

Example of Gabion Calculation in *FLAC3D* 7.00

Problem Statement

Gabions are an often-used tool in the fields of road construction, hydraulic engineering, and landscape architecture as embankments or walls to serve as slope stabilization, retaining walls, temporary flood walls or noise barriers. The optimization of gabions concerning the size of bulk material, bulk density, and material and shape of the surrounding wire can help optimize load distribution and life expectancy of the gabions.

The simulation was performed with *FLAC3D* version 7.00.100.



Figure 1: Gabions as support for a multi-lane roadway, Sveti Rok, Croatia (from Wikipedia, <https://commons.wikimedia.org/wiki/File:SvetiRok.jpg>).

Numerical Model

The model consists of a gabion 2 m long, 0.4 m wide, and 1 m high. The material properties of the wire can be seen in Table 1.

Table 1: Material Properties of the Wire

Density [kg/m ³]	Bulk Modulus [Pa]	Shear Modulus [Pa]
7850	160e9	90e9

Six different rigid block models, created from STL files, are used to simulate a granular material with a simple linear contact model. The rigid blocks are rounded to reduce computational time. The contact model properties are shown in Table 2.

Table 2: Contact Properties of the Rigid Blocks

Normal Stiffness [Pa]	Shear Stiffness [Pa]	Friction Coefficient [-]	Normal Critical Damping Ratio [-]	Dashpot mode [-]
1e6	1e6	0.1	0.8	1

The calculations are done in large strain to allow for contact between rigid blocks and zones representing the wire.

The wire is filled in 10 individual fillings. The maximum number of rigid blocks is limited to 200 per filling and the size ranges from 0.0008 to 0.0015 m.

Figure 2 and Figure 3 illustrate the numerical model during the filling of the wire.

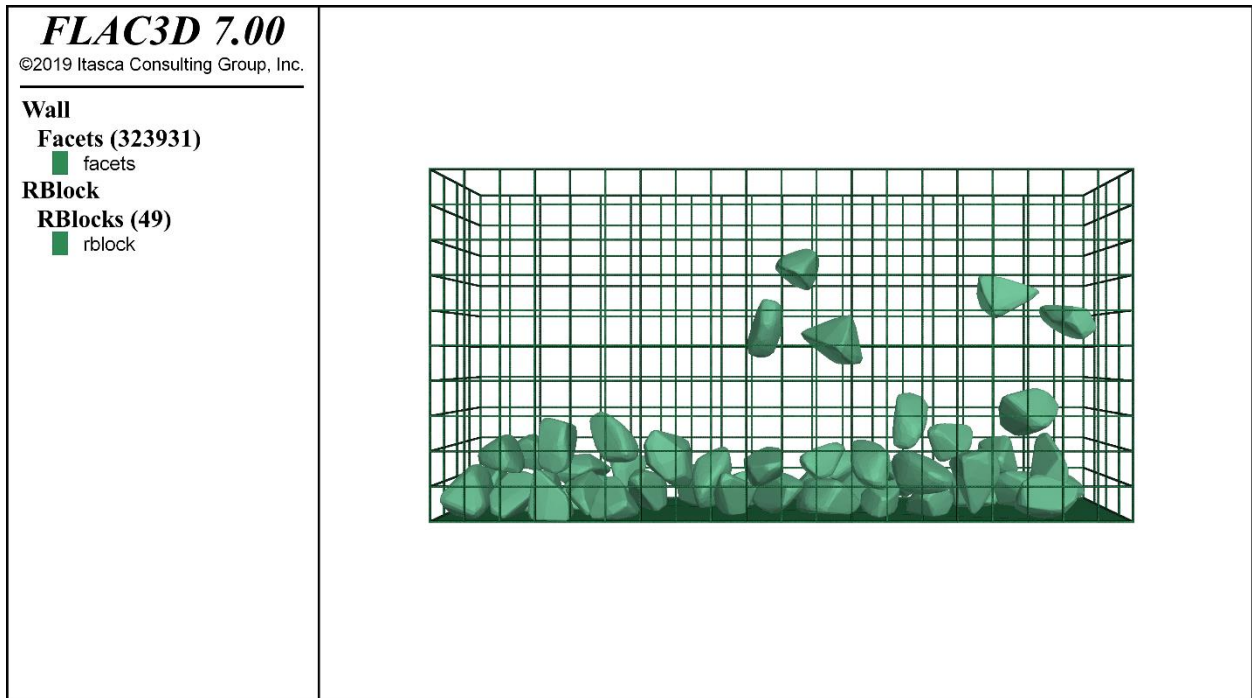


Figure 2: Filling of the gabion (Filling 1).

