Capital Costs for Roadside/Median Barrier Systems

The following basic costs for different roadside barrier systems were developed for use with Alberta Infrastructure and Transportation's new Roadside Design Guide. These costs can be used by designers to compare costs and to do cost-benefit-analysis of different roadside barrier systems, and for budget purposes.

The costs are presented in two sets of tables (one set for post-mounted barrier systems and one set for concrete barrier systems). The tables show a base cost per metre and modification cost for site/job specific features such as soil condition, short-runs and remoteness of location. Separate costs are provided for end treatments of the different barrier systems.

The costs were determined using both average unit prices from past contracts and cost estimates provided by contractors specializing in the installation of barrier systems. For the post-mounted systems, a contractor provided current (2007 dollars) estimates for the four post-mounted barrier systems. For the weak post W-beam and the strong post W-beam, there was sufficient AIT contract unit price data to compare with the estimate received from the contractor. Allowing for inflation, the contractor estimated unit price is fairly consistent with the contract unit price data. For the Modified Thrie beam and High Tension Cable Systems, there was practically no AIT contract unit price data. The contractor's estimates for these systems were compared with some earlier estimates of these systems and a discussion was carried with a contractor that recently installed a High Tension Cable System. Using a combination of this information and data received, unit prices were arrived at for the Modified Thrie Beam and High Tension Cable Systems.

For the concrete barrier systems, a contractor specializing in installation of concrete barriers provided current (2007 dollars) estimate for six concrete barrier systems (two pre-cast and four slip-formed shapes). Recent AIT contract unit price data on concrete barrier was very limited. However, there was some older contract data on the F-Shape Barrier. This information was adjusted for inflation to 2007 dollars and compared to the contractor's estimate for the F-Shape Barrier. Using a combination of contractor's and AIT's unit price contract data, unit cost were arrived at for the F-Shape Barrier. The unit costs for the other shapes were adjusted to be proportional to the prices received from the contractor.

These unit costs are believed to be relatively accurate for comparison of the different systems and for cost-benefit analysis. These costs should be revised as more contract price data become available on future projects.

Capital Cost Comparison of Alterative POST-MOUNTED Barrier Systems for use on Alberta Transportation Projects (Pricing in 2007 dollars)

Barrier System:	**Weak Post W-Beam** Barrier	**Strong Post W-Beam** Barrier		**Modified Thrie Beam** Barrier		**High Tension Cable** Barrier
Drawing Reference:	*(TEB-3.12)*	*(TEB-3.09)*	*(no RDG dwg)*	*(TEB 3.70)*	*(no RDG dwg)*	*(See note 3)*
Application[2]:	Roadside	Roadside	Median	Roadside	Median	Roadside/Median
NCHRP Report 350 Test Level:	TL - 3	TL - 3	TL - 3	TL - 4	TL - 4	TL - 4 system
Base Rate[1]:	**$ 90/ m**	**$ 135/ m**	**$165/ m**	**$ 225/ m**	**$300/ m**	**$ 110/ m**[4]
Premium for Rocky Soil Conditions	*add $20/ m*	*add $30/ m*	*add $30/ m*	*add $30/ m*	*add $30/ m*	*add $30/ m*
Premium for Short Run (less than 200 m of barrier)	*add $25/ m*	*add $35/ m*	*add $35/ m*	*add $45/ m*	*add $45/ m*	*add $65/ m*
Premium for Semi-Remote Installation (based on 4 hour commute one-way)	*add $10/ m*	*add $10/ m*	*add $10/ m*	*add $10/ m*	*add $10/ m*	*add $10/ m*
Premium for Remote Installation (based on 6 hour commute one-way)	*add $15/ m*	*add $15/ m*	*add $15/ m*	*add $15/ m*	*add $15/ m*	*add $15/ m*

[1]Note: "Base Rate" is based on the following conditions:
- Barrier system installed in engineered backfill material (granular base course) along edge of pavement.
- Pavement road structure already in place.
- Runs of at least 200 m in length.
- Installation site within a 2 hour commute from Contractor's office/yard (one-way travel).
- Cost of barrier end treatments (such as energy or non-energy barrier terminal) not included.
-Traffic Accommodation not included.

[2]Note: Roadside application is an application where the barrier is intended for impact from one side only. On divided highways, these barriers are normally used on the right side of the roadway or on the left (median) side of the roadway for wide medians where the barrier is located outside of the clear zone for opposing direction of traffic.

Median application is an application where the barrier is intended for impact from both sides. These barriers are normally used for application on the median side of divided highways with narrow medians. For Strong Post W-Beam and Thrie Beam barriers, a median application has guardrail on both sides of the post.

[3]Note: AIT has currently approved the following three proprietary High Tension Cable Barrier Systems for use on Alberta highways: 1) Brifen, 2) Gibraltar, and 3) Trinity CASS. Drawings may be downloaded from the proprietor's website.

