

## **PROJECT SITE DOCUMENTATION BINDER CONTENTS**

Alberta Transportation is aware of the significant risk inherent with the development and maintenance of infrastructure facilities. These risks are readily evident and manifested as landslides, erosion problems, frost heaves and other geotechnically related phenomena. In many cases the consequences of these problems are considered to be nuisances. However, damage to roads, bridges and other infrastructure can occur, with implications not only toward the cost of repairs and loss of use of the structure, but also the potential lowering of the standard of safety afforded to the public. Alberta Transportation, in partnership with consultants, will continue to use and improve risk management techniques to ensure that sufficient safeguards are in place to identify and mitigate risks. Alberta Infrastructure will also continue to use and improve loss control techniques to prioritize sites for mitigative works based on sound engineering and socio-economic principles.

Risk management is considered to be a function of monitoring, risk identification, risk assessment and analysis and implementation of appropriate risk control processes. The risk management program will aid in prioritizing site for mitigative work, and will identify the type of mitigative work required. As part of the risk management and prioritization functions a binder, or binders if required, will be compiled that contains all pertinent information related to a particular site. In order to encourage consistency in reporting between sites across the Province the following Sections are mandatory in the Binder:

- File Review
- Site Visits and Assessment
- Instrumentation Results (Observations, Interpretation and Recommendations)
- Instrumentation Results (Data Presentation)
- Emergency Call-Out Report
- Drawings and Photos
- Site Documentation

## **Outline of Binder Contents:**

### **Section A. File Review**

The file review will be completed by the Consultant at the start of the assignment and will be presented in the form of a short summary report. A separate file review report is required for each site. File reviews will be required for all new sites identified during the assignment. The file review report should follow the outline provided below.

#### *Project Setting (by Consultant)*

- Physical site location, legal description, highway control section, mileage to nearest landmark
- Site geology, hydrogeologic & geomorphologic setting

#### *Historical Information (by Consultant)*

- Description of past site problems, including construction problems
- Description of past investigations
- Description of mitigative measures implemented
- Use of a chronological table is suggested

### **Section B. Site Visit and Assessment**

This portion of the binder will be updated annually with the most recent site visit and assessment findings. The comments should be brief but descriptive and should highlight any changes in site conditions from the previous year.

#### *Site Observations (by Consultant)*

- Description of present site conditions/problems
- Discussion of changes in site conditions
- Provision of hand-drawn site plan and cross section of slide area (may be annotated copy of earlier drawings)

#### *Site Assessment (by Consultant)*

- Implication of changed conditions
- **Perceived risk level\* (see Attachment 1)**
- Consequences of additional movement
- Uncertainties and residual hazards

#### *Recommendations (by Consultant)*

- Recommendations for field work/investigations/assessments to reduce uncertainties
- Recommendations for immediate action
- Recommendations for future action with approximate time frame
- Discussion of potential mitigative measures and rudimentary cost/benefit analysis

#### *Review Comments and Discussion (by Department)*

*Previous Site Assessments (provided by Department)*

## **Section C      Instrumentation Results (Observations, Interpretation, Recommendations)**

This portion of the binder will be updated twice yearly or according to the monitoring reading schedule. The comments should be brief but descriptive and should highlight any changes in site conditions from the previous year. A single page should be sufficient for most sites as documentation for Task C. The outline below centers on slope indicator sites and should be modified accordingly for other instrumentation. Use of a summary table is encouraged but not required.

Specifically the **Observations** should be factual and identify the following:

*Condition of Instrumentation (by Consultant)*

- Completed “Field Summary of Instrumentation Monitoring” form

*Identification of new zones of movement (by Consultant)*

- Identify “new” zones of movement, indicating SI installation, depth of movement, extent and direction of movement, rate of movement

*Comments on previously identified zones of movement (by Consultant)*

- Comments on “old” zones of movement, indicating SI installation, depth of movement, extent of movement, rate of movement, change in rate of movement, etc.

The Consultant’s **Interpretation** should discuss the implications of the monitoring results and as a minimum discuss the following:

*Changes in monitored values (by Consultant)*

- Hazard and risks posed by new zones of movement.
- Hazard and risks posed by old zones of movement.
- The discussion of risk should include comments on the likelihood of occurrence of the event and the consequence

*Steady movement (by Consultant)*

- Hazard and risks posed by steady rate of perceptible movement.
- Hazard and risks posed by creep or barely perceptible movement.

