Newsletter

Issue 1 | Q4 2008

Editorial

Welcome to the first issue of the LimitState newsletter! With LimitState software now in use across the world, our newsletter is designed to keep users of LimitState:RING (our masonry arch analysis software) and LimitState:GEO (our geotechnical analysis software) abreast of new developments and also to offer practical advice on how to get the most out of the software. We also welcome contributions from users, either suggestions for topics or complete articles. Please feel free to get in touch via feedback@limitstate.com

*Matthew Gilbert, Managing Director, LimitState Ltd.*

News

LimitState:GEO 1.0e now available

LimitState:GEO version 1.0e includes a large number of enhancements and fixes designed to make life easier for users. Note that a new license has been provided which allows trial users to run the software even if they have trialled an earlier version.

Visit www.limitstate.com/download to download your copy.

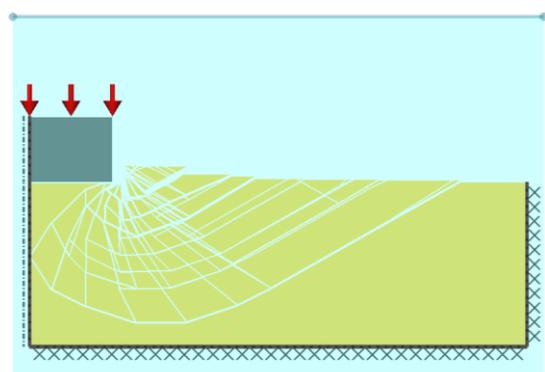### *LimitState:GEO - Verification test results now online*

We are often asked how we verify that results from LimitState:GEO are 'correct'. In fact, every time a change to the software is made, however small, hundreds of tests are automatically run on our servers to make sure that the answers generated remain exactly as expected. We have recently decided to provide public access to many of these tests via the LimitState website. Interested users should go to: www.limitstate.com/geo/verification to find details of the benchmark problems, the corresponding animated output from LimitState:GEO and also input files that can be downloaded. At the moment well over 100 tests are online (covering retaining wall, slope, foundation and other problems) and this number will increase over time. If you have experience of applying LimitState:GEO to problems not currently covered we would be delighted to hear from you, via feedback@limitstate.com.
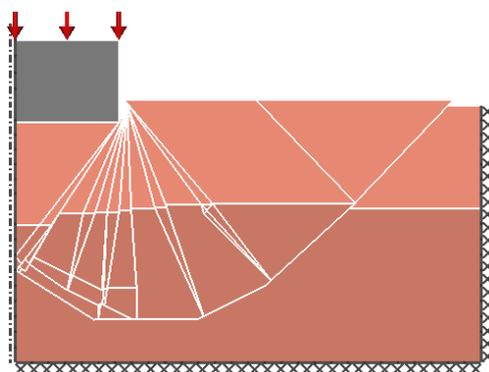
(a)　　　　(b)　　　　(c)

LimitState:GEO verification: (a) Undrained footing on layered soil, (b) Drained trapdoor problem & (c) Submerged, drained footing

Further FREE UK seminars announced

Following on from successful seminars held across the UK and Eire earlier this year, we are pleased to announce a further series of free ½ day seminars on 'Geotechnical Stability Analysis to Eurocode 7' and 'Masonry Arch Bridge Analysis' to be held in early 2009. Venues include Birmingham, Sheffield and Bristol. Full details will be available on the website shortly and interested parties are advised to register early as places are limited.

Visit www.limitstate.com/events to register to attend or find out more.

| Venue	Date	Morning	Afternoon
Birmingham	27/01/09	*Geotechnical stability analysis to Eurocode 7*	*Masonry arch bridge analysis*
Sheffield	29/01/09	-	*Masonry arch bridge analysis*
Bristol	03/02/09	*Geotechnical stability analysis to Eurocode 7*	*Masonry arch bridge analysis*

LimitState seminars Jan / Feb 2009

LimitState:GEO - Soil nails

When we launched LimitState:GEO earlier in 2008, some features were made available only to holders of 'beta' licenses whilst we finalised functionality and verified results. We are pleased to announce that soil nails can now be used by holders of 'full' licenses (in LimitState:GEO 1.0e).

