation. Possible reserves enable to evaluate the possibility of increasing the mineral reserve of deposits or the determination of a new deposit and are a basis for mineral resource search as well as in shaping geological exploration. Action 1.2 of the *Construction Minerals Development Plan* includes a proposal to supplement the list of mineral deposits with possible reserve.

As at September 2009, 372 km^2 (0.8% of land) of Estonian territory was covered with the deposits of construction minerals and 44 km^2 (0.1% of land) with extracting permit areas according to the data of the Estonian Land Board. The sea area includes 28 km^2 of deposits of construction minerals and 8.4 km^2 of extracting permit areas.

A detailed overview of construction minerals has been provided in Annex 2.

3. Analysis of current situation

Extraction of mineral resources is caused by the need of consumption in all important areas of economic activity. Construction minerals are used in the construction of residential buildings and roads as well as in industry. Sand, gravel and crushed limestone are used in the unaltered state and as a filling material in the composition of other construction materials, above all, concrete and concrete elements.

The amount of extracted mineral reserves, as is characteristic to the prevailing market economy system, is determined by demand. However, attention is increasingly turned to the use of sustainable mineral resources with the smallest environmental impact. The growing need for raw materials also activates extraction in Estonia. It is not possible to build without opening new gravel, sand and limestone deposits. If the current living standard is wished to be preserved or improved, natural resources, incl. mineral resources, have to be used as well.

3.1. Extraction of construction minerals in 2004-2008 and established usage trends in Estonia

The speedy development of Estonian economy in recent years, especially in 2006-2007, when the amount of residential buildings, industry and road construction increased, entailed an increasing need for construction minerals, too. Construction minerals were most of all extracted in 2007, the total of 9.65 mn m^3. Compared to 2006, extraction capacity increased by about 17%. The need for above all limestone and gravel increased quickly. Extraction decreased already in 2008, when construction minerals were extracted in the total of 9.06 mn m^3.

A summary of the extraction capacity of construction minerals in 2004-2008 has been submitted in Annex 3 of the *Construction Minerals Development Plan.*

Construction minerals are extracted most of all in the Harju County. This is followed by Lääne-Viru, Pärnu, Jõgeva, Põlva and Tartu County. In 2008, limestone was extracted most of construction minerals, slightly above the 35% general capacity. Sand was extracted almost in the same capacity. A large part of filling sand was used for the construction of the new terminal of Muuga Harbour.

According to the data of the Association of Construction Material Producers of Estonia, approximately 6000 employees were engaged in mining industry in 2008. If the people known to work at enterprises producing sand and crushed stone as well as the people directly processing construction minerals (i.e. dry blends, wall covering, tiles and concrete) are taken into account, then at the end of 2008, approximately 3600 employees were related to these enterprises. Hereby, it has to be taken into account that there is no common data on the small undertakings extracting limestone and especially on small undertakings extracting sand and gravel. Also, some undertakings order transportation elsewhere, as they are not active in transport themselves. There are no precise data on how many employees are engaged in providing other services related to mineral resources, such as blasting operations, land measurement, resource measurement, provision of environmental services, water pumping, supply with fuel, etc. these works are closely related to the extraction of mineral resources. Many employees depend on local construction minerals, such as road constructors, producers and installers of concrete constructions, the conductors of bricklaying and finishing (coating with plaster, caulk), constructors of gable roofs, etc.

According to the data of the register of economic activities, as at October 2009, more than 280 undertakings engaged in the extraction of mineral resources were registered in Estonia, and they have been issued the total of 463 resource extraction permits. The majority, approximately 200 undertakings, are engaged in extracting various construction minerals. These include undertakings which extract mineral resources and handle only first-stage processing (Paekivitoodete Tehase OÜ, OÜ Kiiu Soon, etc.). In addition, there are undertakings for whom quarries are a raw material base and which produce intermediate or final products, such as several producers of construction materials (AS Silikaat, Saint-Gobain Ehitustooted AS - the former Maxit ESTONIA AS, Aerock AS and others) and road constructors (AS Talter, AS Teede REV-2, road centres and others).

A large number of so-called related companies who do not extract mineral resources themselves but whose production is based on construction minerals are also related to the extraction of construction minerals.

These are several producers of construction materials (Lafarge, AS COLUMBIA-KIVI and others), producers of concrete and asphalt concrete (AS Lasbet, AS E-Betoonelement and others), road constructors, producers of glass and ceramics.

The majority of construction minerals (sand, gravel, crushed limestone and landfill) are used as a filling material. This area of application is very wide and encompasses the construction of residential buildings, roads and railroads. Sand, gravel and crushed limestone is used both in the unaltered state and in the composition of other construction materials: in concrete and concrete elements (where three is 80-90% of filling materials) and asphalt concrete (about 95% of filling materials).

There are no precise data on the quantity of filling material used in different areas in Estonia, but according to the estimate of the Association of Construction Material Producers of Estonia, 71% of filling materials is used in road construction and 29% for producing concrete (as a comparison, in Finland, 50% of filling materials is used in road construction, 10% for the production of concrete and 10% for asphalt concrete, 15% in the construction of residential buildings and 15% for other purposes). Larger consumption of materials for the construction of new structures is characteristic to all new Member States of the EU [3].

A detailed overview of the possibilities for the application of construction minerals has been presented in Annex 4.

Problems and existing possibilities

1. Legal problems in the extraction and use of construction minerals belonging to the state have occurred above all due to the fact that until then, state interest had not been defined. In the Development Plan, state interest is defined following from construction minerals; to implement the interest, legislation has to be changed, above all, the Earth's Crust Act.
2. The required interest of the state in the use of mineral resources shall be increased with legislation, the statements of which shall be presented in the bases for the use and protection of the earth's crust (currently, draft legislation).
3. Extraction permits of mineral resources have been issued since 1995 and therefore the extraction reserves indicated in the permits, current residue reserves and allowed extraction capacities shall be analysed; also, the additional or special conditions for the extraction of mineral resources have to be evaluated, following from the current situation.
4. To receive a permit for underground extraction, extracting permit area beneath land will be applied, and the extraction permit is granted without on ground land grant. Later, when the extraction permit has been issued, the owner of the permit will apply authorisation for the construction of communications on the ground and for the assessment of environmental impact, if necessary. Together with the application for extraction permit, the location plan of communications on the ground shall be submitted to the issuer of the extraction permit. As currently there is no such requirement in the Earth's Crust Act, the act has to be supplemented, so that communications on the ground could be taken into consideration already prior to the extraction.

5. If the extraction permit has been issued, the owner of the permit will often start applying for other necessary environmental permits (authorisation for the special use of water, ambient air pollution permit, etc). Current solution (applying for permits separately) entails a situation where the declaration of oppositions during open proceedings may not involve the later application for other permits. A very detailed proposal for the integration of environmental permits has been submitted in the draft legislation of environmental code, meaning that prior to the extraction of mineral resources, there is one public legislative proceeding for being granted one environmental permit.

3.2. Extraction and processing technology of Construction minerals and its impact on the environment

Extraction of each mineral resource permanently changes the nature of the extraction area, above all, landscape, and may influence also the adjacent areas. In general, extraction is no longer as scary an activity as two or three decades ago.

Current method for the extraction of construction minerals in Estonia is quarrying. In case of the use of Maardu granite deposit, underground extraction is used. The environmental impact related to the extraction depends on a number of circumstances, such as the geological composition of the mineral deposit, mining technological decisions as well as the technology and appliances used. The selection of the technology used for the extraction of mineral resources depends on the traits of the rock, especially its properties of strength.

According to draft legislation, the need to organise the structure of the currently valid Earth's Crust Act has been highlighted in the environmental code; also, additional environmental protection requirements have been submitted for the conduction of research and extraction of mineral resources. A separate chapter focuses on the obligations of the operational authority responsible for the fulfilment of environmental requirements (incl. extraction), whereas one of the main obligations include the use of the best possible technology. The owner of environmental permit is obliged to use environmental protection measures and the best technology [17].

The extent of the impact of extraction on groundwater depends on the fact whether the construction mineral is extracted above or beneath the level of groundwater, whether extraction is conducted under water or water level is lowered when going below the water level, whether the quarry is isolated from the layer of groundwater or whether the loss of groundwater is compensated by pumping water back, etc. The change in water regime has an impact on the neighbouring water supply and the growth conditions of plants. The formation of additional water into artificial recipients, caused by the extraction, may influence its biota.

In the Vasalemma, Rummu, Nabala and other limestone deposits located in Harju County, the layer of mineral resources is located often to a large extent beneath the level of groundwater and thus the environment is most significantly influenced by the decrease in the level of groundwater caused by extraction. In the area of limestone deposits, water from the Silurian-Ordovician or Ordovician-Cambrian layer is also used for the water supply of low density areas, in which there are no problems with the radiological indicators of water. Usually, the pumping of water from quarries during extraction entails decrease in the level of groundwater around the quarry, which could reach from hundred meters to several kilometres. The size and extent of decrease depends on the quantity of running of water, which in turn depends on the diameter of the quarry and the water transmission of the surrounding rocks (filtration module). Thus, in order to limit the inflow of water, the water transmission of rocks has to be decreased; the best method for this is to create a water barrier from materials that are less permeable. The water barrier could be a dam, a conture tranche filled with waterproof material, filling of rock fissures (cementing), etc. The majority of the applied methods would isolate the level of groundwater partially, not in full extent. Only the construction of a dam would be economically feasible. This has been tested in the oil shale quarry in Narva. This method suits only if the level of groundwater opened with extraction is local, and watertight rocks are located higher than the bottom of the quarry.

The impact on ambient air is expressed usually in the noise and dust caused with extraction, as well as the exhaust emissions of vehicles into the ambient air. The extent of this impact on the region's nature and residents directly depends on the appliances used, the number of them, their technical situation and the nature of a particular work. Extraction also influences infrastructure and raises the question whether new roads have to be constructed or restrictions established if the transport caused by servicing of a quarry is too encumbering on the neighbouring roads. A significant part of the environmental impact depends on a working culture [3].

If the construction minerals were to be ranked by the size of the environmental impact caused by extraction, then the extraction of clay has the smallest impact, which is followed by the extraction of sand and gravel. The largest environmental impact is exhibited by the extraction of limestone and dolostone, which often entail both a decrease in the level of groundwater, land oscillation caused by boring operations and blasting, as well as the noise caused by extraction with a hydraulic hammer and the noise and dust related to the work of crushing and sorting. An exception is the crushing of lump rock and finishing rock, which occurs on a restricted area and quantity and the impact of which on the surroundings is small. The environmental impact entailed with the extraction of limestone and dolostone stands in equal proportion to extraction capacity. Thus, the impact is usually much more extensive in limestone quarries of average size (with the area of up to 30 ha) than in gravel quarries (with the area slightly over 10 ha), where the average extracted quantities of mineral resources are respectively 85 thousand m^3 and 15 thousand m^3. The environmental impact of smaller limestone quarries, the annual extraction capacity of which does not exceed 50 thousand m^3, is comparable to the impact caused in an average gravel quarry. Both in limestone and gravel quarries, noise barrier walls or barriers shall be constructed to reduce the noise caused by the work of crushing and sorting assemblies.

An exception, however, is the underground quarrying of crystalline construction stone, during which it is reasonable to crush and process all extracted granite underground. Therefore, if the problems related to groundwater have been successfully solved in the project, the main cause of environmental impact is the increasing transportation load, caused by the transport of mineral resources from the quarries.

For the production of crushed stone, different technological solutions may be used, starting from separating the mineral resource from its natural state to the use of various crushing and enrichment technologies when extracting limestone and dolostone. The quality of crushed limestone depends on blasting, crushing with a hydraulic pick hammer, but also on the technical properties of the machines used for the production of crushed stone. The process of fragmenting, that is, loosening is of particular importance, the selection of which depends mainly on the crush resistance of the extracted layer of limestone as well as the extraction capacity. Two most common methods are being used for the fragmentation of limestone and dolostone: boring-blasting works and loosening with a hydraulic hammer. Boring and blasting works entail emissions into air: explosion gases (mainly CO, CO_2, NO_x, N_2, O_2), water vapour, dust; also, noise and land oscillation (seismic waves). When using unpackaged explosives in wet boreholes, chemical compounds leach (mainly nitrogen). The entire area related to blasting works is precisely regulated; only certified explosives may be used that are safe to the environment and human health. The possibility for the management of the environmental impact caused by fragmentation (i.e. noise - pressure impulses) with a hydraulic hammer is much smaller. The impact of blasting is of cyclic nature (occurs only in case of preparation works and during blasting), but fragmentation with a hydraulic hammer is a constant process, and thus, contrary to the widespread opinion, boring and blasting works disturb people by houses less.

In limestone and dolostone quarries, residues are created in processing the mineral resources. These are mainly the screenings (0-5-8 mm), formed when fractioning the crushed stone, the market demand of which is smaller (residue up to 30% of the extracted rock). Environmental impact is caused at the storage of the residue, which occurs on relatively large areas, as well as during the handling process, which creates large quantities of dust in case of dry weather. In large quarries, several mechanisms work at the same time, such as several crushing and sorting assemblies [3].

An alternative to the extraction of limestone with boring and blasting works is a surface miner. This would be particularly useful in mineral deposits where blasting works have been prohibited for some reason. Although the fragmentation of mineral resource by use of a surface miner has a number of advantages, compared to boring and blasting works, the expected productivity has not been reached in Estonia when using the surface miners produced by the German undertaking Wirtgen; the results were not economically efficient. To extract the limestone of Estonian mineral deposits, combine harvester shall be modernised and experimentation continued [18].

