1 Comparison of Liner Force Conventions in RS^2 and RS^3

1.1 Problem Description

This problem involves comparing how moments and axial and shear forces are interpreted in RS^2 (Phase^2) and RS^3. This was done by creating two models in both RS^2 and RS^3: a model of a lined cylindrical tunnel excavation (model A) and a model of a lined surface excavation (model B). Although RS^2 analyzes the model in two dimensions, and RS^3 in three dimensions, the results of both models should be comparable.

In model A, when using RS^3, the Horizontal Mode was selected, while Vertical Mode was used for model B. The option can be found in Analysis → Project Settings → Orientation.

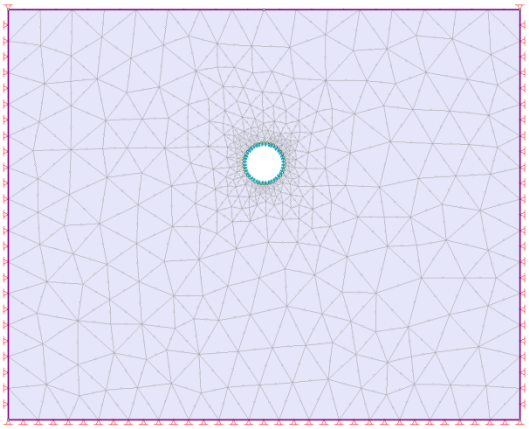

Figure 1-1: RS^2 model A of a cylindrical tunnel

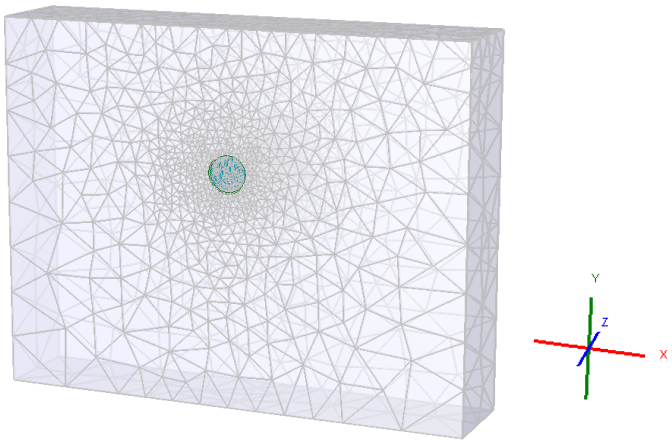

Figure 1-2: RS^3 model A of a cylindrical tunnel

Table 1-1: Model A parameters

Parameter	*Value*
Material type	Elastic
Young's modulus (E)	2e5 kPa
Poisson's ratio (v)	0.25
Hole radius (a)	2 m
Liner properties	
Material type	Elastic
Young's modulus (E)	2e8 kPa
Poisson's ratio (v)	0.2
Thickness	0.8 m

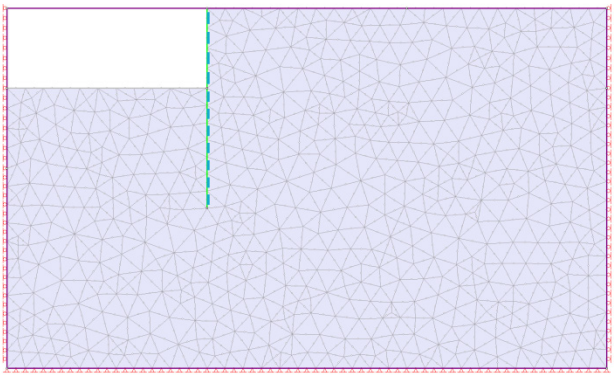

Figure 1-3: RS^2 model B of an excavation

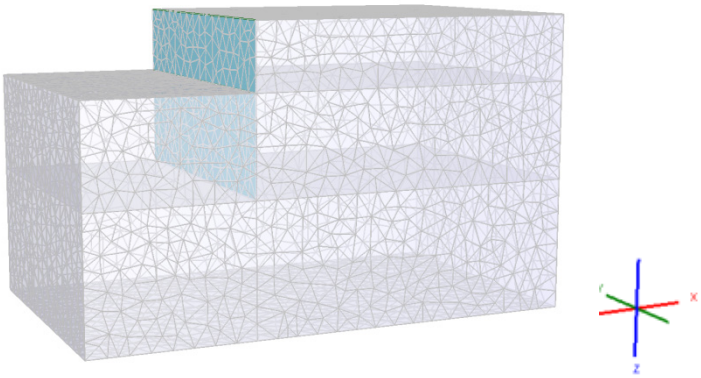

Figure 1-4: RS^3 model B of an excavation

Table 1-2: Model B parameters

Parameter	*Value*
Material type	Elastic
Young's modulus (E)	2e4 kPa
Poisson's ratio (v)	0.25
Liner properties	
Material type	Elastic
Young's modulus (E)	3e7 kPa
Poisson's ratio (v)	0.2
Thickness	0.2 m

1.2 Results

For model A, the axial force, bending moment, and shear force acting along the liner was calculated in RS^2. In RS^3, the axial force hoop, moment hoop, and shear force hoop was calculated.

