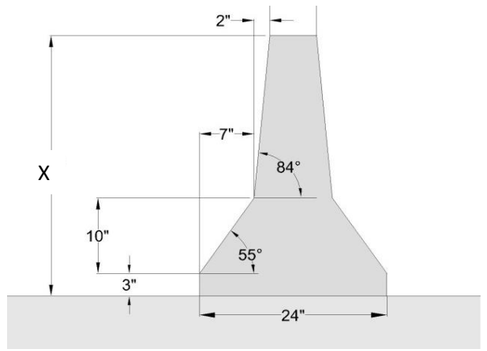
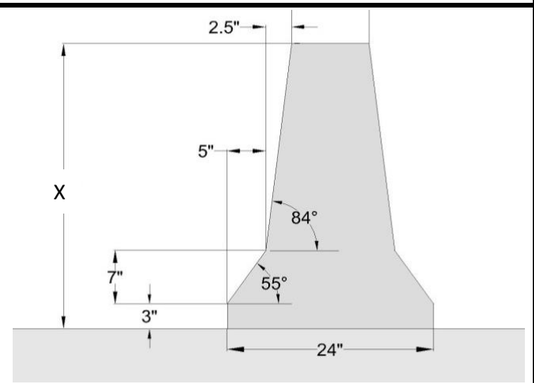
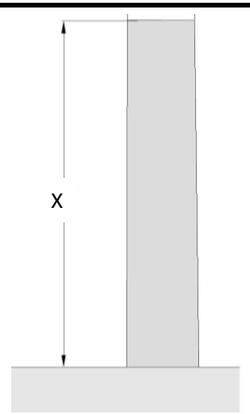
Cast-In-Place Concrete Barriers

NOTE: Reinforcing steel in each of these barrier may vary and have been omitted from the drawings for clarity, only the Ontario Tall Wall was successfully crash tested as a unreinforced section.

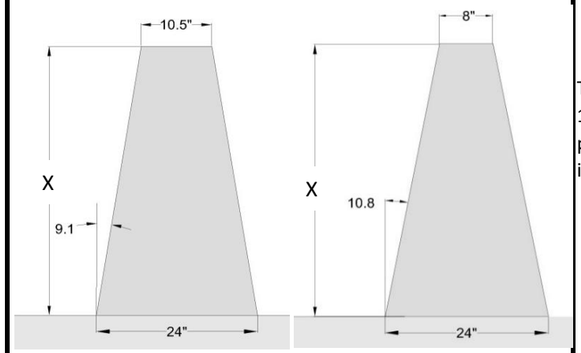
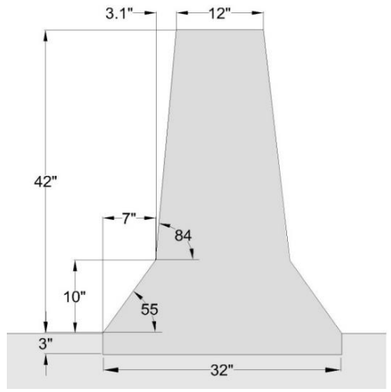
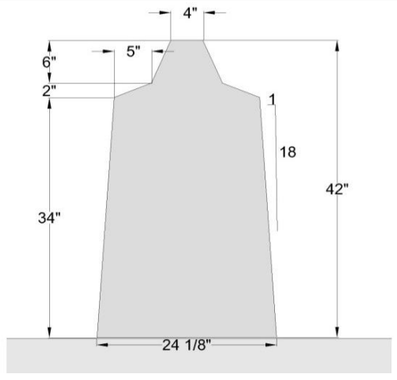
NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	PROFILE GEOMETRIC DIMENSIONS	CHARACTERISTICS
New Jersey Safety-Shape Barrier http://tf13.org/Guides/hardwareGuide/index.php?action=view&hardware=111 Elligibility Letter B-64 - Feb 14, 2000 (NCHRP 350)		TL-3 32" Tall TL-4 32" Tall TL-5 42" Tall		The New Jersey Barrier was the most widely used safety shape concrete barrier prior to the introduction of the F-shape. As shown, the "break-point" between the 55 deg and 84 deg slope is 13 inches above the pavement, including the 3 inch vertical reveal. The flatter lower slope is intended to lift the vehicle which absorbs some energy, and allows vehicles impacting at shallow angles to be redirected with little sheet metal damage; however, it can cause significant instability to vehicles impacting at high speeds and angles.
F-shape Barrier http://tf13.org/Guides/hardwareGuide/index.php?action=view&hardware=109 Elligibility Letter B-64 - Feb 14, 2000 (NCHRP 350)		TL-3 32" Tall TL-4 32" Tall TL-5 42" Tall		The F-shape has the same basic geometry as the New Jersey barrier, but the "break-point" between the lower and upper slopes is 10 inches above the pavement. This modification results in less vehicle climb in severe impacts and improved post-crash trajectories. The 7.5 inch horizontal distance from the toe of the F-shape to its top corner also reduces the roll angle of impacting trucks and other vehicles with high centers-of-gravity. NOTE: 8" minimum top width.
Vertical Concrete Barrier Elligibility Letter B-64 - Feb 14, 2000 (NCHRP 350)		TL-3 32" Tall TL-4 32" Tall TL-5 42" Tall		A vertical concrete barrier may be a good choice where either vehicle lift or roll must be minimized, such as when shielding a bridge pier. This shape offers the best post-crash trajectories with no lift and only slight roll, pitch, and yaw angles. Lateral deceleration forces may be somewhat higher than with a safety shape design.

GENERAL NOTES:

1. It is user responsibility to appropriately utilize all available information on crash testing including review of the device crash test report. The crash test report contains all reportable information on crash testing that is not necessarily considered a pass/fail criterion.
2. For a complete copy of the eligibility letter, visit FHWA website at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/listing.cfm?code=long

Cast-In-Place Concrete Barriers

NOTE: Reinforcing steel in each of these barrier may vary and have been omitted from the drawings for clarity, only the Ontario Tall Wall was successfully crash tested as a unreinforced section.

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	PROFILE GEOMETRIC DIMENSIONS	CHARACTERISTICS
Single (Constant) Slope Barrier CalTrans design – 9.1 degree slope Texas design - 10.8 degree slope Elligibility Letter B-17, dated Feb. 11, 1992 (NCHRP, TX) B-45, dated Feb 4, 1998 (NCHRP, CA)		TL-3 32" Tall TL-4 32" Tall TL-5 42" Tall		The 9.1 degree single-slope barrier with the 10.5" top width was developed by California. The 10.8 degree single-slope barrier with a 8" top width was developed by Texas. This barrier performs comparably to the F-shape barrier under the (severe) test conditions, with good post-impact vehicle trajectories.
Ontario Tall Wall Median Barrier http://tf13.org/Guides/hardwareGuide/index.php?action=view&hardware=113 Elligibility Letter B-19, dated May 13, 1992 (NCHRP)		TL-5 42" Tall		The lower portion of the barrier is very similar to the F shape barrier with its slope "break-point" 10 inches above the pavement. However this barrier is taller and has a larger footprint (32" vs. 24") than the standard F-shape and has no reinforcing steel.
Concrete Median Barrier Incorporating Head Ejection Criteria Elligibility Letter B-182, dated Nov. 14, 2008 (NCHRP)		TL-5 42" Tall		This concrete median barrier was developed to redirect vehicles ranging from small cars to fully-loaded tractor trailers, while safely doing the following: · Maximizing stability in passenger vehicles by limiting wheel climb and roll. · Addressing occupant safety by limiting peak impact forces · Preventing "head slap" · Providing an economical alternative to existing concrete barrier design.

GENERAL NOTES:

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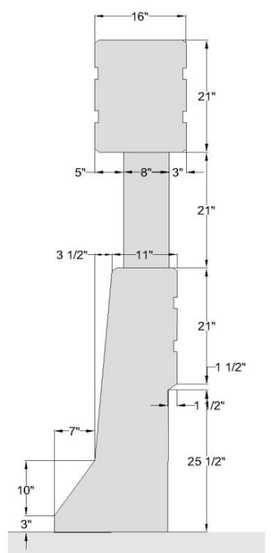
2. For a complete copy of the eligibility letter, visit FHWA website at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/listing.cfm?code=long

Cast-In-Place Concrete Barriers

NOTE: Reinforcing steel in each of these barrier may vary and have been omitted from the drawings for clarity, only the Ontario Tall Wall was successfully crash tested as a unreinforced section.

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	PROFILE GEOMETRIC DIMENSIONS	CHARACTERISTICS
Texas T5 Modified Bridge Rail (i.e., 'Roman Wall')		TL-6 90" Tall		This barrier was developed as a TL-6 design to contain and redirect vehicles up to an 80,000 lb. tractor tanker. The base is essentially a New Jersey barrier slope, followed by an open "window" design, and topped by a continuous reinforced concrete beam 21 inches high and 16 inches deep. It has been used in the US as a bridge railing, a median barrier and as a roadside barrier.

GENERAL NOTES:

1. It is user responsibility to appropriately utilize all available information on crash testing including review of the device crash test report. The crash test report contains all reportable information on crash testing that is not necessarily considered a pass/fail criterion.
2. For a complete copy of the eligibility letter, visit FHWA website at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/listing.cfm?code=long

