APPENDIX B

BARRIER DATA TABLES

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APPENDIX B
BARRIER DATA TABLES

The tables contained in this appendix provide detailed data on each system that may be useful in barrier selection. Table B.1 can be used as a key to the barrier data tables.

Table B.1: Barrier Data Tables

System	Designation	Data Table
Three – Strand Cable	G1	B.2
High-Tension Cable	HTC	B.3
Weak Post W-Beam	G2	B.4
Box Beam	G3	B.5
Strong Post W-Beam	G4	B.6
Thrie-Beam	G9	B.7
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Table B.2: Three-Strand Cable Guardrail, G1

Test Level: 3

Standards Reference: AASHTO Roadside Design Guide

Description: Three strands of cable are mounted on breakaway posts. Penetration of a vehicle is prevented by the tensile strength of the cable.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$20.00	$26.00	Deflection	1.1 *	2.3 *	3.5
		System Depth	0.2	0.2	0.2
		Total	1.3	2.5	3.7
Beam Description: 19 mm diameter steel cables.					
Post Description: S75 x 8.5 steel, 1600 mm long at 5000 mm spacing 9 kg/m steel u-channel, 1525 mm long at 5000 mm spacing 140 mm diameter wood, 1830 mm long at 3800 mm spacing					
Compatibility: A terminal is available. Although transitions are difficult, one is available.					

* Estimated values

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$6.00	$8.00	Deflection	3.5 *	7.5 *	11.5
		System Depth	0.5	0.5	0.5
		Total	4 *	8 *	12
Beam Description: ¾ inch diameter steel cables.					
Post Description: S3 x 5.7 steel, 5 ft-3 inch long at 16 ft spacing 4 lb/ft steel u-channel, 5 ft long at 16 ft spacing 5 ½ inch diameter wood, 6 ft long at 11 ft-6 inch spacing					
Compatibility: A terminal is available. Although transitions are difficult, one is available.					

* Estimated values

Notes: Weathering steel posts are available. Reduced post spacing is recommended for tight curves (3.8 m spacing for radii up to 135 m and 4.9 m for radii up to 220 m) (12 ft spacing for radii up to 440 ft and 16 ft for radii up to 720 ft). Closer post spacing can reduce lateral deflection to some extent.

Potential Benefits: Low cost, very little rebound of impacting vehicles, no drifting of snow, no view obstruction.

Potential Problems: Even minor impacts can cause maintenance problems, the high deflections limit application, spare parts must be available and crews trained in repair and maintenance.