The environmental impact is smaller in case of the extraction of sand and gravel. The technology of extraction is simple; excavators, dumpers, bulldozers and shovel loaders are used, but not together to a recognisable extent, and thus the noise in quarries is low. As sand is being extracted to a large extent also below the level of groundwater, it has an impact on the groundwater. The amount of water directed away from quarries is usually compensated by rain and meltwater; extensive and long-term decrease in water does not occur even in case of large extraction capacities. The relief and land use of the surroundings will change permanently with the formation of a water body after the extraction. Current experience indicates that the quality of water in water bodies formed by quarries is normal also at the occurrence of excavation operations. The extraction of gravel may add the crushing and/or fractioning of material as well as the storage of the finished product. More noise may also be expected when loading the production. The processes mentioned cause above all additional dust emission and noise, as well as exhaust emission into the ambient air, to a lesser degree. The most important source of dust in all quarries of construction minerals is road transport (estimated 80%).

The extraction capacity of clay is often small. The extraction technology is easy, with excavator and dumper mainly being used. The roads within the quarry also create less dust than in other quarries of construction minerals. The extraction of clay does not generally entail significant impact on groundwater; majority of the quarries are not used all year round either.

The efficiency of decreasing environmental impact is directly related to the investments in environmental protection measures and is reflected in product price, influencing also the competitiveness of enterprises. Majority of environmental protection measures increases production costs, but there are also measures which help to save on the expenses. Savings may occur, for example, by using more efficient devices, reducing or optimising some work stages, etc. In limestone quarries, the quantity of water pumped out can be decreased if the territory of the opened quarry is limited (both the flooding of rain and groundwater depends on the area of the quarry), or if the quarry is isolated from the level of groundwater or the extraction occurs below water. As the majority of dust emission is caused by road transport, the optimisation of logistics can provide quite significant effect. For cars which do not have load sheetings, a load irrigation system may be installed, under which cars would pass when driving out of the quarry. Washing of wheels and irrigation of load can be combined into one joint procedure.

Nowadays, model calculations can be used in geological exploration of mineral resources, applying for extraction permits, designing the extraction and evaluating environmental impact; most important of this are the models for groundwater, the spread of dust and air emission as well as noise models. Model calculations enable to experiment quite precisely with the environmental impact entailed with extraction related technologies, which assist in finding a technology corresponding with environmental requirements already in the stage of design.

Constant technological innovations also occur in the use of the earth's crust. Every year new machines are launched on the market, which are much more efficient and work-proof, which consume less fuel, emit less emissions etc. Nevertheless, principal changes introduced by consumers are rather time-consuming, as in most cases the use of technology requires large investments, restructuring of work, etc; therefore, already developed methods are preferred or minimal innovations introduced.

When conducting boring and blasting works, short delay blasting is being used already for some time, which enables efficient regulation of blasting also in extremely restricted situations (if sensitive objects are located in the direct vicinity of the location of blasting). In addition, the noise related to boring charge holes can be reduced. New generation drilling machines have been introduced into production, produced by ATLAS COPCO (models Silenced SmartRig ROC D7C / ROC D9C and others) and TAMROCK. The spread of noise created by them is significantly smaller when compared to other drilling machines. In terms of decrease in emission into air, the application of hybrid transmission on excavators and shovel loaders shall be mentioned.

When loading ore and production, the former irrigation of the material is generally recognised practice in the world, while in Estonia it has not been used extensively. When loading the extraction material, sprinklers are recommended to be used on the fragmented rock in a warm period; while loading the production, fog guns could be used, providing irrigation to the entire loading zone and hindering thus the formation of dust. This technology is used in Väo limestone quarry. Fog guns can be used only in a warm season, but generally there is no need for this in winter anyway. In addition to the common method of road irrigation, chemical processing of gravel roads could be also used. Most common is processing with calcium chloride or any other chemical solution, which functions on the principle of binding the humidity in road covering materials and thus reducing the formation of dust.

There are several innovations in conveyor technology, where the advantage of transportation is that it is relatively cheap, especially in case of longer distances (a couple of kilometres and more) as well as environmentally friendly, which is expressed above all in little noise and dust, compared to road transport (dust does not spread). The disadvantage is relatively large primary investment. In case of the extraction and processing of construction minerals, conveyors with joints and mobile loading heads are worthy of attention, enabling to lengthen the conveyor according to its movement and move it out of the zone of flying fragments during the process of blasting. The use of conveyor transport is reasonable in quarries with large production capacity or on extracting permit areas, where the mineral resource is located close to residential ground. In that case, the processing of ore could be brought away from houses, thereby disturbing people to a lesser extent. There are several possibilities for decreasing dust when crushing and screening ore. For example, wet cleaning and sorting of ore, which does not create any dust at all, and the later loading of the production is practically dust-free, too. The disadvantage of the system is the need for cleaning technological water and the complexity of adjusting it to Estonian climate (requires that production is held indoors or applied seasonally). As currently known, it is only used in Rõstla dolostone deposit. Another possibility would be to produce crushed stone in a covered system. For this purpose, crushers, screening devices and conveyor lines have to be covered, negative air pressure created in the system, and the dust created pulled into cyclones.

An important technological innovation is the washing line of limestone screenings, applied in Väo limestone deposit, where the screenings are washed with water under pressure, using a solvent of flocculants (flocculant loses its traits during the reaction and becomes neutral), which removes thinner limestone and clay dust particles. Water is used in recycling, the output of which is several fractions of clean crushed limestone and limestone sand (0-0.063, 0.063-2, 2-8, 8-16 mm). The experience of Paekivitoodete Tehas OÜ has indicated that the result of enrichment is cleaned crushed stone and sand, of which approximately 8% have the fraction of 0-0.063 mm, which is not currently used in construction activities. Thus, it can be claimed that in the studied case, 90% of the residue created in the process of producing limestone is recoverable. The amount of the screenings used depends, of course on the properties of the source rock and may differ in other quarries in case of the same technology.

Depending on the location of extraction, the mineral resource extracted and the technology used the possibilities for shaping post-excavation landscape either widen or shrink. In Estonia, majority of quarries of construction minerals that have not been maintained originate from the extensive extraction, held in the previous century, when such arrangement works were not specifically emphasised.

An important influencing factor in organising land is the level of groundwater. If extraction occurs below the level of groundwater, one possibility is to shape a water body at the extraction area. Recently, artificial landforms have been tried to be avoided, for example, water bodies' straight shorelines with steep angles, because in nature, transmissions are usually smooth.

Thus, the conture of extracting permit areas has to be turned more attention during extraction, so that the later result of arrangement would be a nature-identical water body. The more varied the result is, the more successful shaping of landscape is. In a varied landscape, there are more suitable living conditions for different organisms, which increase the variety of biota. With skilful landscape shaping, suitable habitats can be created for threatened and protected species on extracted areas [3].

In conclusion, it can be said that by using technological innovations in extraction, it is possible in the future to conduct excavation operations in regions where a number of different restrictions have not enabled this so far. The use of technological innovations is important so that the resources of the earth's crust could be used maximally; currently, they have been generally included as wastage or have been declared passive due to the absence of a suitable technology. The modernisation of technology is aimed at fulfilling the environmental requirements obligatory in extraction to their maximum extent, saving nature and disturbing the residents of extraction area as little as possible.

Problems and existing possibilities

1. The Earth's Crust Act has not established the requirement to use the best technology when extracting mineral resources, oriented at saving of the environment. The draft legislation of the environmental code has established the obligations of the owner of an environmental, which also include the requirement for using the best technology. Thus, when granting an extraction permit, the use of the best technology shall

be taken into consideration following from the recommendations of an expert in environmental impact assessment (EIA).

2. The EIA, to be conducted during the extraction of mineral resources, is ordered and paid by the developer, that is, the future owner of the environmental permit. This has caused protest reactions among the residents of extraction areas, because it is not believed that the process of EIA is impartial if the contracting entity is the developer. The order of EIA, when issuing the environmental permit, shall be analysed and change or supplement legislation, if necessary.

3. The State Audit Office has directed attention to setting quarries of construction minerals into order and established the task to improve monitoring over the management work of extracted areas. An overview of the disadvantages of this process has to be compiled and implement measures for improving the situation.

4. Norms of noise, dust and other emissions into air as well as vibration have been established with the Ambient Air Protection Act, which shall be followed in the extraction of mineral resources. Nevertheless, many complaints have been submitted by residents of extraction areas. National monitoring over extraction process shall be made more efficient, adherence to the norms mentioned and the conformity of extraction permits to the actual situation shall be also monitored; if necessary, the conditions for extraction can be made severer.

3.3. Restrictions influencing the use of mineral deposits

When issuing permits for the geological exploration of mineral resources and extraction, several restrictions have to be taken into account, which are mainly related to historically developed human settlement (settlements, detached houses, roads, railroads, power lines, objects protected under heritage conservation, other structures and communications) and natural objects, which have to be protected from the negative influence of economic activity.

Mineral deposits of construction minerals are often located on inhabited areas or in their direct vicinity. As a large part of the Estonian territory is relatively flat land, which is difficult to cultivate without land improvement or totally unsuitable for cultivation (merely peat areas are approximately 22%), then settlement has often been established to drier regions: ridges, hills, etc, which are not overmoist. However, the formation of construction minerals is also usually related to such largely positive reliefs as drumlins, eskers and kames. Thus, social conflict is already initially programmed into the extraction of construction minerals.

One of the largest objects protected under heritage conservation is Rebala heritage conservation area, where several deposits of construction minerals are located. Currently, limestone is extracted in Maardu mineral deposit and clay in Kallavere (Ülgase) deposit. In addition, applications for extraction permits have been submitted for the extraction of limestone and crystalline construction stone. On Rebala heritage conservation area, mineral resources can be extracted based on the permit of National Heritage Board.

Nationwide cooperation on nature protection is regulated by several agreements. Estonia has concluded bilateral environmental protection cooperation agreements with approximately fifty countries. Estonia is also a member of several important international nature protection organisations. Above all, the International Union for Conservation of Nature (IUCN) shall be mentioned. The legal base for the protection of several natural features is the legislation of the EU and international agreements. The Council of Europe directive 79/409/EEC, the so-called „bird directive" is valid on the protection of natural bird fauna, while the Council of Europe directive 92/43/EEC, the so-called „nature directive" is valid for the protection of natural habitats, flora and fauna. The most important conventions include Ramsari Convention (Estonia joined it in 1993), the aim of which is the protection and sustainable use of threatened wetlands, the Berne Convention (entered into force in Estonia in 1992), the aim of which is the protection of the flora and fauna of Europe as well as their habitats and natural sites, as well as the Convention on Biological Diversity (is valid in Estonia since 1994), the aim of which is the protection of diversity of biota and the sustainable use of natural resources. The aim of the Convention on the Protection of the Marine Environment of the Baltic Sea (entered into force in Estonia 1995) is to ensure the healthy living environment of the Baltic Sea with diverse and balanced biological components.

Nature protection restrictions have been established mainly in the Nature Conservation Act and the related legislation. Many mineral deposits of construction minerals are located on the area of protected nature objects and often restrictions are caused by its relief, which does form, for example, a sand or gravel mineral deposit (eskers, kames, drumlins). Nationally protected nature objects include protected areas, special conservation areas, protected species, species protection sites and individual protected nature objects. The objects undergoing nature conservation have a restriction zone, which is a land or water area of a protected area, where economic activity is allowed, taking into consideration the restrictions established with the Nature Conservation Act. Extraction of mineral resources on protected areas is allowed only if it has been established so in a protection rule. On Natura areas, there are two extracting permit areas of construction minerals in Estonia: Sillaotsa sand quarry on the nature and bird area of Lahemaa and Liivaaugu sand quarry on Otepää nature and bird area. Of the total area (about 400 km^2) of the mineral deposits of construction minerals, 24 km^2, that is, 6%, is located on Natura areas.

Several restrictions of nature protection (based on the Nature Conservation Act, Natura areas, the ecological reserves and limited management zones established by local governments) form the total of approximately 60 km^2, that is, 15% of the total area of construction minerals deposits. Hereby, it has to be taken into account that the area of the deposits used decreases even more than indicated, as individual objects where protected zones do not apply have not been considered; the possibility for using an extracted deposit decreases also due to the mineral deposits being cut into parts. Thus, extraction is complicated or impossible due to direct nature protection restrictions on at least a fifth of the area of construction minerals deposits.

There are five national parks in Estonia, the oldest of which, Lahemaa National Park, was established in 1971. Geological exploration of mineral resources and geological investigations are allowed there only with the consent of the manager of the national park.

Extraction of mineral resources is allowed until the exhaustion of current quarries, while on private land, the extraction of sand, gravel and limestone is allowed for own purposes, in places approved by the manager of the national park.

Natural objects can be placed under nature protection also on the level of local government, for example, landscape, valuable arable land, valuable natural biotic community, separate elements of a landscape, parks, green areas or separate elements of landscaping. Local governments can place the mentioned natural object under protection either on the basis of a comprehensive plan or a detailed plan with a regulation of the council or without compiling a plan with a regulation of the council. The latter possibility has created a contradiction with the need for the extraction of construction minerals, because without a plan on the mineral deposit, the landscape protection area excludes the possibility to extract mineral resources from this deposit. If a plan is not compiled, a coordination process between the owner of the mineral resource and/or the land owner has not been foreseen and thus state interest cannot be expressed, which follows from the need for the extraction of construction minerals.

Infrastructure-related restrictions on a mineral deposit include historically developed human settlement in its vicinity, roads, technical communications and their protected zones (road protection zone, railroad protection zone, aerodrome protection zone, protection zone for electrical installations, etc). Objects of the Defence Forces are also included here.