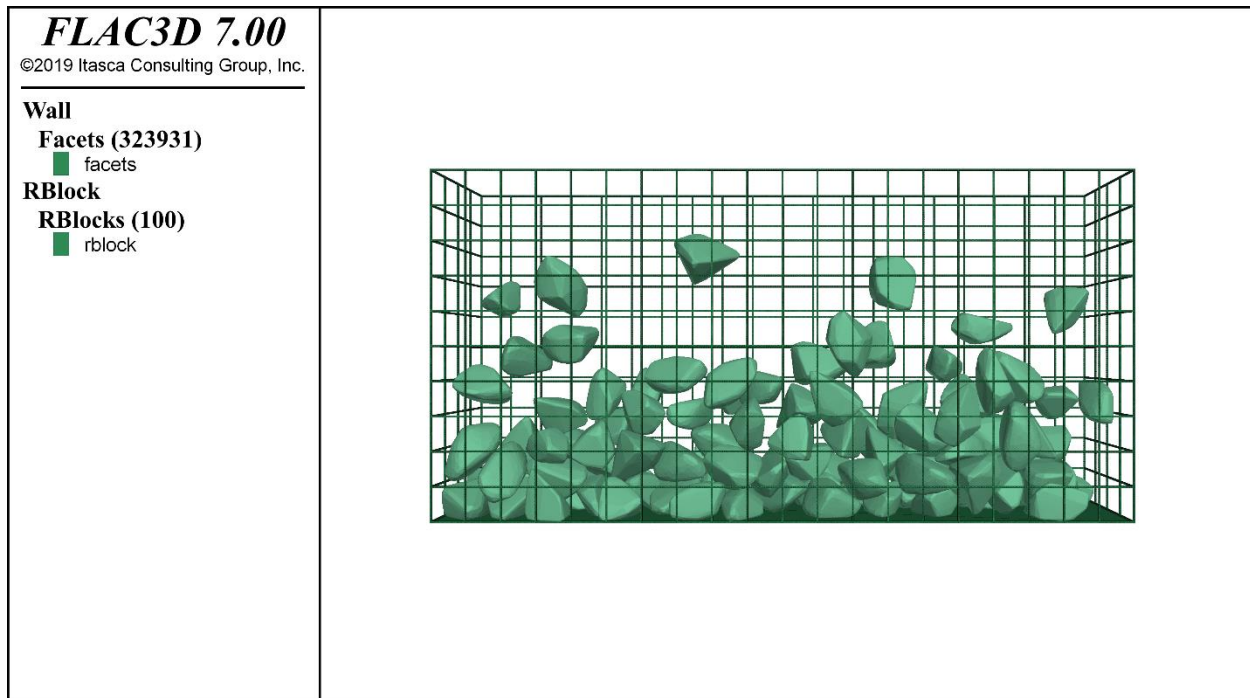


Figure 3: Filling of the gabion (Filling 2).

Simulation Results

Figure 4 depicts the displacements of the wire surrounding the granular material. Displacements of up to 1.32 mm can be observed in the lower part of the gabion.

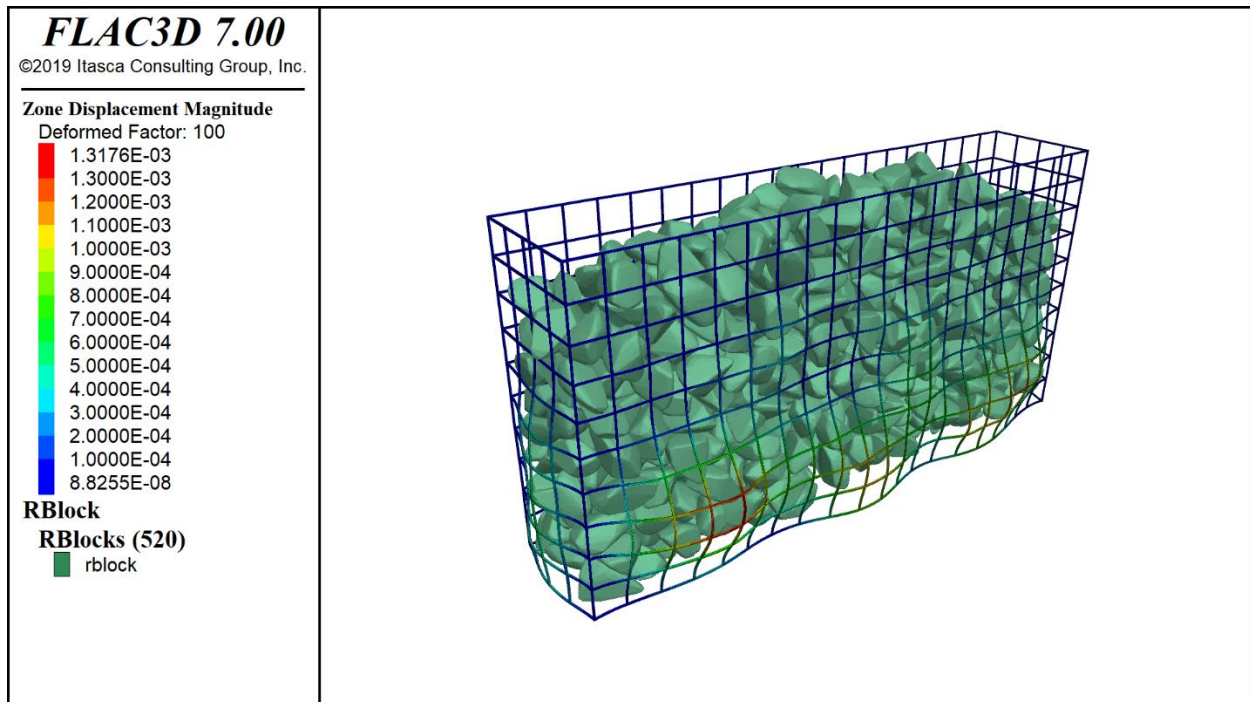


Figure 4: State of the gabion after 10 fillings.

FLAC3D Listing of Data Files

The example project contains the following input files:

- STL files
 - comp1.stl
 - comp2.stl
 - comp3.stl
 - comp4.stl
 - comp5.stl
 - comp6.stl
 - Gab_Bottom.stl
- GabMesh.f3grid
- Example-Gabion.dat
- Example-Gabion.prj