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PERSPECTIVES FOR DEVELOPMENT OF TECHNICAL BUILDING STONE- LIMESTONE IN THE REPUBLIC SRPSKA

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ABSTRACT

Curent situation of raw material base and study of limestone like construction stone deposits in the Republic of Serbian were relatively poorly considered during the last decades, and the main problems are the following: low production capacity,fragmentation of production, needs for raw materials homogenization and delivering of standard quality, undeveloped market, the recession of the domestic economy and the economies in the region, the relatively low level of exploration by many deposits, especially lack of knowledge of the occurrence legality for certain types and quality of raw materials and lack of complete quality indicators for raw material, which sometimes causes the utilization of only the highest quality deposit parts .

This paper provides an overview of active quarries in the Republic Srpska with exploitation of limestone like technical building stone and present an attempt to determine the basic quantitative and qualitative characteristics of the raw material and the current working conditions at these quarries. The purpose of such a review would be in an effort to create a clearer picture about production, market, social and other aspects of the limestone exploitation in the Republika Srpska and the realistic possibilities of maintaining and developing of these mineral resources utilization, which can certainly be interesting for the development of many other industries in the Republic Srpska.

Key words: *building stone, architectural stone, limestone usability, limestone exploitation, systems*

GENERAL PART

On the Republic Srpska territory are currently active about 40 quarries whith surface exploitation of limestone like building stones, and 4 quarries have exploitation of limestone like architectural and building stone). In addition to the limestone deposits are active and a number of dolomite quarries where are the dolomite deposits and reserves explored and elaborated mainly after 1996. Dolomite quarries have their place in the market of technical building stone where several localities in the western part of the Republic of Serbian have decades of existence and production [1,2]. For most quarries are typical:

- Poor exploration of new deposits (deposits studied from 1996 to present): deposits are mainly explored with smaller excavations (kerf or notch) and one or two shallow exploration holes/drills with definition about 1.0 to 1.5 x 10^6 m^3 rock mass reserves

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- Low production: the most quarries with exploitation of limestone like technical building stone product between 30,000 m^3 and 70,000 m^3, and mainly related to certain temporary jobs in

construction industry, while the quarries with architectural building stone have production rate between 800 and 1500 m^3 of stone blocks.

Depending on the application area building stone is divided into two main groups:

The technical building stone-limestone (TBS) is a stone that is blasted,mechanically crushed and grinded and used as: Crushed stone for road maintenance, Crushed stone for making the undercarriage (road base layer), Stone chippings for bituminous materials producing, Stone aggregate for concrete, Gravel for making railroads curtains, Crushed stone for building and development of coastal defense and water failure, A raw material for the production of other construction materials variety, as a binder and thermal insulation materials and in metallurgy, chemical industry, in the production of abrasives, fillers in the paints production, varnishes, polymers, and paper, lime producing, fertilizers production, ceramics, pharmacy, and other.In any case of the stone purpose, this stone is crushed, powdered, chopped or crushed into larger irregular chunks. In order to have utilization value stone prepared on this way presents the technical construction stone and must have certain physical and mechanical properties, grain size distribution and purity. According to the production mode and shape of obtained assortments the technical building stone is divided into: unshaped (not dimensioned) and Shaped (dimensioned).

Unshaped stone is obtained by breaking and grinding of hard rock mass into pieces of irregular shape, which is the classified as:

- Crushed stone, called the stone was obtained mainly by blasting or breaking by manual or mechanized tools, whose lower limit of grain coarseness is 63 mm, and divided into groups:
  - plain crushed stone is not sorted according to size and it is used mainly in hydro-engineering for the development of river dikes, jetties, wave dams, earth dams, dikes, canals, etc.
  - sleek crushed stone used to build the foundations of small buildings, retaining walls, fences, paths paving and other
- Crushed stone, obtained by crushing and sizing blasted rock mass. In this category include the stone assortment with size - 63 to +0.09 mm. According to size class and type of construction for which they are used, crushed stone is divided into:gravel (63-32 mm), stone chippings (32-2 mm) and crushed sand (2 to 0.09 mm).
- Powdered stone, is a powder obtained by grinding of the solid rocks and minerals in different mills. The upper limit of stone assortment is 0.2 mm, and the bottom is not limited. Usually the products in this category are classified as: coarse (<200 μm) grinded stones, medium (<63 μm) grinded stones, fine (<40 μm) grinded stones, very (<20 μm) grinded stones, super fine (<10 μm) grinded stones and ultra fine (<5μm) grinded stone [3].