In order to protect water from diffuse pollution and avoid leaching of the shores of water bodies, water protection zones of various extent are formed, based on the Water Act, on the shore area of water bodies, where extraction of mineral resources and geological exploration are prohibited. During the extraction, a water body is formed on the bottom of the quarry not only below the level of groundwater but also of rain water. Thus, as soon as a water body has been formed on the bottom of the quarry, it is surrounded by a protection zone and is entered into the environmental register, incl. in extraction permit areas. This means that mining shall be immediately terminated. The only way for extraction is by constantly pumping out the water from the quarry, also in cases when mineral resources are not being extracted at the same time. After extraction, maintenance works shall not be done either.

Several environmental restrictions have been applied to extraction; for instance, for the protection of ambient air, maximum levels have been established for noise, dust and transport emissions.

Restrictions on the resource protection of mineral resources shall be considered as well, deducing from the requirements of sustainable development and the Earth's Crust Act:

1) accompanying natural resources (accompanying mineral resources, groundwater, etc) shall be used or preserved as usable, close to its former quality;
2) when issuing an extraction permit, the extracting permit area may not exclude parts of the mineral deposit, the use of which is no longer economically grounded due to the quantity or state of mineral reserves;
3) the usable and extractable preservation of mineral reserves, remaining in a mineral deposit, shall be ensured when extracting the mineral reserves;
4) extraction of mineral reserves may not cause destruction of soil.

As a conclusion, it can be said that the most important restrictions on the use of mineral deposits are the restrictions related to nature conservation and infrastructure. On an area with nature conservation restrictions, the requirements of the object's protection rules shall be considered as well as the fact that the Environmental Impact Assessment and Environmental Management System Act regulates how the impact of the planned activity on protected nature objects is to be assessed.

Problems and existing possibilities

1. Local government is entitled to compile a local protected area with the decision of the council, which does not require co-ordination and thus the state has no possibility to stand for its rights in the extraction of construction minerals. Contradictions related to the Earth's Crust Act and Nature Conservation Act shall be analysed and supplemented or improved if necessary.
2. The plan of forming a green network on the mineral deposits has resulted in contradictory opinions. Although green network does not restrict extraction according to the Planning Act, then especially lately local governments have presented existence of a green network on the extraction area as the argument for not agreeing with the application of an extraction permit. The co-existence of green networks and extraction shall be considered during environmental impact assessment and when developing management directions.

3. In majority of protection rules for ecological reserves, extraction of mineral resources is unconditionally prohibited. In order to use construction minerals sustainably, the suitability of the extraction of mineral resources with the protection rules of the protected area shall be considered, assessing the environmental impact related to extraction and possibilities for mitigation.
4. If a water body is formed on the bottom of a quarry during extraction, mining shall be immediately terminated according to the Water Act. This excludes both further extraction activity and the need for setting the area extracted into order. Contradictions related to the Earth's Crust and Water Act as well as other acts are essential to be quickly eliminated.

3.4. Environmental charge related to extraction

The taxes or fees related to the use of natural resources are not regulated in the EU. In Estonia, environmental charges are in use since 1991. Following from the Environmental Charge Act, environmental charge is the price for the right to use the environment, which currently consists of the charge for pollution charge and the right to use natural resources. The main aim of environmental charges is to ensure the sustainable use of natural resources and motivate the users of natural resources and environment polluters to implement environmental protection measures.

One subclass of the charge for the right to use natural resources is the fee for mineral rights, which is paid for the extraction and use of mineral reserves as well as for making them unusable. Pollution charge is paid in case of directing pollutants from stationary sources of pollution to ambient air, groundwater, water bodies or soil as well as for waste removal. As the extraction of construction minerals is of local and rather modest nature, miners mainly pay the fee for mineral rights.

The fee for the mineral rights of mineral reserves that belong to the state is usually established based on the Environmental Charge Act, established with the Regulation No. 316 of the Government of the Republic of 22 December 2005. A new version of the act has been passed, which entered into force on 1 January 2010.

The expected rise in mineral rights and other environmental charges rate until 2020 has been presented in the draft legislation of Developing the Concept of Environmental Charge for 2010-2020. The rate of mineral rights was significantly raised in 2006 and 2007, based on the taxation of the total production of mineral resources. The rate for mineral resources of higher quality was raised more. For example, of construction limestone, the rate for the mineral right of high-quality limestone was raised the most [19].

A disadvantage of the calculation of mineral rights is the fact that the fee consists mainly of the quantity of the mined reserves. If mineral resources are not extracted, the state does not receive profit, although state land and mineral resources undergo the possession of the miner.
Thus, the miner can maintain the mineral deposit themselves, deciding when and to which extent to extract. Such a situation hinders competition between enterprises and increases contradictions with local people.

A principle shall be implemented where the extraction process occurs during a short period of time, using technology that disturbs the neighbourhood little and recovering the land area changed with extraction quickly after the maintenance works. The use of mining lease would introduce a thorough change in the current system of paying environmental charge.

Mining lease helps to promote the economic value of construction minerals and creates normal competition between mining enterprises. Mining lease as a type of environmental charge shall be paid every year by all miners of mineral resources for the use of a mineral deposit, i.e., rent and the entire extracting permit area, issued for extraction, are imposed with a charge. This is not directly related to the quantity of mineral resources mined during a year. The size of mining lease - the payment conditions of which are fixed in laws, above all, in the Earth's Crust Act and the Environmental Charge Act -depends above all on the size and location of the extracting permit area, the price of land, the properties and quality of mineral resources as well as the technology used. Of special importance is determining the extent of environmental impact, caused during extraction, as well as its assessment and reflection in mining lease.

Problems and existing possibilities

1. The size of the mineral right of the mineral resources belonging to the state depends most of all on the quantity of the extracted reserve. The use of such mining lease which would consider all extraction costs for the state and would ensure competition between miners shall be considered.
2. The State Audit Office has directed attention to violations of law related to the extraction of mineral resources, above all, to the violation of the norms on the allowed extraction capacity and extracting permit area. In order to discover and avoid such violations, the state control over the extraction of mineral resources shall be made more efficient and turned into a unitary system of organisations conducting monitoring.

3.5. Export and import of construction minerals

The import and especially export of construction minerals has raised noteworthy interest in the general public, since it is afraid that construction minerals are exported too extensively, leaving behind changed landscape on large areas. To refute this statement, the import and export of construction minerals is considered more in-depth in this chapter.

The characterisation of the import and export of construction minerals is based on the data of Statistics Estonia, according to which construction minerals include also the natural resources exported from elsewhere, not only the construction minerals extracted in Estonia. Thus, bringing import and export articles into conformity with the varieties of natural resources extracted in Estonia is practically impossible, as the declaration of construction minerals as a good is rather arbitrary and one and the same product can be declared under different commodity codes by different suppliers.

The target countries of export have been above all neighbouring countries, because the transport of construction minerals considerably increases the product price. Russia, who has been holding the dominant leader position as a target country, has lost significance. Finland, Sweden, Germany and Poland have emerged increasingly to the fore. However, external trade with Latvia, Lithuania and Ukraine has been preserved as well. Of new countries, Italy, Norway, Denmark and the United States have been added [3].

In 2004-2008, limestone and dolostone were imported both as blocks and crushed stone in the total of 4,148,000 t, leading to the average import of 830,000 t a year. In 2000-2003, the average annual import was 444,000 t, while during the next five years the average import already to 830,000 tons. State-wise, import was largest from Finland — 2 747,000 t (66% of the total volume) and Sweden 1,268,000 t (31% of the total volume), followed by Russia and Germany.

In the same period, limestone and dolostone were exported 3,062,000 t. In 2000-2001, annual volumes were below 300,000 t, but by 2008, export increased to 701,000 tons. State-wise, in 2004-2008, largest volumes of limestone and dolostone have been exported to Germany — 1,537,000 t (50%), followed by Finland — 595,000 t (19%), Latvia — 342,000 t (11%), Lithuania — 207,000 t (7%), Sweden — 200,000 t (7%) and Poland — 96,000 t (3%).

Because in terms of crushed stone, Statistics Estonia collects both the data on crushed granite, limestone and dolostone, it can be said that mainly crushed granite, used as a construction material, has been imported, while crushed technological limestone and dolostone, used for several sectors of industry, have been exported. In 2004-2008, 41,267,000 t of crushed stone has been imported, while in 2000-2001 the volume exported from Estonia remained below 400,000 t, and in the last five years, the average of 825,000 t a year. Thus, the import of crushed stone increased in the last 2-3 years more than twice. Largest volumes of crushed stone have been imported from Finland, 2,743,000 t, making the average annual volume of 549,000 t (66% of the total volume); for import from Sweden, the volume is 1,267,000 t, the average annual volume, 253,000 t (31% of the total volume). From other countries, import was significantly smaller.

In 2004-2008, crushed stone (mainly technological carbonate rock) was exported the total of 2,801,000 t, which makes the average annual export volume 560,000 t. In 2000-2001, crushed stone was exported slightly more than 200,000 t a year; thereafter, however, export started to increase and in 2008 already 660,000 t was being exported. State-wise, crushed stone was mainly exported to Germany — 1,537,000 t, which makes the average annual volume 307,000 t and comprises 55% of the overall volume of export; Germany is followed by Finland with 594,000 t, with the average annual volume of 119,000 t (21% of the total volume), Latvia with 266,000 t, with the average annual volume of 53,000 t (10%), and Sweden with 199,000 t, with the average annual volume of 40,000 t (8%).

The data of Nordkalk AS indicates that in 2008, 394,000 t of dolostone and 222,000 t of limestone (in addition, 74,000 t limestone meal and lime) were exported in the total value of 122,000 thousand kr. Crushed limestone and dolostone were exported to metal industry and for the production of rock wool to the following export target countries: Finland, Germany, Sweden and Poland. Production was exported both from Kurevere and Vasalemma quarry (technological rock) [3].

In 2004-2008, mainly sand used in construction and glass industry was imported for 20,000 t, with the average annual volume of 4,000 t. It shall be noted that while in 2000-2001, sand was imported respectively for 8,000 t and 11,000 t, then in the following years import extinguished and remained to the average level of 2,000 t a year. Import became again more intensive in 2007 and 200, when respectively 8,000 t and 7500 t of sand were imported. Sand was mainly exported to Latvia and Russia; to other countries, export remained below one percent. In 2004-2008, sand has been imported to Estonia from 21 countries and most extensively from the Baltic States, followed by Ukraine and Belarus. Most of all, sand was imported from Latvia — in 2007 and 2008, the total of 15,000 t. the volume of imported sand formed in the period studied the total of only 20,000 t.

Indicators on the import and export of clay cannot be correctly presented, as the division of construction minerals in the mineral resources balance of the list of mineral deposits and the database of Statistics Estonia is completely different. For example, it is interesting that in 2004-2008, fireclay has been exported 200 t more than it has been imported (import 200 t, export 400 t). However, it is known that in 2004-2008 fireclay was not extracted in Estonia.

In conclusion, Estonia exported 500 t of clay between 2004 and 2008, with an average annual export volume of 100 t. In terms of countries, Estonia has exported unprocessed clay mainly to Latvia, Russia and Sweden. Estonia imported during the same period 23,000 t of clays of different types, with an average annual import volume of 5,000 t. A notable year is 2005, when Estonia imported 16,000 t of clay not classified by the Statistical Office, thus exceeding the average annual import volume more than threefold. The main import partners between 2004 and 2008 were also Latvia and Russia.

While AS Kunda Nordic Tsement does not export or import clay, the company uses clay in producing cement, which is exported to numerous European countries as a ready-to-use product. In 2007, the domestic and external market were supplied with over 1,239,000 t of cement.

According to the Statistical Office, Estonia both exported and imported granite or its derivative products. As Estonia does not currently extract crystalline building stone, the entire granite had previously been imported into Estonia. According to the Statistical Office, Estonia imported between 2004 and 2008 343,000 t of granite (including 58,000 t of natural granite), of which 74,000 t were exported. The main import partners are Finland and Sweden. No separate statistics are collected on crushed granite.

In conclusion, Estonia imported between 2004 and 2008 a total of 4,535,000 t of mineral resources used in the construction industry, with an average annual volume of 907,000 t. The main import in terms of quantities was crushed stone with 4,126,000 t (average annual volume 825,000 t), followed by granite with 341,000 t (average annual volume 68,000 t), clay with 26,500 t (average annual volume 5,000 t), limestone and dolostone with 22,000 t (average annual volume 4,000 t) and the smallest import, sand, with 19,000 t (average annual volume 4,000 t).

Estonia exported between 2004 and 2008 a total of 3,137,000 t of mineral resources used in the construction industry, with an average annual volume of 627,000 t. The main export in terms of quantities was crushed stone with 2,801,000 t (average annual volume 560,000 t), followed by limestone and dolostone with 2,622,000 t (average annual volume 520,000 t), granite with 74,000 t (average annual volume 15,000 t), sand with 400 t (average annual volume 80 t) and the smallest export, clay, with 500 t (average annual volume 100 t) [3].

The ratio of import to export will change considerably when Estonia starts mining granite; and the international marketing options for technological limestone and dolostone products produced by Nordkalk AS and other companies also play an important role.

Problems and existing opportunities

The database of the Statistical Office does not provide adequate data on the export and import of mineral resources mined in Estonia as the database has not been harmonised with the balance of mineral reserves of the environmental register's list of mineral deposits. Cooperation with the Statistical Office is called for in order to harmonise the data on mineral resources contained in different databases.

