



BENTOSURE

GEOSYNTHETIC CLAY LINER

INSTALLATION GUIDELINES

ISO: G 120 010 | DATE: JANUARY 2024 | VERSION 3



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INTRODUCTION

This document describes procedures for the installation of BentoSure. Directions shown below ensure safe, efficient and continuous material placement. These guidelines can be applicable to any type of lining project.

Any information in this document should be verified with the project specific design and in

case of differences designer should determine site specific details.

Proper performance of the lining system fully depends on the installation quality.

Quality assurance on the construction site should describe final procedures to be adopted.

1.0 DELIVERY & STORAGE

BentoSure rolls have to be delivered to the job site in original packaging with two straps placed on every roll. Discharge of the truck or container should be made with use of the straps, stinger equipment or spreader bar attached by chains to the I-beam. It should be considered that roll weights can be from 700 to 1500kgs so proper strength of the materials used has to be ensured. BentoSure rolls are labeled and it is critical to verify roll numbers on the labels with the packing list. Unique roll number is used to trace the product. BentoSure rolls can be stored at the job site. When rolls need to be stored outside they must be covered with tarpaulins and kept off the ground with pallets (or similar). The storage area should be level, without standing water and able to support the roll weights. Rolls must be stacked in a manner that prevents them from being able to slide or roll from their position.



IMPORTANT

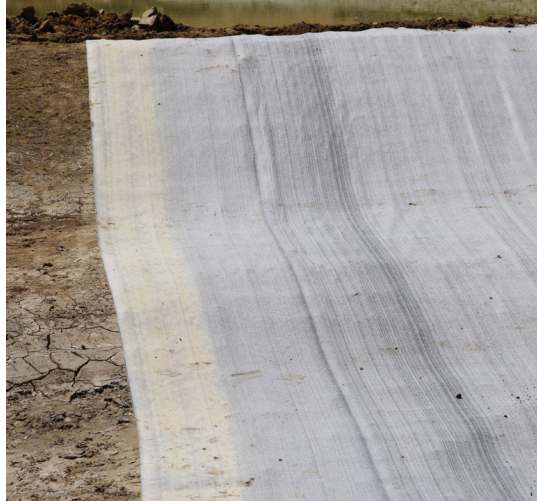
BentoSure rolls must be kept dry at all times prior to installation

2.0 SUBGRADE PREPARATION

Before BentoSure is placed over soil, the subgrade must be prepared according to this guide, project specific requirements and design. Subgrade consisting of the gravel like material may not be suitable for BentoSure installation. It is required that 80% of the soil is finer than 0.25mm unless otherwise approved by the design engineer. The subgrade surface should be smooth and free of vegetation, sharp-edged rocks, stones, sticks, construction debris, and other foreign matter that could damage material. Installation area should be compacted to remove any excessive wheel ruts, footprints, or other abrupt grade changes. The subgrade has to be compacted according to the project requirements. It should stay with no abrupt elevation changes, voids and cracks, ice, or standing water. All protrusions extending more than 12mm from the subgrade surface shall either be removed, crushed, or pushed into the surface.



