SUSTAINABLE AGGREGATES RESOURCE MANAGEMENT

International Conference

Abstract and Short Paper Book

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FOREWORD

In front of you is the Abstract and Proceedings Book for the SARM International Conference that is also the final conference of the project titled "Sustainable Aggregates Resource Management" (SEE/A/151/2.4/X – SARMα). Final conference of the project is usually a time for reflection on a project activities, review of successes and weak points, and then placing project outcomes and results in spatial, social, environmental and economic context. The SARM International Conference, however, is somewhat different. On the one hand, it is the final conference of the project, but on the other hand, it is also an International Conference that welcomes the contributions of interested experts and encourages presentation of different views, including those coming from outside the SARMα project.

The last few years have been strongly marked by the continuing economic crisis in the world. The European Union has not escaped these problems, as is evident in the substantial decrease in production (supply) of aggregates during this time period. Hopefully, in the next few years the outlook will become more optimistic, primarily on the basis of renewed economic momentum, as well as faster societal development. In both scenarios (crisis and economic renewal) a need for different approaches to aggregates resources management and supply at all scales (from local, regional, and national to transnational) are needed. The goals of the SARMα project, and consequently the Ljubljana 2011 SARM conference, are to provide and disseminate new approaches.

This Abstract and Proceedings Booklet presents to you a variety of the SARMα project activities, as well as contributions of experts from outside the SARMα project consortium. The SARMα project is presented in two parallel paths, one "official" and the other "additional". The official path follows the main stream project activities by presenting information on working packages and tasks, while the additional one includes details on some project activities. The reader will also find abstracts from mineral resource experts outside SARMα project consortium. As will be seen, the basic SARMα project paradigm and non-SARMα partner's contributions speak a common language, which reinforces the universality and wide accept of taking sustainable approach to aggregates management and supply.

Such conference is also unique opportunity for broader, open discussion on a host of issues related to aggregates management and supply among experts from the SEE area, European Union and EU neighbouring countries, and those from other continents. These discussions will facilitate comparison and contrast of different practices on aggregates resource management and supply, and of course add to the literature of best practises in the EU area and beyond.

In closing, we wish to thank our colleagues, the contributing authors, for their part in the conference and in the release of this booklet and we invite the readers, conference participants and all other interested parties to read this Abstract and Proceedings Booklet, and hopefully the many reports and Manuals that project partners have produce. Comments, whether complimentary or critical, are invited.

BEST WISHES!

Ljubljana, September 2011

Slavko V. Šolar

Gorazd Žibret

ABSTRACTS

Best practices in quarrying

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Aggregates quarrying provides necessary raw materials for infrastructure and civil development. Mining and / or quarrying operations have a non-zero environmental footprint. Quarrying and post-quarrying activities should always target the mitigation of potential environmental and/or social impacts. This can be further enhanced by incorporating sustainable development principles in this process.

The practices that lead to sustainable development in quarrying are termed ?Best practices' and consist of “effective” or sustainable management of a number of quarry unit operations that apply to operation, closure and post-closure. In many cases “best practices” are set by laws or other regulations, with an overall target of protecting the environment, and promoting a healthier and safer work area. Also a number of issues included in best practices are based on experience and scientific work and although not covered by regulation, they are most effective in achieving the above results. In many cases the application of “best practices” has also a positive economic effect since cleanup operations or additional restoration operations are avoided.

In this paper, there an effort has been made to present procedures and policies that may constitute “best practices” in the quarrying industry. Best practices usually refer to the local level, although one can argue that in some cases Best practices stem from regulations or lack thereof at the national or other levels.

Application of best practices is characterized by a number of items to avoid, a number of actions to take (recommendations), as well as important short messages that are comprehensible by all stakeholders at the local level.

The quarry design process as an essential framework for sustainable planning and operation of aggregates quarries

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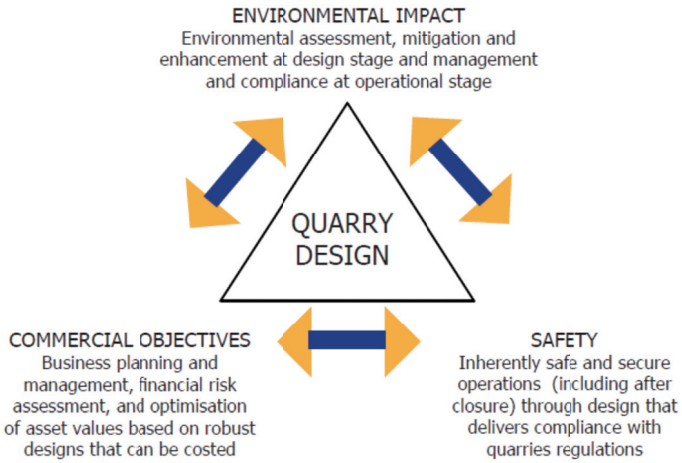
The primary objectives of good quarry/mine design are the safe, efficient and profitable extraction of the maximum usable material from the minimum area of land while causing the minimum environmental and social disturbance and resulting in beneficial final restoration and land-uses. The essential balance and interaction between these objectives is illustrated in the sketch below. Preparation of detailed quarry or mine plans and comprehensive environmental and social impact assessments of the proposals is a requirement in most jurisdictions as a basis for obtaining permits and licences to work. However, a design prepared solely for the purpose of complying with regional or national

laws or regulations will not necessarily deliver sustainable development (*i.e.* the balance illustrated in the diagram).



Where no design is in place and forward planning is undertaken on a month to month or day to day basis, the viability of whole operations can be compromised by failure to plan ahead (e.g. constructing plant on future reserves, or inadequate space allowed for quarry waste leading to the operation becoming 'muck bound').

Even if there is a design in place, an incomplete or ill-considered design may lead to:

- under-performance against the business plan (e.g. increased cost, impacts on productivity compromising the value chain, early closure etc),
- unacceptable environmental or social impacts,
- nuisance or danger to the public,
- danger to the workforce, or
- additional monitoring costs for the operator and Regulators.

These all translate into cost, litigation risk, and loss of profit or asset value to the operator/landowner. Failure to maximise extraction from a quarry (within acceptable safety and environmental/social limits) leads to the need for more quarries or unnecessary pressure on other sources of minerals. For all these reasons good quarry design that goes beyond legal and regulatory compliance is an essential step towards sustainability.

The Life Cycle Assessment Guidelines in the SARMa Project: definition of a common methodology to boost use of LCA tools in sustainable production and recycling of aggregates

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Most of the environmental knowledge presently used to understand or design sustainable industrial systems is derived from an application of Life Cycle Assessment (LCA). The mining/quarrying industry is probably one of the sectors where there has been relatively less use of LCA tools, or where LCA has received less consensus. A key issue is

the integration between three inter-dependent life cycles: Project, Asset and Product life cycles. Given the unique features of mining LCAs, this paper presents a common methodology implemented within the EU SARMa Project in order to boost adoption of LCA in the aggregate industry in South Eastern Europe.

Friendly quarry design: Parma Province and Emilia-Romagna Region experience

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Quarrying is generally known as one of the human activities with more important impact on environment, and generates strong opposition and conflict with local communities. The quarries´ negative reputation comes from the years from ´60 to ´80 of last century, when the lack of regulations in the quarrying brought important environmental and landscape damage, due to lack of restorage quarrying activities. Restorage quarrying in fact was not compulsory and in some cases not even considered. The situation radically changed since the beginning of the ´90 years, when the new regional law was issued. In this law environmental impact evaluation was rendered compulsory, and also environmentally sustainable planning and management. The new regulation brought the obligation of quarries restoration, thus helping to reduce negative environmental impacts of quarrying.

Recently Emilia Romagna Region and Parma Province´s decades of experience in quarrying management, changed the approach to issues still existing in quarrying. The new approach is to contemplate plan restorage since land planning, with great benefit for public image of quarrying and for impact reduction on environment and landscape: by contemplating countervailing measures in quarries planning, impacts on environment are better known and so are better solved in exploitation.

Influence of quarrying on flood risk. Case study: modelling and prediction of the natural and anthropic hazard on Ialomita River

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The detailed applicative investigation of the fluvial systems, as one of the most dynamic natural environments, is required like inseparable part in the strategy of the risk

management along the rivers. This issue involves the control of use of the minor river beds, watershed plans to reduce the floods risk and actions programs for an efficient and sustainable capitalization of mineral resources.

The aim of the research carried out from 2001 to 2010 on 2 km river length was a complex sedimentological study of slopes and alluvial bodies from Ialomita river (left tributary of the Danube). The area was chosen for its individualized morphological and hydrological parameters, in relation with the feedback at some disruptive factors: big variation of the liquid and solid flow due to an excess amount of precipitation, an active dynamic of the slopes, size variation of the alluvial bodies and the changes induced by the human intervention on the elements of the basin (sand and gravel extraction and repeated regularizations at the confluence with a tributary river).

The field work and laboratory analyses showed are not significant differences between the qualitative parameters of the aggregates, despite the constant re-working of most river sediment within the system. The downstream migration of the meander appears to be a response to restriction imposed by the armouring of banks and secondary by the anthropic intervention.

The main contribution was a relative chronology of deposition and identification of primary formative processes and river equilibrium profile along the studied area, which allowed the prediction of its evolution in different situations of hazard and risk.

The results are useful not only for the local and regional management land use programs, but also in the conservation of the area and the prevention of the triggered processes by the natural and anthropic factors.

Providing a Sustainable Supply Mix of Aggregates: State-of-the-art in South-East Europe

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The European SARMa Project focuses on sustainability of both resource extraction (Sustainable Aggregate Resource Management – SARM) and supply (Sustainable Supply Mix – SSM) in South-East Europe – SEE. A specific project action (Work Package 4.2 - SSM) was oriented to the characterization of the state of the art of planning strategies to secure the supply of a mix of aggregate products (primary/extracted and secondary/recycled aggregates) among the Project Partners representative of SEE area. The results of these studies have been presented into the Work Package (WP) 4.2 synthesis report and WP4.2 recommendations).

The main results from collected data through SEE countries have been synthesised in terms of common practices in legislation and planning, knowledge framework required,

and dissemination strategies. The most significant recommendations from best practices of project case studies have been outlined.

What emerges clearly is a lack of homogeneity at national and transnational level, due mostly to the historical and legislative background of each country. This reflects in the strategies routinely adopted to plan for a future supply of aggregates. The lack of a more "holistic" perspective, both when considering different sources of aggregates and when assessing the impacts of a possible scenario, reduces the possibility to achieve resource efficiency. A more harmonised approach is thus highly desirable, and achievable also by adopting some of the best practices emerged by SARMa project.

Rehabilitation of landscapes degraded by stone, clay and sand exploitation – case studies from Serbia

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Key words: opencast mines, quarrying, ecosystems, biological rehabilitation, landscape management, multifunctional use of post-mining landscapes

Opencast mining is one of the oldest ways of exploiting mineral and other resources. In contrast to the old-time opencast mines of relatively limited scale, nowadays opencast mines, thanks to the development of technique and technology, cover huge spaces and the ores are exploited at great depth. These are simultaneously the main reasons why opencast mining is one of the most drastic forms of environmental degradation.

In Serbia, opencast mining percentage in the total mining of mineral resources is higher than deep mining percentage (Pejčinović/Urošević 1996). Of altogether 187 opencast mines, coal is extracted in 9, copper in 4, ferronickel in 2, lead and zinc ores in 1 to 2, asbestos in 1, and other non-ferrous metals in 6 mines. Stone is quarried in 38, clay in 78 and gravel and sand in 23 open pit mines.

It is estimated that in Serbia opencast mining (and environment degradation) will occupy more than 1,000 km2. The greatest changes, both by area and by the intensity, occur in opencast coal mines, as well as in the Bor copper mine.

The contamination of the environment by the extraction of stone, clay, gravel and sand is considerably lower, but the number of about 140 active plants indicates the scale of the environment modification.

Depending on the criterion of area coverage and mine depth, the following three types of opencast mines are most frequent in Serbia:

- Opencast mines occupying large areas, but not deep (coal);
- Large-scale and deep opencast mines for the mining of non-ferrous metals (Bor Basin);
- Small-scale opencast mines for the extraction of stone, sand, gravel and clay.

Technical rehabilitation, followed by biological rehabilitation and management of the area degraded by mining are the generally accepted methods of eliminating the consequences of opencast mining.

Unfortunately, although regulated by the Law, the post-mining rehabilitation is insufficient.

To mitigate the harmful consequences of the development of opencast mines, mining should be followed by biological rehabilitation of minespoil banks and by management of degraded landscape in order to establish different vegetation and other ecosystems on deposol waste heaps.

The paper presents several case studies of possible revitalisation and multifunctional post-mining uses of small-scale mines of stone, gravel, clay and other raw materials in Serbia.

Utilization of Dimension Stone Quarry Waste as Aggregate in Concrete

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Karaburun Peninsula is an important limestone dimension stone production area in the Izmir province. Dimension Stones are produced from the Triassic and Cretaceous aged limestone in actively working 5 quarries. Dimension of the limestone blocs are 2.0x1.3x1.5 m on average and blocs are cut within the quarries and the remaining small parts (artefacts) are dump over the quarry slopes and are not used effectively. The dimension stone production ratio is 10-15 % in the limestone quarries (Elçi et al., 2009). This is a very low value. Thus it is not economical to quarry limestones for only dimension stone production purposes. Additionally, dumping of the artefact of the limestone blocs around the quarries cause destruction and contamination of the environment. Thus, the use artefacts in addition to dimension stones as construction materials will increase the economic potential of the limestone quarries and will decrease the environmental contamination.

In this study, artefacts of the limestone quarries are investigated in terms of their use as an aggregate source for concrete making. The samples obtained from the limestone quarries were broken up in a jaw crusher and standard sized aggregates are prepared them from in order to investigate their use as concrete aggregate. The petrographic, chemical and the physico-mechanical properties of the limestone are found to be within the acceptable limit values given in the TS 706 EN 12620 standard. Test result showed that the Karaburun limestone artefacts are suitable as concrete aggregate source. However, studies have also shown that the quality of concrete is aggregate facies dependent. It has been

found that when the SiO_2/CaO ratio of the limestone exceeds 0.05, alkali-silica reaction is developed in the concrete.

Kosovo quarry plan

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Kosova is a very important knot in the Balkan geology. In its territory are developed various sedimentary, magmatic and metamorphic formations, while the most remarkable aspects are the Vardari and Gjakove-Rahovec ophiolite formations representing the remnants of two branches of the Tethys oceanic basin. Kosova is distinguished also by the large development of the Oligocene-Miocene magmatism spread at the eastern areas and its particular metallogenic potential.

Based on geology conditions, Kosovo disposes of excellent potentials for the development of an extensive construction material industry by, for instance, high quality silicate and carbonate aggregates, volcanic rocks, (quartz) sands, and clays. Alluvial sand and gravel deposits are mainly used as concrete add-on and mostly do not have a large spatial extent.

Competent institutions for mining sector in Kosova, Ministry for Economic Development and Independent Commission for Mines and Minerals through mining policies, Quarry Plan of Kosova and Mineral Resources Management Plan are planning to stimulate and develop the mining sector again. The Kosovo Quarry Plan is an excellent base for outlining potential mining sites, and protection of deposits in the frame of spatial plans and mining industry development plans.

SWOT Analysis as a tool in the C&D debris management after catastrophic events

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Disasters usually create an emergency situation requiring immediate policies for the recovery and rebuilding process of the areas hit by the problem. In these circumstances, the demand for construction minerals increases, leading to an intensification of quarrying activity according to extraordinary procedures notwithstanding current regulations in place at any given time.

This work aims to highlight the effects that catastrophic events, and in particular earthquakes, may produce on both the built environment - i.e. the totality of urban and

suburban settlements and infrastructure - and the natural environment. In fact, both of them are often compromised by hasty emergency procedures which rely heavily on mineral extraction.

In such context, firstly the recycling of earthquake debris and secondly an accurate evaluation of the demand for minerals are some proposed solutions. This way, landfill disposal could be reduced and natural resources required for reconstruction saved.

In order to reach these objectives a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis is suggested. Evaluating strengths, weaknesses, opportunities and threats for the use of natural aggregates (NA) or for the use of recycled aggregates (RA) coming from earthquake debris in the rebuilding process allows for a more accurate situation assessment and for decision making which might have greater impact on the territory.

In conclusion, some recommendations are prescribed in order to plan the quantities of building materials needed for the reconstruction of the area and to orient the post-earthquake policies towards greater environmental protection.

A GIS conceptual model to support aggregates resource efficiency and sustainability

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Sustainable aggregate resource management (SARM) is at the confluence of economic vitality, healthy communities and sustaining the environment. A sustainable management of natural and recycled aggregates requires to quantify impacts during the whole life cycle of the products, needing a large amount of data that can not be easily analysed without a specialized informative system. Geographic Information Systems (GIS) can be used at all steps of the process for evaluation of planning alternatives and monitoring of mining policies.

GIS embrace tools for data gathering, harmonization, and analysis providing a collaborative framework for stakeholders, suitable to communicate ideas among all participants in the planning process.

In the aim of providing a conceptual scheme for SARM-GIS, the SARMa project identified which differences in local policies prevent data harmonization and sharing, and which data and process are necessary to provide a holistic approach to impacts estimation. The conceptual approach being developed will take advantage of the principles and best practices of EU INSPIRE directive, extending it to suit the specific need of aggregate resource management. The first results of a pilot application of this approach by Emilia-Romagna Region (Italy) will be presented.

Key requirements for a sustainable aggregate supply and management on the local level

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It is beyond doubt that society needs aggregates for infrastructure development and building purposes, and therefore a major concern is the cost effective supply of aggregates of acceptable quality. Determination of local aggregate needs and early planning by the local authorities is of great importance in order to achieve sustainable management of the potential resources and sustainable supply mix which in turn contribute to the sustainable development of SEE.

The extraction activity of aggregates from quarries and pits may disturb local communities in various ways and many citizens do not support quarrying in part because they do not recognize the dependence of society on aggregates.

Authorities, industry and society must cooperate at the regional and local planning levels for sustainable aggregate extraction to be successful. To ensure the sustainable management and supply of aggregate resources, each of the relevant stakeholders (authorities, industry and society) must accept certain responsibilities.

Within the framework of SARMa project that was co-funded by ERDF funds in 2009, and the analysis of data from the extensive survey conducted on selected case studies, certain challenges were highlighted related to the sustainable aggregate supply and management on the local level. Such challenges include: achievement of social license to operate; management of potential environmental impacts; prevention of illegal quarrying; exploitation of all potential aggregate resources and promotion of recycling activities; elimination of deficiencies in the related legislative framework.

The present article summarizes the key issues for all stakeholders involved and reviews key parameters for the aggregate industry and key recommendations to local authorities and communities towards sustainable development in SEE countries on the local level.

The Aggregates Sector in the Context of Future of European Funding Systems

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The aggregates sector represents the biggest non-energy extractive industry sector in Europe. However, its recognition when it comes to public funding of necessary R&D activities is limited. This situation needs improvements. In the light of the upcoming new funding programme of the European Commission Horizon 2020 and the European Innovation

Partnership on Non-Energy Raw Materials for a Modern Society as well as in the context of the activities of the European Technology Platform on Sustainable Mineral Resources, the aggregates sector must find its position in order to meet the future challenges.

Airborne geophysical survey in Kosova

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The airborne geophysical survey in Kosova is a very important project, which has been conducted during 2006 -2007, according to the terms of references processed by the ICMM.

The airborne geophysical survey in Kosova is carried out by the British Geological Survey and the Geological Survey of Finland. The geophysical survey is carried out for three components. There are provided the important data with the images of electromagnetic, magnetic and radiometric components.

The ICMM possesses the necessary software, which enables the giving of geophysical data for mining companies, according to the specified coordinates and respective components.

The GPS are used to determine the exact location of each mining source, gaining coordinates in area (x, y, z). The method GPS has accelerated and facilitated the works of project. The same system has been used also by the company of geographic survey.

The study has achieved in the identification of many minerals of interest to use Airborne geophysical survey in Kosovo was conducted by British Geological Survey and Geological Survey of Finland. Geophysical recordings performed on three components. This project provided important data with images of electromagnetic components, magnetic and radiometrike. The method of flying by air through the softerve for obtaining data and softverve to receive data images were created with data for the base metals of attractive properties and resistance to metal materials geophysical methods, electrical, magnetic. From this survey are creating a large number of geological maps with images of the good potential of mineral Kosovo. The method of recording from the air through the Geophysical and incorporation of GPS system for determining the coordinates of specific locations to identify areas of interest in the proper location orjrntiminë concrete and detailed research by drilling, sampling GPS are used to determine the exact location of each source of mining, winning in the coordinates (x, y, z). GPS method Kosovo has been surveyed that has mineral resources, particularly lead, zinc, coal, ferronickel, bauxites, etc. Kosovo is open to further explore its mineral resources Mining and minerals sector in Kosovo is very attractive for all As a result of airborne Geophysical Survey, the areas are located in the territory of which can be extended with detailed surveys of drilling.

Managing Aggregates Supply in England

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Aggregates are essential for our economic well being and quality of life. They underpin a key sector of the economy, the construction industry, which requires adequate and steady supplies over the long term. Large quantities are essential to the delivery of affordable housing, and major regeneration and construction projects, such as the 2012 Olympics, the renewal of power generation capacity and stronger flood and coastal defences. Currently England provides well over 90 per cent of its own primary aggregates needs (which were 109 million tonnes in 2009).

In a small country such as England, with one of the highest population densities in the world, competing pressures on land make it increasingly difficult for the aggregates industry to find environmentally acceptable sites to work. Further, land-based resources of aggregates are unevenly distributed with a resulting regional imbalance between supplying areas (resource-rich) and the areas of greatest demand which are generally resource-poor. For more than 30 years the imbalances in supply and demand have been addressed through a system of managed aggregates supply.

National mineral planning policy promotes the use, where practicable, of alternative (secondary and recycled) aggregates in preference to primary aggregates; encourages the supply of marine-dredged sand and gravel; and makes provision for the remainder of supply to be met from land-won sand and gravel and crushed rock. The managed aggregate supply system assists with the delivery of these objectives. It focuses on supplies of land-won aggregates to ensure that mineral planning policies at the local level reflect the need for meeting demand in the resource-deficient areas.

This paper describes the current aggregate supply mix in England, how the managed aggregates supply system is implemented via national and local minerals planning policy, why monitoring aggregates supply is critical both to the supply system and to informing future planning policy, and current uncertainty over the future of the system.

Management and sustainable development of aggregates quarries examples from center and south of Romania

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Romania is very rich in river and crushed stone aggregates with mil t/year capacities . Crushed stone is very important for industry in south and center from Romania. Number of quarries are 44 with exploitation license and over 500 with exploitation permits. Quarry 1 is open in Neogene andesite from volcanic Neogen area from Eastern Carpathians . Quarry

2 - Iacob Deal quarry - is open in Proterozoic granite from Northern Tulcea county. For crossroad management aspects of quarries with the sustainable aggregate resource management are necessary knowledge of each exploitation from execution project to the end of quarry. The mining authorizing procedure is considered as integral part of any quarrying activity. The management policy of a company carrying out of extraction / exploitation of building raw materials should include a lot of aspects. Quarrying management requirement a permanent equilibrium between pre-set regulation, adapting to the local realities and the initiative of local operators of the quarry being worked. The development plans and the preparation an efficient exploitation documentation represent an essential component of activities carried out in the mining and exploitation of a deposit and have in view the concrete evolution of the derocked areas. (Generally) The companies that have the studied cases limits the negative impact of environment through the mining works in the plans of development that include the necessary elements for a completely safe working the.

Illegal quarrying – a problem to be solved

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The aggregate quarrying is usually regularized by general laws (e.g. Mining or Environmental Law) or specific regulations giving to different national and local organizations attributions in license delivery and to control the operators' activities.

In spite of existing regulations, as over the world, the SEE countries are facing by the increasing number of illegal quarrying activities motivated by a huge and increasing demand on aggregate market and encouraged by laws' imperfections, and lacking of adequate control and monitoring tools. The uncontrolled operations are the major source of environmental pollution and social damages.

The main general causes of illegal quarrying can be summarized as follow:

- The end users, either public beneficiaries or private constructors are not requiring a certificate on the origin of the mineral raw material; the illegal supply could be identify by controlling aggregate users as concern involved material quality and quantity, provenance, etc., and comparing these with the legal suppliers database.
- Legal limitations regulators are unwilling and unable to stop unauthorized extraction operations.
- Institutional obstacles emerged from the existence of more than one control body which can not make a distinction between an authorized operator and an illegal one;

Institutional barriers can be avoided by:

- Competent authorities coordinated control (mining, environmental, police);

- Using monitoring techniques (e.g. LIDAR survey technology) adapted to local, regional or national area;
- Transparency of licensing procedures and social dialog can be the way to enhance the identification of illegal activities by increasing public interest related to quality of life, properties, environmental quality;
- Speeding up the licensing procedures which will have a positive side effect in preventing illegal quarrying activities.

Sustainability development of aggregates supply in cross border areas based on the National, Regional and EU Policies.

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This article gives a review on the natural resources of the region of the border Greece – Albania. It gives an evaluation of the aggregates potential on and their actual exploitations, as well as the flow of the aggregates between two countries and possibilities for further sustainable development of exploitation of aggregates in both cross border areas.

The sustainable development ideas are given based on the frame of the mining strategy of Albania, territorial planning, re-evaluation of mineral reserves.

The long term strategy of minerals of Albania, which include the exploitation of aggregates is carried out under political and institutional reforms toward integration of the country in the EC structures and it intend to ensure a sustainable and long term development through effective investments.

In the article is presented the actual situation and perspective development in mining activity, for the aggregates in the border areas, new concepts for mining activities connected with the European strategy for minerals, challenges, trade and requests for aggregates, new products in this business, recycling possibilities, stronger focus on the supervision and monitoring of existing (and future) activities to eliminate the illegal quarrying, increase transparency to the public and involvement of the local authorities on decision making, with scope to realize profit activities and maximum profit to citizens, with slogan " Minerals and Energy for a sustainable development".

Spatial Planning and Aggregates Resource Management in Croatia

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Planning at the regional level on the territory of the Republic of Croatia is performed through 21 units of regional self-government (20 counties and the City of Zagreb that functions as a county). The spatial (physical) plan contains the spatial and economic structure of the county and the City of Zagreb respectively, the system of central settlements of regional importance, the regional infrastructure development system, starting points for the development and protection of the space, criteria and guidelines for economic development, for preservation and improvement of natural, cultural, historical and landscape values, environmental improvement and protection measures, including other elements of relevance to the county and the City of Zagreb respectively. Mineral resources exploration and exploitation are in these documents considered as facilities that can be developed outside the building area. Physical planning, that is, construction outside the building area is carried out according to the guidelines and criteria of the physical plans for municipalities and towns, or the physical plan of the City of Zagreb. In order to develop criteria for the location of extraction sites in the counties according to the Mining Law (2009) must prepare mineral resource management plans which are incorporated into the spatial planning documents. The areas denoted as potential exploration and exploitation sites are identified as suitable areas for stone aggregate (or mineral resource in general) production, based on criteria that take in account both geological, environmental and marketplace restrictions. Nine counties which have almost 70% of the Croatian aggregate production have to various degrees implemented the mineral resource management plans in their spatial planning documents.

The use of alternative aggregates in Slovenia

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The concept of sustainable development in construction has been getting increasing attention recently. One of the most efficient way to follow this policy is reuse of building rubble and industrial wastes - according to the principle "no waste, just resources". However there is still a lack of confidence in application of alternative aggregates with regard to their quality, long-term durability and environmental impact. The objective of the presentation is to summarize the current situation in the recycling chain in Slovenia, with focusing on main obstacles which hinder higher recycling rates.

UEPG supports the SARMA Project in working together towards a Sustainable European Aggregates Industry

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UEPG has represented the European Aggregates Industry since 1987 and actively lobbies on its behalf in front of the European institutions and all other key stakeholders. UEPG now has members in 31 countries, the annual output of which is an impressive 3 billion tonnes of aggregates, produced by 16,000 companies (mostly SMEs) from 24,000 quarries and pits with 300,000 people employed directly and indirectly. UEPG is currently focused on the key issues of the Raw Materials Strategy, and the associated challenges of access to local resources, resource efficiency and recycling. UEPG is also strongly committed to excellence in environmental stewardship, to enhancing biodiversity in its operating and restored quarries and pits and to the imperative of better health and safety in the industry. In 2012, UEPG will celebrate its 25th anniversary, and for that occasion would be delighted to welcome new members from the SARMa region countries, thereby together ensuring a truly Sustainable Aggregates Industry for a Sustainable Europe.

South east Europe transnational programme: Present and future

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The South East Europe Programme aims to develop transnational partnerships on matters of strategic importance, in order to improve the territorial, economic and social integration process and to contribute to cohesion, stability and competitiveness of the region. For this purpose, the Programme seeks to realize high quality, result oriented projects of strategic character, relevant for the programme area.

The global and specific objectives of the Operational Programme are pursued through four Priority Axes, which contribute differently to the specific programme objectives. SARMa belongs to the Priority Axis 2 *Protection and improvement of the environment*, Area of Intervention 2.4 *Promote energy and resource efficiency*, with a unique topic among the approved projects.

The last three calls showed a great interest from the stakeholders of the SEE area (and beyond) with 66 projects approved in 2 calls. The expectations for the fourth call (to be launched in October 2011) are high, as all Priorities and Areas of Interventions will be open.

Recycled construction materials as supplemental raw materials for the OPC clinker production in Salonit Anhovo

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The main purpose of the project is the reasonable reuse of secondary mineral resources originated from the construction waste materials obtained during demolition of industrial and residential buildings. Processing (grinding and separation phases) of construction waste materials in the quarries became an economical acquisitive activity, therefore many mining companies find an opportunity and decided to place such activity within their ”mining free“ areas.

The quarry Rodež is situated on the left Soča bank. It is developed in wedge shape which consecutively produces a minor disposal of appropriate lithological components for OPC clinker production. In order to assure the adequate amount of raw meal it is necessary to follow the nature and quality of primary raw materials, which - together with the secondary industrial mineral mixture take part in the technological clinker cement process. The groundwork for choosing the right and appropriate secondary mineral resource is the amount of calcium and $n(CaO + MgO)/(n_2Fe_2O_3+n_3Al_2O_3+n_4SiO_2)$ relationship. The industrial thermal process of the cement clinker production requires broad knowledge on chemical and mineralogical properties of the raw materials including waste construction materials which consist mainly of carbonated cement paste, different carbonate or silicate aggregates and industrial steel. From this point of view, we can expect that this secondary raw material can acquire the positive sign namely all components of this type of waste have the adequate composition.

The economic baseline data for this research were obtained from the so-called *Slovenian economic expansion* period. We used the *medium term value*, to predict economic benefit outputs for mining and construction industry. We focused on:

- the quantity of construction waste in the Coastal-Karst and Goriška statistical region (with the special emphasis on the last one), as the potential source of input raw materials,
- financial evaluation of secondary mineral resource, mostly for OPC clinker production

In both regions the statistics results (Pogačnik and Rokavec, 2008) demonstrate, that one third of the municipalities has not have its own source and are therefore dependent on its neighbours or riverbeds material. The results showed that the amount of minerals for build a 1 m^3 of buildings is 1.74 m^3 which includes a raw material for construction binders, bricks and technical stone. From this point of view the price of recycled materials is largely conditioned by the price of the materials acquisition, operational and transport costs as disposal price at landfills. The financial viability of project is demonstrated by the cost-benefits as:

- covering deficit in the quantity of mineral raw materials for aggregates and general construction industry in Goriška statistical region,

- achieving lower mining operational, transport, handling and taxes costs.

From the ecological and economic point of view there are several benefits of the technological process of using construction and demolition waste materials. These positive effects have convinced the Salonit Anhovo company to start all necessary procedures to perform the recycling of waste construction materials in the Rodež quarry. This included also the procedure for environmental permit, which has been recently obtained.

National mineral resource database as a support for mining sector

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One of the priority national tasks is to make appropriate inventory of all active, abandoned and perspective open cast mines, processing plants and waste disposals from mines and extractive industry. They are important from the point of view of organized industrial exploitation as well as from the point of spatial planning and environmental protection.

For the purpose of sustainable management of mineral resources (exploration, exploitation, consumption, spatial planning…) a complex national database of all mineral deposits is developed by Geological Survey of Slovenia, financed by Ministry of the Economy, competent for mining sector.

All sites are described by geological, geographical, spatial, environmental and economic characteristics. They are evaluated from the economic point of view and in the sense of intervention in land and potential environmental impact as well.

SARMa Project: synthesis

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The main foci of the EU project, entitled “Sustainable Aggregates Resource Management” (SEE/A/151/2.4/X – SARMα), have been understanding the state of the play in South East Europe (SEE) with respect to the demand and supply of primary and second aggregates, and developing frameworks for sustainable aggregates resource management (SARM) and the provision of a sustainable aggregates supply mix (SSM). The project runs from 2009 through 2011.

The project was designed in such a way that project activities were interlinked and issues of scale, quarry life cycle, overarching themes, e.g., recycling, best practices, etc, and critical issues, e.g., social license and resource efficiency, were addressed. The organizational structure of the project was hierarchical, starting from the local, quarry site level, broadening to the regional/ national level, and ending with the transnational. As a result, the project had a bottom up approach, starting from the level where most impacts and costs are generated to the level where most benefits are consumed. As the project is a strictly time delimited activity, later activities would commence before early activities were fully completed. As a result, the partnership was engaged in concurrent expert and public discussion within SEE countries on aggregates management and supply at several levels. Starting with the first of the regional and national meetings, SARMα has impacted ongoing debates related to aggregates regulation and mineral policy. It has will continue to influence and add to the European public debate on the Raw Materials Initiative, especially the parts related to minerals and aggregates policy and regulation on EU level.

The main results of the project are messages placed in one to few pages project documents (recommendations, action plans, etc.) that are outcomes of the extensive work done forehand. The ground work was done by preparing case studies from different parts of SEE; case studies were summarized in scale- and topic-focused Synthesis Reports, and these were condensed into Manuals that are written for and understandable to a wide range of stakeholders within and outside the aggregates sector.

Project activities connected institutional actors, decision makers, policy implementers, economic sector, quarry operators, civil society, and NGOs through workshops and targeted results into a well-functioning network. The Reports, Manuals and numerous other outputs will provide a well-organized and extensive reference point on aggregates management and supply long after SARMa has ended. All project outputs are posted on the SARMα project website www.sarmaproject.eu and will stay available for years. The SARMα project has definitely enhanced resource and energy efficiency, and sustainable development and quality of life in SEE, and will continue to do so.

Aggregates Supply in Serbia

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Aggregates industry in Serbia uses almost exclusively primary aggregates – sand, gravel and crushed rock. In the last ten years geological exploration was rather intensive, with more than 30 new aggregate rock deposits explored and prepared for exploitation. Currently, there are around 150 aggregate rock deposits in Serbia, out of which several are still under exploration. These statistics exclude deposits of sand and gravel for construction industry, which are still not completely under jurisdiction of the Ministry of Environmental Protection, Mining and Spatial Planning, which is in charge for exploitation and exploration licenses for all other mineral commodities. The basic factor influencing promotion of aggregate rock industry in the last ten years was road construction, cement

and lime industry, and civil construction. The use of secondary aggregates is restricted almost only to R4 category of industrial waste. There are numerous petrological varieties of rocks used in aggregate industry in Serbia. The majority of deposits are limestone and dolostone, which are almost exclusively used in aggregate rock industry, predominantly in construction industry, but also as filler. Five deposits are used by cement factories, 7 by lime producers, but all of those 7 quarries also produce aggregate rock. There are several deposits which supply by some specific end-users, like Bor copper smelter, filler industry, or production of metal magnesium from dolostone. Majority of magmatic rocks is used in road construction (diabase, andesite, dacite), while granite is exploited for dimension stone and several in ceramic industry (different varieties of kaolin). Metamorphic rocks are mainly used as filler, or as construction aggregate Marble is also used as ornamental stone, although some recrystalized limestone deposits are also included.

