MSR Modular case study

The concept of reference time and time windowing

The reference time denotes a predetermined date and time for which the value of the measurements are set at 0, thereafter all measurements are included. Any measurements prior to the reference time are not utilised in the alarm calculations.

The reference time may be the start of the database, a strategic review period of time or a selected point in time leading up to an event for which only that data is required to be assessed, opposed to the whole database of measurements. This setting allows the user flexibility in assessing and further analysing a sub-set of the database that is specific to tactical or strategic monitoring protocols.

The reference time applies to all the scan regions on the site, and not just the selected region. Time windowing starts at the onset of the reference time and all alarm settings are calculated based on the reference time. Time windowing is available for the average velocity and velocity delta alarms, it does not apply to the relative range. Time windows of 1, 2, 4, 6, 12 and 24 hours can be applied.

The concept of time windowing is that on a sliding scale, based on the time window selected, the difference in measurement of the relative range between the latest scan and the scan at the onset of the time window is divided by the time window value. The time window may be applied to the different regions specific to the geotechnical or critical alarm settings.

The time windows illustrated show the fine balance between 1, 2, 4, 6, 12 and 24 hours. The following observations are made:

- Short duration time windows are more sensitive as smaller amounts of measurement data are being averaged by shorter duration of time. Shorter time window durations are applicable to emergent monitoring situations whereby safety critical or tactical monitoring protocols are adopted and applied. For example; excavation of higher risk areas, rehabilitation of critical areas or the monitoring of an instability. Shorter duration time windows may be applied for the cracking and dislocation leading up to the collapse movements stages of a trigger action response plan

- Medium duration time windows give a good indication of movement and alleviate multiple alarms for situations whereby monitoring protocols require alerts, however the area being monitored may not be close to an area of production or a critical area such as during primary and strategic monitoring. Information pertaining to the triggered alarms can be collected and utilised to refine alarm settings should they need to be refined to be either more or less sensitive. Medium duration alarm settings are also useful during the creep leading up to the onset of the cracking and dislocation stages of pit slope movement.

- Longer duration time windows are much less sensitive as larger amounts of measurement data are being averaged by longer duration of time. Longer time windows are useful for more primary and strategic a longer term monitoring protocols that may range between the elastic and the creep stages of pit slope movement.

The time window is highly dependent on the geotechnical conditions and the anticipated failure mode, how the instability will progress and the site and domain specific trigger action response plan.
Think about these varying geotechnical conditions:

- The geological model.
- The structural model.
- The rock mass model.
- The hydrogeological model.
- How these models inform the geotechnical model, how geotechnical domains are formed and the understanding of the mode/modes of failure per domain.

Trigger events such as:

- Blasting.
- Excavation at the toe.
- Loading of a particular portion of the slope.
- Rainfall.
- Sleet.
- Snow.
- Seismic events.
- Machinery vibration.
- And other site specific trigger events.

Trend plot data and interpreted information:

- The strain component per instability type.
- The speed of average velocity.
- Acceleration and deceleration cycles.

Which indicate:

- Early onset of movement versus progressive movement.
- Movement patterns such as linear, bi-linear, stick-slip, regressive, transitional, slow accelerating, linear accelerating and accelerating (progressive).
- The viscoelastic behavior of the components of the rock mass.

The proceeding diagrams illustrate the differences in sensitivity of the trend plot to the applied alarm settings for a 24, 12, 6, 4, 2 and 1 hour time window. Note how many more times the alarm settings may be triggered based on the time window.

