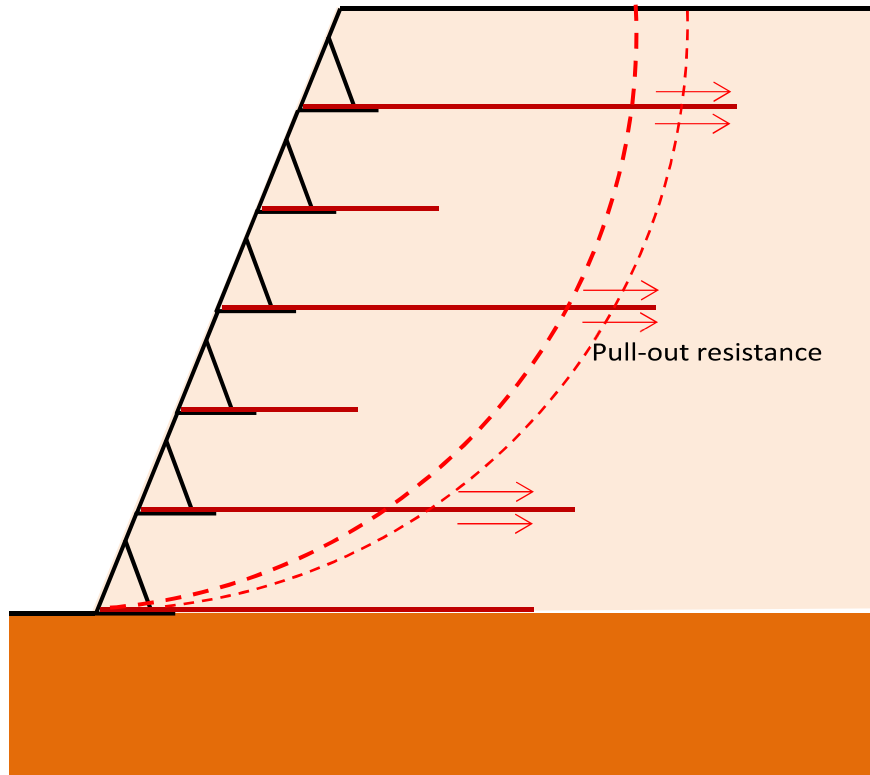


# Reinforced soil wall method with geogrid

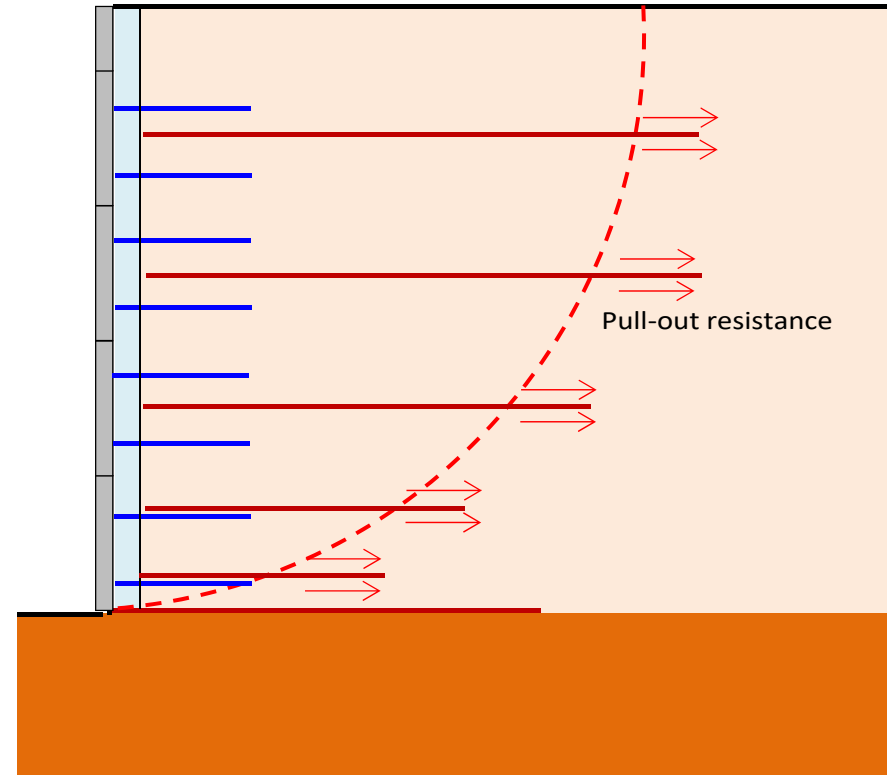
MAEDAKOSEN Co., Ltd.

## 1. Geogrid reinforced soil wall method

- Geogrid reinforced soil wall method is an earthwork structure that makes the embankment self-supporting and makes the wall surface vertically or steeply sloped due to the pull-out resistance of the embankment material and the geogrid by the frictional resistance.
- There are two types of geogrid reinforced soil walls of using a wall surface material with steel frame and concrete panels.