Crash Cushions

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS			TEST LEVEL	DIMENSIONS			LOCATIONS		HOW IT WORKS	LOCATIONS CAN BE USED	MAINTENANCE CHARACTERISTICS (per AASHTO RDG)
			Non-Redirective, Gating	Redirective, Gating	Redirective, Non-gating	NCHRP 350	WIDTH (without transitions)	LENGTH	HEIGHT	PERMENANT	TEMPORARY			
Energite		Energy Absorption Systems	X			TL-2, TL-3	Varies to fit site	VARIABLE (30 to 65 mph)	32" to 36"	X	X	Sand-filled plastic barrels dissipate the kinetic energy of an impacting vehicle by transferring the vehicle's momentum to the variable masses of sand in the barrels that are hit.	Temporary Construction Worksites i.e. Ends of Concrete Barriers; Gore Two-sided Protection; Wide Medians; Bridge Piers	Sacrificial
Fitch		Energy Absorption Systems	X			TL-2, TL-3	Varies to fit site	VARIABLE (30 to 65 mph)	33"	X	X	Sand-filled plastic barrels dissipate the kinetic energy of an impacting vehicle by transferring the vehicle's momentum to the variable masses of sand in the barrels that are hit.	Temporary Construction Worksites i.e. Ends of Concrete Barriers; Gore Two-sided Protection; Wide Medians; Bridge Piers	Sacrificial
Big Sandy http://www.traffixdevices.com/cgi-local/SoftCart.exe/bigsandy.htm?E+scstore		Traffix Devices	X			TL-2, TL-3	Varies to fit site	VARIABLE (30 to 65 mph)	35" to 47"	X	X	Sand-filled plastic barrels dissipate the kinetic energy of an impacting vehicle by transferring the vehicle's momentum to the variable masses of sand in the barrels that are hit.	Temporary Construction Worksites i.e. Ends of Concrete Barriers; Gore Two-sided Protection; Wide Medians; Bridge Piers	Sacrificial
CrashGard https://pss-innovations.com/driver-safety/crashgard-sand-barrel-system		Plastic Safety Systems	X			TL-2, TL-3	Varies to fit site	VARIABLE (25 to 70 mph)	53"	X	X	Sand-filled plastic barrels dissipate the kinetic energy of an impacting vehicle by transferring the vehicle's momentum to the variable masses of sand in the barrels that are hit.	Temporary Construction Worksites i.e. Ends of Concrete Barriers; Gore Two-sided Protection; Wide Medians; Bridge Piers	Sacrificial
RAPTOR https://www.lindsay.com/usca/en/infrastructure/brands/barrier-systems/solutions/specialty-barrier-systems/		Lindsay Barrier Systems, Inc.	X			TL-1	45"	8'-0" and 9'-0"	41"	X		Enclosed energy absorbing material crushes on impact.	Poles/trees located close to the road.	Sacrificial
Absorb 350 https://www.lindsay.com/usca/en/infrastructure/brands/barrier-systems/solutions/crash-cushions/absorb/		Lindsay Barrier Systems, Inc.	X			TL-2, TL-3	24"	VARIABLE 19'-4" (45 mph) to 32'-0" (60 mph)	32"	X	X	Plastic waterfilled elements allow vehicles to be decelerated.	Temporary Construction worksite. Narrow spaces Roadsides, exits and wide medians. Any locations where it is safe for the post impact trajectories to be on the back side of the system.	Sacrificial

Crash Cushions

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS			TEST LEVEL	DIMENSIONS			LOCATIONS		HOW IT WORKS	LOCATIONS CAN BE USED	MAINTENANCE CHARACTERISTICS (per AASHTO RDG)
			Non-Redirective, Gating	Redirective, Gating	Redirective, Non-gating	NCHRP 350	WIDTH (without transitions)	LENGTH	HEIGHT	PERMENANT	TEMPORARY			
ACZ350 https://trinityhighway.com/product/acz-350/		Trinity Highway Products	X			TL-2, TL-3	20"	31'-7"	33"		X	Plastic waterfilled elements allow vehicles to be decelerated.	Temporary Construction worksite. Narrow spaces Roadsides, exits and wide medians. Any locations where it is safe for the post impact trajectories to be on the back side of the system.	Sacrificial
SLED https://www.traffixdevices.com/products/attenuators/sled-us		Traffix Devices	X			TL-2, TL-3	24"	18'-11" (45 mph) and 26'-0" (60 mph)	46"		X	Plastic waterfilled elements allow vehicles to be decelerated.	Temporary Construction worksite. Narrow spaces Roadsides, exits and wide medians. Any locations where it is safe for the post impact trajectories to be on the back side of the system.	Sacrificial
NEAT https://trinityhighway.com/product/n-e-a-t/		Trinity Highway Products	X			TL-2	22.5"	10'-0"	32"		X	Energy absorbing hex foam surrounded by aluminum sheeting is crushed upon impact.	Temporary Construction Worksite. Any locations where it is safe for the post impact trajectories to be on the back side of the system.	Sacrificial
Thrie-Beam Bullnose Guardrail System http://www.fhwa.dot.gov/publications/publicroads/99janfeb/jungle.cfm		Generic		X		TL-3	14'-9" but can vary	Varies 50' minimum	31.6"	X		Breakaway posts and slots in thrie-beam rail weaken the system allowing rail to collapse. Cables inside rail help to capture vehicle.	Wide medians, connections at bridge openings, bridge piers.	Sacrificial
CIAS Connecticut Impact Attenuating System http://www.ct.gov/dot/cwp/view.asp?a=1387&q=259608		Generic		X		TL-3	144"	25'-6"	48"	X		Hollow steel cylinders, some reinforced, crush upon impact. Total 14 cylinders. Requires Paved Pad.	Shield ends of wide hazards.	Sacrificial
NCIAS Narrow Connecticut Impact Attenuating System http://www.ct.gov/dot/cwp/view.asp?a=1387&q=259626		Generic		X		TL-3	36"	24'-0"	48"	X		Hollow steel cylinders, some reinforced, crush upon impact. Cables on the side are for traffic face impacts. Total 8 cylinders. Requires Paved Pad.	Shield ends of narrow hazards.	Sacrificial

Crash Cushions

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS			TEST LEVEL	DIMENSIONS			LOCATIONS		HOW IT WORKS	LOCATIONS CAN BE USED	MAINTENANCE CHARACTERISTICS (per AASHTO RDG)
			Non-Redirective, Gating	Redirective, Gating	Redirective, Non-gating	NCHRP 350	WIDTH (without transitions)	LENGTH	HEIGHT	PERMENANT	TEMPORARY			
Advanced Dynamic Impact Extension Module (ADIEM) https://trinityhighway.com/product/adiem/		Trinity Highway Products		X		TL-3	20"	30'-0"	Varies		X	Lightweight crushable concrete allows vehicles to be decelerated. The modules are placed on a high-strength tapered concrete base.	Wide median protection. Because of durability of concrete modules, system is more suited for temporary applications.	Sacrificial
BEAT-SSCC Single Sided Crash Cushion http://www.roadsystems.com/beat-sscc.html		Road Systems, Inc.		X		TL-3	24"	28'-0" standard but available in lengths of 32', 36', 40', 44'	28"	X		Mandrel section of the impact head bursts the tubing to absorb the impact energy. Attaches directly to rigid barriers, bridge rails and abutments.	Shoulder Protection Ground mounted or surface mounted post on a concrete pad.	Sacrificial
BEAT-BP Bridge Pier System http://www.roadsystems.com/beat-bp.html		Road Systems, Inc.		X		TL-3	Variable to adjust to pier widths	Variable to adjust to number of piers and pier spacing. i.e. 1 pier = 79', 2 pier = 103', 3 pier = 115', 4 pier = 151'	28"	X		Mandrel section of the impact head bursts the tubing to absorb the impact energy. System completely surrounds piers and has attenuator at both approach ends.	Median protection at bridge piers.	Sacrificial
Quadtrend http://www.energyabsorption.com/products/products_quadtrend350_end.asp		Energy Absorption Systems		X		TL-3	15"	20'-0"	32"	X		Quadbeam rail sections translate downstream while sand filled containers are crushed. Attaches directly to rigid barriers, bridge rails and abutments. Requires redirecting cable on backside of system to direct the rail sections away from traffic. Requires Paved Pad.	Shoulder protection at the end of rigid barriers	Sacrificial
X-TENuator https://www.lindsay.com/usca/en/infrastructure/brands/barrier-systems/solutions/crash-cushions/x-tenuator-crash-cushion/		Lindsay Barrier Systems, Inc.			X	TL-3	21"	24'-9"	27.75"	X	X	Impact head has locking bar to lock cables into place. The friction between the cables and the impact head dissipates crash energy.	Median or shoulder Protection Gore Two-side Protection	Sacrificial

Crash Cushions

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS			TEST LEVEL	DIMENSIONS			LOCATIONS		HOW IT WORKS	LOCATIONS CAN BE USED	MAINTENANCE CHARACTERISTICS (per AASHTO RDG)
			Non-Redirective, Gating	Redirective, Gating	Redirective, Non-gating	NCHRP 350	WIDTH (without transitions)	LENGTH	HEIGHT	PERMENANT	TEMPORARY			
QUEST https://trinityhighway.com/product/quest/		Trinity Highway Products			X	TL-2, TL-3	24" 30" 36"	22'-0" (45 mph or less) 28'-0" (50 mph or greater) 34' -0" (70 mph)	31"	X		Consists of a series of W-Beam fender panels supported by diaphragms with a trigger mechanism at the nose that releases the front assembly. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Refer to Manufacturer
Trinity Attenuating Crash Cushion (TRACC) Family https://trinityhighway.com/product/tracc-crash-cushion/		Trinity Highway Products			X	TL-2, TL-3	FASTRACC: 24" TRACC: 24" SHORTRACC: 24" WIDEFAST TRACC: 71"-139" WIDETRACC: 58" 127" WIDESHORT: 39"-108"	25'-9" (70 mph) 21'-3" (50 mph or greater) 14'-3" (45 mph or less) 25'-8" to 48'-10" (70 mph) 21'-0" to 44'-2" (50 mph or greater) 14'-1" to 37'-3" (45 mph or less)	32"	X	X	Metal is sheared at the base and double sets of W-Beam rails translate. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Refer to Manufacturer
QuadGuard Family QuadGuard, QuadGuard-II (NCHRP 350) https://trinityhighway.com/product/quadguard-ii/		Energy Absorption Systems			X	TL-2, TL-3	NARROW: 24", 30" and 36" WIDE: 69" or 90"	VARIABLE 9'-0" (45 mph) to 27'-0" (70 mph) VARIABLE 12'-0" (50 mph) to 27'-0" (70 mph)	32"	X	X	Hex-foam cartridges crush upon impact. Specially fabricated side panels having four corrugations slide back on a single track when struck head-on. Energy absorbing cartridges in each bay need to be replaced after a crash. Requires Paved Pad. Using a transition can be directly attached to a W-beam or thrie beam median barrier or concrete safety shape.	Median or shoulder Protection Gore Two-side Protection	Reusable

