METHODOLOGY OF VISUAL IMPACT ASSESSMENT ON SURFACE MINES AND MEASURES OF MANAGING WITH THE VISUAL RESOURCE FOR THE DESIGN OF SURFACE MINES

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ABSTRACT

Visual resources or natural landscapes are special category of natural resources which are under extremely adverse impact on industrial development. It is specifically expressed in surface exploitation of mineral resources, occupy large areas and have expressed visibility. Mining operations should prevent and minimize negative visual impacts through consultation with local communities about potential post-closure land use, incorporating visual impact assessment into the mine reclamation process.
The primary function of the visual impact assessment is to identify key views of which will be visible mining operation; to assess the sensitivity of these critical views; to assess the impact of visibility; to modify the design of trench in such a way to reduce potential impact to a minimum. Mitigation measures may include strategic placement of screening materials including trees and use of appropriate plant species in the reclamation phase as well asmodification in the placement of ancillary facilities and accessroads.

Key words: *landscape, resource, visual impact assessment, open pit, mitigation,*

Introduction

Mining as one of the most dynamic industries may result with changes and destruction of natural landscapes. The exploitation of mineral resources (surface mining or underground mining) , it creates visible changes that have negative consequences for the environment. Negative visual effects, especially for quarries near urban areas, major transportation routes and tourist and recreational zones, is often expressed a limiting factor for realization of new projects, and development who has already started. To assess the visual impact of any activity was developed numerous methodologies for assessment. Generally, the assessment of the visual impact of the proposed mining operation encompasses three types of questions: spatial, quantitative and qualitative. The spatial issue involves where the operation is seen or specifically where or who is watching. Quantitative questions include how of the operation is seen, how of the surrounding area is affected and to what degree. Qualitative questions cover the visual character of the operation and its compatibility with the environment. All mines are temporary in terms of land use, so it is important to have a plan for what will happen during the operation and after completion of the work the mines. The visual impact of mining and operation of the mine can be assessing using computer hardware and software packages.

Methodology of visual impact assessment covers:
1. Establish zone of theoretical visibility;
2. Select and agree key viewpoints;
3. Predict and illustrate changes to views;
4. Minimize any adverse visual impacts trough design process (embedded mitigation);
5. Assess significance of remaining impacts;
6. Propose and implement mitigation measures for residual adverse impacts.

The methodology of assessment includes observation, identification of sensitive receivers and effects, description and quantification of changes in base and evaluation of the anticipated effects, together with the criteria that are used and what measures should be taken to avoid, reduce or offset the negative effects .

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Open pit mine which will be discussed in this paper is on the western part of mountain Vodno, or in the immediate area of Skopje. Near the pit is a village (Fig. 1).

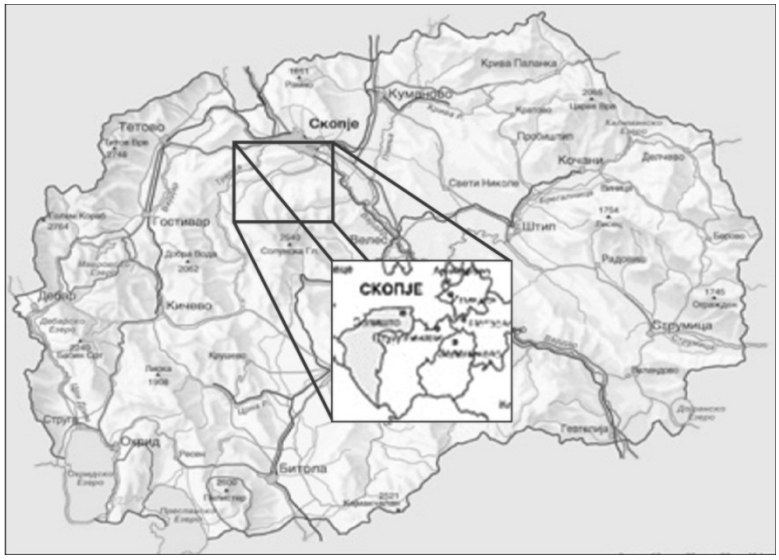

Figure1 Geographical situation of the open pit

1.Timetable and description of the productive activity of the open pit

The open pit is divided on 10 benches with a time of exploitation of 10 years. Exploitation will be in benches of 5 m starting from E-345 then 340, 335, 330, 325, 320, 315, 310, 305, 300 and 295, stable operating angle of slope of the benches will be $\alpha = 55^0 – 60^0$.