3.6. Contradiction between the need for the extraction of construction minerals and anti-extraction attitude

Conflicts between the need to mine mineral resources used in construction and the anti-mining attitude of local governments and residents have become particularly exacerbated recently. This has been brought on to a large extent by the intensification of mining and increasing numbers of opencasts in the context of the construction boom.

As it is possible to extract mineral resources used in the construction industry only in places where they have originated as a result of geological processes and where the explored body has been registered in the list of mineral deposits, it is logical that there are certain areas in Estonia (rural municipalities of Jõelähtme, Koigi, etc.) where extraction or geological exploration permits are issued for adjacent areas. Such a situation understandably creates discomfort and fear among residents of mining areas, as mining inevitably causes permanent changes to the landscape, generates dust and noise and brings about a marked increase in transportation. The quality of the environment has a direct impact on human health and damaging the habitual living environment disrupts people's welfare. Therefore, extraction permit holders must assure the inhabitants of the territories of extraction permit areas that they will uphold environmental requirements regarding noise, dust and possible ground vibration when mining mineral resources used in construction. The quality of air and drinking water may not deteriorate. The requirements can be prescribed to miners when issuing environmental permits and compliance should be monitored randomly or by responding immediately to any complaints. A well-functioning monitoring system would hopefully also diminish the mining-related fears of local people.

Most of the neglected opencasts of mineral resources used in the construction industry date back to the period of intensive mining in the last century, when the main aim was to increase constantly mined reserves, while restoring the opencasts was of secondary importance and therefore largely neglected. This former attitude is also largely the reason for the current opposition to mining, combined with current delays in restoring the landscape altered by mining, despite the requirement for each opencast and mine to have a restoration project. The miner is responsible for the restoration of its mining territory and is obligated to care for the area for three years after the end of the restoration project. Mineral resources must be mined and the mined area restored quickly, so that local people get to use the new landscape - water bodies fit for swimming and fishing, park forests, sports facilities - in whatever form the experts advise based on the EIA and the local government requests.

A common fear is that the possible decrease in the water table would lower the water level in wells or deprive people of drinking water altogether. The geological exploration of mineral resources and environmental impact assessment also entail determining the sphere of influence of the mines outside extraction permit areas and measuring the water level in adjacent wells, which is later followed by scheduled monitoring. If the problems with drinking water are caused by mining, the miner must remedy the situation. The requirements regarding the safety of property and the environment when mining mineral resources are set out in the Mining Act. When consenting to extraction permits, local governments may also add an additional requirement of ensuring drinking water for the residents of territories affected by mining.

Due to the increasingly negative attitude towards mining among local governments, the process of requesting the consent of local governments for permitting the geological exploration or extraction of mineral resources has slowed down the process of commencing the use of mineral resources, including those used in the construction industry, and caused a shortage of raw material (e.g. in Harju County). Based on letter No 2.6-3/838-1 sent by the Parliament's Constitutional Committee to the Supreme Court on 13 May 2009 regarding the need to mine in the Koigi dolostone deposit, it can be claimed that the geological exploration and extraction of mineral resources are a matter of public interest. Granting extraction permits has been entrusted to a state body because the legislator has considered the corresponding sector important for the state. § 5 of the Constitution states that the natural wealth and resources of Estonia are national riches which must be used economically. We are talking about using a resource in the public interest. Therefore, we cannot view granting permits only in the context of the needs and possibilities of separate regions, but must keep in mind the needs and possibilities of the entire country. The exploration and extraction of mineral resources is important for the entire country. The fact that these activities always take place on the territory of a local government does not make mining a local issue only. It is a state issue. If a local government refuses to grant a permit for geological investigation for prospecting, for geological exploration or for extracting a mineral resource, a permit may be issued only with the consent of the Government of the Republic, as stated in the Earth's Crust Act. Local governments do not hold veto power over issuing permits as the Earth's Crust Act gives priority to the public interest over personal interests, and extracting mineral resources usually serves the public interest. However, the opinion of the local government must be taken into account when granting a permit and the requirements presented by the local government are reflected on the permit as special requirements. Pursuant to § 154 of the Constitution, obligations may be imposed on local governments regarding local life, provided that these obligations are justified. The purpose of the Earth's Crust Act is to ensure an economically efficient and environmentally sound use of the earth's crust. Thus, any restrictions of the right of organisation of local governments are based on the objective of ensuring the most rational use of mineral resources taking into account the needs and interest of the entire country. The letter sent to the Supreme Court also includes the opinion of the Parliament's Environmental Committee, stating that exploring and using mineral resources located on the territory of a local government cannot be construed as a local issue, as the intended use of certain mineral resources (technological limestone, etc.) is unrelated to the administrative territory of the local government unit of the mining area [20].

The refusal of one local government to grant a permit for extracting a certain mineral resource used in the construction industry may hinder the life and progress of other regions of the country that need this particular mineral resource. Local governments are not willing to accept environmental impact assessment results and in order to ward off mining, have started to set up local landscape protection areas, which often lack the necessary nature protection justification. Disputes arising from opposition by local governments to mining have also been taken to court.

Problems and existing opportunities

1. Recent years have seen the escalation of the conflict between the need to extract mineral resources and an anti-mining attitude. The reasons for this opposition should be analysed and appropriate remedies taken.

2. State-owned mineral resources used in the construction industry should be explored and extracted with the national interest in mind. If the state owns the land where a mineral deposit is located, the state owns both the land and the mineral resource, and as issuer of permits, decides on the necessary explorations or mining activity, notifying the local government thereof in due time.

Mineral deposits are reflected in the comprehensive and detailed plans of local governments in a variety of ways, although the Earth's Crust Act clearly stipulates the protection of mineral resources and the requirement to allow the extraction of mineral reserves. It is necessary to analyse the discrepancies or shortcomings arising from the Earth's Crust Act and the Planning Act and to supplement this legislation.

3.7. Alternative construction materials to mineral resources used in the construction industry

While the rise in construction activity of recent years has slowed down, it can be expected that despite the temporary general economic downturn, the issue of mineral reserves used in the construction industry - particularly limestone reserves used for producing crushed stone - will become critical already in the next few years, with the exhaustion of the main opencasts in the vicinity of Tallinn and the launch of extensive road construction. Therefore, a lot of emphasis in the consumption of mineral resources used in construction is nowadays put on recovering materials, processing and using waste and residues, which comprises almost 5 % of the consumption of mineral resources used in construction in Europe. Using alternative construction materials more extensively extends the sustainable use of non-renewable natural resources and decreases the environmental impact of extraction.

3.7.1. Oil shale spoil and tailings

The increasing demand for crushed stone and aggregates creates the need to use oil shale tailings in producing crushed stone, which is a justified choice in terms of making maximum use of the mineral resource. The heaps that have been piling up for decades on the territories of several companies and local governments contain hundreds of millions of tons of oil shale spoil of varying quality. 15 million tons of oil shale extracted annually generates almost 6 million tons of oil shale spoil. However, the spoil dumps are not increasing at the former rate as a little over 20 % of spoil is already recovered.

Estonian oil shale deposits are characterised by a very thin oil shale bed, which is ca 2.9 m thick. This bed is made up of seven oil shale layers (5-60 cm thick) interspersed with layers of limestone 10-30 cm thick. Limestone layers make up almost 40 % of the industrial oil shale bed. Extraction product is a mined ore with a mixture of oil shale and limestone. Oil shale is used mainly for fuel and for oil production. Burning limestone, however, would resemble burning lime, which uses up a lot of energy instead of generating it. Thus, if oil shale is mixed with limestone, the quality of the fuel or raw material deteriorates significantly. Therefore, since the beginning of oil shale industry, attempts have always been made to separate the limestone, initially by hand, and later using technology. The main means currently employed in oil shale enrichment is using an aqueous solution of ground iron minerals with a density that is between that of the lighter oil shale and the heavier limestone (oil shale stays afloat and limestone sinks to the bottom). As many ore chunks contain both rocks, some of the oil shale inevitably gets mixed with limestone and vice versa [21].

It is necessary to step up the use of oil shale tailings by implementing fractioning, i.e. crushing and sieving. The options for using crushed oil shale spoil in producing concrete and in road construction should be considered. Other fields lack exact quality requirements for the material used and the necessary quantities are also small. The physical-mechanical properties of spoil, which determine its usability, depend on the quality and purity of the original rock. The natural features of the majority of limestone layers located between oil shale layers allow for producing category IV crushed stone. Production is made more complicated by the enrichment remnants of oil shale in the spoil, whose content is currently ca 3-5 %, but used to be up to 30 %. Oil shale is separated from limestone by repetitive selective crushing. As oil shale is softer and breaks more easily than limestone, it can be sieved out. The repetitive crushing, however, deteriorates the physical-mechanical properties of the remaining limestone, which means that the yield of crushed stone makes up ca 50 % of the spoil [3].

Oil shale spoil has been used for years in local road construction and to a small extent as filling material under buildings and in landscape design. Several spoil processors, Eesti Energia Kaevandused AS being the largest one, provide different fractions of certified-quality crushed stone, and some of it can be used in producing concrete. Limestone retrieved in selective mining (oil shale opencasts of Narva and Põhja-Kiviõli) and enrichment of oil shale (Aidu opencast) is mostly used as filling for closed dumps, in landscape maintenance and partly for building roads inside the opencasts. Rock material forming in the enrichment process of broken oil shale in opencasts is deposited in open spoil dumps near the opencasts. Consumers use crushed spoil as a filling material in construction, and crushed stone made from spoil as a construction material. For example, crushed stone made from spoil was used in building the stretch of road between Sonda and the Tallinn-Narva Road, and producers of concrete from Tartu and Jõhvi have also used it. Unfortunately, the crushed limestone produced from oil shale spoil can be used only for producing concrete of a lesser environmental category, and the demand for this product is currently very small.

According to Eesti Energia AS, active efforts to add value to oil shale spoil are under way. In 2006, a crushed stone production unit was launched in the Aidu opencast with an annual production capacity of 400,000 t of crushed stone. The fractions produced are 4-16, 16-32 and 32-40 mm. The crushed stone has been tested in an accredited laboratory and meets the standards of quality grade IV. Besides crushed stone, the Aidu opencast also markets spoil as a filling material. At the beginning of 2008, the Estonia opencast launched work on a crushed stone unit with an annual capacity of 1 -2 million t of crushed stone, produced in fractions of 4-16, 16-32 and 32-64 mm. According to preliminary testing, the crushed stone meets the standards of quality grade IV. In addition to crushed stone made from spoil, the Estonia opencast also markets the spoil itself. In the 2007/2008 financial year, auxiliary mining products of crushed limestone and spoil were marketed for the amount of 17 million kroons. The annual sales volume of crushed stone and spoil amounted to 927,500 t, of which 860,300 t (up more than 40 % from 2006/2007) were sold to external buyers and 67,200 t were consumed by the opencasts themselves.

At the beginning of 2008, the permanent dumps of AS Eesti Põlevkivi contained ca 140 million t of spoil (34 million t in the Viru opencast and 86 million t in the Estonia opencast). The Environmental Fees Act, passed in 2006, doubled the pollution charges for spoil and tailings deposited in open dumps. Since then, the pollution charge for 1 t of spoil has increased by 2 kroons a year. Pollution charge is not required for recovered spoil. In 2007, AS Eesti Põlevkivi paid pollution charges for depositing spoil in the amount of 33.3 million kroons, after having generated ca 6.4 million t of spoil, of which 5.1 million t (79 % of the spoil generated) were deposited in dumps.

The obstacles to using spoil more extensively, for example in crushed stone, have to do with improving the quality of the material produced (partly by selective extraction, mainly by crushing and sieving), but also with logistics as the biggest consumer, Harju County, is located far away from Ida-Viru County, particularly in terms of road transport. Eesti Energia Kaevandused AS sells crushed stone made from spoil ex factory, without transportation costs, at around 40-50 kroons per ton. The main factor limiting the consumption of crushed stone made from spoil has been high transportation costs as production is located far away from the main consumption areas. For example, when transporting crushed stone made from spoil to Tallinn, the region with the greatest demand for crushed stone, transportation costs make up about half of the price (up to 75 kroons per ton). To optimize transportation costs, larger quantities could be transported by rail, using distribution terminals and interim storage facilities. These should be set up in the principal consumption areas, such as Tallinn and Tartu; applying cheaper rates to the transportation of crushed stone made from oil shale spoil might also be considered. Another option would be to apply for support for the transportation of crushed stone made from tailings, which would mean that a portion of the mining rights fee would be channelled to the consumption of crushed stone made from spoil.

Eesti Energia AS is planning to increase the production capacity of turning spoil into crushed stone to up to 2 million t a year. This amount should correspond to the potential market demand and logistical options. It should also be kept in mind that it is not possible to turn the entire spoil into proper crushed stone. As the quality of the spoil fluctuates by opencasts and mineral layers, less than 50 % of the generated spoil is suitable for use in producing crushed stone [22].

According to the Estonian Road Administration, oil shale spoil generated after removing the oil shale may be used in road construction provided that the resulting crushed stone meets the standards of quality grades III or IV. Crushed stone made from spoil is suitable for assembling certain elements of roads with less traffic, while it is not suited for major highways. As the quality of the spoil is low and its composition fluctuates greatly, a solution must be found for expanding the use of lower-quality materials by using various strengtheners and binders, be it oil shale ash or cement clinker dust, etc.

It is a fact that spoil and crushed stone made from spoil are not a complete substitute for crushed stone produced from better-quality construction limestone in all building structures as the material obtained from oil shale certainly does not meet all the current building material standards. Therefore, it is inevitable that new opencasts should be activated at least partially; the best-quality limestone in Estonia is found in the Lasnamäe deposit in Harju County. Using high-quality material is the only option in many building structures.

