Introduction by John Dunnicliff, Editor

This is the seventy-ninth episode of GIN. One article this time.

The first GIN was in the September 1994 issue of this magazine. If you're wondering why this isn't the 81st episode, keep wondering (I don't know!). In that first GIN, when my introduction was called a 'column', I wrote:

> *This is the first episode of what may become an ongoing saga in Geotechnical News. Its purpose is to share useful information relating to geotechnical instrumentation. Each part will be brief, and I intend to focus on performance of instruments. As a practitioner, I know how difficult it is to be confident that such-and-such an instrument will work well, and it seems to me that if we share performance information with each other, we will make this less difficult.*
>
> *This is therefore not "my column", but "our column" … Whether or not this idea stays alive will depend on you (as Stephen King says: "constant reader") than me.*

Poppi street party.

The content has broadened from the originally intended focus on performance of instruments, and I have no problem with that. But what I DO have a problem with is my regular need to ask, as I did yet again in the previous GIN, **"Is anybody there?"** and **"Do you want GIN to continue?"** If you DO want it to continue, I need articles from **YOU**.

Resolving unexpected monitoring results

The article by Glenn Tofani is just the kind of contribution that I like to have in GIN—clear and useful to others. It presents two case histories with unexpected monitoring results. The focus is on the importance of developing an analytical model, or an understanding of the underlying processes, in order to understand the monitoring data.

International Course on Geotechnical and Structural Monitoring in Italy

Our first international course in Tuscany, Italy in the 10th century Poppi castle is now history. The course attracted some 100 participants from 27 countries with 18 different languages. In general it seems to have been a success, but of course we'll make some changes to improve the next one in June 2105. We intend that this will become an annual event.

My primary memories of the course are:

- The outstanding organization by my Italian colleagues (far better than any other courses that I've been involved in).
- The beauty, culture and warm hospitality of Tuscany.
- The close interactions among us all. The town of Poppi was so small that at the end of every day we sat together at the outdoor bar alongside the castle (recommended wine: Prosecco), and in the same restaurants and, most memorably,

- The unforgettable street party, for which the main street of the little town was blocked for us! See the photo.

You may note that none of these four memories is about technical content – but I was happy with that too! I hope to meet some of you in June next year. For more information, see *www.geotechnicalmonitoring.com*.

Presentation style for technical lectures

For many years I've been trying to find a model of the best style for presenting technical lectures. Eureka, on youtube! ---

- Search for "entabulator by erik fraz".
- Search for "the brain as explained by john cleese".

So now we have our models. Yes, they're funny, but have you had to sit through lectures that are as gobbledy-gooky as these? I have.

Closure

Please send an abstract of an article for GIN to *john@dunnicliff.eclipse.co.uk* —see the guidelines on *www.geotechnicalnews.com/instrumentation_news.php*

Fee sihetak! (Egypt)

Resolving unexpected monitoring results - Two case histories

Glenn Tofani

An important aspect of most monitoring programs is the development of an analytical model, or an understanding of the underlying processes, that produce the responses that were recorded. Monitoring programs occasionally yield results that are either unexpected or not easily explained by conventional models. This article presents short summaries of two projects where unexpected monitoring results were obtained. These summaries describe the type of monitoring that was performed, how the data that were collected differed from the expected results, and how those discrepancies were ultimately resolved. The type of instrumentation associated with these case histories includes inclinometers and piezometers.