Technical Architectural (decorative) stone-limestone must possess superior physical and mechanical properties as well as the technical construction stone, but in addition it has a certain decorative (aesthetic) properties and durability. Decorative stone is mainly used for various decorative purposes:External and internal paneling of buildings, Paving of squares and promenades, Making of stairs and railings and Creation of architectural elements (portals, columns, arches, etc.). Technical architectural (decorative) stone is obtained by solid rock splitting or sliced into pieces with the proper form and precisely dimensions defined, and is divided into:

- Cleaved stone, obtained by rocks splitting along certain naturally predisposed directions by discontinuity-cracks, cleavage, schistosity. Splitting is performing manualy or with machines. Cleaved stone is mainly used for making blocks,cubs, curbs, pillars, sills, plates for roofing and paving, as well as the building blocks for buildings, fences, poles and bridges. As cleaved stone are mainly used igneous rocks (granite, gabbro, etc.), and rarely sedimentary (limestone and sandstone) and metamorphic (gneisses and schists).

- obtained by cutting of solid rock pieces in certain sizes and shapes. There differ primarily cutting blocks (separating from the mass) in the quarry through the exploitation process, and secondary cutting or blocks processing and processing of other resulting assortment [3].

At the mentioned 40 sites in the Republic Srpska, where the limestone exploitation, carried out certain geological surveys, in a smaller scale. At a certain (small) number of sites made extensive and comprehensive studies (Drenovača, Hardovac ...) where reserves confirmed that amounts to about 192.26 million m^3 and potential reserves in amounts approximately 285.5 million m^3 of limestone:Novi Grad- Derviš Kula, Prijedor- Drenovača, Banja Luka - Planina Vranovina, Švrakava-Jasenov Do, Ljubačevo,Dobrnja, Čelinac: Crni Vir-Ukrina, Prnjavor:Čelar, Grič, Ribnik: Čađavica, Teslić- Gradina, Krečnica, Kamenica, Doboj- Karabegovac, Hardovac-Ševarlije, Šaj-kamen, Orlovača, Brod- Dubokovac, Lopare- Mićino brdo-Mijatovac, Ugljevik- Jablan Grad, Vučijak, Zvornik-Jošanica,Žlijebac, Pilica, Milići- Gradina, Bratunac-Gradac, Sokolac-Podromanija, Han Pijesak: Jevovci, Sadilov Čair, Rogatica: Dub, Pale: Han Derventa, Lapišnica, Sarajevo: Krupac, Hreša, Bijele vode-Kijevo, Bileća: Drakuljica, Gacko: Ponikve i Trebinje: Lučin Do, Zgonjevo, Rudeži (Picture 1). Dolomite deposits are located mainly in the western part of the Republic Srpska (Bekici, Brezičani, Mountain Vranovina, Ljubovo, Blatna, Čirakovac) and in the eastern part localities Krupac and Bijele Vode -Kijevo. Total proved reserves amount to about 44.5 million m^3 and the total potential reserves are approximately 45.4 million m^3 of dolomite, Picture 1.