3.7.2. Oil shale ash

According to Directive 1999/31/EC of the Council of the European Union on the landfill of waste, landfills may not accept waste which, in the conditions of landfill, is explosive, corrosive, oxidising, highly flammable or flammable.

Upon joining the European Union, Estonia undertook to make oil shale ash depositing technology more environmentally sustainable as of 16 July 2009. Estonia promised to bring the depositing of oil shale ash into compliance with the Directive on the landfill of waste. In an exchange of letters in 2008 and 2009, it was agreed with the European Commission that the stone formed out of the ash was no longer considered corrosive and that hydro transportation was not viewed as depositing liquid waste, provided that the water circulated.

Expanding the recovery of oil shale ash significantly decreases deposit volumes. Oil shale ash is actually a valuable resource that can be used in a variety of areas, and Eesti Energia AS is developing significant projects in that field. Oil shale ash is raw material for producing cement and building blocks, it can be used as a substitute for cement in large-scale stabilization processes, as filling material in road construction and neutralizer of acidity in fields and for soil fertilization.

It has also been explored whether a mix of oil shale ash and spoil could be used for providing stability in underground mining instead of protective structures made of mineral resources and also as a CO_2 mineral binding agent. The properties and ability of oil shale ash to bind CO_2 is directly related to the above-mentioned formation of ash stone or carbonated ash. It takes time for contact to occur between the initially strongly alkaline mixture and the atmosphere's CO_2, resulting in a reaction; the existing depositing technology has not allowed for the stable and guaranteed origination of ash stone.

3.7.3. Limestone screenings

In terms of production residues, mineral resources used in the construction industry can also be substituted with limestone extraction residues deposited in opencasts - limestone screenings, which are a by-product of processing and fractioning rock material. The screenings (fraction 0-5 mm) produced as a result of crushing and sorting are currently not used effectively and entirely. The screenings have been used for opencast restoration, as filling material and for liming fields, but most opencasts still contain huge screening dumps that have piled up over the years.

Paekivitoodete Tehase OÜ has installed a production line in the Väo opencast that separates different fractions of limestone screenings (see Chapter 3.2 for a more detailed explanation). Employing such a technology allows for a more complete use of the mineral resource, with the finest screenings exported to Norway for use in fertilisers. AS Kaltsiit and OÜ Põltsamaa Graniit in Jõgeva County have also begun sieving crushed stone of fractions 2-6 mm and 2-5 mm from the screenings.

Testing commissioned by the Estonian Road Administration (report compiled by Ramboll Eesti AS) revealed that it is feasible to use washed limestone sand in road drainage structures and track beds only at a depth deeper than 1.25 m of the road surface [23].

Limestone sand is suitable for refilling communications routes, squares and green areas as well as supporting basements and floorings, provided that the load is not dynamic [24].

If follow-up testing gives good results, limestone sand can be used as a partial substitute for sand in road construction.

The production of granular limestone additives is successfully practiced in Western Europe and Scandinavia. Limestone additives produced from crushed stone screenings can be used in agriculture.

In summary, the physical-mechanical properties of crushed limestone vary by region. Opencasts should have more technology available for processing limestone screenings. This would decrease the use of sand as soil filling in the longer term. Experience shows that up to 90 % of limestone extraction residues are recoverable [3].

The use and further trends of alternative construction materials can be assessed in more detail when all costs incurred by the owner during the life cycle of buildings or roads are also taken into account.

3.7.4. Construction waste

According to the environmental information provided by the Estonian Environment Agency, construction waste made up 8.5 % of all waste generated in 2008; the best option for treating this waste is to sort it and either reuse or recover the materials. According to the waste report, the total volume of concrete and similar waste amounted to 244,000 t in 2008 [25].

It is important to separate hazardous waste (to be transmitted to a licenced treatment company) from the rest of the waste before recovery. Such waste includes waste containing asbestos (asbestos cement, asbestos-cement sheets) and oil products (tar paper, impregnated insulation materials, asphalt containing tar), polluted soil, etc.

Production residues are generated in road construction and the production of construction materials. Demolishing old buildings also leaves residues. Construction material, demolition and road construction residues are used for various purposes; the majority are processed and used as filling material and in road construction and maintenance. The major processing companies in Estonia are AS Floccosa, ATI Grupp OÜ, OÜ Lustrum, Aspen Grupp OÜ, OÜ Melija and OÜ Levkoriin&KA, who process ca 600,000 t of concrete and brick waste annually.

Filling material is the destined use for construction material residues crushed by companies that process construction materials or generate waste (e.g. road builders and construction material factories) and also for waste generated by washing concrete trucks. Pavement waste (defective products, concrete rubble) is used for filling squares.

Road construction and maintenance can make use of milled and crushed asphalt, which is used for light covering of gravel roads. Asphalt removed in patches is also used in road repairs in wintertime asphalt mixes.

The sand and crushed stone dug out from under roads during road reconstruction cannot usually be separated and is usually used together as a mixture for building road bases and embankments. The soil removed for road construction is also often suitable for building track beds. The soil that is peeled away when constructing a new road can be sieved and used in landscaping.

The offcuts of producing building blocks from aerated concrete that are generated in the cutting process before autoclaving are also redirected back into the production process - they are mixed with water and redirected to the product casting phase. The production process also reuses the clay dust caught in smoke-gas filters in producing light gravel and building blocks, by mixing it into the clay. Construction waste is also used for restoring and maintaining opencasts.

The amounts of production waste are directly dependent on production volumes. Unused waste is usually deposited at the nearest waste disposal sites [3].

Problems and existing opportunities

1. Oil shale spoil makes up 40 % of the extracted reserve! About 20 % of the spoil is currently recovered. As spoil is not a high-quality construction material, a solution must be found for expanding the use of lower quality materials.

2. 30 % of the extracted material for producing crushed limestone is currently made up of limestone screenings. Employing newer technology in the production process would allow for using almost 90 % of the screenings.

3.8. Security of supply of mineral resources used in the construction industry and forecast until 2020

It is difficult to characterize in general terms the process and regional distribution of extracting mineral resources used in the construction industry. Mining practices vary greatly by county. This is explained by the uneven distribution and consumption of mineral reserves. As the environmental register's list of deposits and mineral reserve balance, county plans and rural municipality comprehensive plans as well as data on road construction, repair and maintenance submitted for the use of mineral resources are all structured based on counties, security of supply must also be based on the needs of counties.

Exhausting opencasts of mineral resources used in the construction industry and opening new ones is a constantly ongoing process. In the context of rapid economic development and increasing consumption, which we witnessed in the past couple of years, reserves are exhausted in existing extraction permit areas faster than normally and companies submit numerous requests for expanding extraction permit areas or introducing new areas.

Table 2. Residual reserve of mineral resources used in the construction industry in extraction permit areas as at 31.12.2008. thou. m^3 [31

COUNTY	Construction limestone and dolostone	Cement limestone	Dolostone used in finishing	Technological lime-, dolostone	Sand used in construction	Filler sand	Technological sand	Construction gravel	Ceramic clay	Clay ceramsite	Cement clay	**TOTAL**
Harju	24.405	-	-	789	40.884	804	-	2.345	1.635	-	-	**70,862**
Hiiu					680			527				**1,207**
Ida-Viru	-	-	-	-	1.876	401	-	857	4.319	-	-	**7,453**
Jõgeva	4.787	-	-	-	6.082	1.424	-	629	-	-	-	**12,922**
Järva	3.288			704	361	15		833	58			**5,259**
Lääne	443			15	225			2.290				**2,973**
Lääne-Viru	8.655	6.657	-	767	1.136	-	-	999	-	-	7.685	**25,899**
Põlva					5.103	886	984	1.178				**8,151**
Pärnu	3.623				2.658	2.245		1.228		941		**10,695**
Rapla	1.898	-	-	-	149	13	-	491	-	-	-	**2,551**
Saare	1.461	-	762	27	838	761	-	1.669	-	-	-	**5,518**
Tartu	-	-	-	-	15.362	862	-	1.927	-	-	-	**18,151**
Valga	-	-	-	-	3.282	450	-	1.842	-	-	-	**5,574**
Viljandi	-	-	-	-	8.111	772	-	2.130	-	-	-	**11,013**
Võru	417	-	-	-	2.236	1.064	1.497	2.547	-	-	-	**7,761**
Total	**48,980**	**6,657**	**762**	**2,303**	**88,983**	**9,700**	**2,480**	**21,492**	**6,012**	**941**	**7,685**	**195,989**

What matters in terms of security of supply is not so much the general amount of residual reserve but how long the reserve will last based on extraction capacity. Therefore security of supply is characterized by the speed of exhausting the mineral resource, i.e. the time it takes to completely exhaust a mineral reserve based on the time it has taken to exhaust extraction permit areas at the average extraction capacity of the past five years per mineral resource used in the construction industry. In most cases it is not possible to extract the entire reserve of an extraction permit area which means that the actual time it takes to exhaust a resource is even shorter. Neither do the calculations take account of increases in extraction capacity in the longer term. Therefore considering the time it takes to acquire an extraction permit and prepare the permit area, a situation becomes critical when the mineral resource used in construction is going to be exhausted in less than 10 years. This period may be still too short for launching lime- and dolostone extraction as the geological exploration, permit acquisition process and preparations for extraction may take longer. When there is 10-20 years' worth of reserve left, preparations for introducing a new resource should begin. It would be reasonable to link the durability of the available supply of mineral resources used in the construction industry in counties.

Table 3. Speed of exhausting the reserves of mineral resources used in the construction industry (years) based on the data in the list of deposits as at 31.12.2008 [31].

COUNTY	Limestone, dolostone used in construction	Cement limestone	Dolostone used in finishing	Technological lime-, dolostone	Construction sand	Filler san	Technological sand	Construction gravel	Ceramic clay	Clay ceramsite	Cement clay	**AVERAGE**
Harju	16			49	23	0		11				**20**
Hiiu					85			8				**47**
Ida-Viru					59	25		16	114			**53**
Jõgeva	11				52	5		22				**22**
Järva	61			8	60			16				**36**
Lääne	15			0	28			24				**17**
Lääne-Viru	38	16		256	114			17			97	**90**
Põlva					32	11		14				**19**
Pärnu	20				30	16		26		10*		**20**
Rapla	33				5	0		5				**11**
Saare	39		762		44	27		21				**179**
Tartu					78	9		13				**33**
Valga					22			16				**19**
Viljandi					173	34		19				**75**
Võru	32				80		32	18				**40**
AVERAGE	**29**	**16**	**762**	**78**	**59**	**14**	**32**	**16**	**114**	10*	**97**	**46**

*As the Arumetsa deposit was granted a ceramsite clay extraction permit on 21.09.2009, the corresponding security of supply is no longer critical. The critical speeds of exhaustion of mineral resources used in construction are marked in red in Table 3. Where reserves last for another 10-20 years,

Table 3 indicates that in addition to the known issues with security of supply in Harju County, there is also a shortage of mineral resources used in the construction industry in Rapla County. The problematic mineral resources are mainly sand and gravel. The distribution of limestone deposits is rather uneven and depends on the geology of Estonia. Crushed stone can also be produced from construction gravel, which is distributed more evenly and is actively extracted from significantly more numerous deposits than limestone and dolostone, but in terms of security of supply, most counties are supplied with construction gravel for only 19 more years or supply is already critical. Crushed stone produced from gravel opencasts is used primarily for smaller projects of local importance, while crushed limestone is saved for larger projects of national importance. A future consideration when granting new extraction permits on the basis of security of supply should be whether increasing the extracted reserve is in the interest of the state, county or company.

In the vicinity of Tallinn, reserves in the current extraction permit areas for construction limestone will last for another 18 years in the Harku deposit, 6 years in the Maardu deposit and also only 6 years in the Väo deposit, and for an even shorter time if construction volumes and the pace of road construction increase. The best-quality construction limestone reserves are located in Northern Estonia and consumption is the greatest in the Tallinn area. The limestone reserves in the deposits in the extraction permit areas in Harju County will be exhausted in the next 10 years. It is inevitable that new high-quality limestone deposits should be opened near Tallinn, but nature protection restrictions and high population density make it difficult to find suitable locations. The reserves of the Väo deposit are the most limited. A possible solution would be to expand the deposit to neighbouring areas, but this is not feasible due to high population density near the urban area. The local government is opposed to expanding the extraction permit areas of the Harku deposit. In order to solve the situation, companies have submitted extraction permit requests for extracting construction limestone in other deposits located in Harju County (Jägala and Nabala) where nature reserves do not yet extend to the entire deposit and where environmental conditions are at least somewhat suitable for extracting mineral resources. However, no agreements have been reached with local governments. In order to specify the volume of active construction limestone reserves in the Nabala deposit, additional geological exploration has been planned for the period from 2011 to 2013, with the aim of determining the extent of karstic features in the deposit and providing a complementary assessment of the feasibility of extracting mineral resources.

It is rather difficult to forecast the extraction capacity of mineral resources used in construction for the period from 2011 to 2020. The likely annual need for mineral resources used in construction between 2011 and 2020 will be 6-8 million m^3, of which 50-60 % will be used for the construction, repair and maintenance of state roads and 20 % for local roads. 25-30 % of the rest of mineral resources used in construction will be used for producing concrete and other construction mixes in the construction material industry.