Collision of laws

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There are no so rare situations when collision of different laws causes unclear situations for all involved stakeholders and hinders efficient management of the aggregates, as well as of other mineral resources. Not only young states as it is Bosnia and Herzegovina face this problem in one or another area, but due to the complexity of laws even develop countries are sometimes faced with situations, when one law allows something, that is forbidden by another law and people often find themselves in ambiguous situations. This problem is in Bosnia even more exacerbated by the complexity of state constitution with different levels of authorities (state, federation, and municipality) which jurisdictions often overlap with one another. That is especially represented when it comes to the jurisdictions over certain activities for instance over issuing permits where federal law puts that in charge of the federal bodies and cantonal laws puts that in charge of the cantonal bodies. So, there are problems both - vertically and horizontally.

When it comes to aggregates, in the Federation of Bosnia and Herzegovina, in 2009, there was Law on Mining, which together with Law on Geological Investigations and Law on concessions dealt with all aspects of aggregates exploitation, from geological investigations, procedures for granting concessions to the reclamation of excavated areas.

These three laws fully regulate in the detail whole procedure of exploitation from the geological investigations to the reclamation of excavated area.

However other laws as is Law on spatial planning, Law on waters, or Law on forests sometimes cause dubious situations in the field as they overlap with these three.

SARMa Project: overview

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In 2009 the EU Commission approved the project titled "Sustainable Aggregates Resource Management" (SEE/A/151/2.4/X – SARMa), which they are jointly funding with ERDF. The project partnership comprises participants from ten countries of South East Europe (SEE) and builds on previous projects, studies, and on current best practices and programmes of partners and their networks. Past work was done (and funded) within regional and/or national frameworks.

The partnership has: (a) broad geographical coverage, (b) the inclusion of partners from old member states, new member states, and candidate countries, (c) competence and expertise of partners, (d) vertical coverage in different countries of activities at different scales and knowledge transfer from experts to stakeholders at the policy and implementation levels, and (e) continuing partnership among project members and observers representing ministries in charge of mining, regional authorities, chambers of commerce, and industry.

Aggregate management takes place in all partner areas (region, country), but nowhere is every aspect of management or supply planning at sustainable, best practice levels. Therefore SARMa focuses on two main objectives. First, partners are developing a common approach to sustainable aggregates resource management (SARM) across SEE, which stresses efficient, low socio-environmental impact quarrying and waste management. The second goal is to ensure a sustainable supply mix (SSM) of aggregates in SEE, which necessitates that the benefits of aggregate production, use, waste disposal and recycling exceed the costs and that both are fairly distributed, so as to enhance resource and energy efficiency and quality of life. Within the project, SARM and SSM are being dealt with on three levels: local, regional / national, and transnational. Project transfer to policy level on local/regional and national level is facilitated with national (HR, AL, HU), regional (Emilia Romagna, Styria) and local (Pella, Parma, MGK10 – Bosnia in Herzegovina) authorities as project partners. Practices from SEE countries were discussed within the project and numerous recommendations made.

Sustainable Aggregate Resource Management on transnational level

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Aggregates (that is crushed stone, sand and gravel) are an essential ingredient of the key building components that make up the residential, social and commercial infrastructure of modern European society. Europe currently needs some 3 billion tonnes of aggregates a year, equivalent to over 6 tonnes per capita. The Aggregates Industry accounts for more than 22.000 production sites. Taking an EU average price of €7-8/tonne, the aggregates sector represents a turnover of around €20-25 billion. The demand for aggregates in Europe will continue to rise. As economies continue to grow, it is reasonable to anticipate that European demand for aggregates will reach 4 billion tonnes in the medium term, driven mainly by economic growth in Central and South-Eastern Europe.

This growing demand for aggregates requires efficient and sustainable supply chain and needs to be addressed by national minerals policies and research projects. The SARMa-project is the first EU-project on aggregates which is exploring these issues in South East Europe (SEE).

One of the SARMa-objectives is related to the transnational scale. Transnational activities focus on harmonization of relevant policies and legislation across SEE in order to develop a common approach to sustainable aggregate resource management (SARM) and sustainable supply mix (SSM), information transfer, and creation of an Aggregates Intelligence (data) System. Conditions and patterns of aggregates flows/markets and aggregates resource management in selected areas bordering to other countries have been examined and placed in a broader framework (including policies and legislation) in order to provide recommendations for harmonizing SARM/SSM in SEE. Increased capacity through transfer of knowledge shall improve (national) SARM and SSM planning policies, and realize a greater policy coordination within and among SEE nations (e.g. more energy efficient aggregates transport).

Harmonizing mineral extraction activities and EU Nature Directives requirements (Natura 2000) through application and/or development of general and national guidance documents (COAST project) related to appropriate assessment in accordance with article 6(3,4) of the Habitat Directive

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Nature protection on the level of EU is based on two directives: Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (1979, 2009) – Birds Directive (EC, 2010) and Council Directive 92/43/EEC of 21 May 1992 on the conservation of Natural habitats and of wild fauna and flora (EC, 2010) - Habitat Directive. These two directives are the basis for establishment of the Europe-wide ecological network Natura 2000.

One of the most important mechanisms for the protection of Natura 2000 is so-called appropriate assessment of plans and projects as defined in the article 6 (3,4) of the Habitat Directive. In this way the directive aims to ensure that implementation of various plans and project does not threaten Natura 2000 sites and that no unnecessary limitations are made to the projects that have no significant impact on the sites.

As a support for expert work related to appropriate assessment and to standardize the approach across EU, several EC guidance documents have been created in the past decade. The importance of sustainable mineral extraction and the need to harmonize strategic documents such as Raw Mineral Initiative of 2008 with Nature Directives resulted in the EC guidance document: „Undertaking non-energy extractive activities in accordance with Natura 2000 requirements“. This document emphasizes that mineral exploitation within and around Natura 2000 areas is possible - appropriate assessment and strategic planning are the mechanisms that should ensure coherence of Natura 2000 network either by mitigation or avoidance of adverse impacts or compensation if reasons of overriding public interest are established.

As Croatia has already transposed provisions of EU Nature Directives in its national legislation State Institute for Nature Protection has, through activities of the EU PHARE 2005 project „Institutional Building and Implementation of Natura 2000 in Croatia“, organized workshops and printed brochure about the standard methodology and procedure of appropriate assessments in accordance with EU directives in 2008.

This line of activity was continued with the support of a UNDP GEF project “Conservation and Sustainable Use of Biodiversity in the Dalmatian COAST through Greening COASTal Development”. Activities of its component “Integration of the National Ecological Network and Natura 2000 in coastal area management: Support to the State Institute for Nature Protection (SINP) on introduction of Nature Impact Assessment (NIA) practices in coastal areas” are aimed on development of national guidance documents. For this purpose a team of international and local experts was formed to present and standardize methodology within the framework of Croatian legislation. Such guidance

should ensure protection of the sites of Croatian national ecological network and support sustainable development (including exploitation of mineral resources) through development of rational, scientifically sound and cost effective planning and assessment methodology.

Aggregate production in İstanbul

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Rapidly growing population, increasing industrialization and the need of housing and other structures in Istanbul have resulted in intensive building and construction activity in recent years. Crushed stone, sand and gravel are the main types of natural aggregate used in this city. The high demand of aggregate, production facilities without planning and insufficient investigations, the lack of good quality aggregate and urban development forces the investigators on the evaluation of further aggregate potential. In this study, the properties of aggregates produced in Istanbul are classified according to the production areas. There are different types of rocks in Istanbul. Paleozoic limestone, sandstones, Mesozoic limestone and Tertiary limestone, natural sand are the main aggregate resources of Istanbul. Furthermore, different types of rocks are discussed as other aggregate resources. On the other hand, as the aggregate resources on the surroundings of Istanbul are limited, it is emphasized that, materials from underground excavations and deep excavations and recycled aggregates (collapsed buildings, waste concretes etc.) should be used as much as possible.

Sustainability and the EU Raw Material Initiative – strategies of the European Commission

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Raw materials provide the essential building blocks we need for our society and are a vital input for the EU's manufacturing sector. The European Commission has recognised this, and with the Raw Materials Initiative (RMI), has set the political framework for the future actions to ensure sustainable access to these materials. This strategy is based on three pillars, which cover 1) international market aspects, 2) framework conditions within the EU and 3) resource efficiency and recycling.

The principle of "sustainability" is incorporated into all three pillars of the RMI. This means that improved access to raw materials should be pursued using a globally-balanced approach where ecological, economical and societal factors are fully and equally considered.

In this context, the European Commission wishes to set-up a European Innovation Partnership on Raw Materials. Such a partnership, involving experts, authorities and other stakeholders, would foster the development of innovative solutions for the management of raw materials along the entire value chain, including exploration, extraction, processing, recycling and substitution.

Disclaimer: The presentation is of an informal nature. It neither represents the official position of the European Commission nor that of its services.

Usability of granitic rock wastes as asphalt aggregate

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In recent years, Turkey has been one of the world's leading dimension stone manufacturing centers. This development has been realized not only by dimension stone but also processing of dimension stones. Nowadays, production of granites as dimension stone and their processing with huge scales are performed in almost every region in Turkey, especially in Kirklareli, Yalova, Izmir, Balikesir, Çanakkale, Giresun and Aksaray Regions. At the end of the production and processing, 40-45% of granite blocks are evaluated as dimension stone, rests are send to dumping ground and generally not used.

Properties of aggregates that used more than 90% in asphalt pavements play an important role during service life of roads. To achieve good asphalt pavement performance, the strength and durability of aggregates should be at intended level and should not be separated from asphalt (stripping) by the effect of water and traffic loads. As known; properties of granitic rocks like hardness, strength and durability are more favorable than many rock types. But these types of rocks have limited usage as asphalt aggregates because of their operating difficulties and stripping problem. However, there are few data about correlating the effects of different granitic rocks on asphalt properties.

The aim of this study is to correlate the usability of different types of granitic rocks as asphalt aggregate. The granite samples were collected from different region in Turkey and tested to determine their petrographic, mineralogical and chemical characteristics and aggregate properties. During the evaluation stage of the results, limestone and basalt aggregates which have been widely used in asphalt production in Istanbul are used as reference aggregates. The study reveals that the influence of the grain size, composition and textural characteristics on the aggregate properties appears to be very important. It is also determined that the percentage of quartz, plagioclase and orthoclase in granites and

therefore their chemical compositions affect the stripping properties of granite aggregates.

Regional Centre on SARM and SSM

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Key issues recognized within current state of aggregate supply, which points out for the need of the Regional Centre on SARM and SSM are: high rate of the obscurity of the aggregate market, problems related to the sufficient supply of aggregates on some areas and for specific companies, illegal quarrying, hard and long-term process for obtaining the mining permits, complicated and unharmonised legislation through south European countries, no planning for aggregates extraction (no land reserved for mining of aggregates in spatial plans), low rate of recycling, almost no use of secondary aggregates, almost no information regarding availability, trends and bottlenecks in aggregates supply. Main activities of the centre might be: (a) collecting data (aggregates demand/supply, available resources, high-quality aggregate areas, policies etc.), (b) analysing data (supply opportunities, transportation patterns, aggregate zones, bottlenecks, trends etc.), (c) providing data (to interested companies, policy makers, spatial planning authorities and other interested public) and (d) awareness rising (awards, seminars, workshops and similar).

The vision of the centre is that in 4 years after establishment the Regional Centre for SARM and SSM will be recognized in European Countries as the leading institution for aggregate resources management with the widest database about the supply of aggregates (quantity, price, location, means of transportation, quality etc...), including majority of aggregate producers in EU countries. With such a database in a combination with the other relevant information (policies, trends, spatial planning data etc) it will represent the meeting point of demand and supply of aggregate resources, an educational and informative entity in support of regional, national and transnational spatial planning, a support for investors and policy makers, a research and development centre where scientists may share their experience about natural resources and their management. It will have also a promotional role for the recycling of aggregates, the use of secondary aggregates and the sustainable use of natural resources with the care of the environment. Most of the activities (especially in initial years) will be carried out on line, with the internet platform representing its core meeting point.

PAPERS

The Life Cycle Assessment Guidelines in the SARMa Project: definition of a common methodology to boost use of LCA tools in sustainable production and recycling of aggregates

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Abstract: Most of the environmental knowledge presently used to understand or design sustainable industrial systems is derived from an application of Life Cycle Assessment (LCA). The mining/quarrying industry is probably one of the sectors where there has been relatively less use of LCA tools, or where LCA has received less consensus. A key issue is the integration between three inter-dependent life cycles: Project, Asset and Product life cycles. Given the unique features of mining LCAs, this paper presents a common methodology implemented within the EU SARMa Project in order to boost adoption of LCA in the aggregate industry in South Eastern Europe.

Key Words: Mining, Recycling, Natural Aggregates, Recycled Aggregates, LCA Life Cycle Assessment

Introduction

Sustainability is the official goal of many EU policies, including that on waste management. Thus, in 2008 the European Union issued Directive 2008/98/EC, which included the objective of increasing recycling of Construction and Demolition Waste (C&DW) to at least 70% by the year 2020. C&DW is in fact a possible source of recycled aggregates, but the current rate of recycling is still very low in many Member States.

In 2009, the European Commission financed the SARMa project, Sustainable Aggregates Resource Management (www.sarmaproject.eu), as a concrete action to promote efficient resource use and increased C&DW recycling. SARMa is a medium-large scale, multi-year, collaborative project that is focused on construction aggregates, i.e. gravel, sand and other granular inert materials used in the construction industry. SARMa partners recognise that aggregates are essential and valuable resources for the economic and social development of mankind, but that they must be produced, used and disposed of according to Sustainable Development principles if their contribution to society is to be a net positive.

The SARMa project is committed to helping aggregate producers, typically small and medium-sized enterprises (SMEs), embrace best practices in environmental management so as to make their business operations more sustainable. Then, SARMa will provide tools and methods to assist Member States achieve the C&DW recycling goal in the Waste Directive.

One of the main expected outcomes of the SARMa project is a methodology for selecting a sustainable supply mix (SSM) of aggregates for different areas of South Eastern Europe. An SSM for aggregates would be that blend of natural aggregates, quarry by-products and recycled waste, which together maximize net benefits of aggregates supply across generations. An SSM therefore requires procurement from multiple sources, which would be selected based on comparison of each one's environmental and socio-economic impacts and benefits.

In the case of natural aggregates (NA), different environmental impacts can be associated with quarrying and subsequent use. In addition, a complex set of direct and indirect issues must be taken into account (Blengini and Garbarino, 2010a). In the case of recycled aggregates (RA) produced from C&DW, recycling can avoid landfill and partially displace environmental impacts of quarrying activities, but the recycling process itself has environmental impacts related to re-processing and might lead to increased transport-related impacts. It is possible that more energy would be spent and higher impacts caused by one or more activities in the recycling chain than would be saved as a consequence of avoided primary production (Blengini and Garbarino, 2010a-b).

The Life Cycle Assessment (LCA) methodology, standardised according to ISO14040 (2006), can be used to quantify a product's natural resources consumption and pollutant emissions over its life cycle, i.e. from "cradle to grave". Therefore, LCAs of aggregates could help decision makers understand the role of both natural and recycled aggregates in the SSM. Bearing this in mind, a sector- specific LCA methodology was created for the 14 SARMa project partners in order to standardise and boost adoption of LCA in the aggregate industry in South Eastern Europe. Such a methodology is outlined here.

The three inter-dependant life cycles in mining/quarrying

Now days, an important part of the environmental information used to interpret, forecast or design sustainable development issues related to industrial systems or is derived from an application of LCA or a life cycle approach. In spite of such a great interest on life cycle issues and although the general LCA methodology is well defined, there is still lack of sector-specific standardisation in many fields. The mining/quarrying industry is one of the sectors in which there has been relatively less use of LCA-based tools, and where consensus with respect to implementation of the methodology has yet to be achieved. LCA can more effectively be applied to standardised production systems, while extractive activities always differ from one another. Thus, while production of polyethylene is more or less similar worldwide, it is incorrect to assume that all mines or quarries or processing plants will impact the environment to an equal degree or in the same way (Van Zyl, 2005). This is an obstacle for standardisation and adoption of LCA.

Availability of site specific data is a real concern, as average data retrievable from databases are often not representative of the systems under study. According to Reid et al. (2009), environmental impacts of mining activities have to be evaluated using site-specific data, otherwise there is a real risk of reaching misleading conclusions.

LCA is more effective in quantifying environmental impacts of production systems at global level, while extractive activities impact relatively more at the local/regional level,

for which available indicators and impact models are less developed, or received less consensus. Land use and/or land transformation are typical examples where there is a huge interest, but relatively less well established impact assessment methodologies.

However, there is another reason why the application of LCA to the mining/quarrying sector is unique. This reason originates in important economic peculiarities of mineral resources. As a geological legacy, mineral resources are located in well specific sites (with their site-specific unique characteristics) and, as non-renewable resources, every mining project has a finite life cycle (Van Zyl, 2005), from exploration to post-closure, each step of which impacting the environment in its own way. To run a mine/quarry project, heavy infrastructures/plants/facilities (Assets, in general) must be constructed/developed; these assets have their own life cycle and attendant environmental implications. LCA practitioners usually refer production equipment and facilities as "capital goods" or "capital equipment" or "infrastructure" (Frischknecht et al., 2007), which fall within the above mentioned general term "Asset". The mine/quarry itself, or part of it, can be regarded as an asset and also as operational activity. Mine/quarry operation generates mineral products (metals, aggregates, industrial minerals, etc.) that have their own life cycle and are part of a supply chain.

Three inter-dependent life cycles are thus identified (Figure 1), which need to be integrated and jointly understood in terms of sustainability implications:

(1) Life cycle of mining/quarrying projects;

(2) Life cycle of mining/quarrying assets;

(3) Life cycle of mining/quarrying products.

Aggregates, and minerals in general, are valuable resources used in economy, thus their contribution to sustainable development should be the focus of the analysis. The leading approach should therefore be the product life cycle, but within the context of a holistic life cycle management (LCM) of the three life cycles. This holistic LCM is one of the specific objectives to be achieved within the SARMa project.

While also for other products and sectors it is possible to distinguish between Project, Asset and Product life cycles (Brent, 2005), the joint management of the three life cycles is much more important in the mining industry, for at least two reasons.

(1) In the mineral industry the Project life cycle is limited by the non-renewability; when the natural resource is depleted, the mine is closed and it's usually impossible to duplicate the project in the same site. However, according to Van Zyl (2005) there can be temporary closures or future conditions that allow new activities such as treatment or re-processing of mining waste. Moreover, recycling can turn a non-renewable resource into a renewable one, at least partially.

(2) For many products the environmental implications relevant to Project and Asset life cycles are usually negligible, in comparison to the Product life cycle, while for minerals this is usually untrue.

For these reasons, the LCA methodology proposed for the SARMA project is focused on the Product life cycle, but with integration among Product, Mining Project and Asset life cycles.

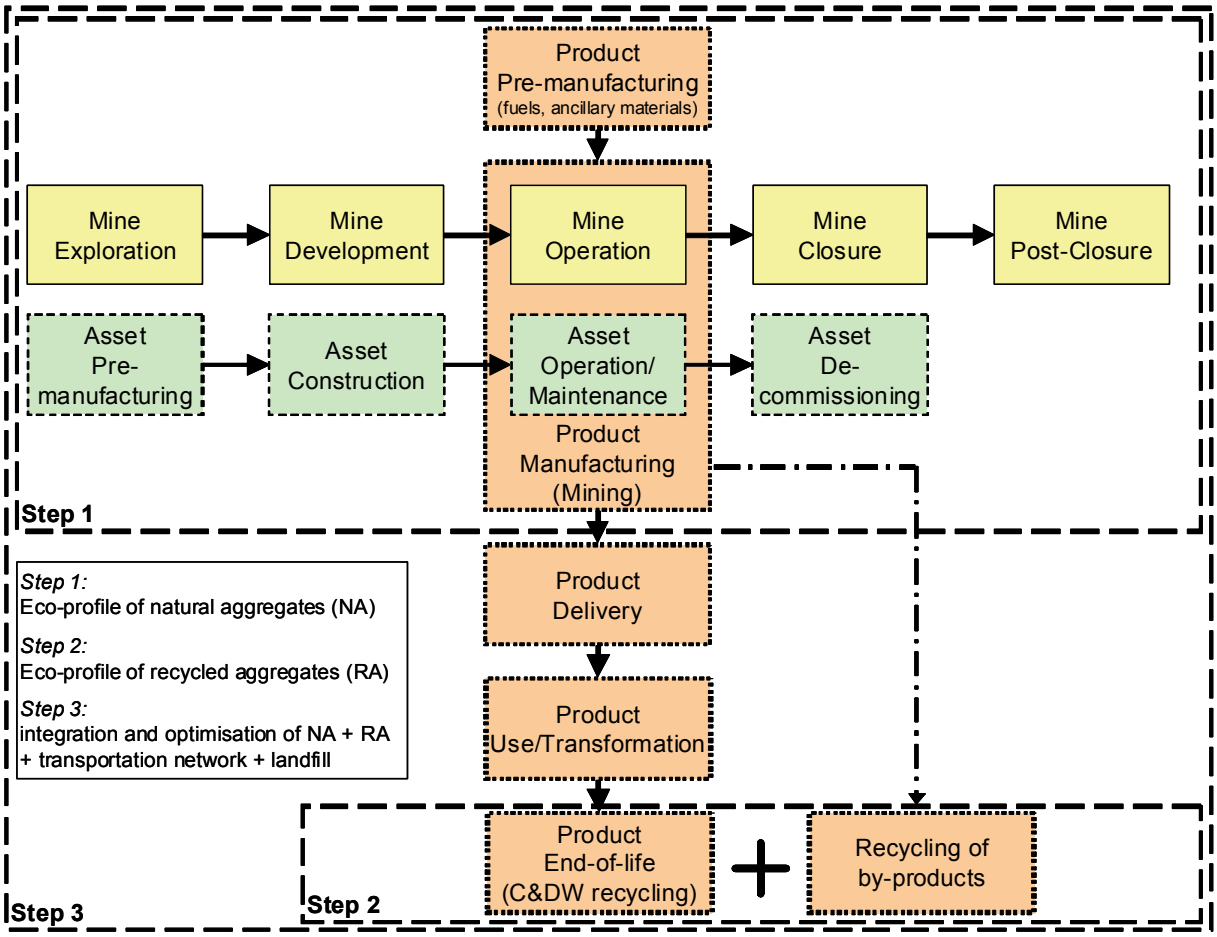

***Figure 1**: Integration of the three life cycles in the mining/quarrying industry and steps of the LCA implementation within the SARMa Project.*

Implementation of the LCA methodology in SARMa

Within the SARMa project, the implementation of the LCA methodology is divided in three steps (Fig. 1). Step1 is focused on the analysis of the from-cradle-to-gate environmental implications (eco-profile) of NA, in other terms, the first part of the product life cycle plus the mine life cycle plus mining assets life cycle. In step 2, the LCA methodology is extended and adapted to C&DW recycling and the production of RA with the objective of pointing out strengths and drawbacks of actual recycling chains as opposed to theoretical ones. Finally, in step 3 a comprehensive methodology is proposed in order to assess the environmental performance of an integrated system where quarrying, recycling, landfill avoidance and transportation are consistently managed to optimise energy and environmental efficiency at system level, also in order to better define the SSM of aggregates.

The adopted Functional Unit is 1 ton of NA or RA, associated with one (or more) parameter describing the product quality, or the potential end-uses.

The Product System to be described can be any kind of aggregate quarry (wet/dry, small/large), which produces different aggregate products (sand, round/crushed gravel, tout-venant, etc…) from different ore bodies (alluvial deposits, igneous rocks, etc…) and with different excavation techniques (blast/mechanical). The system boundaries, i.e. the activities/products to be accounted for in the LCA model, are those included in the dashed box corresponding to step 1 in Figure 1. According to the experience gathered by the LCA research group of the Politecnico di Torino, it is almost impossible, and it is almost useless, to model aggregates production strictly following the real process step by step. Under these circumstances it can be understood that it is not possible to keep the three life cycles separated. The idea is to integrate the three life cycles using pure (i.e. belonging to one of the three life cycles) and hybrid (i.e. that can be ascribed to a mix of the three life cycles) unit processes also in order to collect and easily handle homogeneous clusters of data and obtain meaningful results. To integrate the three life cycles of Figure 1, the LCA model can be built up according to the inter-linked unit processes described in the framework of Figure 2, which shows the unit processes that should be included in the LCA model. As it can be seen, some of them belong to the Mine life cycle, some can be ascribed to the life cycle of some Assets and some are a mix that can be connected to all the three life cycles.

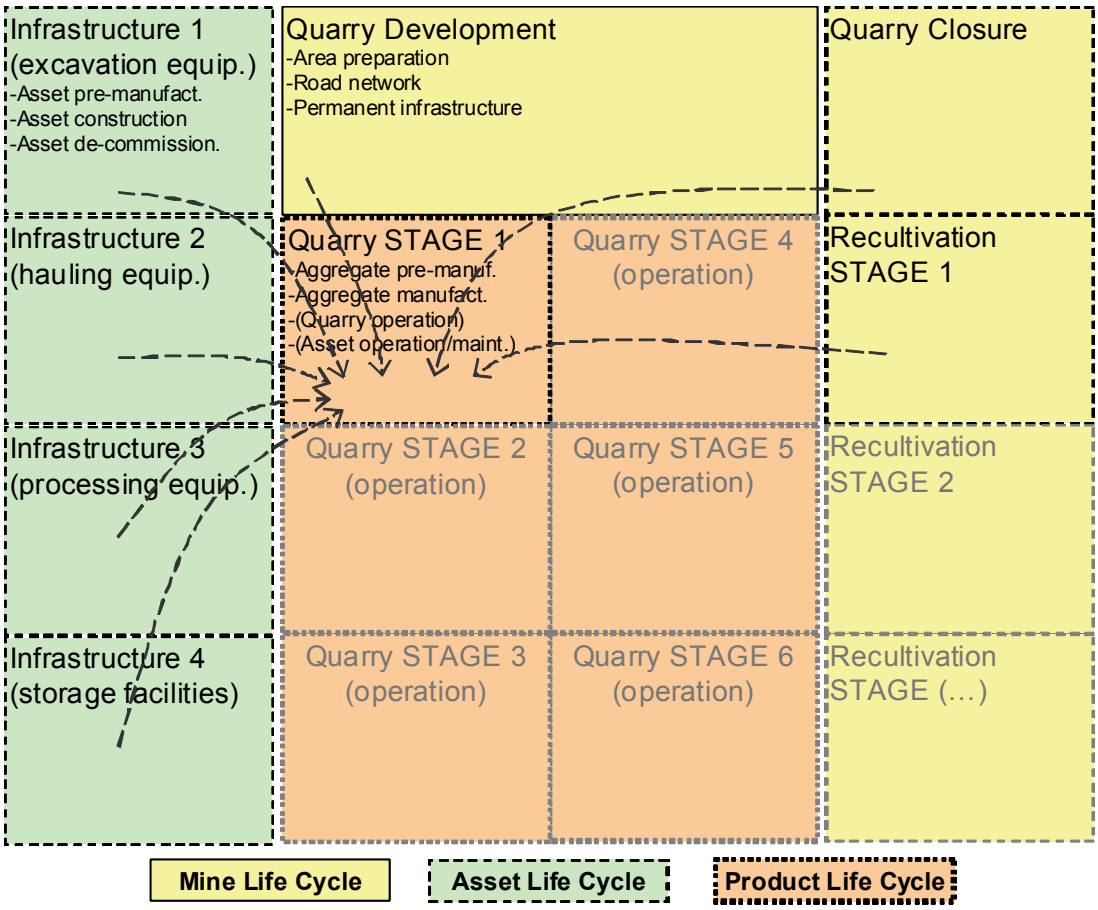

***Figure 2**: Implementation of the three Life Cycles into a LCA model.*

Conclusions

The promotion of recycling and the encouragement of Sustainable Supply Mix (SSM) policies are two of the main challenges addressed by the EU SARMa Project: Sustainable Aggregates Resource Management. According to the SARMa approach, SSM would benefit from an increased recycling rate and an integrated life cycle management of quarrying, processing and recycling. However, recycling rates are still low in several EU member states, and particularly in South East Europe, and there is still scepticism among conventional natural aggregate producers about the opportunity to extend their business by integrating recycled aggregates production.

As one of the main SARMa project outputs, a common methodology was implemented in order to standardise and boost adoption of LCA in the aggregate industry in South Eastern Europe. Such a sector-specific LCA methodology takes into account site-specific environmental implications and the unique characteristics of aggregates, as mineral products, by integrating three inter-dependent life cycles: Project life cycle, Asset life cycle and Product life cycle.

In fact, while also in other sectors it is possible to distinguish between Project, Asset and Product life cycles (Brent, 2005), the joint management of the three life cycles is much more important in the mining industry, for two main reasons: (1) in the mineral industry the Project life cycle is limited by the non-renewability of the resource; (2) for many non-mining products the environmental implications relevant to Project and Asset life cycles are usually negligible, while for minerals this is usually untrue.

The proposed methodology emphasises the importance of resource efficiency and recycling.

Through the adoption of the proposed methodology, SARMa partners will gain confidence with LCA tools and will be able to address aggregate producers/recyclers and public decision makers towards consistent and meaningful life cycle analyses of natural and recycled aggregates.

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Influence of quarrying on flood risk. Case study: modelling and prediction of the natural and anthropic hazard on Ialomita River

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Abstract: The detailed applicative investigation of the fluvial systems, as one of the most dynamic natural environments, is required like inseparable part in the strategy of the risk management along the rivers. This issue involves the control of use of the minor river beds, watershed plans to reduce the floods risk and actions programs for an efficient and sustainable capitalization of mineral resources.

The aim of the research carried out from 2001 to 2010 on 2 km river length was a complex sedimentological study of slopes and alluvial bodies from Ialomita river (left tributary of the Danube). The area was chosen for its individualized morphological and hydrological parameters, in relation with the feedback at some disruptive factors: big variation of the liquid and solid flow due to an excess amount of precipitation, an active dynamic of the slopes, size variation of the alluvial bodies and the changes induced by the human intervention on the elements of the basin (sand and gravel extraction and repeated regularizations at the confluence with a tributary river).

The field work and laboratory analyses showed are not significant differences between the qualitative parameters of the aggregates, despite the constant re-working of most river sediment within the system. The downstream migration of the meander appears to be a response to restriction imposed by the armouring of banks and secondary by the anthropic intervention.

The main contribution was a relative chronology of deposition and identification of primary formative processes and river equilibrium profile along the studied area, which allowed the prediction of its evolution in different situations of hazard and risk.

The results are useful not only for the local and regional management land use programs, but also in the conservation of the area and the prevention of the triggered processes by the natural and anthropic factors.

Key Words: Alluvial Bodies, Slopes, Gravel and Sand, Quarrying, Risk Management

Introduction

The detailed applicative investigation of the fluvial systems, as one of the most dynamic natural environments, is required like inseparable part in the strategy of the risk management along the rivers. This issue involves the control of use of the minor river beds, watershed plans to reduce the floods risk and actions programs for an efficient and sustainable capitalization of mineral resources.

The aim of the research carried out from 2001 to 2010 on 2 km river length was a complex sedimentological study of slopes and alluvial bodies from Ialomita river (left tributary of the Danube).

General features of studied area

The area belongs to the median part of the river Ialomita (with a total length of 417 km), mainly developed in the geographical space of Romanian Plain. The valley is dendritic - parallel type, strongly meandering, and has a wide meadow grows 0.3 - 1 km, dominating the minor bed with 2-4 m. Sinuosity coefficient is about 3.5 along the investigated area. Minimum daily average flow in the warm period is 0.48 m^3/s. The fine particle suspension has an average of 18.5 kg/sec, respectively 1970 g/m^3. During the research period, were not only normal climatic years, but also a year (2005) with lower temperature and amount of precipitation excess, followed by flood.

Geological, the studied area belongs to Wallachian Platform, part of Moesia Platform. Structurally, it overlaps Dacian Basin, a major underwater sedimentary unit of the Parathetys area (Jipa et.al., 2004). The valley has a W-E direction, as a result of regional subsidence.

Selection criteria. Observation points

The area of research was chosen for its individualized morphological and hydrological parameters, in relation with the feedback at some disruptive factors: big variation of the liquid and solid flow due to an excess amount of precipitation, an active dynamic of slopes, size variation of the alluvial bodies and the changes induced by the human intervention on the elements of the basin (sand and gravel extraction and repeated regularizations at the confluence with a tributary river).

The perimeter included 2 km of typical areas for such categories of fluvial systems along were developed 2 meanders (A and B – Figure 1). Those are characterized by presence of high slopes with dynamic aspects, clearly expressed as amplitude and effects. On the opposite side of the river grow two big point bars and one longitudinal bar, with a clearly spatial and volumetric delimitation and variation of depositional processes. The both meanders were studied individually (two observation points), but were also correlated.

The most important dynamic processes taking place are two categories of effects (Figure 2):

- Erosion – destructive: landslides of slopes from the most exposed area at erosion, collapse, transportation and sedimentation of varying sizes plant debris drawn from areas by the impact of water flow;
- Depositional cumulative effects: accretion processes on alluvial bodies.

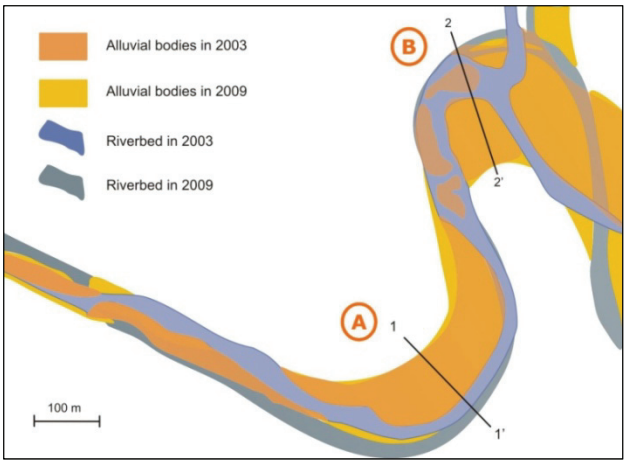

***Figure 2**: Erosional - destructive processes on slopes and accretion processes on the point bar.*

***Figure 1**: Location of the observation points. River channel and alluvial bodies in 2003 and 2009.*

Manifestation of anthropogenic factor

Gravel and sand exploitation had seasonal variations between 2001 and 2004, when a big part of aggregates from the A point bar and from the minor bed were extracted. Consequently, it increased water velocity (and hence its erosional effect on the banks), as well as thalweg position. In this context, the flood from 2005 had a bigger impact through the huge stream flow and solid suspensions, with one positive aspect: recovery of aggregate volumes, with the contribution of upstream material.

Another example of human activities in the area is the conservative adjustment work (simultaneously with extraction of aggregates) at the confluence with a left tributary: carrying out of a debris dam with variable geometry, linearization of the minor bed of tributary river before confluence, moving the point of confluence, point bar surface enlargement in B observation point.

Objectives. Sedimentological features

The main objectives of the research were the study of alluvial bodies, of riverbed slopes and the channel parameters (curvature, width, thalweg position, cross sections, speed flow, suspensions), to establishing the control elements for the process of migration of meanders and changing of environmental conditions, to contribute at the management of associated risk.