The Consultant’s **Recommendations** should provide details on action items related to reducing site uncertainties and hazards. These may include:

*Action Items (by Consultant)*

- Installation of additional instrumentation

- Increased or decreased monitoring frequency
- Recommendations for additional investigation and study

*Previous Instrumentation Monitoring reports (provided by Department)*

## **Section D Instrumentation Results (Data Presentation)**

The format of the instrumentation data presentation should be consistent with the sample sheets attached to the T.O.R. An electronic copy of all instrumentation data should be provided in addition to the hardcopy plots of slope indicator movement, piezometer data, etc. The disk will be stored at Alberta Infrastructure head office for safe keeping and incorporation onto CD-ROM disks for ease of distribution.

All data plots are to be signed off by the responsible Consultant to indicate they have completed an internal review of the data integrity and accuracy. Upon receipt of the monitoring report and data presentation the binder will be updated with the current monitoring results. If appropriate the previous plots will be discarded.

Specifically, this Section will contain the following:

### *Slope Indicator Results (by Consultant)*

- Cumulative and incremental displacement in A direction on same page
- Cumulative and incremental displacement in B direction on same page
- Displacement – time plot showing zone(s) of movement in A direction
- Displacement – time plot showing zone(s) of movement in B direction

If there is a significant component of the movement directed in the A and B directions the movement should be resolved into a single movement vector and additional plots showing cumulative and incremental displacements, and rate of displacement along the vector direction should be presented. In this case the compass direction of movement should also be indicated. The data for the cumulative and incremental plots should be culled to remove nonessential readings and to emphasize current readings. However all valid data should be used for the displacement – time plots. The displacement scales used for the graphs should be consistent for all inclinometers at a given site.

### *Piezometer Results (by Consultant)*

- Updated table of piezometer data including  $r_u$  calculations for each instrument
- Piezometric elevation – time plot

The elevation – time plot may contain all pneumatic installations at a site depending on how cluttered the graph becomes. If ground surface elevations are not known it is preferred that a separate graph be prepared for each instrument.

### *Other Instrumentation (by Consultant)*

Other instrumentation, such as frost probes, standpipe piezometers, vibrating wire settlement plates, etc. may be installed by the Department. The Consultant may be requested to monitor this instrumentation as part of the Regional Geotechnical

Consultant contract, in which case the data may be presented in a manner consistent with the slope indicator and piezometer results.

*Previous Instrumentation Data results and plots (provided by Department)*

## **Section E      Emergency Call-Out Report (2 – 4 pages, not including sketches or photographs)**

A brief report is required to document all emergency call-outs for existing or new sites. The report should be concise, and should contain the following:

- Description of circumstances of the emergency call-out request, and site background.
- Observations noted during site visit.
- Preliminary site assessment based on field observations, review of available data and experience, indicating the potential root cause of the slide and preliminary assessment of **risk level** (see **Attachment 1**) to the public and A.I. facilities
- Recommendations for action. This would include requirements for road closure, detour location, immediate earthworks required to limit additional loss of infrastructure and ensure safety of public. This would also include recommendations for additional field investigations (drilling), monitoring requirements, survey, analysis, etc.
- Preliminary or conceptual mitigative measures
- Hand-drawn annotated site plans and profiles, drawn to approximate scale.
- Annotated photographs, in hard copy and digital form (jpeg)

## **Section F      Site Plans, Plots and Photos**

The documentation of site conditions through pictures is an important component of the binder resource. The Department will provide reproductions of the selected photographs

*Site plans, cross-section profile plots, photos (identified by the Consultant, provided by the Department)*

During the Consultant's file review the Consultant is directed to select representative photographs, site plans and cross sections from the Department archives to depict:

- Changing site conditions
- Remedial work
- Crack patterns
- Other geotechnical anomalies

*Aerial photographs (Request by Consultant, supplied by Department)*

The Department will provide selected sets of stereo aerial photograph as requested by the Consultant. The Consultant should provide legal location references to enable ordering of aerial photographs.

Photographs supplied by the Consultant as documentation of site visits should be provided in hardcopy (conventional prints or high resolution colour digital prints) and in electronic format (jpeg).

## **Section G     Site Documentation**

This section contains relevant historic file material from the Department archives.

## ATTACHMENT 1 - RISK LEVEL

\*On a trial basis the risk level will be determined by the following equation:

$$\text{Risk} = \text{Probability Factor} * \text{Consequence Factor}$$

Where the PF is ranked on a scale of 1 to 20 as follows:

- |    |  |
|----|--|
| 1  | Inactive, very low probability of slide occurrence   |
| 3  | Inactive, low probability of remobilization  |
| 5  | Inactive, moderate probability of remobilization, uncertainty level moderate, or active but very slow rate of movement or indeterminate movement pattern             |
| 7  | Inactive, high probability of remobilization or additional hazards, uncertainty level high, or active with perceptible movement rate and defined zone(s) of movement |
| 9  | Active with moderate steady, or decreasing, rate of ongoing movement   |
| 11 | Active with moderate but increasing rate of movement   |
| 13 | Active with high rate of movement, steady or increasing  |
| 15 | Active with high rate of movement with additional hazards  |
| 20 | Catastrophic slide is occurring  |