Picture 1. Quarries in the Republic Srpska

NATURAL CHARACTERISTICS OF DEPOSITS

Deposits of technical building stone limestone in this area are related to the Upper Permian-Mesozoic-Paleogene formations. Limestone participation in the lithostratigraphic structure gradually increases going from the upper Devonian and Carboniferous through Permian-Triassic, Triassic, Jurassic to the Cretaceous where reached the maximum representation, or become the main lithological member within which are subordinate occur dolomite and dolomitic limestone. From Cretaceous to the end of the Miocene, presence of limestone lithological column decreases, and in Pliocene sediments completely disappeared.Paleozoic limestones are less distribution, rarely are chemically pure,and they has been cracked and tectonised where their domain of application is limited, and in most cases with unsuitable exploitation conditions without greater economic importance. This work presents deposits of technical building stone limestone belonging to the larger geological units whether they are allocated by the stratigraphy, abiotic, tectonic or other geological basis. This work provides a stratigraphic affiliation and other basic characteristics of the individual/specific deposits:

Triassic limestones and dolomites - with the wider domain of application,they are shown on a few places in the larger mass, but the other part consists of limestones with limited domain of application and limestones which are often alterated with terrigenous creations with contaminations. Significant active quarries of building stone - limestone and dolomite of Triassic age are [1,2]: Drenovača - Prijedor, "Crni Vir"–Ukrina, Lapišnica – Istočno Sarajevo, Krupac - Istočno Sarajevo, Gradina - Teslić , Dub – Rogatica, Blatna – Otoka near Novog Grada, Podbrdo near Mrkonjić Grada, Čirakovac near Mrkonjic Grad and Bijele Vode - Kijevonear Trnovo.

Jurassic limestones - represent quality raw material with wider applications domain. These are usually massive and layered to banked limestones, light gray and dark gray to yellowish brown. Tectonic are quite intensively disturbed and deformed, and occasionally with cracks presence that are filled with a clay material. The most active quarries of building stone - limestone of Jurassic age are [1,2]: Ljubačevo near Banja Luka, Planina-Vranovina near Banja Luka and Dub near Rogatica.

Cretaceous limestones - cover large areas and usually have a wide applications domain. Active Cretaceous age quarries, in addition to detailed presented in the following text are significant [1,2]: Rujevica near Kotor Varos, Dubokovac near Brod and Dobrnja near Banja Luka.

Tertiary limestones - generally speaking, in the Tertiary age sediments limestone are subordinate, less masses of Miocene limestone are allocated to areas of Neogene basins, which due to impurities which contain have limited use. The exceptions are the Paleocene-Eocene formations which belong to the most important and largest limestone deposits in the region [1,2]: Karabegovac – Doboj, Hardovac - Ševarlije near Doboj and Orlovača – Doboj. Natural characteristics which determine limestone usability are very important for technical building stone. In this sense, it is necessary to standardized methods and procedures to determine the following:

The mineralogical and petrographic characteristics microscopic treatments at all deposits shown that the limestone represents a typical carbonate rocks, where in addition to fine-grained calcite masses are also larger crystals which surround fossil remains (their passages and filling fissures and cracks). Organic matter is mainly in the coatings form, rarely in backlogs, but because of its small presence, her character is not important. Organogenic composition determined by microscopic evaluation where the rock is determined as organogenic limestone, or organogenic-detrital limestone. Based on these tests, it is evident that it is about hard and compact limestone, which may have wide application in the construction and chemical industry.

Physical and mechanical properties of technical building stone-limestone are determined by their laboratory tests using standardized methods and procedures. For technical construction stone it is necessary to carry out the following tests:

Table 1 Laboratory tests

Density	Toughness according Treton
Volumetric mass	Compressive strength (in a dry, water saturated and after 25 frost cycles)
The degree of density	Flexural strength
Porosity	Wear resistance to scraping (Deval)
Water absorption	Wear resistance (Los Angeles)
Resistance to frost	Resistance the edge to impact

In Table 2 are given the tests values of basic physical and mechanical properties of construction builing technical stone-limestone and dolomite for most surface mines/quarries in the Republic Srpska [1,2]. Depending on the technical building stone application there are standards which are clearly defined in terms of quality. The results of the physical-mechanical, mineralogical and chemical tests for all deposits of technical building stone opened by open pit mines in the Republic Srpska indicate that the limestone from these reservoirs can be used as a technical building stone: Crushed stone for

road maintenance, Crushed stone for making the undercarriage (road base layer), Stone chippings for bituminous materials producing, Stone aggregate for concrete, Gravel for making railroads curtains, Crushed stone for building and development of coastal defense and water failure and as a raw material for the manufacture of lime [4].