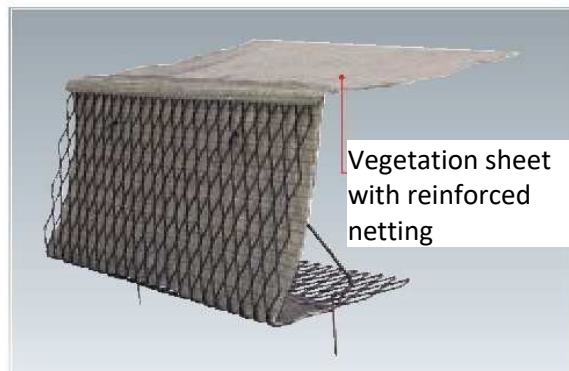
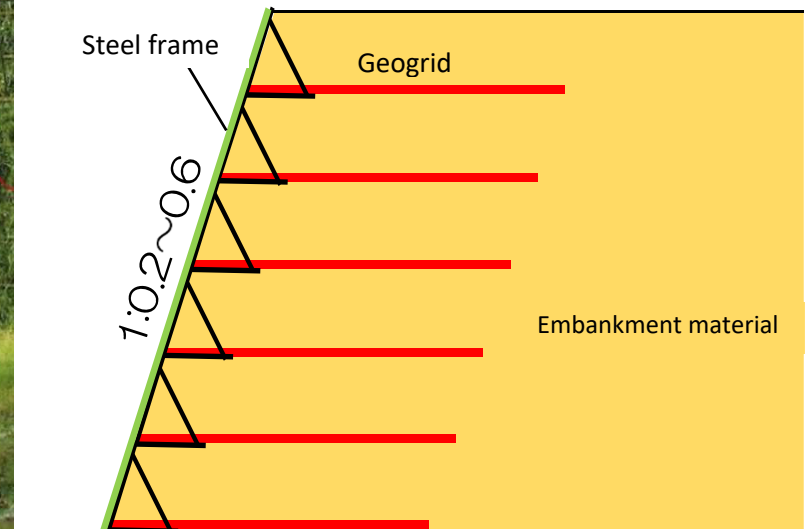


Reinforced soil wall using steel frames



Reinforced soil wall using concrete panels

◇ Structure of reinforced soil wall using steel frame



Steel frame (Wall surface material)



Geogrid



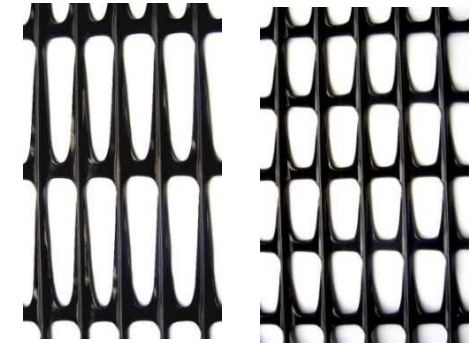
Embankment material



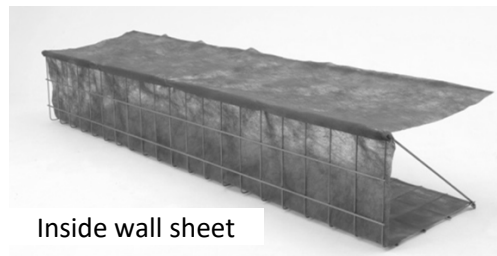
◇ Structure of reinforced soil wall using concrete panels