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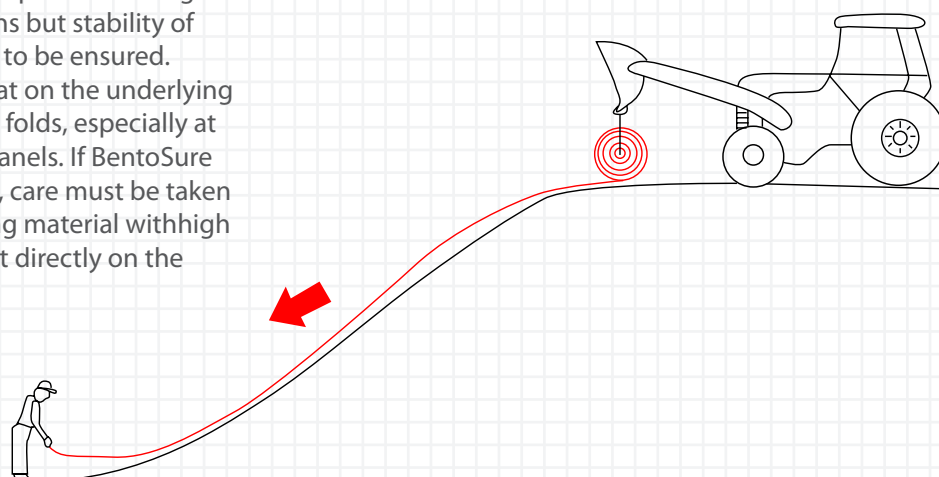
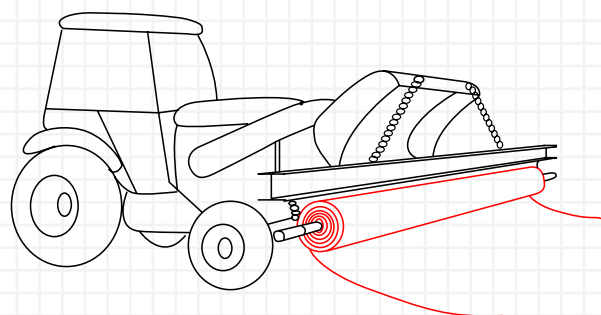
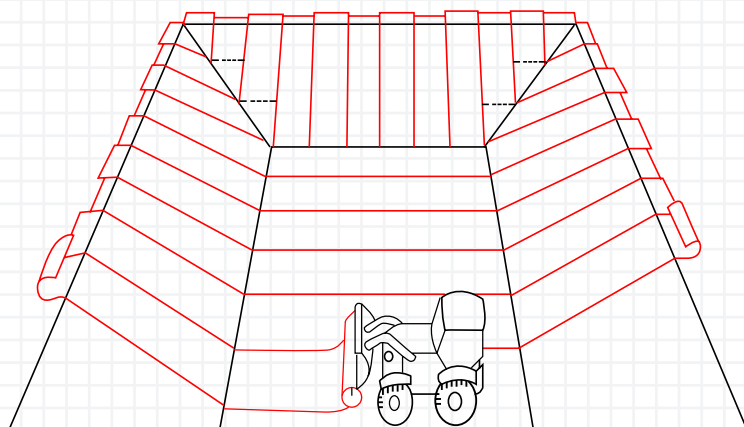


3.0 INSTALLATION

Packaging should be removed immediately prior to installation, without damaging the BentoSure. The orientation of the panels (that is, which side faces up) has to be determined at the design stage. It is recommended that panels layout plan is prepared before installation work – this is to avoid material losses and proper seaming execution. In case of laminated product (BentoSure C) when cover membrane is welded, difficult welding details should be prepared before installation.

No equipment that could damage material shall be allowed to travel directly on BentoSure. Acceptable installation, may be accomplished such that material is unrolled in front of the backwards-moving deployment equipment, such as a front-end loader or bulldozer. Machines with pneumatic wheels (all terrain vehicle) are allowed to move on the surface of BentoSure.

Care must be taken to minimize the extent to which BentoSure is repositioned across the subgrade in order to minimize damage to the subgrade and to the bottom surface of the material. Panels should be placed so that seams are parallel to the direction of the slope. Other installation can be adopted according to the site specific conditions but stability of the seams and material has to be ensured. BentoSure GCL should lie flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels. If BentoSure is placed over geosynthetic, care must be taken as to not damage underlying material with high ground pressure equipment directly on the geosynthetic.