MSR Modular case study

Figure1: 24 hour time window

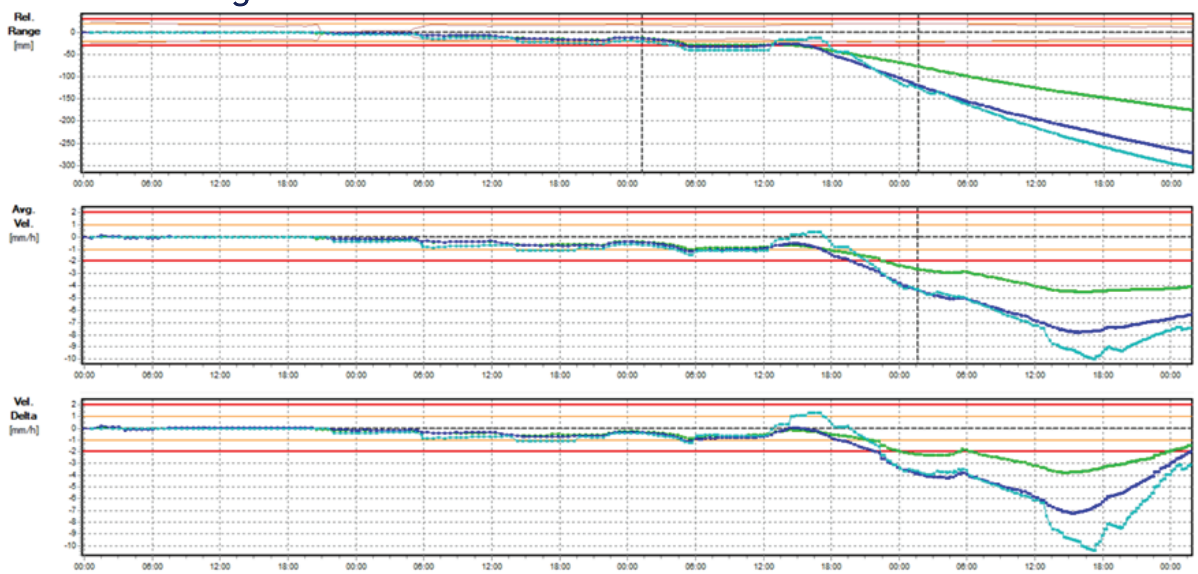
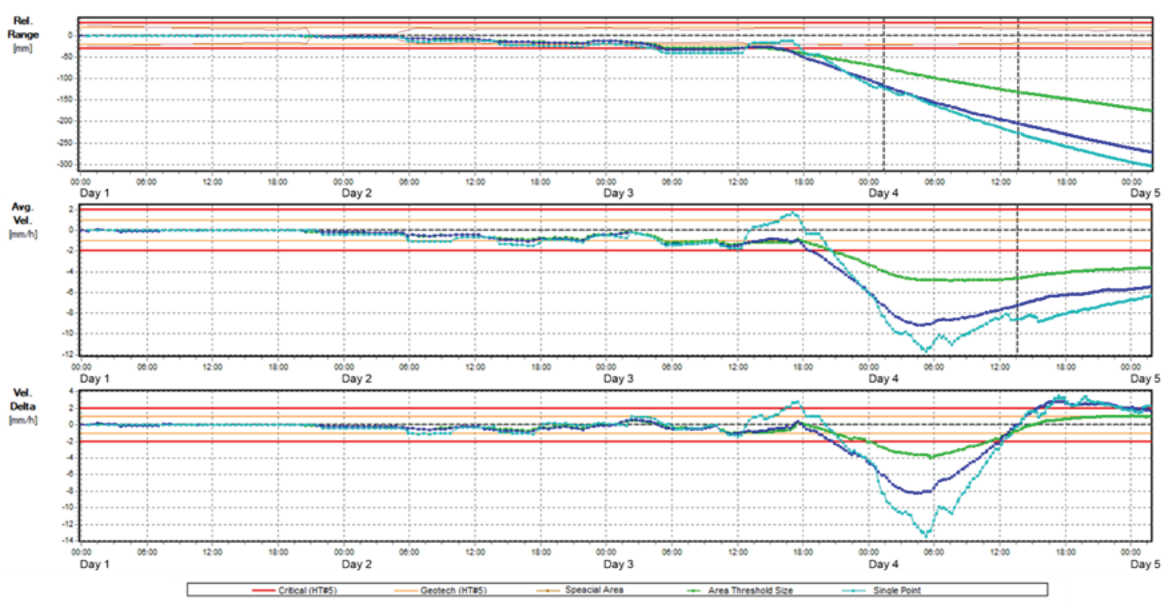