The investigation of constitution and stability of banks and the avulsion processes showed the presence of two types of slopes. Those with a height of 5-9 m and having angles of 60 - 80^0 are dug in 2-5 loess - clay levels, overlapping on 1-2 levels debris. The slopes excavated in the old point bar deposits, resulting from the abandonment or anastomosis of old meanders, have 2 - 4 m height and their slope in generally between 40 and 60^0; 1-2 gravely levels from basement are followed by 1-3 clay-silt levels and a coarse debris level, resulting by natural +/- anthropic filling.

Highlighted alluvial bodies are of two types: *point bar*, as representative facies of river in terms of accumulation sandy-gravely volumes, and respectively *longitudinal bar*, as accretion macroforms, parallel to the thalweg and generated by a rapid flow. Regarding the geometry, position and quality of the alluvial bodies, there were no significant differences between the two observation points in the period of study. The only changes were recorded in the volumes of aggregates in the both point bars and a small variation of the granulometry. No changes of qualitative parameters of aggregates before or 2 years after quarrying and a big flood in the area.

Evolution and dynamic of the alluvial bodies

Channel migration is observed even on the other side of the riverbed, with consequences on the dynamics of the slopes on which acts (Persson, L., 2001). Changing the riverbed cross-section was influenced by the magnitude of accretion processes, human works, erosion and channel migration.

When the stream flow was maxim, there were counted the stronger processes of lateral erosion, those that are destructive especially to the minor riverbed geometry. The amplitude of the erosional effects were visible on a small interval of time (3-6 years): sliding of slopes and collapse blocks in the most exposed areas, avulsion processes, transport and sedimentation of variable-sized plant debris and fine material suspensions and lateral accretion processes in the alluvial bodies.

The accretion as a process to increase the volume of a body by adding new particles, determine the sedimentation of alluvium in the convex river bank river, as a result of erosion which he exercised in the concave bank (Figure 2). Thus, stratification of point bar deposits is inclined type and clayey intercalations could appear. The progradation processes were identified in 2003 at the confluence with the main tributary, when the accumulated alluvial bodies cover successively the latest surpassing earlier ones. This process has almost entirely disappeared in 2009 due to human intervention through regulation conservation works.

By the point of view of the dynamic in the main riverbed and its environmental impact, the most spectacular process is the migration of meanders. Although most encountered processes in the plains are the emphasis on meandering (Radoane, M., Radoane, N., 2006), along the studied area occurs the opposite process: river length diminished and the coefficient of sinuosity decreased. Between the multiples causes of migration were identified: processes of erosion of most exposed slopes, transport and sedimentation of detrital fragments in normal alluvial processes, the effect of heavy rain periods, floods.

The study tracked how the migration of meanders changes the morphology of area issues and what impact can have on the inhabited area. The final reason was to identify evolution of the river equilibrium profile and to reduce the consequences of possible floods and their associated effects. To study these processes has been used multiple base mapping, field measurements and observations at different moments (2003, 2007, 2009) which showed numerous changes in the position and shape of meanders (Figure 3) and length of deployment between the same limits.

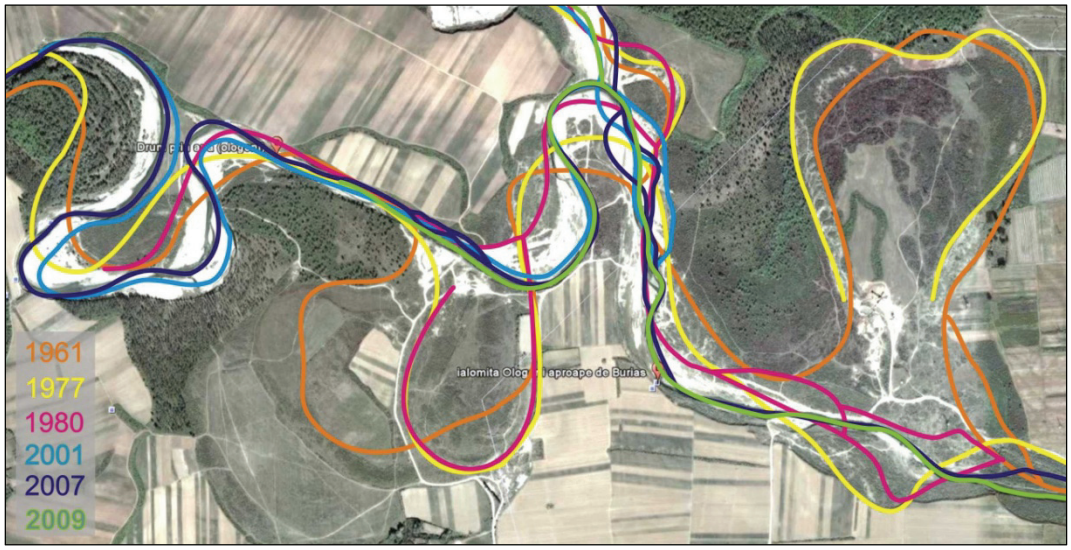

***Figure 3**: Historical evolution of river channel and its traces in the geomorphology.*

Changes can be observed today in morphology and structure of accumulated deposits. The meander from A observation point experienced the sharpest change of shape between 1961 and 1980. The main course is currently taking place in that area from NW to SE, with a strong erosion process of the right river bank. The meander from B observation point migrated from S to N in at least four stages detectable on the topographic – geodesic maps. At least 3 from the preceding items are recognized currently in the morphology of associated point bar. Subsequently, the abandoned area became part of the lower accumulation type terrace.

***Table 1**: The main geometrical parameters of meanders in the last 50 years along the studied area.*

Year	*Meander A*					*Meander B*				
	Wave-length (m)	*Ampli-tude (m)*	*Average radius of curvature (^{0})*	*Minimum distance between the heads of meander (m)*	*Sinuo-sity index*	*Wave-length (m)*	*Ampli-tude (m)*	*Average radius of curvature (^{0})*	*Minimum distance between the heads of meander (m)*	*Sinuo-sity index*
1961	1850	660	225	270	*6.9*	768	274	171	353	*2.2*
1977	1472	594	160	260	*5.7*	930	348	184	380	*2.4*
1980	1485	564	160	196	*7.6*	640	212	144	275	*2.3*
2001	608	219	148	354	*1.7*	590	220	110	272	*2.2*
2007	645	235	164	363	*1.8*	533	192	98	235	*2.3*
2009	660	238	166	374	*1.8*	536	201	102	214	*2.6*

Regarding the environmental consequences and according to observations, topographic / GPS measurements carried out from 2001 to 2010 and data processing, without any anthropic intervention, can predict in the next 35-50 years the both sides of the river erosion in the area have to aggressively pursue. In the studied area, this process will involve the abandon of actual active channel to the confluence with the left tributary, followed by moving the position of the confluence with approx. 300 m downstream.

Conclusion

The results of the field work and laboratory analyses within the specified timeframe of research showed are not significant differences between the qualitative parameters of the aggregates, despite the constant re-working of most river sediment within the system. The downstream migration of the meander appears to be a response to restriction imposed by the armouring of banks affected by natural processes and secondary by the anthropic intervention.

Occurrence of floods cannot be avoided, but they can be managed. The effects can be reduced through measures and actions to decrease the risk associated with these phenomena. Knowledge and responsible management of alluvial processes contributes to maintaining the quality of the environment in areas near settlements.

The main contribution of this scientific work was brought through time analysis and modelling of the river equilibrium profile along the studied area, a relative chronology of deposition and identification of primary formative processes, which allowed the prediction of its evolution in different situations of hazard and risk. The results are useful not only for the local and regional management land use programs, but also in the conservation of the area and the prevention of the triggered processes by natural and anthropic factors.

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Providing a Sustainable Supply Mix of Aggregates: State-of-the-art in South-East Europe

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Abstract: The European SARMa Project focuses on sustainability of both resource extraction (Sustainable Aggregate Resource Management – SARM) and supply (Sustainable Supply Mix – SSM) in South-East Europe – SEE. A specific project action (Work Package 4.2 - SSM) was oriented to the characterization of the state of the art of planning strategies to secure the supply of a mix of aggregate products (primary/extracted and secondary/recycled aggregates, SARMa partnership, 2011) among the Project Partners representative of SEE area. The results of these studies have been presented into the Work Package (WP) 4.2 synthesis report and WP4.2 recommendations documents (Cibin et al. 2011a, b).

In this work, the main results from collected data through SEE countries have been synthesised in terms of common practices in legislation and planning, knowledge framework required, and dissemination strategies. The most significant recommendations from best practices of project case studies have been outlined.

What emerges clearly is a lack of homogeneity at national and transnational level, due mostly to the historical and legislative background of each country. This reflects in the strategies routinely adopted to plan for a future supply of aggregates. The lack of a more "holistic" perspective, both when considering different sources of aggregates and when assessing the impacts of a possible scenario, reduces the possibility to achieve resource efficiency. A more harmonised approach is thus highly desirable, and achievable also by adopting some of the best practices emerged by SARMa project.

Key Words: Primary Aggregates, Secondary Aggregates, Sustainability, Planning, South East Europe

The characterization of the state of the art of planning strategies to secure the supply of a mix of aggregate products - SSM in the SEE area has been prepared from the data collected via an extensive questionnaire, from detailed reports on partners' procedures and data bases, and the best practices from selected project partners that are representative of ten countries. Regional/national approaches to implement SSM have been analysed through seven case studies implemented at two different scales: regional and national. Relevant regional/national legislation, regulations, procedures and their bottlenecks have been studied. This kind of work lays the foundation for more effective management and implementation of legislation, inclusion of aggregates in land use planning, and harmonization of regulations.

Legislation, planning and common management procedures

In every country, a set of laws exists to regulate extraction but not every country in SEE has adopted a national/regional minerals planning policy. The general tendency is to develop such a plan: more than two thirds of the investigated countries have already implemented a precise policy or at least a strategy document. Among the countries missing this kind of document are Romania and, partially, Bosnia-Herzegovina. The Herzegbosnian Canton at the moment has only a federal law for mining in effect, but soon expects to develop a strategy.

Not every country thus forecasts the future demand of aggregates. Where this is calculated, the countries consider many possible uses: industrial, private, building of infrastructure and landscape/environmental remediation. The aggregates demand is calculated on a national basis only in Serbia and Hungary, in all other countries the demand is estimated at regional level. Calculating the national demand is usually a good approach since it gives more space to optimization of resources production. In Austria, Greece and Croatia the demand is calculated at regional level, and in all other countries the demand is calculated on a local basis (county to municipality scale).

When considering the laws governing extraction, in many countries constraints to extraction are defined only by national/sub-national level with the noticeable exception of regulation of *Natura 2000* sites (EU Council Directive 92/43/EEC of 21 May 1992 on the *conservation of natural habitats and of wild fauna and flora* and subsequent emending acts). Laws may pose absolute constraints (forbid any type of extraction) or define special cases when extraction interferes with existing urban setting and environmental or landscape preservation, sometimes requiring harmonisation among different administrative levels.

The major aspect emerging from the evaluation of the data collected is the difference between countries when comparing absolute vs. amendable legal constraints. In Austria, Albania, Italy, and Slovenia the constraints are usually absolute, whereas in Serbia, Hungary, Romania and Herzegbosnian Canton they are usually relative, thus amendable. This discrepancy can lead to significantly different extraction modalities even on adjacent areas, potentially creating areas not subject to all the laws/rules/fees applying in the surrounds.

The aggregate planning policy should then determine which authorities are in charge to develop a plan for future aggregates resources extraction and supply: depending on the rate of decentralisation of each country the planning role is in charge from national agencies to municipalities. According to the questionnaires, historical reasons and fitting to existing normative infrastructure are governing this choice more than size of the country, resource availability or the demand of aggregates. Several countries attribute various level of responsibilities (e.g. at national, regional and local level) in planning for aggregates, including Albania, Austria, and Emilia-Romagna Region (Italy). According to the results, countries with an area < 100.000 km^2 are more inclined to adopt a single national policy. Another aspect of the mineral policy is the authority/board in charge to approve the plan: this depends on many aspects, but in general the approving board is at the same administrative level of the authority in charge of developing the plan.

Aggregates supply plans are effective for not less than 10 year (Emilia-Romagna Region - Italy, and Slovenia), and up to 18 years (Austria), being updated every 3-5 years in almost all countries except Albania where no updates are expected, Croatia (no time limit) and Greece (where an authorisation to extract may expire or may change when new environmental constraints apply to designed excavated areas).

Best practices emerged: some aspects, relevant for SARM and SSM, should be part of any National/Regional Mining Law, including: (a) ensuring resource efficiency, i.e. avoiding waste; (b) guaranteeing a well-mixed supply of primary and secondary aggregates resources; (c) the requirement to use the best technical environmental standards; (d) the adoption of optimal transportation modalities to reduce impacts; (e) funding guarantees for restoration; (f) the consideration of land use planning in permitting procedures; (g) the consideration of aggregates security at a broader level.

In terms of sustainability, each policy and legislation possibility should be realized in order to use secondary resources as much as possible. It should be noted that this is also a matter of recycling market structure and prices. This not only reduces the need for primary resources (i.e. prolongs the availability of natural resources for future generations), but it also reduces landfilling of industrial waste. Therefore, each aggregates supply concept based on land use planning and management should include *appropriate tools, instruments* to increase the use of secondary resources.

Permitting procedures, then, should be efficient and effective. All departments involved should be well connected and united in one department if possible (one-stop-shop approach). Also it is assumed that permitting procedures will be based on land use planning and management at least in terms of the selected aggregates resource priority zones, discussed in the next chapter.

When granting permissions for hard rock quarries a 50-year timescale (i.e. approved aggregates reserves) should typically be considered to secure investments made by the operators. No permissions should be less than 15 years, otherwise the major capital investment cannot be justified. Even in such cases, renewals for similar periods should be anticipated from the outset. For sand & gravel pits, the permission timescale should be 15-50 years depending on the scale of the deposit, with further renewals anticipated, also proportionate to the scale of the deposit.

When granting permissions, the duration of these should always be in line with the lifetime of the deposit: sustainability requires the extraction of the total deposit. In that regard, some concern may arise particularly in terms of non lithified deposits, like sand and gravel extraction, where the environmental impacts reduction practices and good restoration practices require that only a part of the deposit can be extracted.

A remediation strategy, defined during the first phases of development of the planning phase for quarrying, avoids exhausted quarries to become uncontrolled waste disposal sites. To ensure that a restoration plan will be actuated it is necessary then to secure economic resources, e.g. by guarantees or deposits.

To achieve better results on rehabilitation and restoration final disposition, restoration types planned by national, local plans and quarry extraction plans should better fit the environmental context in which they will be realized.

The knowledge framework

Regarding which informative layers are routinely consulted when developing an aggregates management plan, the emerging scenario is quite homogeneous. In all countries, geological and geomorphological maps are collected to estimate resources, location and availability. The geological knowledge, i.e., knowledge of location, quantity and quality of mineral deposits in general, is well known (a good example is provided by Croatian County mining-geology studies). In Austria the lithological information is enriched by details on the quality of materials, and only in Greece and Serbia does the information provide details on the final uses of the aggregates resources.

When a resource is potentially available, to plan for future extractions it is necessary to verify that the designed area can effectively host a quarry. This verification is achieved by two approaches: the first one is to check directly against legal constraints (like in Austria, Croatia, Emilia-Romagna Region, Romania, Serbia), the other is to refer to a more general land-use map (Slovenia) integrated by specific checks on archaeological, environmental and landscape protection requirements.

After a potential site have been identified, the impacts of granting an authorisation to excavation should be evaluated. This is one of the fields that more clearly reflects the heterogeneity of approaches in SEE. Sustainability evaluations are taken into account as suggestions and/or prescriptions when developing a mining plan in Austria, Italy, Serbia and Slovenia. Processing yards can obtain environmental certifications (ISO 9000/ISO 14000) based on specific technical and environmental requirements. In some management plans (like the Emilia-Romagna one) yards compatibility evaluation is also determined by a set of indicators that includes environmental parameters, such as: distance from fluvial habitats and naturalistic defence strips; visual impacts; depuration processes; and distance from inhabited areas. Only a few countries seem to have a common source of environmental information; all the others rely on small area studies or a multiplicity of sources. Among different environmental themes, the commonest is land-use, followed by vegetation and agro-vegetation maps. Habitats and faunal characteristics are neglected. This may be explained by the national role of many partners. Usually complete and detailed environmental information are available only at local scale, whereas land-use is more likely to be available at national scale.

Best practices emerged: It is useful to improve the coordination between permitting procedures/authorities and land use planning management. A coherent aggregates planning policy must be based on relevant data and information: an accurate knowledge framework, combined with Geographic Information Systems (GIS) can contribute to improved efficiency. This is also true when considering the optimization of logistics, the analysis of costs vs. benefits during the planning phase, during sustainability evaluations, and when monitoring quarrying activities.

In some countries aggregates management plans forecast future demand of aggregates and secure aggregates supply. Good examples of such plans are provided by Leibnitz, Deutschlandsberg and Graz areas in Austria, and by Parma Province in Italy. Regarding future demand for aggregates in the concerned regions, it would be important to establish short, medium and long-term aggregates demand and supply (i.e. forecasting) scenarios

taking into account future supply potential including primary and secondary resources. Based on such demand and supply scenarios, aggregates land use supply concepts could be developed (including material flow analyses for different needed application).

A regional land use plan designed for the extraction and protection of mineral resources has to contain a precise planning depiction and a textual statement. The textual statement included in the plan has to define the term "*aggregates resource priority zones*" so that these should be guaranteed, while carefully considering the medium and long term mineral resource demands, and the limited availability of mineral resource deposits.

The determination of "*aggregates resource priority zones*" itself is an encroachment in the basic property right (and thus needs a clarification with the concerned ground owner). It is justified if there is the need of public interest, which is true in the case of aggregates supply/extraction as required for economic development. However it should be clear what quantity and quality and for which application the resource will be needed in the mid-and long term. To justify the designation of an area as "*aggregates resource priority zone*" requires an analysis of aggregates market structure, and a material flow analysis.

Besides that, and based on Austrian experience, it must be mentioned that aggregates extraction also may be permitted outside raw materials priority zones, i.e. in the agriculture zones – if the municipality *agrees*. That will certainly depend on the quality of conflict management between the operator and the municipality (and concerned citizens). However, this possibility is regarded as positive by the local operators; thus, the social component of SSM will be of importance (for instance providing a mediator etc. seems to be useful).

Dissemination of aggregates management plans

One of the main negative factors influencing aggregates extraction is the negative perception of the public opinion (which does not differentiate between legal operator and illegal ones), time consuming processes of licensing, and conflicting regulations.

In almost all countries, the sustainability assessment results are simultaneously presented to inhabitants, environmentalists, industrialists and businessmen, as a draft document or eventually at the end of the evaluation process. Stakeholders can participate in the development of management plans in all countries where such plan exists, but only in a few countries can they impose changes. In Austria, Slovenia, and in some Italian provinces like Parma, stakeholders are informed about the actuation of the management plan, and in the majority of countries they can access the plan anytime (usually upon request). Web publication and presentation seminars are not routinely adopted as communication approaches.

Media coverage of the sector is targeted towards negative practices while positive examples or sustainability assessments can fail to reach a broad part of the population since they are not divulged properly or neglected by media. In general, this happens despite the fact that many companies contribute more to the local communities than they are legally obliged to do, such as co-financing of sports, cultural activities and similar

efforts, as well as maintaining good local community relationships. Another widespread, good practice is to do the extraction in the way that waste is kept to a minimum.

It should be highlighted, however, that most concessioners are reluctant to implement best practice codes when that reduces their profit. This is due to the fact that most companies do not have management vision and do not consult modern management practices. This is reflected also in a lack of investment towards better machinery, and reduction of noise/dust emissions, despite the fact that this is mandatory to avoid financial penalties, issued by the Mining inspectors. In Croatia, Slovenia, and also in many other countries, most producers are ignorant of sustainable practices and environmental conscience: for this reason areas of environmental protection are usually seen as barriers.

Best practices emerged: to increase the social acceptance of sand and gravel pits and quarries a stronger involvement of the communities in the planning and management process should take place at the earliest stage as possible (and during the whole process) both in terms of land use and pit/quarry project management and the restoration plan definition. Only in a few countries are maps of resources, barriers to extraction, and the registry of authorised quarries actively divulged. In many circumstances the documents are freely available upon request, but they are not placed on a website or other public dissemination media. This has a double effect on illegal quarrying: on one side it makes it more difficult to establish new (illegal) extractions on areas with relevant mineral resources, but on the other side it reduces the possibility for citizens to check if an area is authorised or not, and this favours illegal quarrying.

Another best practice is to educate people to sustainable quarrying activities and provide the opportunity to discuss bringing together environmentalists, administrators, aggregates producers and cultural workers. Quarry operators are usually aware that environmental and social attention during extraction is vital for the company's future. Companies today are trying, in general, to practice “Corporate Social Responsibility” on high level. Consequently, business would embrace responsibility for the impact of its activities on the environment, consumers, employees, communities and stakeholders.

Conclusions

Sustainable Aggregate Resource Management and Sustainable Supply Mix require bottom-up best practices for resource efficiency and top-down strategic plans for transnational harmonization of policies and legislation to intersect.

From the collected results emerges a tendency towards the development of national/regional aggregate resources management plans that take in account for social, environmental and economical impacts. The recognised need for a more efficient and sustainable approach gets, however, heterogeneous answers. The cause for the lack of homogeneity can be recognised in the heterogeneity of national laws regulating land use and aggregate resources supply, and in the different approaches adopted. The development of communitarian guidelines, harmonised with existing EU legislation, is therefore highly desirable.

According to the best practices collected, to achieve excellence in sustainable aggregate resource plans it is necessary to develop long-term plans that account for aggregate demand, aggregate availability, and that forecast impacts during the whole life cycle of the products. The final goal is to achieve resource efficiency. From the results it has been recognised also that the actual social involvement in SEE is still inadequate, and should be increased.

These recommendations, combined with the results of the SARMa products like transnational legislation comparison and guidelines will hopefully provide a further step toward the definition of a communitarian approach to aggregate and raw materials management.

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Kosovo Quarry Plan

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Abstract: Kosova is a very important knot in the Balkan geology. In its territory are developed various sedimentary, magmatic and metamorphic formations, while the most remarkable aspects are the Vardari and Gjakove-Rahovec ophiolite formations representing the remnants of two branches of the Tethys oceanic basin. Kosova is distinguished also by the large development of the Oligocene-Miocene magmatism spread at the eastern areas and its particular metallogenic potential. Based on geology conditions, Kosovo disposes of excellent potentials for the development of an extensive construction material industry by, for instance, high quality silicate and carbonate aggregates, volcanic rocks, (quartz) sands, and clays. Alluvial sand and gravel deposits are mainly used as concrete add-on and mostly do not have a large spatial extent. Competent institutions for mining sector in Kosova, Ministry for Economic Development and Independent Commission for Mines and Minerals through mining policies, Quarry Plan of Kosova and Mineral Resources Management Plan are planning to stimulate and develop the mining sector again. The Kosovo Quarry Plan is an excellent base for outlining potential mining sites, and protection of deposits in the frame of spatial plans and mining industry development plans.

Introduction

The term Construction Raw Material is not strongly defined in this paper. Construction raw materials include all kind of hard rocks usable as primary aggregates, as dimension and decorative stones, as raw material for cement, lime and brick construction as well as silica sand. Not included are energy minerals, sulphate rocks, salt, special clays (halloysite, allophane, illite, hormite) and silica raw materials (diatomite, cristobalite and opal, tripoli and siliceous earth).

The Kosovo Quarry Plan, it contains an inventory of the complete surface-mineability construction mineral potential of the Kosovo territory, an inventory of the existing exploitation sites, estimate of minerals demand for the next 10 years and recommendations for further development. This is the best and environmentally mining policy document, which support sustainable mining, processing and use of construction minerals in Kosovo.

Basically, only construction raw materials deposits and occurrences were captured and described, which fulfil state requirements. No omnipresent materials have been taken into consideration, which can be used as mineral mixture or as filling material (e.g. soils, unsorted clays etc.). Additional criteria for the compilation and limitation of a deposit (occurrence) are the minimum thickness of the deposit, the thickness of the overburden and the stripping-ratio respectively, for gravel and sand the content of fines etc.

Special attention was drawn to the sites that were attainable and suitable for the mining of aggregates and other construction minerals. Inhomogeneous units (e.g. Mesozoic flysch sediments, Proluvium, volcanogene-sedimentary formations consisting of ash, tuff,

volcanic rocks, Tertiary interbedding of clay, silt, marl and sand) were excluded. Soft rocks (e.g. serpentinised basic and ultrabasic rocks, slates and schists, deeply weathered rocks) were excluded, too. This is because these rocks are unsuitable for construction or other production purposes that fulfil today's technical and quality requirements.

Functioning of mineral sector in Kosovo and licensing

In September 2010 has entry into force New Law on Mines and Miner Minerals, Nr. 03/L-163. By this Law competent institutions for mineral sector in Kosova are: Ministry for Economic Development and Independent Commission for Mines and Minerals.

Ministries for Economic Development responsibility's are:

- Prepares policies, strategies and legislative framework for mining and mineral sector development in Kosovo, and organizes work on their implementation;
- Promotes mineral resources of Kosovo for research and exploitation;
- Monitor the issuance by the independent mining regulator of licenses and permits for mining activities in Kosovo;
- Supports creation of a favourable environment for private investment in the mining field.

Functions of Independent Commission for Mines and Minerals are:

- Independent Commission for Mines and Minerals is an independent regulatory body responsible for regulating and monitoring the mining industry in Kosovo;
- The issuing, transfer, extension, suspension and revocation of exploration and exploitation licenses and permits;
- The issuing, suspension and revocation of permits and licenses related to the use of explosives in mining operations.

License types for construction minerals are: exploration, retention and exploitation license.

Exploration license for construction minerals is valid for two years and may be extended for an additional two years. There is a maximum area of 250 ha per individual license. Retention license for construction minerals is maximum of one year from expiry of the exploration license.

Exploitation license for construction minerals shall have a maximum term of no more than twenty five (25) years, and may be extendable for an additional term having a maximum duration of twenty five (25) years.

In principle, there are two ways obtaining an exploration/exploitation license in Kosovo: First come, first served and competitive tendering for areas declared as zone of special interest.

Construction raw material potential and estimate of future demand

Calculation of future demand of construction raw materials in Kosovo cannot be done by use of state-of-the-art formulas because of the very weak statistical data for Kosovo and lack of available data for related economic sectors. Hence, estimates are based on assumptions in terms of population / household growth rate, construction / maintenance of new roads and railways according to EU standards, enlargement and rehabilitation of water supply, improvement of urban and rural infrastructure and rehabilitation and new construction of industrial objects, commercial and public buildings. No assumptions were made concerning the use of secondary aggregates (construction and demolition waste, secondary materials) because of the currently low reuse rate and missing data.

The following demands for construction minerals for the next ten years were estimated and are shown in relation to the maximum reserves of deposits (Table 1).

Table 1.

Commodity Group	Demand for next 10 years (Thousand tones)	Geological Reserves with highest Protection Value (Thousand tones)
Silicate Hard Rocks	50,000	14,289,000
Carbonate Hard Rocks	90,000	13,510,000
Gravel and Sand	70,000	233,000
Clay, Kaolin and Bentonite	20,000	939,000

Although Kosovo's deposits are modest by global standards, they enjoy a competitive advantage in being close to Western Europe with relatively low transport costs to markets. Below we are giving some data for each commodity.

Silicate Hard Rocks

According to the exploitation licenses issued, the estimated percent age of silicate hard rocks used as ballast, grit etc., and as dimension stones is much less than that of carbonate hard rocks and less than that of gravel and sand. Based on the assumption that larger infrastructure measures like construction of the motorway and rehabilitation of the main railway track, the estimates for ten years demand will be 50 million tones.

More than the half of the silicate hard rocks is estimated to be mined as high quality crushed rock (35 million tonnes). The low quality serpentinite which is currently mined in large amounts will not be accepted as road construction material in accordance with European standards.

The estimated geological reserves of silicate hard rocks with the highest Protection Value are about 14,289 million tonnes. Even when we consider the fact, that only ten percent of these reserves can be used for the foreseen purposes, there will be enough silicate hard rocks for the next 285 years.

Nevertheless it has to be mentioned that at present the licensed deposits (approved and active licences) do not cover the estimated demand for (higher quality) silicate hard rocks for the next 10 years. For the time being some demand can be substituted by

carbonate hard rocks, but relevant measures will have to be taken in the short to medium term.

Carbonate Hard Rocks

It is estimated that about 45 % of mined primary aggregates are carbonate hard rocks. This estimate is based on the number of active and approved licenses, available deposits and used techniques for mining.

The estimated geological reserves of carbonate hard rocks with the highest Protection Value are about 13,510 million tonnes. When we consider the fact, that only one quarter of these reserve can be used for the foreseen purposes, there will be enough carbonate hard rocks for the next 375 years.

Gravel and Sand

About one third of mined primary aggregates are estimated to be gravel and sand. This estimate is based on the number of active and approved licenses, available deposits mining techniques. It has to be mentioned, that as a result of limited reserves, cobble and boulders, which have as yet hardly been used, will have to be mined using crushers in future.

Based on the known assumptions, 70 million tones of gravel and sand can be estimated as demand for next ten years.

The estimated geological reserves of gravel and sand with the highest Protection Value are about 233 million tonnes. Because of some differences between aggregate and hard rock deposit geometry and exploration techniques, more than 60 percent of the estimated reserves seem to be mineable in practice. Considering this fact, the available reserves will only last for about 20 years.

At the end of this decade, gravel and sand deposits will therefore have to be substituted by silicate and carbonate hard rocks.

Clay

According to both estimates, the demand for clay, including bentonite and kaolin, will be about 20 million tonnes for next 10 years. The annual demand is mainly based on household growth within the next 10 years.

The estimated geological reserves of clay, bentonite and kaolin with the highest Protection Value are about 939 million tonnes. When we proceed on the assumption, that about two thirds of the estimated reserves can be used for brick making and other relevant purposes, the available reserves will last for the next 300 years.

Substitution

According to European standards, on the one hand a maximum of about 70 % of mineral construction materials used in civil engineering can be substituted by recycled raw

materials, on the other hand a maximum of about 90 % of mineral construction residuals that accrue from civil engineering can be processed to secondary (recycled) raw materials.

Because of the fact, that firstly there isn't any data available concerning the reuse of secondary aggregates in Kosovo and secondly at present all construction waste is illegally dumped along roads and pathways everywhere in Kosovo, no estimates concerning the reuse of secondary, recycled and renewable raw materials is made.

Conclusions and recommendations

The Environmentally Kosovo Quarry Plan presents a comprehensive inventory of the construction raw materials of Kosova. All non-blocked deposits were evaluated and assessed to identify the most prospective and worth of protection deposits. Together with the construction minerals demand and analysis, a strategy for Kosovo's construction mineral supply can be given for the frame of one decade. This report summarizes all relevant available data on construction minerals, the construction mineral demand and base planning data.

Within the frame of the Kosovo Quarry Plan, construction minerals of high quality and mineability were identified as follows:

- Within the group of silicate hard rocks, gabbros and ophiolitic rocks were identified as high quality aggregates. They meet the requirements for the production of the railroad ballast. Well suited for engineering construction purposes are fine grained gneisses, as well as andesites and quartzites. At the moment, these rock types are only mined in a limited amount.
- Recrystallised limestones and marbles are also a source of high quality aggregates. Currently, they are of fundamental importance for the aggregate supply of Kosovo.
- Material from alluvial sand and gravel deposits is mainly used as concrete add-on. Beside some Pliocene sands, which can be utilized for the production of lime silica bricks, high quality sand and gravel deposits do not exist. Furthermore, the gravel deposits are of low thickness and size and often blocked by other land use purposes.
- Pliocene clay occurs widespread and in large deposits. Currently, the material is used only for brickmaking. Potentially, these clays can also be used for the production of roof and floor tiles and as landfill sealing material.
- Based on the results of the KQP project, the following is recommended:
- Continuation of the exploitation site data capture,
- Continuation of implementation of certifications and quality control of the exploited material according to European standards.
- Focusing of exploration activities on large-scale construction raw material occurrences of high mineability values that could satisfy Kosovo's demand for further decades and not only in short-term.

- Intensification of measures to prevent and stop environmental damage by illegal operations.
- Expansion of mineral industry to meet the demands of the neighbouring countries (strengthening of the export potential of Kosovo).
- Definition of Mineral Protection Areas, protection especially of the high class deposits against blocking by other land use.
- Implementation of the Kosovo Quarry Plan results into spatial plans and mining industry development plans.
- Use and expansion of the GEO- Database Kosovo as the only instrument for data capture of all economic geological and mining related data.

Because of strong construction activities in Kosovo and the (potentially) growing demand in the neighbouring countries, the development of the construction mineral industry can have an important initial effect on the economy of Kosovo as a whole.

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SWOT Analysis as a tool in the C&D debris management after catastrophic events

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Abstract: Disasters usually create an emergency situation requiring immediate policies for the recovery and rebuilding process of the areas hit by the problem. In these circumstances, the demand for construction minerals increases, leading to an intensification of quarrying activity according to extraordinary procedures notwithstanding current regulations in place at any given time.

This work aims to highlight the effects that catastrophic events, and in particular earthquakes, may produce on both the built environment - i.e. the totality of urban and suburban settlements and infrastructure - and the natural environment. In fact, both of them are often compromised by hasty emergency procedures which rely heavily on mineral extraction.

In such context, firstly the recycling of earthquake debris and secondly an accurate evaluation of the demand for minerals are some proposed solutions. This way, landfill disposal could be reduced and natural resources required for reconstruction saved.

In order to reach these objectives a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis is suggested. Evaluating strengths, weaknesses, opportunities and threats for the use of natural aggregates (NA) or for the use of recycled aggregates (RA) coming from earthquake debris in the rebuilding process allows for a more accurate situation assessment and for decision making which might have greater impact on the territory.

In conclusion, some recommendations are prescribed in order to plan the quantities of building materials needed for the reconstruction of the area and to orient the post-earthquake policies towards greater environmental protection.

Key Words: Recycling, Aggregates, Construction and Demolition Waste, Earthquake, Reconstruction

Introduction

Earthquakes cause extensive damage, often exacerbated by both geomorphological conformation and incorrect use of the territory, characterized by a concentration of urban settlements that exceeds regulated limits. In this context, the procedures for post-seismic reconstruction, i.e. the removal of debris, the demolition of unsafe buildings, and their reconstruction, show an inexorable increase in the demand for construction minerals, in particular, for aggregates (sand, gravel and crushed stone). Common uses of aggregates are road filling, railway ballast or armour stones; alternatively they can be used in the production of glass (quartz sands), ready-mixed concrete (made of 80% aggregates), pre-cast products, asphalt (made of 95% aggregates), etc. (UEPG, European Aggregates

Association). Such structures are all examples of the urban and suburban settlement and infrastructure usually needed to rebuild an area after a seismic event.

However, this extraordinary demand for building materials can be covered by recycling, thus reducing the extraction of natural minerals. More and more countries are investing in the recycling of Construction and Demolition (C&D) waste: for example, the Netherlands and Japan recover almost all the concrete from their construction waste; in 2007 Germany recycled 89.2% of C&D waste (Spies, 2009). During the years 2005, 2006 and 2008 nearly 6% of the demand in the EU was covered by recycled aggregates (UEPG). Despite this, there are still too many European States in which C&D waste is rarely reused, while by an extensive use of recycled aggregates (RA), greater environmental protection could be attained thus reducing the extraction of natural aggregates (NA). In order to reach this objective, even the debris coming from catastrophic events may become a resource. This work aims to investigate how the emergency could be managed in order to mitigate the potential damage caused by a seismic event and the subsequent reconstruction. Therefore, the recycling potential of the debris resulting from earthquakes through the use of RA against NA has been assessed by means of a SWOT analysis, in order to identify the actions needed for the reconstruction process aimed at enhancing environmental safeguard.