Analyses of the chemical composition of the rock mass are performed in order to determine the quality of limestone and its applicability, and determine the content of useful and harmful components . Building technical stone limestone from this area has an average content given in the Table 3.

Table 2. Physical -mechanical properties of construction builing technical stone-limestone and dolomite

Locality	Compressive strength (Mpa)			Water absorption %	Wear resistance cm^3 /50 cm^2	Density g/cm^3	Specific density g/cm^3	Porosity %
	dry	water saturated	after frost cycles					
KARABEGOVAC	125,8	113,9	115,0	0,47	23,51	2,690	2,725	1,29
HARDOVAC	136,11	126,66	114,49	0,194	11,86	2,661	2,687	1,00
ČAĐAVICA	88,91	74,25	66,06	0,184	29,13	2,680	2,703	0,85
ORLOVAČA	128,00	115,00	-----	0,32	12,40	2,664	2,683	1,00
PILICA	137,90	120,50	104,10	0,209	13,20	2,645	2,722	1,28
ŠAJ KAMEN	150,39	140,69	137,35	0,23	18,32	2,670	2,730	2,05
DUB	170,98	157,17	150,53	0,04	21,09	2,690	2,710	0,42
RUDEŽI	101,00	84,10	77,50	0,33	17,40	2,649	2,662	0,63
ŠVRAKAVA	153,00	120,00	108,00	0,10	19,34	2,690	2,750	2,68
JOŠANICA	115,00	108,00	90,23	0,38	19,80	2,651	2,690	2,80
HANDERVENTA	135,35	123,24	128,13	0,18	21,20	2,692	2,714	0,42
KRUPAC	139,21	126,41	130,00	0,24	19,50	2,700	2,710	1,12
BIJELE VODE -	*131,93*	*123,31*	*111,0*	*0,08*	*17,69*	*2,710*	*2,760*	*0,90*
KIJEVO	*125,63*	*112,75*	*117,00*	*0,24*	*14,00*	*2,560*	*2,684*	*1,42*
LJUBAČEVO	126,75	111,48	----	0,20	17,58	2,672	2,702	0,004
PLANINA -	*132,50*	*122,00*	*113,40*	*0,30*	*20,80*	*2,692*	*2,728*	*1,25*
VRANOVINA	*120,70*	*104,40*	*98,60*	*0,84*	*28,50*	*2,702*	*2,812*	*3,88*
DUBOKOVAC	83,14	67,58	53,45	0,52	29,37	2,708	2,758	0,40
RUJEVICA	85,30	78,03	----	0,12	16,75	2,568	2,679	0,23
DRENOVAČA	130,93	121,39	120,83	0,22	17,66	2,699	2,708	0,50
ČELAR	88,91	74,25	66,06	0,18	29,13	2,680	2,703	0,85
CRNI VIR	176,00	153,30	146,30	0,40	19,72	2,670	2,730	2,50
GRADINATeslić	103,23	88,31	96,30	0,25	17,46	2,670	2,700	1,21
JOŠANICA	115,16	108,42	90,12	0,38	19,80	2,567	2,734	0,38
PODROMANIJA	96,72	86,72	77,00	0,18	14,90	2,617	2,639	0,80
LAPIŠNICA	131,55	125,18	95,11	0,22	18,60	2,682	2,711	1,24
GRADINAMilići	107,18	86,43	71,80	0,118	23,65	2,682	2,710	0,704