Upslope inclinometer offsets at Big Rock Mesa Landslide

The first case history involves a large (200+ acre) landslide in Malibu, California referred to as the Big Rock Mesa Landslide (see Figure 1). The landslide activated in 1983 after an extended period of heavy rainfall. The basal rupture surface of the landslide was up to approximately 250 feet deep with a series of apparent secondary failures along the steep coastal bluff. The general orientation of the basal rupture surface was defined using a series of inclinometers. A simplified cross section through the landslide is provided as Figure 2. One of the inclinometers was installed along the top of the coastal bluff. That inclinometer indicated progressive shearing in an upslope direction with no offsets in the apparent direction of landslide movement. This data initially confounded a number of investigators and it was speculated that either the orientation of the inclinometer axes had been recorded incorrectly or the inclinometer casing was twisted or rotated above the depth at which the movement was occurring. Both of these potential explanations were evaluated and disproved. A finite element model of the landslide was developed to evaluate stresses and deformation patterns within the mass (see Figure 3). This model indicated the abrupt upward curvature of the basal rupture surface which occurred along a fault that extended along the shoreline would indeed induce a stress pattern consistent with the reverse shearing observed in the inclinometer. To further evaluate the results predicted by the computer model, a 1:50 scale physical model of the landslide was created (Figure 4). The physical model consisted of a ¼“ thick piece of aluminum plate that was bent to match the shape of the basal rupture surface. The upper surface of the aluminum plate was then covered with a thin layer of wax. Fine, moist sand was then placed on the aluminum plate and molded to conform to the topography of the landslide. A small amount of powdered bentonite was mixed with the sand to provide a scaled level of apparent cohesion consistent with the formational materials that comprised the landslide. The simulated landslide failure surface was then slowly heated using a series of thermal strips attached to the bottom

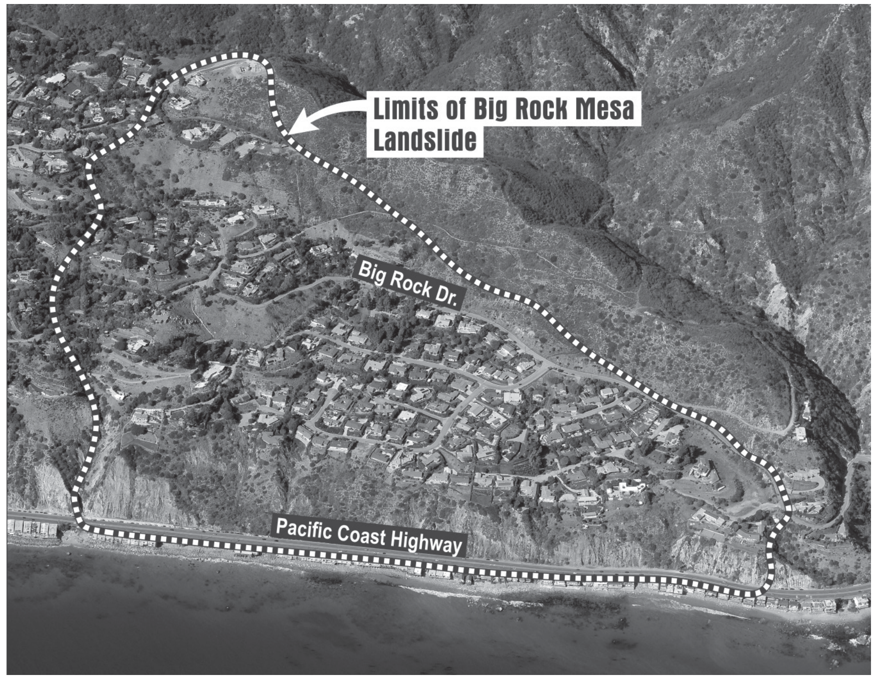

Figure 1. Big Rock Mesa Landslide – Malibu, California.