The Government of the Republic approved by Order No 126 of 21 April 2009 the investment plan for the development of transport infrastructure, which contains information on the planned road construction projects. The development plan for mineral resources used in the construction industry is connected to the development plan on transport mainly in terms of building and developing national transport infrastructure (construction, reconstruction and reconstructive repairs of Via Baltica and the Tallinn-Narva corridor; reconstruction of sections of the Tallinn-Tartu-Luhamaa Road; Riia-Pihkva Road).

The Estonian Road Administration submitted for this development plan an estimate of the needs for mineral resources used in the construction industry for major road construction and road maintenance and repairs in the period from 2010 to 2020 by counties. According to the estimate, major road construction will require ca 2.6 million m^3 of crushed limestone (including in Harju County 0.9 million m^3), ca 2.1 million m^3 of crushed granite (including in Harju County 0.8 million m^3) and ca 143,000 m^3 of gravel (including in Harju County 45,000 m^3). The repair and maintenance of state roads in the same period will require ca 3 million m^3 of sand (including in Harju County 0.2 million m^3), ca 6.7 million m^3 of gravel (including in Harju County 0.4 million m^3), ca 3.1 million m^3 of crushed limestone (including in Harju County 0.2 million m^3) and crushed granite ca 2.4 million m^3 (including in Harju County 0.3 million m^3).

Annex 5 of this development provides a summary of the data provided by the Estonian
Road

The estimate by the Estonian Road Administration does not specify the launch date of most of the road construction projects (work will not begin before 2016) and we do not have an exact picture of the options to recover the materials contained in the track beds of existing roads. The use of mineral resources in road construction is affected by the standards required of construction materials. The greatest need for mineral resources in road construction until 2020 is the need for filling sand, while there is no information on the extent to which mineral resources could be substituted with alternative building materials, such as oil shale extraction residues (limestone layer, tailings, crushed stone made from spoil), stone and concrete building demolition residues, ash, limestone screenings.

Mining intensity has been the highest in Northern Estonia. The current recession has decreased the consumption of mineral resources used in the construction industry. It is to be expected that an increase in consumption is followed by a decrease. We could forecast the consumption of mineral resources based on economic cycles, beginning from 1991, with the period from 1991 to 2001 constituting a transitional period when Estonia switched from planned economy to market economy. During that period, the extraction of most mineral resources was on a decline until 1995. From then on, mining capacity began to increase slowly but more or less steadily. The peak was reached in 2007. The significant decline in the demand for construction materials that hit already in 2008 and 2009 also had a strong effect on extracting mineral resources used in construction. The years of the worst general recession will probably be 2010 and 2011. When Estonia enters a new period of growth, the mining capacity of mineral resources used in construction will probably increase as well, and the cycle's peak could be reached by 2016 or 2017. Consequently, the best time for forecasting mining capacity would be after 2011, when we will know the capacity of 2009-2011; it would be expedient to tie the forecast in with possible developments in the construction field, construction material industry and import and export of mineral resources used in construction.

A study commissioned for the purposes of compiling this development plan estimated that the total mining capacity of mineral resources used in construction in the period from 2010 to 2020 will be 79,655,000 m^3 [3].

Problems and existing opportunities

1. As this is the first time that a development plan for mineral resources used in the construction industry is compiled, we lack a mining capacity forecast for these mineral resources and an overview of

the security of supply in the sectors that need mineral resources used in construction. Considering the current precarious economic situation, it is not rational to draw up a detailed forecast for the extraction and consumption of mineral resources. It would be appropriate to wait with the forecast until 2012 or 2013, when the situation is expected to stabilize and the Estonian Road Administration will be able to provide more detailed data on the need for mineral resources used in construction.

2. There is a need for a template for determining the security of supply of mineral resources used in construction, which should use data from the list of deposits. Such a template would allow for forecasting the mining capacity and consumption of mineral resources, making it easier to decide where new mineral deposits should be opened for extraction.

4. National interests, strategic objectives and tasks

The development plan for mineral resources used in the construction industry is compiled for the period 2011-2020. **The main objective of using mineral resources used in the construction industry is to ensure the supply of these mineral resources, taking into account their conformity to quality standards, optimum price, minimum transportation distance and sustainable use of resources and the environment.**

This development plan helps to ensure the required supply (meeting quality standards, optimum price and minimum transportation distance) of mineral resources used in the construction industry for national construction infrastructure and consumers, to increase the efficiency of extraction and consumption, to manage the protection of mineral resource reserves and to decrease the environmental impact resulting from mining and using mineral resources used in the construction industry.

The measures presented in this development plan are used to implement mining in a way that primarily serves the interest of the state, using the balance of mineral reserves together with a template for ensuring security of supply structured by counties and types of mineral resources (Table 3). Employing mineral resources in the construction industry forms part of the strategic national infrastructure, where the production, distribution and consumption of construction materials must ensure the security of supply and reliability of national infrastructure at a minimum cost.

At the same time, the effective use of mineral resources used in the construction industry must ensure that the Estonian economy remains competitive and that the quality of construction materials meets the standards necessary for maintaining and improving the welfare of the Estonian population. Ensuring regional development plays an important role in the use of mineral resources used in the construction industry.

An important task of this development plan is to solve the conflict between the increasing need for mineral resources used in the construction industry and the increasing opposition towards mining among local governments and residents. The opposition among local residents is understandable as the changes in living conditions caused by mining affect them the most.

The active deposit reserves suitable for mining are approved and extraction permits are issued in accordance with applicable legislation, primarily the Earth's Crust Act. Environmental problems, primarily significant environmental impact, must be determined separately when issuing each extraction permit, by assessing environmental impact on the basis of the Environmental Impact Assessment and Environmental Management System Act, where necessary.

The main objective and tasks of this development plan give rise to the need to define the concept of national interest and to provide it with a legal basis. The Earth's Crust Act provides that it is possible to refuse to issue a permit for geological investigation, an exploration permit or an extraction permit if the action in question is contrary to the national interest. As the national interest regarding mining and using mineral resources used in the construction industry had not been previously defined, it was not possible to comply with this provision of the Earth's Crust Act.

In terms of mineral resources used in the construction industry, the national interest is to ensure that consumers, primarily the national construction infrastructure, are supplied with high-quality mineral resources used in the construction industry in an economically optimum manner that meets the required standards, and to further the complete development of extraction and consumption technology, while taking all measures to ensure the rational use of mineral resources used in construction and to protect mineral resources and the environment.

In order to actually fulfil the tasks stemming from the national interest, there is a need to amend legislation: primarily the Earth's Crust Act, so that the state would have power of decision over its mineral resources, and the Evironmental Fees Act, in order to meet the EU environmental protection requirements and thus motivate the users of mineral resources to implement environmental protection measures to the fullest.

4.1. Strategic objective 1

To ensure a supply of mineral resources used in the construction industry for the national construction infrastructure and consumers

Indicator	Base level	Target level
1) Regularly updated publicly available information on the security of supply of and estimated need for mineral resources used in the construction industry	Not available	The template for calculating security of supply is ready and functional as of 2013.
2) Security of supply of mineral resources used in the construction industry for a term of 10 years	As at 31.12.2008, security of supply was guaranteed for at least 10 years for construction lime- and dolostone, cement-limestone,	2020
	dolostone used in finishing, technological sand and clay; supply was critical for technological lime- and dolostone, sand and gravel.	
3) Agreement of local governments to extract mineral resources (on the basis of requests for geological exploration and extraction permits and comprehensive plans)	Ca 30 % of local governments agreed to the extraction of mineral resources in 2009.	In 2020, 75 % of local governments agree to requests for geological exploration and extraction permits.

As extracting mineral resources has generated various tensions and opposition in society in recent years, it is important to stress the role of the state in using mineral resources belonging to the state and in protecting the earth's crust (mineral resources).

Many problems have their roots in the fact that the comprehensive and detailed plans of local governments view deposits as potential mining areas differently. When local governments consider planning needs and deposits in designing their development, this should be done based on legislation and both national-level economic decisions and the wishes of the local population. Although the Earth's Crust Act stipulates the requirement to ensure access to mineral reserves, i.e. the possibility to mine, the state as the owner of mineral resources does not have the right to decide on mining activities in deposits even if the state itself owns the land where a deposit of national importance is located. Cooperation with the Ministry of the Interior is needed in harmonizing the requirements established in the Earth's Crust Act and Planning Act regarding restrictions related to deposits in the comprehensive and detailed plans of local governments and county plans.

The permit processing procedure of the draft Environmental Code integrates the existing permit for the special use of water, temporary permit for the special use of water, ambient air pollution permit, special pollution permit, extraction permit, radiation practice licence and waste permit into a single environmental permit. The permits issued under the existing legislation will cease to be under the new draft legislation. When applying for an extraction permit, the applicant must indicate all expected environmental disturbances, which are processed in a single procedure. Another aim of integrating the permits is to simplify the procedures and improve access to environmental information and administrative decisions as it is enough to apply for one single permit with a single open procedure and where necessary, a single environmental impact assessment.

In terms of supplementing legislation, it would be reasonable to consider integrating the Earth's Crust Act and the Mining Act into one single legislation as their scopes overlap to a large extent and as many problems arise because these acts use different definitions and requirements for the same objects or actions. Matters regulated under the Mining Act currently fall within the sphere of competence of the Ministry of Economic Affairs and Communications. The Statistical Office deals with data on the export and import of mineral resources extracted in Estonia and operates in the area of government of the Ministry of Finance. As the data on the export and import of mineral resources in the Statistical Office's database do not correspond to the division of mineral resources in the mineral reserve balance of the environmental register's list of deposits, the cooperation of the Statistical Office is needed for harmonizing the data on mineral resources contained in different databases.

In order to ensure that the consumers and primarily the major national construction infrastructure is supplied with high-quality mineral resources used in construction, information is needed on the planned construction projects and on the needs for mineral resources used in construction in the different regions of Estonia. As the state currently does not have sufficient power over the use of mineral resources, the supply of mineral resources used in construction has become chaotic and may come to hinder economic development in the entire country.

At the same time, the state does not have an exact overview of the quantities of mineral resources needed for building and maintaining state projects. It is therefore necessary to regularly forecast the need for mineral resources used in construction for certain periods in addition to ensuring security of supply.

When entering deposits into the list of deposits and carrying out the corresponding geological exploration, it necessary to determine the deposit's impact zone (including buffer zone), primarily taking into account the specific extraction technology. Determining the impact zone allows for maximum extraction of the mineral resource up to the border of the extraction permit area and prevents the extraction area from extending too close to residential areas. Where needed, deposits should undergo economic assessment in terms of mining availability and rationality of use, taking into account the technology, possibilities to use alternative building materials, etc. (the needs are determined by the results of gathering the corresponding data on the earth's crust). We should also consider the option of activating the previously passive reserve located below groundwater level, provided that the required extraction technology is available.

When several subsequent extraction permits have been issued for a deposit of a mineral resource of national importance used in construction, problems may stem from the ever-increasing extraction permit areas in the deposit, making it difficult to find an integrated solution for restoring the entire area in the future (extraction permit areas are currently restored one project at a time). In such cases having a deposit management plan could be useful, covering both activating and restoring the deposit and alleviating conflicts with the residents of the mining area.

Legislative changes regarding the earth's crust must ensure that mineral resources are extracted and used in construction in a professional, constant and targeted manner. The aim of amending legislation is to prevent mining-related conflicts between different stakeholders, primarily between miners and residents of mining areas. In order to clarify the issues surrounding the extraction of mineral resources used in the construction industry, a sociological survey (where local government representatives and residents of mining areas are interviewed, where needed) is called for, providing an overview of the attitudes of different target groups regarding the extraction of mineral resources used in the construction industry; the survey results could be used when implementing the necessary measures for alleviating conflicts.