Concrete panel



Geogrid



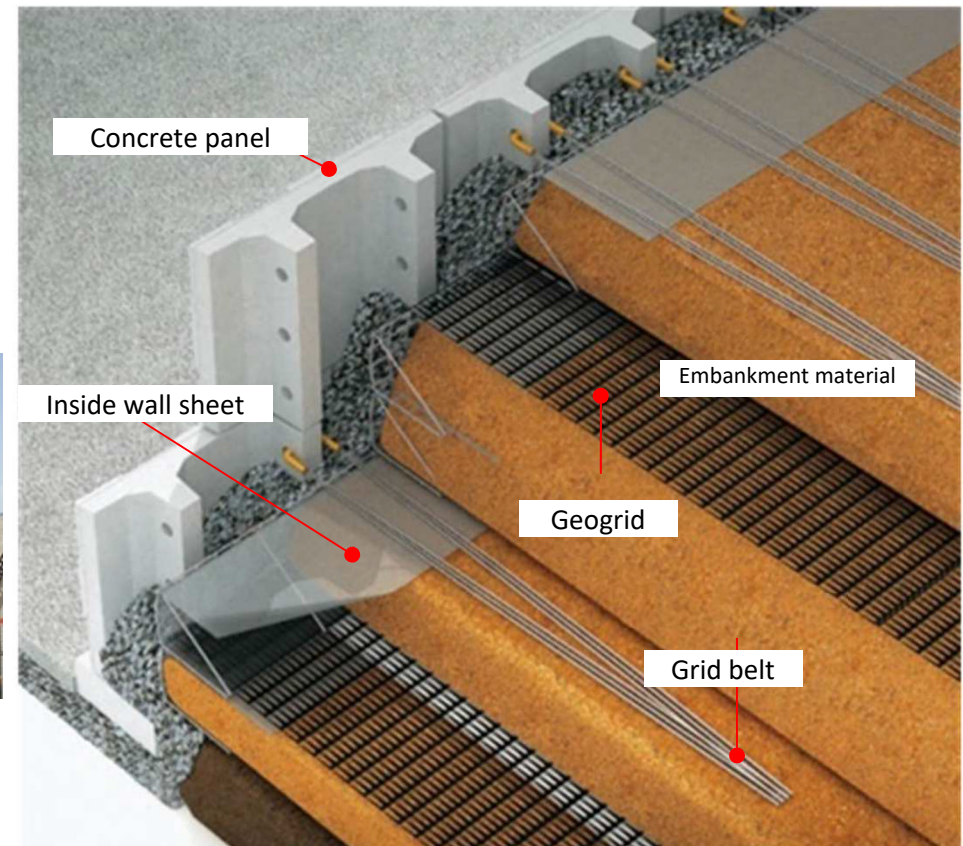
Inside wall sheet



Embankment material

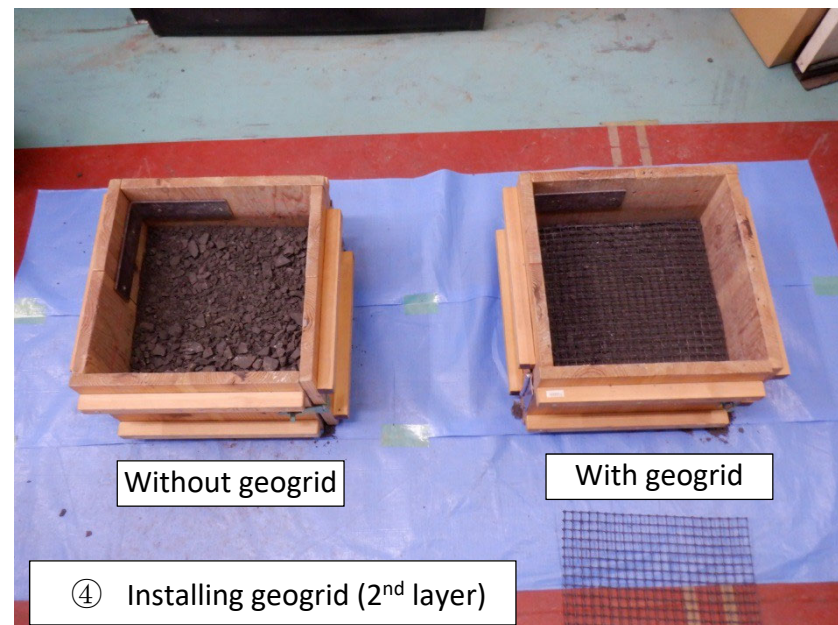
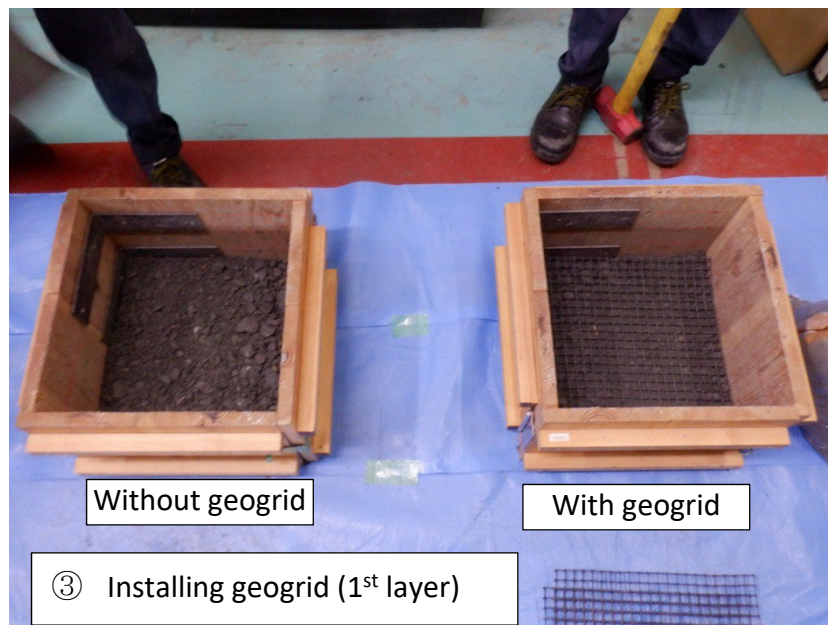
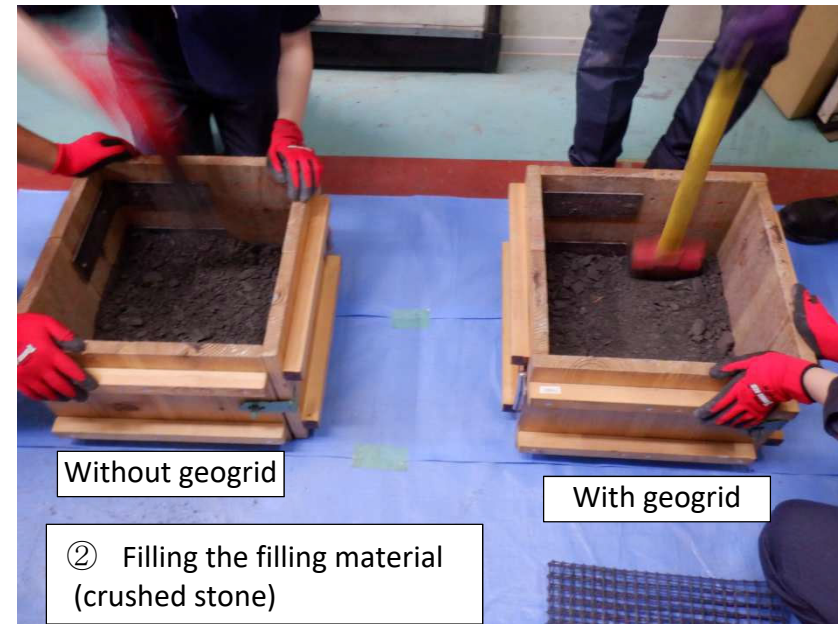
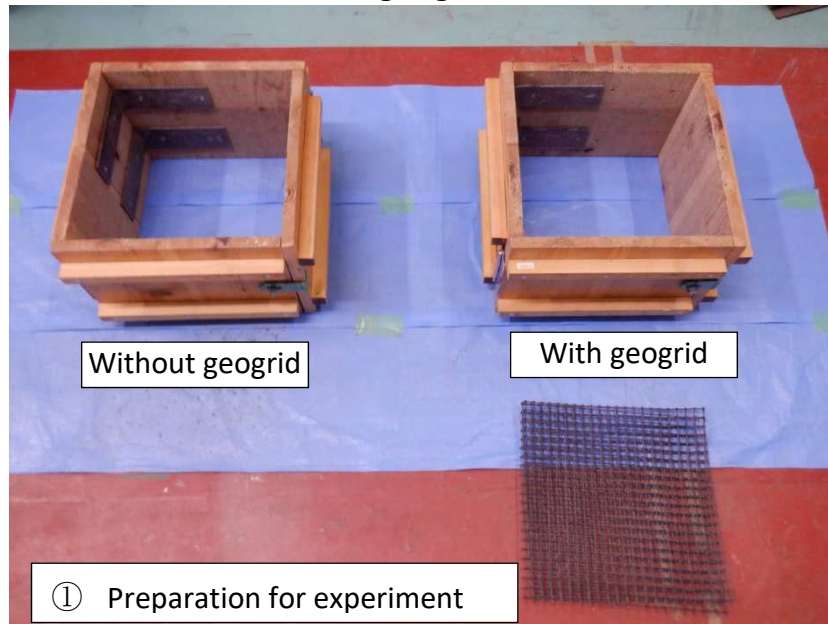