And CF is ranked on a scale of 1 to 10 as follows:

- |    |   |
|----|---|
| 1  | Shallow cut slope where slide may spill into ditches or fills where slide does not impact pavement, minor consequence of failure, no immediate impact to driver safety, maintenance issue   |
| 2  | Moderate fills and cuts, not including bridge approach fill or headslopes, loss of portion of the roadway or slide onto road possible, small volume. Shallow fills where private land, waterbodies or structures may be impacted. Slides affecting use of roadways and safety of motorists, but not requiring closure of the roadway. Potential rock fall hazard sites. |
| 4  | Fills and cuts associated with bridges, intersectional treatments, culverts and other structures, high fills, deep cuts, historic rock fall hazards areas. Sites where partial closure of the road or significant detours would be a direct and unavoidable result of a slide occurrence  |
| 6  | Sites where closure of the road would be a direct and unavoidable result of a slide occurrence.   |
| 10 | Sites where the safety of public and significant loss of infrastructure facilities or privately owned structures will occur if a slide occurs. Sites where rapid mobilization of large-scale slide is possible.   |

Based on this the highest risk level would be 200 while the lowest would be a value of 1.

The terms small, moderate, shallow, etc are subjective and are not defined herein. The purpose of assigning a level of risk to a particular site is to aid the Department in determining priorities using a rational (if subjective) approach. The Consultant is encouraged to interpolate, develop and refine this rating scheme for future discussion and revision. Please note that the Department will review all ratings and may request clarification of the Consultants ratings. In addition, the Department has several internal

interests and review processes that will be used to prioritize sites across the Province, with the aid of the Consultants assessments.

The Consultant is directed to the attached Glossary of Landslide Terms<sup>1</sup> (see Attachment 2). The terminology used by the Consultant to describe landslide features should be consistent with the definitions provided in the Glossary.

<sup>1</sup>Cruden, D.M., 1993, The Multilingual Landslide Glossary, Bitech Publishers, Richmond., British Columbia, for the UNESCO Working Party on World Landslide Inventory in 1993.



## **ATTACHMENT 2 - GLOSSARY OF LANDSLIDE TERMS**

### **English Version of Landslide Features**

1. Crown: The practically undisplaced material still in place and adjacent to the highest parts of the main scarp (2).
2. Main scarp: A steep surface on the undisturbed ground at the upper edge of the landslide, caused by movement of the displaced material (13) away from the undisturbed ground. It is the visible part of the surface of rupture (10).
3. Top: The highest point of contact between the displaced material (13) and the main scarp (2).
4. Head: The upper parts of the landslide along the contact between the displaced material and the main scarp (2).
5. Minor scarp: A steep surface on the displaced material of the landslide produced by differential movements within the displaced material.
6. Main body: The part of the displaced material of the landslide that overlies the surface of rupture (10) between the main scarp (2) and the toe of the surface of rupture (11).
7. Foot: The portion of the landslide that has moved beyond the toe of the surface of rupture (11) and overlies the original ground surface (20).
8. Tip: The point of the toe (9) farthest from the top (3) of the landslide.
9. Toe: The lower, usually curved margin of the displaced material of a landslide, it is the most distant from the main scarp (2).
10. Surface of rupture: The surface which forms (or which has formed) the lower boundary of the displaced material (13) below the original ground surface (20).
11. Toe of surface of rupture: The intersection (usually buried) between the lower part of the surface of rupture (10) of a landslide and the original ground surface (20).
12. Surface of separation: The part of the original ground surface (20) overlain by the foot (7) of the landslide.
13. Displaced material: Material displaced from its original position on the slope by movement in the landslide. It forms both the depleted mass (17) and the accumulation (18).

14. Zone of depletion: The area of the landslide within which the displaced material lies below the original ground surface (20).
15. Zone of accumulation: The area of the landslide within which the displaced material lies above the original ground surface (20).
16. Depletion: The volume bounded by the main scarp (2), the depleted mass (17) and the original ground surface (20).
17. Depleted mass: The volume of the displaced material, which overlies the rupture surface (10) but underlies the original ground surface (20).
18. Accumulation: The volume of the displaced material (13), which lies above the original ground surface (20).
19. Flank: The undisplaced material adjacent to the sides of the rupture surface. Compass directions are preferable in describing the flanks but if left and right are used, they refer to the flanks as viewed from the crown (1).
20. Original ground surface: The surface of the slope that existed before the landslide took place.