Crash Cushions

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS			TEST LEVEL	DIMENSIONS			LOCATIONS		HOW IT WORKS	LOCATIONS CAN BE USED	MAINTENANCE CHARACTERISTICS (per AASHTO RDG)
			Non-Redirective, Gating	Redirective, Gating	Redirective, Non-gating	NCHRP 350	WIDTH (without transitions)	LENGTH	HEIGHT	PERMENANT	TEMPORARY			
Universal TAU II Family https://www.lindsay.com/usca/en/infrastructure/brands/barrier-systems/solutions/crash-cushions/tau/		Barrier Systems, Inc.			X	TL-2, TL-3	NARROW: Up to 36" WIDE: 42" up to 102" in 6" increments	VARIABLE 8'-6" (30 mph) to 37'-0" (75 mph) VARIABLE 8'-8" (30 mph) to 31'-6" (70 mph)	32"	X	X	Energy absorbing cartridges crush upon impact. Thrie beam panels slide back when struck head-on. Anchored at the front and rear of system. Width and lengths are variable depending on hazards, site conditions and design speed. Energy absorbing cartridges in each bay need to be replaced after a crash. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Reusable
EASI-CELL	 Not being produced	Energy Absorption Systems	X			TL-1	51" but can vary	8'-6" but can vary	39"	X		Clusters of high molecular weight, high density polyethylene collapse to absorb energy of impacting vehicle.	Low Speed, High frequency impact sites.	Low-Maintenance
TAU II R https://www.lindsay.com/usca/en/infrastructure/brands/barrier-systems/solutions/crash-cushions/tau/		Lindsay Barrier Systems, Inc.			X	TL-2, TL-3	NARROW: Up to 36" WIDE: 42" up to 102" in 6" increments	VARIABLE 8'-6" (30 mph) to 37'-0" (75 mph) VARIABLE 8'-8" (30 mph) to 31'-6" (70 mph)	32"	X	X	Hyperelastic modules crush upon impact. Thrie beam panels slide back when struck head-on. Anchored at the front and rear of system. Width and lengths are variable depends on hazards, site conditions and design speed. Requires Paved Pad.	Median or shoulder Protection Gore Two-Side Protection	Low-Maintenance
Compressor https://www.traffixdevices.com/docs/attenuators/compressor/traffix-compressor_product-bulletin.pdf		Traffix Devices			X	TL-3	48.7"	21'-3"	53.5"	X		Modules molded from High Density Polyethylene absorb the impact energy. Steel side panel translate during end-on impacts. The assembly is combined with Uni-Base. Requires Paved Pad.	Median or shoulder Protection Gore Two-Side Protection	Low-Maintenance

Crash Cushions

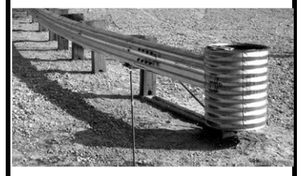
NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS			TEST LEVEL	DIMENSIONS			LOCATIONS		HOW IT WORKS	LOCATIONS CAN BE USED	MAINTENANCE CHARACTERISTICS (per AASHTO RDG)
			Non-Redirective, Gating	Redirective, Gating	Redirective, Non-gating	NCHRP 350	WIDTH (without transitions)	LENGTH	HEIGHT	PERMENANT	TEMPORARY			
Hybrid Energy Absorption Reusable Terminal (HEART) https://trinityhighway.com/product/heart/		Trinity Highway Products			X	TL-3	28"	15'-9 1/2" (45 mph or less) 28'-3" (50 mph or greater) 30'-9" (70 mph)	32.2"	X	X	High Molecular Weight / High Density Polyethylene side panels connected to steel diaphragms mounted on tubular steel tracks and compress upon impact. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Low-Maintenance
QuadGuard Elite https://trinityhighway.com/product/quadguard-elite/		Energy Absorption Systems			X	TL-2, TL-3	NARROW: 24" to 36" WIDE: 69" or 90"	5 Bay - 18'-0" (45 mph or less) 8 Bay - 27'-0" (50 mph or greater) 11 Bay - 36'-0" (70 mph) 7 Bay - 18'-0" (45 mph or less) 8 Bay - 27'-1" (50 mph or greater) 11 Bay - 36'-0" (70 mph)	32"	X	X	High Density Polyethylene cylinders and flex-belt nose collapse upon impact. Specially fabricated side panels having four corrugations slide back on a single track when struck head-on. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Low-Maintenance
Reusable Energy Absorbing Crash Terminal REACT 350 & REACT 350 II https://trinityhighway.com/product/react-350/		Energy Absorption Systems			X	TL-2, TL-3	NARROW: 30"-36" WIDE 60" WIDE 96" WIDE 120"	13'-9" and 15'-3" (45 mph) 19'-5" and 21'-3" (62 mph) REACT II 26'-9" and 30'-7" (70mph) 30'-10" 34'-9" 33'-10"	51.5" 46"	X	X	Hollow high molecular weight, high density polyethylene cylinders crush upon impact. Cables on the side are for side impacts. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Low-Maintenance

Crash Cushions

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS			TEST LEVEL	DIMENSIONS			LOCATIONS		HOW IT WORKS	LOCATIONS CAN BE USED	MAINTENANCE CHARACTERISTICS (per AASHTO RDG)
			Non-Redirective, Gating	Redirective, Gating	Redirective, Non-gating	NCHRP 350	WIDTH (without transitions)	LENGTH	HEIGHT	PERMENANT	TEMPORARY			
QuadGuard LMC		Energy Absorption Systems			X	TL-3	NARROW: 36" WIDE: 69" or 90"	5 Bay - 18'-0" (45 mph or less) 8 Bay - 27'-0" (50 mph or greater) 11 Bay - 36'-0" (70 mph) 7 Bay - 18'-0" (45 mph or less) 8 Bay - 27'-1" (50 mph or greater) 11 Bay - 36'-0" (70 mph)	32"	X	X	Elastic cylinders collapse upon impact. Specially fabricated side panels having four corrugations slide back on a single track when struck head-on. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Low-Maintenance
Smart Cushion Innovations (SCI) https://hillandsmith.com/products/smart-cushion/		Hill and Smith			X	TL-2, TL-3	24"	13'-8" (45 mph or less) 21'-8 1/4" (60 mph or greater)	33.4"	X	X	Hydraulic cylinders in the attenuator provides resistance used to stop the vehicle before it reaches the end of the cushion's usable length. Requires Paved Pad.	Median or shoulder Protection Gore Two-side Protection	Low-Maintenance

Roadside Terminals

Proper grading in advance of the system and a traversable runout area beyond the beginning of the system is required for all terminals. When the unshielded upstream roadside is similar to the area downstream of the terminal and it is impractical to extend the barrier, a lesser runout area may be permissible. Refer to AASHTO Roadside Design Guide

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS		TEST LEVEL	FLARED	TANGENT	DISTINGUISHING CHARACTERISTICS	LOCATIONS CAN BE USED
			Energy Absorbing	Non Energy Absorbing	NCHRP 350				
Breakaway Cable Terminal (BCT)		Generic		X	Does not meet Criteria	X		No impact head or ground strut between the two end posts. Should have a parabolic flare with a 4-ft offset at first post. Only two weakened posts.	Should not be used for new installations. (Shown on charts for identification purposes only)
Vermont G1-d		Generic		X	TL-2	X		No impact head. Shop-bent w-beam 5 ft flare. Concrete anchor block with steel rod connecting at post 3.	Driveway turnouts
Modified Eccentric Loader Terminal (MELT)		Generic		X	TL-2	X		No impact head. Rail installed on parabolic curve. Strut between the steel tube foundation for the two end posts to act together to resist the cable loads. All wood posts.	Should be installed at locations where runout area exists behind and downstream of the terminal. End of W-beam rail with offset of 4'-0".
Buried-in-Backslope Terminal		Generic		X	TL-3	X		No impact head. Height of W-beam rail should be held constant in relation to the roadway shoulder elevation until barrier crosses the ditch bottom. Rubrail should be added below the w-beam.	Cut sections of a roadway When the road transitions from a cut to a fill.
Regent-C		Energy Absorption Systems		X	TL-3	X		No impact head. Modified w-beam panels containing slots and includes a 1/2" diameter 6 x 9 wire rope nested into the traffic -face of the w-beam. Uses a standard strut and cable end anchorage and seven weakened wood post to support the rail.	Should be installed at locations where runout area exists behind and downstream of the terminal. End of W-beam rail with offset of 4'-0".
Eccentric Loader Terminal (ELT)		Generic		X	TL-3	X		End consists of a fabricated steel element inside a section of corrugated steel pipe. Rail installed on parabolic curve. Strut between the steel tube foundation for the two end posts to act together to resist the cable loads. All wood posts.	Should be installed at locations where runout area exists behind and downstream of the terminal. End of W-beam rail with offset of 4'-0".

Roadside Terminals

Proper grading in advance of the system and a traversable runout area beyond the beginning of the system is required for all terminals. When the unshielded upstream roadside is similar to the area downstream of the terminal and it is impractical to extend the barrier, a lesser runout area may be permissible. Refer to AASHTO Roadside Design Guide

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS		TEST LEVEL	FLARED	TANGENT	DISTINGUISHING CHARACTERISTICS	LOCATIONS CAN BE USED
			Energy Absorbing	Non Energy Absorbing	NCHRP 350				
Slotted Rail Terminal (SRT-350) http://www.highwayguardrail.com/products/et-srt350.html		Trinity Highway, LLC		X	TL-3	X		No impact head. Longitudinal slots on W-beam rail element. Strut and cable anchor bracket between post 1 and 2 act together to resist the cable loads. Slot Guards on downstream end of slots. Steel and wood post options available. Parabolic flare on wood post. Straight line flare on all SYTP steel post version and HBA steel/wood post version.	Should be installed at locations where runout area exists behind and downstream of the terminal. End of W-beam rail with offset of 4'-0". Wood post option has 3'-0" to 4'-0" offset.
Flared Energy-Absorbing Terminal (FLEAT) http://roadsystems.com/fleat.html		Road Systems, Inc.	X		TL-2, TL-3	X		Rectangular impact front face, with steel tube on top. Rail has 5 slots (1/2”x4” long) on both the top and bottom corrugations of the w-beam section. There may also be 3 additional (1/2”x4” long) slots in the valley of the rail which makes it interchangeable with the first SKT section. Breakaway steel end posts #1 and #2, standard steel guardrail post #3 and beyond. Cable anchor bracket is fully seated on the shoulder portion of the cable anchor bolts. All hinge steel post, plug weld steel posts, or wood posts available.	End of W-beam rail with offset of 2'-6" to 4'-0".
TREND 350 https://trinityhighway.com/product/trend-350-tangent/		Trinity Highway, LLC	X		TL-3		X	Rectangular Impact Face All steel driven posts. Breakaway steel posts at #1 and #2, standard steel guardrail posts #3 and beyond. Steel Strut between posts #1 and #2. During head on impacts the system telescopes rearward, using friction between the guardrail panels and deformation of the rail sections to decelerate the vehicle.	End of W-Beam rail with offset of 1' to 4'0"

Roadside Terminals

Proper grading in advance of the system and a traversable runout area beyond the beginning of the system is required for all terminals. When the unshielded upstream roadside is similar to the area downstream of the terminal and it is impractical to extend the barrier, a lesser runout area may be permissible. Refer to AASHTO Roadside Design Guide