Figure B.1: Three-Strand Cable Guardrail, G1

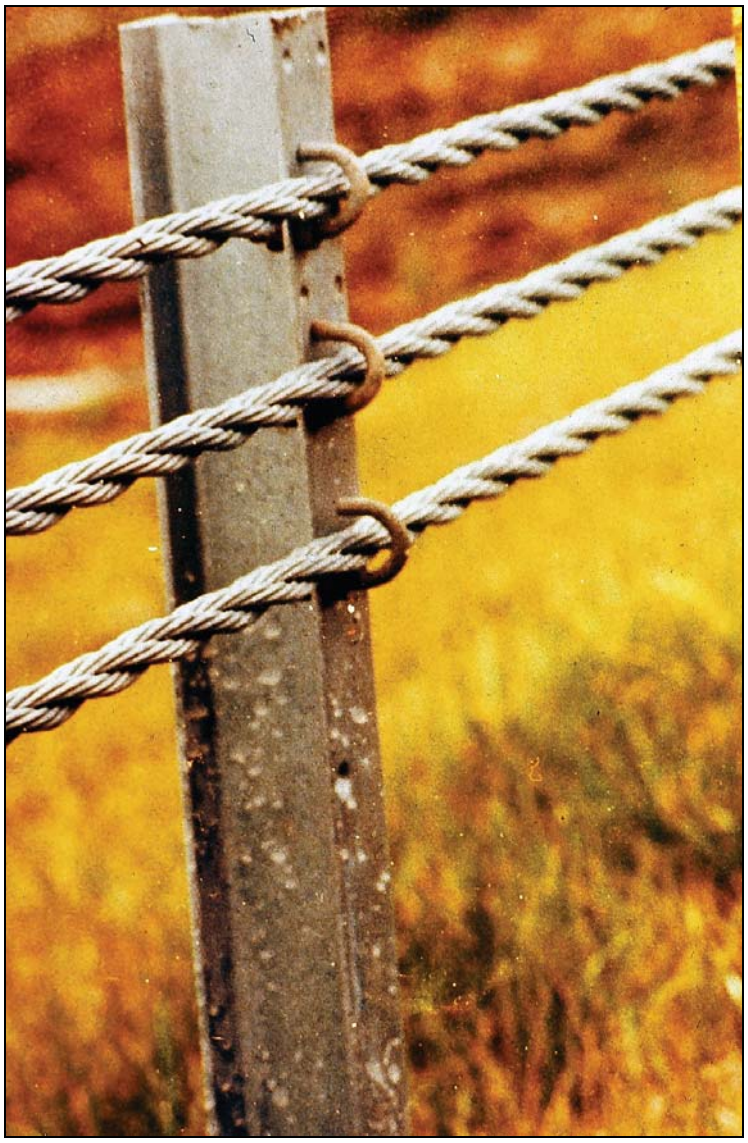

Table B.3: High Tension Cable, HTC

Test Level: 3

Standards Reference: Manufacturers' Published Data

Description: Three or four strands of pre-stretched cable are mounted on steel posts. Penetration of a vehicle is prevented by the tensile strength of the cable.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$60.00	$100.00	Deflection	1.2 *	1.5 *	2.0
		System Depth	0.2	0.2	0.2
		Total	1.4	1.7	2.2
Beam Description: 19 mm diameter high tension steel cables.					
Post Description: Steel posts. Length and spacing varies by manufacturer and design deflection					
Compatibility: A terminal is available. Although transitions are difficult, some manufacturers have tested transitions available.					

* Estimated values. Deflections vary by manufacturer and post spacing.

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$18.00	$30.00	Deflection	3.5 *	4.5 *	6.5
		System Depth	0.5	0.5	0.5
		Total	4.0	5.0	7.0
Beam Description: 0.75 inch diameter high tension steel cables.					
Post Description: Steel posts. Length and spacing varies by manufacturer and design deflection.					
Compatibility: A terminal is available. Although transitions are difficult, some manufacturers have tested transitions available.					

* Estimated values. Deflections vary by manufacturer and post spacing.

Notes: Some systems have been tested on 1V: 6H slopes. Weathering steel posts are available. TL-4 systems are available.

Potential Benefits: Maintenance is relatively easy, crash damage to system is limited, little rebound of impacting vehicles, no drifting of snow, no view obstruction.

Potential Problems: Since this is a new technology, contractors are not likely to be experienced. Spare parts must be available and crews trained in repair and maintenance. All available systems are proprietary.

Figure B.2: High Tension Cable, HTC

Table B.4: Weak Post W-Beam, G2

Test Level: 2

Standards Reference: AASHTO *Roadside Design Guide*

Description: This system consists of a w-beam mounted on weak posts with no block-outs. Upon impact the posts break away and the tensile strength of the beam contains the vehicle.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$40.00	$52.00	Deflection	1.1 *	1.4 *	2.0
		System Depth	0.2	0.2	0.2
		Total	1.3	1.6	2.2
Beam Description: 2.67 galvanized steel w-beam.					
Post Description: S75 x 8.5 steel posts, 1600 mm long at 3.8 m spacing.					
Compatibility: A turned down terminal is available. Although transitions are difficult, some manufacturers have tested transitions available.					

* Estimated values.

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$12.00	$16.00	Deflection	3.5 *	4.5 *	6.5
		System Depth	0.5	0.5	0.5
		Total	4.0	5.0	7.0
Beam Description: 12 gauge galvanized steel w-beam.					
Post Description: S3 x 5.7 steel posts, 5 ft-3 inch long at 12 ft spacing.					
Compatibility: A turned-down terminal is available. Although transitions are difficult, some manufactures have tested transitions available.					

* Estimated values.

Notes: The system is rated at TL-3 if the following modifications are made:

- Raise the mounting height of the center of rail to 660 m (26 in)
- Add w-beam back-up plates at each post
- Center rail splices mid-span between posts

The system can be constructed with weathering steel.

Potential Benefits: The primary benefit is initial cost.

Potential Problems: Problems include accommodation of the deflection distances and large repairs usually required when system is hit. Variations in mounting height, caused by either poor construction or surrounding terrain, can result in a system failure.