Grid belt



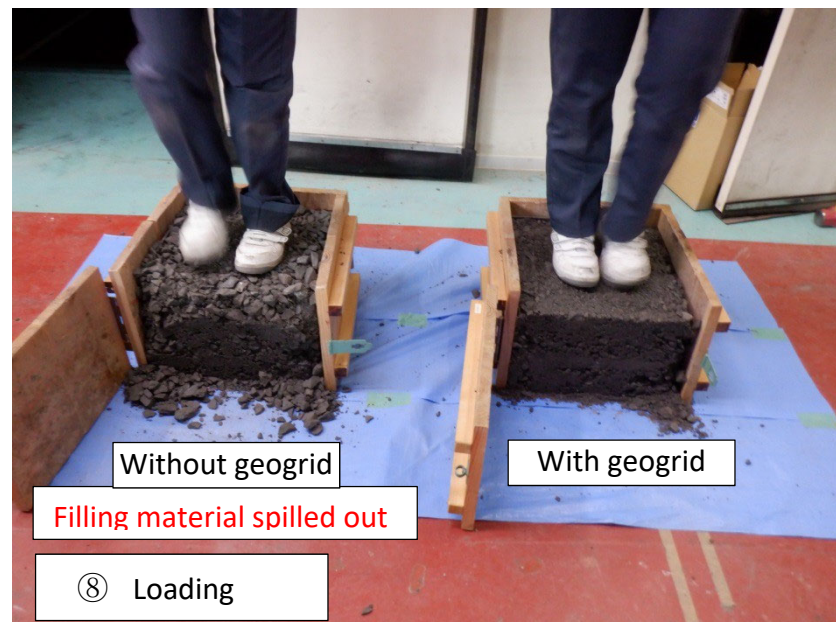
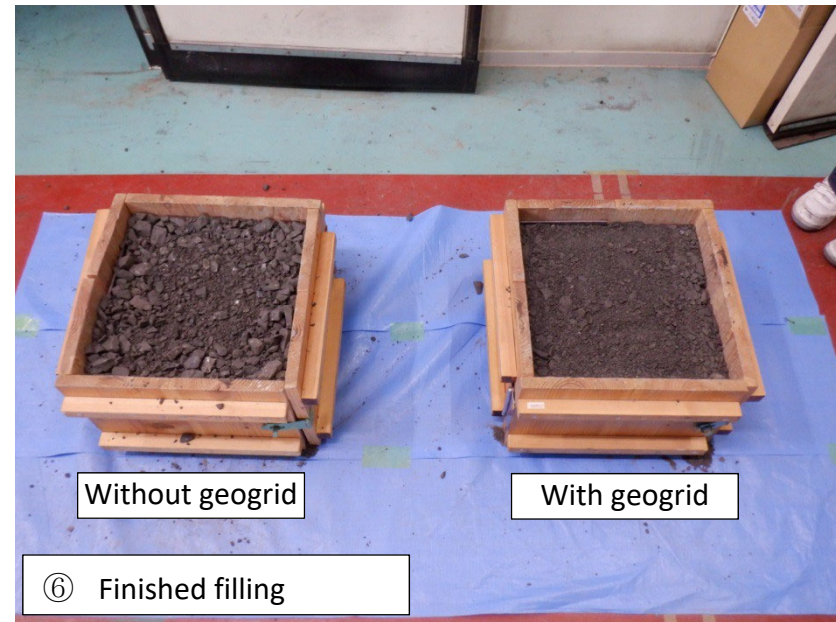
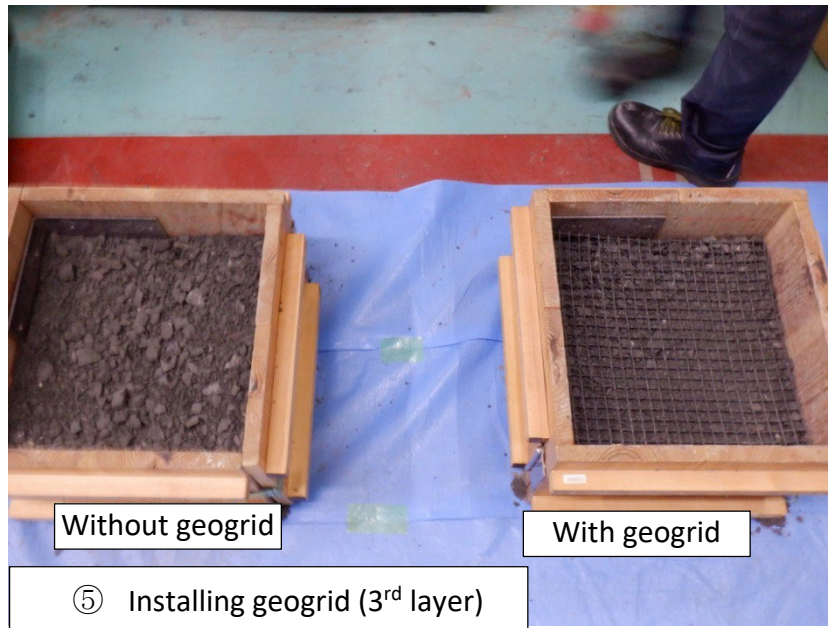