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS		TEST LEVEL	FLARED	TANGENT	DISTINGUISHING CHARACTERISTICS	LOCATIONS CAN BE USED
			Energy Absorbing	Non Energy Absorbing	NCHRP 350				
Sequential Kinking Terminal (SKT) http://roadsystems.com/skt.html		Road Systems, Inc.	X		TL-2, TL-3		X	Square Impact Face. Has a feeder chute (channel section that surrounds the rail) that gets wider at the downstream end. Breakaway steel end posts #1 and #2 and standard steel guardrail posts #3 and beyond. Rail has 3 (1/2”x4” long) slots in the valley of the rail. There may also be an additional 5 slots (1/2”x4” long) on both the top and bottom corrugations of the w-beam section, which makes it interchangeable with the FLEAT section. Cable anchor bracket is fully seated on the shoulder portion of the cable anchor bolts. All hinge steel post, plug weld steel posts, or wood posts available.	End of W-beam rail with offset of 0 to 2'-0".
Extruder Terminal (ET-Plus) http://www.highwayguardrail.com/products/etplus.html		Trinity Highway, LLC	X		TL-2, TL-3		X	Rectangular Impact Front Face (Extruder Head). Rectangular holes in 1st rail support the tabs of the cable anchor bracket. Steel HBA and SYTP and wood post options are available. SYTP Retrofit in tube sleeve option available.	End of W-beam rail with offset of 0 to 2'-0".
X-Tension Guardrail End Terminal http://www.barriersystemsinc.com/xtension-guardrail-end-treatment		Barrier Systems, Inc.	X		TL-3	X	X	Impact head with locking bar to lock cables into place. Strut between the first post and a front anchor post. Steel and wood post options available. Tension Cable Based Energy Absorber. Two cables attached to soil anchor extend the entire length of the terminal.	End of W-beam rail with offset of 0 to 4'-0".

Roadside Terminals

Proper grading in advance of the system and a traversable runout area beyond the beginning of the system is required for all terminals. When the unshielded upstream roadside is similar to the area downstream of the terminal and it is impractical to extend the barrier, a lesser runout area may be permissible. Refer to AASHTO Roadside Design Guide

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS		TEST LEVEL	FLARED	TANGENT	DISTINGUISHING CHARACTERISTICS	LOCATIONS CAN BE USED
			Energy Absorbing	Non Energy Absorbing	NCHRP 350				
X-Lite Terminal http://www.barriersystemsinc.com/xlite-end-terminal		Barrier Systems, Inc.	X		TL-3	X	X	Only approved with steel post. Uses a slider mechanism between post 1 and 2 that gathers and retains the rail when hit. The anchor consists of posts #1 and #2 connected by tension struts and a soil plate below grade on post #2. Tangent systems uses 3 modified crimped posts and special shear bolts at second and third splice location. Flared layout uses 6 modified crimped posts and special shear bolts at second splice location. Flared layout uses blockout at post #2 where tangent does not.	End of W-Beam rail at tangent locations or at flared locations with a 4-ft offset
Wyoming Box-Beam End Terminal (WY-BET) http://www.highwayguardrail.com/products/et-wybet.html		Trinity Highway, LLC	X		TL-3		X	Square Impact Face. Nose plate welded and insert into box beam and held in place by an end wood post. Energy absorbing material inside the tubing crushes as the rails telescope. Uses an oversized outer tube that telescopes over the downstream tube. There is a strut between the first post and a second tube that has no post.	End of 6" x 6" box beam.
Bursting Energy Absorbing Terminal (BEAT) http://roadsystems.com/beat-beat-mt.html		Road Systems, Inc.	X		TL-3		X	Square Impact Face. The unique components of the terminal attach directly to standard box beam allowing part of box beam barrier to function as part of the terminal. Breakaway steel end post and a cable anchor system. Mandrel section of the impact head bursts the tubing to absorb the impact energy. End tube is 1/8". Remaining tubes are 3/16".	End of 6" x 6" box beam.

Median Terminals

Rev. April 19, 2021

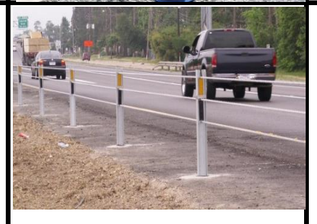
NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS		TEST LEVEL	DISTINGUISHING CHARACTERISTICS	HOW IT WORKS	LOCATIONS CAN BE USED
			Energy Absorbing	Non-Energy Absorbing	NCHRP 350			
Brakemaster 350 http://www.energyabsorption.com/products/products_brakemaster350_crash.asp		Energy Absorption Systems, Inc.	X		TL-3	Steel posts are not embedded. Break Tension System at post #1. Short W-Beam rail sections that translate over each other.	During head-on impacts, the system telescopes rearward, using friction technology to decelerate the vehicle.	Low frequency impact areas. In the median with 1-way or 2-way traffic.
Crash Cushion Attenuating Terminal (CAT-350) http://www.highwayguardrail.com/products/cat350.html		Trinity Highway Products, LLC	X		TL-3	Breakaway wood posts and a cable anchorage system. The beam elements are slotted W-beam rail sections. Nose is 10 gauge And first set of rails are 12 gauge and second set of rails are heavier 10 gauge.	During head-on impacts, the system telescopes rearward, shearing out tabs between the slots to decelerate the vehicle.	Low frequency impact areas. Attached directly to a W-Beam median barrier, or to a Thrie-Beam median barrier using the standard W-Beam to Thrie-Beam transition section.
TREND 350 Median http://www.highwayguardrail.com/products/median.html		Trinity Highway Products, LLC	X		TL-3	Square Impact Face. All steel driven posts. Breakaway steel posts at #1 and #2, standard steel guardrail posts #3 and beyond. Steel Strut between posts #1 and #2.	During head on impacts the system telescopes rearward, using between the system rails and the deformation of the rails to decelerate the vehicle.	Low Frequency impact areas. Attached directly to a W-Beam Median Barrier, or to a Thrie-Beam median barrier using the standard W-Beam to Thrie-Beam transition section.
FLEAT Median Terminal (FLEAT-MT) https://roadsystems.com/nchrp-350-fleat-mt/		Road Systems, Inc.	X		TL-3	Two impact heads, two modified W-beam rails, standard W-beam rails, two breakaway cable anchor assemblies and weakened steel or wood posts. Uses many of the same components as the roadside FLEAT terminal.	During head-on impacts, the impact head translates down the rail kinking the rail to decelerate the vehicle.	Low frequency impact areas. Attached directly to a W-Beam median barrier, or to a Thrie-Beam median barrier using the standard W-Beam to Thrie-Beam transition section.

Median Terminals

NAME	MANUFACTURER		PERFORMANCE CHARACTERISTICS		TEST LEVEL	DISTINGUISHING CHARACTERISTICS	HOW IT WORKS	LOCATIONS CAN BE USED
			Energy Absorbing	Non-Energy Absorbing	NCHRP 350			
X-Tension Median Attenuator System (X-MAS) http://www.barriersystemsinc.com/xmas-impact-attenuator		Barrier Systems, Inc.	X		TL-3	Impact head with locking bar to lock cables into place. Two cables attached to soil anchor extend the entire length of the terminal. Only available with steel posts.	During head on impacts, X-Tension is energy absorbing with resistance at the impact head. As the head is pushed down the two cables, the cables are pulled through the cable friction plate in a twisting path which dissipates the energy.	Low frequency impact areas. Attached directly to a W-Beam median barrier, or to a Thrie-Beam median barrier using the standard W-Beam to Thrie-Beam transition section.
Wyoming Box-Beam End Terminal (WY-BET) http://www.highwayguardrail.com/products/et-wybet.html		Trinity Highway Products, LLC	X		TL-3	Square Impact Face. Nose plate welded and insert into box beam and held in place by a wood post There is a strut between the first post and a second tube that has no post.	Energy absorbing material inside the tubing crushes as the rails telescope. Uses an oversized outer tube that telescopes over the downstream tube.	End of 6" x 8" box beam.
Bursting Energy Absorbing Terminal-Median Terminal (BEAT-MT) http://roadsystems.com/beat-beat-mt.html		Road Systems, Inc.	X		TL-3	Square Impact Face. Attached directly to box beam rail end section. Breakaway steel post and a cable anchor system. End tube is 1/8". Remaining tubes are 3/16".	Mandrel section of the impact head bursts the tubing to absorb the impact energy.	End of 6" x 8" box beam.

Cable Barriers

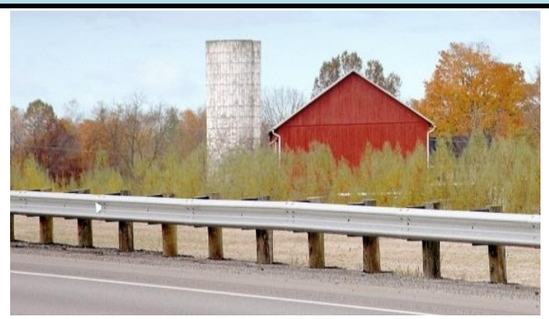
* Systems can be installed on 1V:6H and 1V:4H slopes, but cable configuration and offsets from the roadway edge and from the ditch bottom must be in accordance with test results and manufacturers' recommendations.

NAME	MANUFACTURER	TEST LEVEL NCHRP 350	POST TYPE	CABLE	DISTINGUISHING CHARACTERISTICS
Generic Weak-post Cable Guardrail (Low Tension)	 Generic	TL-3	I-Beam Post Flanged steel U-Channel Post Weakened rounded Timber Posts	3 cable configuration. Cables placed on one side of post; the side closer to the road - Roadside Application. Two cables are placed on one side of the post and the other cable is placed on the opposite side - Median Application.	Cables are attached with hook bolts. Uses a crashworthy generic terminals. Typical Post Spacing 4 ft to 16 ft.
Brifen Wire Rope Safety Fence (WRSF) http://www.brifenusa.com	 Brifen	TL-3 TL-4	Z Shaped Posts	3 and 4 cable configuration. Interweaving of cables between adjacent post.	Top cable is placed in a slot at the center of the post. Other 2 or 3 cables are weaved around post. Uses proprietary terminal. Posts can be driven or socketed. Typical Post spacing 10.5 ft to 21 ft.
Gibraltar http://gibraltartx.com	 Gibraltar	TL-3 TL-4	C Channel Posts	3 and 4 cable configuration. Pre-stretched or Non-pre-stretched.	Cables are attached using a single steel hair pin. Posts are placed such that adjacent post are on opposite sides of the cable. Uses proprietary terminal. Posts can be driven or socketed. Typical Post spacing 10 ft to 30 ft.
NU-CABLE https://trinityhighway.com/product/nu-cable-cable-barrier/	 Trinity Highway Products, LLC	TL-3 TL-4	Rib-Bak® posts	3 and 4 cable configuration. Pre-stretched or Non-pre-stretched.	Cables are attached using locking hook bolts or hook bolts and a strap. 2 of 4 cable are placed on one side of post and the other two are placed on the opposite side. Uses proprietary terminal. Posts can be driven or socketed. Typical Post spacing 6.6 ft. to 20 ft.
Safence http://www.gregorycorp.com/highway_safence.cfm	 Gregory Highway Products	TL-3 TL-4	C-shaped Posts	3 and 4 cable configuration.	All cables are inserted in a slot at the center of the post and separated by plastic spacers. Uses proprietary terminal. Posts can be driven or socketed. Typical Post spacing 6.5 ft to 33.2 ft.
CASS http://www.highwayguardrail.com/products/cb.html	 Trinity Highway Products, LLC	TL-3 TL-4	C-shaped and I-Beam Post (S3 & S4)	3 and 4 cable configuration. Pre-stretched or Non-pre-stretched configuration.	Cables are placed in a wave-shaped slot at the center of the post and separated by plastic spacers. Some versions also have cables that are supported on the flanges of the post. Uses proprietary terminal. Posts can be driven or socketed. Typical Post spacing 6.5 ft to 32.5 ft.

