



SETOF Soil Erosion and TOrrential Flood
*Prevention: Curriculum Development at the
Universities of Western Balkan Countries*

APPLICATION OF SIMPLE ADDITIVE WEIGHTING METHOD FOR SELECTION OF APPROPRIATE MEASURES IN THE REHABILITATION OF THE LANDSLIDE

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Introduction



- Landslides represents a significant problem in our country and in the world;



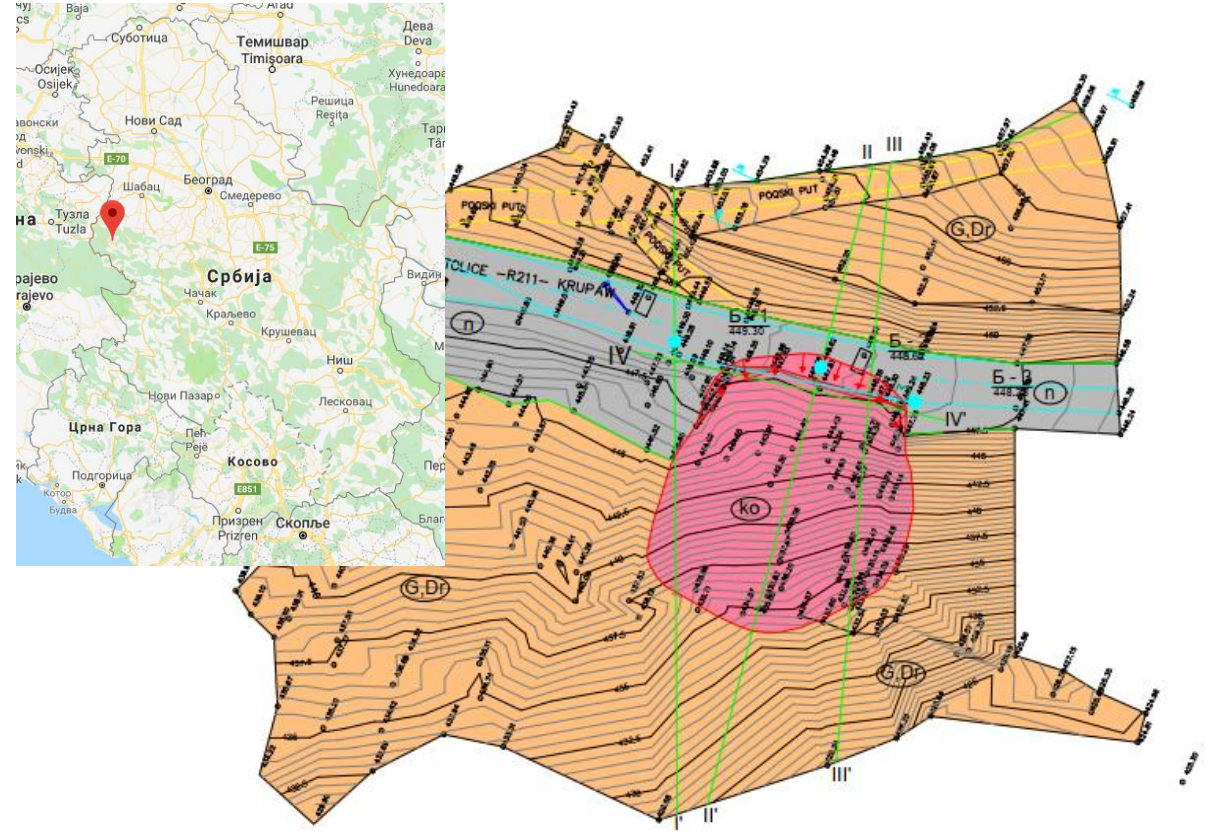
- Aim: Choosing the best solution and preventing further movement of the terrain by applying technical measures for the rehabilitation of landslides.





Material

- Western Serbia: on the section of the regional road R-211 Stolice – Krupanj;
- The average **width** of the landslide: 20.0 m;
- The **length**: 30.0 m;
- The **depth** in its central part: 4.0 to 4.5 m;
- The **height** difference from the foot part to the top of the forehead scar: 15 m.





