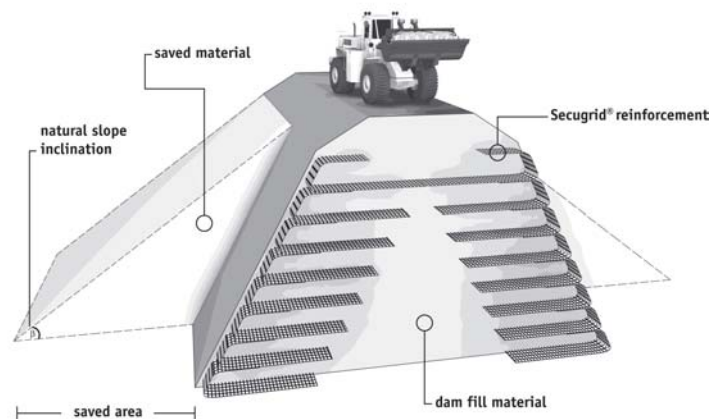


# Secugrid® & Combigrid® Installation Guidelines: Steep Slope Applications



## NAUE GmbH & Co. KG

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## 1. SCOPE

This installation guide is valid for all Secugrid®/Combigrid® geogrids used in steep slopes and in retaining walls applications. They apply likewise to all permanent and temporary structures subjected to static stress or dynamic stress (e.g. caused by traffic) conditions. It details the receipt, storage and handling, installation of geogrid and fill placement.

## 2. APPLICATIONS

This guide is appropriate for geogrid installation in applications such as

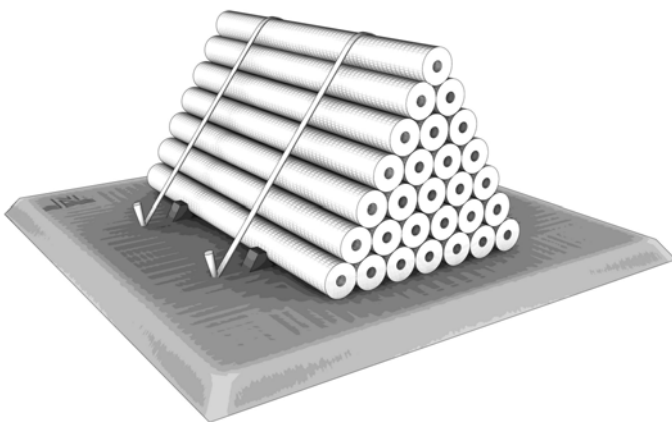
- steep slopes and undulations
- retaining walls
- tieback structures

Both Secugrid® and Combigrid® can be used in these applications whereby the Combigrid® products are used wherever a separating and drainage function is required in addition to a reinforcing function.

These installation guidelines deal with the above-listed applications. Other applications such as the reinforcement of

- Unpaved roads and/or roads subsequently paved
- Parking areas, unpaved and/or subsequently paved
- Area stabilization for laydown yards, and multidirectional traffic areas
- Reinforcement over subsidence prone areas
- Similar applications

are dealt with in a separate installation guideline.



## 3. RECEIPT, STORAGE AND HANDLING

Geogrids received shall be verified as being the type, grade or designation required for the project, as defined by the project documents. Material shall be clearly marked, and in good condition before acceptance by the installation contractor.

Geogrids are transported and stored in rolls, and may be stacked on top of each other, but no more than seven rolls in height. If stored on the ground the soil on which they are stored must be dry, even and free of foreign matter. A tarpaulin for protection from the elements must cover material stored onsite for a period exceeding two months.

Geogrids may be installed either manually or by use of mechanized equipment. Edges of the geogrid rolls can be sharp, so gloves may be used during hand carrying and placement to prevent injury. Mechanized equipment may be used providing the said installation equipment does not damage the geogrid during this process.

#### **4. SECUGRID® INSTALLATION**

Ground surface shall be prepared prior to placement, providing a level and uniform ground surface, with appropriate clearing and grubbing performed to accomplish this. Additional preparation, as outlined in the project documents may be required.

Geogrid shall be placed in the location and orientation specified in the project plans and specifications. Geogrid shall be laid flat and smooth directly on the prepared subgrade. All wrinkles and folds shall be removed. When required, geogrid may be pretensioned to eliminate slack.

#### **5. FILL PLACEMENT AND COMPACTION CONTROL**

Prior to fill placement the geogrid shall be inspected by the certified inspector, to make sure it is placed in the proper location, and has not been damaged during installation. Damaged geogrid, as determined by the engineer shall be repaired immediately as described in section 9.