Roadside Post and Beam Rail Element

NOTE: No barriers should be placed on any slope steeper than 1V:6H, unless it has been crash tested in accordance with NCHRP 350 evaluation criteria.

If a barrier is to be placed on a slope steeper than 1V:10H, a flexible or semi-rigid type should be used.

NAME	ILLUSTRATION	NCHRP 350	POST	BLOCKOUT	DISTINGUISHING CHARACTERISTICS
SEMI-RIGID SYSTEMS					
W-beam (strong post) https://www.aashtotf13.org/Files/Drawings/sgr04a-c.pdf Generic		TL-3	W6 x 9 or W6 x 8.5 x 6 ft. Steel post. Timber post 5 ft. 4 in. or 6 ft. Post spacing 6 ft. 3 in.	6 in.wide x 8 in. x 14 in. blockouts Routed (w/steel posts) timber or composite blockout Double blockouts can be used	Top height of rail 27.75 in. FHWA recommends new applications to have 29 in. +/-1 in. rail height. Strong post barrier systems usually remain functional after moderate to low speed impact, thereby minimizing the need for immediate repair Dynamic lateral deflection 2.6 ft. (wood post), 3.3 ft. (steel post) for NCHRP 350 impact condition
		TL-2	Steel post	Steel Blockout	Uses 12-gauge panels. Specific applications may use 10 -gauge panels.
Nu-Guard 27 Nucor Steel Marion, Inc.		TL-3	6 ft. 6 in. RIB-BAK U-channel 2 in. deep and 3-1/2" wide Post weight 5 lbs.per foot 3/4-in. wide x 7 in. long slot is located 1 in. down from the top of the posts in the middle cross section Post spacing 6 ft. 3 in.	3-5/8 in. x 8 in. x 14 in. plastic blockouts W-beam is held with 5/8"x 12" post bolt and standard guardrail splice nut	Top rail height 27 in to 31 in. Uses standard 12-gauge panels Can be used to repair sections within an existing run of wood or I-beam posts Dynamic lateral deflection 3.8 ft.
Midwest Guardrail System (MGS) http://engineering.unl.edu/specialty-units/mwrsf/Newsletter-MidwestGuardrail.shtml Generic		TL-3	W6 x 9 or W6 x 8.5 x 6-ft long steel posts Post spacing 6 ft. 3 in. Rectangular or round timber posts allowable	12" (recommended), 8", or no block. Backup plate needed with non-blocked option. When steel posts are used, timber or plastic blockouts may be routed or toenailed.	Top height of rail between 27-3/4" and 32 in. Uses standard 12-gauge panels. One-half and one-quarter standard post spacing allowable Rail splices are located at midspan between adjacent posts Dynamic lateral deflection 3 ft. 7 in. NCHRP 350 Long-span (25 ft.) installation without intermediate post to conflict with underground structures allowable **Applications**: use on curbs, over long span culvert, at slope break point, approach to slopes, varying flare rates, with 8 in. blockouts, at wire-faced MSE wall, without a blockout, approach transition. Deflection values varies by applications. **NOTE:** MGS adjacent to 2:1 slope: Crash test report noted fuel tank (or surrotgate) heat shield damage reported in one crash test.

Roadside Post and Beam Rail Element

May 18, 2021

NOTE: No barriers should be placed on any slope steeper than 1V:6H, unless it has been crash tested in accordance with NCHRP 350 evaluation criteria.

If a barrier is to be placed on a slope steeper than 1V:10H, a flexible or semi-rigid type should be used.

NAME	ILLUSTRATION	NCHRP 350	POST	BLOCKOUT	DISTINGUISHING CHARACTERISTICS
Gregory Mini Spacer (GMS) http://www.gregorycorp.com/highway_gms.cfm Gregory Highway Products		TL-3	W6 x 9 or W6 x 8.5 x 6-ft Steel posts 6 x 8 in. rectangular or 7 in diameter round timber posts Post spacing 6 ft. 3 in. or 12 ft. 6 in. or 3 ft. 1.5 in.	No blockouts or backup plates Rail is attached to post using a 5/16-in diameter standard hex head bolt incorporated with the GMS	Top height of rail between 27 and 32 inches Splices can be at mid span or at the post Uses standard 12-gauge or 10-gauge panels and standard post. Can be used with Thrie-beam at 39 in. tall GMS fastener may be used in place of a standard guardrail bolt on any non-proprietary strong or weak post W-beam guardrail design
Nu-Guard 31 www.trinityhighway.com www.nucorhighway.com Nucor Steel Marion, Inc.		TL-4	6 ft. 6 in. RIB-BAK U-channel 2 in. deep and 3.5 in. wide Post weight 5 lbs.per foot 3/4-in. wide x 7 in. long slot is located 1 in. down from the top of the posts in the middle cross section Post spacing 6 ft. 3 in.	No blockouts Round spacer washers are installed between the guardrail and the legs of the posts Spacers are 3.5 in outer diameter, with a 1 in diameter hole Washer is placed with 5/8 in. x 3.5 in. post bolt and standard guardrail splice nut	Top height of rail 31 in. Uses standard 12-gauge panels Dynamic lateral deflection TL-3: 3.4 ft. Dynamic lateral deflection TL-4: 4 ft. (NCHRP 350)
Trinity T-31 Guardrail System https://trinityhighway.com/product/t-31-guardrail/ Trinity Highways, LLC		TL-3	W6 x 9 or W6 x 8.5 x 6 ft. Steel post 6 ft. long Steel Yielding Line Posts (SYLP) Each post has four 13/16-in. diameter holes in the flanges at ground line Post spaced at 6 ft. 3 in.	No Blockouts Uses a 6-inch long flange protector at each post (W-beam)	Top of rail height 31 in. Rail is attached to the post using a 5/8 in. diameter x 1.75 in. long special bolt with a slotted countersunk head Uses standard 12-gauge panels All splices in the W-beam rail element fall midspan, between adjacent posts Dynamic lateral deflection 3.2 ft. NCHRP 350

Roadside Post and Beam Rail Element

May 18, 2021

NOTE: No barriers should be placed on any slope steeper than 1V:6H, unless it has been crash tested in accordance with NCHRP 350 evaluation criteria.

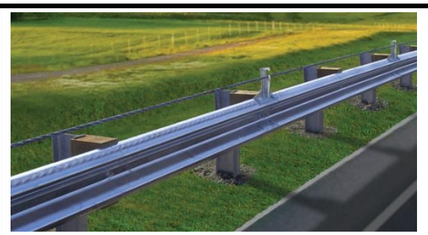
If a barrier is to be placed on a slope steeper than 1V:10H, a flexible or semi-rigid type should be used.

NAME	ILLUSTRATION	NCHRP 350	POST	BLOCKOUT	DISTINGUISHING CHARACTERISTICS
Thrie-Beam https://www.aashtotf13.org/guide_display.php Generic		TL-3	Wood or steel strong post W6 x 9 or W6 x 8.5 x 6 ft. 6 in. Steel post Post spacing 6 ft. 3 in.	6 in. wide x 8 in. x 21.75 in. blockouts Wood or composite routed blocks with steel posts.	Mounting height 32 in. Stronger version of the blocked-out W-beam barrier Additional corrugation in the Thrie-beam rail element stiffens the system Dynamic lateral deflection 2.2 ft. wood post and blockouts Dynamic lateral deflection 1.9 ft. steel post and routed timber or composite blockouts.
Modified Thrie-beam https://www.aashtotf13.org/guide_display.php Generic		TL-3 and TL-4	W6 x 9 or W6 x 8.5 x 6 ft. 9 in. Steel post. Post spaced at 6 ft. 3 in.	Steel block with a triangular notch cut from its web W14x22x17" long steel block	Mounting height 34 in. Dynamic deflection TL-4: 3 ft., TL-3: 2 ft. Requires a backup plate at non-spliced post.
Trinity T-39 (Thrie-beam) http://highwayguardrail.com/products/grT39.html Trinity Highways, LLC		TL-4	W6 x 9 or W6 x 8.5 x 6 ft. Steel post. 6 ft. long Steel Yielding Line Posts (SYLP) Each post has four 13/16-in. diameter holes in the flanges at ground line Post spacing 6 ft. 3 in.	No Blockouts Uses a 6 in. long flange protector at each post (W-beam)	Mounting height 39 in. Uses 12-gauge panels Rail is attached to the post using a 5/8 in. diameter x 1.75 in. long special bolt with a slotted countersunk head Rail splices are located at midspan between adjacent posts Dynamic lateral deflection TL-4: 2.6 ft. (NCHRP 350)
Gregory Mini Spacer (GMS-TB) http://www.gregorycorp.com/highway_gms.cfm Gregory Highway Products		TL-3	W6 x 9 or W6 x 8.5 x 6 ft. Steel post. Post spacing 6 ft. 3 in.	No blockouts or backup plates Thrie-beam is attached with the GMS fastener at each post, attached to the lower post-bolt slot of the Thrie-beam	Top height of rail 39 in. Uses standard 12-gauge or 10-gauge panels and standard post. The rail is mounted with the top corrugation protruding above the post and only one post bolt is used per post All splices are at the post Dynamic lateral deflection 4.33 ft.

Roadside Post and Beam Rail Element

NOTE: No barriers should be placed on any slope steeper than 1V:6H, unless it has been crash tested in accordance with NCHRP 350 evaluation criteria.

If a barrier is to be placed on a slope steeper than 1V:10H, a flexible or semi-rigid type should be used.