Note that for the cylindrical excavation, the hoop data type, and not the longitudinal, is used.

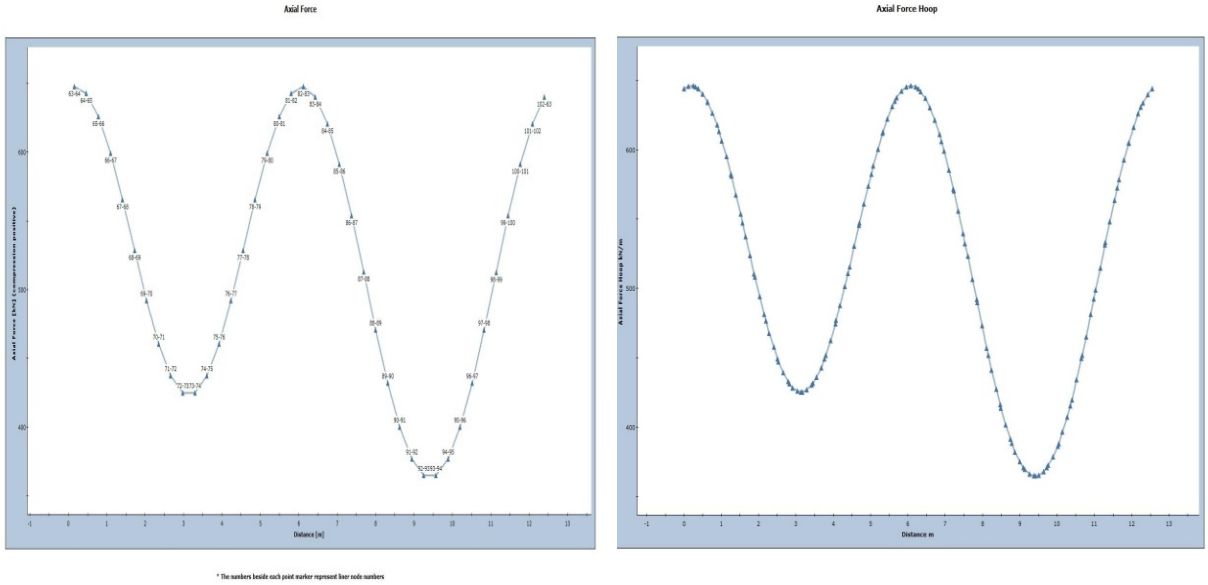

Figure 1-5: Model A axial force along liner in RS^2 (left) and RS^3

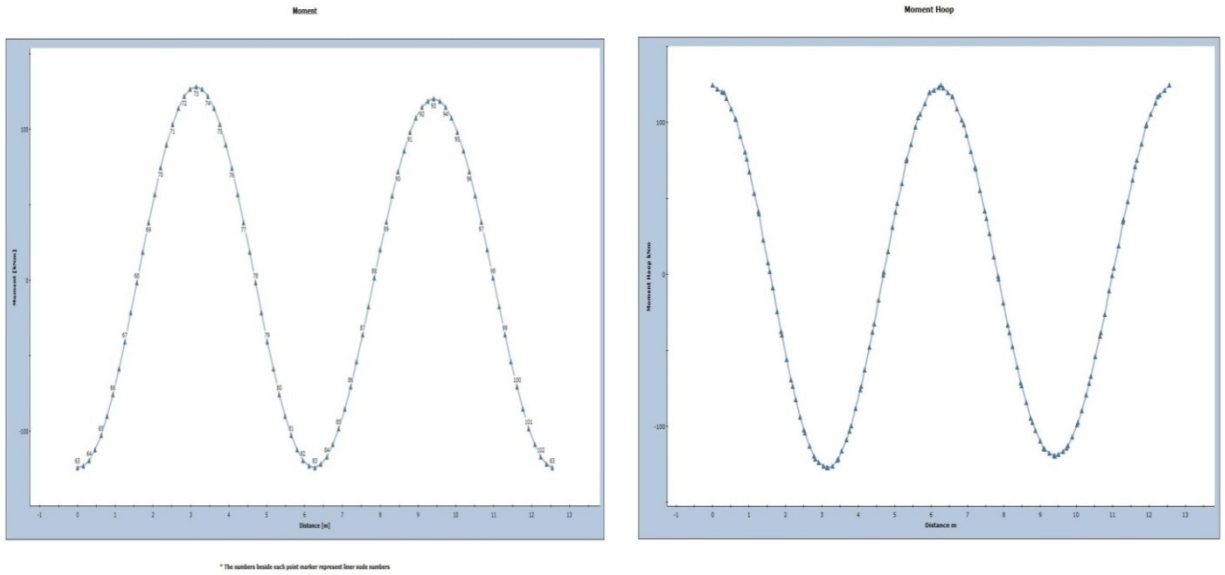

Figure 1-6: Model A moment along liner in RS^2 (left) and RS^3

Note that the sign convention is inverted between the two programs for the bending moment.

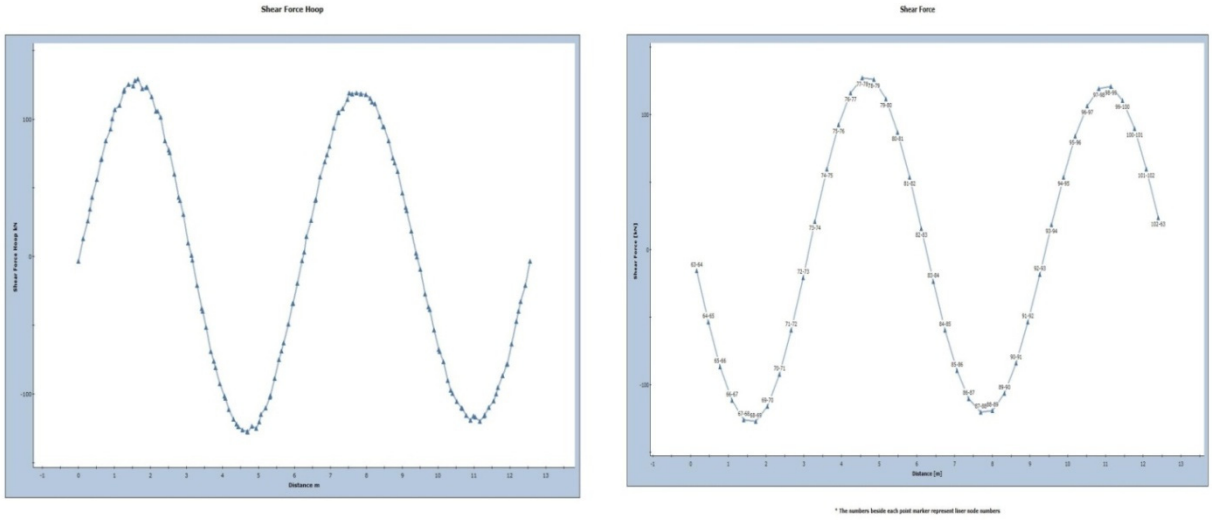

Figure 1-7: Model A shear force along liner in RS^2 (left) and RS^3

The sign convention for the shear force is also inverted between RS^2 and RS^3.

For model B, the axial force, bending moment, and shear force acting along the liner is calculated in RS^2. In RS^3, the axial force longitudinal, moment longitudinal, and shear force longitudinal is calculated. Note again that the sign convention is inverted between the two programs for the bending moment and shear force.