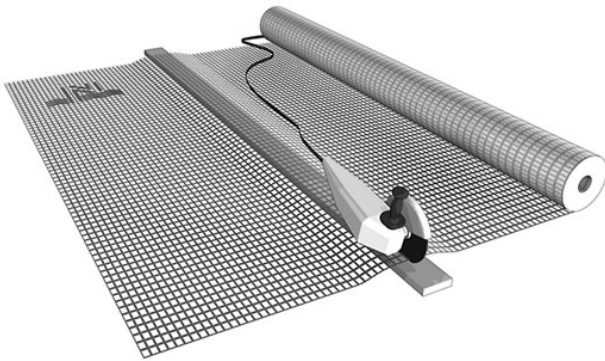


Typically construction vehicles are not allowed to traffic directly on the geogrid. The subbase or cover material shall be placed so a minimum of 200 mm is in place before trafficking may occur.

Typically granular fill is used for steep slope applications. In all cases fill used shall be as required in the specifications, and shall be placed and compacted accordingly. If guidance is not provided, compaction shall be carried out according to the minimum standards set forth by appropriate local guidelines.

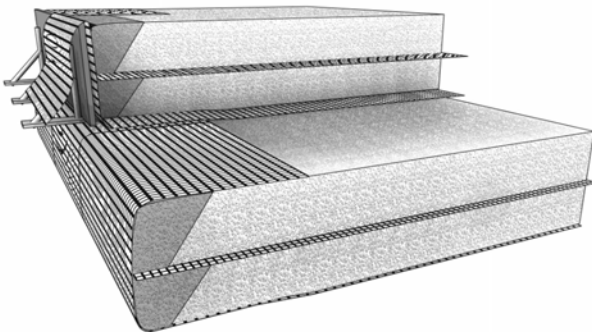
The mechanical parameters of the soil in each case must be taken into consideration during the dimensioning process and the parameters of the fill material used must be in line with the static calculations.

## **6. CUTTING /CUTTING TO SIZE OF SECUGRID®/COMBIGRID® GEOGRIDS**



The cutting and cutting to size of Secugrid®/Combigrid® geogrids to the specified installations lengths given in the design can be carried out using a customary abrasive-wheel cutting machine fitted with a diamond wheel whereby it is useful to lay a wooden plank beneath the grid and to carry out the cutting process either on or next to the plank. Secugrid® with up to 40 kN/m strength can be cut using customary cutter knives.

## **7. INSTALLATION OF SECUGRID® USING TEMPORARY SUPPORT FRAMES (APPENDIX A)**



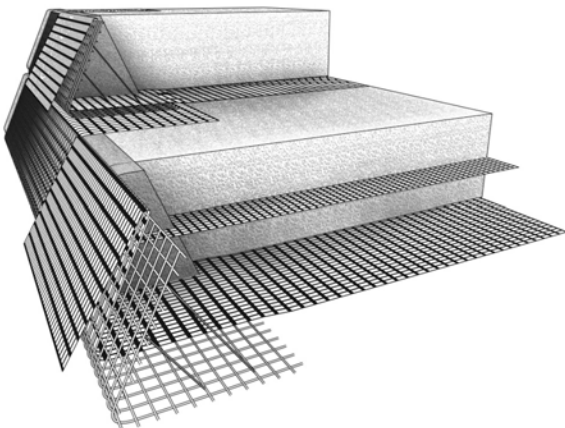
The temporary support frame is placed on the subgrade as described in Section 4. The Secugrid® geogrid is installed onto the soil preventing any folds and considering the main direction of tensile strength. It is then aligned and folded up along the temporary steel formwork. The part required as tieback structure is laid to the outside of the temporary steel formwork and, if necessary, fixed. If required, a filter nonwoven geotextile (e.g. Secutex®) can be installed at the facing between the geogrid and the fill material. Secugrid® geogrids are usually butt-jointed sidewise. If required by the design overlapping reinforcement layers may be required. The support frame can be vertical

but application related could also have an inclination. It is the responsibility of the contractor to ensure the stability of the support frame at any time of the construction. In the next stage the approved fill material is placed in the area of the steel formwork. If requested approved vegetation soil is placed in the front facing area. This process fixes Secugrid® into the support frame area. If required, the exposed ends of Secugrid® are stretched tight and if approved fixed with pins, U-shaped staples or with the approved fill material. If different Secugrid® types are required in the design it must be ensured that the correct Secugrid® type is installed in the designated layer.

In any case the installed Secugrid® reinforcement must lay flat, without wrinkles and slack on the subgrade and maintain this condition during and after the placement of fill material. Driving over Secugrid® is not allowed at any time.