The proposed mine should be assessed according to the following criteria.

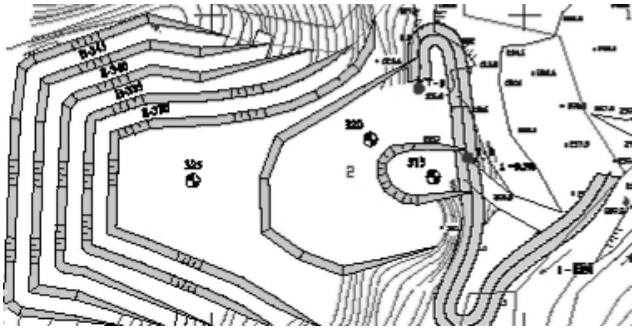

Figure 2. Development of a open pit for 5 years

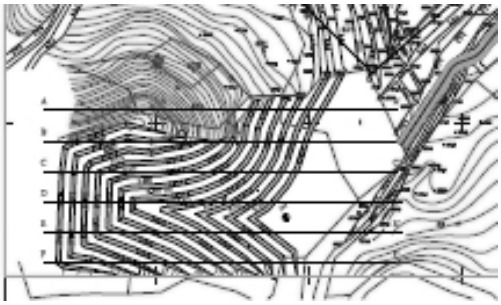

Figure 3. Development of a open pit for 10 years

2. Visibility criteria

2.1. Visual exposure

The area which can be seen from a certain place is mapped using a geographic-based 3D modeling tools. In order to simplify exposure reduced the visibility of objects given the ranking categories (Table 1 and 2).

Table 1
Visual exposure zones

Visual exposure zones	Exposure Rating
Zone 1: 100m	Very high
Zone 2: 400m	High
Zone 3: 2 km	Moderate

Table 2
Visual quality zones

Visual quality zones	Quality Rating
Zone 1:North	Moderate
Zone 2: South	Moderate

2.1.1. Visual value

The region is known for its nature, mountains, and wild.

2.2. Viewing criteria

2.2.1 Visual receptors

Near the pit is a village with a few hundred residents. There are two different visual recipients: the local population and visitors (Table 3). Visitors are trying to direct their attention to their surroundings, because they want to join in that. Also among, sensitivity for the local population is high because there windows are overlooking to the site of development, in the case of open pit.

Table 3

Visual receptor zones

Visual Receptor Zones	Sensitivity
Zone 1: Tourist	Very High
Zone 2: Local people	High

2.2.2. Representative viewpoints

It makes no sense to approach the visual impact from a good position from which it can be observed. Positions are taken from locations where the visual receptors find points of view to the proposed development of open pit.

We identified three visual effects:

- Visual impact from the southeast side - road across open pit
- Visual impact from smaller settlement
- Visual impact from larger settlement