Figure B.3: Weak Post W-Beam, G2

Table B.5: Box Beam, G3

Test Level: 3

Standards Reference: AASHTO *Roadside Design Guide*

Description: This system consists of a box beam mounted on weak posts with no block-outs. Upon impact the posts break away and the tensile strength of the beam contains the vehicle.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$40.00	$52.00	Deflection	1.1 *	1.4 *	2.0
		System Depth	0.2	0.2	0.2
		total	1.3	1.6	2.2
Beam Description: 152 mm x 152 mm x 4.8 mm steel tube.					
Post Description: S75 x 8.5 steel posts, 1600 mm long at 1.8 m spacing.					
Compatibility: A turned-down terminal is available. Although transitions are difficult, some transitions are available.					

* Estimated values.

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$12.00	$16.00	Deflection	3.5 *	4.5 *	6.5
		System Depth	0.5	0.5	0.5
		Total	4.0	5.0	7.0
Beam Description: 6 in. x 6 in. x 0.19 in. steel tube.					
Post Description: S3 x 5.7 steel posts, 5ft-3 in. long at 6 foot spacing.					
Compatibility: A turned-down terminal is available. Although transitions are difficult, some transitions are available.					

* Estimated values.

Notes: Variations in mounting height, caused by either poor construction or surrounding terrain, can result in a system failure. The system can be constructed with weathering steel.

Potential Benefits: Minimum snow drifting and view obstruction. Less visually obstructive than w-beam.

Potential Problems: Problems include accommodation of the deflection distances, large repairs usually required when system is hit, unique spare parts, and maintenance crew training.

Figure B.4: Box Beam, G3

Table B.6: Strong Post W-Beam, G4

Test Level: 3

Standards Reference: RDG, M617-10 and M617-11

Description: The strong post w-beam is the most commonly used roadside barrier. It has proven effective in a wide range of conditions. The strong posts serve to limit deflection. Block-outs are necessary to prevent wheel snags on the non-breakaway posts.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$52.00	$82.00	Deflection	0.2*	0.6 *	1.0
		System Depth	0.2	0.2	0.2
		Total	0.4	0.8	1.2
Beam Description: 2.67 galvanized steel w-beam.					
Post Description: Wood posts can be either 200 mm square, 200 mm deep by 150 mm wide or 180 mm in diameter, with a minimum length of 1620 mm. W150 x 13.5 steel posts with a minimum length of 1780 mm can also be used. In either case, block-outs are required. Block-outs may be either wood or recycled plastic. **If steel block-outs are used, the system becomes TL-2.** Standard post spacing is 1905 mm.					
Compatibility: Several terminals and transitions are available					

* Estimated values.

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$16.00	$25.00	Deflection (ft):	1.0 *	2.0 *	3.0
		1	1.0	1.0	1.0
			2.0	3.0	4.0
Beam Description: 12 gauge galvanized steel w-beam.					
Post Description: Wood posts can be either 8 inches square, 8 inches deep by 6 inches wide or 7 inches in diameter, with a minimum length of 5 ft-5 in. 6 x 9 steel posts with a minimum length of 5 ft-11 in. can also be used. In either case, block-outs are required. Block-outs may be either wood or recycled plastic. **If steel block-outs are used the system becomes TL-2.** Standard post spacing is 6 ft-3 in.					
Compatibility: Several terminals and transitions are available					

* Estimated values

Notes: There are several options available to reduce the deflection characteristics including reducing the post spacing by fifty percent, nesting w-beams, using a rub rail mounted on the posts below the block-outs, and increasing the embedment of the posts by up to 0.3 meters (1 ft). The system can be constructed with weathering steel.

Potential Benefits: This system is commonly used. Damage as a result of crashes is usually limited. Although severe hits can destroy the system, it is not uncommon for the system to remain serviceable after several crashes.

Potential Problems: Aesthetics of the system may be a problem, although the wood posts with weathering steel do provide an attractive alternative. May obstruct views somewhat and drift snow.