The fill material placed over Secugrid® should have a thickness of at least 0.20 m and compaction should be able to be effectively compacted. Intermediate layers of Secugrid® should be installed in the designated position if requested by the design calculations. Once the height of the support frame is reached and the soil has been compacted to the requested value, the overhanging tieback Secugrid® is pulled back and if approved fixed with pins, U-shaped staples or with the approved fill material. The support frame used can be removed be used for other sections once stability of the system is ensured. The following layers are installed in the same described manner.

## **8. INSTALLATION OF SECUGRID®/COMBIGRID® USING STRUCTURAL STEEL LATTICE ELEMENTS AS PERMANENT FORMWORK (APPENDIX B)**

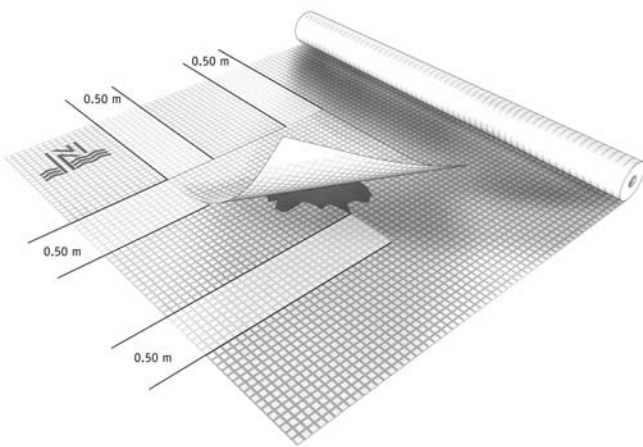


The temporary steel formwork is placed on the subgrade as described in Section 4. The Secugrid geogrid is installed onto the soil preventing any folds and considering the main direction of tensile strength. It is then aligned and folded up along the temporary steel formwork. The part required as tieback structure is laid to the outside of the temporary steel formwork and, if necessary, fixed. If required, a filter nonwoven geotextile (e.g. Secutex®) can be installed at the facing between the geogrid and the fill material or towards the steel formwork. Some steel formworks are pre-manufactured with nonwoven geotextiles, some even pre-seeded. Secugrid® geogrids are usually

butt-jointed sidewise. If required by the design overlapping reinforcement layers may be required. The steel formwork is typically bent on site or pre-bent to the desired inclination of the front facing and is fixed by a steel connection anchor to prevent a deformation during the filling and compaction process. In the next stage the approved fill material is placed in the area of the steel formwork. If requested approved vegetation soil is placed in the front facing area. This process fixes Secugrid® into the formwork area. If required, the exposed ends of Secugrid® are stretched tight and if approved fixed with pins, U-shaped staples or with the approved fill material. If different Secugrid® types are required in the design it must be ensured that the correct Secugrid® type is installed in the designated layer. In any case the installed Secugrid® reinforcement must lay flat, without wrinkles and slack on the subgrade and maintain this condition during and after the placement of fill material. Driving over Secugrid® is not allowed at any time.

The fill material placed over Secugrid<sup>®</sup> should have a thickness of at least 0.20 m and compaction should be able to be effectively compacted. Intermediate layers of Secugrid<sup>®</sup> should be installed in the designated position if requested by the design calculations. Once the height of the steel formwork is reached and the soil has been compacted to the requested value, the overhanging tieback Secugrid<sup>®</sup> is pulled back and if approved fixed with pins, U-shaped staples or with the approved fill material. The following layers are installed in the same described manner.

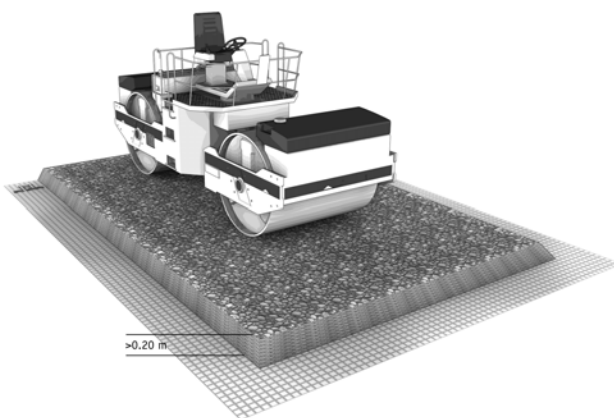
### **9. REPAIRING SECUGRID<sup>®</sup>/COMBIGRID<sup>®</sup> REINFORCING LAYERS**



Should the installed Secugrid<sup>®</sup> geogrids be damaged in any way prior to placing the fill material, the type and extent of the damage should be reported to the site supervisor or engineer in charge. Damages in cross direction to the main reinforcing direction may be less of a concern and can be repaired by simply overlapping the damaged area with replacement material at least 0.50 m over the damaged area. If the main reinforcing direction is damaged the design engineer must approve an overlap repair with a minimum overlap of 0.50 m next to

the damaged area. In some cases it might be suitable to replace damaged material, again overlapping with at least 0.50 m into undamaged areas. However, it is recommended to replace the entire reinforcing length of damaged material to ensure the safest solution.