Italian earthquake case studies

The first case study concerns the earthquake that struck a zone between Umbria and Marche on 26 September 1997, which gave rise to a good management of the debris. Since 1987, a policy of recycling C&D waste has been implemented by the Regional Government with the Plan for waste management which focuses on the recovery of "mixed waste resulting from demolition". This allowed speedy reconstruction policies, which were launched with the Umbria Regional Directive on "Removal of debris, demolition of buildings and materials recovery" (1998). This defined the role of the local authorities and set as targets both the control of the number of demolitions and the re-use of debris. Moreover, each municipality has since been obliged to re-use at least 50% of the materials recycled from the earthquake debris in the reconstruction of public and/or private civil works.

An initial methodological assessment of the types of buildings in the Umbria region (masonry buildings, typical of medieval city centres) was carried out, and considering that for each building the amount of debris expected from normal demolition operations is 20-25% of the volume of the whole building (estimated at 700-750 cubic metres), an average of 300 cubic metres of debris for each building was defined, obtaining a total of 474,000 cubic metres. In total, earthquake debris was 903,000 cubic metres because 429,000 cubic metres deriving from the reconstruction of the destroyed buildings were added to the amount of aggregates obtained from earthquake debris.

Many recycling activities were undertaken and led 3 years after the earthquake (31 December 2001), to the production of 189,362 cubic metres/year of recycled aggregates. From this amount, 103,333 cubic metres/year or 55% of the total were sold. The recovery rate of the debris conferred consisting of inert materials and iron ranged between 96% and 98% (Valentini, Umbria Region, 2002).

The second case study concerns the recent earthquake which shook the Abruzzo region on 6 April 2009. Decree No. 39 of 2009, the so-called "Abruzzo Decree" gave the delegated Commissioner the responsibility to identify the areas where new houses, infrastructure and services should be built, and to oversee their construction. The objective was to ensure rapid implementation of emergency measures.

According to Fusero (2010), after the reconstruction activity, the built area in the zone considered increased either in previously unbuildable areas (because of landscape and historical-architectural constraints), or in agricultural zones (reduced buildability).

The provisions for the management of the waste resulting from the collapse and the demolition of buildings were set by the Abruzzo Decree; this combines municipal waste and debris into one category while they are normally considered two different ones.

Although the local municipalities were obliged to deal with waste and debris removal, collection, transportation, recovery and disposal, they could not proceed as planned because they lacked the necessary technical and economic resources. Thus, there is still uncertainty about the quantification of debris and in their removal. On 1 February 2010 the criterion of "solidarity redistribution", which identified debris storage sites in neighbouring territories was proposed to the mayors in the area. Furthermore, the terms of the quantification and the treatment of the debris was agreed in collaboration with the University of L'Aquila and scheduled to be completed in 24 months.

Application of the SWOT technique and discussion

Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was originally created to support the development of effective business strategies. Hill and Westbrook (1997) traced back SWOT analysis to the work of business policy academics at Harvard Business School and other American business schools from the 1960s. In particular, according to Andrews (1971; 1980), good SWOT should take into account a two-fold perspective: the external context (threats and opportunities) and the internal characteristics of an organisation (strengths and weaknesses). Although currently there are numerous approaches to SWOT analysis, they generally maintain a clear distinction between external and internal factors. It is important to remember that since strengths and weaknesses are internal factors, they can be modified by the strategy adopted, while threats and opportunities can not be changed because they are external forces.

Lately, this decision-support system has been extended from the field of business management to public intervention strategies and to town planning. For instance, SWOT analyses are included in the regulations of the European Commission for strategic regional planning: within the regional development environment SWOT analyses are intended to highlight those predominant factors, both external and internal, which may influence the success of a project, and link the project to its environment (European Commission 1999: 42).

Review of literature on the subject (Hill and Westbrook, 1997; Storti, 2003; Nikolaou and Evangelinos, 2010) suggests that there is still a lack of rigour in the SWOT approach which can lead to some flaws such as its unpredictability related to external factors, its overly simplistic nature and its subjectivity. On the other hand, the SWOT tool allows for

some important advantages: first of all, it is easy to implement without the need for external technical support, secondly it provides the analysis of external contexts and the delineation of development strategies.

Table 1: SWOT analysis.

NA use	*internal*	**STRENGTHS**	**WEAKNESSES**
		- production of high-quality natural aggregates	- high environmental impacts due to the extraordinary demand of natural resources
			- opening of new quarries
	external	**THREATS**	**OPPORTUNITIES**
		- need for additional landfill to dispose of earthquake debris	- quick production of materials needed for reconstruction

NA/RA combined use	*internal*	**STRENGTHS**	**WEAKNESSES**
		- avoided quarry production	- recycling plants often not yet present in the territory affected
		- avoided opening of new quarries	- lengthy process: necessary preventive selection and treatment of the debris instead of faster landfill
		- mitigated environmental impacts of reconstruction activities	- production of RA of varying quality, often too poor, usable only for road filling, since the achievement of high quality aggregates could be compromised by the difficult separation of unwanted fractions and non-recyclable materials
		- limited landfill disposal of earthquake debris	
	external	**THREATS**	**OPPORTUNITIES**
		- slow procedures to identify appropriate location of the sites for recycling facilities	- part of the materials needed for the recovery and rebuilding process directly present in the territory shaken by the earthquake
		- slow construction of recycling facilities	- opportunity to create new businesses which can generate employment
		- possible increase of delivery distances	
		- possible increasing of transport costs	

On the strength of these considerations, and taking into account the good practice of the Umbria Region, a SWOT analysis, reported in Table 1, has been undertaken. The purpose of this analysis is to highlight the actions for the reconstruction process after the earthquakes oriented towards greater environmental sustainability. In particular the specific objective is to make a comparison and assess the opportunities between a recovery and rebuilding process totally based on the use of NA or based on the use of both NA and RA. In fact, a joint utilisation of natural and recycled resources is worthwhile, especially if RA are employed for the production of concrete, glass and other high-quality construction materials. RA which comes from earthquake debris however can translate into reduced quality of recycled products due to the presence of elements such as rubber, plastic or other non-recyclable or even dangerous materials such as asbestos that cannot be taken out before reuse.

However, RA and NA for the reconstruction process are not in competition, in fact, their combination could become a resource in the context of the extraordinary demand for building minerals after a disaster.

Conclusions

Earthquake debris can turn into a valuable resource if they become part of recycling schemes. The large amounts of building materials needed by the reconstruction process may cause heavy environmental impacts. The outcome of the SWOT analysis is that the re-use of the debris can contrast these impacts and allow greater environmental sustainability.

Thanks to this method, relevant economic and environmental advantages of recycling earthquake debris have been identified and highlighted. In particular, as for the internal parameters, the SWOT analysis showed the following:

- Strengths: the environmental advantages of using a combination of NA and RA are presented. The exploitation of natural resources would be prevented and improved control of landfill disposal of debris would be possible.
- Weaknesses: while through NA the production of high quality building materials is guaranteed, the quality of RA coming from a recycling plant can vary depending on a number of factors such as the methods of collection, whether or not the separation of unwanted fractions has been done, and the type and features of the plant (stationary, with higher level technologies, semi-mobile and mobile).

As far as external parameters are concerned, the following issues were identified:

- Threats: the joint utilisation of NA and RA presents some risks with reference to the slowness of the procedures to locate the appropriate sites and to build the recycling facilities needed to treat the extraordinary amounts of waste; in addition, delivery distances and consequent transport costs could be a further risk which may invalidate the environmental and economic worthiness of the process.
- Opportunities: if recycling is implemented, in addition to the environmental benefits, earthquake debris can be reused and a good proportion of the materials needed for the recovery and rebuilding process can be found directly in the territory stricken by the disaster. Moreover, there would be a chance to create new businesses and employment for the community affected.

In conclusion, with reference to the case study of the Abruzzo earthquake, the RA coming from the debris could directly be re-used in the reconstruction process. Otherwise, the RA could be used to satisfy the ordinary annual demand for aggregates in the Abruzzo region, estimated as 4 cubic metres/inhabitant (Guida all'industria estrattiva ed al riciclaggio, 2006).

This project will go on to investigate on the feasibility of the application of the Life Cycle Assessment (LCA) methodology to the recycling of the debris coming from disasters. According to ISO 14040-44 (ISO 14040, 2006; ISO 14044, 2006), this methodology can be useful to evaluate the environmental impacts of using recycled resources rather than natural resources in the reconstruction process. This also takes into account those environmental impacts caused by the recycling facilities and those caused by delivery distances and therefore the environmental transport costs.

Acknowledgment

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The Aggregates Sector in the Context of Future of European Funding Systems

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Abstract: The aggregates sector represents the biggest non-energy extractive industry sector in Europe. However, its recognition when it comes to public funding of necessary R&D activities is limited. This situation needs improvements. In the light of the upcoming new funding programme of the European Commission Horizon 2020 and the European Innovation Partnership on Non-Energy Raw Materials for a Modern Society as well as in the context of the activities of the European Technology Platform on Sustainable Mineral Resources, the aggregates sector must find its position in order to meet the future challenges.

Key Words: Aggregates, Research, Policies, Funding

Introduction

The aggregates sector represents the biggest non-energy extractive industry sector in Europe. Aggregates are crushed rock, sand and gravel, used to construct Europe's essential infrastructure including homes, roads, railways, schools and hospitals. Some 3 billion tonnes per year of aggregates are produced by 17,000 companies (the majority of which are SMEs) on 24,000 extraction sites, providing jobs for more than 300,000 direct and indirect employees. These impressive figures clearly show the importance of the aggregates sector in and for Europe.

Via UEPG, the European Aggregates Association, the sector has actively participated in the European Commission's Raw Materials Initiative (RMI) right from its conception as well as in other Europe-based initiatives. In this context, UEPG has positively contributed to the two Working Groups on Criticality and Land-Use Planning. Unfortunately, the new draft EC Communication shows a high degree of dilution in the focus on Raw Materials and specifically on aggregates. Therefore, in order to refocus high-level political attention at EC and national levels on the necessity of access to Raw Material resources, the sector is calling for:

- Good future local access to aggregate resources
- Prioritised access to resources in minerals planning
- Simplified planning and permitting processes
- Recognition of the compatibility of extractive activities and environmental protection
- Removal of inappropriate barriers to recycling

The following paragraphs will discuss about future European funding systems and their ability to provide support to problem solving.

The European Technology Platform on Sustainable Mineral Resources – ETP SMR

The European Technology Platform on Sustainable Mineral Resources (ETP SMR) established in 2005 and officially recognised in September 2008 unites many stakeholders from mining industry, the research community, regulators, consumers and civil society around the major technological challenges to the sector, in order to jointly act towards a common vision.

ETP SMR is to cooperate with appropriate DG's of the European Commission and support the EU Raw Materials Initiative and its main activities. The main topics are as follows :

1. Defining and establishing critical raw materials base for European industry from EU and non-EU sources;
2. Promote skills and focused research on innovative exploration and extraction technologies, recycling, materials substitution and resource efficiency;
3. Increase resource efficiency and foster substitution of raw materials;
4. Promote recycling and facilitate the use of secondary raw materials in the EU.

The main strategic objectives of the ETP SMR are to promote skills and focused research on innovative exploration, extraction technologies, recycling and materials substitution. Further to that the platform is committed to increase resource efficiency and foster substitution of raw materials as well as to promote recycling and facilitate the use of secondary raw materials in the EU. The work within the ETP SMR is organized in Focus Areas dedicated to the particular objectives.

Since the beginning of 2006 ETP SMR has discussed the Strategic Research Priorities with the European Commission in the drafting process of the first call of FP7. The Platform was successful in getting the Strategic Research Priorities into the 2008 Nanosciences, Nanotechnologies, Materials and New Production Technologies work programme and got the approval of ProMine project. Just recently, the IntelliMine project was approved that answered the related 2010 call. Now ETP SMR is going to be successful in getting the Strategic Research Priorities into the final calls until the end of FP7 in 2013.

The Strategic Research Priorities identified in the frame of the ETP SMR are covering aggregates as an integral part of mineral raw materials. Therefore, the priorities are also supporting the research needs of the aggregates sector. Through involvement of e.g. UEPG in the work of the ETP SMR, the specific research needs of the aggregates sector are always on the agenda in Europe. The ETP SMR is a good vehicle to transport specific research needs and feed them into the European pipeline.

The possible European Innovation Partnership: Non-Energy Raw Materials for a Modern Society

In March 2010, the European Commission launched its "Europe 2020" strategy for smart, sustainable and inclusive growths. This is now Europe's main strategy for generating growth and jobs, backed by the European Parliament and the European Council.

Parts of this strategy are seven so-call flagship initiatives, one of which is called "A Resource-Efficient Europe", where raw materials are part. This flagship initiative aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy. It sets out a framework to help ensure that long-term strategies in areas such as energy, climate change, research and innovation, industry, transport, and environment policy produce results on resource efficiency. As a concrete measure to contribute to this strategy, the Commission proposed the European Innovation Partnership (EIP): Non-Energy Raw Materials for a Modern Society.

European Innovation Partnerships are a new way of bringing together public and private actors at EU, national and regional level to tackle the big challenges we face. There is already one EIP approved on active and healthy ageing. This EIP is a kind of pilot case for EIPs in general. The EIP on raw materials is one of six other EIPs that are currently under preparation. The European Parliament and Council will decide around summer 2011 about their acceptance.

Objective

The main objective of the EIP "Non-Energy Raw Materials for a Modern Society" will be by 2020 to have in place innovative technological solutions and/or appropriate mechanisms and instruments that contribute to a higher security of supply and a more efficient and sustainable management of non-energy materials in Europe while increasing resource efficiency in the EU, and developing new European based recycling activities. Ten innovative pilot plants for raw materials extraction and processing and recycling, and to find substitutes for at least three key applications of critical raw materials shall therefore be in operation by 2010. A raw material dialogue at international level will be up and running.

Cross-sector collaboration

Several existing tools on the European scene will collaborate for realising the objectives: European Technology Platforms (ETP) such as Sustainable Minerals Resources, Artemis, Manufuture, SusChem, Forest-Based Industries, ECTP, EUROP and EuMaT; Public Private Partnerships such as Factories of the Future on enabling manufacturing technologies; Energy-efficient Buildings, Green Cars; Ecolabelling, Eco-design and Green Public Procurement; European and joint national research within FP7 with dedicated calls for research for the substitution of critical raw materials and an ERA-NET on industrial handling of raw materials, TIC; GMES (Global Monitoring for Environment and Security) and its environmental information services, with European component and global component (in particular Africa); GALILEO and EGNOS applications and extension to Africa and Middle East.

Further to that, research funding schemes will complement the activities, such as FP7 until 2013 and FP8 (Horizon 2020) from 2013 onwards, SME orientated CIP and Public procurement, ESFRI for further developments of European Geological Survey infrastructure towards a pan-European research and innovation infrastructure, multidisciplinary marine research projects and ENRTP (Thematic Programme for the Sustainable Management of

Natural Resources), COST, ERA-NET and ETPs for networking, LIFE+ for environmental issues.

Intended implementation

The collaboration will concentrate on five building blocks for implementing the partnership:

- Developing new innovative technologies and solutions for sustainable raw materials supply
- Innovative technologies along the entire value chain for cost effective, safe and environmentally and socially sound raw materials exploration, extraction (including mining), processing, recovering and recycling of primary and secondary raw materials, e.g. from mining waste.
- Developing new innovative technologies and solutions for the substitution of critical materials.
- Achieving solutions to reduce the use of or finding substitutes of critical, scare or hazardous materials.
- Improving Europe's raw materials knowledge and infrastructure base.
- Building an innovative knowledge base of European resources, including exploration of primary and secondary raw materials (on land and in the marine environment) and estimations of the resource including urban mines.
- Improving the regulatory framework via promotion of excellence and promoting recycling through public procurement and private initiatives.
- Streamlining the non-technological driven aspects of resource efficiency along the entire value chain, including materials flows, collecting, sorting and re-delivering raw materials to increase the recycling and by-product rate of raw materials also while in trace amounts and boost the overall recycling rate.
- International cooperation
- Dealing with horizontal aspects with regards to the international dimension and regulatory frame work of all four WP mentioned, including cooperative efforts in research, trade, environmental and development aspects

Governance of the Partnership

The Partnership will be steered by a High-Level Steering Group and underpinned by an Expert Group. Possible members for the High-Level Steering Group could be Vice President Commissioner for Industry and Entrepreneurship (chair), and Commissioner for the Environment and Commissioner for Research and Innovation will be associated; 6 Ministers in total (2 for each of the domains Industry/Economy, Environment and Research); 10 CEO´s of major European Industries (mining and materials producers including chemical, and mechanical engineering and waste management industries) EIB and EIF high-level representative; NGO high-level representative (e.g. EEB, EITI); 5 high-level representative

of research organisations (e.g. coordinator of ERA-NET, Director General of EuroGeoSurvey, Director-General of the European Space Agency). 2 MEP's.

The High-Level Steering Group will prepare a multi-annual roadmap 2011-2020. An Expert Group that will prepare the Partnership meetings and coordinate the milestone details among the stakeholders will support the High-Level Steering Group.

A broader Stakeholders' Forum will be called to meet once a year to assess the work done by the Partnership and to provide inputs for the continuation of the activities. With ERA-NET and ETP-SMR, the SCP and waste consultations groups the EU have already set up the right fora to provide continuity among stakeholders and the steering group.

Financing the Partnership

Financial support to research via the EU Framework Programme(s) is decided with separate acts. Under NMP theme within the FP7 for the period of 2007-2013 €, calls for proposals are expected with regard to: i) networking at MS level ii) developing new technologies for clean intelligent mining activities, iii) eco-design for new products and eco-efficient and cost-effective method of production and iv) finding substitutes for some critical raw materials. SMEs are also supported via the research for the benefit of SMEs programme6 of the FP7. The timeframe 2014 to 2020 would be covered by FP8 (Horizon 2020) which could address some of the specific milestones.

Apart from this ‘big’ funding source, a couple of other means for financial support are and will be available for financing different necessary activities in the frame of the EIP.

Benefits

The minerals sector, which of course includes the aggregates, can largely benefit from the EIP initiative. The major issue is that topics dedicated to mining and mineral raw materials will be at the heart of the upcoming public research agendas. This will give a lot of opportunities to launch projects and other initiatives. Raw materials are now one of the core parts of European policies. The minerals sector will benefit from that.

Horizon 2020

Horizon 2020 - the proposed Framework Programme for Research and Innovation, will be introduced post-2013 and build upon the successes of the current Framework Programme for Research (FP7), the Competitiveness and Innovation Framework Programme (CIP) and the European Institute of Innovation and Technology (EIT).

The ultimate aim is to maximise the contribution of EU funded research and innovation to sustainable growth and jobs and to tackling the grand challenges facing Europe – for example climate change, resource efficiency, energy and food security, health and our ageing population.

This will be achieved by creating a coherent set of instruments, along the whole "innovation chain" starting from basic research, culminating in bringing innovative products

and services to market; and also to support non-technological innovation, for example in design and marketing.

Horizon 2020 is currently under public consultations. Several thematic workshops have taken place in order to allow stakeholders to provide their views and expectations. It is important to notice that the topics raw material supply and resource efficiency are right in the heart of the envisaged programme.

This simply means that the minerals sector including aggregates will have funding opportunities also from 2014 onwards. Together with a hopefully running Innovation Partnership on Non-Energy Raw Materials for a Modern Society, funding of necessary research activities seems to be secured at least until 2020.

Conclusions

The aggregates sector is one of the most important providers of non-energy raw materials for the European economy. Further to that, the sector contributed significantly in the process of the establishment of the current European Raw Materials policy. However, when it comes to funding of pressing research needs of the sector, the success was limited.

In the light of the described future funding regimes and instruments, it is vital for the sector to continue the engagement to influence dedicated research programmes. One promising way could be the active participation in the frame of the ETP SMR. This ensures that the research topics important for the sector will be visible on the European research agenda, although sometimes hidden behind general phrases.

The aggregates sector can be successful in acquiring European research grants if e.g. UEPG continues to be present on the European research level. Related efforts are worth it because the sector is important enough for the European society.

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Managing Aggregates Supply in England

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Abstract: Aggregates are essential for our economic well being and quality of life. They underpin a key sector of the economy, the construction industry, which requires adequate and steady supplies over the long term. Large quantities are essential to the delivery of affordable housing, and major regeneration and construction projects, such as the 2012 Olympics, the renewal of power generation capacity and stronger flood and coastal defences. Currently England provides well over 90 per cent of its own primary aggregates needs (which were 109 million tonnes in 2009).

In a small country such as England, with one of the highest population densities in the world, competing pressures on land make it increasingly difficult for the aggregates industry to find environmentally acceptable sites to work. Further, land-based resources of aggregates are unevenly distributed with a resulting regional imbalance between supplying areas (resource-rich) and the areas of greatest demand which are generally resource-poor. For more than 30 years the imbalances in supply and demand have been addressed through a system of managed aggregates supply.

National mineral planning policy promotes the use, where practicable, of alternative (secondary and recycled) aggregates in preference to primary aggregates; encourages the supply of marine-dredged sand and gravel; and makes provision for the remainder of supply to be met from land-won sand and gravel and crushed rock. The managed aggregate supply system assists with the delivery of these objectives. It focuses on supplies of land-won aggregates to ensure that mineral planning policies at the local level reflect the need for meeting demand in the resource-deficient areas.

This paper describes the current aggregate supply mix in England, how the managed aggregates supply system is implemented via national and local minerals planning policy, why monitoring aggregates supply is critical both to the supply system and to informing future planning policy, and current uncertainty over the future of the system.

Introduction

Aggregates play a key role in creating, maintaining and enhancing our built environment and the infrastructure on which society and our quality of life so depends. They are fundamental to the very fabric of homes, roads, hospitals and schools. Without aggregates we would be able to build very little; they are essential raw materials for the construction industry.

The construction industry is an important sector of the UK economy. Its products underpin almost all economic and social activity. Adequate supplies of aggregates are essential to the delivery of affordable housing, and major regeneration and construction projects, such as the 2012 Olympics, the renewal of power generation capacity and stronger flood and coastal defences.

The amount of aggregates required each year by society and the economy is very large, both for new construction and maintenance of the built environment. Prior to the global economic downturn, typically 216 million tonnes of aggregates, of all types, were consumed in England each year. This had reduced by over 30% by 2009 to around 145 million tonnes (Figure 1). England still, however, provides well over 90 per cent of its primary aggregates needs. A range of sources contributes to annual supply. For recycled and secondary aggregates, maximising their use is a key objective of national minerals policy and supply from these sources has increased significantly in the last decade to around 25 per cent of total supply. However, these alternative sources of aggregates are neither sufficient in quantity nor of adequate quality to meet all demand, and the limits of suitable available material are being approached.

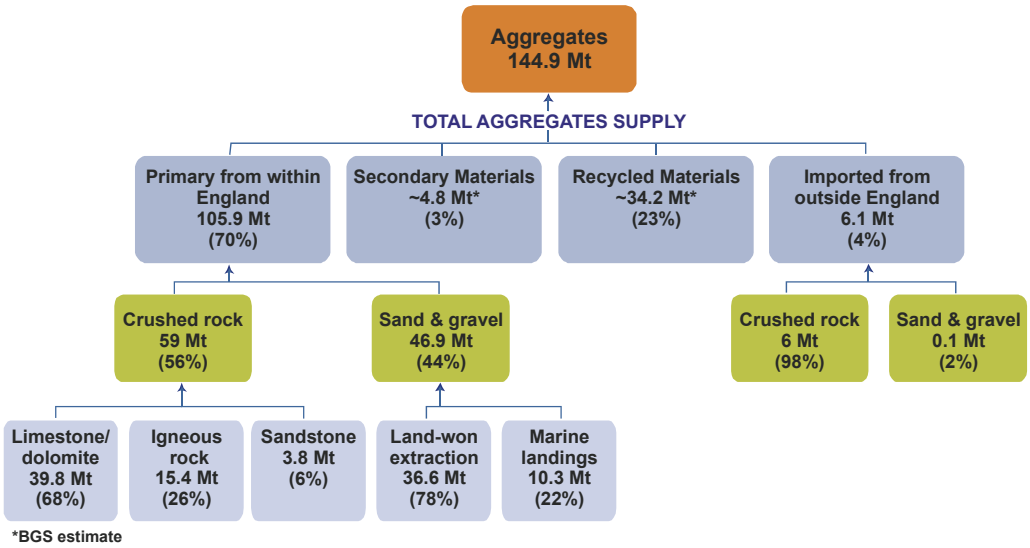
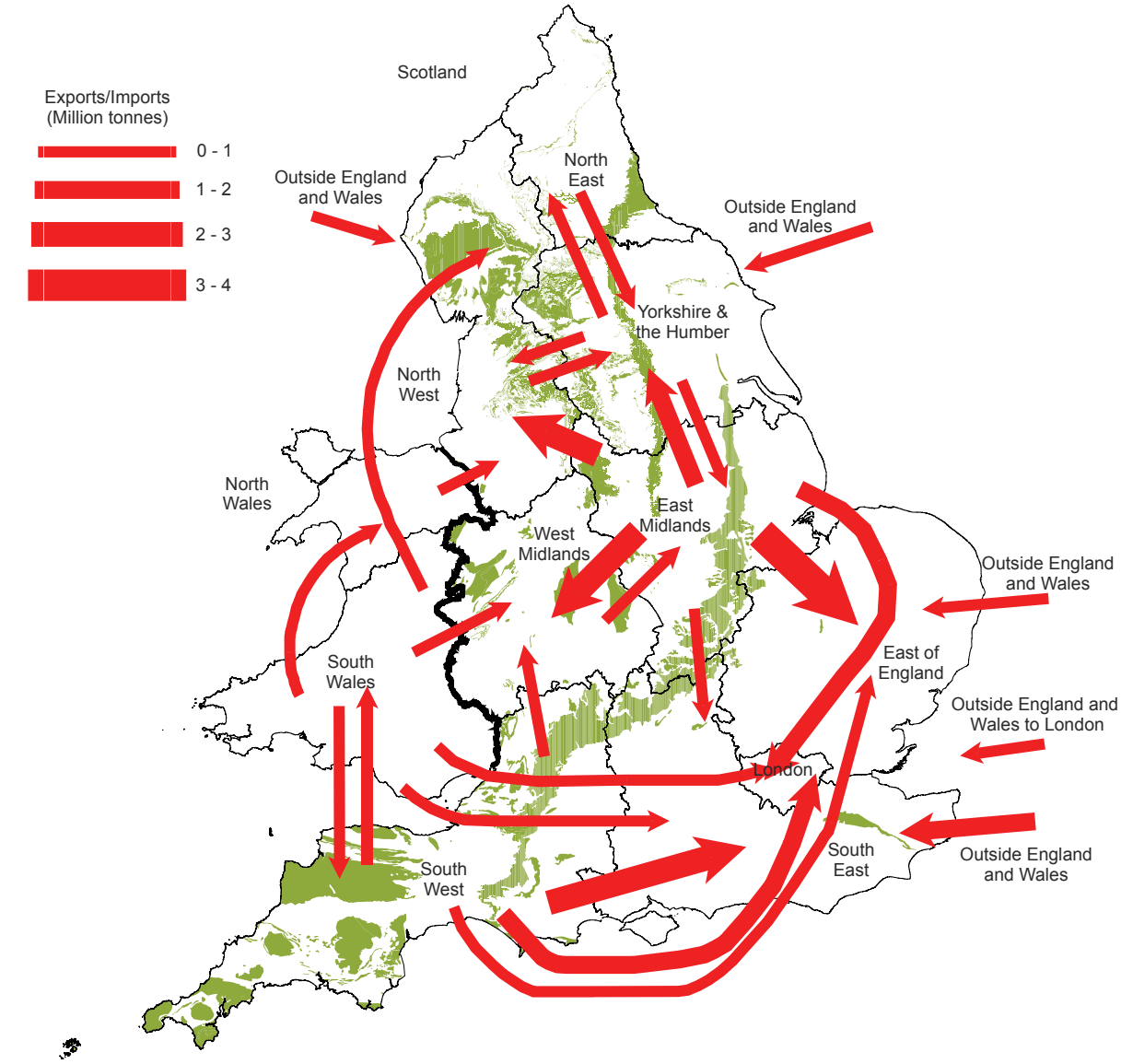


***Figure 1**: Aggregates supply chain in England, 2009. Source Mankelow et al. (2011).*

There are large resources of primary aggregates in England, but deposits are unevenly distributed. For example, the hard strong rocks from which crushed rock aggregate is produced form the uplands in northern and western England because they are more resistant to erosion (Figure 2). In contrast, southern and eastern England, where demand for aggregates is high, are more low-lying and essentially devoid of hard rock resources. Production in these areas is dominated by land-based sand and gravel, augmented by significant landings of marine-dredged sand and gravel. This regional imbalance in supply and demand requires that large amounts of aggregates, in particular crushed rock, are transported from net-producing areas to net-importing areas. Of particular significance are the exports from the East Midlands and South West regions to London, the South East and East of England (Figure 2).

In a small, densely populated country such as England, there is already considerable pressure on land. Land-based resources are also increasingly constrained by environmental designations and other competing uses of land. Consequently it can be difficult for the aggregates industry to find environmentally acceptable sites to work close to market,

particularly as the less sensitive sites are exhausted. For this reason amongst others future aggregates supply is not assured over the long term, during which time it appears inevitable that the construction industry will continue to require an adequate and steady supply of aggregates in the absence of a major change in bulk mass construction technologies. As a result aggregates supply in England has been maintained through a system of managed aggregates supply, which ensures that planning policies reflect this need.



*For clarity, exports less than 100 000 tonnes are not shown.

***Figure 2**: Crushed rock inter-regional flows (Mankelow et al., 2011) superimposed upon the distribution of crushed rock aggregate resources in England.*

The Managed Aggregate Supply System

The case for Government intervention through planning powers to ensure a continuing supply of construction materials was recognised early in the development of England's modern planning system in the late 1940s. This was progressively developed, particularly through the 1970s, into a nationally-agreed management system that finally emerged in 1982 (Gunn *et al.*, 2008). This system has been in operation with modest refinements over the succeeding 30 years.

The purpose of the managed aggregates supply system in England is to help the planning system address effectively the imbalances in aggregates supply and demand at the national level. It is simultaneously a set of objectives, a process, and a policy set out in two key documents. The numerical aggregates supply figures are currently stated in the *National and regional guidelines for aggregates provision in England 2005-2020* (DCLG, 2009). These are often simply called the *Guidelines*. The current *Guidelines* indicate how provision for the supply of aggregates should be met in accordance with anticipated need to 2020 (Table 1).

National objectives and planning policies for all minerals are set out in the second key document: Minerals Policy Statement 1: *Planning and Minerals* (MPS1) (DCLG, 2006). For aggregates these are supplemented with three further objectives specified in Annex 1: *Aggregates*:

- to encourage the use, where practicable, of alternative aggregates in preference to primary aggregates;
- to encourage the supply of marine-dredged sand and gravel to the extent that environmentally acceptable sources can be identified and exploited, within the principles of sustainable development; and
- to make provision for the remainder of supply to be met from land-won sand and gravel and crushed rock.

***Table 1**: The current guidelines for aggregates provision in England 2005-2020 (DCLG, 2009).*

	Guidelines for Land-won Production		Assumptions		
	Million tonnes				
Regions	**Land-won Sand & Gravel**	**Land-won Crushed Rock**	**Marine sand & Gravel**	**Alternative Materials**	**Net Imports to England**
South East	195	25	121	130	31
London	18	0	72	95	12
East of England	236	8	14	117	7
East Midlands	174	500	0	110	0
West Midlands	165	82	0	100	23
South West	85	412	12	142	5
North West	52	154	15	117	55
Yorkshire & the Humber	78	212	5	133	3
North East	24	99	20	50	0
England	**1028**	**1492**	**259**	**993**	**136**

The managed aggregates supply system assists with the delivery of these objectives. A key objective for mineral planning in MPS1 and a central force shaping the purpose of the managed aggregates supply system, is "*to secure adequate and steady supplies of minerals needed by society and the economy within the limits set by the environment, assessed through sustainability appraisal, without irreversible damage*".

The national and regional *Guidelines* document is the main vehicle for achieving continuity of supply while resolving the imbalances of supply and demand. It principally focuses on land-won supplies of primary aggregates and only assumptions are made about alternative supplies (Table 1). The preparation of the *Guidelines*, and the institutional arrangements for this, comprise the main part of the managed aggregates supply process.

At the national level, the Department for Communities and Local Government (DCLG) makes the key contribution to the managed aggregates supply system. It is responsible for the preparation and maintenance of policy and for monitoring the performance of the system. It also maintains an economic model to project investment in construction activity and a projection of demand for primary aggregates in each region based mainly on projected investment. The Government's finalised *Guidelines* allocate supply commitments to each English region for a period of 16 years. These supply commitments are apportioned amongst the local mineral planning authorities (MPAs) within each region. The arrangements are centred on the work of specially-established Aggregates Working Parties (AWPs), with one AWP for each English region (there are two corresponding AWPs in Wales, one each in North Wales and South Wales). These forums comprise representatives of local (mineral) planning authorities (MPAs), central government and the aggregates industry, supplemented by special interests as necessary (e.g. on the environment and rail transport).

Each AWP makes recommendations on the apportionment of the regional total between each MPA. This largely technical process is followed by an administrative democratic process to take account of the regional *Guidelines* in the preparation of formal planning documents. The agreed apportionments to each MPA are expected to be incorporated into Local Development Frameworks (local land-use planning documents) at the earliest opportunity. The development plan scrutiny process is the opportunity for identifying allocations and testing democratically their practicability and acceptability to each MPA, using the AWP advice. Once the sub-regional apportionments are decided, they are expected to be used by all parties to inform the preparation and consideration of aggregates planning applications, and in taking decisions on those applications. National policy on aggregates requires MPAs to grant sufficient planning permissions (licences to operate) to maintain appropriate 'landbanks' of permitted reserves, so that continuity of supply is achieved.

The landbank

An aggregates landbank is the tonnage of already permitted reserves in operational and those non-operational (inactive) sites which still have a valid planning permission for extraction within an MPA area at a given point in time. It is usually expressed in terms of number of years' supply at an average rate of output.

The aggregates landbank is intended to allow reasonably for the length of time it takes to apply for and obtain planning permission and then to bring a site into production. It is also there to provide a buffer against sudden increases in demand. Policy on landbanks is an integral part of the managed aggregates supply system. MPS1: Annex 1 requires MPAs to use landbanks as an indicator of when new permissions for aggregates extraction are likely to be needed. The landbank indicators are at least seven years for sand and gravel at the intended rate of supply and at least ten years for crushed rock. A longer period may be appropriate to take account of the need to supply a range of aggregates types and qualities, the location of permitted reserves relative to markets, and the productive capacity of permitted sites. It is often the case that production rates cannot simply be increased at sites with large reserves to increase output in order to compensate for the loss of sites where reserves have run out. Production rates are likely to be constrained for operational, logistical, economic and planning control reasons and may not be sustainable over the longer term. Alternatively it may be that the reserves in existence are simply not available to the market, the reason being that much of the total reserve is locked up in a small number of sites with low output rates.

The landbank arrangement depends on mineral companies submitting sufficient applications and on these being acceptable in terms of location and impact on amenities. There will be a more pressing case for landbanks larger than the minimum if there is a need to supply a range of types of aggregates within an MPA or if substantial reserves are held in a small number of permissions where they may largely be unavailable for some years. In either case, in order to maintain continuity of supply within an MPA there may be a need to grant more planning permissions.