- *Dolomite deposits – italic letters*

Table 3 Chemical composition of the rock mass

Loacality	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	SO_3	S	Na_2O	LoI
KARABEGOVAC	53,55	1,06	0,60	0,39	1,03	0,09	0,008		42,85
HARDOVAC	54,68	0,89	0,32	0,18	0,43	0,06	0,017		43,19
ČIRAKOVAC	34,82	17,82	∑1,08			0,00	0,0	0,0	46,09
ČAĐAVICA	55,80	трar	0,28	0,08	0,13	0,07	0,00	0,06	43,25
ORLOVAČA	53,74	0,97	0,60	0,37	0,99	0,08	0,07	0,3	42,94
PILICA	47,30	4,30	1,51	1,10	7,45	0,12	0,04		38,19
ŠAJ KAMEN	55,19	0,63	0,36	0,98	0,36	0,25	0,1		42,65
DUB	53,77	0,86	0,21	0,33	1,28	0,01		0,26	41,88
DRENOVAČA	53,99	0,91	0,28	0,24	0,75	0,16	0,03	0,09	43,10
CRNI VIR	51,83	3,15	0,21	0,15	0,37	0,085	0,003		44,15
JOŠANICA	53,84	0,49	0,31	0,26	1,70	0,00			42,23
DUBOKOVAC	43,64	2,70	1,79	2,17	16,80	0,03	0,00		42,75
KRUPAClimestone	55,25	0,38	∑1,44		0,15	0,06	0,00		42,04
KRUPAC dolomite	50,53	18,32	∑0,79			0,06	0,00	0,034	45,08
BIJELE VODE -	52,15	0,94	1,29	0,40	0,36	0,00			42,12
KIJEVO	30,65	20,98	0,63	0,63	0,44				44,65
JABLANGRAD	45,78	5,01	3,10	0,89	5,16	0,20	0,03	0,043	39,55
LAPIŠNICA	54,08	0,59	1,04	0,19	0,62	0,00	0,00	0,07	43,14
GRADINA Milići	55,06	0,32	0,10	0,42	0,31	0,03	0,00	---	42,47
PODROMANIJA	55,03	0,38	0,24	0,02	0,12	0,00	0,00	0,02	43,60
LJUBAČEVO	55,55	0,29	0,05	0,11	0,15	0,00	0,02	0,08	43,83

EXPLOITATION OF BUILDING STONE-LIMESTONE

Exploitation of technical building stone/limestone is performing by open pits, mostly mountain-type (open pit method), with discontinuous exploitation systems and the corresponding structure of the equipment / technology. The exploitation system of technical building limestone on the open pit and surface mining is characterized by the following parameters: the number of benhces and its height, bench slope, construction - geometry of the open pit (width and length of the block), the length of the work front (on the overburden and useful raw materials), width of working and haulage surfaces, angle of inclination of working and other slopes in the open pit and other geometric elements [5,6].

The number and height of benches - when we are determining the optimal bench height must be taken into account: the technology of exploitation and types and dimensions of the working machines in the quarry, natural characteristics of deposits (stratification, quality, physical and mechanical characteristics, terrain and deposits configuration), the required capacity, safety and other. With the increasing of quarry bench height increases the capacity of drilling rigs and equipment and loading equipment and reduces the haulage routes and distances (costs). From the other side with the decreasing of bench height increases security, the number of excavated benches and improves the degree of fragmentation during the blasting [5,6]. At the end of the last century on the our quarries are projected benches with hright betwen 20-30 m, and even more, but today benches are designed with smaller height, primarily due to increased security and smaller capacity which exist on the quarries. At the quarry is almost a rule that the bench heights are designed on H = 15 m (10 to 20 meters).