NAME	ILLUSTRATION	NCHRP 350	POST	BLOCKOUT	DISTINGUISHING CHARACTERISTICS
Box Beam weak Post https://www.aashtotf13.org/Files/Drawings/sgr03.pdf Generic		TL-3	S3 x 5.7 post 5 ft. 3 in. long with soil plate Post spacing 6 ft.	No blockouts	Top height of rail 27 in. Post near the point of impact are designed to break or tear away, distributing impact forces to adjacent post Dynamic lateral deflection 3.75 ft. (NCHRP 350)
Trinity Guardrail System (TGS) https://trinityhighway.com/product/tgs-guardrail/ Trinity Highways, LLC		TL-3	W6 x 9 or W6x8.5 x 6ft Steel post. Post spacing 6'-3"	No blockouts	Mounting height 31" Uses standard 12 gauge W-beam panels and standard post. Rail is attached to the post using a 5/8 in. diameter x 1.75 in. long special bolt with a slotted countersunk head
Retro-Rail™ Guardrail Retrofit http://www.highwayguardrail.com/products/gr.html Trinity Highways, LLC			N/A Can be used with both wood and steel post w-beam installations.	N/A Can be used with 8" wood or composite blocks.	Mounting height 31" to 35" The Retro-rail™ is a guardrail retrofit system that is effective for use on 25" to 29" high strong post guardrail. It consists of two cable end brackets, a single wire rope and cable mid brackets to support the cable along the length of the installation. The Retro-rail™ elevates the effective height of exisitng guardrail by 6". The cable mid bracklets are installed at 12.5' intervals, maximizing the use of existing splice bolt holes in the rail for these attachments.
FLEXIBLE SYSTEMS					
W-beam (weak post) https://www.aashtotf13.org/Files/Drawings/sgr02a.pdf Generic		TL-2	S3 x 5.7 post 5 ft. 3 in. long with soil plate Post spacing 12 ft. 6 in.	No blockouts	Mounting height 28 in. Dynamic lateral deflection 4 ft.7 in. for TL-2 System was redesigned for TL-3 as shown below and called "Modified W-beam (weak post)"

Roadside Post and Beam Rail Element

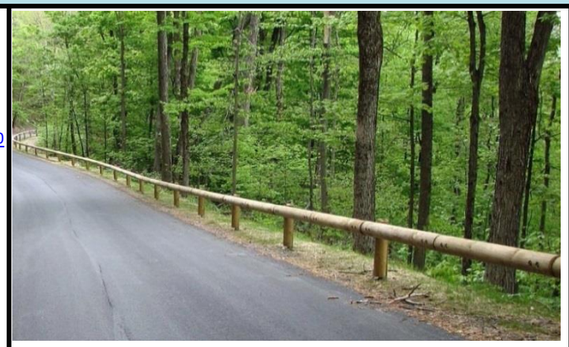
May 18, 2021

NOTE: No barriers should be placed on any slope steeper than 1V:6H, unless it has been crash tested in accordance with NCHRP 350 evaluation criteria.

If a barrier is to be placed on a slope steeper than 1V:10H, a flexible or semi-rigid type should be used.

NAME	ILLUSTRATION	NCHRP 350	POST	BLOCKOUT	DISTINGUISHING CHARACTERISTICS
Modified W-beam (weak post) https://www.aashtotf13.org/guide_display.php Generic		TL-3	S3 x 5.7 post 5 ft. 5 in. long with soil plate Post spacing 12 ft. 6 in.	No blockouts Backup plates at each post	Mounting height 32.3 in. Rail splices are centered mid-span between posts Dynamic lateral deflection 7 ft. (NCHRP 350)

Aesthetic Barrier

NAME	MANUFACTURER	TEST LEVEL NCHRP 350	POST AND BLOCKOUT	RAIL	DISTINGUISHING CHARACTERISTICS
FLEXIBLE SYSTEMS					
NatureRail Gregory Highway Products https://www.gregorycorp.com/sites/default/files/2020-01/NatureRail%20-%20Sell%20Sheet%202017.pdf		TL-2	6" diameter Wood-clad steel post. NatureRail 2m - 5'-11 7/8" post, 6'-6 3/4" post spacing NatureRail 4m - 5'-11 7/8" post, 13'-1 1/2" post spacing Steel spacer unit separates the post from the rail. No blockout.	Composite rail: 2m: Modified 7" diameter log and 3-15/16" x 3/16" x 13'-1 1/16" steel rail internally located in slotted wood rail with no exterior steel rail. 4m: Modified 7" diameter log and 3-15/16" x 3/16" x 13'-1 1/16" steel rail internally located in slotted wood rail with an additional steel rail mounted to the back of the wood rail.	Rail height 2'-3 1/2" All wood appearance blends into the surrounding environment. Dynamic Deflection 2m: 4'-7" and 4m - 6'-2". Use along edge of roadway. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.
Ironwood Aesthetic Barrier West - East Partners, LLC http://www.west-eastpartners.com/		TL-3	S3 x 5.7, 5'-3" long steel post, with a 8" x 2' steel soil plate Steel post encased by a 6 3/4" diameter wood sleeve. Post Spacing 6'-6".	Composite rail: 8" diameter routed wood beams and 1/4" thick steel channel embedded in and bolted to the timber rail. 8" x 7 " rectangular timber rail - alternate design	Rail height 2'-2" All wood appearance blends into the surrounding environment. Dynamic deflection 5'-4 1/2" No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.
High Tension Cable Barrier Brifen (WRSF) http://www.brifenusa.com Gibraltar http://gibraltartx.com Gregory Highway Products http://www.gregorycorp.com/highway_safence.cfm Trinity Highway Products http://www.highwayguardrail.com/products/cb.html		TL-3 and TL-4	Sizes and post spacing designs vary. Refer to manufacturer's specifications. **For details on a specific system please go to manufacturer's website. For a comparisons of all systems, please refer to FHWA Cable Barrier Chart**	Three and four cable designs available.	All systems are propriety. Blends in with surrounding environment, and reduces visual impairment. Refer to manufacturer's specifications for distance from post to embankment hinge point. Refer to manufacturer's specifications for availability of end treatments. Steel posts are typically galvanized. Coating alternatives are available to enhance aesthetic appearance. Use in medians and along edge of roadways.

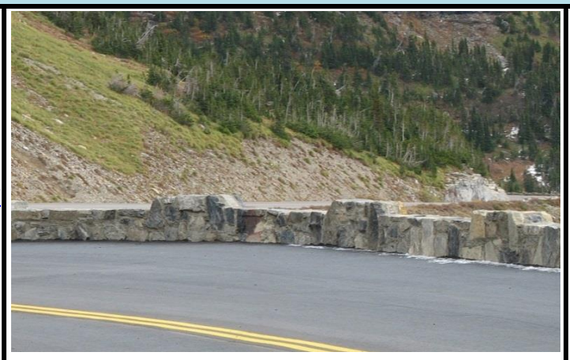
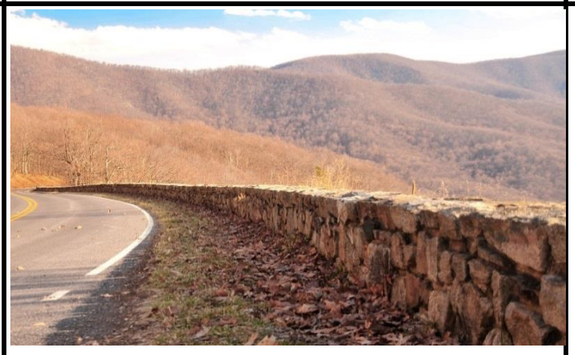
Aesthetic Barrier

NAME	MANUFACTURER	TEST LEVEL NCHRP 350	POST AND BLOCKOUT	RAIL	DISTINGUISHING CHARACTERISTICS
SEMI-RIGID SYSTEM					
Deception Pass Log Rail http://www.wsdot.wa.gov/Research/Reports/600/642.1.htm		TL-2	Reinforced concrete, rock and mortar, bollard posts designed to replicate the historic Civilian Conservation Corp construction. 18' bollard spacing Intermediate spacing of 6" diameter steel posts. No blockout.	Composite rail: Modified 12" diameter log and 6" x 6" x 3/8" steel plate embedded into the log rail.	Rail height 2'-3" Wood and rock appearance blends into the surrounding environment. Design reduces visual impairment of the environment. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.
TimBarrier StreetGuard Plus S.I. Storey Lumber Co. http://www.sistoreylumber.com/pdf/StreetGuardPlusFlyer.pdf		TL-2	6" x 8" x 6' long timber post Wood blockouts 6" x 8" x 10" Post spacing 8'	Composite rail: 4" x 12" x 7'-11" long timber rail backed by 1/4" x 6" x 7'-6" long steel plates.	Rail height 2'-5" All wood appearance blends into the surrounding environment. Use along edge of roadway. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone. Dynamic deflection 4'-4".
Steel-Backed Log Rail http://flh.fhwa.dot.gov/resources/pse/standard/#fp617_		TL-2	12" diameter x 7' log post Wood blockouts 8" x 6" x 8" notched into log post Post spacing 10'.	Composite rail: Modified 10" diameter log rail, backed with 6" x 3/8" thick steel plate.	Rail height 2'-7" Wood appearance blends into the surrounding environment. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone. Dynamic deflection 4"

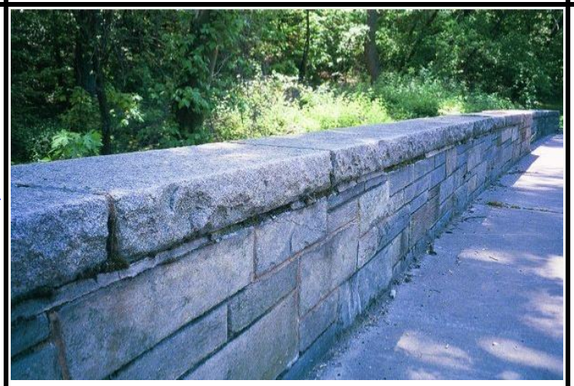
Aesthetic Barrier

NAME	MANUFACTURER	TEST LEVEL NCHRP 350	POST AND BLOCKOUT	RAIL	DISTINGUISHING CHARACTERISTICS
SEMI-RIGID SYSTEM					
Steel-Backed Timber Guardrail		TL-3 (with blockouts) TL-2 (no blockouts)	10" x 12" x 7' long timber post. Post spacing 5'. Wood blockouts 4" x 9" x 12"	Composite Rail: 6" x 10" wood rail backed with a 3/8" thick steel plate.	Rail height 2'-3" All wood appearance blends into the surrounding environment. System can connect to Straight and Curved Stone Masonry Guardwall. Dynamic deflection 1'-11" with blockout
Steel Backed Timber Guardrail Tangent End Terminal http://flh.fhwa.dot.gov/resources/pse/standard/#fp617		TL-2	The SBT end terminal is 40'-9" long and is designed to collapse when hit end-on. 9 - 6" x 10" weakened wood posts. 9 - 6" x 10" rail segment with angled ends and special attachment hardware.		
Merritt Parkway Aesthetic Guardrail Connecticut DOT http://pubsindex.trb.org/view.aspx?id=474497		TL-3	W6 x 15 X 6' - 6" steel post Post below ground is galvanized. Post Spacing 9'-6". Wood blockout 4" x 8" x 11"	Composite Rail: 6" x 12" timber beams backed with 6" x 3/8" steel plates and splices to provide tensile continuity.	Rail Height 2'-6" All wood appearance blends into the surrounding environment. No crashworthy end terminal was developed for this system; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone. A granite transition curbing is required at transition to a bridge parapet. Dynamic deflection 3'-10" without a curb and 3'-4" when installed 12" behind a 4" sloped face curb.
Rustic-appearance Metal Beam Guardrail		TL-3	Uses wood or steel posts. **For a complete comparisons of these systems, please refer to Roadside Post and Beam Chart**	Standard metal beam guardrail	Blends in with the surrounding environment Propriety treatments to achieve rustic appearance on both post and rail elements: acid-etched, powder coated and weathered steel.