Method

Slope stability analysis

JANBU method

Bishop method

Method for determining F_s for geosynthetics applying

Dimensioning of the
technical measures

Geotechnical software GEO5

Active pressure

Stability calculation

Multi-criteria
decision analysis
method

Rank sum method

Simple Additive Weighting Method





Method

- Rank sum method

$$W_j = \frac{2 \cdot (n + 1 - r)}{n \cdot (n + 1)}$$

- W_j – the weight of criteria expressed numerically,
- n – number of criteria to be compared,
- r – the assigned rank of the given criterion.





Method

- Simple Additive Weighting Method

$$U_i = \sum_{j=1}^n v_{ij} \cdot w_j, \quad i = 1, 2, \dots, m$$

- U_i - the overall performance score of the alternative, overall benefit,
- m – number of alternatives,
- n – number of criteria,

- w_{ij} – criterion weight, where $0 \leq w_{ij} \leq 1$, $\sum_{j=1}^n w_{ij} \neq 1$

- v_{ij} – normalized value of criteria, which can be obtained by applying max-min normalization [0-1].

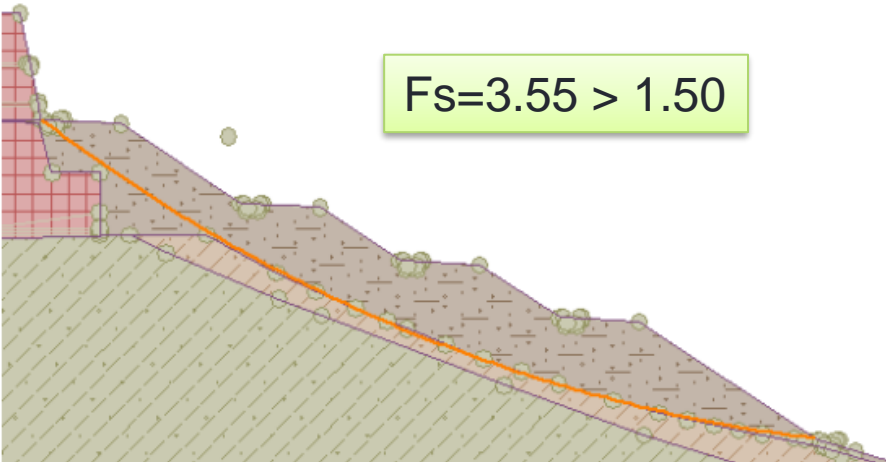


Results

- 4 alternatives and 4 criteria

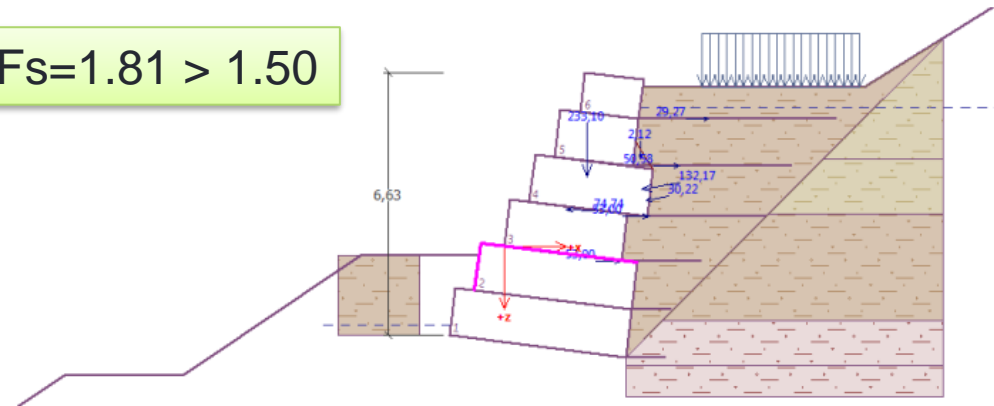
A1 – Concrete wall

$F_s = 3.55 > 1.50$



A2 – Gabion wall (A)