◇ Reinforced effect of a geogrid



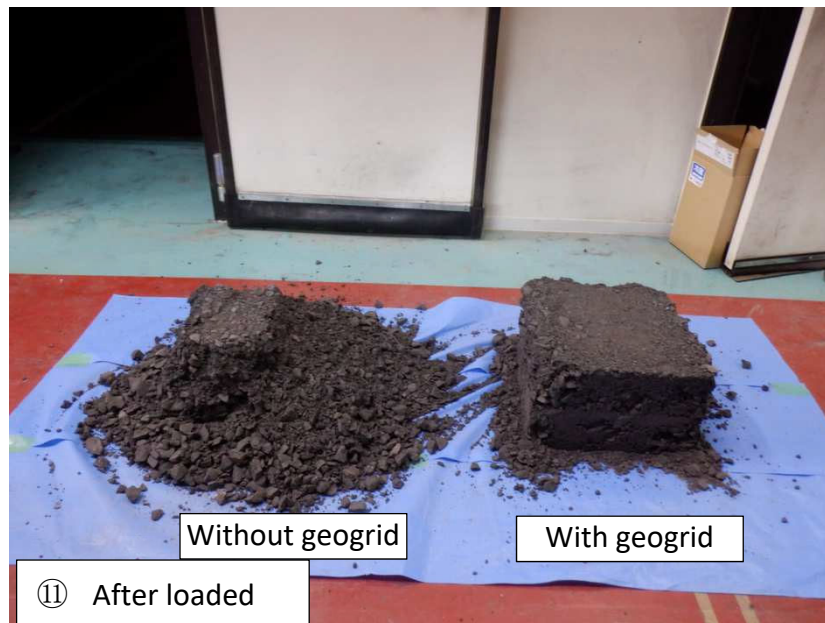


◇ Reinforced effect of a geogrid





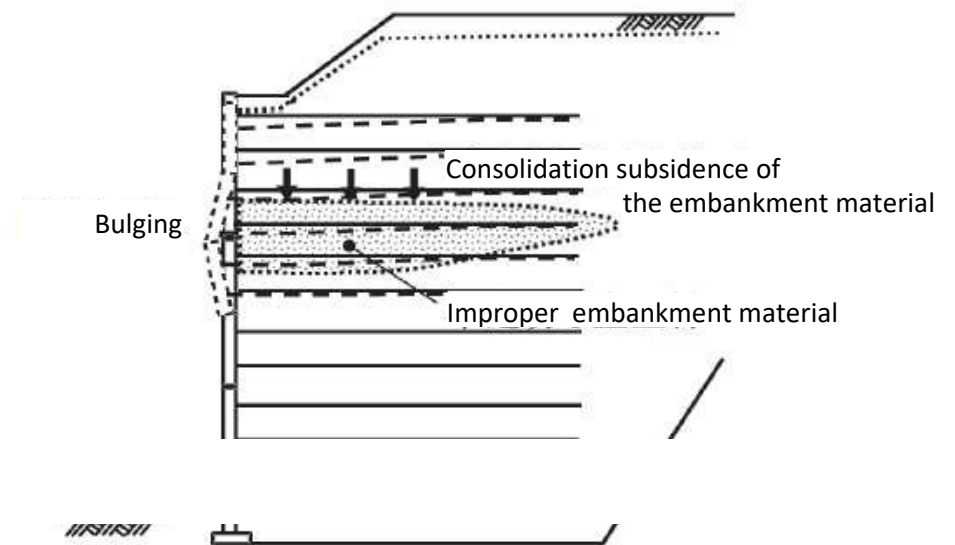
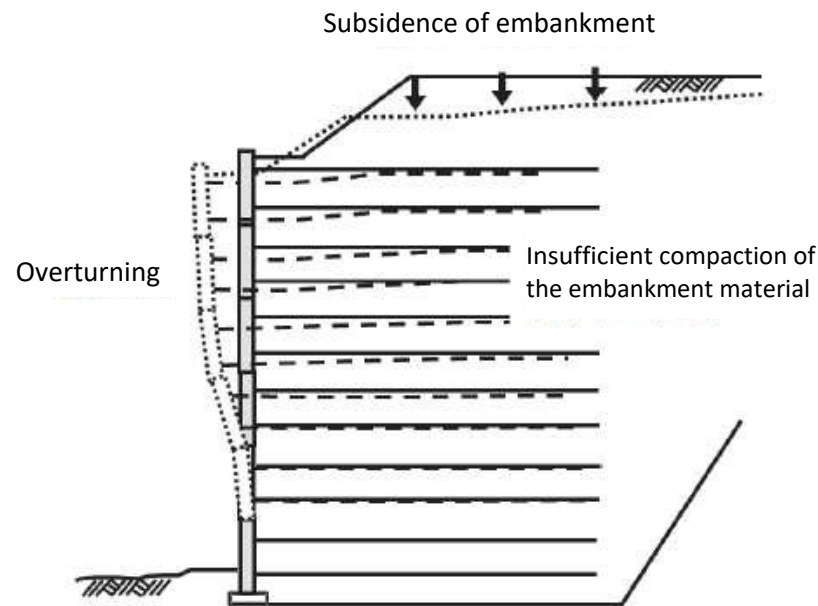
◇ Reinforced effect of a geogrid



- The specimen “Without geogrid” cannot stand on its own and collapses.
- The specimen “With geogrid” stands on its own even after loaded.
- Ground material sandwiched between geogrids is confined by geogrids.
- As a result, it shows that the structure with geogrid can maintain self-standing, and can construct a strong structure.