Although landbanks are central to the operation of MASS, as this is one of the key performance measures of the system to be monitored, a range of complicating factors has long been recognised as reducing the effectiveness of landbanks as a tool for securing continuity of supply. Landbanks are primarily a proxy for the ability of the industry to supply aggregate but, given that almost all aggregates are processed before sale, the actual ability of the industry to supply aggregate is controlled by the existence or otherwise of processing plant. The key objective should, therefore, be to sustain the 'productive capacity' of the industry. If a small number of sites have large permitted reserves (enough to ensure that an area's landbank is comfortably in excess of the threshold levels of concern), then the landbank figure may fail to take into account the significance of other sites which are running out of workable aggregates. Recent research undertaken by the BGS promotes additional monitoring of the landbank in a way that allows for identifying when actual shortfalls in supply within an MPA are likely to occur (Mankelow *et al.*, 2008, 2010 and Lusty *et al.*, 2011).

The need for aggregates monitoring

An essential prerequisite for monitoring and managing aggregates supply in England is reliable and up-to-date information on sales (Figure 3), movement, consumption and permitted reserves of primary aggregates. Similar information is required on the arisings and use of alternatives to primary aggregates, such as selected mineral wastes; construction, demolition and extraction wastes; and selected industrial by-products. These

requirements are underpinned by four key surveys commissioned by DCLG. The data are used to monitor and, as necessary, revise the *Guidelines*.

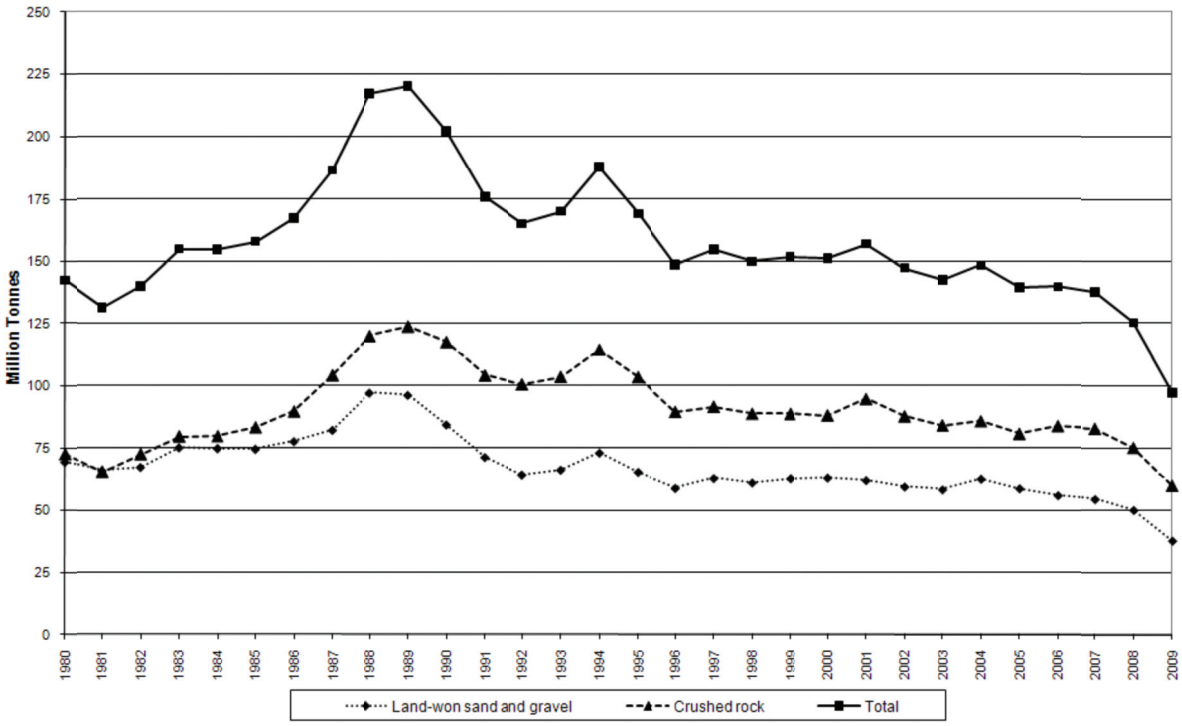


***Figure 3**: Sales of land-won primary aggregates in England 1980-2009.*

The *Annual Minerals Raised Inquiry (AMRI)* is a statutory survey carried out by the Office for National Statistics (ONS). It collects and publishes information on the volume and value of extractors' sales of non-energy minerals, including primary aggregates by type and broad end use. The survey has produced a consistent time series of data since 1973 on which aggregates demand forecasts for England are, in part, based.

Aggregate Minerals (AM) Surveys, undertaken every fourth year since 1973, provide detailed information on regional and national sales, flows, transportation, consumption and permitted reserves of primary aggregates in England and Wales. The surveys are central to the managed aggregates supply system and the preparation, monitoring and review of the *Guidelines*. The aggregates industry is very supportive of this detailed work and has been crucial in facilitating its conduct. The most recent survey was carried out for DCLG in 2009 (Mankelow *et al.*, 2011).

Surveys of secondary and recycled aggregates providing comprehensive data on the arisings (potential supply) and use of alternative aggregates has only become available in recent years. The most recent detailed survey was carried out for DCLG in 2005 (Capita Symonds, 2006) although another concentrating only on construction, demolition and excavation waste was undertaken in 2008 (Capita Symonds, 2010)

Annual Monitoring Reports are published by each AWP. These are based on information provided annually by MPAs on planning applications, planning permissions and refusals for mineral working. This indicates the rate of replenishment of reserves and the

scope for continued production. The AWPs annually collect, collate and publish in these *Annual Monitoring Reports* data provided by mineral companies on aggregates supply, uses and permitted reserves of primary aggregates. This information is collated at regional level by the AWP from data collected by MPAs.

In order to be effective and credible the managed aggregate supply system must be actively 'managed'. The above surveys form part of the management of the system. Without such active monitoring and specifically access to reliable and up-to-date data and information, apportionment allocations made by MPAs in their Local Development Frameworks for aggregate extraction could be challenged on the basis that the *Guidelines* produced by central government are out of date and no longer credible.

The future

The managed aggregates supply system has been in existence for the past 30 years and in that time about 5 billion tonnes of land-won sand and gravel and crushed rock aggregates have been produced in England. Since its inception, the system has been enshrined in national minerals planning policy (the latest document being Mineral Policy Statement 1: *Planning and Minerals*). England is, however, currently undergoing a period of change in planning policy. The Government is committed to devolving more power to local communities to take decisions on land-use planning. A 'Localism' Bill is currently passing through parliament which will shift power from central government into the hands of individuals, communities and local authorities (DCLG, 2010). At the same time, the Government has undertaken a comprehensive review, designed to consolidate all existing national policy statements, circulars and guidance documents into a single National Planning Policy Framework (NPPF) with the aim promoting sustainable development through a simplified planning system.

In July 2011 the Department for Communities and Local Government published the draft NPPF which is currently undergoing a period of consultation (DCLG, 2011). With regard to minerals, the draft NPPF consolidates about 680 pages of policy and guidance contained within 13 national mineral policy documents into 3.5 pages. The draft NPPF retains the obligation on MPAs to take account of the existing national and regional *Guidelines* for aggregates provision as established by the managed aggregate supply system. As part of this assessment of national planning policy, the Government intends to consult on the future of the managed aggregates supply system later in 2011. Given these changes, there is currently some uncertainty over how the national system of managed aggregate supply within England will operate in the future.

Acknowledgements

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Management and sustainable development of aggregates quarries examples from center and south of Romania

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Abstract: Romania is very rich in river and crushed stone aggregates with mil t/year capacities. Crushed stone is very important for industry in south and center from Romania. Numbers of quarries are 44 with exploitation license and over 500 with exploitation permits. Quarry 1 is open in Neogene andesite from volcanic Neogen area from Eastern Carpathians. Quarry 2- Iacob Deal quarry -is open in Proterozoic granite from Northern Tulcea county. For crossroad management aspects of quarries with the sustainable aggregate resource management (SARMa online document, 2010) are necessary knowledge of each exploitation from execution project to the end of quarry. The mining authorizing procedure is considered as integral part of any quarrying activity. The management policy of a company carrying out of extraction / exploitation of building raw materials should include a lot of aspects. Quarrying management requirement a permanent equilibrium between pre-set regulation, adapting to the local realities and the initiative of local operators of the quarry being worked. The development plans and the preparation an efficient exploitation documentation represent an essential component of activities carried out in the mining and exploitation of a deposit and have in view the concrete evolution of the derocked areas. (Generally) The companies that have the studied cases limits the negative impact of environment through the mining works in the plans of development that include the necessary elements for a completely safe working the.

Key words: Management, Aggregates, Quarry, Resources

Introduction

Aggregates resources are essential for infrastructure and development. They (sand, gravel and crushed stone resources) represent the second raw natural material as importance all over the world in construction, after concrete- artificial material with aggregates in composition. On a world scale about 90% of the non-combustible rocks and minerals are requested by the building industry, but the building industry, one of the most important industry in the world contributes by the massive consumption of aggregates, clay, lime and sized stone resources to the degradation of the environment (Table 1, Gheorge & Marica, 2004).

All the statements of the international meeting on the environment and factors of disequilibrium, the last one being the Kyoto Conference, had major objective with the reconciliation of the two conflict requirements: proclaimed the principles of sustainable and long term development and environment protection with reducing the risk of climatic change and VOC (volatile organic components). The extractive industry was considered a some of the major factors of modification of the bio-geological equilibrium at a local and regional level.

Table 1: Share of minerals in various industrial products (2005).

Application	Value *10^6 euro	Share of natural minerals(%)
Concrete	38600	100 %
Aggregate	-	100 %
Building glass	26800	100 %
Fine ceramics	20000	100 %
Bricks and roof tiles	6600	100 %
Cement , lime and plaster	38600	100 %
Sized stone	5300	100 %

In the present days, the ravings in natural mineral resources depend on the reasonable use and management of the systems of natural mineral resources. The activities from extractive industry generate dust, noise, emission from fuel composition in transport, large quantities of waste and damages to the local flora and fauna. The estimation is about a quarter of the energy uses in the building industry is consumed for the manufacture and transport of the building materials (Gheorge & Marica, 2004).

Any quarry extraction of aggregates resources lead directly or indirectly environment modifications, often negatives ones. Gradually, these modifications became so important that the introduction of a supervising and management system got necessary, meant at diminishing/eliminating the effect of the negative action of economic and antropic factors.

Aggregate resources from south and center of Romania

Romania is very rich in river and crushed stone aggregates with mil t/year capacities. In south of Romania (Muntenia and Dobrogea region) exist rivers and plateau quarries on Ialomita valley (the most of all), Dambovița plateau not far away from Bucharest , on Argeş and Jiu rivers , inclusive on Danube river.

Crushed stone there are in center of Romania, in Covasna (case study 1) and Harghita counties and also in south east of country: in Tulcea county (case study 2, Iacob Deal, SARMa online document, 2010). Number of quarries are 44 with exploitation license and over 500 with exploitation permits. The need of crushed stone is biggest (60 – 70 % of total aggregates production) then river aggregates. The main sorts are crushed stone sorts 0,2 – 3, 3 – 7, 7 –16,16 –31 mm and crushed sand and criblure 0-3; 3 - 8; 8 – 15, 15 – 30. Quarry 1 is open in Neogene andesite from volcanic Neogen area from Eastern Carpathians.

Phisical-mechanical properties are showed in Table 2.

Table 2: Phisic-mechanic properties of case study 1 andesite.

Characteristic	Density kg/dm^3	Porosity %	Absorption %	Compactity %	Compression Resistance N/mm^2	Mechanic shock resistance N/mm^2	Abrasion resistance g/cm^2
Andesite 1	2.80	5	1	95	194	4,7	0,08

Iacob Deal quarry is open in Proterozoic granite from Northern Tulcea county (SARMa online document, 2010).

***Table 3**: Phisic-mechanic properties of Iacob Deal granite.*

Characte-ristic	Density Kg/dm^3	Porosity %	Absorption %	Compactity %	Compression Resistance N/mm^2	Mechanic shock resistance N/mm^2	Abrasion resistance
Granite 2	2.69	1.86	0.34	98.14	190	4	0,07

For crossroad of management aspects of each quarry with the sustainable aggregate resource management (SARMa online document, 2010) are necessary knowledge of each exploitation from execution project to the end of quarry. All this process is about 20 years from Romanian legislation and involve:

- geological knowledge
- feasibility of extraction
- impact on the environment
- recondition plan on environment
- social impact

All of these about aggregate resources produce an adaptable and flexible monitoring mechanism in accordance with the management.

A flexible management adaptable to the local realities – as each quarry is unique of its kind – may rich the profitability target under reasonable ecological conditions.

Quarrying management

Quarrying management requirement a permanent equilibrium between pre-set regulation, adapting to the local realities and the initiative of local operators of the quarry being worked. In present, the activities from south and center of Romania carry out by big private company and a lot of small firms, in the regulatory conditions.

The mining authorizing procedure is considered as integral part of any quarrying activity (Mining Law and normatives, 2009). A bad exploitation of river aggregates can to produce serious problems for bed river and river meadows. In Romania granting of mineral resource mining is conditioned by the preparation of a complex documentation: geological surveys, feasibility studies. Plans of developments, studies of impact on the environment.

Very few companies from south and center of Romania with mining and production activities have introduced a really efficient management system of quality and quite exceptionally have applied an environment system. The environment management system aims to support in the same time carrying out of all the industrial processes and the environment protection within an organization in accordance with the European norm – Standard ISO 14001 respectively, in view of supplying elements of a new efficient management system.

***Figure 1**: Aggregate quarry from Case study 1.*

The management policy of a company carrying out of extraction / exploitation of building raw materials should include:

- conformity of own activity with the environment policy;
- real or potential impact on the environment of own activity, as there are positive effects on the environment;
- the competence and responsibilities of personnel, the emergency situation and the reaction capacities of everybody involved included;
- the necessity of personnel training and being aware of the consequences of a producing activity on the environment;

In south and center of Romania there are some aggregates quarries with some problems which affected environment (Figure 2) through the kind of the exploitation machines and the extraction.

***Figure 2**: Iacob deal quarry.*

In the two research quarries there is problems with slope (affected environment in case study 1 with slope , dust and noise). Another case there is in Harghita county with one of the largest pollution crushed stone andesite quarry Suseni Chileni. Station of crushed stone have capacities approximately 1mil t/year and supplying sorts are 0-3, 3-7, 7-16, 16-31.

Station of crushed stone have capacities approximately 1mil t/year and supplying sorts are 0-3, 3-7, 7-16 and 16-31.

The development of fit economical politics of firms involves o lot of measurements for environmental protection), concomitant with the activity or post-closure.

For the firms from south and center of Romania that carry out an aggregate exploitation activity, is necessary to establishing some important directions for sustainable aggregate resource management:

- the conformity with proper activity;
- the real or potential impact concerning environment, in special by the growth of individual performances (the inventory of all pollution and environmental aspects concerning to current activity);
- the duties and responsibilities of employments, and the reaction capacity for any environmental problem;
- the adoption of measures for decreasing the pollution

In present, the mean directions for such firms are:

- to certify the quality of products by Romanian and European rules;
- to achieve the products only by conformity with standards, norms, technique specifications;
- to pursuit of the flux manufacture;
- to change the unperformed equipments;
- to introduce on the current activity a good Quality and Environmental System of Management.

Development plan – essential component of a efficient management

The problem of implementing a total management (quality and environment management) with respect to aggregate resource working has to take into account both the geological structure of the deposits, the way these are worked and the environment impact during the mining and exploitation process of the raw material.

Impact on the environment and pollution in the working of the aggregates mineral resources generally presence the following aspects:

- changes in the natural background
- gravitational accumulation of the mined material
- non-controlled stockpiling
- generation of steep slopes
- decrease of evapoexudation in the area
- releasing of noxius substances and production of noises following mining and production (Mining Law and normatives, 2009)

The development plans and the preparation an efficient exploitation documentation represent an essential component of activities carried out in the mining and exploitation of a deposit and have in view the concrete evolution of the derocked areas and the extracted volumes of rock presented in the layouts a reduced scale (1:2000, 1:1000) to 5 year to the final image of the quarry, after the reserved were worked out.

For the river quarry there exists in special exploitation permit for 1 year, case with affected sometimes the bed of river.

For the development plan (one of the part of exploitation documentation (SARMa online document, 2010)) geological and land measurement works carried out.

In carrying out these works several components are taken into consideration, especially for crushed stone quarries : general slope angle, configuration of the working face , dimensional elements of the working steps (where is necessary) , relief bed valley configuration in the nonmines spaces

The crushed stone quarry, from Covasna county is a “strip banding” type (Mining Law and normatives, 2009). It developing north –south (Fig.1), near Olt valley orientation with steps configurations and not affect the slope stability.

After research of exploitation activity is important for Know that control in the primary stage if the negative effects of the mining is an activity less cost (SARMa online document, 2010; Gheorge & Marica, 2004) by than restoring of the environment after the destructive effect was produces . The working method for the quarry also in Iacobdeal provides further extension of quarry, creation of final wall pillars and restoration aspects until the last year of exploitation at the mining capacities (Figure 2)

To limit the negative impact of the mining works in the plans of development, the environment management of the two companies must provide:

- limiting of the intervention on the soil to the strictly necessary yearly surfaces ;
- fitting out the extraction platform ;
- works for providing slope stability ;
- observing the slope angles , generally of 45 ^{o} with respect to the quarry benches ;

- maintaining under good operation condition of the equipment ;
- carrying out continuous technological flows ;
- waste management ;

These include the necessary elements for a completely safe working from the point of view of the protection and monitoring of the deposit, of labour and environment protection.

Conclusions

The industry of aggregates exploitation and processing give all the raw materials to the civil and industrial buildings activity. Quality and environment management are one of the most important protection of aggregates deposits.

The main conclusion of this investigation is that environment management is an essential in understanding the complex actions between the present earth surface and the control of production in the extractive field.

The analysis and monitoring works and the specific assessments and expert appraises carried out on the two deposits with crushed stone (Covasna county) and Iacob deal aggregates demonstrate the possibility of efficiently implementation an unitary quality , production and environment management system. The authorizing procedure of a mining activity is considered an integrant part of any quarry's exploitation activities.

From among the documents necessary for authorizing and carrying on the operation for working , exploitation , protection and restoring of a deposit , the plan of development - a document based an the analysis of evaluative lay is one of the most important components and essential for implementing an efficient environment management.

From this paper conclude that an environment management is flexible and adaptable to local realities –as each quarry is unique of its kind- and may rich the profitability target under reasonably ecological conditions. As the same time, the environment management in aggregates resources in general –the two deposits constituting a model that may be applied in this industry –also includes a quality analysis and conditions for applying of thee components of standard ISO 14001.

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Sustainability development of aggregates supply in cross border areas based on the National, Regional and EU Policies.

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Abstract: This article gives a review on the natural resources of the region of the border Greece – Albania. It gives an evaluation of the aggregates potential on and their actual exploitations, as well as the flow of the aggregates between two countries and possibilities for further sustainable development of exploitation of aggregates in both cross border areas. The sustainable development ideas are given based on the frame of the mining strategy of Albania, territorial planning, re-evaluation of mineral reserves. The long term strategy of minerals of Albania, which include the exploitation of aggregates is carried out under political and institutional reforms toward integration of the country in the EC structures and it intend to ensure a sustainable and long term development through effective investments. In the article is presented the actual situation and perspective development in mining activity, for the aggregates in the border areas, new concepts for mining activities connected with the European strategy for minerals, challenges, trade and requests for aggregates, new products in this business, recycling possibilities, stronger focus on the supervision and monitoring of existing (and future) activities to eliminate the illegal quarrying, increase transparency to the public and involvement of the local authorities on decision making, with scope to realize profit activities and maximum profit to citizens, with slogan " Minerals and Energy for a sustainable development".

Introduction

Development of mining industry of Albania has passed through three stages: the first stage includes the post-World War I period and is marked by two important events of the mining industry, in 1922 was compiled the first Geological Map of Albania, the first of its kind in the Balkans, whereas 1929 signs the endorsement of the Law On Mining of the Albanian Kingdom, which paved the way to the exploration and exploitation of mineral resources; the second stage (1944-1994) marks the period when the mining activity was organized in state-owned enterprises characterized from a wide range of development of mining industry and the third stage, the period of the mining industry after 1994, enabled the transition from an economically centralized type of operation, into one based on the free market. Although the production of the mining industry collapsed when the country shifted to a market economy in 1990 s, the mining industry now is resorted as a core industry of the country and its production in volume is 20 % more. International demand for mineral resources has been increasing in recent years and Albania has been gathering interests from investors as a promising target of mining investment. It is expected that mining industry can play an effective role in improvement of the quality of life and on the sustainable economical growth of the country. Main mineral resources of Albania are given in the figure 1.

***Figure 1**: Distribution of main mineral resources in Albania.*

The main relevant policies and strategies for the mining sector are:

- Program of the Government of Albania (2009-2013).
- National Strategy for Development and Integration (2007 to 2013) (Government of Albania).
- Business and Investment Development Strategy 2007 to 2013 (METE) (2007).
- Strategy for the Development of the Mining Industry (METE) (2011).
- Updated National Environmental Action Plan (UNEAP) (2001)

General Objective of the Albanian Mining strategy is to develop a dynamic steady growth and sustainable development of the mining sector friendly to environment, certified from community for a maximum profit of Albanian citizens.

The sustainable development on Albanian mining policy is treated in legislation programs and action plans as a balance on three pillars:

i) investment development through better legal frame work and regulation, to reduce the administrative barriers, finishing the process of privatization, promotion of industrial business with higher value added, strengthening of the institutions dealing with business, ensuring well-management of natural and human resources, by inciting, supporting,

encourage the development and increment of domestic production, education and training for entrepreneurship, coordination and cooperation of the developing programs of the country with those regional and more, improvement of the climate for foreign investments, saving the professionalism and transparency **for** a sustainable development.

ii) investment development friendly to the environment, **through** enforcing the mitigation measures, rehabilitation process, strengthening of the supervision on remediation, monitoring and post monitoring process; ensure level of work safety, less damages and pollution to environment, **by** application and implementation of advanced technologies, **for** a clean environment and nature, to minimize as much as possible the effects on life of communities.

iii) social aspects, **through** the involvement and understanding of community, transparency, civil society involvement in a wider way, taking in consideration profits and damages to the community as an approach to fight poverty, **by** encouraging the creation of new jobs, possibilities for infrastructure improvement, help in health system and education particularly for the areas with poor economic activity, **for** a better life of the citizens.

Aggregates reserves of the cross border areas

The study area is located in the south-east Albania. From the administrative point of view in the study area are taking part districts of Korces, Maliqit. Bilishtit, Leskovik, Ersekes, Permet, Gjirokaster, and Saranda.

***Figure 2**: Case Study Area Size.*

Type of primary aggregates, reserves and quality

In the area of study are revealed aggregate types such as Limestones which are well spread in all the region, Inert connected with the riverbeds, Travertine represented from the deposits of Vithkuqi and Polican, Decorative stones are widespread in the region of Gjirokastra, Saranda and Korça, plate stones at Permeti and Gjirokastra area, etc. The quality of limestones is good for different applications such as constructions sector, agriculture, production of Portland cement etc. Referring to the chemical analysis of the limestones in the region (the content of CaO varies from 47-55%, MgO = 0.1 -1.33%, SiO2 = 0.4 – 2.7 %) and to the physical-mechanical parameters (volumetric weight ranges between 2.4 - 3.7 %, compressive strength 820 – 870 kg /cm^2).

In the region of Korça, especially in Devolli area, are known the deposits and objects of sand and quartz sands in Ziçisht, Çipan, Hoçisht, Vranisht, Zaroshkë, etc. Their chemical composition is SiO_2 75-85 %, Al_2O_3 5-13 %, Fe_2O_3 0.8-2.5 %, Na_2O 2.5-2.8 %, CaO 0.5-1 %, MgO 0.4-0.6 %, TiO_2 0.18-0.2 %, K_2O 1.2-2.3 %. The mineral content is quartz = 75-80%, feldspars 3-14%, micas 5-6%. The reserves are considerable and with a prognosis to be extended 3-4 times. These have been used in the glass industry, foundry and ceramics.

The main deposit of treples is Muzina – Saranda region. The chemical composition of the trepels of Muzina (Saranda Region) is: SiO_2 67-80 %, Al_2O_3 4.4-11.5 %, Fe_2O_3 3.99-5.95 %, CaO 0.16-0.53 %, MgO 0.04-0.87 %, LOI 2.7-3.9 %. Physical properties are: volumetric weight 0.68 to 0.75 t/m^3, porosity 60-67 %, strength 50-100 kg/cm^2 and refractivity 1230-1450°.

The platy pelagic limestones mainly in the Ionian Zone and Krasta-Cukali zone are generally characterized by fine layers from few cm up to 20-30 cm. They have white colour, light beige up to reddish. They are used as plates in buildings or as decorative stones. To these belong the platy limestones along the Jorgucat-Gjirokaster road, in Shkalle, Dropull, Muzine etc. These limestones have these parameters: compressive strength: 848-1200 Kg/cm^2, tensile strength 80 - 145 Kg/cm^2, shear strength 110 - 193 Kg/cm^2. The chemical composition is CaO 51.5- 55%, MgO 0.3 – 1.26 %, SiO_2 0.2 – 6.32 %.

Conglomerate limestones occur in the region of Korca and are represented by the deposits of Bitincka, Polena, and Vithkuqi. These limestones show variegated colour and have these parameters: compressive strength: 700-1000 Kg/cm^2, tensile strength 39-80 Kg/cm^2, shear strength 89 - 163 Kg/cm^2. The chemical composition is CaO 44- 55%, MgO 0.3 – 2.3%, SiO2 0.4 – 13 %.

In the following table are all deposits of the aggregates and their location (coordinates X, Y geological reserves expressed in thousand tons(coefficient for limestone k= 2.5 coefficient for clay k=2.1).

Production of the aggregate

In our area of the study, (Vlore, Gjirokastra and Korca districts) are 73 companies in exploitation of aggregates under operation. The greatest number of licenses belong those companies that quarrying limestones (56), followed by clay's permits (5), sandy's permits (4.) and slab bed limestone (4), breccias (2) peat (2) and 1 for gypsum.

Table 1: Reserves of deposits after AGS.

Deposit's name	Type of mineral	Reserves 1000/ton	Classifications (after size of deposits)	East	Nord
Vrion	Clay	2700	I	4417925	4417582
Mesopotam	Clay	1000	I	4421551	4420170
Krekez	Clay	5715	I	4414628	4421334
Bezhan	Clay	22000	II	4477518	4476087
Inonisht	Clay	4130	I	4495980	4491124
Vranisht	Clay	779	I	4491304	4503773
Delvine	Dolomite	20000	II	4421955	4425368
Germenj	Marbled limestones	1000	II	4470643	4456057
Vithkuq	Conglomerate limestone	1000	II	4464043	4488601
Polene	Conglomerate limestone	2473	II	4473204	4496021
Bitincke	Conglomerate limestone	1500	II	4499237	4503790
Çuke	Slabed limestone	1000	II	4417051	4414134
Muzine	Massive limestone	1200	II	4434706	4423971
Shkalle	Slabed limestone	1000	II	4423370	4397323
Jorgucat	Slabed limestone	1000	II	4437040	4423147
Dropull-Terihat	Slabed limestone	2000	II	4433539	4427897
Derviçan	Slabed limestone	1200	II	4429600	4432768
Frasher	Slabed sandrocks	500	I	4452700	4469700
Dhrovian	Limestone	10000	II	4432801	4419631
Poliçan	Limestone	4000	I	4446812	4443751
Bezhan	Limestone	5000	I	4477542	4477539
Biranje	Limestone	2724	I	4475500	4503100
Proger	Limestone	400	I	4496530	4505947
Zvezde	Limestone	5000	I	4488256	4511829
Çiflig	Gips alabaster	6300	II	4424418	4393871
Bistrice	Gips alabaster	2860	II	4427732	4421516
Mesapotam	Inert	2000	II	4422332	4419036
Vrisera	Inert	1200	II	4443222	4419226
Glinë	Inert	2500	II	4438359	4425039
Gjirokaster	Inert	1200	II	4428993	4437427
Kodra e Bardhe	Carbonatite inert	2000	I	4430000	4440750
Ziçisht-Çipan	Quartzited sand	3000	II	4493986	4492456
Hoçisht	Quartzited sand	2000	II	4493474	4496201
Vranisht	Quartzited sand	1000	I	4491308	4502416
Zaroshke	Quartzited sand	500	I	4492097	4514190
Kuc i Zi	Talc	161,6	II	4486546	4504467
Zemblak	Talc	700	II	4489100	4506000
Poliçan	Travertine	10	II	4444300	4443000
Vithkuq	Travertine	61	II	4464937	4488456
Muzine	Trepele	2000	II	4432081	4420867
Lefterohor	Trepele	1300	II	4425927	4427545

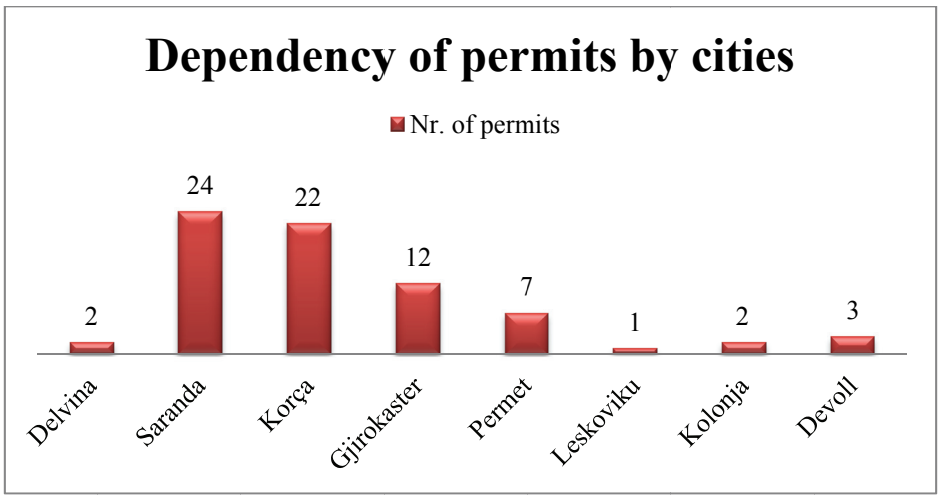
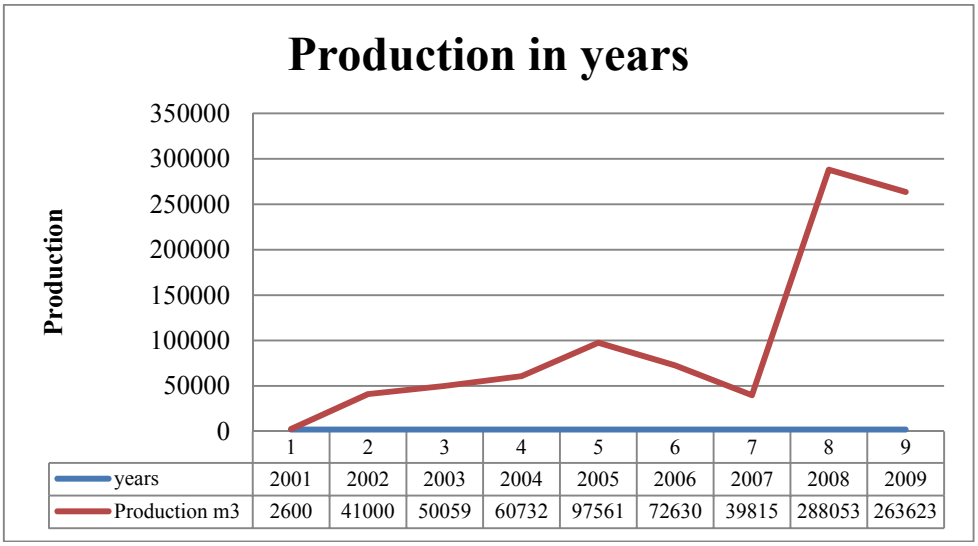


Figure 3: Distribution of the mining permits by regions.

Production of the aggregate: In our area of the study, (Vlore, Gjirokastra and Korca districts) are 73 companies in exploitation of aggregates under operation. The greatest number of licenses belong those companies that quarrying limestones (56), followed by clay's permits (5), sandy's permits (4.) and slab bed limestone (4), breccias (2) peat (2) and 1 for gypsum.



	1	2	3	4	5	6	7	8	9
years	2001	2002	2003	2004	2005	2006	2007	2008	2009
Production m3	2600	41000	50059	60732	97561	72630	39815	288053	263623

***Figure 4**. Production of aggregates in years.*

Material flows

Aggregates industry is an industry where price and location are important factors. Transportation is the major factor in determining the delivered price of aggregates - as freight costs from plant to market can exceed the sale price of the product. Because of high transportation costs, and the large quantities of material necessary for each project, aggregates are usually marketed to local customers. The high transportation costs explain the large number of quarries throughout the area. The flow of material from Albania to Greece is mainly realized through the road transport in the four cross border points connecting South of Albania with Western part of Greece:

- Kapshtica (AL) – Krystallopigi (GR)
- Tre Urat (AL) – Melissopetra (GR)
- Kakavije (AL) – Kakavia (GR)
- Qafë Botë (AL) – Sagiada (GR)

The railway transportation is not practicable for aggregates because the absence of rail track in southern part of Albania. Limestones are used for local use, the flow of aggregates is composed mainly from decorative stones (Berat, Saranda, Gjrokaster). The only way of maritime transport used until now is Saranda Seaport (and Limioni).

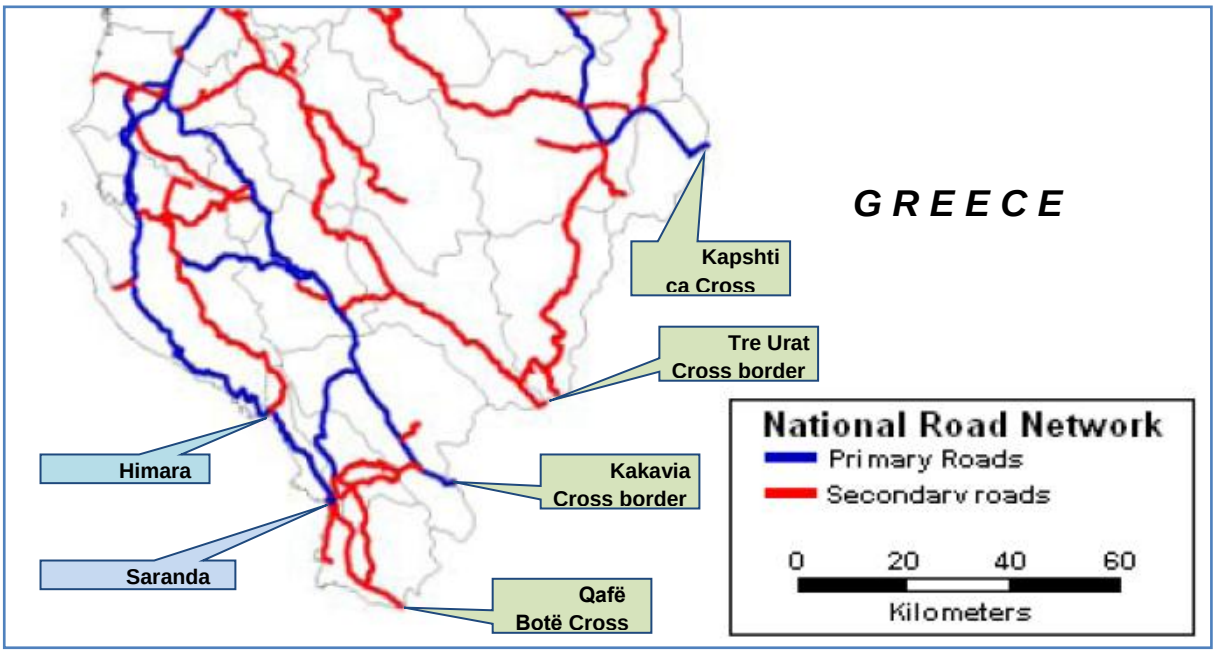


Figure 5: *South Albania Primary and secondary road networks, including planned roads.*

Table 2: *The quantity of exports of aggregates from Albania to Greece.*

Year	V_Exp	Q_Exp
2006	839,28	50.270,91
2007	1.208,16	68.888,31
2008	1.185,60	60.318,52
2009	1.447,45	82.509,49
2010	1.088,22	76.976,04

Figure 6: *The quantity of exports of aggregates from Albania to Greece.*

Policy, legal and social framework of aggregates

The policy for the exploitation of minerals (which include aggregates) is national. Any way the Action Plan for Implementation of the Mining Strategy as midterm mining planning document is prepared based on Mining Strategy and is valid for a 3 (three) years period. For the aggregates it is considered in the mining law nr.10304, date 15.07.2010 "For the mining sector in the Republic of Albania", issue of the exploitation permits for the local authorities which can use this permit for their needs through companies created from them based on the law of local authorities or other companies involved in the works, or infrastructure in the territory of commune. The long term strategy of minerals of Albania is carried out under political and institutional reforms toward integration of the country in the EC structures. The new draft strategy has taken in consideration the new draft of strategy on raw material strategy initiative launched from the EU, in the description of priorities with the vision that sustainable development is planning. The targeted measures to secure and improve access to raw materials for the EU is based on three pillars:

- ensure access to raw materials from international markets under the same conditions as other industrial competitors;
- set the right framework conditions within the EU in order to foster sustainable supply from European sources;
- and boost overall resource efficiency and promote recycling to reduce the EU's consumption of primary raw materials and decrease the relative import dependence.