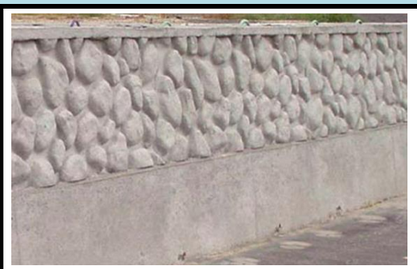
Aesthetic Barrier

NAME	MANUFACTURER	TEST LEVEL NCHRP 350	COMPONENTS	CHARACTERISTICS
RIGID SYSTEM				
Random Rubble Cavity Wall http://www.efl.fhwa.dot.gov/files/technology/abs/Random-rubble/B181RubbleGuardwall-WFLHD-FIN.pdf		TL-1	Wall width 1'-6" Composed of alternating height sections: Section 1 is 1'-6" tall x 12' long Section 2 is 2' tall x 5'-6" long. Reinforced concrete footings and core wall are poured and stone placed prior to filling the cavity with concrete. Rock size is between 12" and 1'-6" with smaller rocks and masonry mortar.	Wall height: 1'-6" and 2' alternating height sections Stone facing blends into the surrounding environment. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.
Rough Stone Masonry Guardwall http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b202.cfm		TL-2	Wall width: 2' single or 2'-3" double faced. Three main components: reinforced concrete foundation slab, inner reinforced concrete core wall and rough stone masonry face with an attachment system. Masonry face can have the projections a maximum of 1-1/2" beyond the working line. Avoid projections oriented toward oncoming traffic. Rake joints can be up to 2" deep, and mortar beds can be 2" - 3" thick.	Wall height: 1'-10" Stone facing blends into the surrounding environment. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.
Rough Stone Masonry Guardwall		TL-3	Wall width: 2' single or double faced. Three main components: reinforced concrete foundation slab, inner reinforced concrete core wall and rough stone masonry facing with an anchor attachment system. Masonry face can have the projections a maximum of 1-1/2" beyond the working line. Avoid projections oriented toward oncoming traffic. Rake joints can be up to 2" deep, and mortar beds can be 2" - 3" thick.	Wall height: 2'-3" Stone facing blends into the surrounding environment. Used in medians when double-faced. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.

Aesthetic Barrier

NAME	MANUFACTURER	TEST LEVEL NCHRP 350	COMPONENTS	CHARACTERISTICS
RIGID SYSTEM				
Smooth Stone Masonry Guardwall http://flh.fhwa.dot.gov/resources/pse/standard/#fp620_		TL-3	Wall width: 2' single or double faced. Three main components: reinforced concrete foundation slab, inner reinforced concrete core wall and rough stone masonry face with an attachment system. Masonry face can have the projections a maximum of 1-1/2" beyond the working line. Avoid projections oriented toward oncoming traffic. Rake joints can be up to 2" deep, and mortar beds can be 2" - 3" thick.	Wall height: 2'-3" with 3" crenulations above primary height. Stone facing blends into the surrounding environment. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.
Precast Concrete Guardwall http://flh.fhwa.dot.gov/resources/pse/standard/#fp618_		TL-3	Wall width 2'-2" 10-ft long pre-cast units include 12 inch deep footings. Foundation, core, and concrete stone facing are precast as a single unit.	Wall height: 2'-3-1/2" Precast concrete stone facing and capstone blend into the surrounding environment. Use in medians if double-faced or along edge of roadway. Approved for use with 4" mountable curb at any offset. No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.
Stone Cast Barrier Stonecastinc@gmail.com Stone Cast, Inc.		TL-3	Unit dimension: 2'-7" tall; 1'-7" width at top and 2' at bottom. Unit footing: 1' deep x 4' wide, cast integrally with its stem. Foundation, stem , and stone veneer cast integrally as a single unit. Units can be made in 5',10' or 20' long segments, and can be curved to fit a specified radius	Wall height: 2'-7" No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.

Aesthetic Barrier

NAME	MANUFACTURER	TEST LEVEL NCHRP 350	COMPONENTS	CHARACTERISTICS
RIGID SYSTEM				
California's Type 60 Concrete Barrier e.g.: Mission Arch, Deep Cobblestone Reveal, Dry stack, Fracture Granite	 	TL-3	Barrier has a constant single slope approximately 9 degs from the vertical. General texture guidelines: 1. Sandblast textures with a maximum relief of 1/5". 2. Images or geometric patterns inset into the face of the barrier 1" or less and having 45-deg or flatter chamfered or beveled edges. 3. Textures or patterns of any shape and length inset into the face of the barrier up to the 1/2" deep and 1" width. 4. Any pattern or texture with gradual undulations that have a maximum relief of 3/4" over a distance of 1'. 5. Gaps, slots, grooves or joints of any depth with a maximum width of 3/4" and a maximum surface differential across these features of 1/5" or less. 6. Any pattern or texture with a maximum relief of 2-1/2", if such pattern begins 2' or higher above the base of the barrier and all leading edges are rounded or sloped. No part of this pattern or texture should protrude above the plane of the lower, untextured portion of the barrier.	Wall height: 2'-3" (vertical wall) to 2'-8" (single-slope barrier) No crashworthy end terminal is currently available; acceptable end treatments include anchoring in a backslope or flaring the barrier to the edge of the clear zone.

Work Zone Barrier - Steel

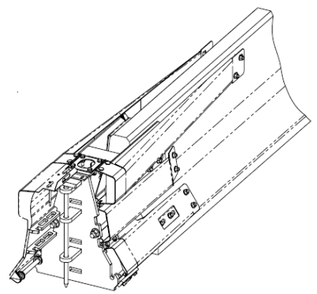
NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
Vulcan Barrier (B134, A, C, D) Trinity Highway, Inc. https://trinityhighway.com/product/vulcan-barrier/		TL-3, TL-4	*Section Dimensions:* Height: 2'-8" Width: 1'-9" 4M: Length: 13'-6", Weight: 871 lbs. 12M: Length: 38'-6", Weight: 2243 lbs. *Section Connections:* ASTM A53 Steel pins.	*Foundation Type:* Asphalt and Concrete *Unanchored Installation:* Must have a minimum of 236' of barrier in advance of the BLON and 236' of barrier at the trailing end of the system. BLON (TL-3): At the 24th section (4M Sections) Dynamic Deflection: 13.12'; Test Length: 243' *Anchored Installation:* Anchor feet installed on the traffic side of the Vulcan. Dynamic Deflection (TL-3): 6.89'; Test Length: 189' (4M Sections) Dynamic Deflection (TL-4): 7.87'; Test Length: 231.3' (4M or 12M Sections Acceptable) *Limited Deflection:* 12M Vulcan Barrier and Vulcan Barrier Anchor System (VAS). The VAS is a steel strap that is placed every 13.1' to reduce deflection. Dynamic Deflection (TL-3): 3" (base), 12" (top); Test Length: 157'.	Consist of standard Thrie-beam guardrail panels at the top and sheet metal rub rails at the bottom. 5 steel bulkhead tie the sides of the Vulcan together. End bulkheads has vertically aligned holes for pinning segments together. Center bulkhead incorporates a lifting tabs for assembly and transport. A stiffener plate runs the length of the segment. For straight section installation an optional steel spacer can be installed to reduce lateral deflection.
RELATED SYSTEMS **Vulcan Barrier Transition (B134C - 2007)** Vulcan to QuardGuard CZ		TL-3	*Transition Dimensions:* Height: 2'-7.4" Length: 6'-8" Width: variable	*Foundation Type:* Asphalt and Concrete *Anchored Installation:* 4 Sections pinned to a Crash Cushion end anchorage. Dynamic Deflection: 2'-4"	Transition incorporates a lower steel mounting plate with twelve mounting holes for anchoring transition to a rigid foundation.
Vulcan Gate System (B201)		TL-2, TL-3, TL-4	*Section Dimensions:* Height: 2'-8" Width: 1'-9.5" Weight: 1080 lbs. Min. Installation Length: 30 ft. Max. Installation Length: Unlimited.	*Unanchored Hinge* Connected to the end transitions and the Vulcan. 4" diameter steel pins	Consists of two steel transitions, two hinges and at least one section length of Vulcan Steel Barrier (either 13.5 ft or 40 ft) equipped with wheels and jacks.