$F_s = 1.81 > 1.50$

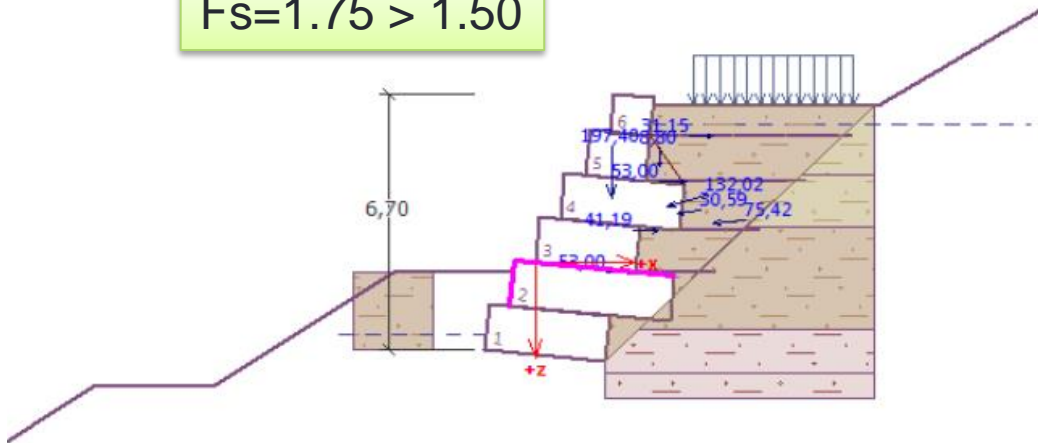


Results

- 4 alternatives

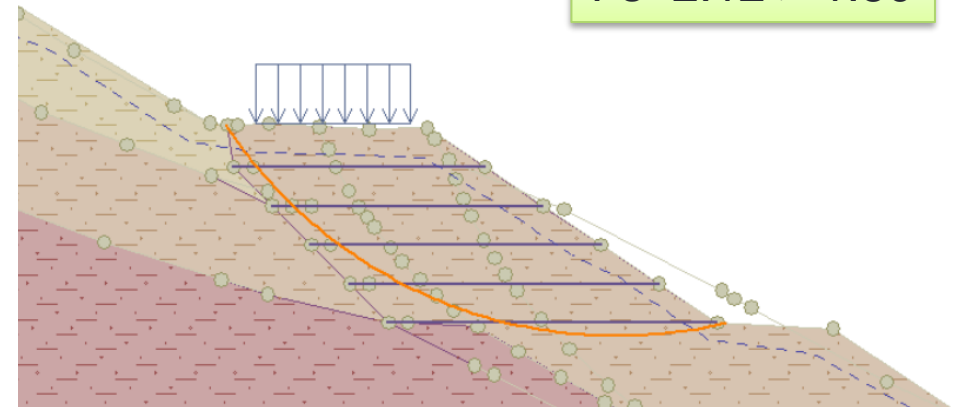
A3 – Gabion wall (B)

$F_s = 1.75 > 1.50$



A4 - Geogrid

$F_s = 2.12 > 1.50$



Results

- 4 criteria

K1 – Construction costs

K2 – Fitting into the environment

K3 – Lifetime of the object

K4 – Susceptibility to damage

Table 1. Criterion values for proposed landslide rehabilitation alternatives

Criteria	Alternatives			
	A ₁	A ₂	A ₃	A ₄
K ₁ [din]	9 963 868	2 095 940	2 399 040	690 770
K ₂ [1-5]	2	4	4	5
K ₃ [1-5]	5	4	4	3
K ₄ [1-3]	3	2	2	1

Results

Table 2. Criterion weight values

	Criteria	Rank of all criteria	Weight of criteria
$W_j = \frac{2 \cdot (n + 1 - r)}{n \cdot (n + 1)}$	K ₁	1.	0,40
	K ₂	3.	0,20
	K ₃	2.	0,30
	K ₄	4.	0,10
			$\Sigma W_j = 1,0$

K1 – Construction costs

K2 – Fitting into the environment

K3 – Lifetime of the object

K4 – Susceptibility to damage

Results

Scenario 1

$$W_{j1} \neq W_{j2} \neq W_{j3} \neq W_{j4}$$

Table 3. Overall utility and ranking of alternatives for Scenario 1

Alternatives	U_i	Rank
A_1	0,30	4.
A_2	0,67	2.
A_3	0,65	3.
A_4	0,70	1.

Scenario 2

$$W_{j1} = W_{j2} = W_{j3} = W_{j4} = 0,25$$

Table 4. Overall utility and ranking of alternatives for Scenario 2

Alternatives	U_i	Rank
A_1	0,25	4.
A_2	0,63	2.
A_3	0,62	3.
A_4	0,75	1.

* U_i - overall benefit



Conclusion

- As a result of application of multi-criteria decision analysis method, **the use of geogrid proved to be the best solution** to prevent damage caused by landslides.
- Application of SAW method has great importance and we can use it as a component of decision making during the many problem solving in erosion control.





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Thank you for your attention!

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