Albanian mining strategy take in consideration the conclusions and basis of the EU-strategy, stressing the idea that at this stage strategy shall include also the Balkan countries which prospered to be part of the European Union. This document clarify the roadmap to realize a sustainable development of mining industry (which include aggregates) under privatization and market-oriented economic reform, defining items necessary for implementation such as performance goal, critical points (restriction and difficulty which arise in the course of action) and countermeasures to overcome with priority, and the global image with a time schedule.

Top 10 priorities for the country's economic development, this strategy intend to:

- Sustainable development of Albanian economy based on short-mid-long terms objectives for maximum profit and a better life of Albanian citizens by creation of appropriate investment environment with aim to bring the sector to its economic potential,
- Realization of a robust legal framework that is essential to the development of the mining sector, with the alignment of national legislation to EU legislation and standards of mining activity, transparency, environmental protection, health and safety management;

- Increased investment in exploration and development; stimulate the transfer of technologies and knowledge,
- Encourage treatment activities as a value added policy for the mining sector through fiscal policies;
- Transparency to the public , transparency on decision making, Participation of communities;
- Prioritize unaddressed environmental / social legacy issues to define a strategic long-range program through the preparation and implementation of a Strategic Environmental and Social Assessment;
- Improving productivity and competitiveness, product internationalization, foreign investment promotion and the better use of financial, human and natural resources;
- Offering alternatives based on mining activity diversity, Territorial planning, land use strategy, coordinate and cooperate with sector strategies and programs of the country with those regional, EC and more;
- Improvement on economical and financial balance of the country by development of exports;
- Maintain a balance of benefits derived from the mining sector among various regions and population groups in the country through increasing revenues of the local authorities by division of royalty to central and local authorities and other taxes.

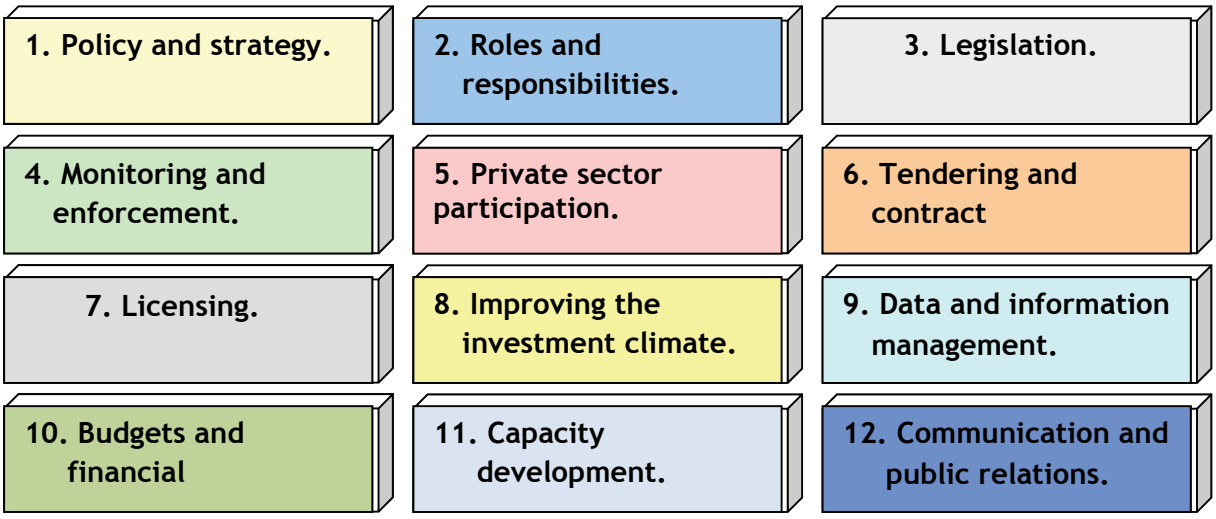


***Figure 7**: Main components (or building blocks) of the institutional and legal framework for the sustainable development and strengthening of the mining sector in Albania.*

Sustainability of current state of aggregates supply in cross border areas

Actually we can say that SME (Small Medium Enterprises) operate in aggregates sector. The sources of aggregates in our study zone reach millions of tons. Good quality of the aggregates create possibility and opportunities for their use. Great reserves of them in the area ensure a sustainable development of this sector.

From a general SWOT analysis it is revealed that aggregates activity in the cross border area has:

Strengths:

- Rise in demand for minerals, due to infrastructure development in the area;
- Continuous improvement on mineral resources information, continuous improvement on transparency.
- International standard of the mining legislation, improvement on land access provisions, stable legislation.
- Use of international currency leave to be competitive and simply trading.
- Young, cultured and healthy population. Good level of education, young professionals.
- Well placed, good climate, good roads
- Clear rules for supervision, monitoring of mining activities, clear standards based on best international practices.
- Low cost of labour cost, low cost on exploration due to explored occurrences of the ore bodies.

Weaknesses:

- Lack of efficient and cost-effective access to R&D.
- Low level on promotion, lack of online information for mineral resources, needs for complex geological studies for evaluation of mineral resources. Low level of marketing for mineral products.
- Inside emigration is high, a lot of professional immigrate abroad. Movement of skilled force in other industries or activities.
- Needs for further improvement of infrastructure.
- Agrarian economy, mining sector is a not a strategically sector even that is treated as such, low level of technology, needs to bring the technology from abroad.
- Non developed economy compared with the region,
- A lot of small scale companies that sometimes compete with each other, Low demand and big offer especially for limestones.
- Need for improvements on infrastructure, energy distribution and supply network.
- Not organized or related companies for trade of such products in both countries which make trade chaotic
- Low level of technology especially for decorative stones;

- Low financial capital of SSM and hard procedure for financing in both countries especially for Greece due to financial crisis;

Opportunities:

- Well established position with a well defined market
- Open market for local and foreign companies, welcomed and supported investments in the sector, stable policy.
- Possibility for investment on mining sector and energy sector at the same time, due to existence of both sources at the same place.
- Possibility to be cost effective by application of new technologies and to be competitive.
- Low royalty tax.

Threats:

- Small production, cannot become a big player, speculation in prices, uncertainties for the big players,
- Possible changes on the rules for environment protection by imposing of new EU directives as obligation of SAA, Movement of the trained personnel abroad.
- In case of lack of electricity energy supply priority for the provider is for citizen not for the industry. In case of lack of water supply priority for the provider is for citizen not for the industry.
- Low request of this material due to economical situation in Greece;
- Delays in the custom offices at the borders.

Conclusions and Recommendations

Importance of extractive industries requires a new approach in the policies towards the sustainable development of mining activities balancing them with the environment and social issues.

Mining activities in the globalization process of the economy should take in consideration new development of the sector regionally, globally, in this context the policies and strategies of the EC shall be oriented towards involvement of all countries especially Balkan countries rich in mineral resources.

For a specific country mining strategy shall take in consideration policies of its neighbours, region and globally because of a free world market of minerals.

The improvement definition of SSM need to be done, because actually we called SSM company even the familiar business which is now well spread in Albania. We think that activities on the mining sector need much more especially for the part of financial investment as well as for its professional point of view. There are companies which are doing aggregate business composed just from 3 people.

Restructuring of the mining capital is in order of the day (agenda), to protect it from fictional competition.

The size of quarries need to be increased with the tendency to limit the number of them. We need to reach quarries with a capacity 500 000 m3/year in order to be efficient. To achieve the developed countries norms of aggregates (tons/habitant) are not need more than 10 units (objects). The losses (damages) from this kind of units distribution, firstly for these private companies (small production capacity and high cost) and also for customer which finally is asking to buy a more expensive flat built by these aggregates. The environment is damaged 8-10 times more that the economy demand, and at the same time the damage (negative effects) to the community around from the surface exploitation regardless of the permitted norms.

Use of the by-products and treatment of residues (wastes). Encouragement of Recycle processes and use of secondary aggregates.

Territory planning need to take in consideration regional market.

Cooperation and promotion of aggregates especially for the border areas. Cooperation of small-scale mining companies for decorative stones in bigger units, intending in the total (full) processing of minerals, to increase the value of them by final products and to find more rational using fields of each product, exploring the domestic and regional market to enter with its' products.

Participation on Extractive Industry Transparency Initiative of all Balkan countries to increase transparency of mining activities to the mining communities and generally to the public. Involvement of civil society in mining issues. Engagement of local authorities in decision making.

Need for improvement in the cooperation between geological and mining institution especially on compilation of the regional "Maps of Territory Planning", available on line, and complex studies for the region on the aggregates.

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UEPG supports the SARMA Project in working together towards a Sustainable European Aggregates Industry

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Abstract: UEPG has represented the European Aggregates Industry since 1987 and actively lobbies on its behalf in front of the European institutions and all other key stakeholders. UEPG now has members in 31 countries, the annual output of which is an impressive 3 billion tonnes of aggregates, produced by 16,000 companies (mostly SMEs) from 24,000 quarries and pits with 300,000 people employed directly and indirectly. UEPG is currently focused on the key issues of the Raw Materials Strategy, and the associated challenges of access to local resources, resource efficiency and recycling. UEPG is also strongly committed to excellence in environmental stewardship, to enhancing biodiversity in its operating and restored quarries and pits and to the imperative of better health and safety in the industry. In 2012, UEPG will celebrate its 25th anniversary, and for that occasion would be delighted to welcome new members from the SARMa region countries, thereby together ensuring a truly Sustainable Aggregates Industry for a Sustainable Europe.

UEPG has represented the European Aggregates Industry since 1987 and actively lobbies on its behalf in front of the European institutions and all its other key stakeholders. UEPG now has members in 31 countries (see map), and will welcome aggregates producers and associations in the SARMa Project region of South-Eastern Europe (SEE). The annual output of those countries now represented by UEPG is an impressive 3 billion tonnes of aggregates, produced by 16,000 companies (most of which are SMEs) from 24,000 quarries and pits with 300,000 people employed directly and indirectly. In 2012, UEPG will celebrate its 25th anniversary, and for that occasion would be delighted to welcome new members from the SARMa region countries. The annexes which follow give an overview of UEPG activities, its organisational structure and European economic data.

Annex 1 summarises our key work areas, current and ongoing priorities, achievements in the past year and objectives for the next year. The highlights are:

- We continue to lobby on the Raw Materials Strategy, with a strong focus on the second pillar, seeking for better future access to local resources, better minerals planning and more efficient permitting. In parallel we are also actively lobbying on Resource Efficiency, which is primarily focused on the promotion of more recycling of construction and demolition materials.
- We have made significant strides in promoting the Safer by Design initiative and were honoured to be invited to become a partner of the 2010-2011 EU-OSHA

Campaign. Significant progress has also been achieved on strengthening the implementation of the European Social Dialogue Agreement on Respirable Crystalline Silica, and we look forward to even more comprehensive industry reporting in early 2012.

- We have made good progress on developing our Biodiversity Strategy to 2015. Our significant database of case studies shows that our quarries and pits, both active and restored, are real biodiversity havens. We also made significant progress on water management guidelines, and continue to watch and advise the industry on a variety of emerging environmental initiatives.
- We have continued to successfully engage on challenges related to the Construction Products Regulation (CPR), CEN standards, and legislation concerning Classification, Labelling and Packaging (CLP) and REACH.
- We have continued to promote the deserved positive messages of our industry, which already have done much to enhance our reputation in front of the European institutions and our many other stakeholders.

Annex 2 then gives a broader picture of our Vision, Mission, Core Values and Strategic Objectives, while Annex 3 describes our Organisational Structure, geared to providing maximum service to all our Members. Annex 4 gives an overview of recent economic developments in Europe, its impact on the aggregates sector, as well as our belief that we will see an overall return to growth as of 2012.

UEPG believes that it can greatly help towards promoting a sustainable aggregates industry in SEE by sharing its experiences and best practices openly with the SARMa Project participants. The ideal follow-on from the SARMa project would be the inclusion of all countries within that SEE region within UEPG membership. Then we all can truly work forward together in championing a Sustainable Aggregates Industry for a Sustainable Europe.

Annex 1: UEPG Activity Areas, Priorities, Achievements and Objectives.

Activity Area	Current Priorities	Ongoing Priorities	Achievements In 2010-2011	Objectives for 2011-2012
Economic Committee	Raw Materials Strategy. Resource Efficiency and 2020 Strategy Flagships.	Promote Transport Efficiency Reliable Sustainable Development Indicators (SDIs)	Significant lobbying & engagement on the EC Raw Materials, Resource Efficiency and 2020 Strategies. Developed more accurate industry SDIs	Continue to lobby on and achieve better access to local resources, better minerals planning and permitting in all EU countries, promoting recycling and resource efficiency
Technical Committee	Reviews of CEN standards & associated issues With EPRA, promotion of recycling	Issues on implementing Construction Products Regulation End-of-Waste Criteria	CEN developments closely monitored, including debates on dangerous substances, CLP and REACH Created more awareness of need for higher recycling levels	Ensure industry interests are achieved in technical standards. Resource Efficiency & Innovation Union: develop good practice guidelines to promote more recycling across Europe
Health & Safety Committee	Promoting Safer by Design Further promoting the ESDA on RCS	Furthering fatality and accident prevention Postponement of Directive on Explosives for Civil Uses	Atlantic Alliance 6 Meeting in Oct 2010, Safer by Design promoted at European level: UEPG invited to be partner within EU-OSHA Campaign Further roll-out of the ESDA to more EU countries Adopted CSI initiatives on fatality & accident prevention	Atlantic Alliance 7 meeting planned to take place in US in 2012 to roll out Safer by Design globally Further improve next ESDA/NePsi reporting in Feb/Mar 2012 Continue to create awareness and action on fatality & accident elimination
Environment Committee	Monitoring of and alerts on all emerging EC initiatives Promoting Biodiversity & Natura 2000 aspects Water Management	Marine Strategy TEEB initiative and associated issues on ecological offsets	Developed biodiversity strategy to 2015, including KPIs, analysed case studies, joined B@B Platform, strengthened IUCN links Developed good practice guidelines on water management and case studies	Further develop biodiversity as a key industry strength, including TEEB and offset issues Further develop marine aggregates task force Continue to lobby on the many emerging environmental initiatives
PR & Communications Task Force	Good PR Practice Exchanges Industry Image & PR Messages	Supporting European Minerals Day and other PR initiatives Create more awareness of funding opportunities	Good PR Practice Exchanges Industry Image & Messages 2010 Sustainable Development Awards, next in 2013	Continue to share excellent activities between members. Keep driving positive industry messages on responsibility and dedication to excellence

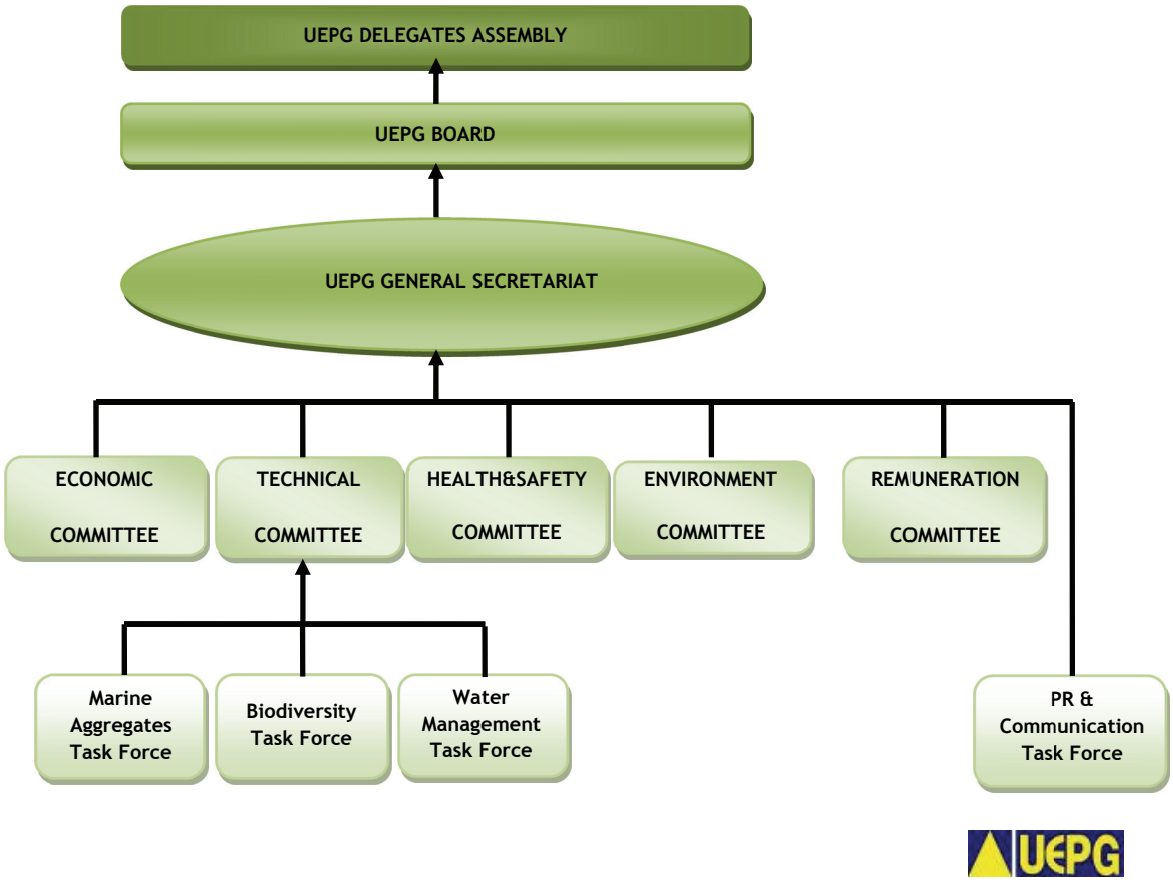
Acronyms:
CLP = Classification, Labelling and Packaging (where aggregates are deemed as "articles".)
EPRA = European Platform for Recycled Aggregates
ESDA/RCS = European Social Dialogue Agreement on Respirable Crystalline Silica,
NePSi = European Network for Silica,
PR = Public Relations,
TEEB = The Economics of Ecosystems and Biodiversity.

***Annex 2**: UEPG Vision, Mission, Core Values and Strategic Objectives.*

	Economic Objectives	**Social Objectives**	**Environmental Objectives**
Our **Vision** is a Sustainable Industry for a Sustainable Europe Our **Mission** is to be the Industry Champion and a trusted Partner Our **Core Values** are to be Open, Transparent and Honest Our **Objectives** are as follows:	**Economic Survival** Many UEPG members continue to suffer highly adverse market conditions in their national economies. Drastic actions were necessary to survive the recession. European economic recovery is now beginning, albeit at a slow pace. UEPG campaigns to create better economic conditions for the aggregates industry in Europe. **Supplying essential Building Materials** UEPG member companies supply materials vital for the residential, social, transport and commercial infrastructures of modern society. Continued long-term access to local raw materials is a vital issue for the industry, and is central to our lobbying on the Raw Materials Strategy. **Retaining Jobs** Despite the current recession, UEPG member companies continue to be an important source of long-term jobs, both direct and indirect, particularly in rural areas. **Contributing to Europe's Competitiveness** The Aggregates Industry is highly competitive. Its activities are a key pillar of the European Economy.	**Promoting Health & Safety** UEPG member companies are dedicated to ensuring the health and safety of its employees, contractors and visitors. UEPG has developed further partnerships with several health and safety initiatives such as EU-OSHA and the NePSi Agreement. On safety, the industry recognises that further improvement is much needed, and it is committed to actively addressing that challenge. **Partnering with Local Stakeholders** UEPG member companies aim to engage with all relevant stakeholders. Their operations are an integral part of regional and local communities. The industry is committed to Open-Door communications with its neighbours and other key stakeholders. **Contributing to Europe's Heritage** UEPG members acknowledge the importance of the common natural and built European heritage and will continue to promote best practices in its extractive and restoration activities.	**Promoting Biodiversity** UEPG members are strongly committed to promoting Biodiversity both during its extractive activities and subsequent restoration. UEPG is convinced that quarries and pits are Biodiversity havens. UEPG has established a database of impressive Biodiversity case studies across Europe and has developed leading partnerships with IUCN and the B@B Platform. **Sustainable Production** UEPG actively promotes the recycling of construction and demolition materials, and is strongly committed to Resource Efficiency. UEPG also promotes the further development of marine and manufactured aggregates in order to conserve land-based resources. In all activities, the highest standards of environmental stewardship are set as an operational imperative of the aggregates industry **Awards** UEPG promotes triennial Sustainable Development Awards in order to recognise and further promote excellence in the Industry.

The Health & Safety, Environment, Technical and Economic Committees and their associated Task Forces are the "engine-room" of UEPG activities. These Committees meet twice yearly over two days and report with the General Secretariat to Board. The Board reviews progress and strategy twice yearly in April and November/December. The highest level meeting is the Delegates Assembly, held in May of each year, where all Members debate and decide ongoing UEPG budgets, administration, activities and strategy.

Annex 3: UEPG Organisational Structure.



Current trends in the European Aggregates Industry

In 2009, just on 3.25 billion tonnes of aggregates were produced in 24,000 quarries and pits, making aggregates as the largest non-energy extractive sector, the direct value of this production amounting to over €20 billion,

Recent years have shown a dramatic decline in numbers of producing companies, down from nearly 30,000 in 2006 to about 16,000 in 2009, an indication both of the severity of the economic crisis and of ongoing consolidation in the industry. Annual aggregates production peaked in 2006 at about 3.7 billion tonnes. As a consequence of the onset of economic problems, aggregate production declined to 3.25 billion tonnes in 2009, and is predicted to have declined further to around 3 billion tonnes in 2010 (Figure 1). Some countries are reporting even further declines in 2011, though this will hopefully reverse as economic recovery gradually takes hold.

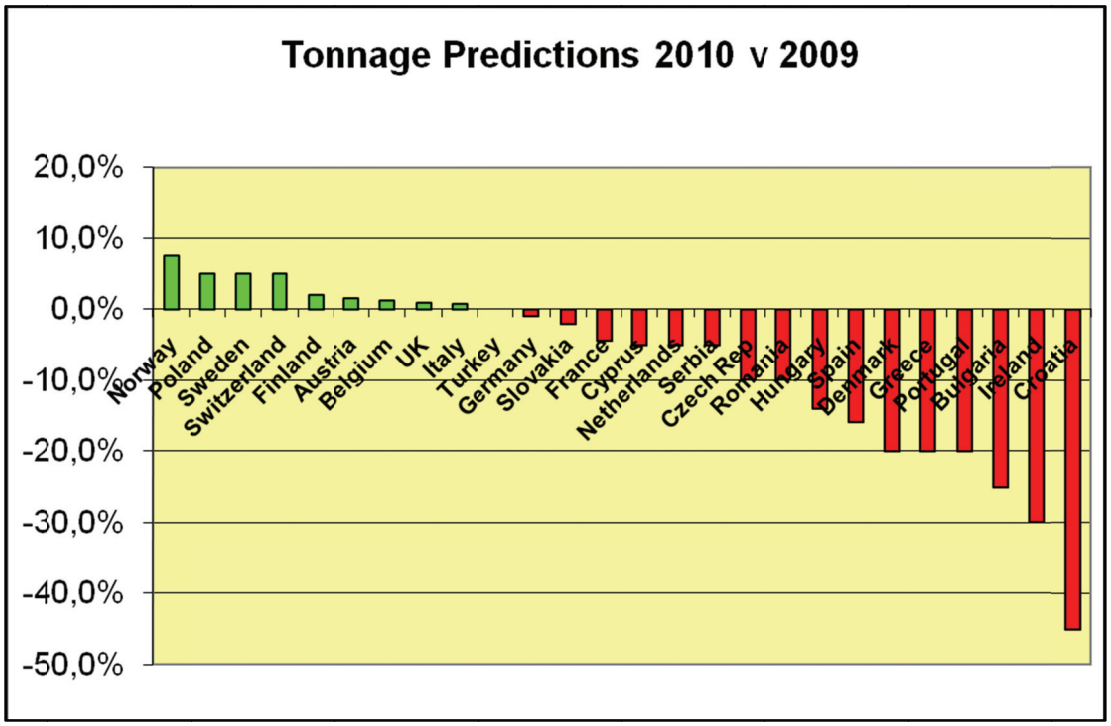


***Figure 1**: Estimated changes in tonnages 2010 v 2009 (Source: UEPG, 2011).*

In 2009, it is estimated that 300,000 people were employed in the aggregates industry, including both direct employees and contractors. The economic crisis has unfortunately led to loss of over 100,000 jobs since 2006/2007 in the industry, as companies took drastic measures to survive. Better economic and legislative conditions are essential for the industry to create more jobs, in line with UEPG's mission.

Figure 2 shows the variation in tonnes/capita across the various countries. These figures are influenced by several factors, including state of economic development, population densities and climatic conditions. The European 2009 average was 5.5 tonnes/capita, down from 6.2 tonnes/capita in 2008, further down from 7 tonnes/capita in 2006, again dramatically confirming the extent of the economic crisis over the last 5 years.

Figure 3 demonstrates the relationship between tonnes/capita and Gross Domestic Product (GDP)/capita, each point representing a country. The key positive message from this graph is that the tonnes/capita continues to increase as the GDP/capita increases. Therefore once the current economic crisis is over (hopefully as of 2012), the demand for aggregates across Europe will return to growth.

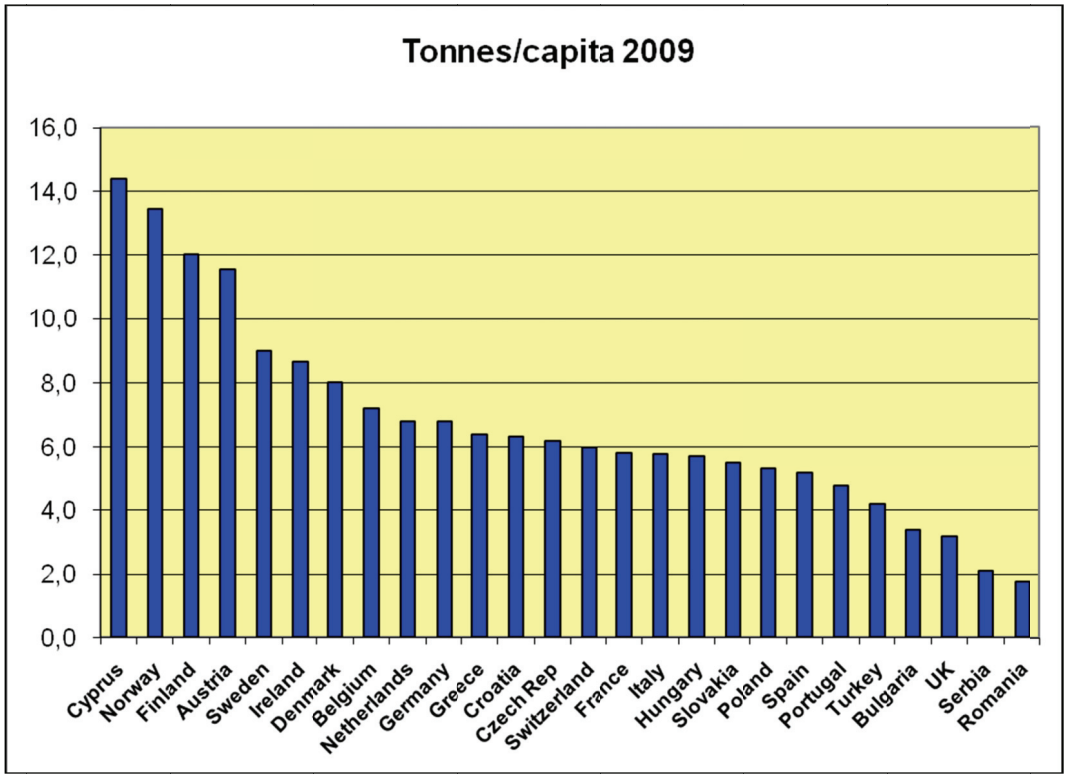


***Figure 2**: Aggregates production in 2009 in Europe by decreasing tonnes/capita (Source: UEPG, 2011).*

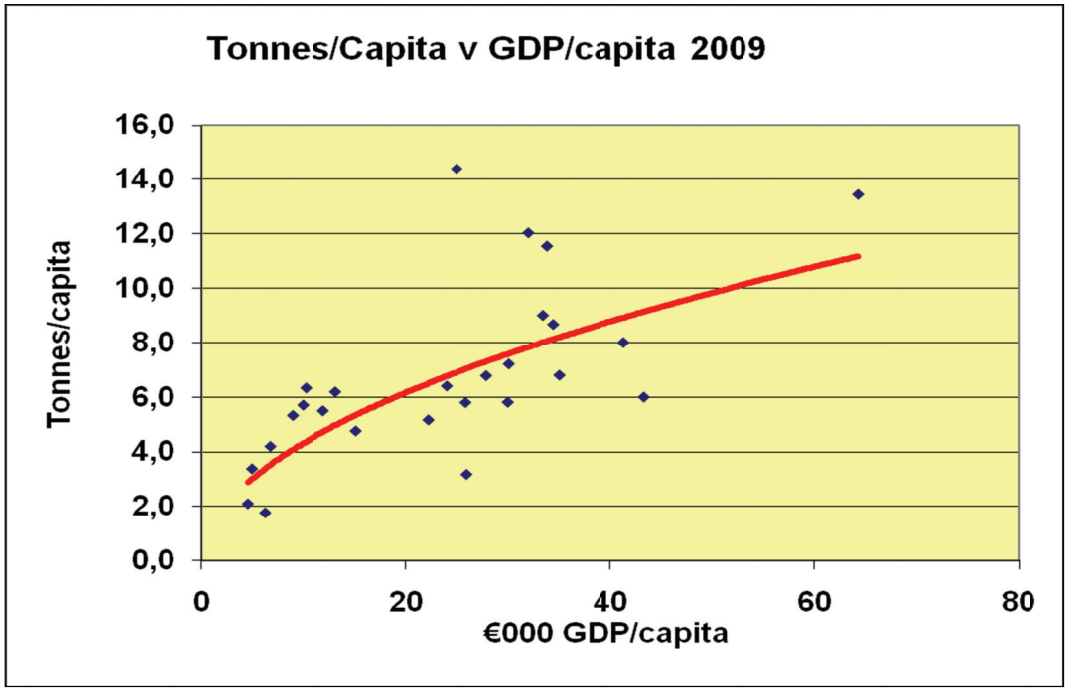


***Figure 3**: Aggregates production in 2009 in Europe - tonnes/capita (vertical scale) & GDP (horizontal scale) (Source: UEPG, 2011).*

National mineral resource database as a support for mining sector

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Abstract: One of the priority national tasks is to make appropriate inventory of all active, abandoned and perspective open cast mines, processing plants and waste disposals from mines and extractive industry. They are important from the point of view of organized industrial exploitation as well as from the point of spatial planning and environmental protection.

For the purpose of sustainable management of mineral resources (exploration, exploitation, consumption, spatial planning…) a complex national database of all mineral deposits is developed by Geological Survey of Slovenia, financed by Ministry of the Economy, competent for mining sector.

All sites are described by geological, geographical, spatial, environmental and economic characteristics. They are evaluated from the economic point of view and in the sense of intervention in land and potential environmental impact as well.

Key Words: Database, GIS, Mineral Resources, Mining Right, Concessionaire

Introduction

In connection with the sustainable management of natural resources and land use planning in Slovenia the need for complex overview and control of the deposits of available non-metallic mineral raw materials and of their exploitations became urgent at the Geologic Survey of Slovenia (GeoZS). The establishment of an information system that would comprise all data on exploration and exploitation of all groups of mineral raw materials in the country became necessary. In the framework of the Geologic Information System we established the database, comprising all important data of deposits and owners of mining rights for their exploration and profitable exploitation. The database contains a complex survey of the entire state of issued decrees and permits, and of basic characteristics of the deposits themselves. The connection of attributive entities with the spatial data in the considered database permits a simultaneous insight into the mineral deposit as a part of a specific area on the topographic map (coordinates, community of the deposit), into the elementary attributes of the deposit (kind of deposit, size of the exploitation and exploration area, deposit type, potential…), and also into the basic characteristics of the concessionaire. By constructing this information system we are approaching the environment more friendly and economically efficient exploitation of mineral resources, avoiding the conflicts between satisfying the market demands and interests of other activities in the Slovenian area.

At Geological Survey of Slovenia a huge number of data is organized as a database in GIS environment (Hribernik et al, 2010), which consists of the following segments: mines

and open-pits with mining rights, interventions in land with the aim of mineral exploitation (temporary active or abandoned), abandoned coal mines, closed metal mines with known administrator, abandoned metal mines and coal mines in closing procedure. These data are updated permanently and represented on thematic maps at different scales.

Within the frame of the Mineral Resources of Slovenia database GeoZS in the role of mining public service also developed a database of mining concessionaires. This database contains data on private persons and companies who were given by the Government a lawful right for exploration and exploitation of mineral resources. Beside two active underground coal mines sixteen types of non-energy raw materials are currently being extracted in Slovenia, with crushed stone (limestone, dolomite, igneous and metamorphic rocks) and gravel with sand reaching the largest quantities per year. It provides a precise overview and control over the availability of those non-renewable natural resources from the point of view of the Government, as their manager, as well as their users.

Beside the basic data on location and material, the entity – relational model include data on the size of exploration / exploitation area, quantity and use of the extracted mineral raw material, major data on the concessionaire as well as administrative data on each pit and its manager.

Methods

Investigations of mineral deposits are based on large amount of qualitative and quantitative data which demands a complex approach to modelling and organizing information into logical data model, useful on local, regional and national level.

For that purpose the conceptual, logical and physical data modelling was designed, resulted as an entity-relationship (E-R) data model.

The transfer of archive data to computer environment and the construction of final application allow the user a simple overview of data and various analyses of them.