### **10. NOTES ON THE PLACEMENT OF FILL MATERIAL AND COMPACTION AND COMPACTION CONTROL**



The fill material is to be placed without driving directly on Secugrid<sup>®</sup>. The minimum thickness of this layer prior to any traffic and compaction must be at least 0.20 m. The Secugrid<sup>®</sup> reinforcement must lay flat, without wrinkles and slack on the subgrade and maintain this condition during and after the placement of fill material. It must be ensured that Secugrid<sup>®</sup> is not negatively affected during this process. Fill material should be in accordance with the project specifications or national regulations. In any other case contact NAUE for further recommendations.



The proctor densities according to the project specification should be followed. Typically they should be > 95 % for heights up to 5 m, 98 % for walls 5 – 10 m high (layers under 5 m should have 100 %) , and 100 % for all layers for walls over 10 m high.

Under no circumstances should heavy compaction equipment be used in the area of 1 m or less to the front facing.

## **10. ADDITIONAL COMMENTS**

Contact the design or responsible engineer, or the NAUE site engineer directly should there be any issues which require clarification or if you have any further questions.



**APPENDIX A: INSTALLATION OF SECUGRID® USING TEMPORARY SUPPORT FRAMES**

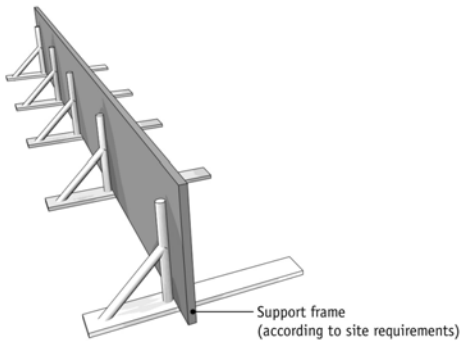


Figure 1: Removable support frame

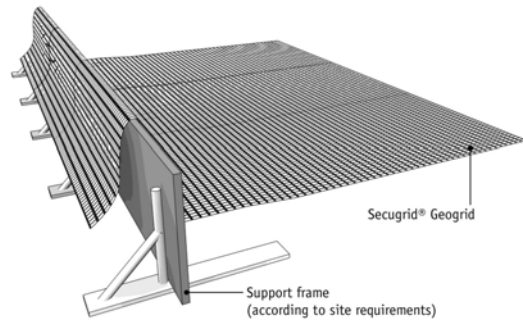


Figure 2: Placement of Secugrid®

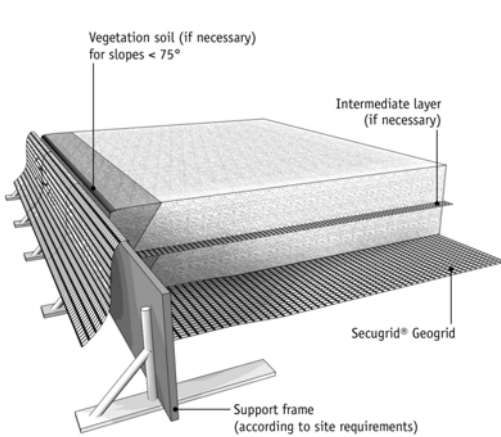


Figure 3: Placement of soil layer(s)