Measure 1.1. Strengthening the state's legal say as owner of mineral resources

Measure, sub-measure	Immediate result	Target value (deadline)
1.1.1. Conducting an analysis of the legal context regarding the extraction and use of mineral resources used in the construction industry, and amending and supplementing legislation (incl. different environmental legislation based on the need to extract mineral resources)	The state's legal say and access to the use and protection of mineral resources owned by the state have increased considerably.	Legislation has been amended by 2015; the results of implementing the legislation have been achieved by 2020.
1.1.1.1. Amending the Earth's Crust Act: the state commissions and funds geological explorations of mineral resources owned by the state.	The state commissions 80 % of the explorations of mineral resources owned by the state.	2020
1.1.1.2. Amending the Earth's Crust Act: granting extraction permits for state-owned mineral resources by auction	The income of the state, as the owner mineral resources, increases; all permits are granted by auction.	Measure launched in 2015; result achieved in 2020.
1.1.1.3. Amending the Earth's Crust Act and other legislation: introducing the procedure for an integrated environmental permit based on the Environmental Code	Mining-related environmental permits have been integrated into a single environmental permit.	2015
1.1.1.4. Amending the Earth's Crust Act and the Planning Act: harmonizing deposit-related requirements in drafting plans and making planning into a three-dimensional process.	Planning for the extraction of mineral resources in county and local government comprehensive plans is regulated.	2014
1.1.1.5. Supplementing the Statistical Office's database structure with data on the export and import of mineral resources extracted in Estonia	Data on the export and import of mineral resources is compatible with the mineral reserve balance contained in the environmental register's list of deposits.	2014
1.1.1.6. Amending the Earth's Crust Act and the Mining Act: eliminating discrepancies and harmonizing the two acts or integrating them into one act	The Earth's Crust Act and the Mining Act have been amended.	2015
1.1.2. Organising training events (seminars) on the extraction and use of mineral resources for county and local government officials and drafters of plans	Increased awareness and competence and improved cooperation among various stakeholders	2011 -2020 (an ongoing process during the implementation of the implementation plan)

Measure 1.2. Ensuring the security of supply of mineral resources used in the construction industry

Measure	Immediate result	Target value (deadline)
1.2.1. Harmonising and supplementing information on the earth's crust in the databases related to mineral resources (environmental register, Statistical Office database, etc.) and conducting necessary development work	Information on the earth's crust has been harmonised across different databases.	2015 (ongoing updating until 2020)

1.2.2. Forecasting the need for mineral resources	The list of deposits has been supplemented with a forecast	Forecast completed by 2013,
used in the construction industry for the period 2013-2020 and regular updates in order to ensure security of supply	template, along with a calculation of security of supply; regular updates are made.	regular forecasting of the need for mineral resources used in construction continues up to 2020.
1.2.3. Complete geological mapping of Estonia on the scale of 1:50,000	Supplementing the data of the environmental register's list of deposits	2011-2020 (ongoing process)
1.2.4. Preparing and implementing a pilot project on planning the use of a deposit of national importance	The pilot project has been prepared; implementation begins.	2013 2014
1.2.5. Supplementary geological-hydrogeological explorations of the Nabala limestone deposit (preparing and testing a hydrogeological model)	Determining the feasibility of extracting mineral resources in Nabala	2013

Measure 1.3. Minimising the conflict between the need to extract mineral resources used in the construction industry and opposition to mining among local governments and residents

Measure	Immediate result	Target value (deadline)
1.3.1. Conducting a survey on the conflicts arising from extracting mineral resources used in construction	Conflicts arising from extracting mineral resources used in construction and the relevant reasons have been analysed.	2012
1.3.2. Implementing the measures necessary for alleviating conflicts, based on survey results	Conflicts and the accompanying risks have decreased.	2015

4.2. Strategic objective 2

To increase the effectiveness of extracting and using mineral resources used in the construction industry and the use of potential alternative construction materials

Indicator	Base level	Target level
1. Percentage of offences related to extracting mineral resources used in construction in the context of a new national control system	5 offences per 27 extraction permits in 2008, i.e. almost 19 % of checked permits	Number of offences down to 10 % of checked permits by 2016, and to 5 % by 2020
2. Percentage of checked extraction permit areas	In 2008, the Environmental Inspectorate checked almost 8 % of extraction permit areas.	As of 2015, 15-20 % of extraction permit areas are checked regularly.
3. Percentage of recovered oil shale	8.1 % of the total volume	Up to 15 % of the total
ash	in 2008	volume by 2020
4. Volume of oil shale spoil used	31.4 % of the total volume in 2008	40 % of the total volume in 2020
5. Percentage of recovered demolition waste of buildings (code 17 09 04)	40 % of the total volume in 2008	60 % of the total volume in 2020
6. Crushed limestone production residues	25-30 % in 2008	Less than 10 % by 2020

The main alternatives to mineral resources used in the construction industry are oil shale spoil and ash, limestone screenings and construction waste.

Crushed stone made from spoil is suitable for use in certain elements of secondary roads, but is not suited for use in the construction of main highways. Therefore, crushed stone made from spoil cannot be used as a universal substitute for high-quality crushed stone used in construction. At the same time, crushed stone made from spoil can be used for producing low quality grade concrete.

Oil shale ash can be used for producing cement and building blocks, as a substitute for cement in large-scale stabilization processes, as filling material in road construction and in agriculture as neutralizer of acidity in fields. In 2008, 8.1 % of the total volume of oil shale ash was recovered.

Limestone is used mainly for producing crushed stone, where currently the main issue is the large quantity of residues - limestone screenings, which are generated due to the technology used and constitute up to 30 % of the extracted mineral resource. The volume of residues can be decreased by using better technology, as has been shown by testing in the Väo limestone deposit. Limestone screenings have been used for restoring opencasts, as filling material, in liming fields, coating sports trails and de-icing roads in the winter. As enriched limestone screenings can be used as substitutes for construction sand and fine crushed stone, there is a future in using them in the production of construction materials.

According to the environmental information service, the total demolition waste of buildings (code 17 09 04) amounted to 156,000 t in 2008, of which 63,000 t, i.e. 40 % of the total volume were recovered [25]. Construction waste can be used as filler soil and for restoring and maintaining opencasts.

In order to increase the sustainability and competitiveness of mining mineral resources, we should analyse the efficiency of the current system of environmental fees and consider the possibility of replacing it with a system of mining leases, where the fee is calculated on the basis of the size and location of the extraction permit area, the price of land, quality of the mineral resource, the technology used in mining, possible environmental impact, etc.

Although the state has monitored the geological explorations and extraction of mineral resources in accordance with legislation, the National Audit Office's audit results reveal that surveillance should be stepped up significantly, particularly in terms of extracting mineral resources [26]. The obligation to check the reports on the volumes of extracted mineral reserves and the calculation of environmental fees is laid down in the Earth's Crust Act. The aim of monitoring is to prevent mining-related environmental damage, to respond adequately to environmental damage and to demand that the damage be remedied. We need to provide opportunities and conditions for cooperation among institutions monitoring the extraction of mineral resources, primarily by coordinating the work of the Environmental Inspectorate and the Technical Surveillance Authority. We should consider establishing a national authority dedicated to the exploration, extraction, use and protection of mineral resources that would plan, manage and monitor these activities.

In order to eliminate the deficiencies referred to in the audit results of the National Audit Office, it is essential to introduce a national control system of the extraction of mineral resources used in the construction industry.

Measure 2.1. Stepping up the efficiency of economic measures

Measure, sub-measure	Immediate result	Target level (deadline)
2.1.1. Analysis of the efficiency of environmental fees and mining leases in regulating the extraction and use of mineral resources used in construction, and implementing analysis results	Analysis results have been employed in the extraction and use of mineral resources used in construction.	Analysis results by 2012; results have been implemented by 2014.
2.1.1.1. Implementing mining leases in the extraction of mineral resources used in construction	The Government has established and employed mining lease limits.	2014

Measure 2.2. Introducing a national control system of geological explorations and extraction of mineral resources used in construction

Measure	Immediate result	Target level (deadline)
2.2.1. Establishing a national control system of the extraction of mineral resources, accompanied by establishing a new national authority, if needed	The national control system has been launched, a decision has been made regarding the national authority.	2014
2.2.2. Increasing the competence of monitoring employees regarding the earth's crust by providing training	Surveillance of the extraction of mineral resources used in construction has improved and the number of offences has decreased.	Ongoing process until 2020
2.2.3. Considering the use of best available techniques* within the meaning of the draft Environmental Code when granting extraction permits, taking into account EIA expert recommendations	The requirement has been defined in the Earth's Crust Act based on the Environmental Code and is employed in the extraction process of mineral resources used in construction.	2015
2.2.4. Increasing the use of alternative construction materials by implementing mining leases	The usage of alternative construction materials has reached the maximum possible level.	2020

* According to the draft Evironmental Code, best available techniques are the most efficient reasonably accessible techniques, technologies and functions designed for integrated environmental protection [27].

4.3. Strategic objective 3

To decrease the environmental impact of extracting and using mineral resources used in the construction industry

Indicator	Base level	Target level
Percentage of audited and registered restored opencasts previously disturbed by mining and abandoned of the total area of sites disturbed by mining and abandoned	Base level can be determined after the mined areas are audited in 2014.	The 2020 target level can be determined based on audit results.

Sustainable mining means that both the mineral reserves in the earth's crust and nature receive maximum protection from the negative impact of mining. Factors contributing to decreasing the environmental impact of extracting and using mineral resources used in construction include the above-mentioned increase in the use of alternative construction materials, the introduction of mining leases and considering the security of supply of mineral resources used in construction when processing extraction permits. An important requirement for ensuring environmentally sustainable mining is increasing the efficiency of national monitoring of mining (see measure 2.2.).

The question of how mining affects the water table has become increasingly relevant in terms of extracting mineral resources used in construction. As water is pumped out in standard mining, this may lower the water table around the opencast within a radius from about a hundred metres to a couple of kilometres. Lime- and dolostone is often mined below the water table and initial testing results show that this can be done in the water at a depth of at least 5 m. One option to decrease the amount of water pumped out of opencasts (diminish impact on ground and surface water) is to install watertight soil barriers along the edges of the opencast's extraction permit area. Large opencasts allow for mining in sections, so that the entire extraction permit area is not kept open [3].

Extraction permits should be granted under the general requirement that mining should take as little time as possible, that the technology used should disturb the environment as little as possible and that the areas changed by mining should be recovered as quickly as possible after being restored. When the earth's crust under a road or another structure about to be built contains mineral reserves or a natural rock or deposit resembling a mineral resource in quality, but not registered in the list of deposits, it would be rational to consider extracting this mineral resource, rock or deposit, based on the principles of sustainable development. This means that the road and other structures would be cut and the extracted mineral resource would be most probably used in building the same road.

Just as mining changes the landscape, so too it is inevitable that it generates dust, noise and vibration, but corresponding limits have been established in the Ambient Air Act [28] and Public Health Act [29]. Miners have to take these into account and respect the permitted levels. In general, if a company wishes to invest into environmental protection, including into developing its technology or cleaner production, it cannot currently count on the major banks in Estonia offering better terms on loans.

When selecting mineral resource extraction sites, preference should be given to locations where the expected environmental impact is weaker. To this end, we are planning to supplement the list of deposits (see measure 1.2.), taking into consideration restrictions resulting from nature and heritage protection, buildings, etc. The EIA is usually commissioned and the work and report paid for by the miner, who often also holds the extraction permit and is responsible for the EIA. The results of the EIA are usually favourable towards granting an extraction permit and if certain conditions are met, the EIA considers extraction feasible. Although the general public has grown concerned about current statistics, the main reason for positive EIA results is that the experienced specialists conducting geological explorations recommend that miners apply for extraction permits in areas where the requirements allowing for

Measure, sub-measure	Immediate result	Target level (deadline)
3.2.1. Overview of the deficiencies in restoring mined areas and implementing measures for restoring the areas disturbed by mining	The measures resulting from the overview have been implemented; miners have begun meeting restoration deadlines.	2020
3.2.1.1. Holders of valid extraction permits must submit restoration projects at least 5 years before the expiry of permits.	The Earth's Crust Act stipulates the restoration project requirement.	2013
3.2.1.2. Audit of opencasts of mineral resources used in construction that have been disturbed by mining and abandoned.	The audit has identified the neglected opencasts located on state land.	2014
3.2.1.3. Restoring the opencasts of mineral resources used in	The abandoned opencasts have been restored.	2020

extraction are probably known already before the EIA. Nevertheless, when implementing the development plan, we should consider how to make the EIA more easily understandable for the public.

The obligation to restore the landscape changed by mining lies with the owner of the extraction permit. Restoration must begin as soon as it is technically possible and be completed before the permit loses its validity. It would be expedient to obligate the extraction permit holder to submit a detailed restoration project at least five years before the permit loses its validity. This would decrease the number of requests for extending the permits with the aim of restoring the extraction site after the initial expiry of the permit.

Measure 3.1. Promoting environmental sustainability among undertakings extracting and using mineral resources

Measure, sub-measure	Immediate result	Target level (deadline)
3.1.1. Clarifying the requirements of the environmental permits issued for extracting mineral resources used in construction	Legislation and environmental permits have been amended as necessary.	2013
3.1.2. Implementing project-based mining for decreasing and limiting environmental disturbances: preliminary extraction and restoration projects are submitted together with extraction permit applications.	The processes of applying for permits, extraction and restoration of mined areas is clearer for the general public. Environmental disturbances have decreased.	2015
3.1.3. Survey on the optimum use of local mineral materials in Estonian transport*	Survey results have been published and are being used for forecasting mineral resources used in construction.	2014
3.1.4. Analysis of the efficiency of the EIA in processing extraction permit applications	The EIA process has been amended as needed.	2015

*Survey commissioned by the Estonian Road Administration, where mineral resources used in construction (primarily limestone) are discussed among local mineral materials.

construction located on state land that have been disturbed by mining and abandoned		
3.2.2. Introducing a financial security for ensuring that mined areas are restored.	The Government has established the security and the corresponding limits.	2015

Measure 3.2. Restoration of the land disturbed by mining

5. Implementation of the development plan for mineral resources used in the construction industry

5.1. Management structure for the implementation of the development plan for mineral resources used in the construction industry

The management structure of this development plan is described in accordance with Government of the Republic Regulation No 302 of 13 December 2005 "Types of strategic development plans and the procedure for drafting, amending, implementing, evaluating and reporting thereof".

The Government of the Republic has named the Ministry of the Environment as the ministry responsible for the compilation of the development plan for mineral resources used in the construction industry. The Ministry of the Environment is entrusted with the task of coordinating the compilation, supplementing, implementation, assessment and reporting of the development plan. The development plan is implemented under the Estonian National Environmental Action Plan, whose section on mineral resources used in the construction industry has been supplemented with the measures, actions and expenditure resulting from this development plan. The implementation plan has been drafted for the periods 2011-2014 and 2015-2020, and the envisaged measures are implemented by the Ministry of the Environment together with the Ministry of Economic Affairs and Communications, Ministry of Finance,

Ministry of Social Affairs and Ministry of the Interior. The Ministry of the Environment submits this development plan for approval to the Government of the Republic. The National Environmental Action Plan containing the relevant amendments will be submitted for approval to the Government of the Republic within three months after the approval of this development plan.

Reporting to the Government of the Republic on the implementation of the development plan. On achieving the objectives established in the development plan and implementation plan and on the efficiency of measures will be done in the framework of reporting on the National Environmental Action Plan.