The very procedure of the database construction is called in theory the data modelling, and it is performed in logical steps. It consists of the process of defining the data dictionary and the contents of the database. In modelling, the terminology for describing the attributes and connections between objects in the system is defined first. The modelling process is independent of the available programming equipment. For being useful it must be appropriately designed, efficient and easily accessible to the user. The first stage of construction comprises the study of the model of considered problems and standardization of data. Follow the definition and description of relations between objects and their functionality. The result of these processes is the conceptual model, which represents the simplification, or ideal interpretation of reality with respect to objects and their interrelations. The second modelling phase comprises the establishment of the logical data model, which is based on provable facts. The model consists of logically most acceptable arrangement of tables that are based on normalization of data. The result of logical modelling is the relational model with object hierarchically arranged which enables connections and analysis of interactions among the objects, queries and complex insight into the entire system. The third stage of establishing of the data collection consists of the physical data presentation. The physical model shows the actual storage of data, amounts

of data, access to them and their organization. Usually they are organized on external memory that enables fast access, input, updating, search, adding, deleting and storage of large amounts of data. At this point also decision on the choice of programming equipment is taken. Database is designed on SQL server 2008. In our case for the input forms program package MS Access was selected. The forms for input and screening, various listings of data and forms for search were elaborated. The last phase of data modelling is external level or so called execution data model. It represents the ways how the end users can see the data. During creation of the database the data must be checked, reclassified and regrouped several times, and relations among them reasonably established. The relational model must be tested. The final scheme must assure maximum of information, minimum of redundancy and optimum possibility for analyses. The capabilities of the program and technical equipment (software and hardware) must be also taken into account, and the limits accordingly set.

The database provides all significant attributive data of deposits themselves, concessionaires, decrees and permits for exploitation or exploration areas. Those attributive entities are connected with spatial data in GIS system, which permits a simultaneous insight into the mineral deposit as a part of a specific area on the topographic map (coordinates, community of the deposit, parcels), into the elementary attributes of the deposit (kind of deposit, size of the exploitation and exploration area, deposit type, potential…), and also into the basic characteristics of the concessionaire.

The mineral resources information system of Slovenia, which was started back in 2002, consists of two integrated parts, mentioned relational database of mineral deposits, which relates information in tabular way so that rules of relational algebra can be applied, and geographic information system (GIS), which relates spatial information of deposits.

The complex relationships between objects and the concepts of normalized data structures, lead to the practical informative and useful data model, transparent to the user and to better decision-making by allowing future scenarios to be developed and inspected.

Computerized storage, and display system is as already said, developed and managed under the support of Geological Survey of Slovenia, which conducts research on the occurrence, quality, quantity, and availability of mineral resources in order to help the Nation make informed decisions using earth-science information.

Information about deposit is stored in records in approximately hundred data fields. A numeric record number uniquely identifies each site. The data fields are grouped under principal categories. Each record comprise elementary data of deposit (name, type, location, prospect, rock), administrative data (concessionaire, number of decree in official paper, object of decree, number of contract and its duration) and data of mineral resource produced amount and size of exploration area). The data can also be searched, sorted and printed using any of these fields. New records are being added annually, and existing records updated or upgraded.

Relational database is connected with scanned exploration/exploitation areas of deposits, defined on the base of digital ortho-photo. Register of those areas is indispensable because of spatial planning and spatial municipal and regional strategy development.

Graphic representation with accurate locality of the mineral deposit permits comparisons with other interests in land use, as the nature preservation and environment

protection, conservation of natural and cultural heritage, agricultural land, water protection areas and others.

Web based GIS application was establish for visualizing, and analyzing data about mineral resources deposits and owners of mining rights for their exploration and profitable exploitation (http://akvamarin.geo-zs.si/ms/).

Database is also part of internet application for quick search and review of data and part of web page of mineral resources of Slovenia. It allows users to readily and easily display, analyze, and interpret spatial data from desktop using a Web browser connected to the Internet.

We believe that there is an opportunity for cooperation within this activity. We can offer a single location where users can come to browse relatively simply for geo-science related digital data sets.

Results

For the purpose of sustainable management of mineral resources a huge national database of all mineral deposits is developed by Geological Survey of Slovenia.

Relational database is available on SQL server 2008. In the evidence there are 227 deposits and 170 concessionaires (Šolar, Senegačnik, 2010).

All the sites are described by geographical, geological, spatial, environmental and economic characteristics. They are evaluated from the economic point of view and in the sense of intervention in land and potential environmental impact as well.

The attributes are divided into next groups:

- Geological (type of mineral deposit, geological reserves and resources, raw material quality determined by different analyses, …)
- Geographical (position of the site)
- Spatial (land use, surface mine dimensions, distance from settlement, infrastructure)
- Environmental (underground water deepness, water protection zone, phase of reclamation…)
- Economic (commercial resources, possibility of site access, feasibility of exploitation).

Owing to their evolutiveness and adaptability such type of representations provide an organized scheme for collecting, storage, modifying and displaying of georeferenced geological data, simultaneous access to data, exchange with other programs, creation of web sites and connecting with other databases. Using geoscientific information model leads to better decision-making by allowing future scenarios to be developed and inspected. By constructing such information system we approach the environmental more friendly and economically efficient exploitation of mineral resources, avoiding the conflicts between satisfying the market demands and interests of other activities in the Slovenian area.

Graphic representation with accurate locality of the mineral deposit permits comparisons with other interests in land use, as the nature preservation and environment protection, conservation of natural and cultural heritage, agricultural land, water protection areas and others (Hribernik et al, 2008).

The geologic data stored in the databases are easily utilized for graphic modelling and various investigations. GIS is used increasingly in geologic research for construction of digital databases comprising diverse parameters. The GIS procedures involve input, storage, treatment and output of georeferential data. Geologic data are complex, as they provide information on geology, hydrology, geomorphology, soils, climate, land use, topography and anthropogenic elements. Therefore they must be adequately analyzed and combined with spatial data on maps. For geology the use of databases in the future is absolutely necessary.

Certain data from national database which have public character will be included in a common database in the frame of EuroGeoSource project at the EU level that would allow the development of advanced measures against supply shortages (http://www.eurogeosource.eu/).

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Collision of laws

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There are no so rare situations when collision of different laws causes unclear situations for all involved stakeholders and hinders efficient management of the aggregates, as well as of other mineral resources. Not only young states as it is Bosnia and Herzegovina face this problem in one or another area, but due to the complexity of laws even develop countries are sometimes faced with situations, when one law allows something, that is forbidden by another law and people often find themselves in ambiguous situations. This problem is in Bosnia even more exacerbated by the complexity of state constitution with different levels of authorities (state, federation, and municipality), which jurisdictions often overlap with one another. That is especially represented when it comes to the jurisdictions over certain activities for instance over issuing permits where federal law puts that in charge of the federal bodies and cantonal laws puts that in charge of the cantonal bodies. Or another example, cantonal and federal laws require mining companies to fulfil different conditions as a prerequisite for performing geological investigations. So, there are problems both - vertically (different levels of government) and horizontally (different sectors).

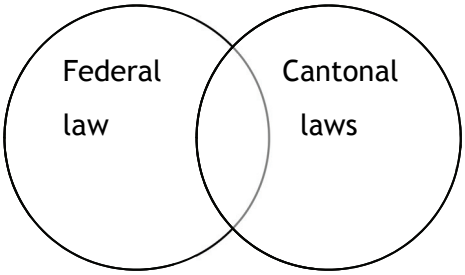

***Figure 1**: Overlapping of laws on different level of authorities.*

When it comes to aggregates, in the Federation of Bosnia and Herzegovina, in 2009, there was Law on Mining in force ("Official Gazette of Federation of BiH No:20/02, 29/03 i 37/04), which together with Law on Geological Investigations ("Official Gazette of Federation of BiH No: 9/10, 14/10) and Law on concessions ("Official Gazette of Federation of BiH No 40/02), dealt with all aspects of aggregates exploitation, from geological investigations, procedures for granting concessions to the reclamation of excavated areas.

These three laws fully regulated in the detail whole procedure of exploitation from the geological investigations to the reclamation of excavated area.

However other laws as is Law on spatial planning, Law on waters, or Law on forests sometimes cause dubious situations in the field as they overlap with these three.

To say it simply Federal Law on Geological Investigations says that certain company-investor can perform geological investigations only upon approval of competent body and if investigations show that there are significant reserves, that is usually followed by tender published by the competent ministry and granting concession to the best bidder.

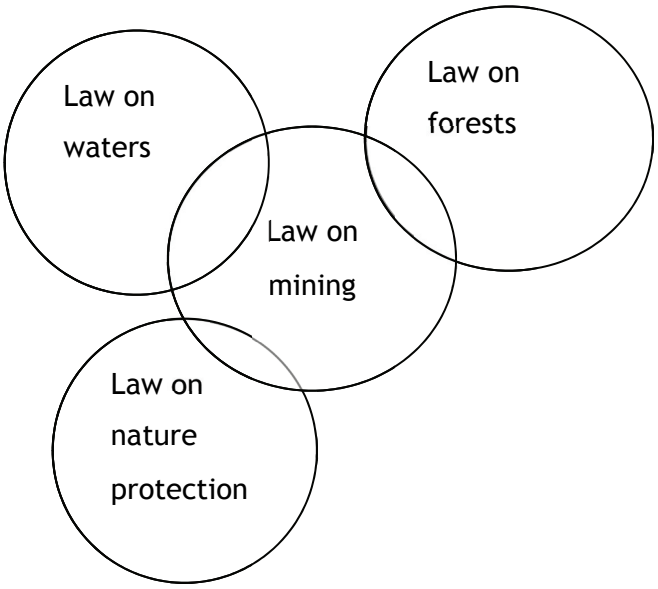

***Figure 2**: Overlapping of different laws on the horizontal level.*

On the other side, while Federal Law of Forests said that it is forbidden to exploit humus, clay, peat, sand, gravel, limestone, stone and mineral resources, it still allowed exception from this rule enabling cantonal forest managing associations (bodies in charge for managing forests) and the owners of the private forests to exploit above mentioned resources and use them either for their own needs or to even obtain commercial gain by selling them to the citizenry or to the other companies.

This enabled cantonal forest managing associations as well as owners of the private forests to totally avoid whole procedure of obtaining concession and other necessary permits for exploitation as well as to avoid paying concession fee. This situation puts mining inspectors in difficult situation and causes disputes hard to resolve as both sides had base in laws.

Also there are some differences in terminology regarding concept of geological investigations between Federal Law on geological investigations and federal Law on Environment Protection, Law on Water Protection and Law on Forests.

Also sometimes there are collisions between laws and bylaws.

In Bosnia and Herzegovina this problem is often caused by simply rewriting laws from some other countries or from EU without taking into consideration legal legacy and real situation in the field.

Solution of these problems would require inter-sectoral analysis as well as vertical coordination.

Legal act, directive etc:

Law on Mining ("Official Gazette of Federation of BiH No:20/02, 29/03 i 37/04), Parliament of the Federation of Bosnia and Herzegovina,

Law on Geological Investigations ("Official Gazette of Federation of BiH No: 9/10, 14/10), Parliament of the Federation of Bosnia and Herzegovina,

Law on Concessions ("Official Gazette of Federation of BiH No 40/02), Parliament of the Federation of Bosnia and Herzegovina,

Law on Physical Planning and Utilization of Land at the Level of the Federation of Bosnia and Herzegovina ("Official Gazette of the Federation of Bosnia and Herzegovina", No. 2/06), Parliament of the Federation of Bosnia and Herzegovina,

Law on Environment Protection ("Official Gazette of the Federation of Bosnia and Herzegovina", No. 33/03) Parliament of the Federation of Bosnia and Herzegovina,

Law on Water Protection ("Official Gazette of the Federation of Bosnia and Herzegovina", No. 33/03), Parliament of the Federation of Bosnia and Herzegovina,

Law on Forests ("Official Gazette of the Federation of Bosnia and Herzegovina", No.20/02, 29/03 i 37/04), Parliament of the Federation of Bosnia and Herzegovina,

Harmonizing mineral extraction activities and EU Nature Directives requirements (Natura 2000) through application and/or development of general and national guidance documents (COAST project) related to appropriate assessment in accordance with article 6(3,4) of the Habitat Directive

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Abstract: Nature protection on the level of EU is based on two directives: Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (1979, 2009) – Birds Directive (EC, 2010) and Council Directive 92/43/EEC of 21 May 1992 on the conservation of Natural habitats and of wild fauna and flora (EC, 2010) - Habitat Directive. These two directives are the basis for establishment of the Europe-wide ecological network Natura 2000.

One of the most important mechanisms for the protection of Natura 2000 is so-called appropriate assessment of plans and projects as defined in the article 6 (3,4) of the Habitat Directive. In this way the directive aims to ensure that implementation of various plans and project does not threaten Natura 2000 sites and that no unnecessary limitations are made to the projects that have no significant impact on the sites.

As a support for expert work related to appropriate assessment and to standardize the approach across EU, several EC guidance documents have been created in the past decade. The importance of sustainable mineral extraction and the need to harmonize strategic documents such as Raw Mineral Initiative of 2008 with Nature Directives resulted in the EC guidance document: „Undertaking non-energy extractive activities in accordance with Natura 2000 requirements“. This document emphasizes that mineral exploitation within and around Natura 2000 areas is possible - appropriate assessment and strategic planning are the mechanisms that should ensure coherence of Natura 2000 network either by mitigation or avoidance of adverse impacts or compensation if reasons of overriding public interest are established.

As Croatia has already transposed provisions of EU Nature Directives in its national legislation State Institute for Nature Protection has, through activities of the EU PHARE 2005 project „Institutional Building and Implementation of Natura 2000 in Croatia“, organized workshops and printed brochure about the standard methodology and procedure of appropriate assessments in accordance with EU directives in 2008 .

This line of activity was continued with the support of a UNDP GEF project “Conservation and Sustainable Use of Biodiversity in the Dalmatian COAST through Greening COASTal Development”. Activities of its component “Integration of the National Ecological Network and Natura 2000 in coastal area management: Support to the State Institute for Nature Protection (SINP) on introduction of Nature Impact Assessment (NIA) practices in coastal areas” are aimed on development of national guidance documents. For this purpose a team of international and local experts was formed to present and standardize methodology within the framework of Croatian legislation. Such guidance should ensure protection of the sites of Croatian national ecological network and support sustainable development (including exploitation of mineral resources) through development of rational, scientifically sound and cost effective planning and assessment methodology.

Key words: Appropriate Assessment, Natura 2000, Guidance Document, National Ecological Network, Croatia

Introduction

Nature protection on the level of EU is based on two directives: the Birds Directive (1979, 2009) (Directive 2009/147/EC the European Parliament and of the Council of 30 November 2009 on the conservation of wild bird (EC, 2010) and the Habitats Directive (1992) (Council Directive 92/43/EEC of 21 May 1992 on the conservation of Natural habitats and of wild fauna and flora (EC, 2010). These directives require from member states to ensure favourable conservation status of habitats and species of European importance (as indicated on the annexes of the directives) within the range of their Natural distribution. For this purpose countries establish areas for their conservation in accordance with each directive (SPA or SAC) which together make up European ecological network Natura 2000.

One of the most important mechanisms for the protection of Natura 2000 areas is so-called appropriate assessment of plans and projects as defined in the Article 6 (3 ,4) of the Habitat Directive. In this way directive aims to ensure that implementation of various plans and projects does not significantly adversely impact the habitats and species for which site was established and its ecological integrity.

Consequently each plan or project likely to have an impact has to pass the assessment procedure to determine whether its implementation might have negative impact on the Natura 2000 area, taking into account direct, indirect, as well as cumulative impacts. If it is determined that even after implementation of mitigation measures significant negative impacts remain the plan or project cannot be approved. In that case Article 6 (4) gives possibility to carry out plan or project only if an overriding public interest for the plan or project is established and the member state ensures coherence of Natura 2000 through compensatory measures and informs or consults the European Commission.

Standard appropriate assessments methodology has been proposed for the whole EU (EC 2002), dividing appropriate assessments procedure in four parts: screening, appropriate assessment, assessment of alternative solutions and establishment of overriding public interest. The goal of such division is to avoid assessment of projects for which it is unnecessary and to focus the assessment on the conservation goals and integrity of the Natura 2000 areas.

EC guidance documents on article 6 of the Habitat Directive

Habitats and Bird Directive are one of the examples of complex pieces of EU legislation that impose legal and scientific norms which have to be adhered to ensure achievement of their goals.

The legal aspect of directives is binding to the member states in a sense that they have to transpose it in its own legislation in accordance with principle of subsidiary. If

some doubts about the process of transpositions arise European Court of Justice gives in its rulings additional interpretation of the directive usually after a complaint pertaining to certain case. Habitats and Birds Directives are available on the web site of the European Commission (EC, 2011a) and rulings of the European Court of Justice are available on its web site (ECJ, 2011). A brochure presenting most important ruling of the court of justice until 2005 in regards to nature and biodiversity has been published and it is available on the web site of the European Commission (EC, 2011a)

The specific expert methodological aspects of the directives are presented in the EC guidance documents. Guidance documents are non-binding and their purpose is to recommend the best way to perform the actions necessary to achieve certain goals of EU importance. The complexity of the article 6(3, 4) of the Habitat Directive initiated creation of several EC guidance documents that provide information about the best approach for its implementation. They can be classified in two groups: general guidance documents and sector-specific guidance documents. All documents are available on the EC nature and biodiversity web page (EC 2011b)

The general guidance documents in regards to Article 6:

- Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (2000)
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites (November 2001)
- Guidance document on Article 6(4) (January 2007)

Sector -specific guidance documents:

- The implementation of the Birds and Habitats Directives in estuaries and coastal zones
- Integrating biodiversity and nature into port development
- Wind energy developments and Natura 2000
- Non-energy mineral extraction and Natura 2000

As the process of transposition is specific for each member state, many EU countries have developed in addition to EU guidance documents specific national guidances that explain assessment methodology within the national legal framework.

The EC guidance document: Non-energy mineral extraction and Natura 2000

The guidance document “Non-energy mineral extraction and Natura 2000” aims to reconcile non-energy mineral extraction and Natura 2000. In its introduction it clarifies that EU Nature Directives do not exclude mineral extraction activities in and around Natura 2000 areas. As the Raw Mineral Initiative adopted in 2008 has a goal to secure and improve access to raw materials for EU through specific set of the measures, the correct implementation of Nature Directives, in particular of the article 6 of the Habitat Directive, should ensure that mineral extrication does not have negative impact on Natura 2000 network. Some of the possible negative impacts of mineral extraction are associated with land clearance, changes in hydrological or hydrogeological conditions, changes in water quality, habitat changes that promote invasive species colonization, noise and vibration, etc. Possible consequences for the Natura 2000 sites include habitat loss and degradation,

species disturbance and displacement. The guidance document also presents case studies that illustrate how mineral extraction can also have positive impact on some species of European importance by creating new diversified habitats. In example steep perched rocks preferred by some birds of prey can be created by extraction activities in quarries and water filled gravel and sand pits can host aquatic and wetland habitats and water birds. Strategic planning is a mechanism that should identify, as early as possible, conflicts between nature conservation efforts and mineral extraction, and provide appropriate solutions. It is envisioned as multistage complex process that starts with general development strategies and ends with assessment of particular projects. Overlying of Natura 2000 and mineral resources map is key element of this process but analysis has to be complex and cannot be performed automatically.

Croatian Guidance Documents

Croatian legislation has transposed provisions of EU nature directives through the Nature Protection Act (NN70/05, NN 139/08) (MINK, 2010) and Ordinance on the assessment of acceptability of plans, programmes and interventions for the ecological network (OG 118/09) (NN 109/07) (MINK, 2010).

In the PHARE 2005 project „Institutional Building and Implementation of Natura 2000 in Croatia“ *(PHARE 2005, 2011),* the main beneficiary was the State Institute for Nature Protection and the project provided framework to communicate provisions of Article 6(3,4) to national and regional stakeholders. The workshops led by European experts were organized, and a brochure „Appropriate assessment and Natura 2000 in Croatia” was published (Roth P, Venn O, 2008). The project emphasized sharing information about variety of approaches to AA in different EU countries.

The UNDP GEF COAST: CROATIA – Conservation and Sustainable Use of Biodiversity in the Dalmatian COAST

The UNDP GEF COAST project: “Conservation and Sustainable Use of Biodiversity in the Dalmatian COAST through Greening COASTal Development”, component “Integration of the National Ecological Network and Natura 2000 in coastal area management: Support to the State Institute for Nature Protection (SINP) on introduction of Nature Impact Assessment (NIA) practices in coastal areas” provided opportunity for development of national methodology for appropriate assessment of plans and projects in Croatia (COAST, 2011). The UNDP-GEF COAST expert team defined this component in collaboration with the State Institute for Nature Protection and the activities include development of two guidance documents for appropriate assessment of plans (Venn, O., Mesić. Z., Kusan V., Birov T., Šteko V., COAST, 2011) and projects (Peternel H., Roth P., Mesic Z., Antonić O., Mazija, M., COAST, 2011) within the project area. The developed guidance documents present standard EU methodology within the framework of national legislation. The activities were carried out by a team of EU and national experts. The project activities included workshops and consultations with competent authorities on the regional and national level responsible for the sectors of physical planning, environment and nature

protection. Such guidance documents should contribute to protection of Croatian national ecological network sites and support sustainable development (including exploitation of mineral resources) through rational, scientifically sound and cost effective assessment procedure.

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Aggregate production in İstanbul

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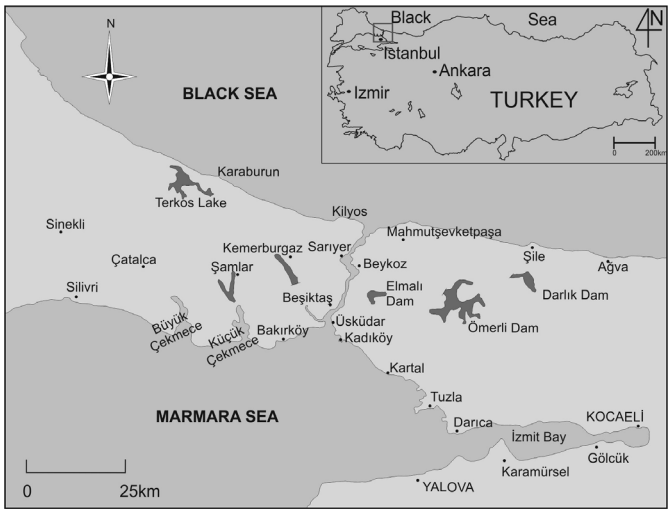
Abstract: Rapidly growing population, increasing industrialization and the need of housing and other structures in İstanbul have resulted in intensive building and construction activity in recent years. Crushed stone, sand and gravel are the main types of natural aggregate used in this city. The high demand of aggregate, production facilities without planning and insufficient investigations, the lack of good quality aggregate and urban development forces the investigators on the evaluation of further aggregate potential. In this study, the properties of aggregates produced in Istanbul are classified according to the production areas. There are different types of rocks in İstanbul. Paleozoic limestone, sandstones, Mesozoic limestone and Tertiary limestone, natural sand are the main aggregate resources of Istanbul. Furthermore, different types of rocks are discussed as other aggregate resources. On the other hand, as the aggregate resources on the surroundings of Istanbul are limited, it is emphasized that, materials from underground excavations and deep excavations and recycled aggregates (collapsed buildings, waste concretes etc.) should be used as much as possible.

Key Words: Aggregate, İstanbul

Introduction

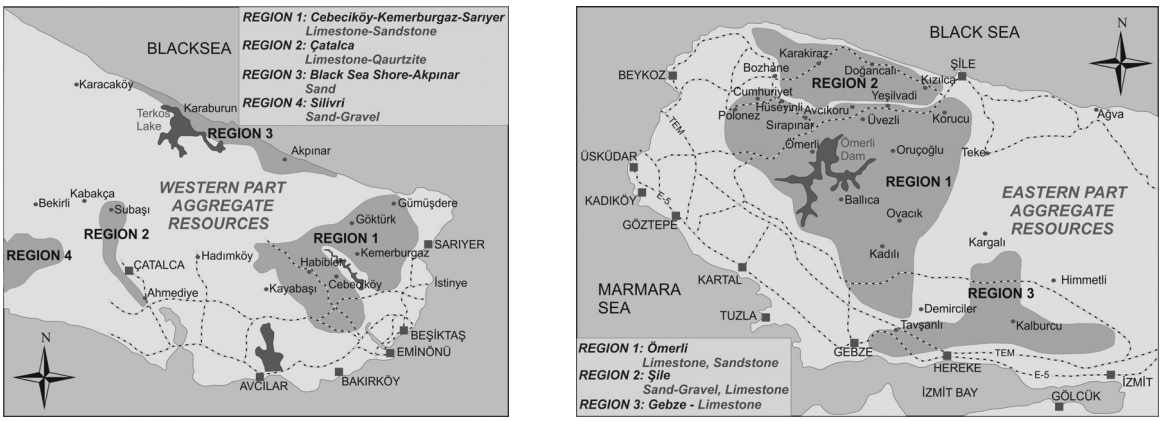


İstanbul is one of the largest and rapidly developing cities both in Turkey and Europe. Paleozoic rocks have been widely used as aggregate both in eastern and western part of İstanbul. Mesozoic and Cenozoic rocks and sands obtained from both Black sea side, Ergene River and Şile have also been used (Figure 1).

***Figure 1**: Location map of the study area.*

The main aggregate productions today are obtained from limestones, sandstones, quartzites and natural sand (Figure 2a and 2b). The abundance of these rocks varies in different parts of İstanbul, but in general, it can be concluded that in most densely populated areas, much of the good quality limestones and sandstones have already been

used up. In general, İstanbul aggregates that are mainly used in concrete production have sufficient quality, as far as materials requirements as crushed rock aggregates, limestone and sandstone have been used as basic raw material of the construction industry (Tugrul and Zarif, 2003).



(a) *(b)*

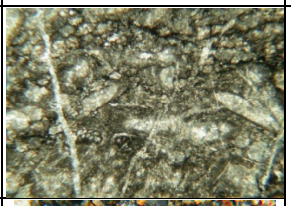
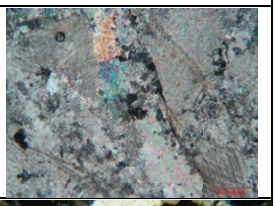
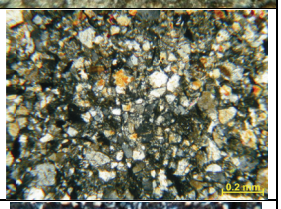
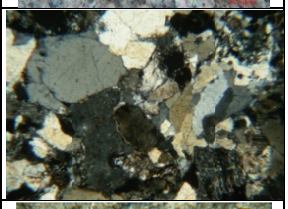
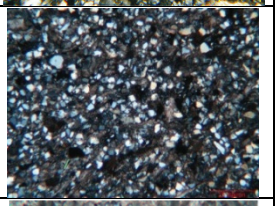
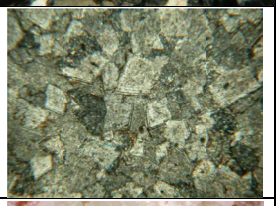
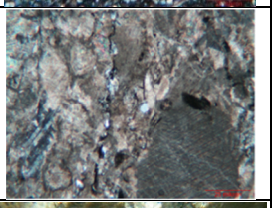
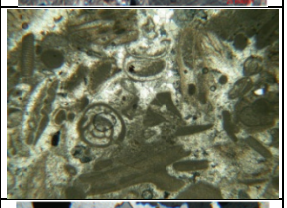
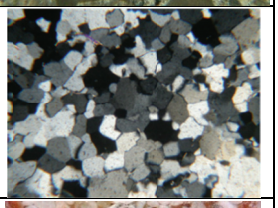
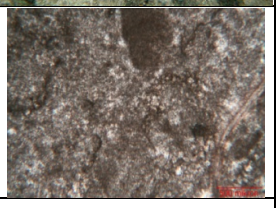
***Figure 2**: Aggregate production areas at the (a) western side (b) eastern side of İstanbul.*

There are four regions at the western side (Figure 2a), and three regions at the eastern side (Figure 2b) of the İstanbul. Many operating quarries produce different types of rocks as a concrete aggregate in these regions. This paper presents and discusses the results of a series of tests on the limestones, sandstones, quartzites and natural sands of different composition and characteristics.

***Table 1**: Geological characteristics of aggregates produced in İstanbul.*

	Location	Formation	Age	Geological Characteristics
WESTERN SIDE OF İSTANBUL	Cebeciköy I	Trakya	Carboniferous	Dark grey, few dolomitic, sparitic and fossiliferous micritic limestone
	Cebeciköy II	Trakya	Carboniferous	Greenish grey, micaceous sandstone-shale sequence
	Kemerburgaz	Trakya	Carboniferous	Greenish grey, micaceous sandstone-shale
	Sarıyer	İstinye	Devonian	Greyish white limestone
	Çatalca I	Kırklareli	Eocene	Grey-white, limestone and marl
	Çatalca II	Şermat	Permo-Triassic	White-light grey quartzite
	Black Sea Shore-Akpınar		Holocene	White grey gravel, sand, silt and clay
	Silivri	Ergene	Middle-Upper Miocene	Yellowish white-green, gravel, sand, silt and clay
EASTERN SIDE OF İSTANBUL	Ömerli I	İstinye	Devonian	Dark grey-blue, fossiliferous limestone
	Ömerli II	Kapaklı	Triassic	Red and pinky sandstone
	Ömerli III	Karakiraz	Triassic	Yellowish white-grey limestone, dolomite
	Şile I	Meşetepe	Upper Oligocene-Lower Miocene	Greenish grey and white sand
	Şile II	Ahmetli	Cretaceous	Grey dolomitic limestone
	Gebze	Hereke	Triassic	White-grey, limestone, dolomitic limestone and dolomite

Table 2: *Lithological properties and microscope photographs of İstanbul aggregates.*

	Location	Lithology	Microscope photographs		Location	Lithology	Photomicrograph
WESTERN SIDE OF İSTANBUL	Cebecikӧy I	*Fossiliferous micritic limestone		EASTERN SIDE OF İSTANBUL	Ömerli I	*Limestone	
	Cebecikӧy II	*Sandstone (subarkose)			Ömerli II	*Quartz sandstone	
	Kemerburgaz	* Sandstone (subarkose)			Ömerli III	*Dolomitic limestone	
	Sarıyer	*Limestone			Şile I	****Sand	
	Çatalca I	*Limestone			Şile II	*Dolomitic limestone	
	Çatalca II	*Quartzite			Gebze	*Limestone-dolomitic limestone	
	**Black Sea Shore - Akpınar	Dune-sea sand					
	***Silivri	Sand-gravel					

* According to Folk (1968).

**Black Sea Shore-Akpınar; Q: Quartz, Kçt: Limestone, KP: Rock grains, K: Clay, F: Feldspar.

***Silivri; Q: Quartz, F: Feldspar, OQ: Oxide quartz.

****Şile 1; F: Feldspar, Q: Quartz, K: Clay.

Geology of the aggregate resources

There are many types of aggregate resources in İstanbul. Their locations, lithological properties and geological characteristics are given in Table 1 and Table 2.

Petrographical and mineralogical characteristics

Petrographic and mineralogical studies were performed to determine the petrographic composition of the limestones, sandstones and quartzites by using polarizan microscope and natural sands by using binocular microscope. Limestone, sandstone and quartzite samples were classified according to Folk (1968). The results are given in Table 2. Mineralogical properties and the modal composition of the aggregates were also determined and given in Table 3.

Table 3: *Mineralogical composition of aggregate resources in İstanbul.*

	Q (%)	Fel. (%)	M+Op (%)	Ca/Do (%)	Op (%)	Sh+Fel (%)	Fel+Cl (%)	Plj+K+Op (%)	RG (%)
Cebeciköy I	<5			>95	<1				
Cebeciköy II	50-60	15-20	15-25						
Kemerburgaz	50-60	15-20	15-25						
Çatalca I				90-95	5-10				
Çatalca II	>90								
Black Sea shore-Akpınar	>90					>5			
Silivri	>75						<25		
Ömerli I				80-90				5-10	
Ömerli II	20-60	3-10							15-35
Ömerli III				85-95	5-10				
Şile I	90-95						5-10		
Şile II				45 Ca, 30 Do				20	
Gebze				90-95	<5				

Q: Quartz, Plj: Plagioclase, M: Mica, Op: Opaque min., Ca: Calcite, Do: Dolomite, Fel: Feldspar, Sh: Shell, RG: Rock grains, Cl: Clay.

Aggregate properties

The aggregate tests were performed in accordance with European Standards (EN). The results of these tests are given in Table 4 and Table 5.

Table 4: The results of aggregate tests.

Location	SSD particle density (gr/cm^3) EN 1097-6 (2000)	Water absorption (%) EN 1097-6 (2000)	Methylene blue absorption (gr/Kg) EN 933-9 (2009)	Sand equivalent (%) EN 933-8 (1999)
Cebeciköy I	2.67-2.71	0.4-1.3	1.2	83
Cebeciköy II	2.68-2.71	0.5-1.6	1.8	65
Kemerburgaz	2.68-2.72	0.7-1.6	1.8	36
Sarıyer	2.58	0.61	-	-
Çatalca I	2.60-2.61	1.2-2.2	1.6	78
Çatalca II	2.65-2.66	0.06-0.33	0.25	-
Blacksea Shore-Akpınar	2.61-2.62	1.02-1.33	1.0-1.3	86-96
Silivri	2.56-2.58	2.32-2.54	1.5-2.3	80-86
Ömerli I	2.69-2.70	0.35-2.03	0.66	50
Ömerli II	2.57-2.60	2.43-3.16	1.0-1.75	25-35
Ömerli III	2.72-2.77	1.0-1.9	1.5-1.7	37-44
Şile I	2.61	1.22	1.0	63
Şile II	2.74	0.068	-	-
Gebze	2.67-2.71	0.31-1.01	0.4-1.2	63-85

Table 5: The results of aggregate tests.

Location	Flakiness indices (%) EN 933-3 (1997)	Los Angeles coefficient (500 cycles) (%) EN 1097-2 (2010)	$MgSO_4$ value (%) EN 1367-2 (2009)
Cebeciköy I	13	18	9
Cebeciköy II	20	22	12
Kemerburgaz	19	20	10
Sarıyer	19.8	30	-
Çatalca I	14	25	8
Çatalca II	30	13.5	-
Blacksea Shore-Akpınar	-	-	8.5-12.8
Silivri	-	-	9.8-14.5
Ömerli I	12-33	-	-
Ömerli II	-	-	-
Ömerli III	11-19	18	-
Şile I	-	-	5.5
Şile II	22.6	20.7	-
Gebze	8-9.6	18-19	-

Discussion and conclusion

There are totally 50 crushed stone quarries at both side of İstanbul. Approximately, 78.7MT crushed stone are produced in these quarries. Total aggregate production in western part of İstanbul is 50.5MT and in eastern part of İstanbul is 28.2MT for road and concrete production (Erdoğan et al., 2006; Halili and Ilgaz, 2006), (Figure 3).

There are also totally 35 sand quarries at both side of İstanbul. Nearly, 14.1MT sand and gravels are produced in these quarries. Total sand-gravels production in western side of İstanbul is 13MT and in eastern part of İstanbul is 1.1MT.

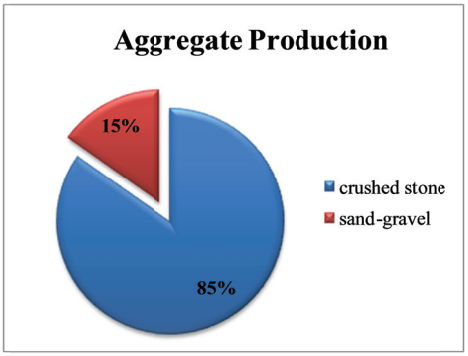


Figure 3: *Aggregate production in İstanbul.*

Limestones and dolomitic limestones are the most important source rock for concrete and asphalt aggregates in İstanbul. In the city, nearly 85% of aggregate production is crushed stone and limestones comprise about 55-65% of all crushed stone aggregates. The test results on the limestone aggregates are generally similar and the results are within the acceptable limits for use in concrete and road production.