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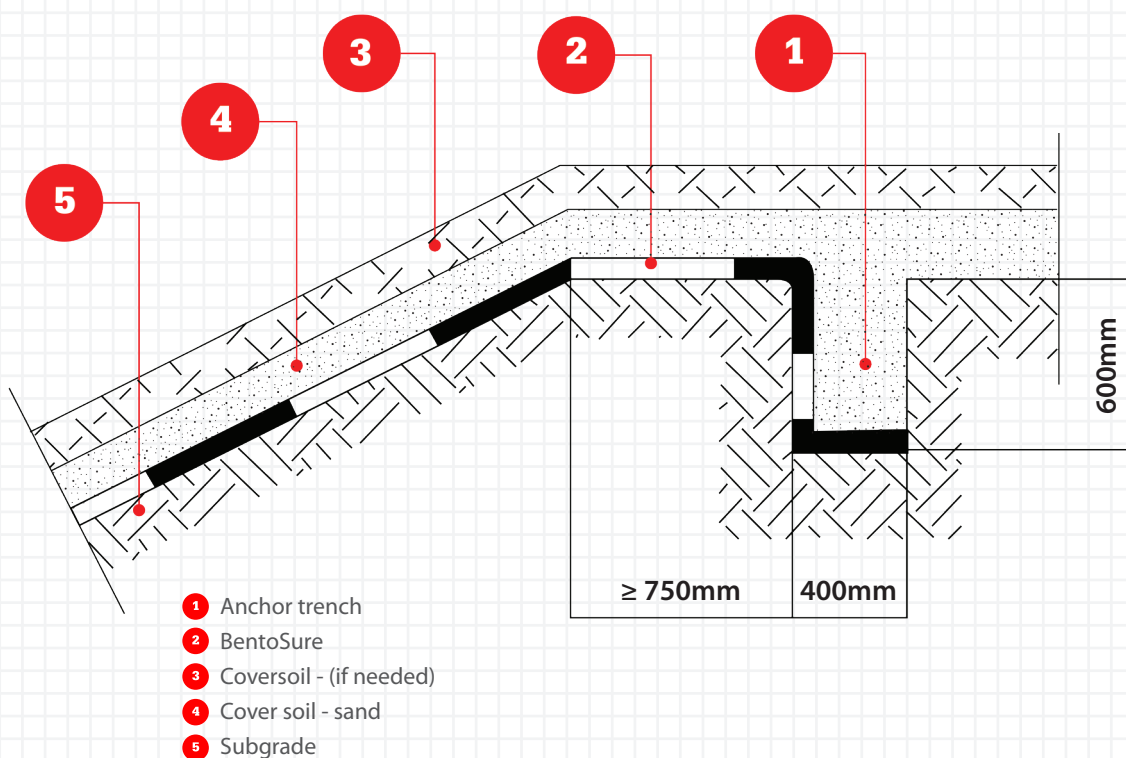


4.0 ANCHORAGE

At the top of a slope, depending on the project specific condition BentoSure roll end may be placed in an anchor trench. The front edge of the trench should be rounded so as to eliminate any sharp corners that could cause excessive stress on the material. Dimensions of the trench should be part of the design. If a trench is used for anchoring the end of the GCL, soil backfill should be placed in the trench to provide resistance against pull-out. The size and shape of the trench, as well as the appropriate backfill procedures, should be in accordance with the project drawings and specifications.

When BentoSure is placed in the anchor trench and temporarily ballasted, it will then be installed down the slope in a controlled manner. The anchor trench will then be backfilled. In case of laminated material it should be done the following morning (or in extreme cases, later that night) to control waves or wrinkles.

Alternatively anchorage may be obtained by extending the end of the BentoSure roll back from the crest of the slope, and placing cover soil. The length of this "runout" anchor is project-specific.