As the implementation period of the development plan is 10 years developments are to be expected during that time in the technology of exploring, extracting and using mineral resources as well as in the uses of mineral resources. It is therefore possible that the initial objectives and corresponding requirements of the development plan will be adjusted while preparing the second phase of the implementation plan.

As about 70-80 % of mineral resources used in construction are employed in road construction this development plan is closely connected to the Transport Development Plan, which requires active cooperation with the Ministry of Economic Affairs and Communications, particularly with the Estonian Road Administration, operating in the Ministry's area of government. The Road Administration provides this development plan with data on the expected need for mineral resources used in construction in large-scale road construction and in the maintenance and repair of roads. Based on this forecast, the list of deposits is supplemented with a template for the security of supply of mineral resources used in the construction industry. The Ministry of the Environment is also planning to draft a new Earth's Crust Act, which also requires judicial cooperation between the two ministries as the Earth's Crust Act and the Mining Act are closely interlinked and complement each other. Pursuant to legislation, the two ministries also share the task of monitoring the extraction of mineral resources, which must be made systematic and efficient with this development plan.

Implementing this development plan also requires cooperating with the Ministry of Finance as the Statistical Office operates in its area of government. The Statistical Office publishes data on the export and import of mineral resources used in the construction industry. The Statistical Office's database does not currently provide data on the export and import of mineral resources extracted in Estonia as the database integrates information on the mineral resources used in construction extracted in Estonia with those imported from elsewhere. Cooperation among ministries and the Statistical Office aims at restructuring the database in a way that it would be possible to ascertain the export and import volumes of mineral resources used in construction extracted in Estonia separately by mineral resource. This would allow refuting the false claims that circulate on the extensive export of mineral resources used in the construction industry.

One of the main problems in extracting mineral resources is the opposition to extracting mineral resources among local governments and residents of mining areas, which has escalated in recent years and is threatening the required supply of mineral resources used in construction to consumers. This development plan envisages a survey on the problematic issues of extracting mineral resources used in construction. Processing the results of this sociological survey and translating them into legislation requires close cooperation with the Ministry of Social Affairs.

The Ministry of the Interior is responsible for the legal framework of planning. The Planning Act regulates the contacts of the state, local governments and other entities in planning activities. If the aspect of extracting mineral resources is to be considered in planning, there should be a requirement to view a plan as a three-dimensional space. Any problems related to planning and extracting mineral resources must be solved together with the Ministry of the Environment.

The main tasks and obligations concerning the implementation of this development plan are discussed during the preparation of the development plan and implementation plan, so that all relevant ministries could reflect the resources needed for the implementation of this development plan in their respective development plans and budget applications. The Ministry of the Environment needs information on the volumes of mineral resources used in different sectors to be able to estimate the expected need for mineral resources, primarily in terms of building and maintaining national infrastructure.

5.2. Cost estimation of the development plan for mineral resources used in the construction industry

The estimated cost of this development plan for the years 2011-2020 is ca 9.46 million euros.

Measure	2011	2012	2013	2014
1.1. Strengthening the legal say of the state as the owner of mineral resources	2	2	2	2
1.2. Ensuring the security of supply of mineral resources used in construction	756	900	801.1	800
1.3. Minimising the conflict between the need to extract	50	25	-	-

mineral resources used in the construction industry and opposition to mining among local governments and residents				
2.1. Analysis of the efficiency of environmental fees and implementing mining leases	27	14.5	-	-
2.2. Establishing a national control system of the geological exploration and extraction of mineral resources	3.2	3.2	3.2	3.2
3.1. Promoting environmental sustainability among undertakings extracting and using mineral resources	25.6	25.6	25.6	25.6
3.1. Promoting environmental sustainability among undertakings extracting and using mineral resources	-	38.3	38.	38.
TOTAL	863.8	1008.6	870.2	907.4

The planned budget for the implementation of this development plan is ca 3.65 million euros for the years 2011–2014 and ca 5.81 million euros for the years 2015–2020.

Summary

The task of this development plan is to guide the use of mineral resources used in the construction industry over the next 10 years. The accompanying implementation plan is drawn up in two stages. The first stage includes the measures and actions implemented from 2011 to 2014, and the second stage those implemented from 2015 to 2020.

The Minister of the Environment initiated together with this development plan the environmental impact assessment of this development plan by Directive No 960 of 16 June 2009, pursuant to § 52 (1) of the Government of the Republic Act, and § 33 (1) 1) and § 35 (1), (2) and 5 of the Environmental Impact Assessment and Environmental Management System Act; the results of the EIA are presented in Annex 6.

The objective of this development plan is to ensure the clean extraction of mineral resources and the effective use of the earth's crust's resources with minimum losses and residues. Clean mining means that deposits are opened quickly, mineral resources are extracted fast, groundwater is affected as little as possible, noise, dust and seismic limits are not exceeded and the mined areas are quickly restored according to corresponding projects. The effective use of resources means that mining-worthy mineral resources are extracted as completely as possible and that the accompanying mineral resources are also used [1].

An important line of action in the development plan's implementation plan is analysing the options for introducing mining leases. Currently, the fee for the right to mine mineral reserves owned by the state depends on the volume of the mined reserve, which means that miners are not motivated to mine as quickly as possible so that the land disturbed by mining could be restored for reuse as soon as possible.

If miners halt mining in order to wait for a better situation in the market of mineral resources used in the construction industry, the state's mineral resource remains in the possession of the miner with no cost for the miner. The mining lease fee would be determined when issuing the extraction permit and the miners of mineral resources would have to pay the same fee for every year they use the deposit, and the fee would include the entire extraction permit area. Therefore, mining leases would include all costs generated for the state by mining and would ensure normal competition among miners as with mining leases it would be costly to keep the mineral resource unmined in the extraction permit area.

The Estonian National Environmental Development Plan stipulates that oil shale, mineral resources used in the construction industry (limestone, sand and clays) and peat should be provided with optimum extraction rates over a certain period (up to 20 years). This suggestion is justified in the cases of oil shale and peat, and extraction limits have already been established for these mineral resources. However, this development plan does not include annual extraction rates for mineral resources used in the construction industry as this would not solve the issue of sustainability of mineral resources used in the construction industry. For example, we get completely different optimum extraction rates based on the extraction data of the past three years with intense construction activity or based on the data corresponding to the past 10 years. In addition, most deposits of mineral resources used in the construction industry are small and of local importance. Instead of establishing optimum extraction rates for mineral resources used in construction, the development plan employs a calculation template for the security of supply of mineral resources used in construction. Almost 92 % of extracted mineral resources used in construction are consumed in Estonia and maximum extraction rates would hinder construction activity, including the construction of infrastructure of national interest. In order to ensure the sustainable consumption of

mineral resources used in construction, we should concentrate on selecting appropriate mining sites and technology and on restoring mined areas.

This development plan introduces the notion of security of supply in terms of mineral resources. Regularly calculating security of supply indicates on the basis of consumption how long the mining reserves in extraction permit areas will last and helps to prevent unexpected shortages of mineral resources used in the construction industry. Public information on security of supply is also necessary for the rational use of deposits, which means primarily that optimum locations are selected for extraction permit areas, environmental conditions are taken into consideration and the mineral resource is used sustainably.

When using deposits, preference should be given to the maximum use of already opened deposits, which have been sufficiently analysed in terms of environmental conditions and the technological options for mining. Another aim of exhausting these deposits is to delay the introduction of new deposits as long as possible.

When opening new potentially suitable deposits, we should take into consideration the properties and volume of suitable reserves, geological and hydro-geological conditions, nature protection requirements, and archaeological, heritage and infrastructure restrictions. The confluence of all these conditions shows whether sustainable mining is feasible in the deposit, which also prevents unnecessary losses of non-recoverable natural resources [3].

If there are environmental restrictions affecting the deposit and if no satisfactory technological solution is found in the planning phase of mining, using the deposit in question is postponed. It is therefore impossible to specify the exact time of launching mining in the deposits registered in the environmental register. It is also not known when the need to extract a certain mineral resource arises. Neither is it possible to exactly schedule mining in all deposits when drawing up county and local government comprehensive plans as the function of the list of deposits is not only to provide specific mining-related data, but also to provide information on explored mineral resources that can be employed in the future, where needed.

This development plan envisages several studies, which will be used for supplementing or amending the actions designed for the implementation of the development plan. Other relevant ministries and institutions will be included in implementing the measures.

The three strategic objectives together with relevant indicators show that the development plan is in line with the Estonian Environmental Strategy objective of extracting mineral resources used in the construction industry in an environmentally sustainable manner.

Managing the use of and protecting the national treasure of natural resources is primarily a task for the state as the state is responsible for the sustainable use and preservation of natural resources. This also applies to the optimum introduction of deposits, considering the expediency of this practice and the restoration of mined areas, which should be guided by uniform principles throughout the country.

References (primary sources)

1. Estonian Environmental Strategy until 2030. Ministry of the Environment. *Internet:* http://www.envir.ee/orb.aw/class=file/action=preview/id=328494/Keskkonnastrateegia+2030+%28eeln%F5u%29.pdf (04.02.2007).
2. Estonian National Environmental Implementation Plan 2007-2013. Ministry of the Environment. *Internet:* http://www.envir.ee/orb.aw/class=file/action=preview/id=1131705/Keskkonnategevuskava 2007-2013 uuendatud.pdf (22.02.2007).
3. A study for the purposes of a national development plan for the use of natural construction materials 2010-2020. OÜ Inseneribüroo Steiger. Tallinn 2009.
4. A study on drafting a development plan for mineral resources used in natural construction materials in the Tallinn area and on determining potential areas. Department of Mining of the Tallinn University of Technology. Tallinn 2005.
5. Estonian National Strategy on Sustainable Development "Sustainable Estonia 21". *Internet:* http://www.riigikantselei.ee/failid/Saastev Eesti 21.pdf (14.09.2005).
6. Transport Development Plan 2006-2013. Ministry of Economic Affairs and Communications. *Internet:* http://www.riigiteataja.ee/ert/get-attachment.jsp?id=12784610 (24.01.2007).
7. Estonian Nature Conservation Development Plan until 2020 (draft). Ministry of the Environment. *Internet:* http://www.envir.ee/1690
8. National Waste Management Plan 2008-2013. Ministry of the Environment. *Internet:* http://ww.valitsus.ee/failid/j__tmekava 2008 2013.pdf (29.05.2008).
9. River basin management plans. Ministry of the Environment. *Internet:* http://www.envir.ee/204372
10. Sustainable Development Act. Ministry of the Environment. *Internet:* http://www.riigiteataja.ee/ert/act.jsp?id=13148461
11. Earth's Crust Act. Ministry of the Environment. *Internet:* https://www.riigiteataja.ee/ert/act.jsp?id=13186989 (01.04.2005).
12. Mining Act. Ministry of Economic Affairs and Communications. *Internet:* https://www.riigiteataja.ee/ert/act.j sp?id= 12991177 (01.12.2003).
13. Eesti aluspõhja geoloogia. A. Rõõmusoks. Tallinn 1983.
14. Maavarade geoloogia. E. Pirrus. Department of Mining of the Tallinn University of Technology. Tallinn 2000.
15. Geology and Mineral Resources of Estonia. A. Raukas, A. Teedumäe. Institute of Geology. Tallinn 1997.
16. List of deposits of the environmental register. Land Board. *Internet:* http://www.maaamet.ee/index.php?lang id=1&page id=280&menu id=0
17. Draft Environmental Code. Ministry of Justice. Tallinn 2009.
18. Killustiku kaevandamine ja kasutamine. Estonian Mining Society, Department of Mining of the Tallinn University of Technology. Tallinn 2009.
19. Concept of developing environmental fees for 2010-2020 (draft). Ministry of the Environment. *Internet.* http://www.envir.ee/1051528
20. Letter No 2.6-3/838-1 of 13.05.2009 to the Chief Justice of the Supreme Court Märt Rask. Parliamentary Constitutional Committee.
21. "Aherainemäed võivad leevendada ehitusmaavarade puudust." (Spoil heaps may alleviate the shortage of mineral resources used in the construction industry) R. Raudsep, P. Eek. Article in Eesti Päevaleht's business insert Ärileht, 12.03.2008. *Internet:* http://www.arileht.ee/? majandus=421893
22. Keskkonnakaitse majandushoobade arendamine jäätmemajanduses (Employing the economic instruments of environmental protection in waste management). SEI-Tallinn, commissioned paper, 2008. *Internet:* http://www.envir.ee/orb.aw/class=file/action=preview/id=1085401/HMoora_aheraine.pdf
23. Testing of washed limestone sand. Final report. AS Ramboll Eesti, March 2009.
24. Blending washed limestone screenings (limestone sand). Research report. Paper No 09-04-0844. P. Talviste. Tallinn 2009.
25. Environmental information. Estonian Environment Agency. *Internet:* http://www.keskkonnainfo.ee/.
26. State management of the extraction of mineral resources used in the construction industry. Report of the National Audit Office to the Parliament. Tallinn, 14 May 2009. *Internet:* http://www.google.com/search?hl=et&source=hp&q=Ehitusmaavarade+kaevandamise+riiklik+korraldamine&btnG=G oogle+otsing&lr=lang_et&aq=f&oq=
27. Draft Environmental Code. Ministry of Justice. *Internet:* http://www.just.ee/41314

28. Ambient Air Protection Act. Ministry of the Environment. *Internet:* http://www.riigiteataja.ee/ert/act.jsp?id=13202035
29. Public Health Act. Ministry of Social Affairs. *Internet:* https://www.riigiteataj a.ee/ert/act.j sp?id=13101746