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# Project Report

# Slope Stabilisation in Miesbach

## Bavaria, Germany

Fig. 1: Finished slope stabilisation

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## General Project Data

**Client and design**

Fa. Xaver Riebl Bauunternehmung
Büro München
Landsberger Straße 368
München/ Germany

**Installation**

Fa. IST Deggendorf
St.-Martin-Straße 12
D - 94469 Deggendorf/ Germany

**Assignment**

Slope stabilisation with static load bearing soil nailing and suspended plantable surface protection

To attain adequate static stability during the excavation of a pit for the foundation of new apartment buildings

Construction of a natural looking steep slope which is optically attractive for the residents of the apartments

**Construction method**

Soil nailing combined with Krismer System® as erosion protection

Soil nailing and shotcrete as temporary protection of the excavation pit

**Execution time**

June to November 2005

**Project dimensions**

| | |
|---|---|
| Total surface of the slope: | ~ 2.070 m² |
| Depth of the excavation pit: | 4 - 5.5 m |
| Inclination of the slope: | ~ 65° - 75° |
| Height of the slope: | 4 - 12.5 m |

Maximum total height of the slope
(excavation pit + slope): ~ 16.5 m

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## Initial Situation

On the lot of a former dairy farm, in the middle of the city Miesbach, new apartment houses were to be built after demolition of the old dairy buildings.

To obtain sufficient space for the new buildings and gardens, it was necessary to cut the eastern part of the slope very steeply (a step into the terrain of almost 13.0 m height) with a gradient of at least 65°.

Extensive works to secure the new 65° slope were necessary to achieve long-lasting static stability. The planned excavation of a pit for the construction work of the cellar at on the base of the steep slope increased the requirements on the already exceptional slope stabilisation concept.

As an alternative, a massive gravity wall made out of gabions would have caused space problems and also a big detraction of the appearance of the slope, especially for the new apartments with a view to the slope, hence the client was interested in finding a “green” alternative.

In cooperation with the promoter of the housing project, a geological expert and a soil engineer, the Krismer Company developed a constructive concept which proposed a steep slope with an angle of gradient of 65° that included long lasting static stability and a natural green, planted surface.

For this reason, it was decided to use soil nailing in combination with the Krismer System®. The Krismer System® was fixed, load carrying, to the soil nails using special system-inherent connecting elements and reinforced with steel ropes that were laid over the steel lattice surface and pre-stressed.

To guarantee the static stability of the cut slope, the soil nailing was done with soil nails up to 8 m long, in accordance with the static calculation.

To adequately meet with all the requirements of an effective and long-lasting erosion protection of the free slope, the constructing method with “Krismer System®” proved to be predestined.

As in several other previous installations, in this project the Krismer System® also proved that it is optimally suited to protect extreme surfaces while enabling the cultivation of steep surfaces with natural vegetation.

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## Slope Stabilisation with Krismer System® - System construction

### Slope surface:
(after excavation was finished)

- Approx. 5 cm special humus was seeded to develop a thick mat of grass

- cover net: type HaTe, made of plastic web, mesh width 10 x10 mm, fixed with high strength steel clamps on the three-dimensional steel lattice mats

- Krismer System®: three-dimensional steel lattice mats, type J.K.S. A02-80|1,5-FEZ, height = 80 mm, fixed on the heads of the soil nails with special system-inherent connecting elements. For the transfer of the nail head loads a rope netting of Ø 12 mm steel ropes was laid over the anchored lattice mats and pre-stressed.

- stone filling of the three-dimensional J.K.S. steel lattice mats with crushed gravel, grain size 32/ 60 mm, Volume approx. 7 - 8 m³ per 100 m², contributes surface drainage and acts as a support for the humus

Fig. 2: Initial situation - demolition of the old dairy

During the stepwise excavation of the slope the old buildings of the dairy had to be broken down gradually because they were partially built into the slope.

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## Project Execution

Fig. 3: First excavation step, excavating the new 65° cut slope in stages

Fig. 4: The excavation work is immediately followed by the stabilisation work for the slope, done from the interim berm

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Fig. 5: Second excavation step, immediately followed by stabilisation of the slope

Fig. 6: Finished cut slope, inclination 65°, down to the level of the floor of the excavation pit for the foundation

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Fig. 7: Beginning the excavation work for the foundation of the apartment houses, with adjoining finished stabilised steep slope

Fig. 8: A crane bucket (in the foreground) with an opening on the side for stone filling

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Fig. 9/10: Filling of the anchored lattice mats with gravel, grain size 32/60 mm, Volume approx. 7 - 8 m³ per 100 m²

The three-dimensional J.K.S. steel lattice mats in combination with the stone filling act as a support layer for the humus. In addition, the stone filling makes optimal surface drainage possible. The filling work was done with a crane and bucket from the base of the slope.

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Fig. 11/12: Cut slope, Spring 2006 - The topsoil was applied onto the slope surface using the wet spraying method. Seeds were mixed into the humus during its application.

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Fig. 13/14: State of the slope in June 2006, surface covered with germinating plants

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Abb. 15/16: Integration of the Krismer System® approx. 1.50 m over the top of slope into the surrounding terrain

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Abb. 17/18: State of the slope in October 2006

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Fig. 19: State of the slope in October 2006

The buildings and gardens are finished. The cut slope with an inclination of 65° and up to 13 m high is permanently stabilised, optimally planted and optimally integrated into the base of the slope and adjacent gardens. The natural character of the surface creates a very pleasant general impression of the housing complex, which is especially important for the well-being of the new owners.

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## Results

- The newly excavated slope was permanently stabilized according to current construction standards using static carrying soilnailing.
- The surface of the slope was stabilised with the Krismer System® and effectively secured against every kind of erosion.
- The stone filling guarantees that the whole installation stays water permeable and prevents an excessive build up of flow pressure from emerging slope water
- In addition, the low height of the Krismer System® enabled the laying out of gardens on the base of the slope because valuable space was saved.
- Supported by the steel lattice mats, the humus layer was optimally stabilised and already after two growing periods a very thick layer of grass could develop.
- In addition to all the technical advantages of the installation, today the whole excavation no longer looks as threatening any more, thanks to the thick and natural green layer. The visual effect is much more attractive than other slope stabilisation methods. The impact of the enormous cut of almost 13 m high, immediately next to the houses, could be reduced by giving the slope a natural surface.

Fig. 20: Finished cut slope combined with to neighbouring gardens