[4]Note: AIT has tendered one 10 km long job for a High Tension Cable System. The price for this job was $61.25/m plus $20,000 per end anchor. However, this price is not considered typical.

Capital Cost Comparison of Alterative End Treatments for POST-MOUNTED Barriers for use on Alberta Transportation Projects (Pricing in 2007 dollars)

	Non-Energy Absorbing End Treatments		
End Treatment:	**W-Beam Cable Anchor[3]**	**Thrie Beam Cable Anchor[3]**	**High Tension Cable End**
Barrier System:	(W-Beam Barrier)	(Thrie Beam Barrier)	(High Tension Cable Barrier)
Drawing Reference:	*(RDG-B1.1)*	*(RDG-B5.1)*	*(Refer to Proprietor's Dwgs)*
Application[2]:	Roadside/Median	Roadside/Median	Roadside/Median
NCHRP Report 350 Test Level:	N/A	N/A	TL-3
Base Rate[1] (Per End):	**$2,500**	**$3,500**	**$6,500**

	Energy Absorbing End Treatments[4]					
End Treatment:	**ET PLUS / ET 2000**	**FLEAT 350**	**FLEAT MT**	**SKT 350**	**CAT 350**	**Thrie Beam Bullnose**
Barrier System:	(W-Beam Barrier)	(W-Beam Barrier)	(W-Beam Barrier)	(W-Beam Barrier)	(W-Beam Barrier)	(Thrie Beam Barrier)
Drawing Reference:	*(RDG-B1.4)*	*(RDG-B1.5)*	*(RDG-B1.6)*	*(see note 5)*	*(RDG-B1.7)*	*(TEB-3.60 sheets 1 to 9)*
Application[2]:	Roadside	Roadside	Median	Roadside	Roadside/Median	Roadside/Median
NCHRP Report 350 Test Level:	TL-3	TL-3	TL-3	TL-3	TL-3	TL-3
Base Rate[1] (Per End):	**$6,500**	**$6,500**	**$7,900**	**$8,500**	**$16,500**	**$15,000**

[1]Note: "Base Rate" is based on the following conditions:
- Pavement road structure already in place.
- Installation site within a 2 hour commute from Contractor's office/yard (one-way travel).
- The contractor who installed the barrier system is the same contractor installing the barrier end treatment.
- Therefore, premium for travel cost to remote and semi-remote locations covered in premium for barrier installation.
- Traffic Accommodation cost not included.

[2]Note: Roadside application is an application where the barrier is intended for impact from one side only. On divided highways, these barriers are normally used on the right side of the roadway or on the left (median) side of the roadway for wide medians where the barrier is located outside of the clear zone for opposing direction of traffic.

Median application is an application where the barrier is intended for impact from both sides. These barriers are normally used for application on the median side of divided highways with narrow medians. For Strong Post W-Beam and Thrie Beam barriers, a median application has guardrail on both sides of the post.

[3]Note: For use on the leaving end of a W-Beam/Thrie Beam barrier only or on the approach end when installed at or beyond the clear zone.

[4]Note: For use on the approach end of a W-Beam/Thrie Beam barrier when installed inside the clear zone.

[5]Note: Details of the Sequential Kinking Terminal (SKT) are available on the proprietor's website for Road Systems, Inc.

Capital Cost Comparison of Alterative CONCRETE Barrier Systems for use on Alberta Transportation Projects
(Pricing in 2007 dollars)

Barrier System:	**PRECAST** Concrete "**F-Shape**" Barrier (810 mm high)	**PRECAST** Concrete "**Single Slope**" Barrier (910 mm high)	**Slip-Formed** Concrete "**F-Shape**" Barrier (810 mm high)	**Slip-Formed** Concrete "**Single Slope**" Barrier (900 mm high)	**Slip-Formed** Concrete "**Tall Wall**" Barrier (1050 mm high)
Drawing Reference:	*(CB6-4.2M16)*	*(see note 3)*	*(CB6-4.3M3)*	*(RDG-B6.1)*	*(see note 4)*
Application[2]:	Roadside/Median	Roadside/Median	Roadside/Median	Roadside/Median	Roadside/Median
NCHRP Report 350 Test Level:	TL - 3	TL - 3	TL - 4	TL - 4	TL - 5
Base Rate[1&5]:	**$ 335/ m**	**$ 375/ m**	**$ 275/ m**	**$ 310/ m**	**$ 345/ m**
Premium for Short Run (less than 200 m of barrier)	*add $30/ m*	*add $30/ m*	*add $120/ m*	*add $120/ m*	*add $120/ m*
Premium for Semi-Remote Installation (based on 4 hour commute one-way)	*add $25/ m*	*add $30/ m*	*add $25/ m*	*add $30/ m*	*add $35/ m*
Premium for Remote Installation (based on 6 hour commute one-way)	*add $40/ m*	*add $45/ m*	*add $40/ m*	*add $45/ m*	*add $55/ m*

[1]Note: "Base Rate" is based on the following conditions:
- Pre-grading already in place. Barriers supported on existing granular base course of road structure or placed directly on the finished wearing surface.
- Runs of at least 200 m in length.
- Installation site within a 2 hour commute from Contractor's office/yard (one-way travel).
- Cost of barrier end treatments (such as tapered end or crash cushion) not included.
- Traffic Accommodation not included.
- Cost does not include initial cost of forms.