Slope angle of benches - depends on the rock mass physical and mechanical characteristics, stratification and selected bench height. depends on the physical and mechanical characteristics of the rock mass, stratification and selected bench height. Stability of the bench slope depends of fissures orientation and stratification has sometimes crucial importance, where is the aim that fissures and stratification shoulh have direction like rock massif, and not direction of the excavated area [1,5]. In terms of solid limestone are selected Slope angle of benches 70^0 to 80^0, as the levels of the selected 10 to 20 m bench height provides a stable safety. In terms of mountain-type open pit is important to emphasize that the cutting and the development of mining operations can be performed only from top to bottom, so that the most commonly used longitudinal single wing system of exploitation where the open pit benches are opened with external individual or joint notch. Besides of that, mostly common is huge number of benches with narrow working areas, or on most of our quarries is present system of gravitational blasted rock mass bringing down from higher benches on the main quarrie plateau.

Width of bench flat (berm) - depends on the lime production structure, or on lime haulage system from higher to basic/lowest working bench. If we are working with gravitationally haulage system (without classic method) when blasted limestone masses are moved from the higher to the lowest benches gravitationally and distributed to the primary processing plant usually located on the lowest bench. In this case bench flat/berm should be less in width as possible and the conditions on the open pit define the berm width between 5-10 m. Gravitationally haulage system demands engaging the dozer that performs cleaning up the mined/blasted limestone from higher bences, where materials gravitationaly fall to the lowest (work) bench and direct shipp to a limestone processing plant. In case the blasted material loading at working benches, the bench working width must be set so as to enable safe and smooth equipment maneuvering Width of bench flat depends on the size and characteristics of the adopted equipment, and the equipment to be used in mining (hydraulic excavator, truck, etc.) adopt the width of the working surface of the bench [1,5]. For discontinuous exploitation system of technical building limestone are characteristic of the following technological stages:

Removal of overburden-waste material overburden and waste at the quarry make the most of the loose clay, clayey and decomposed limestone and partly humus-clay material. For most quarries is typical to have a stripping ratio less than 1 m^3 / m^3. Waste removal is performing by ripering and pushing to load or disposal by dozer. The waste disposal is performing on the location near open pit or forming the inside landfill, what is not a problem at most of the quarries because of the small

overburden quantity . Since this is a mix of stone, clay and sand are usually there are no problems with the stability of the landfill.

Drilling and Blasting Proper development of the open pit with technically safety and techno-economically rational limestone obtaining means the application of drilling and blasting technology with defined the following parameters :explosives, diameter drill holes, slope of drill holes, depth of the drill holes, burden/the line of least resistance,overlap coefficient, spacing,initiation, delay time, nominal and specific powder factor and explosive loading construction. Granulometric composition and strength of the raw rock mass has a very significant impact on the optimal technological schemes choice of limestone processing, and on the quality of the obtained aggregates and the total quarry techno-economic production indicators. Because of that the choice of optimal parameters of drilling and blasting should have special attention [5].

- Loading and haulage of blasted technical building stone to processing plant: For loading of raw limestone at the base bench depending on the length of haulage distance used: loader - the initial stage of development of the open pit for a short distance to receiving hopper or excavator - when raw limestone loading in mining trucks (dampers) and transport to receiving hopper of the processing plants. It is recommended to use the excavator due to the ongoing needs of bench maintance, cleaning of hanging rocks, removing outsized and the proper conduct of bench development.
- auxiliary technological phases are: road maintenance, landfills and basic plateau, dewatering of open pits and and disposal facilities, machinery and equipment maintenance , supply of energy, etc.

PROCESSING OF TECHNICAL BUILDING STONE/LIMESTONE

The processing of technical building stone limestone depends on the natural characteristics of the rock mass (rock mass strength, grain size distribution of raw rock mass, etc.), the yearly capacity range of production, production assortment and relations of various classes derived aggregates as well as aspects of the application of the obtained aggregates [5].

