

J. KRISMER Handelsgesellschaft m.b.H

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Project Report

Stabilisation of a Steep Slope during construction of the new K 1897 County Road between Backnang and Erbstetten Baden-Württemberg, Germany



Project Data

Contracting authority	Schorndorf Road Construction Authority Schloss D - 73614 Schorndorf Waiblingen Regional Headquarters Beinsteiner Straße 163 D - 71334 Waiblingen
Main contractor	Lukas Gläser GmbH & CoKG Backnanger Straße 66 D - 71546 Aspach
Technical supervision	Construction Material and Soil Testing Centre of the Government Presidium of Stuttgart Ludwigsburg
Slope stabilisation subcontractor	Injekta Spezialtiefbau GmbH Oberschlesienstraße 21 D - 83024 Rosenheim
Assignment	Permanent stabilisation of a fractured platy limestone slope, parts of which contain a heavy covering of rubble Stabilisation of slopes excavated in stages during road construction
Construction method	Krismer System®
Execution period	Autumn 2000
Project volume	Total slope surface (incl. system integration into border zones): ~ 1.700 m ² Slope inclination: ~ 60° - 65° Slope height: 5 - 7 m

Initial Situation

The K 1897 county road had a particularly dangerous blind railway crossing, which induced the authorities responsible for local road safety to build a new section of road that included an underpass beneath the rail line.

The original road design project called for the construction of a gabion retaining wall with backfill material for the stabilisation a very steep slope. For this project however, this method was considered very labour intensive and too costly.

For this reason, the main contractor presented an alternative proposal during the tendering procedure.

The proposal was to permanently stabilise the slope with the Krismer System®, anchored to the subjacent subsoil by means of rock- and soil nails. In addition, the slopes excavated during construction could be stabilised in stages as they were being dug. Slope areas with a high concentration of rubble were stabilised with shotcrete.

This alternative proposal was eventually accepted, since it offered a solution that was both technically sound as well as economically feasible.



Fig. 1: Earth movement work for the new K 1897 county road

Slope Stabilisation with the Krismer System® - System Design

For the slopes to be stabilised with the **Krismer System®**, the following system design was chosen:

- 3-5 cm layer of top soil (~1-2 cm of which should be above the upper edge of the J.K.S. screen)
- Krismer System®: three-dimensional steel screen panels (J.K.S. panel), type J.K.S. A02-80 | 1,5-FEZ, height = 8 cm, fixed with special T-steel nails (with welded-on hook and point) and strengthened with hot-dip galvanised distribution rods \varnothing 10 mm and \varnothing 12 mm, type R10/2500 or R12/2500
- gravel filling (into the J.K.S. panels): grain size 32/60 mm, volume 6 m³/100 m²

Anchoring of the shotcrete layer (in slope rubble areas):

- rock bolts, type GEWI 25, length = 3-5 m

Project Execution

Once the initial earth movement stage was finished, the slope surface had to be prepared for the installation of the Krismer System®.

First, slope areas with a high rubble content were stabilised with shotcrete and GEWI rock bolts (length = 3 - 5 m). Afterward, the whole slope surface was cleaned and uneven terrain was back-filled.

Then the step-by-step installation of the Krismer System® began.

For this the three-dimensional J.K.S. panels were laid on the slope surface at an angle diagonal to the fall line of the slope. The panels were overlapped both longitudinally and laterally and these joints were secured with stainless steel wire binding loops.

The installation was done from top to bottom in three steps, corresponding to the three stages of excavation (vertical height approx. 2-3 m / stage).



Fig. 2: Installation of the Krismer System® in several steps

To increase the compound action of the Krismer System®, distribution rods were systematically inserted into the J.K.S. panels.

In addition, the complete system structure was adequately integrated into the border zones surrounding the installation.

The system was firmly anchored to the subsoil by means of special T-steel nails.

For the installation of the T-Steel nails, holes had to be pre-drilled on account of the rocky surface, using a hand-operated drill. Then the nails were rammed by use of a pneumatic hammer into the boreholes, which had previously been filled with mortar.

The areas where the slope had high rubble content were stabilised with shotcrete combined with GEWI anchors (fig. 3), the anchor heads were later connected to the J.K.S. panels by means of special connecting-elements.



Fig. 3: Areas which were pre-stabilised with shotcrete and GEWI anchors

After the J.K.S. panels were anchored they were filled with gravel (grain size 32/60 mm). This work was carried out with a bank-hoe from the top of slope (fig. 4).

The gravel filling provides surface drainage which enables both surface and ground water to be led away.



Fig. 4: Gravel filling (grain size: 32/60 mm)

The gravel filling (up to about half the height of the three dimensional J.K.S. panels) combined with the 3D steel structure, provide extra grip to hold the top soil fill layer that is later added.



Fig. 5: J.K.S. panel with gravel fill

Afterwards top soil was filled into the J.K.S. panels using the dry spraying method.



Fig. 6: Filling the top soil by means of a spraying machine

The spraying machine was filled with prepared, dry top soil which was blown by compressed air through conveyor tubes and later mixed at the exit nozzle with the amount of water necessary to make the soil adhere to the gravel filled J.K.S. panels. Soil/water dosage is calibrated by the nozzle operator.

The resulting soil/water mixture that is blown into the J.K.S. panels is compressed and adheres to the slope permanently.

Results

The adopted construction measures achieved the following verifiable results:

- the slope was thoroughly stabilised
- fragmented rock was permanently protected from damage caused by varying weather conditions (e.g. frost)
- the gravel filling forms a suitable surface drainage to lead away water emanating from rock fractures
- the stabilised layer of top soil forms a base for long lasting plant growth
- a slope was constructed with an inclination that complied with road design requirements, while offering optically perfect landscape integration.
- compared to retaining structures, huge cost savings could be attained with the application of the Krismer System®



Fig. 7-8: Slope stabilised with the Krismer System®: 1 year (Fig. 7 - left) as well as 6 years (Fig. 8 - right) after the installation was completed

Appendix I: Additional Images of the Installation



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Hydraulic Engineering/ Drainage

Retaining Structures

Rockfall/ Avalanche Protection

Special Constructions

Services

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