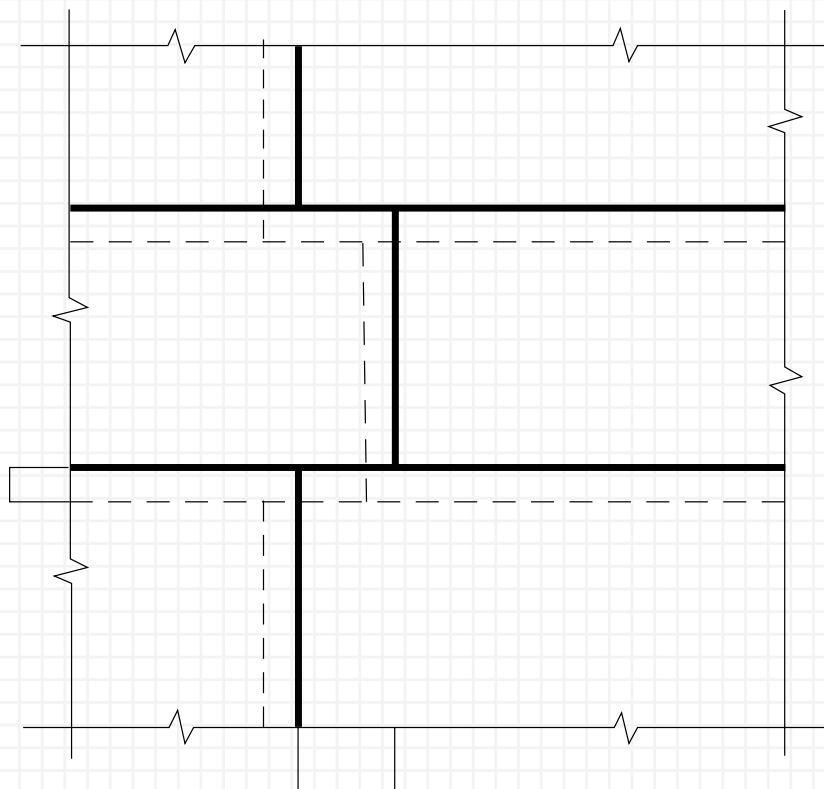




5.0 SEAMING

GCL seams should be made by overlapping adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris. Most of the BentoSure overlaps don't require treatment of supplemental (powdered or granular) bentonite. Longer edges of the panels are pre-treated at the plant. Short edges should be treated with granular bentonite which is delivered together with BentoSure. Required bentonite amount is 200g per linear meter. Geomembrane-based GCLs also may be welded together.

Recommended overlay between adjacent panels is 300mm, with no less than 230mm at any given point. End-of-roll overlapped seams should be constructed similarly but the minimum overlap should measure 500 mm. Care should be taken to maintain these overlap dimensions at the time of covering in all climatic conditions. Overlap width can be adopted to the site specific condition. In case of differential settlement or if material is expected to stay longer uncovered, wider overlaps should be considered. Seams should be constructed such that they are shingled in the direction of the grade in a manner that prevents the potential for flow entering the overlap zone.