Figure 2: 12 hour time window



MSR Modular case study

Figure 3: 6 hour time window

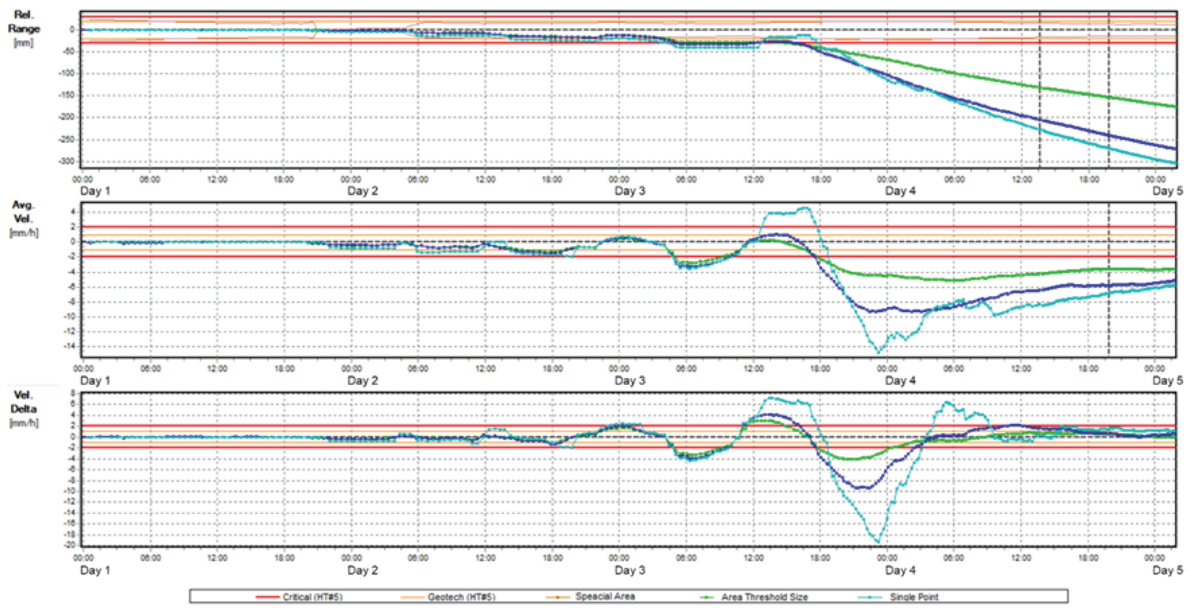


Figure 4 : 4 hour time window

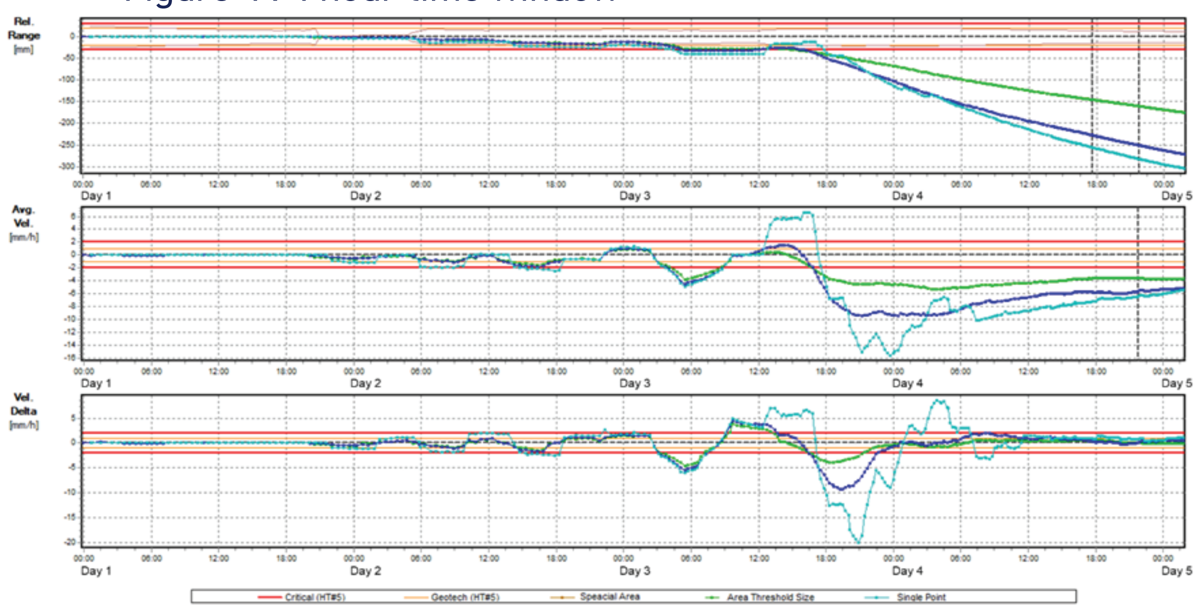


Figure 5: 2 hour time window

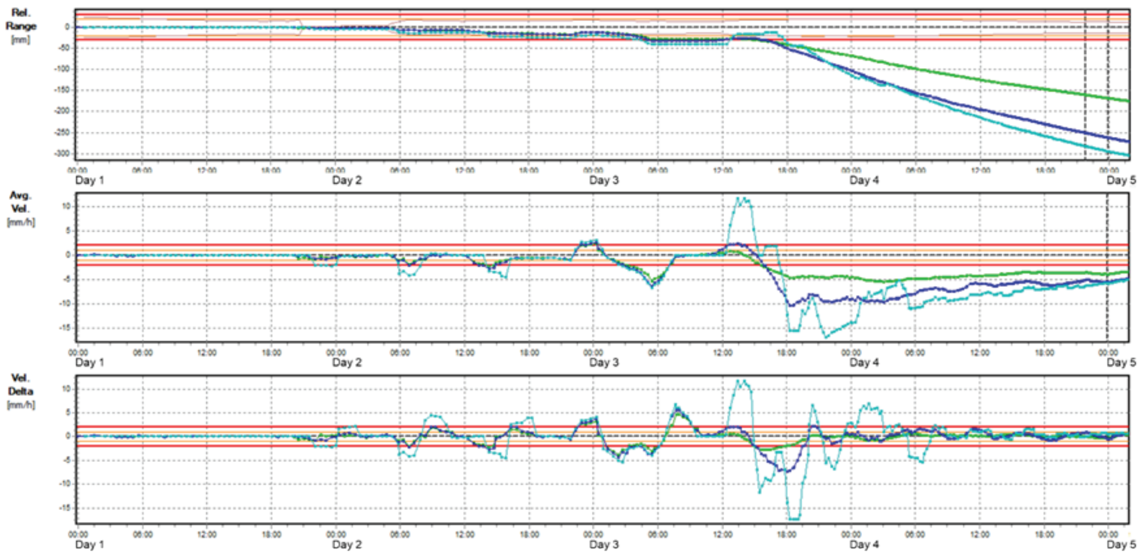
