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EXPOSED AREAS AT LANDSLIDINGS RISKS IN BOTOSANI

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Resumé : *Ville chef Botoşani est située sur un plateau naturel qui représente l' interfluve qui sépare les cours d´eau Sitna et Dresleuca. L´aspect géomophologique général du microrelif est un sculptural interfluve ayant les frontières brodé par diluvium pente ,intermittente grâce à l'érosion d´une grande nombre de torrents et avec le fondement marqué par les cours des eaux et glissements de terrain.*

Les motifs principal aux glissements de terrain dans le municipe Botoşani sont:

Le grade majeur de friabillité aux roches; les roches friable sont tres légerdans les conditions lequel croître l'outrance d´ humidité dessus une limite du valeur ;

Le niveau hydrostatique, qui est située au profondeur moyenne (-1m et 3,5m) peut grossit avec 0,5-1m pendant les riches précipitation provoquant l'humectage et la déstabilisation de la terrain;

L´eaux courante ; partiellement régulières s´épancher dans l'étape avec une grande quantité des précipitation et créer des bourbiers temporairement ou permanente .Ces, humectent le fondement de la dépôt diluvium et favoriser la réactivation de la glissements de terrain antécedents;

Les activités anthropiques; les pertes au système d'alimentation avec d'eau et canalisation ;le chargement des versants avec terril;les excavations pour le fondations de la voisinage au versants avec les grands pantes; les défrichage des arbres.

Definition of landslides is represented by removals of mass of rocks either by rotation ,translation or complex movements toward the base of a slope along some breaking or sliding surfaces.

Physically talking the massive of rocks or earth submitted to natural trials (erosions, floods, variations of underwater regime) or to hard physic factors (excavations , vibrations, deforestations) can change the efforts state until the partial or even total breaking. When the breaking is full, complete, the massive are loosing their stability, usually followed by brutal change of their initial geometry and by an accelerate change of the slopes.

Landslides could be split up in two categories. **Primary (basic) landslides** when the phenomenon is produced in massifs of rocks unaffected by previous slides (removals), so in not yet affected areas. **Reactivated landslides** areas, when the phenomenon is produced along of some already existing yielding areas , so in areas affected by previous slides.

Botosani town is located on a natural plateau, representing the portion of land bordered by two main water courses with their tributaries (Sitna with Luizoaia and Dresleuca with Teascu). Between the natural plateau and the major water courses exist an energy of relief of 30-40 metres transposed through smooth slopes to the North-North-East or more abrupts like in the South Eastern part.

The general geomorphologic aspect of the natural plateau relief no matter which way you enter the town is of a sculptural plateau with the frontiers bordered by incontinuous slopes caused by the erosion of a multitude of torrents having the base marked partially by water courses or totally regulated and because of the land slides.

In Botosani, the main causes of the producing of the landslides are :

a) the soil composition.

Main rock is represented by marnes , marno-limstones, oolitics limestones and friable limstones gritstones ,fossils consolidates from Sarmatian Age, which currently have a lack of underground water accumulations. The covering deposits are constituted by maximum 15 metres of layers from Quaternary Age notconsolidated or very weak consolidated, very humid or saturated with water represented by :

- vegetal soil of 10-1,5 metres;
- unhomogeneous fillings of inorganic origin (like rests from demolitions, debris from constructions) or organic (like households, industrial or agricultural wastes)
- a clay dusty complex which is either dusty either dusty sandy very plastic, with a macropores structure sensitive at moisturizing(according to the normative) which when contains sand in proportion of 20% may easily have contractions and big swells (according to the normative);
- clays with alternations of very fine sand which borders the layer ;
- at the bottom there is a big layer of a yellow greenie hard plastic clay marne with interferences of sand which interact with the base stratified rock rigid and having a reduced plasticity. As a remark is that the thickness of the deposits is reduced at only 2-3 metres at the superior part of the slope becoming of 10-12 metres at the bottom. The layers are very humid and saturated and they also are in a metastable balance which means the balance is very sensible with the increase of the humidity over a limit value.

b) Underground water

The hydrostatic level of the bottom layer sand is situated at an average depth of 1000 metres from the normal height towards the edges of the natural plateau and of 2,00 -3,00 metres toward the centre of the town, excepting the South and the South – Eastern area where the depth is of 3,00- 3,50 metres. In the seasons rich in precipitation the depths of the hydrostatic level have a growing tendency with 0,5 – 1,00 metres and also a tendency of softening of the soil which is easily loosing the stability.

c) Surface waters

Surface waters with permanent flowing are the following four small rivers:

- **Sitna** with the right affluent called **Luizoaia**
- **Dresleuca** with the left affluent called **Teascu**

The entire regulation of these water streams is not finished yet. Because of this, during the rich precipitation season of the year, the streams are flooding the neighbourghood areas creating temporary or permanent lake areas which moisturize the bottom of deposits and reactivate the existing slidinglands.

Surface water with temporary flowing are represented by the local streams which become active during the time of precipitation season of the year or are generated by coast springs having the emergence at the limit of the natural plateau on which is developed the town ,fact which causes the starting of the instability phenomenon.