[2]Note: Roadside application is an application where the barrier is intended for impact from one side only. On divided highways, these barriers are normally used on the right side of the roadway or on the left (median) side of the roadway for wide medians where the barrier is located outside of the clear zone for opposing direction of traffic.

Median application is an application where the barrier is intended for impact from both sides. These barriers are normally used for application on the median side of divided highways with narrow medians. For Strong Post W-Beam and Thrie Beam barriers, a median application has guardrail on both sides of the post.

[3]Note: Alberta Infrastructure and Tranpsortation does not currently have a typical barrier drawing for the precast concrete single slope barrier. Details of this portable barrier may be found on the California Department of Transportation website under the standard plan titled "Portable Concrete Barrier (Type 60K)". This reinforced barrier comes in 4.0 m long precast segments 'connected together using two 31.8 mm diameter steel pins 760 mm long at each joint. The FHWA has approved this barrier as meeting the requirements of TL - 3.

[4]Note: The Tall Wall barrier was developed by the Ministry of Transportation of Ontario (MTO) and has been approved by the FHWA as meeting the requirements of TL - 5. Details of this unreinforced barrier are available on the MTO's website as standard drawing OPSD-911.132 Type TW.

[5]Note: Consideration should be given to the lower maintenance cost of concrete barrier systems when evaluating life cycle costing.

Capital Cost Comparison of Alterative End Treatments for CONCRETE Barriers[3] for use on Alberta Transportation Projects
(Pricing in 2007 dollars)

Energy Absorbing End Treatments[4]

End Treatment:	**QuadTrend 350**	**Quadguard CZ**	**Quadguard HS/Elite**	**Quadguard LMC**	**TRACC**	**TAU II**	**CAT 350**	**Sand Barrel System**
Drawing Reference:	*(RDG-B6.9)*	*(RDG-B6.9)*	*(RDG-B6.9)*	*(RDG-B6.9)*	*(RDG-B6.8)*	*(no RDG dwg)*	*(RDG-B1.7 & RDG-B6.12)*	*(TEB-3.19)*
Application[2]:	Roadside/Median	Roadside/Median	Roadside/Median	Roadside/Median	Roadside/Median	Roadside/Median	Roadside/Median	Roadside/Median
NCHRP Report 350 Test Level:	TL - 3	TL - 3	TL - 3	TL - 3	TL - 3	TL - 3	TL - 3	TL - 3
Base Rate[1](Per End):	**$24,000**	**$56,000**	**$73,000**	**$116,000**	**$57,500**	**$41,300**	**$16,500**	**$11,500**

[1]Note: "Base Rate" is based on the following conditions:
- Installation is for the end of a concrete **median** barrier.
- Pre-grading of granular base course of road structure already in place.
- Installation site within a 2 hour commute from Contractor's office/yard (one-way travel).
- The contractor who installed the barrier system is the same contractor installing the barrier end treatment.
- Therefore, premium for travel cost to remote and semi-remote locations covered in premium for barrier installation.
- Traffic Accommodation cost not included.
- Test level ratings greater than TL-3 are available for some energy absorbing end treatments. Refer to proprietor drawings.

[2]Note: Roadside application is an application where the barrier is intended for impact from one side only. On divided highways, these barriers are normally used on the right side of the roadway or on the left (median) side of the roadway for wide medians where the barrier is located outside of the clear zone for opposing direction of traffic.

Median application is an application where the barrier is intended for impact from both sides. These barriers are normally used for application on the median side of divided highways with narrow medians. For Strong Post W-Beam and Thrie Beam barriers, a median application has guardrail on both sides of the post.

[3]Note: Roadside concrete barriers may be terminated using post-mounted energy absorbing barrier end treatments if a transition to a Thrie Beam and then a Strong Post W-beam is provided. Refer to drawings RDG-B6.12, RDG-B6.13 and RDG-B6.15.

[4]Note: For use on the approach end of a concrete barrier system. Concrete barriers may be terminated with a blunt end on the leaving end for roadside applications. Terminating with a blunt end on the leaving end may also be used for median applications when installed at or beyond the clear zone for the opposing direction of traffic.