Figure B.5: Strong Post W-Beam, G4

Table B.7: Thrie-Beam, G9

Test Level: 3

Standards Reference: AASHTO Roadside Design Guide

Description: This system is very similar to the strong post w-beam, with the extra depth of the thrie-beam.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$72.00	$100.00	Deflection	0.2 *	0.2 *	0.7
		System Depth	0.3	0.3	0.3
		Total	0.5	0.5	1.0
Beam Description: 2.67 galvanized steel thrie-beam.					
Post Description: Two types of posts are available. Wood posts are 200 mm deep by 150 mm wide and 1980 mm long. W150 x 13.5 steel posts, 1980 mm long can also be used. In either case, block-outs are required. Block-outs may be either wood or recycled plastic. Standard post spacing is 1905 mm.					
Compatibility: A manufactured transition to standard w-beam must be used, then a w-beam terminal. A transition to a rigid system is available.					

* Estimated values.

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$22.00	$30.00	Deflection	1 *	1 *	2
		System Depth	1	1	1
		Total	2	2	3
Beam Description: 12 gage steel thrie-beam					
Post Description: W6 x 9 steel, 6 ft-6 in. long or 6 in. x 8 in. wood, 6 ft-6 in. long. In either case, block-outs are required. Block-outs may be either wood or recycled plastic. Standard post spacing is 6 ft-3 in.					
Compatibility: A manufactured transition to standard w-beam must be used, then a w-beam terminal. A transition to a rigid system is available.					

* Estimated values.

Notes: If steel posts and steel block-outs are used, the system is TL-2. The system can be constructed with weathering steel.

Potential Benefits: Minimum sensitivity to variations in height, small deflections provide design flexibility.

Potential Problems: Obstruction of views, drifting of snow, cost and unique spare parts.