In LimitState:GEO 1.1, due for public release in January 2009, this functionality will be further enhanced (e.g. allowing reporting of the detailed distribution of forces along nails). Also the ability to model rotations at the edges of solid objects will also be made available to holders of 'full' licenses, opening up many new analysis possibilities - further details will be provided in the next newsletter.
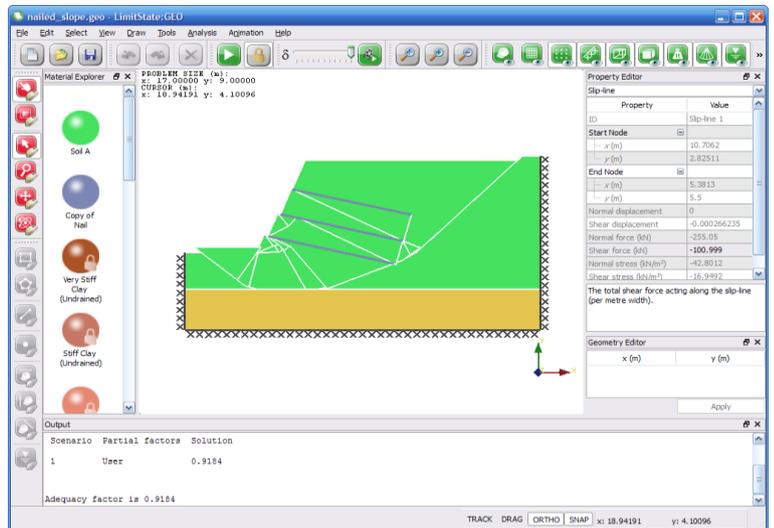
**LimitState:GEO output: nailed slope**

LimitState:RING - French, German, Spanish & Arabic interfaces

International users of LimitState:RING will be pleased to learn that the software has now been translated into **French** and **Spanish**. Additionally 'beta' **German** and **Arabic** language interfaces are also available.

Users can switch language in LimitState:RING version 2.0j (or later) by selecting:

```
Tools > Preferences > Language
```

These new additions come as part of our aim to make LimitState software as accessible as possible for engineers across the globe. If you would like to see the software interface available in other languages, please let us know, via feedback@limitstate.com.
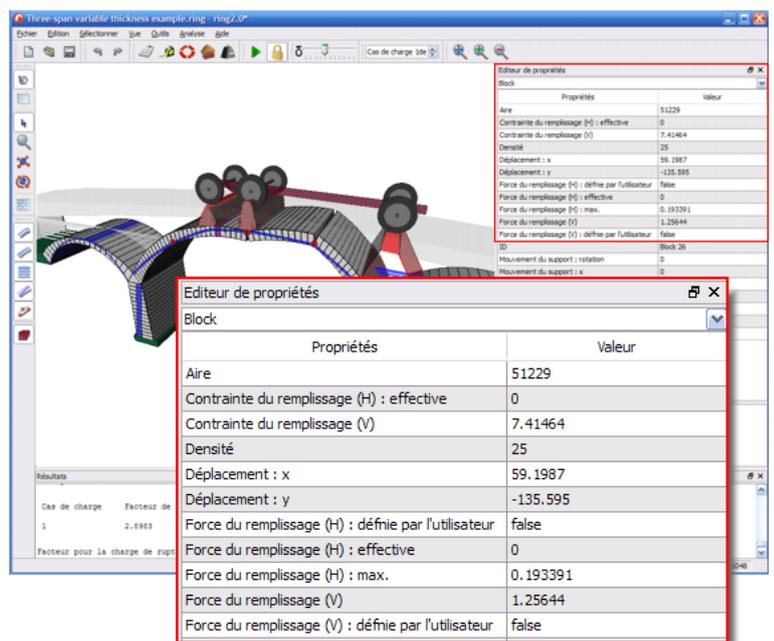
LimitState:RING French interface

LimitState:GEO Application Notes

Applying LimitState:GEO to slopes

In conventional slope analysis software a global factor of safety is applied to the soil shear strength parameters. However, with the default slope model generated by the LimitState:GEO slope wizard, the adequacy factor is applied to the self weight of the soil itself, which raises some interesting theoretical issues that have repercussions on what you will see in the software:

In a purely frictional soil, geotechnical theory tells us that the slope is:

- stable for any friction angle greater than, or equal to, the slope angle and
- unstable for any friction angle less than the slope angle.

