APPENDIX A
Rockslope Assessment Metrics

Table A.1: Detailed rating of rockslopes in the Rockfall Hazard Rating System (RHRS). (From Pierson, 1993).

CATEGORY			RATING CRITERIA AND SCORE			
			3 POINTS	9 POINTS	27 POINTS	81 POINTS
SLOPE HEIGHT			25 FEET	50 FEET	75 FEET	100 FEET
DITCH EFFECTIVENESS			Good catchment	Moderate catchment	Limited catchment	No catchment
AVERAGE VEHICLE RISK			25% of the time	50% of the time	75% of the time	100% of the time
PERCENT OF DECISION SIGHT DISTANCE			Adequate sight distance, 100% of low design value	Moderate sight distance, 80% of low design value	Limited sight distance, 60% of low design value	Very limited sight distance 40% of low design value
ROADWAY WIDTH INCLUDING PAVED SHOULDERS			44 feet	36 feet	28 feet	20 feet
GEOLOGIC CHARACTER	CASE 1	STRUCTURAL CONDITION	Discontinuous joints, favorable orientation	Discontinuous joints, random orientation	Discontinuous joints, adverse orientation	Continuous joints, adverse orientation
		ROCK FRICTION	Rough, Irregular	Undulating	Planar	Clay infilling, or slickensided
	CASE 2	STRUCTURAL CONDITION	Few differential erosion features	Occasional erosion features	Many erosion features	Major erosion features
		DIFFERENCE IN EROSION RATES	Small difference	Moderate difference	Large difference	Extreme difference
BLOCK SIZE / VOLUME OF ROCKFALL/EVENT			1 Foot / 3 cubic yards	2 Feet / 6 cubic yards	3 Feet / 9 cubic yards	4 Feet / 12 cubic yards
CLIMATE AND PRESENCE OF WATER ON SLOPE			Low to moderate precipitation; no freezing periods; no water on slope	Moderate precipitation or short freezing periods or intermittent water on slope	High precipitation or long freezing periods or continual water on slope	High precipi–tation and long freezing periods or continual water on slope and long freezing periods
ROCKFALL HISTORY			Few falls	Occasional falls	Many falls	Constant falls

Table A.2: Evolved RHRS system to assess both rockfall risk and potential hazard levels (From ODOT, 2001).

Hazard Score

1.	Failure Type/ Hazard	Very small or insignificant failures that do not affect the roadway. (Not Scored)	**LOW HAZARD**; Slower slides with low potential for causing a road hazard. (9 Points)	**MEDIUM HAZARD**; Slides that have not moved suddenly in the past, but have the potential to cause a road hazard. (27 Points)	**HIGH HAZARD**; Rapid slides that have created a road hazard in the past. Includes debris flows and rockfalls. (81-100 Points based on sight distance)				
		LOW hazards receive 0 points	**MEDIUM** hazards receive maximum of 54 points				**HIGH** hazards can receive full point range		
2.	Roadway Impact (pick one)	Landslides: All **LOW HAZARD** slides above (0 Points)	Would only affect shoulder during major failure (3 Points)	Two-way traffic would remain after major failure (9 Points)	One-way traffic would remain after major failure (27 Points)	Total Closure in the event of major failure; 0-3 Mile Detour (54 Points)	Total Closure in the event of major failure; 3-10 Mile Detour (70 Points)	Total Closure in the event of major failure; 10-60 Mile Detour (85 Points)	Total Closure in the event of major failure; >60 Mile Detour (100 Points)
		OR							
		Rockfalls: Rocks are completely contained in ditch (3 Points)	Rocks fall into shoulder only (9 Points)		Rocks enter roadway (27 Points)		No ditch, all falling rocks enter roadway (81 Points)		Rocks occasionally fill part or all of a lane (100 Points)
3.	Annual Maintenance Frequency	0-5 Failures Per Year Sliding Scale from 0-100 Points							
4.	Average Daily Traffic	0 - 40,000 Cars per day Sliding Scale from 1 - 100 Points							
5.	Accident History	No accidents (3 Points)	Vehicle or Property Damage (9 Points)		Injury (27 Points)		Fatality (100 Points)		

500 Total Possible Points

Table A.3: Slope mass rating (SMR) categories used in the IMS (from Budetta et al., 2004).

Class	V	IV	III	II	I
SMR	0–20	21–40	41–60	61–80	81–100
Description	Very bad	Bad	Normal	Good	Very good
Stability	Completely unstable	Unstable	Partially stable	Stable	Completely stable
Failures	Big planar or soil-like	Planar or big wedges	Some joints or many wedges	Some blocks	None

Table A.4: Categories for the Italian modified system (IMS) adapted from the RHRS (from Budetta et al., 2004).

Category	Rating criteria by score			
	Points 3	Points 9	Points 27	Points 81
Slope height	7.5 m	15 m	22.5 m	> 30 m
Ditch effectiveness	Good catchment: properly designed according to updates of Ritchie's ditch design chart + barriers	Moderate catchment: properly designed according to updates of Ritchie's ditch design chart	Limited catchment: wrongly designed	No catchment
Average vehicle risk (% of time)	25%	50%	75%	100%
Decision sight distance (% of design value)	Adequate (100%)	Moderate (80%)	Limited (60%)	Very limited (40%)
Roadway width	21.5 m	15.50 m	9.50 m	3.50 m
Slope Mass Rating (SMR)	80	40	27	20
Block size	30 cm	60 cm	90 cm	120 cm
Boulder volume	26 dm^3	0.21 m^3	0.73 m^3	1.74 m^3
Volume of rockfall per event	2.3 m^3	4.6 m^3	6.9 m^3	9.2 m^3
Annual rainfall and freezing periods	h=300 mm or no freezing periods	h=600 mm or short freezing periods	h=900 mm or long freezing periods	h=1200 mm or long freezing periods
Rockfall frequency	1 per 10 years	3 per year	6 per year	9 per year