Figure B.6: Thrie-Beam, G9

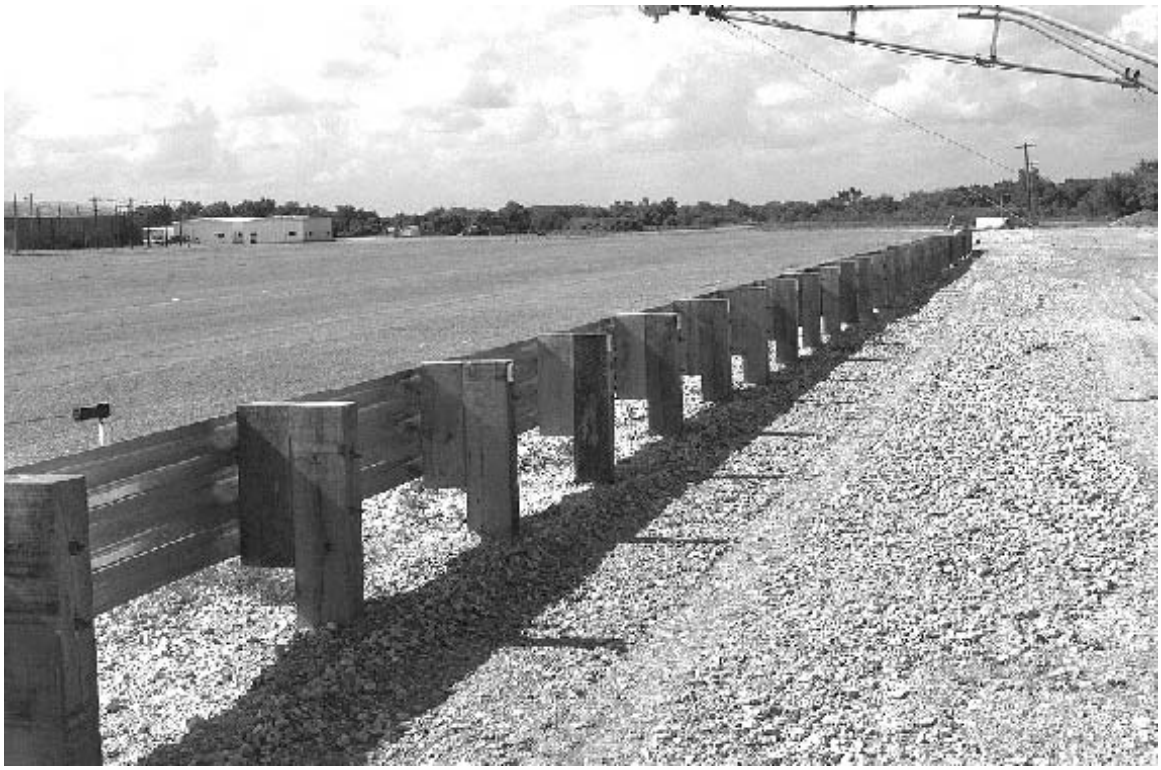

Table B.8: Modified Thrie-Beam, G9M

Test Level: 4

Standards Reference: AASHTO *Roadside Design Guide*

Description: The modification to the standard thrie-beam is a triangular notch in a steel block-out that allows the rail face to remain near vertical in an impact, reducing the potential of a vehicle rolling over the rail.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$72.00	$100.00	Deflection	0.2 *	0.2 *	0.7
		System Depth	0.3	0.3	0.3
		Total	0.5	0.5	1.0
Beam Description: 2.67 galvanized steel thrie-beam.					
Post Description: W150 x 13.5 steel posts, 2060 mm long with block-outs. Block-outs are M360X25.6 steel with a triangular notch in the web. Standard post spacing is 1905 mm.					
Compatibility: A manufactured transition to standard w-beam must be used, then a w-beam terminal. A transition to a rigid system is available.					

* Estimated values. Tests with a 20,000 school bus yielded a deflection of 1.0 meter.

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$22.00	$35.00	Deflection	1.0 *	1.0 *	2.0
		System Depth	1.0	1.0	1.0
		Total	2.0	2.0	3.0
Beam Description: 12 gauge steel thrie-beam					
Post Description: W6 x 9 steel, 6 ft-9 in. long with block-outs. Block-outs are M 14X18 steel with a triangular notch in the web. Standard post spacing is 6 ft-3 in.					
Compatibility: A manufactured transition to standard w-beam must be used, then a w-beam terminal. A transition to a rigid system is available.					

* Estimated values. Tests with a 20,000 school bus yielded a deflection of 3.0 feet.

Notes: The system can be constructed with weathering steel.

Potential Benefits: Minimum sensitivity to variations in height, small deflections provide design flexibility, very little repairs necessary for moderate to severe crashes.

Potential Problems: Obstruction of views, drifting of snow, cost and unique spare parts.

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Table B.9: Concrete Safety Shape, CSS

Test Level: 4

Standards Reference: AASHTO *Roadside Design Guide*

Description: Rigid concrete barrier. Impacting vehicles tend to ride up on the lower slope, dissipating some of the energy of the crash and thus reducing the rebound that might occur. This system is normally used as a median barrier but can be used in a single-face configuration on the roadside.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$260.00	$360.00	Deflection	0.0	0.0	0.0
		System Depth	0.6	0.6	0.6
		Total	0.6	0.6	0.6
Beam Description: The New Jersey shape has a lower slope of 55^0, breaking to 84^0 255 mm above the vertical reveal. The "F" shape is similar, breaking at 180 mm.					
Post Description: N/A					
Compatibility: Crash cushions or transitions to a strong post W-beam with a crashworthy end treatment are commonly used as terminals. Transitions to other systems are available.					

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$80.00	$110.00	Deflection	0.0	0.0	0.0
		System Depth	2.0	2.0	2.0
		Total	2.0	2.0	2.0
Beam Description: The New Jersey shape has a lower slope of 55^0, breaking to 84^0 10 inches above the vertical reveal. The "F" shape is similar, breaking at 7 inches.					
Post Description: N/A					
Compatibility: Crash cushions or transitions to a strong post W-beam with a crashworthy end treatment are commonly used as terminals. Transitions to other systems are available.					

Notes: The "F" shape is preferred because vehicle lift and roll is less pronounced than with the New Jersey shape. The CSS should not be used with a curb, since placing this system on a curb prevents an impacting vehicle from riding up the lower slope as designed. Textured designs are available to improve the aesthetics of the system.

Potential Benefits: Many situations require that the barrier have no deflection and/or a higher test level. No repair is necessary on most impacts.

Potential Problems: Initial cost, obstruction of views, drifting and storage of snow and pavement drainage.

Figure B.7: Concrete Safety Shape, CSS

Table B.10: Steel-Backed Log Rail, SBL

Test Level: 2

Standards Reference: M617-80 and M617-81

Description: This system was developed as an aesthetic alternative. Impact forces are distributed to the posts through the steel rail.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$130.00	$165.00	Deflection	0.3 *	0.3	N/A
		System Depth	0.6	0.6	
		Total	1.0	1.0	N/A
Beam Description: 250 mm diameter log with steel rail backing.					
Post Description: 300 mm diameter log with a 140 mm block-out. The post is notched 40 mm for the block-out attachment. Standard spacing is 3 meters.					
Compatibility: One terminal design is available. No transition design is available.					