Collapse is therefore entirely independent of the self weight of the soil (crudely speaking, as the self weight of the material goes up, the normal stresses go up, but frictional stresses also go up in exact proportion).

For the above reasons, in a slope that is shallower than the angle of friction, factoring up the self weight on a frictional soil will not cause collapse and LimitState:GEO will return a `*locked*` result. Conversely, if the slope is steeper than the angle of friction then it will be found to be `*unstable*` under its own self weight.

To find the point of transition between these two states, a series of scenarios should be set up (using the LimitState:GEO scenario manager) each with a progressively increased partial factor on $\tan\phi$. Solving will indicate at what point the problem changes from being `*locked*` to being `*unstable*`. To visualise the failure mechanism, simply repeat the process with a very small cohesion (say 0.01 kN/m^2) so that the mechanism becomes visible when the partial factor on $\tan\phi$ is sufficiently high.

In a purely cohesive soil, for certain slope geometries, the failure surface will always touch the edge of the domain. This may seem counter-intuitive but is entirely in accordance with 'infinite slope' theory. Therefore, changing the distance to the outer boundary of the problem (whether in the wizard or by dragging a boundary in the viewer) will change the adequacy factor and accompanying failure mechanism.
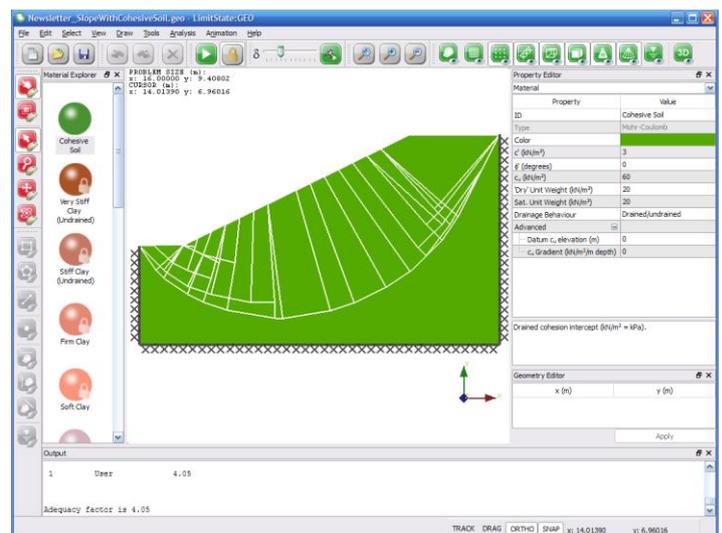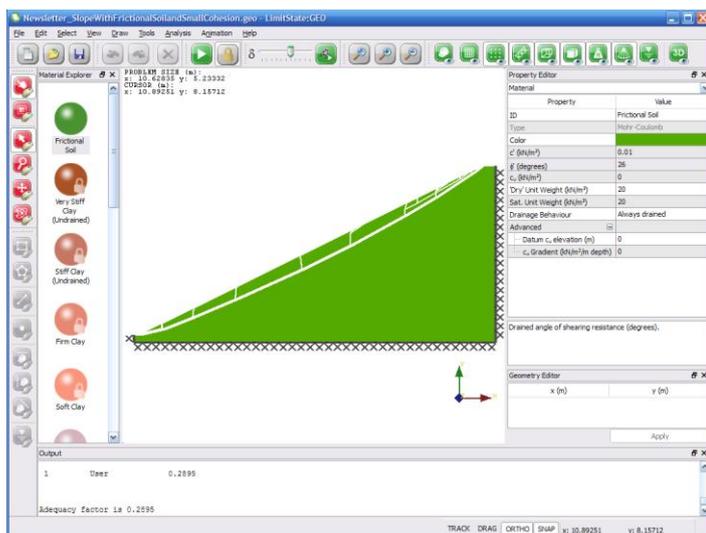
A drained analysis of a purely frictional slope (adding a small cohesion highlights the failure mechanism) and an undrained analysis of a purely cohesive slope (failure mechanism always touches the edge of the domain)