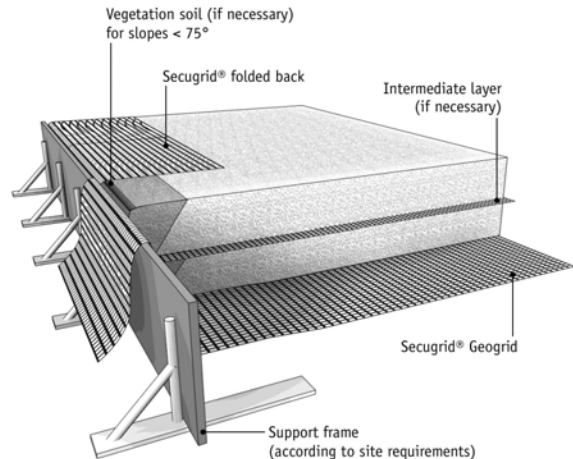


Figure 4: Back folding of Secugrid®

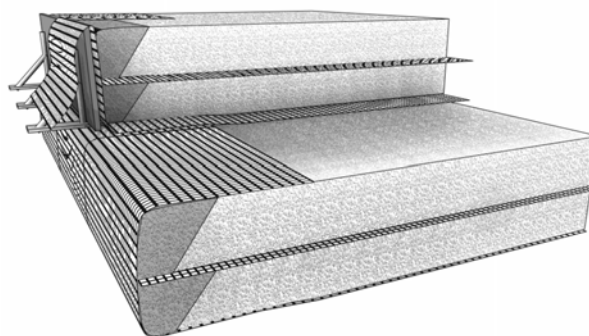


Figure 5: Final view and re-using of support frame

**APPENDIX B; INSTALLATION OF SECUGRID®/COMBIGRID® USING STRUCTURAL STEEL LATTICE ELEMENTS AS PERMANENT FORMWORK**

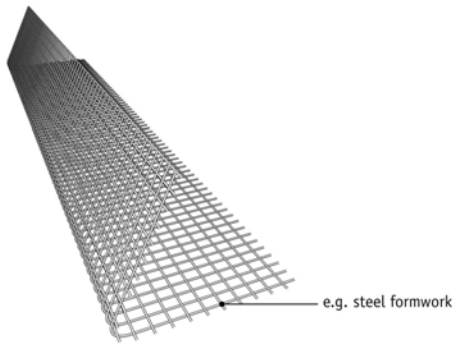


Figure 6: Set-up of steel frame work

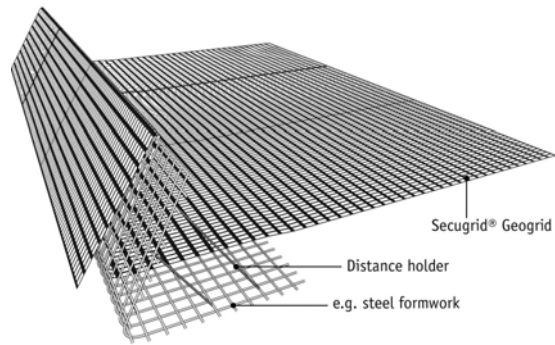


Figure 7: Placement of Secugrid®

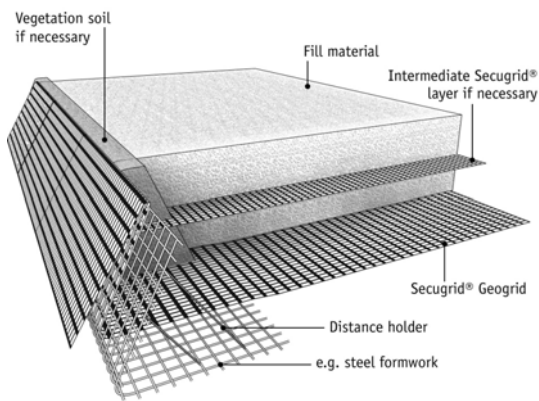


Figure 8: Placement of soil layer(s)

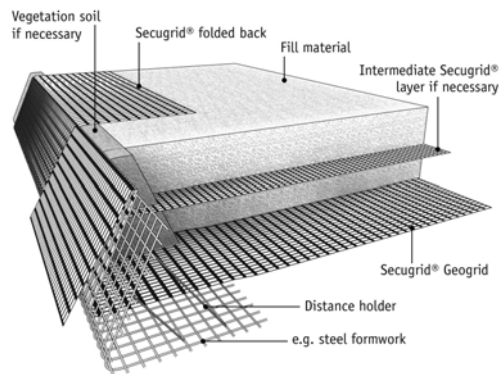


Figure 9: Back folding of Secugrid®

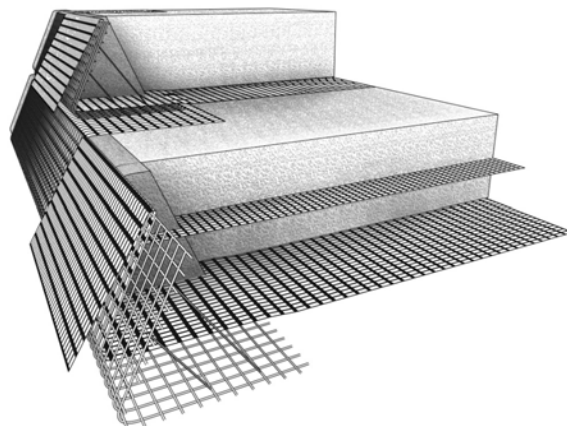


Figure 10: Final view