## 2. The stability of reinforced soil wall

- The stabilities of reinforced soil walls vary depending on the properties of the embankment material (soil type, compaction level). If the embankment material is defective or compaction is insufficient, **the wall may be bulged or the crest may sink.**



Overturning and subsidence of embankment caused by insufficient compaction

Bulging from wall surface caused by improper embankment material

(Cited Document Japan Road Association : Road earthworks retaining wall construction guideline (2012 edition))



◇ For example

- Have you ever made a mud dumpling when you were a child?

There should have been a difference in the hardness (strength) between the mud dumplings that were gripped with force and the mud dumplings that were made without effort.



Here, the act of "grasping with force" is similar to the act of compacting embankment materials carefully in earthwork. Therefore, if **compaction is loose** and reinforced soil wall is constructed, it becomes a weak structure, **increasing the risk of deformation**.

◎ The point where the amount of water contained in the soil makes solid mud dumplings!

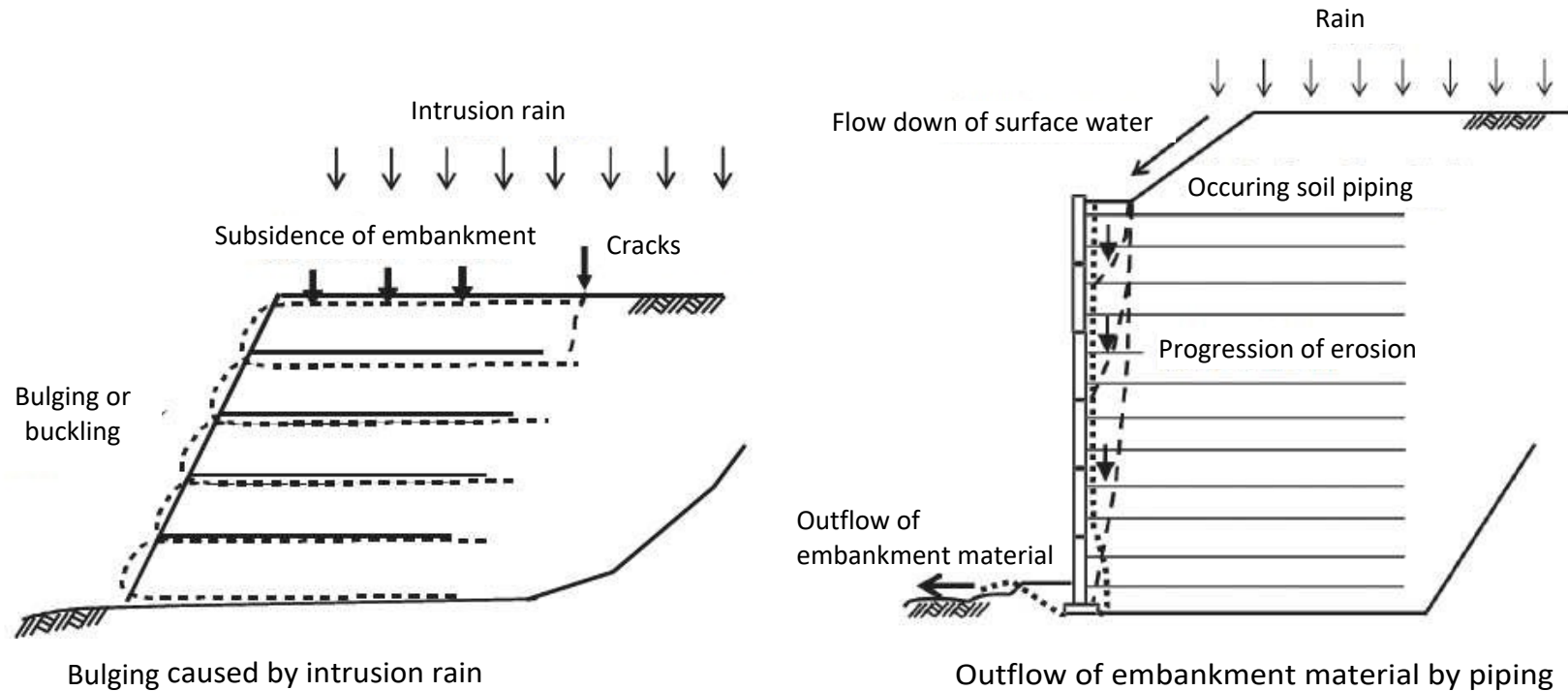
When the amount of water contained in muddy dumplings is small, hard muddy dumplings cannot be made even with hard effort. On the other hand, if there is too much water, the form of dumpling cannot be maintained. There is the amount of water that the mud dumpling can make the hardest.



Here, the amount of water that mud dumplings can make the hardest is the optimum water content ratio in earthworks.

### 3. The weakness of reinforced soil wall

- If water enters reinforced area, friction resistance from shear strength or geogrid of the filling material is reduced, which may cause deformation such as bulging of the wall surface. Also, if excessive water flows in and the embankment material turns outflow, reinforced soil wall may collapse.