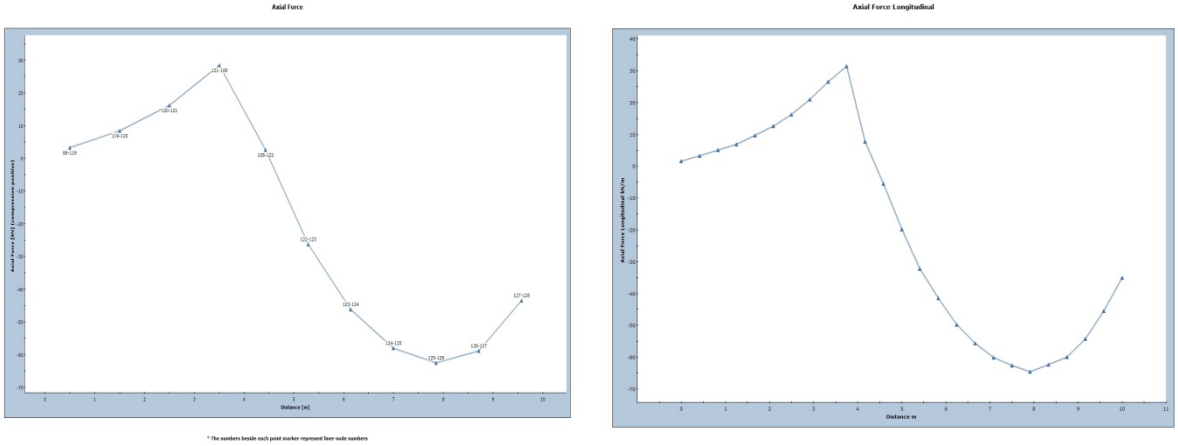

Figure 1-8: Model B axial force along liner in RS^2 (left) and RS^3

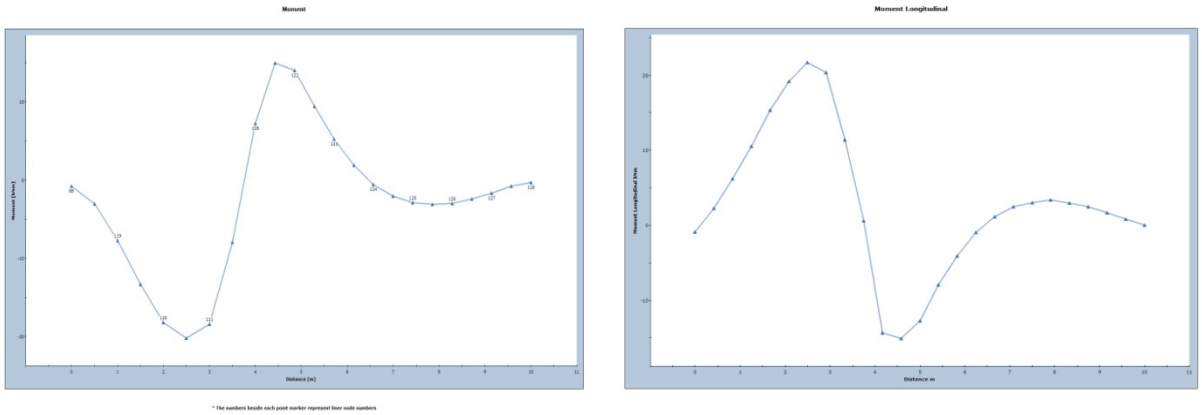

Figure 1-9: Model B moment along liner in RS^2 (left) and RS^3

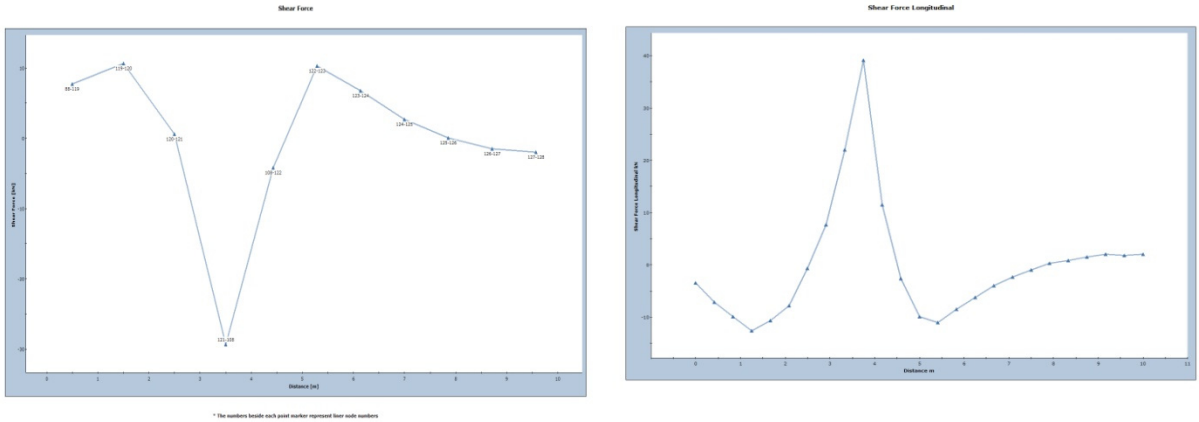

Figure 1-10: Model B shear force along liner in RS^2 (left) and RS^3