

SHIRLEY CONSULTING ENGINEERS : EXPLANATORY NOTE

RISK ASSESSMENT : PROCESS AND TERMINOLOGY

In a report by Shirley Consulting Engineers [SCE], the likelihood of a particular event occurring, and the consequences of that event occurring are usually described using qualitative terms. These qualitative terms are described in relation to a particular timeframe, typically over the design life of a particular development, but can also be described over a shorter timeframe [e.g. over the period of the construction of a specific structure].

This explanatory note has been prepared in accordance with the relevant Australian Standard⁽¹⁾ & Companion Guidelines⁽²⁾ to describe the risk assessment process, the qualitative terms used in SCE reports with attached definitions and a quantification range.

Note: Where a SCE report addresses land stability issues and landslides, SCE adopts the AGS Landslide Risk Management Guidelines⁽⁴⁾ & ⁽⁵⁾ which are appended to this explanatory note.

RISK ASSESSMENT PROCESS

The process of undertaking a risk assessment involves four steps being:

1. The identification of an Event [or Hazard].
2. The assessment of the Likelihood of the Event occurring.
3. The assessment of the Consequences of that Event occurring.
4. An assignment of a Risk Category based on the Likelihood and Consequence.

Whilst a mathematical quantification and calculation based approach can be used, as the level of uncertainty in the Likelihood and Consequence is often quite high, most Risk Assessments are made by assigning qualitative terms to the Likelihood and Consequence.

1. Identification of an Event

In a risk assessment, the first step is to identify the Event to be assessed. In the context of an engineering risk assessment, some examples of Events are:

- a) A rock falling from a cliff face, bouncing down a hill and impacting a building.
- b) During an excavation, the shoring system deflecting more than a neighbouring building can tolerate without damage.
- c) A section of brickwork falls off a building and hits a person who is standing below that brickwork at the time the fall occurs.

2. Likelihood of the Event Occurring

The Likelihood of an Event occurring is divided into seven categories as described in the following Table 1. It is important to note that the Likelihood must be assessed within the context of a specific timeframe, or timescale. For example:

- a) The Likelihood of a 30 year old person dying within 200 years would be Certain.
- b) The Likelihood of a healthy 30 year old person dying within the next year would be Rare or Barely Credible.

Where a Risk Assessment for a new or existing development is being prepared by SCE, the Australian Geomechanics Society Landslide Risk Management 2007 guidelines⁽²⁾ are used.

3. Consequence Assessment

When assessing the Consequence of a particular Event occurring, the Event is assumed to have occurred, and the Almost Certain damage of that event is assessed. Whilst the Consequences can be in many categories, for Engineering Risk Assessments the Consequences typically fall into two categories being:

- a) Personnel Injury – Death or series injury.
- b) Physical Damage to a Structure – the cost of repairing the damage caused by the Event.



SHIRLEY CONSULTING ENGINEERS : EXPLANATORY NOTE RISK ASSESSMENT : PROCESS AND TERMINOLOGY

4. Assignment of a Risk Category

After the Likelihood and Consequence qualitative assessments are complete, the Risk Category is assigned. This assignment can either be mathematically compared to the Risk Categories, or based on a Matrix or Table lookup [e.g. The AGS Qualitative Risk Analysis Matrix & Risk Level Implications table in the AGS guidelines].

Note: Additional information on the risk assessment process is provided in the attached Appendix C to the AGS Landslide Risk Management Guidelines.

The Risk Category for the Risk to Life is typically compared to other community accepted Risks to Life. Examples of the currently accepted Risks to Life are provided in AGS Geoguide LR7⁽⁵⁾ and in NSW Planning 'Hazard Industry Planning Advisory Paper No. 4'⁽³⁾.

The Risk Category for Physical Damage depends on the cost-benefit of lowering the risk and the financial capacity of the person or organisation taking the risk. The Risk Categories [sic: Descriptor] for residential properties are provided in the AGS *Qualitative Measures of Consequences to Property* table [see page 1 of the AGS attachment].

TABLE 1 : SCE's QUALITATIVE LIKELIHOOD TERMS [Timescale Independent]

Qualitative Term	Definition	Range
Certain	The event will occur within the timeframe being considered unless impacted by another unforeseen event.	98% to 100%
Almost Certain	The event has a high probability of occurring within the timeframe being considered.	90% to 98%
Likely	The event is more probably going to occur than not occur within the timeframe being considered.	65% to 90%
Possible	The event has about an even probability of occurring or not occurring within the timeframe being considered.	35% to 65%
Unlikely	The event has a higher probably of not occurring, than occurring within the timeframe being considered.	10% to 35%
Rare	The event has a high probability of not occurring within the timeframe being considered.	2% to 10%
Barely Credible	The event will not occur within the timeframe being considered, unless impacted by another unforeseen event.	0% to 2%

References

1. "Risk Management"; AS/NZS 4360:2004 - Standards Australia.
2. "Risk Management Guidelines"; companion to AS/NZS 4360:2004 - Standards Australia.
3. "Risk Criteria for Land Use Planning" : Hazard Industry Planning Advisory Paper No. 4, NSW Planning January 2011.
4. "Practice Note Guidelines for Landslide Risk Management 2007"; Walker et al : Australian Geomechanics Vol. 42. No.1, March 2007.
5. "The Australian Geoguides for Slope Management and Maintenance"; Australian Geomechanics Vol. 42. No.1, March 2007.



PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10 ⁻¹	5x10 ⁻²	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10 ⁻²		100 years		The event will probably occur under adverse conditions over the design life.	LIKELY	B
10 ⁻³	5x10 ⁻³	1000 years	200 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10 ⁻⁴	5x10 ⁻⁴	10,000 years	2000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10 ⁻⁵	5x10 ⁻⁵	100,000 years	20,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10 ⁻⁶	5x10 ⁻⁶	1,000,000 years	200,000 years	The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%		Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	40%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	10%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%	1%	Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not *vice versa*

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10 ⁻¹	VH	VH	VH	H	M or L (5)
B - LIKELY	10 ⁻²	VH	VH	H	M	L
C - POSSIBLE	10 ⁻³	VH	H	M	M	VL
D - UNLIKELY	10 ⁻⁴	H	M	L	L	VL
E - RARE	10 ⁻⁵	M	L	L	VL	VL
F - BARELY CREDIBLE	10 ⁻⁶	L	VL	VL	VL	VL

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.

(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator’s approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.