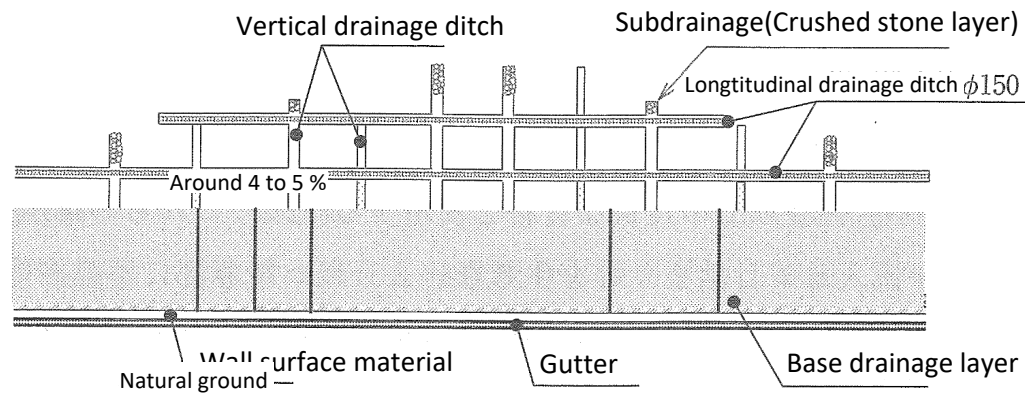


(Cited Document Japan Road Association : Road earthworks retaining wall construction guideline (2012 edition))

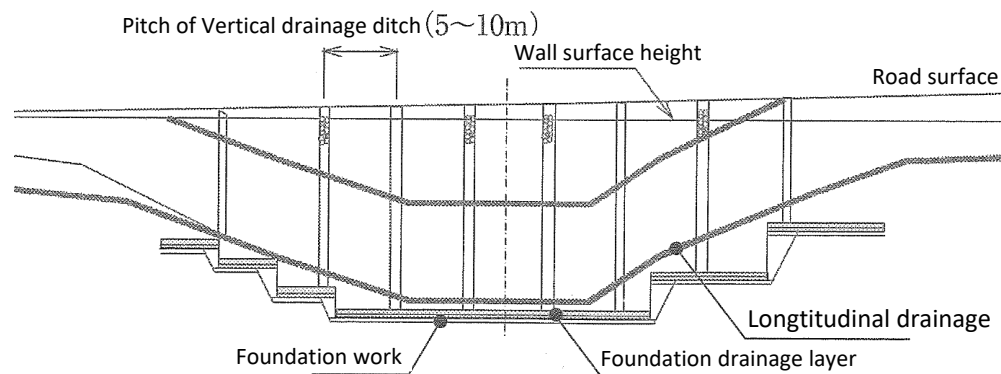


◇The example of drainage measure implementation e.g. (quoted from Road earthworks retaining wall)

Reliable drainage measure implementation is necessary to construct the enforced soil wall.

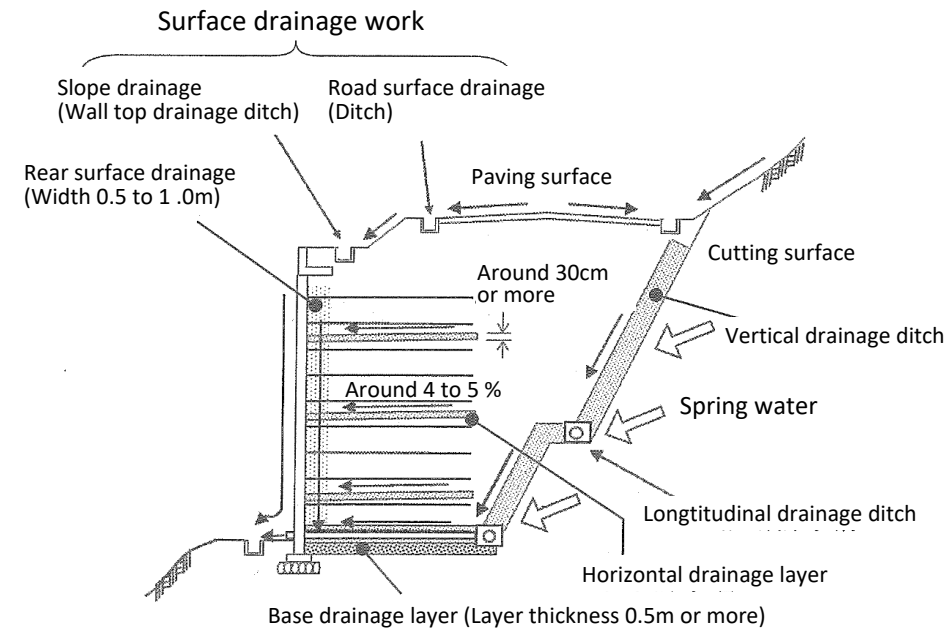


Plan view



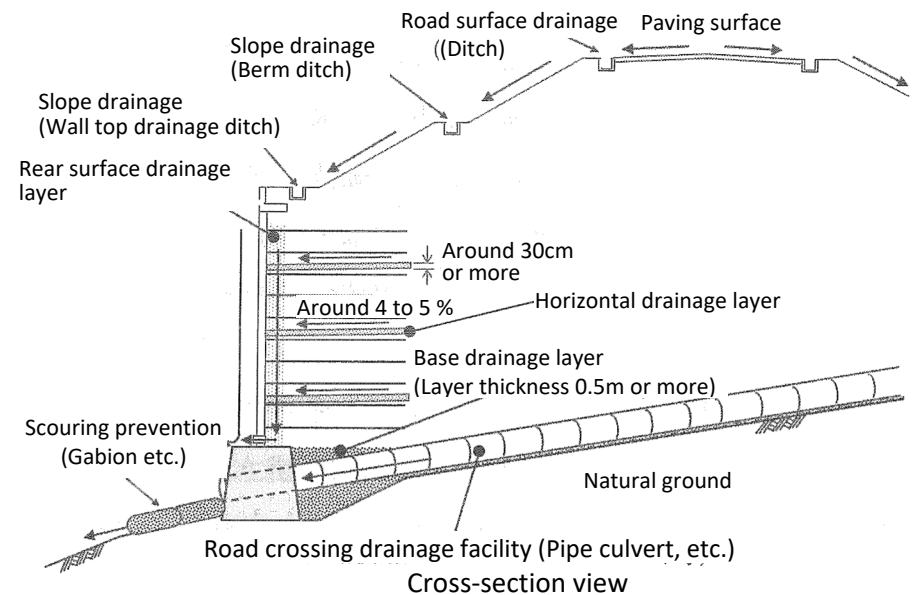
Front view

Example of arrangement of underground drainage work to be installed on the cut surface