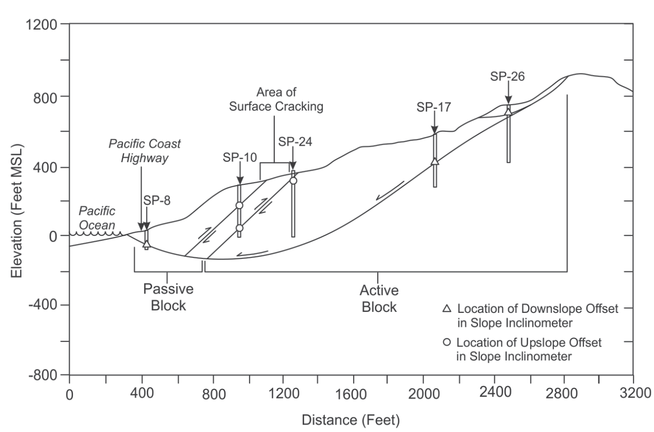

Figure 2. Cross section through Big Rock Mesa Landslide.

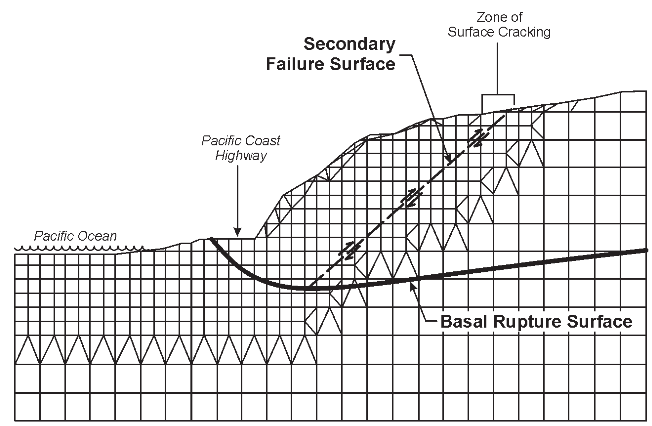

Figure 3. Portion of landslide finite element model.

of the aluminum plate. As the plate was heated, the wax softened, and the simulated landslide displaced along the failure surface. A grid pattern was painted on both sides of the model to allow any internal deformation to be more easily identified. As the landslide moved along the failure surface, a well defined zone of reverse shearing developed through the bluff consistent with the inclinometer results. The combination of the finite element and the physical models confirmed the validity of the inclinometer results and the interpreted configuration of the basal rupture surface. That knowledge facilitated the development of remedial measures to stabilize the landslide. Those measures have been effective to date.

Landslide movement induced by expansive soils

The second case history involves movement of a landslide that occurred after the construction of a large gravity buttress. The presence of the recently active landslide was identified during the pre-grading investigation of a residential development in Clayton, California. The majority of the landslide was removed during grading, however a portion of the slide debris was left in place behind a gravity buttress that was designed to provide a factor of safety in excess of 1.5 with respect to gross stability. An aerial photograph of the landslide area is provided as Figure 5, while a stratigraphic cross section though the site is provided as Figure 6. Up to approximately 100 feet of fill was placed above the landslide debris that remained in place. The fill consisted predominately of moderately to highly expansive clay and clayey silt derived from the Martinez and Domengine Formations. Shortly after the residential development was completed, a series of cracks formed within streets and other improvements parallel to the top of the descending slope. Inclinometers were installed within the development and monitored for several years. Up to approximately three inches of lateral movement was

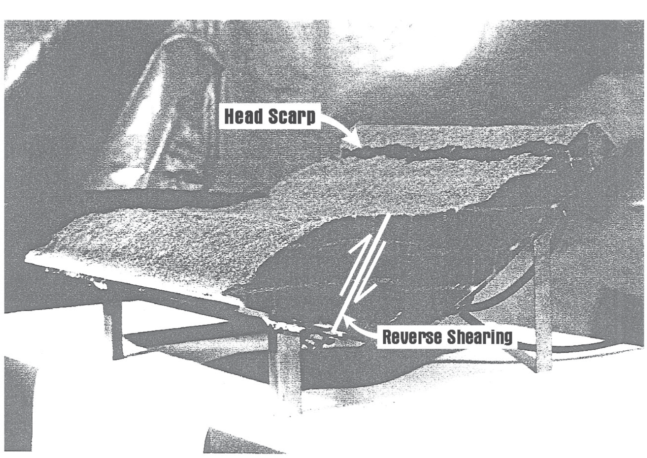

Figure 4. Physical model of landslide.