Based on performed mineralogical, physical-mechanical and chemical tests limestone produced on open pits in the Republic Srpska is used for the purposes of the concrete preparation, the lower and upper bituminous layers for the asphalt production (rarely limestone can be used for the production of class size was necessary for the wearing course because of physical -mehaničkih characteristics of the raw materials).Limestone is used also as a “pad” material for the construction and maintenance of roads. For each of these application of technical building stone are defined standards that the final product has to meet, and there is necessary, according to these conditions, define the processing and treatment process.
The processing of the technical building stone limestone is carried out through the following stages of the production process:

Pre-screening ("screening") of the rock mass - performed for the purpose of separating the clay and other bad admixtures, which has a significant impact on increasing the quality of finished products/classes. Raw rock material mined by blasting on the open pit contents beside useful mineral raw materials and certain amounts of harmful substances such as clay materials and friable or weak rock. Pre-screening is most performing on vibrating bars/feeders, whereby the efficiency of these processing phase is reduced and significantly depends on the moisture in the clay components and laminar grains in the rock mass.

- **The rock mass crushing -** should be carried out in several stages, which means that it comes to the required granulation gradually, wherein in each stage used “closed” cycle schemes. Crushing the rock mass is performed on the jaw, cone or impact crusher, where the majority of our quarry crushing applied in one or two stages usually on impact crushers. Selecting of the crushing type is very important for the quality of the produced products and their usability.

Application of multi stages crushing process makes it possible to gradually crushing of rock mass, with enabling separation of fractions smaller than crusher outlet orifice before of each crushing phase. On this way substantially relieves the process separating a significant amount of the weak grain (rock mass grains, which are softer and easier to crush) and decreases in proportion of smaller grains in the products. Crusher choice is also very important because each type of crusher has certain characteristics in terms of particle shape, energy consumption, capacity, cost per products unit and so on.

- Jaw crushers are used most often in the first stage (primary crushing), and they are characterized by a robust construction and for normal operation is necessary to ensure a continuous supply of rock material with mandatory selection and separation of dirty and dusty material. Jaw crushers give the laminar /flattened shape of crushed grain.

- Cone crushers are used for both the first and the second stage of crushing (primary and / or secondary crushing), and for proper operation is necessary to ensure continuous supply/dosing of rock material, in order to allow "fill in" mode work of crusher where a crushing product significantly increases the proportion of cubic grain shapes (up 80%).

- Impact crusher can be used in all stages of crushing, but their main purpose is for secondary and tertiary crushing, which is sometimes referred to grind, and this process is usually ground (chopped) coarser/larger fractions earlier produced. The basis of this machine is the utiliyation of dynamic strike-breaking of stone pieces. On the rotor with hammers that revolves at high speed in the housing, stone heaps and so comes to crushing. Impact crushers give the product with a cubic shapes.

Sieving- is the process of distribution of bulk and granular rock material by grain size classes. On our quarries classification is performed mainly through the dry sieving process on the following classes: gravel (63-32 mm), "pad" material (63-0 mm), chippings (32-2 mm): 32-16 mm, 16-8 mm, 8-4 mm and 4-0 mm. In accordance with the division on the crushing stages, after each stage of crushing is necessary to introduce, the so-called. control screening, which enables control of the upper limit size of the material that has passed through the process of crushing and prevent excessive fragmentation or creation of "undergrains" in the final products. Most of our quarries have a triple-deck vibrating screens with mesh openings of 16 mm, 8 mm and 4 mm. The screened material of these sieving surfaces by a system of belt conveyor transported to final products depots. In the process of limestone sieving is evident the presence of dust, which negatively affects the working and living environment, and there must be applied certain methods and procedures for eliminating dust [5].

The processing often have the possibility to create and create return flows of materials and the so-called "closing system" that they become adaptable to current market needs in terms of volume and market needs for specific size class. Many companies deal with those problems purchasing additional equipment for crushing and grading/screening thereby processses complicating and often subsequently purchased tools and equipment capacitive do not comply with existing, previously purchased equipment.