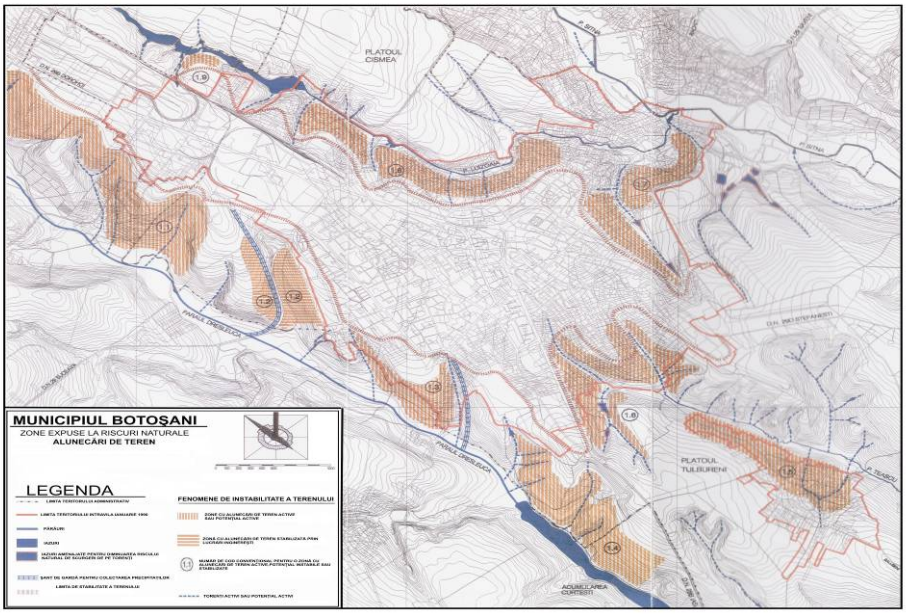
d) Physic activities

Mainly, these activities generated by people ,more or less consciously are:

- Subdimensioned sewerage system around the Botosani Railway Station and Calea Nationala Street;
- The losses from the water supplies and sewerage systems due to the untightness and damages of the pipes;
- Charging of some of the slopes with residues like the remains from the asphalt Station from the town ;
- Excavation for the foundations or installing the used water collectors recipients at 8,00- 12,00 metres in deep right next to the high slopes (like next to Imparatul Traian Street);
- Massive deforestations and slow soil regeneration are leading at the end at the landslides;

- Designing of ponds for fishing right next to the edge of the town takes to the moisturizing of the soil;
- Designing of a secondary route in the former industrial area of the town was implemented in an endangered area which in the end took to an evoluation of sliding land phenomenon;

The identified areas with potential sliding land danger were registered and given with a code number between 1.1-1.9 and represented at the scale 1/ 25 000



1.1-North–West of the town area between S.C. Mecanica S.A.–S.C. Alcor S.A.- secondary route, from the former Botosani Industrial Area;
1.2-Western part of the town: Suceava Exit on DN 29;
1.3-Southern part of the town: Pacea Cemetery- exit to Curtesti;
1.4-Southern part of the town exit to DN 28 B;
1.5-South-Eastern part of the town Tulbureni Area–Western part of the small river Teascu;

1.6 Southern part of the town–Radio Station–Petru Rares Street-Ion Creanga Street;

1.7-East slope–Parcul Tineretului Area–Drumul Tatarilor Street;

1.8-Northern Part of the town- Imparatul Traian Street-Hatman Arbore Street;

1.9-Northern East part of the town-Botosani Railway Station–Leorda–Army Unit Area.

As a result of the researches done in the sliding areas, here are the conclusions:

a) all the slidinglands identified and registered represent reactivated sliding land

b) the approximate total surface of the areas affected by the sliding of the lands is 3330000 sq m. 333 hectares) and the volume of the carried soil is of around 4230000 cube metres.

c) in the area there have not been registered catastrophic landslides with massive material or human losses or corporal damages of persons .

d) there is a single landslides registered with code 1.2 now stable by drain works and consolidated, located in the western part of the town toward the ending to Suceava on DN 29.

e) the rest of the Western slopes from the natural plateau have the edges instable, showing specific aspects like folds and waves of the ground, benched trees, visible cracks, small springs, persisting surface waters with specific vegetation.

In order to limit the danger of potential land slidings a complex program in two phases was set up:

Phase no. 1 : Stabilization actions

- obstruction of the cracks from the sliding surface of the land;
- obstruction of the cracks from the sliding surface of the slided land;
- the discharging of the artificial charged lands by the existing deposits of slags, soils, wastes;
- making of trenches or ditches for a better drainage, trickling of the rainfalls;
- the ceasing of any excavations on the slopes affected by landslides;
- restrictions of circulations for the heavy transportation cars.

Phase no.2 : Remedy and/or combat of the effects actions

- topographic studies, geological studies, geotechnical studies, in order to specify the land types ;
- installing of fix and mobile marks to monitor the speed of the movement of the landslides;

- designing and implementing of a consolidation project of the slopes affected by the slidinglands ;
- repairing of the damaged buildings;
- total regulation of the active streams(torrents) ;
- the drainage of the surfaces where the water stays for a long time, making puddles;
- reducing the level of the underground water;
- designing of a new concept of a better use of the lands affected by slidings.

Because of the lack of the financial resources, for the moment, none of the actions of the both phases of the Project is implemented yet.

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