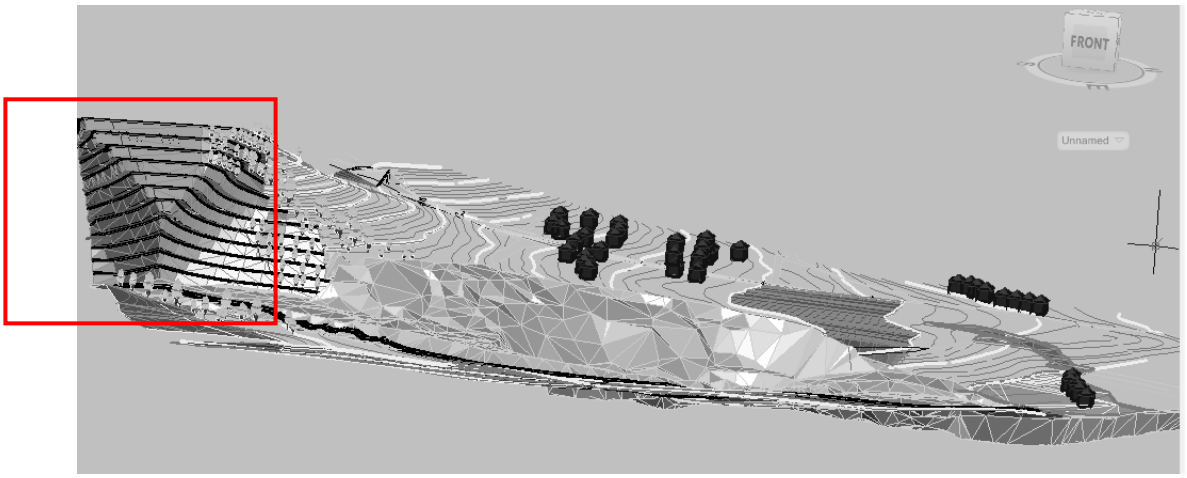

Figure 4: View from the southeast side - road across open pit

This view may be important for the passersby and the local population who are approaching the area covered by the pit.

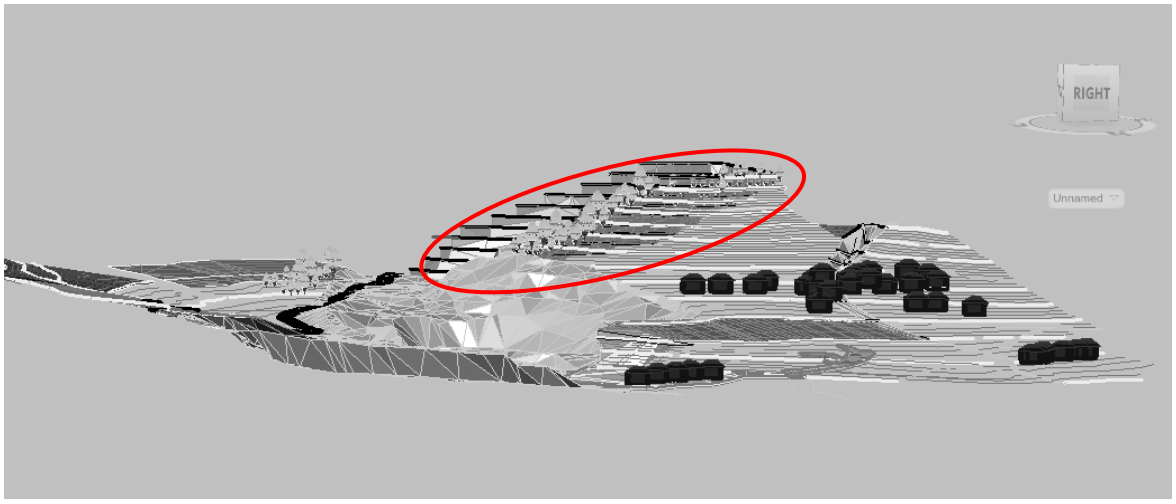

Figure 5: View from the north side, from the smaller settlement

Figure 6: View from the northwest side, view of a larger settlement

Table 4

Representative viewpoint zones

Representative viewpoint zones	Sensitivity
Zone 1:Regional road	Very high
Zone 2: smaller settlement	High
Zone 3: Bigger settlement	Low

2.3. Assessing the impact

2.3.1. Receptor sensitivity

It is important to set a common level between different visual recipients and representative views. This common level is classified as an area of the recipient. The complete sensitivity of the receptive zone is determined by the compilation of factors that bind to receptors as category and geographical location of the visual receptor (Table 5).