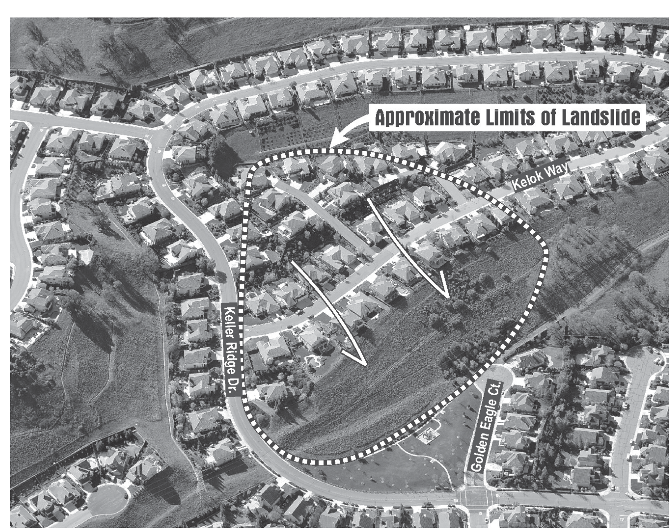

Figure 5. Aerial photograph of Keller Ridge Landslide area – Clayton, California.

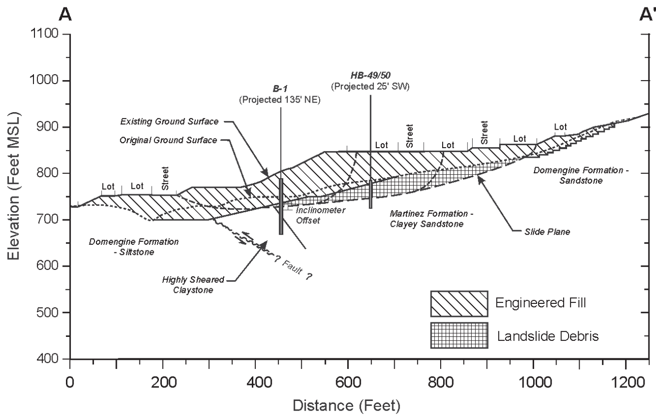

Figure 6. Cross section through Keller Ridge Landslide.

recorded by the inclinometers. Where the ancient landslide debris had been left in place, the movement occurred along the basal rupture surface. Downslope of the slide debris, the movement generally occurred as a dispersed zone of deformation within the fill without any well defined offsets. The monitoring results and crack patterns indicated the amount of movement increased in the downslope direction. Piezometers were also installed within the development to delineate groundwater levels. The effective shear strength parameters for the landslide rupture surface were relatively well defined by back-calculations based upon a factor of safety of unity prior to grading. The shear strength parameters for the fill soils were based upon a large number of tests that had been performed on that material. Slope stability calculations using all of the available data for the post-graded condition yielded factors of safety in excess of 1.5. Those results appeared to be inconsistent with the fact that several inches of movement had occurred along the basal rupture surface. A finite element model of the site was created to more thoroughly evaluate the induced stresses and deformation. This model incorporated the shrink-swell characteristics of the expansive fill soils and simulated the post-grading wetting that had occurred as a result of the residential landscaping and irrigation. As a result of the post-grading soil wetting and expansion in conjunction with the upslope topographic confinement and lack of confinement downslope, the model predicted stress levels and displacement patterns that were consistent with the observed conditions. The model provided a basis for predicting the maximum amount of ground movement that could be anticipated and confirmed the factor of safety against gross instability remained relatively high.

In both of the cases outlined above, analytical and/or physical models were developed and utilized to evaluate monitoring results that could not be readily understood or explained without the use of those models. The use of this type of modeling has proven useful in the evaluation of data from monitoring programs on many occasions.

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