Cross-section view

Example of drainage work on steep slopes due to cutting



Cross-section view

Example of drainage work in the valley

#### 4. Note when constructing reinforced soil wall

##### ① Soil of the embankment material

- Use coarse grained soil with a small amount of fine particles (Fine particle less than 50%)
- When fine-grained soil is unavoidably used
  - Implement sufficient drainage measure
  - Carefully compaction with a thin layer to reduce air gap
  - Use high-quality soil near walls where compaction is difficult

##### ② Compaction of embankment materials

- When the soil is compacted in a condition close to the optimum water content, the strength and rigidity of the compacted soil become large and the permeability becomes low.
  - The reinforced soil wall deforms small and the water is hardly intrude
- For this reason, when constructed reinforced soil wall, determine the compaction level of the embankment material to satisfy the requirements (95% or more in the lower part of compaction layer) and conducted to compact carefully.





#### 4. Note when constructing reinforced soil wall

##### ③ Drainage measure while constructing

- If spring water from the cut slope is found during the construction of the reinforced soil wall, install a subdrainage to prevent water from entering the reinforced area.
- If rain is expected during construction, conduct a countermeasure to prevent inflow of surface water.
- At the end of the drainage system, water should be guided to the outside of reinforced area so that water can be drained.



Sample drainage of cut and fill boundary area



Sample countermeasure against spring water

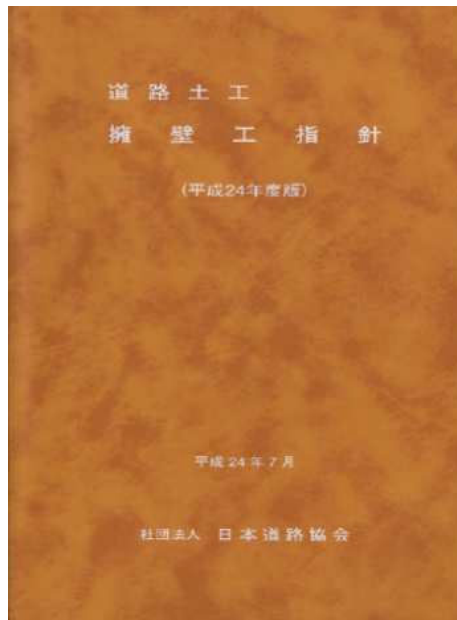


Sample countermeasure against rain



## 5. Details for notes

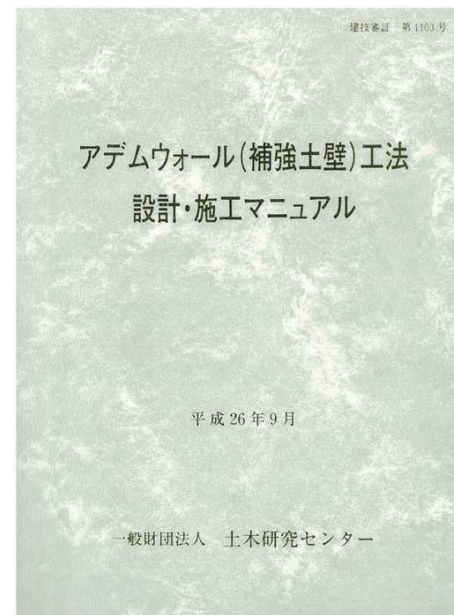
For detailed items to be noted when constructing reinforced soil walls, check **the guidelines, procedures, manuals**, etc. shown below.



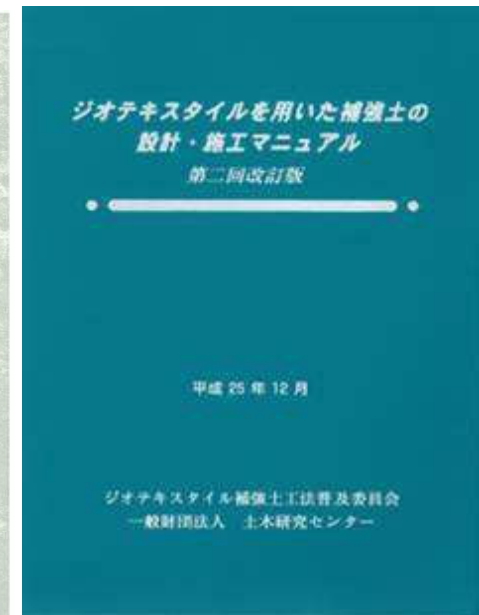
Road earthworks retaining wall construction guideline  
(Japan Road Association)



Design Procedure-Part II-Retaining Wall  
(NEXCO East)  
(NEXCO Central Japan)  
(NEXCO West)



ADEAM Wall (Reinforced soil wall) method  
Design and Construction Manual  
(Public Works Research Center)



Design and Construction Manual of reinforced soil using geotextiles  
(Public Works Research Center)



## 6. Summary

- Since reinforced soil wall is an earthwork structure, the stability of reinforced soil wall depends on the soil and compaction of the embankment material. For this reason, the following must be considered when constructed reinforced soil wall .
  - Use coarse grained soil with a **small amount of fine particles**, for the embankment material.
  - Determin the compaction level of the embankment material to satisfy the requirements (95% or more in the lower part of compaction layer) and **conducted to compact carefully**.
  - **Drainage measure at natural ground, cut and fill boundaries, and during construction shall be conducted sufficiently.**