REMEDIATION AND ENVIRONMENT PROTECTION

During the exploitation work occurs continuously distort the quality of living and working environment. Since the first element is determined by the degradation of existing ecosystems. Endangering the living and working environment in mining operations at open pits of technical building stone is reflected in:land degradation,dust, gases and waste emission, disturbance of surface and groundwater regimes,noise and vibration creating during blasting and mining machinery work, aesthetic disruption of the natural landscape [7]. For rehabilitation of degraded areas caused by mining activities is necessary to apply measures of technical and biological reclamation and remediation. For proper approach to land reclamation on a degraded area needs to be a detailed analysis of pedology-waste, climate and other factors. Besides of that choise of technology exploitation and waste disposal

has also importance. Physico-chemical properties of the substrate for remediation, with the ruling climatic features are the factors that most greatly influence on the selection of plant species for remediation. Postponed waste, in a particular case of the final tailings slope in the natural terrain, affects the type of remediation, time for creation and shaping of the final state changed relief [8].

During the processing of limestone, calcium carbonate dust is formed, which is non-toxic to humans, and which acts to deposition in the lungs can cause certain occupational diseases, while this dust has a positive effect on the plants and the surrounding land by correcting pedological soil characteristics. To create dust are very important limestone grain size and humidity, as well as weather conditions (particularly pronounced in dry windy weather). In the processing of limestone there are certain areas that are particularly significant for the dustiness increasing: number and construction of ladling location for material reloading from one conveyor to the other, the outlet crushing size (especially fine crushing) and the type of vibrating sieve. Although investors perceive the investments in the dedusting systems like lay stress costs these investments represent the binding activity in terms of environmental protection in order to reduce the negative impacts and dust formation during crushing, grinding and classification of limestone, which is one of the solutions, in addition to the dust bringning down by wetting and sprinkling of material. By investing in the dedusting systems could potentially be produced and additional product-called filler material or/and product that can be used in the production of animal feed, organic fertilizers, fillers and the like.

CONCLUSION

Intensive development of each country are constantly seeking increase the production of building stone, where along with the requirements for higher stone production growth and requirements for its quality as well as the quality of the produced products and building stone. When we talk about exploitation systems and technology of limestone production on the quarries in the Republic Srpska need to specify some problems and difficulties related to the exploitation systems and technology with which the companies that organize production and work on these quarries meet:

- Production capacities are highly variable and generally at a very low level, which can be explained disordered and unstable technical building stone market, mainly leaning on the construction industry, which is now in a big recession in our region, to a lesser extent in other industrial sectors (agriculture, industry, animal feed, fillers, cement industry, and metallurgy industry, etc.). This leads to the situation that the possibility of limestone placement is smaller and without some further examination of this mineral raw materials type in order to prove its wider and greater usability/utilization in other mentioned industry branches. Without that continuity and higher levels of usage and annual capacity will be at the current level and largely dependent on building materials market.

- A great obsolescence of machinery and equipment used in quarries and which is determined by the real limited opportunities for companies to regularly and timely refresh machinery and equipment, both through permanent and limited annual production and reduced financial flows and the (im)possibilities of those companies. In addition, it should be noted that quite a number of companies are importing already outdated technology used equipment and machinery from abroad, which in turn is caused by the above-mentioned financial constraints possibilities and impossibilities of securing larger or more quality financial resource.

- Restrictions on legislation related to the exploitation of mineral resources that do not provide enough space for companies which exploit to organize production through greater engagement with other companies / contractors in the production and exploitation (the contract mining). That would be those companies (especially those with smaller capacities of production) allow to organize production rationally through engagement better equipped and specialized companies for jobs in mining, which already possess the necessary equipment and personnel, and that certainly can achieve lower operating costs of labor and investors are not forced into the large investments and thus increase their own capital costs and production costs.

It is essential that the company intensified its marketing activities in terms of finding new forms of limestone utiliyation and expanding its product range to its quarries where the analysis of qualitative characteristics of raw materials and opportunities for additional processing and preparation consists of the main activities in this area.

Companies should make their strategies and plans for longterm development and operations where the cost of additional technological and geological tests and research calculated through the sales price of their products and thereby created a real base their funding. Companies need, through strategies, plans and development, have the rationalization and optimization of their processing, which certainly can reduce processing costs but also expand the range of products and market for their products.

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