Table 5

Receptor Sensitivity

Receptor Sensitivity			
Receptor Zone	**Representative Viewpoints**	***Visual receptors***	***Visual sensitivity***
View from road across open pit(regional road)	Very high	High	High
View from the smaller settlement	High	Moderate	Moderate
View from the biggest settlement	Low	Very low	Very low

The views are selected to illustrate the potential worst views of the proposed mine and represent the only location where we can preserve the views of mine. The visual impact along the regional road will be very high for observers in vehicles because their attention is increased when they cross despite open pit. The visual impact of the smaller settlement is classified as a high influence because they have direct views from the windows of their residential properties to the pit. Finally, the assessment of the visual impact of a larger settlement is low or very low because of this side open pit is not seen.

The assessment of visual impact can assist in avoiding or minimizing the negative effects of the development of open pit and thus a way to protection environmental.

3. Measures of protect

As a basic measure to protect the open pit, is to avoid negative visual impacts with change in the design of the open pit and afforestation.To reduce impacts and the planned facility to make more acceptable, is developed a series of secondary measures of protection primarily expressed through the obstruction of views to mine by afforestation.

The first measures of protect is planting trees along the road across the open pit where in short period (necessary for the development of vegetation) view to the open pit mine by the road would be completely isolated, and therefore adverse effects to the landscape avoided (marked with a red line in Figure 7).

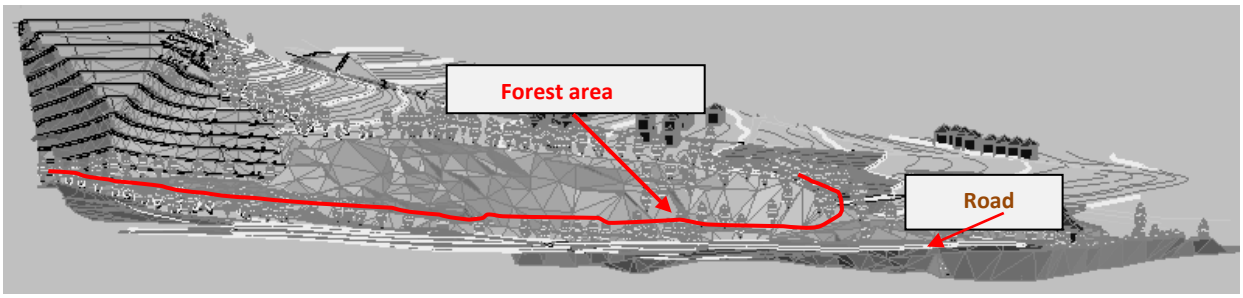

Figure 7: View from the southeast side-road across open pit

The second series of measures is consists of obstruction of the view of the smaller settlement.