In most of the quarries, there is a transition between sandstones and shales. In addition, there are also diabase or andesite intrusions. Therefore, in some part of the quarries, it is difficult to differentiate these kinds of rocks (Kara et al., 2009). Different rocks in the quarry show a variety of textural and mineralogical characteristics that may affect their usage as concrete aggregate. The test results on the sandstone aggregates are being boundary or slightly within the acceptable limits for use in concrete.

Quartzites produced in Çatalca Region (Region 2) are characterized by hard, stiff and sound structure (Tugrul et al., 2006). As Smith and Collis (2001) indicated that these rocks produce a higher proportion of flakes and conchoidal fragments when crushed. Unlike limestone and sandstone aggregates, a puzzolanic reaction between Si^{4+}, leached out from quartzite, and the CH may possibly be the reason for high bond strength in concrete (Tasong et al, 1998).

Sand quarries are especially widespread in western side of İstanbul (Region 3 and Region 4). The test results on the natural sands are generally similar and the results are within the acceptable limits for use in concrete production.

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Sustainability and the EU Raw Material Initiative – strategies of the European Commission

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Abstract: Raw materials provide the essential building blocks we need for our society and are a vital input for the EU's manufacturing sector. The European Commission has recognised this, and with the Raw Materials Initiative (RMI), has set the political framework for the future actions to ensure sustainable access to these materials. This strategy is based on three pillars, which cover 1) international market aspects, 2) framework conditions within the EU and 3) resource efficiency and recycling.

The principle of "sustainability" is incorporated into all three pillars of the RMI. This means that improved access to raw materials should be pursued using a globally-balanced approach where ecological, economical and societal factors are fully and equally considered.

In this context, the European Commission wishes to set-up a European Innovation Partnership on Raw Materials. Such a partnership, involving experts, authorities and other stakeholders, would foster the development of innovative solutions for the management of raw materials along the entire value chain, including exploration, extraction, processing, recycling and substitution.

Key Words: Raw Materials Initiative, Innovation Partnership, Extraction

Body Text

Raw materials provide the essential building blocks we need for our society and are a vital input for the EU's manufacturing sector. Over the last ten years, Europe's access to raw materials has become increasingly vulnerable, due in part to increased competition for raw materials caused by growing global demand. In 2009, in order to analyse this situation, the European Commission started the process of identifying raw materials which are of key importance for the EU. This resulted in the publication, in 2010, of the report on the "critical raw materials for the EU". The European Commission intends to regularly update and repeat this exercise in the coming years.

The European Commission has recognised the EU's need for undistorted access to raw materials, and as such, with the Raw Materials Initiative (RMI), has set the political framework for a future strategy aimed at ensuring this access, COM(2008) 699 final and COM (2011) 25 final. The raw materials strategy is based on three pillars:

- Fair and sustainable supply of raw materials from international markets
- Fostering sustainable supply within the EU
- Boosting resource efficiency and promote recycling

All three pillars of the RMI incorporate the principle sustainability. This means that improved access to raw materials should be pursued using a globally balanced approach where ecological, economical and societal factors are fully and equally considered.

The **first pillar** deals with to the sourcing of raw materials in the globalised economy. This pillar is underpinned by raw material dialogues with both industrialised and developing countries. Capacity- building in the mining and raw materials sector in developing countries, and the stabilisation of the political structures in these countries, is the basis for securing investments and providing local development. This development will lead to an improved, sustainable management of raw materials which will in turn improve access to important raw materials for all. These actions will create a more diverse, sustainable set of supply sources of raw materials. Research, development and innovation will further foster this diversification.

The **second pillar** is our response to improving the supply of raw materials from mining within the EU. Reliable and clear licensing procedures are of high importance, as is improved knowledge on EU resources and how they can be exploited in an economically-, ecologically-, and socially-acceptable and safe manner. Where applicable, rules covering raw materials extraction should be in line with EU Birds and Habitats legislation, including provisions on protected areas covered by Natura 2000.

In this regard, work has been undertaken on how mining and quarrying can contribute to increasing biodiversity. In 2010, the European Commission published, guidelines on non-energy mineral extraction and Natura 2000[1], which underline that there is no automatic exclusion of sustainable mining projects in or near Natura 2000 areas. There are a wide variety of excellent examples of how these guidelines have been put into practice by companies in the EU. This also actively contribute to the Biodiversity Platform of the European Union.

Moreover, increasing pressure on access to land in the EU - for uses other than mining such as building and farming – is also an important factor affecting mining in Europe. Having the right regulatory framework conditions in place is also a key concern. In spite of Europe's mining potential, many barriers to extraction and materials management exist, some of which are administrative while some are due to the sector being subject to various overlapping and conflicting policies. These hurdles need to be overcome. While this is an area which falls largely within the competence of Member States, the Commission is working together with national authorities and other stakeholders to facilitate an exchange of best practices in this area (European Commission report 2010[2]).

Even when the above challenges are tackled, the right decisions can still only be made when the right resource knowledge is available. This knowledge needs to be easily-accessible and transparent, not only for national, regional and local authorities, but also for companies and other stakeholders. This knowledge also requires a good understanding of the interconnections between different systems and the expertise of several disciplines e.g. life science and geophysics.

The European Union is perceived sometimes, as a rather raw material-poor region. In terms of aggregates, sand and gravel, this is absolutely not the case. For these materials, the European Union is mostly self-sufficient. In addition, even for those industrial minerals and ores which are currently imported in large quantities, Europe has some considerable resources and reserves. The ongoing European research project 'ProMine' – part of the 7th Framework Programme of the European Union, and funded with a budget of €17 million by

[1] http://ec.europa.eu/environment/nature/natura2000/management/docs/neei_n2000_guidance.pdf
[2] http://ec.europa.eu/enterprise/policies/raw-materials/files/best-practices/sust-full-report_en.pdf

the European Commission– is aimed at improving the EU's knowledge base on deposits of important raw materials in Europe, in particular critical raw materials. Preliminary results of this research indicate where these highly-coveted raw materials can be found within the European Union.

Strategic actions are needed to further improve the EU's knowledge base, in particular through enhanced co-operation between national geological surveys. There is still scope for increased information-sharing at EU level, in terms of production as well as on resources and reserves for all raw materials, including by-products. Better networking and increased transparency of knowledge on EU resources and reserves requires, for example, the use of the same terminology and standards for provided data.

The basis for the provision of such coherent data is not yet in place. A first step has been made here with the INSPIRE Directive on establishing an Infrastructure for Spatial Information in the European Community which calls for geographical data coherence. Projects such as "OneGeology Europe" have provided for the creation of a coherent geological map of Europe in the scale of 1: 1 Million – which is a necessary but not sufficient step to respond to current needs.

Another promising initiative is the EuroGeoSource project which started in April 2010 and where the initial focus is on providing harmonised spatial geological and geographical data sets. This project is co-financed by the Commission within the ICT Policy Support Programme which aims at stimulating innovation and competitiveness by accelerating the wider uptake and best use of innovative digital technologies. This type of information is all the more important because land use planning and strategic planning for long term decisions, such as investments in mining and efforts to be taken to fulfil the permitting process, rely on the quality and availability of data. We are still far away today from delivering a pan-European picture as only 10 of the 27 Member States are actively participating in this project.

Of course, all of the abovementioned challenges require the availability of highly-skilled specialists. Despite this need, in most regions of the European Union, investment and efforts to improve education and skills in earth science and mining engineering, as well as in the development of new and advanced technologies, have been reduced significantly in the last few decades. This situation has to be overcome, if Europe wants to keep its traditional leading role, at a time when the worldwide needs to have such expertise available to meet the growing demands of raw materials in the years to come.

The raw materials strategy does not only cover the supply of primary raw materials; there is also a need to improve the potential for secondary supply, or 'urban mining', of recycled raw materials. The **third pillar** of the RMI envisages a more efficient use of raw materials, which is also reflected in product design and is supported by high-quality recycling. The EU's 'urban mines' provide a considerable potential as a source of minerals and metals for European industry. Recycling of metal products puts less pressure on the need for primary resources and can allow for substantial savings on energy costs. For instance, producing 1 tonne of aluminium from aluminium scrap consumes only 5% of the energy needed to produce 1 tonne of aluminium from primary bauxite.

Besides the need for advanced technological solutions for a higher recovery rate of materials from waste, collection and sorting processes also need to be improved. Beyond recycling, there is a need for greater resource efficiency in the production of goods, including in the recyclability, durability and design of the final end product. The

complexity of the impact which material use has on the economy and the environment requires that impacts are assessed using a life-cycle approach. Finally, the effects of raw material use on the environment, including on biodiversity, also need to be carried out in order for the right decision to be made.

Since its launch in 2008, the European RMI has led to a significantly-improved understanding of the importance of having a secure and sustainable supply of raw materials. However, while the political framework for this has been put in place, a real improvement in the situation can only be ensured through concrete measures.

This is the reason why, in the framework of the EU 2020 "Innovation Union" flagship initiative, the European Commission is currently preparing a proposal for a European Innovation Partnership on Raw Materials. The aim of such a Partnership with Member States and Industry is to use and accelerate raw materials research, development and the introduction of innovation to the market in order to solve difficult societal problems (e.g. how to reduce waste; how to improve acceptance of mining in Europe), bundle know-how and resources and increase European competitiveness.

This result-oriented network of authorities and experts will foster the development of innovative solutions for the management of raw materials along the entire value chain, including exploration, extraction, processing, recycling and substitution. Finally, this Innovation Partnership will not only consider land based resources; it will also look into opportunities in the marine environment.

Man's interaction with his environment has always been influenced by social attitudes which prevail at any given time. Hence, our attitudes and behaviour change in line with our improved understanding and knowledge of our environment. Such behavioural changes are brought about when the uptake of such knowledge is realised at all levels of decision making. An Innovation Partnership on raw materials could help this process by providing the right EU forum for decision-makers.

The development of innovative and efficient exploration techniques, safe and efficient mining and processing methods, sustainable substitution of critical or hazardous raw materials, enhancement of geological knowledge, new or improved collection and sorting processes for better recycling; these are some of the areas where innovative business models could be implemented in the framework of such a partnership.

Such an Innovation Partnership will not only lead to a better cooperation between the actors involved in the supply of raw materials, it will also improve the transparency of the sector and will increase the involvement of, and acceptance by, civil society. It will also provide the basis for future applications and input for political, technical, economical decision-making.

Disclaimer

The presentation is of an informal nature. It neither represents the official position of the European Commission nor that of its services.

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Usability of granitic rock wastes as asphalt aggregate

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Abstract: In recent years, Turkey has been one of the world's leading dimension stone manufacturing centers. This development has been realized not only by dimension stone but also processing of dimension stones. Nowadays, production of granites as dimension stone and their processing with huge scales are performed in almost every region in Turkey, especially in Kırklareli, Yalova, İzmir, Balıkesir, Çanakkale, Giresun and Aksaray Regions. At the end of the production and processing, 40-45 % of granite blocks are evaluated as dimension stone, rests are send to dumping ground and generally not used.

Properties of aggregates that used more than 90% in asphalt pavements play an important role during service life of roads. To achieve good asphalt pavement performance, the strength and durability of aggregates should be at intended level and should not be separated from asphalt (stripping) by the effect of water and traffic loads. As known; properties of granitic rocks like hardness, strength and durability are more favourable than many rock types. But these types of rocks have limited usage as asphalt aggregates because of their operating difficulties and stripping problem. However, there are few data about correlating the effects of different granitic rocks on asphalt properties.

The aim of this study is to correlate the usability of different types of granitic rocks as asphalt aggregate. The granite samples were collected from different region in Turkey and tested to determine their petrographic, mineralogical and chemical characteristics and aggregate properties. During the evaluation stage of the results, limestone and basalt aggregates which have been widely used in asphalt production in Istanbul are used as reference aggregates. The study reveals that the influence of the grain size, composition and textural characteristics on the aggregate properties appears to be very important. It is also determined that the percentage of quartz, plagioclase and orthoclase in granites and therefore their chemical compositions affect the stripping properties of granite aggregates.

Key Words: Aggregate, Asphalt, Granitic Rocks

Introduction

The highway industries consume a huge amount of aggregates in İstanbul, Turkey. In recent decades, the growth in asphalt production and consequent increase in consumption has caused a rapid reduction in available natural aggregate resources. Beside this, in several areas, good quality aggregates are non-existent or not freely available because of urban settlements or environment restriction. Due to the increasing demand for good quality asphalt aggregates in İstanbul, evaluation of granitic rock aggregates become important.

On the other hand, a high volume of dimension stone production around İstanbul causes a considerable amount of waste materials which have also adverse impacts on the

environment. Nearly 60% of granitic rock resources get wasted during mining, cutting and polishing processes. The waste generated during quarrying operations is mainly in the form of rock fragments which are dumped into nearby empty pits or slopes leading to wide-spread environmental pollution (Figure 1).

***Figure 1**: Examples from granitic rock wastes around the quarry region.*

The aim of this paper is to study the use of different types of waste granitic rocks collected from different regions in Turkey (Figure 2) as asphalt aggregates.

***Figure 2**: Location map of the granitic rocks tested.*

Petrographic characteristics

The mineralogical and textural characteristics of the granite samples were studied by polarizing microscopy. The point-count method, as described by Hutchinson (1974), was used to determine modal composition (Table 1). Modal analyses were made on 3000 randomly selected points. The location, descriptions and classification of each rock type are given in Table 1 and Figure 3. All rocks studied were fresh or slightly weathered.

Table 1: Location, composition, grain size and classification of the granitic rocks tested.

Sample code	Location	Composition	Modal mineral composition (%)	Grain size/texture (Erkan, 2004)	Classification (Streckeisen, 1976)
KB	**Kırklareli-Balaban**	Orthoclase, quartz, plagioclase, biotite, amphibole, hornblende, chlorite, epidote, sphene, opaque min	Orthoclase: 28.2 Quartz: 21.5 Plagioclase: 16.4 Others: 33.9	Fine-medium/ granoblastic	Monzo-granite
ÇK	**Çanakkale-Kestanbol**	Orthoclase, plagioclase, quartz, hornblende, biotite, titanite, zircone, apatite, opaque min	Orthoclase: 37.5 Plagioclase: 37.4 Quartz: 12.1 Others: 13	Medium-coarse/ holocrystalline	Siyeno-granite
BE	**Balıkesir-Erdek**	Plagioclase, orthoclase, quartz, biotite, amphibole, horblende	Plagioclase: 40.5 Orthoclase: 26 Quartz: 24 Others: 9.5	Fine/holocrystalline	Monzo-granite
YF	**Yalova-Fıstıklı**	Quartz, plagioclase, orthoclase, biotite, amphibole	Quartz: 29.3 Plagioclase: 24.8 Orthoclase: 21.9 Others: 24	Medium-coarse/ holocrystalline	Quartz monzonite
İK	**İzmir-Kozak**	Plagioclase, orthoclase, quartz, hornblende, biotite, titanite, zircone, apatite	Plagioclase: 43.9 Orthoclase: 21.9 Quartz: 14.7 Others: 19.5	Fine-medium/ holocrystalline	Quartz monzonite Monzo-granite
AY	**Aksaray-Yaylak**	Orthoclase, plagioclase, quartz, biotite, amphibole, zircone	Orthoclase: 31.6 Plagioclase: 25 Quartz: 14.3 Others: 11.8	Medium/ holocrystalline	Quartz monzonite
AS	**Aksaray-Sipahi**	Plagioclase, orthoclase, quartz, biotite, apatite, titanite, zircone, epidote, chlorite, opaque min.	Plagioclase: 33.4 Orthoclase: 28.5 Quartz: 19.5 Others: 18.6	Medium-coarse/ holocrystalline	Quartz monzonite
GB	**Giresun-Bulancak**	Plagioclase, orthoclase, quartz, hornblende, biotite, chlorite, epidote	Plagioclase: 39 Orthoclase: 34.6 Quartz: 7.6 Others: 18.8	Fine-medium/ holocrystalline	Monzo-granite

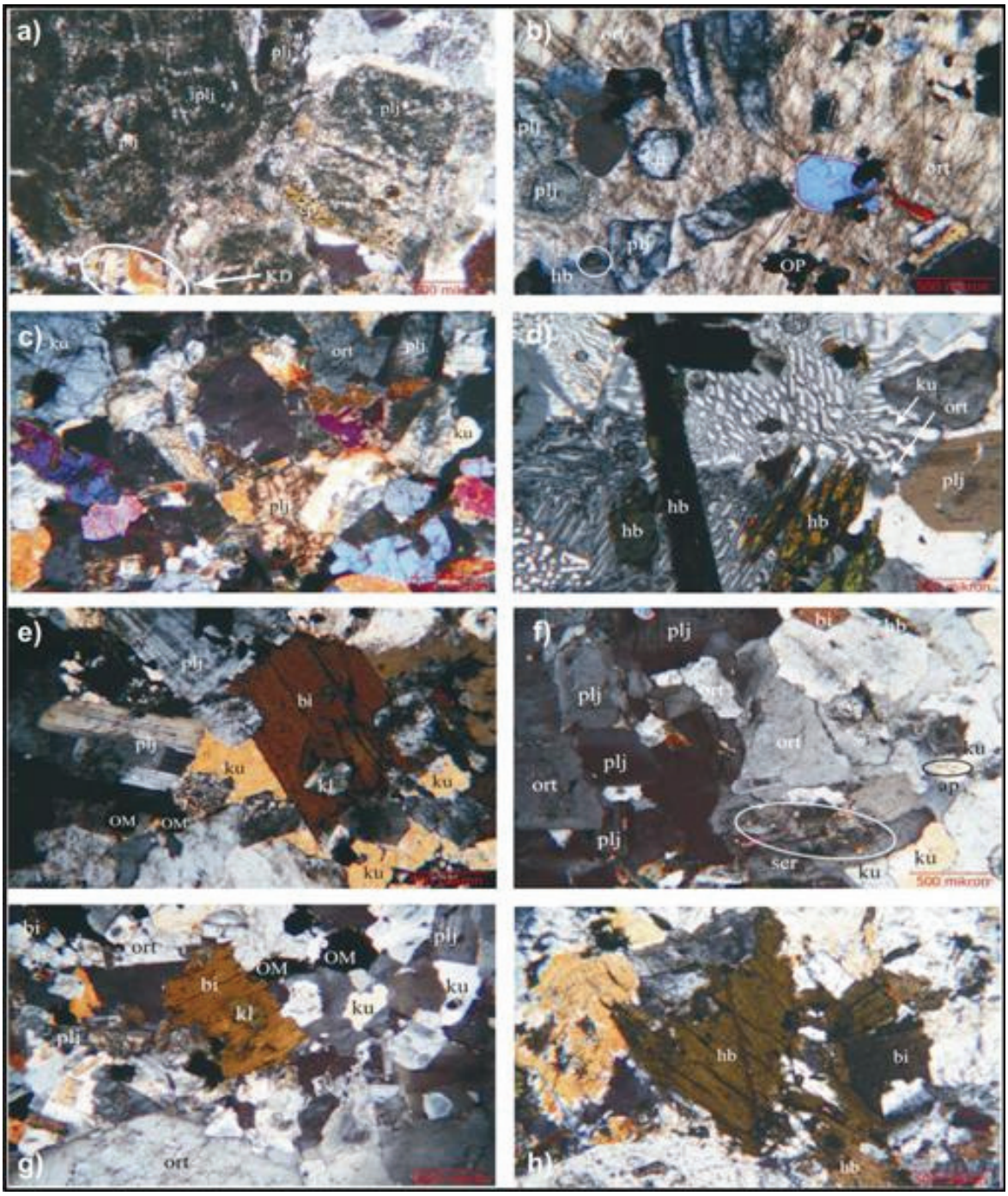

***Figure 3**: Photomicrograph of granite samples (a) Kırklareli-Balaban, (b) Çanakkale-Kestanbol, (c) Yalova-Fıstıklı, (d) İzmir-Kozak, (e) Giresun-Bulancak, (f) Balıkesir-Erdek, (g) Aksaray-Yaylak, (h) Aksaray-Sipahi (ku: quartz, plj: plagioclase, ort: orthoclase, hb: hornblende, kl: chlorite, bi: biotite; OM: opaque minerals, e: epidote, ap:apatite, ser: sericite, KD: cataclastic texture).*

Chemical composition

To determine chemical characteristics of the studied granites, chemical analyses were performed by semi-quantitative elementary analysis using X-Ray fluorescence (XRF) spectrometry (Philips PW-2404). Chemical compositions of the samples are given in Table 2.

Table 2: Percentages of major element oxide of the granitic rocks.

Sample Code	Major element oxides (%)						
	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O
KB	69.45	12.80	3.49	1.66	3.50	2.88	3.26
ÇK	63.53	14.84	4.87	2.21	4.52	3.82	4.06
BE	71.63	14.39	2.01	0.50	2.90	3.84	3.15
YF	67.77	15.45	3.08	0.78	2.54	3.84	3.22
İK	65.29	14.36	4.46	2.34	5.03	3.29	2.93
AY	71.79	14.52	2.32	0.35	2.58	3.28	4.14
AS	68.76	15.30	2.49	0.70	3.94	4.41	2.51
GB	60.94	16.49	5.92	1.10	3.75	3.09	6.39

Aggregate properties

Studied granitic rocks were broken into smaller pieces with a hammer. Aggregate fractions were prepared from the smaller pieces using a laboratory jaw crusher. The aggregate tests undertaken included fine materials, flakiness indices, methylene blue, particle density, water absorption, stripping value, Los Angeles coefficient and magnesium sulfate ($MgSO_4$). Tests were performed in accordance with European Standards (EN). Each test was performed at least three times. The results of these tests are given in Table 3.

Discussion and conclusion

Basalts and limestones are the most important source rock as asphalt aggregates in İstanbul. Aggregate properties of these rocks are shown in Table 3. As seen in this table, except flakiness indices and Los Angeles coefficient, aggregate properties of granitic rocks are generally better than basalts and limestone aggregates. However Smith and Collis (2001) indicated that granitic rocks tend to produce flaky particles when crushed with laboratory jaw crusher. This is because of the texture and mineralogical composition of these rocks (Bell, 1998). In this study, granitic rocks were crushed by laboratory jaw crusher and this would cause higher flakiness indices and Los Angeles coefficients than basalt and limestone aggregates.

Silica (SiO_2) usually causes a reduction in the bond between asphalt and aggregate (Abo-Qudais and Al-Shweily, 2007). Table 2 shows that ÇK and GB samples contain less SiO_2 and more Al_2O_3, Fe_2O_3, Na_2O and K_2O than other granitic rock samples. This would cause high stripping value than other samples (Table 3). On the other hand, ÇK and GB samples indicate less percentage of quartz and high percentage of plagioclase and orthoclase (Table 1). This would also increase the stripping value of these granitic samples which is pointed out by Bagampadde et al. (2006).

***Table 3**: Results of aggregate tests.*

Aggregate Tests		KB	ÇK	BE	YF	İK	AY	AS	GB	B.	L.
Fine materials (%) EN 933-3 (1999)		2.9	3.8	3.4	2.6	3.3	1.9	3.2	2.7	10	11
Flakiness indices (%) EN 933-3 (1997)		25	18	28	21	30	25	22	19	13	9
Methylene blue (g/Kg) EN 933-9 (2009)		0.8	0.85	0.4	0.65	0.25	0.5	0.2	0.3	0.5	1
Particle density (Mg/m3) EN 1097-6 (2000)	0-4.76 mm	2.69	2.67	2.64	2.59	2.53	2.63	2.63	2.62	2.84	2.7
	4.76-19.1 mm	2.70	2.68	2.65	2.62	2.62	2.64	2.68	2.68	2.90	2.75
Water absorption value (%) EN 1097-6 (2000)	0-4.76 mm	1.22	0.93	0.59	1.16	1.02	0.96	1.66	1.60	2.14	1.15
	4.76-19.1 mm	0.48	0.61	0.45	0.68	0.56	0.49	0.62	0.59	0.78	0.81
Stripping value (%) EN 12697-11 (2006)		25-35	25-35	15-25	15-25	15-25	15-25	15-25	25-35	55-65	65-75
Los Angeles coefficient (%) EN 1097-2 (2010)		22	33	26	30	31	38	33	29	13	19
MgSO4 value (%) EN 1367-2 (2009)		0.4	0.5	0.4	0.4	0.6	0.5	0.4	0.2	5	9

B. – basalt; L. - limestone

According to Yılmaz et al. (2003), stripping value of rocks should not be under 50%. In this study, stripping value of granitic samples are under 50%. The results of this study indicate that significant visual stripping was detected at studied granitic samples. When these low stripping granitic samples are used in asphalt production, an antistripping additives such as chemical additives or hydrated lime should be used.

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Regional Centre on SARM and SSM

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Abstract: Key issues recognized within current state of aggregate supply, which points out for the need of the Regional Centre on SARM and SSM are: high rate of the obscurity of the aggregate market, problems related to the sufficient supply of aggregates on some areas and for specific companies, illegal quarrying, hard and long-term process for obtaining the mining permits, complicated and unharmonised legislation through south European countries, no planning for aggregates extraction (no land reserved for mining of aggregates in spatial plans), low rate of recycling, almost no use of secondary aggregates, almost no information regarding availability, trends and bottlenecks in aggregates supply. Main activities of the centre might be: (a) collecting data (aggregates demand/supply, available resources, high-quality aggregate areas, policies etc.), (b) analysing data (supply opportunities, transportation patterns, aggregate zones, bottlenecks, trends etc.), (c) providing data (to interested companies, policy makers, spatial planning authorities and other interested public) and (d) awareness rising (awards, seminars, workshops and similar).

Key words: SARM, Aggregates, Regional Centre, Sustainable Development

The vision of the centre is that in 4 years after establishment the Regional Centre for SARM and SSM will be recognized in European Countries as the leading institution for aggregate resources management with the widest database about the supply of aggregates (quantity, price, location, means of transportation, quality etc...), including majority of aggregate producers in EU countries. With such a database in a combination with the other relevant information (policies, trends, spatial planning data etc) it will represent the meeting point of demand and supply of aggregate resources, an educational and informative entity in support of regional, national and transnational spatial planning, a support for investors and policy makers, a research and development centre where scientists may share their experience about natural resources and their management. It will have also a promotional role for the recycling of aggregates, the use of secondary aggregates and the sustainable use of natural resources with the care of the environment. Most of the activities (especially in initial years) will be carried out on line, with the internet platform representing its core meeting point.

Introduction

Aggregates are of vital importance for a modern society and are a core building material used by human society. Without them, we will have no roads as we know them today, no railroads and no airports. Roads would not have been paved with asphalt.

Without aggregates, houses would be build solely with wood, glass or steel. We would have no tunnels, no shopping centres, no defence against flooding, and we would be without many other modern acquirements. According to the European Aggregates Association (UEPG), Europe consumes $3*10^9$ tons of aggregates annually with a direct turnover of $20*10^9$ €. Every EU citizen needs 5,5 tons of aggregates per year. Almost half of them are used for making a concrete. But on the other hand, because aggregates are so basic material, they are not recognized in a general public and within a decision makers as a vital part of almost every construction project. Moreover, with general unawareness about the importance of aggregate supply, and negative impacts of quarrying to the environment (despite they can be drastically reduced with the proper prevention measures), public is also not interested to have the aggregates producers in their backyards. Putting also the clash of land use interests and long-lasting and complicated permitting processes to the equation we get a fertile land for growth of illegal quarrying, which makes the unfair competition to legal quarries. And this is the reason, why construction companies, having their own legal quarries, are not interested to sell aggregates at all.

Several issues regarding aggregates supply have been recognized in the SARMa project. The most important issue recognized was the lack of the information at all levels. At the production/consumption level, there is a lack of information regarding an aggregates market. Local consumers (mainly construction companies) are by their own when looking for the aggregate supplier, so this is why they are having usually their own quarry. This can be a serious limitation in the case of a small civil engineering enterprises.

There is no transparent information about aggregates quality, which determine their usability for different purposes (for asphalt, for concrete, for special concrete, as an unbound material, as an armour stone, etc.). Several parameters are important, mainly in the respect of abrasiveness, shape, granulometrical composition, frost resistance, chemical composition, durability, hardness, etc. Many questions arise when someone is interested in buying aggregates without personal connections with producers: who produce them, who sells them, how much can be produced/purchased, where can aggregates be bought? Also, a price is a big enigma for everyone, and is very dependant on facts like: who is buying, how much, is an aggregates producer interested to sell aggregates to third parties at all. At local level (supplier/consumer), there is a lack of transparency about aggregates market. And even less information is available when looking for an aggregate supplier outside a host country, which can result in prolonged transportation routes of aggregates, and this fact can drastically influence the price of a construction project nearby international borders.

The lack of the information exists also at the regional level. Politicians are basically unaware that aggregates supply is an important part for the functioning of the society, and commonly forget about future planning for appropriate aggregates supply. The consequence is that almost no or absolutely no land is reserved for aggregates extraction. Permitting procedures for mining rights are also subjected to long-lasting procedures, and aggregate producers might face serious problems where aggregates are exhausted in their deposit.

Not all countries and regions are facing such problems, but there are still many countries which are having some or all aforementioned issues at their aggregates supply. Taking into account all aforementioned elements, a transparent market, or at least an

information centre, which will function also as the aggregate supply bottleneck indicator, is almost a "must" for many areas.

This is why a new Regional Centre on SARMa is of vital importance. Its scope is to provide all relevant and constantly updated information to interested parties. In the supplier/consumer level its function can be similar as an exchange market, where supply and demand can meet in one specific place. On decision-level, it will provide the decision-makers and also the investors with relevant information about supply gaps and investment opportunities. Summarizing all available data, regional centre will issue aggregate indicators and temporal and spatial trends to interested public. Regional Centre on SARM and SSM is foreseen to be non-profit and non-governmental body, having an ideas of sustainable development as a guidelines.

Main activities of the centre

Main activities of the Regional Centre on SARM and SSM are, but not limited to can be divided into (a) collecting data (about): demand and supply of aggregates (natural, recycled and secondary aggregates), available resources and quality of aggregates from different deposits, areas containing high-quality material for aggregate production, aggregates regulations and spatial planning policies in different areas, areas reserved for aggregates production in the local/regional/national spatial plans, etc.; (b) analyzing data about aggregates transportation patterns, aggregates zones, policies, bottlenecks of supply, spatial and temporal trends, fertile land for illegal quarrying, etc.; (c) providing data to interested parties via web pages, reports, publications and other means and (d) awareness rising activities, such as awards, best practices, workshops, courses etc.

The basic idea is that good data will allow making good synthesis and good quality of service, which will make even more motivation to use the Centre as a useful tool when planning future construction activities and when calculating the price of the construction works (Figure 1). Furthermore, spatial planning authorities, politicians and investors will use the SARM and SSM Centre's products as important baseline for their decisions.

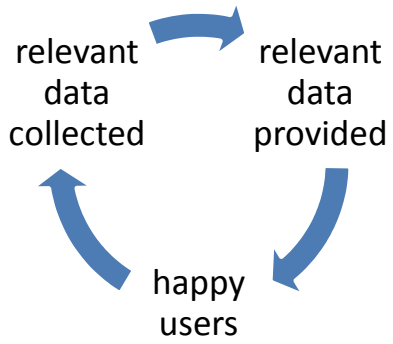

***Figure 1**: Data cycle within Regional centre on SARM and SSM.*

Added value of the centre

The Centre might thus deliver added value on different scales; local, regional, national transnational. On local scale the added value of the centre can be: lower price of aggregates, cheaper construction projects, higher quality of constructions, new business opportunities, less environmental and social impact of quarrying, decreased operational costs for many construction companies, less costs and negative impacts due to shorter transportation routes, higher social acceptability for quarrying. At regional, national and transnational scale, the added value of the centre is foreseen to be higher competition among aggregate producers, more stable price of aggregates, better security for planned projects and theirs funding schemes, higher rate of recycling, less corruption in the civil engineering sector due to higher transparency of aggregates market, optimization of transport of aggregates, increased crossborder cooperation, and at the end, lower CO2 emissions and lower pollution, more transparency on the aggregates market, reduced chance for bottlenecks in supply and more stable construction sector, more stable aggregates market, harmonized policies and long-term planning for aggregates supply.

Stakeholders

Since the centre shall be organized as a non-profit and non-governmental organization, the stakeholders are very important for its functioning and development. Therefore we have divided the stakeholders into three groups. Interested stakeholders are those which will get a positive benefit from a such regional centre and might occasionally use information from a web portal, but will not play a vital role in it, among them to mention: local community, environmentalists, teachers, students, journalists, investors, statistical offices, different decision makers, land owners, other interested public.

Active stakeholders are stakeholders, which actively contribute or search from centre's database, or use services on regular basis. They can be private enterprises, policy makers and planning authorities (spatial planning, infrastructure and others). Among private enterprises, sectors to be mentioned are: construction companies, aggregate producers, other industry with secondary by-products, suitable for a secondary aggregates production (foundry, steel works, power plants, etc.), demolition companies, waste processing companies.

Responsible stakeholders are the stakeholders which are responsible for the centre to work effectively. Responsibility can be placed on one, two or more responsible stakeholders. Some possible entities recognized are (but not limited to), listed according to the appropriateness for a such task:

- a consortium of geological surveys, research organizations and industry;
- geological survey or a consortium of surveys;
- research organization or a consortium of research organizations;
- government or governmental body;
- a consortium of governments from different countries;

- European commission;
- different aggregates associations;
- non-governmental association;
- a specially formed group of interested companies or individuals, who run the centre on volunteer basis or for income;
- a private investor, interested to earn a money from a such centre.

Funding of the centre

Funding schemes can be different, depending on the area, covered by a centre, which can be focused on SE Europe, or on whole Europe. Regional centre is not foreseen to begin its operation without the funding boosts at the beginning. Funds will be used for promotion among all stakeholders, and for covering the purchase of equipment, payment for contractors and salary for employees. On longer term, centre would need to be able to function by its own. Boost funds (at the beginning) can be, from best to worst option:

- funding in the scope of a new international project (SEE, Framework7);
- funding on the basis of the partner's consortium contribution (in this case, funding can be also based on the basis of working hours, office availability, etc.)
- funding in the scope of government contribution (every European government a specific lump-sum of money);
- funded by the European Commission by different available instruments;
- voluntarily funding by stakeholders (aggregate producers/consumers);
- founded from the selling of commercials space at web portal (least likely).

At the end of the start-up stage (after 3-5 years), centre should have a widely developed database, covering a majority of the area, a lot daily users, a lot of promotional activities and its own recognisable logo. It needs to be able to collect funds by itself, on the basis of (from more to less likely):

- funding on the basis of a voluntarily contributions of companies;
- selling a commercial space for interested companies;
- "Google-type" of funding scheme, with sorting of the search hits according to the company financial contribution to the centre;
- funding on the basis of a membership fee.

According to the rough estimations of the costs, at least 2 million euro project would be required for the start-up period (3-5 years). After start-up period and according to the experiences about which activities would be a vital part of the centre, and which activities will be discarded, the centre would need from about 50.000 € / year (web portal and database maintenance and data provision service) up to 500.000 / year in the case experts would be needed in order to prepare all different analysis and publications.

Conclusion

This contribution is the synthesis of the "The feasibility study for the Regional Centre on Sustainable Aggregates Resource Management (SARM) and Sustainable Supply Mix (SSM)" which is a deliverable for the SARMa project under activity 5.4, funded by South East Europe programme, contract No. SEE Eol/A/151/2.4/x. It was made on the basis of brainstorming exercises of two experts, each one in his own field: the professor of economy and mineral resource geologist. Despite some information in this contribution might not be 100% true, and some visions are too ambitious, this contribution might still be, not the aggregates, but "ideas extraction site" for the possible upcoming preparation of the another aggregates project. Extraction permit is granted by authors to everybody, who read this contribution.

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