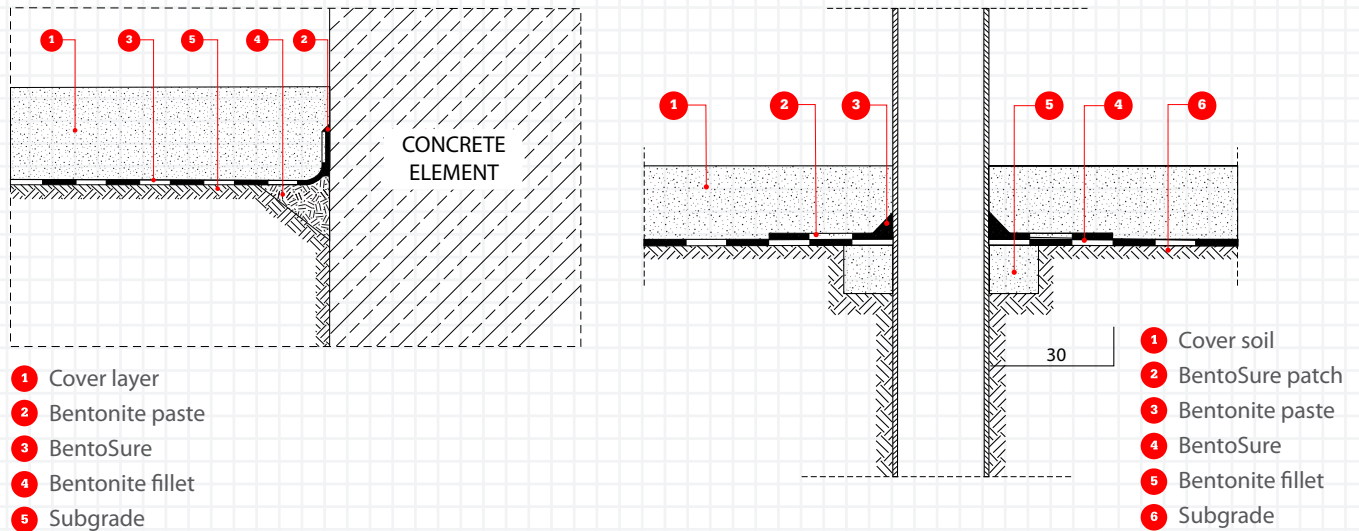


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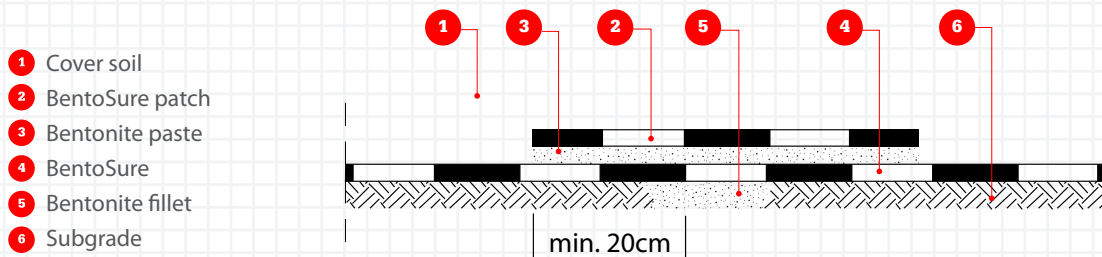
6.0 SEALING AROUND PENETRATIONS AND STRUCTURES

Cutting the BentoSure should be accomplished using a sharp utility knife. The GCL shall be sealed around pipe penetrations and structures embedded in the subgrade using granular bentonite, powdered bentonite, or bentonite paste, in accordance with the design drawings or as recommended by the manufacturer.



7.0 DAMAGE REPAIR

If BentoSure is damaged (torn, punctured, perforated, and so forth) either the entire GCL must be replaced or the affected area must be repaired by cutting a patch to fit above or below the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 300 mm is achieved around all parts of the damaged area. Dry granular or powdered bentonite or bentonite paste should be applied around the damaged area prior to placement of the patch. It may be desired to use an adhesive or other approved means to affix the patch.





8.0 COVER PLACEMENT

Cover soils shall be free of sharp-edged stones or other foreign matter that could damage the GCL. Cover soils should be an approved material with respect to particle size uniformity, moisture content, and chemical compatibility. Recommended cover soils typically have a well-graded particle size distribution ranging between fines and 25 mm. In the case of a coarser material protection geotextile may be used.

Soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL. A minimum of 300 mm of cover shall be maintained between the equipment tires/tracks and the GCL at all times during the covering process. It is recommended that cover soil is placed from the bottom towards top of the slope. Soil cover should be placed in a manner that prevents the soil from entering the GCL overlap zones. A temporary cover consisting of a waterproof tarpaulin or plastic sheet to protect GCL end-of-roll until construction the next day is acceptable, provided that the sheet is adequately ballasted and that water cannot enter from the sides. When another geosynthetic material is placed over the GCL, care must be taken to avoid using equipment and construction practices that could damage the GCL. Direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel all-terrain vehicles) may be used to facilitate the installation of the overlying geosynthetic. In case cover soil contains materials producing high conductivity leachate, its effect on BentoSure should be verified.



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