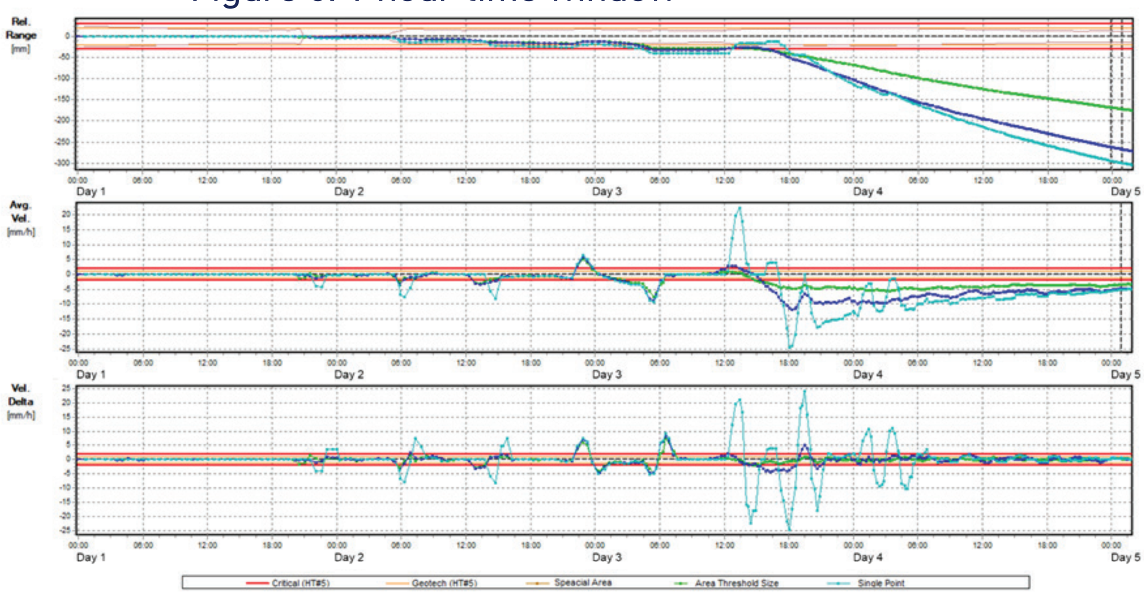


Figure 6: 1 hour time window



REUTECH AUSTRALIA,
PTY LTD.

6 Babel Road, Welshpool,
WA, 6106
Australia

T +1300 899 235

E info@reutechaustralia.com
www.reutechaustralia.com.au

REUTECH AUSTRALIA