* Estimated values

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$30.00	$40.00	Deflection	1.0 *	1.0	N/A
		System Depth	2.0	2.0	
		Total	3.0	3.0	N/A
Beam Description: 10 inch diameter log with steel rail backing.					
Post Description: 12 inch diameter log with a 5.5-inch block-out. The post is notched 1.5 inches for the block-out attachment. Standard spacing is 10 feet.					
Compatibility: One terminal design is available. No transition design is available.					

* Estimated values

Potential Benefits: The log elements give the system a rustic appearance that may be appropriate for many park and forest settings.

Potential Problems: Cost is the primary problem, along with limited terminal options and no available transition section. It may require periodic application of stain to maintain the aesthetic appearance.

Figure B.8: Steel-Backed Log Rail, SBL

Table B.11: Steel-Backed Timber Rail, SBT

Test Level: 3

Standards Reference: M617-60

Description: This system was developed as an aesthetic alternative. Impact forces are distributed to the posts through the weathering steel plate.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$165.00	$230.00	Deflection	0.2 *	0.2 *	0.6
		System Depth	0.6	0.6	0.6
		Total	0.8	0.8	1.2
Beam Description: 150 x 250 mm timber with steel plate backing.					
Post Description: 250 x 300 x 2.1 m rough sawn timber with a 100mm block-out. Standard spacing is 3 m.					
Compatibility: Two terminal designs are available and transitions designs are available.					

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$50.00	$70.00	Deflection	1.0 *	1.0	2.0
		System Depth	2.0	2.0	2.0
		Total	3.0	3.0	4.0
Beam Description: 6 in. X 10 in. timber with steel plate backing.					
Post Description: 10 in. X 12 in. X 7 ft rough sawn timber with a 4-inch block-out. Standard spacing is 10 feet.					
Compatibility: Two terminal designs are available and transition designs are available.					

* Estimated values

Notes: Type A includes the block-out described above. If the 100 mm (4 in) block-out is not provided (Type B), the system is rated as Test Level 2.

Potential Benefits: The timber and weathering steel elements give the system a rustic appearance that may be appropriate for many park and forest settings.

Potential Problems: Cost is the primary problem, along with limited terminal options. It may require periodic application of stain to maintain the aesthetic appearance.

Figure B.9: Steel-Backed Timber Rail, SBT

Table B.12: Precast Concrete Guardwall Type 1, PCG

Test Level: 3

Standards Reference: M 618-2

Description: This is a precast, reinforced concrete wall capped with artificial stone facing. The wall functions as a rigid vertical faced barrier.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$575.00	$750.00	Deflection	0.0	0.0	0.0
		System Depth	1.2	1.2	1.2
		Total	1.2	1.2	1.2
Beam Description: 685 mm high and 650 mm wide, with a 360 x 1050 mm footer.					
Post Description: N/A					
Compatibility: A terminal section is available.					

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$175.00	$225.00	Deflection	0.0	0.0	0.0
		System Depth	4.0	4.0	4.0
		Total	4.0	4.0	4.0
Beam Description: 27 inches high and 26 inches wide, with a 12 inch X 42 inch footer.					
Post Description: N/A					
Compatibility: A terminal section is available.					

Potential Benefits: The artificial stone elements give the system a rustic appearance that may be appropriate for many park and forest settings.

Potential Problems: Initial cost is the primary problem, along with limited terminal options. Other problems include obstruction of views, drifting and storage of snow and pavement drainage.