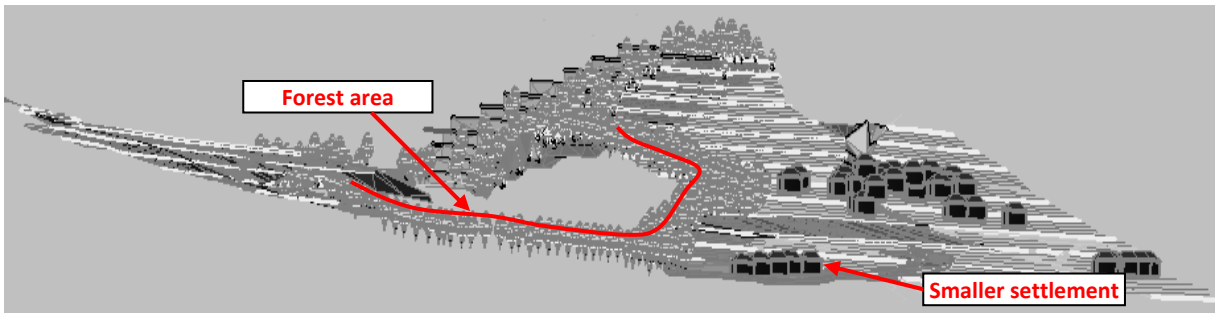

Figure 8: View from the north side, from the smaller neighborhood

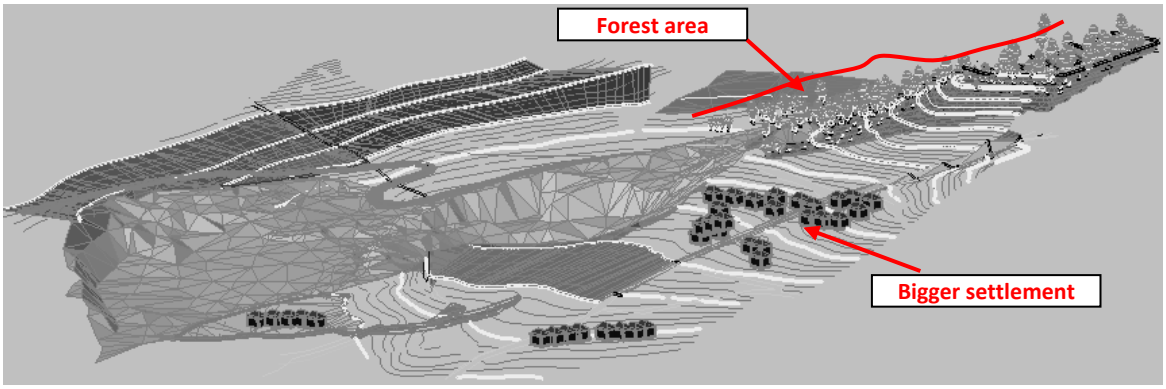

Figure 9: View from the northwest side, view of a larger settlement

To check the effectiveness of measures is taken is re-analysis of visual impact.

Table 8

Receptor Sensitivity

Receptor Sensitivity			
Receptor Zone	**Representative Viewpoints**	***Visual receptors***	***Visual sensitivity***
View from road across open pit(regional road)	Very high	High	High
View from the smaller settlement	High	Moderate	Moderate
View from the biggest settlement	Low	Very low	Very low

Table 9

Table Impact severity

Impact Severity					
Receptor Zone	**Visual Exposure**	**Visual Discord**	**Visual Quality**	**Visual Value**	**Impact Severity**
View from the regional road	Moderate	Moderate	Moderate	Moderate	Severe
View from the smaller settlement	Moderate	Moderate	Moderate	Moderate	Severe
View from the bigger settlement	Moderate	None	Low	Little	Slight to no effect.

Table 10

Impact Significance

Impact Significance				
Visual Impact	**Impact Severity**	**Receptor Zone Sensitivity**	**Significance**	**Significance -with mitigation**
Visual impact from the regional road	Moderately severe	High	Moderate	Moderate
Visual impact from the smaller settlement	Moderately severe	High	Moderate	Moderate
Visual impact from the bigger settlement	Slight to no effect	Low	Low	Low / no significance
Visual impact during exploitation of open pit	Severe	Very low	High	High

Conclusion

The results of the assessment are presented by giving a short description of the existing view from each perspective, followed by a description of changes in the view of the landscape as well as analysis of the size and nature of effects. With the planting of seedlings will be create a forest area which will conceal the view to pit and proposed measures to protect pit will not be visible and will have extremely limited visibility. The assessment in this case helped in avoiding or minimizing the negative effects of the development, and thus find a way to improve the visual view of the local population to the pit.

In market economic conditions mining experts cannot allow their own dehumanization, not leaving behind a huge hill of waste and fields with no life and vegetation, but must fight for such a technological process that will be in function of overall socio - economic and environmental efforts.

Project arrangement of the landscape need to be developed simultaneously with the major mining project, and it makes mining engineer together in collaboration with biologist and geologist. With the eventual entry to the European Union, mining companies will have to respect environmental standards and legislation regulative to the environment, thus residents of mining areas will be protected from existing sources of pollution in the process of exploitation. The process of production and measures of environmental protection are implemented and controlled in accordance with the procedures of ISO 9001 and ISO 14001.

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