Spotlight on material drainage behaviour

In LimitState:GEO the user does not have to separately define two materials of ostensibly the same type – i.e. one that has drained properties and one that has undrained properties. Instead, a single material can be defined that can act either in a drained or undrained manner depending upon how the drainage behaviour is set (see table right).

When choosing the drainage behaviour, the user should bear in mind that a granular material such as sand is likely to drain extremely quickly and could therefore be regarded as having 'Always drained' properties, no matter which type of analysis is undertaken. On the other hand, the shear strength of a solid rock (modelled as a Mohr Coulomb material) will be largely independent of the water conditions and could be regarded as acting in an 'Always undrained' manner for both long and short-term analyses. Other materials may behave 'normally' in that they remain undrained in the short term, but drained in the long term. Ultimately, the choice of drainage behaviour is a matter of engineering judgement and LimitState:GEO allows the user the option to modify the drainage behaviour of a material as they wish.

By default the analysis mode is set to 'short-term', though this can be changed to 'long-term', either in the Scenario Manager (accessed via the Analysis menu) or, from LimitState:GEO 1.0e onwards, also in the Property Editor when the Project is selected.

As this more unified approach to modelling materials will be unfamiliar to users migrating from traditional software packages, in LimitState:GEO version 1.0e we have taken steps to ease the transition, for example ensuring that in the 'Create New Material' dialog users can clearly see which material strength properties will be used in 'short term' and 'long term' analyses (see figure on the right). Version 1.1 will see similar enhancements being made in the Wizards and Property Editor.

Material Drainage Behaviour	Strength Properties to be Used	
	Long Term Analysis	Short Term Analysis
Always drained	Drained	Drained
Drained / undrained	Drained	Undrained
Always undrained	Undrained	Undrained

LimitState:GEO material drainage behaviour for long and short term analyses
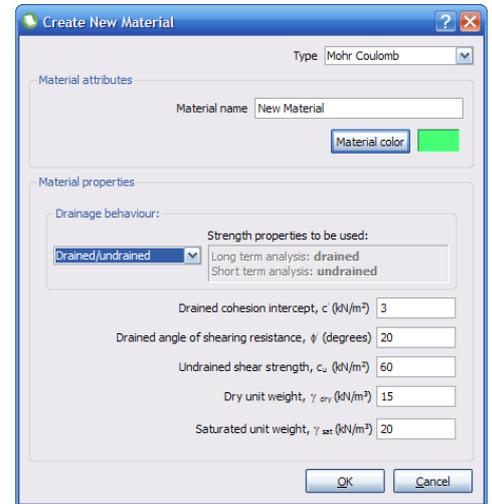
LimitState:GEO 'Create New Material' dialog showing which properties will be used in long and short term analyses

LimitState:RING Application Notes

Including reinforcement in LimitState:RING

Since LimitState:RING 2.0 was launched in 2007, many users have enquired whether it is possible to include reinforcement in the software. Although caution needs to be exercised before introducing reinforcement in a masonry arch, principally because of the danger of precipitating brittle modes of failure, a test version of LimitState:RING (version 2.1 beta) has now been developed which allows reinforcement to be modelled. Licensed users who wish to try out this new functionality should contact early-adopters@limitstate.com.

Recent Media Coverage

LimitState:RING - The Structural Engineer (July 2008)

Visit http://www.masonryarch.com/news to download the pdf article.

LimitState:GEO - Ground Engineering (September 2008)

Visit http://www.limitstate.com/news to download the pdf article.