Figure B.10: Precast Concrete Guardwall Type 1, PCG

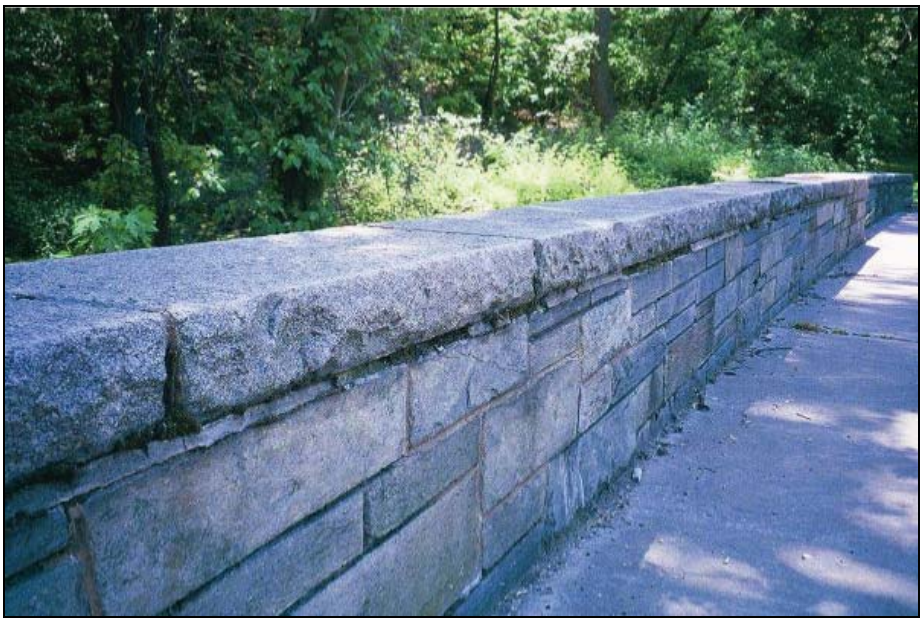

Table B.13: Stone Masonry Guardwall, SMG

Test Level: 3

Standards Reference: M620-1

Description: This is a reinforced concrete wall capped with a natural stone and mortar. The wall functions as a rigid vertical faced barrier.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$650.00	$1,000	Deflection	0.0	0.0	0.0
		System Depth	1.2	1.2	1.2
		Total	1.2	1.2	1.2
Beam Description: The concrete core is 685 mm high and 650 mm wide, with a 225 x 1050 mm footer, 150 mm below the ground and reinforcing steel.					
Post Description: N/A					
Compatibility: A sloping terminal design is available, but it must be placed outside the clear zone.					

U.S. Customary Units

Cost Range ($ / ft)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$200.00	$300.00	Deflection	0.0	0.0	0.0
		System Depth	4.0	4.0	4.0
		Total	4.0	4.0	4.0
Beam Description: The concrete core is 27 inches high and 16.5 inches wide, with a 9 inch X 42 inch footer, 6 inches below ground and reinforcing steel.					
Post Description: N/A					
Compatibility: A sloping terminal design is available, but it must be placed outside the clear zone.					

Potential Benefits: The stone elements give the system a rustic appearance that may be appropriate for many park and forest settings.

Potential Problems: Cost is the primary problem, along with limited terminal options. Other problems include obstruction of views, drifting and storage of snow and pavement drainage.

Figure B.11: Stone Masonry Guardwall, SMG

Table B.14: Random Rubble Cavity Wall, RCW

Test Level: 1

Standards Reference: Park Service Drawings

Description: This is a reinforced concrete wall capped with a natural stone and mortar. The wall functions as a rigid vertical faced barrier.

Metric Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (m)**			
Low	High	Speed:	30 –50 km/h	55 – 70 km/h	80 (+) km/h
$500	$750	Deflection	0.0		
		System Depth	0.6		
		Total	0.6		
Beam Description: 685 mm high with a core wall height of 510 mm above grade and a width of 600 mm. The steel reinforced concrete footing is 225 mm by 1050 mm, 150 mm below ground level.					
Post Description: N/A					
Compatibility: A terminal can be constructed by flaring the barrier to beyond the clear zone.					

U.S. Customary Units

Cost Range ($ / m)		**Minimum Barrier – Hazard Offset (ft)**			
Low	High	Speed:	20 – 30 mph	35 – 45 mph	50 (+) mph
$150	$225	Deflection	0		
		System Depth	2		
		Total	2		
Beam Description: 27 in high with a core wall height of 20 in above grade and a width of 24 in. The steel reinforced concrete footing is 9 in by42 in, 6 in below ground level.					
Post Description: N/A					
Compatibility: A terminal can be constructed by flaring the barrier to beyond the clear zone.					

Potential Benefits: The stone elements give the system a rustic appearance that may be appropriate for many park and forest settings. The smaller design of a TL-1 system is less expensive to construct than the SMG.

Potential Problems: Cost is the primary problem, along with limited terminal options. Other problems include obstruction of views, drifting and storage of snow and pavement drainage.

Figure B.12: Random Rubble Cavity Wall, RCW