Work Zone Barrier - Steel

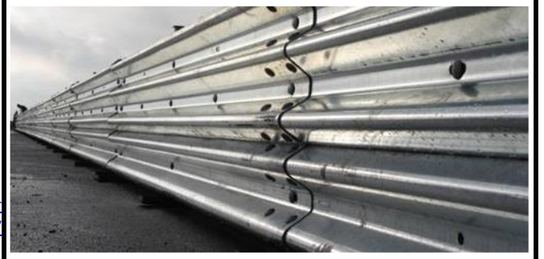
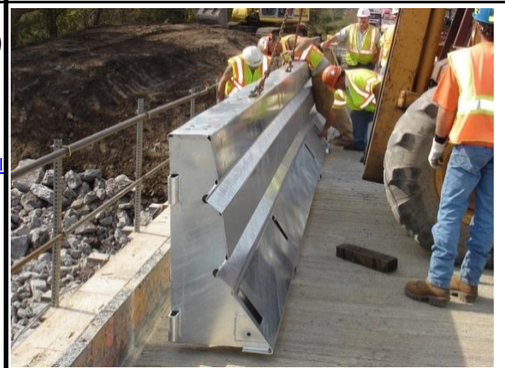
RELATED SYSTEMS

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
BarrierGuard 800 (B131, B158) Highway Care, USA		TL-3, TL-4	*Section Dimensions:* Height: 2'-7.5" Width: 1'-10" (base), 9" (top) Length: 19.7', Weight: 1,182 lbs. Length: 39.4', Weight: 2,381 lbs. *Section Connections:* Quick-link Connection *Section Dimensions w T-top:* Height: 3'-1/16" Width: 1'-10" (base), 1'-7" (top) Length: 19.7', Weight: 1,800 lbs. Length: 39.4', Weight: 3,600 lbs.	*Foundation Type:* Asphalt *Standard Anchored Installation:* Anchored each end with 8 threaded steel rods (4 rods at each end anchor location) and 4 threaded rods (2 at each anchor location) 19.7 ft from terminal end. Dynamic Deflection (TL-4): 4.9'; Test Length: 236' *Minimum Deflection System:* Barrier is anchored every 20 ft. with either joint anchors or intermediate anchors. Barrier is fitted with a T-top attachment to aid in the redirection and stability of the vehicle after impact. Dynamic Deflection (TL-3): 12"(top), 3"(base); Test Length: 157'	BarrierGuard 800 has a "step profile" face, which begins 10" above the ground.
BarrierGuard 800 Gate (B159)		TL-3	*Section Dimensions:* Height: 2'-7.5" Width: 1'-10" (base), 1'-7" (top) Length: 20' (min), 40'(max)	*Anchor Installation:* Two types: asphalt anchors (upstream end) and soil anchors (downstream end) of test installation. Gate install is anchored. Dynamic Deflection: 3.81'; Test Length: 256'.	BarrierGuard Gate can be unpinned and swung open from either end to allow vehicle or pedestrian passage. The gate is positioned between two (20 ft) gate post connecting systems, making a total length of the basic gate system 60 ft. Larger gate sections in 20 ft increments are available. Standard 20' or 40' section of BarrierGuard can be inserted into the center section of gate.
BarrierGuard 800 Variable Length (B160)		TL-3	*Section Dimensions:* Height: 2'-7.5" Width: 1'-10" (base), 9" (top) Length: 5'-3" (nominal)	*Unanchored Installation:* No anchors within 20 ft of the either end of units. T-top attachment should be used for 39.4' on either side of the BGVLB and terminate with a 9.85' transition section.	The Variable Length Barrier (VLB) is designed to provide clearance and flexibility for expansion joints on bridges, overpasses, and roadways. It allows movement of up to 7" expansion and 7" contraction for a total 14" slow relative movement for conditions such as thermal expansion/contraction, bridge joint movement, etc., but hydraulically locks when the movement is fast, such as an impacting vehicle.

Work Zone Barrier - Steel

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
ArmorGuard™ Barrier (B108) (formerly named SafeGuard Link System) Lindsay Transportation Solutions https://www.lindsay.com/usca/en/infrastructure/brands/barrier-systems/solutions/temporary-barriers/		TL-2, TL-3	*Section Dimensions:* Height: 2'-9" Width: 2'-4" (base), 1'-8" (top) Length: 28' Weight: 3,362 lbs. *Section Connections:* The barrier sections are pinned together with a hinge and pin assembly.	The ArmorGuard Barrier is designed to be a portable freestanding longitudinal barrier. Multiple barriers can be pinned together to form on continuous run of barriers or the barrier can be used as a gate between openings in both permanent or temporary concrete barrier. *TL-2 Condition:* BLON: At 4th Section (112 ft) Dynamic Deflection: 3.41'; Test length: 223'. *TL-3 Condition:* BLON: At 8th Section (224 ft) Dynamic Deflection:6.3'; Test length: 223'.	The ArmorGuard Barrier is designed for short term durations work zones. The barrier sections are easily raised and lowered manually or with optional compressed air. Sections can be moved, by hand, a forklift or pickup truck. Sections can also be attached or joined to create controlled access gates.
RELATED SYSTEMS **SafeGuard Gate System (B87)**		TL-3	*Section Dimensions:* Height: 2'-9" Width: 2'-4" (base), 1'-8" (top) Length: 13.12' Weight: 1488 lbs. *Section Connections:* Hinge assembly.	The ArmorGuard Barrier Gate attaches to concrete barrier with the use of a special transition section.	The ArmorGuard Barrier Gate is designed to be used between openings in both permanent or temporary concrete barrier to create controlled access gates.
Alternative Universal Transition (B173)		TL-3	*Section Dimensions:* Height: 2'-8" Width: 2'-4" (base), 1'-8" (top) Length: 3'-4" (base), 7'-1" (top)	There are two types of transitions, temporary and permanent. For short term projects, temporary transitions do not require anchoring to a foundation only to the concrete barrier that is it being attached to. For permanent applications, the permanent transitions require anchoring to a foundation and barrier.	The transitions are designed to fit standard New Jersey style barrier. For alternate barrier types please contact manufacturer.

Work Zone Barrier - Steel

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
Armorflex ORION ™ (B217) Lindsay Transportation Solutions https://www.lindsay.com/usca/en/infrastructure/brands/barrier-systems/solutions/temporary-barriers/		TL-3	*Section Dimensions:* Height: 2'-10" Width: 1'-6" (effective), 2' (total) Length: 39'-2" Weight: 1985 lbs. *Section Connections:* Twin-pin steel connectors	*Foundation Type:* Asphalt or Concrete Hold-down Pins: Threaded rods epoxied in place. *Standard Anchored Installation:* Barrier end segments anchored using eight (8) hold-down pins at each end segment. Dynamic Deflection: 6.07'; Test Length: 161.7' *Low Deflection Anchored Installation:* First and last barrier segments anchored using eight (8) hold down pins. Additionally, barrier should be anchored every 12.5 ft. on the traffic face only. Dynamic Deflection: 3.15'; Test Length: 154'	The Orion Steel Barrier consists of a standard 8-space thrie-beam guardrail and standard w-beam guardrail connected to internal bulkheads using standard guardrail splice bolts. The internal bulkhead (framework) are unique to the Orion and can be obtained separately.
MDS Temporary Barrier (B165) MDS, LLC http://www.mdsbarriers.com/mds-tl4.html		TL-4 (EN1317 test TB51), TL-5 (EN1317 test TB81)	*Section Dimensions:* Height: 4.04' (TL-4), 5.22' (TL-5) Width: 1.60' (TL-4, TL-5) Length: 19.7' (TL-4, TL-5) Weight: 1023 lbs. (TL-4); 1594 lbs. (TL-5) *Section Connections:* Panel hinges. Base plates.	*Foundation Type:* Concrete *Anchored:* Base plate is attached to the deck using four anchor bolts. Anchor bolts can be drilled through he deck or epoxied into the deck. Dynamic Deflection (TL-4): 1.62' ; Test Length: 19.7' Dynamic Deflection (TL-5): 1.38'; Test Length: 19.7'	Barrier has a unique sliding base assembly that is bolted directly to the bridge deck.

Work Zone Barrier - Steel

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
RELATED SYSTEMS **ZoneGuard (B176, B176A)** Hill and Smith, Inc. http://hshighway.com/products/zoneguard		TL-3, TL-4	*Section Dimensions:* Height: 2'-8" Width: 2'-3-9/16" (base), 6 3/16" (top) Length: 50' Weight: 3,097 lbs. *Section Connections:* Speed Joints: The end of each section slides over the other and are connected together and are held together via a latching mechanism.	*Foundation Type:* Concrete *Standard Anchored Installation:* First and last sections anchored at 1.64' and 16.67' (4 anchors - steel rods) Dynamic Deflection (TL-3, 350): 6' (Top), 5.44' (Base), ; Test Length: 250' Dynamic Deflection (TL-3, MASH): 6.33' (Top), 6.17' (Base); Test Length: 250' Dynamic Deflection (TL-4, 350): 4.75' (Top), 4.17' (Base); Test Length: 250' *Minimum Deflection Installation:* First and last sections anchored at 1.64' and 16.67' (4 anchors - steel Dynamic Deflection (TL-3, 350): 12" (Top), 2" (Base); Test Length: 250' Dynamic Deflection (TL-3 MASH): 16" (Top), 5"(Base); Test Length: 250'	Comprises of eight-gauge, (0.165 in thick) galvanized steel panels. Each section has a 0.5 ft wide step on each side just above surface level, which slopes upward to meet the upper beam section. The base of each section has a 12 rubber feet, which are fixed using an adhesive compound.
Expansion Joints (B220)		TL-3	*Section Dimensions:* Height: 2'-8" Length: 46'-5.5"	*Anchored:* Anchored similar to above. Dynamic Deflection (TL-3): 3.18 ft.	Three part expansion joint with longitudinal expansion provided by eight sleeved tubes.

Work Zone Barrier - Plastic Water Filled

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
MB 350 Barrier System (B34F, B34G, B34H) (formerly called the Roadguard) OTW Safety		TL-3	*Section Dimensions:* Height: 3'-6" Width: 2' (base), 20" (top) Length: 6' Liquid: 150 gals.of liquid. Weight: 80 lbs. (empty) Weight: 1525 lbs. (full and with kit) Color: Orange *Section Connections:* Connected with bars welded to the inside of the pipes on one end and slotted on the other end for a bolted connection.	*Foundation Type:* Concrete Unanchored installation. Dynamic Deflection (TL-3): 11.2'; Test Length: 198.5'	MB350 barrier are made of a high-density polyethylene modules filled with liquid ballast. There is an exterior mounted steel frame assembly called the MB350 kit that creates a connection between each segment. It uses a hitch pin and steel straps to hold the steel cage in place and is required for barrier performance.
Triton Barrier (B21, B48, B179) Trinity Highways, Inc https://trinityhighway.com/product/triton-barrier-tl-2/ https://trinityhighway.com/product/triton-barrier-tl-3/	 **Photo of TL2 system. TL2 system was the only system successfully crash tested with lights. Contact Manufacturer for these specific specifications.**	TL-1, TL-2, TL-3	*Section Dimensions:* Height (TL-1/2): 2'-8" Height (TL-3): 3'-3" Width: 1'-9" Length: 6' 6" Liquid: 145 gal. water ballast Weight (TL-1): 99 lbs. (empty) Weight (TL-2/3): 140 lbs. (empty) Weight (TL-1): 1312 lbs. (full) Weight (TL-2/3): 1350 lbs. (full) Color: White and orange *Section Connections:* Section interlocks together and pinned.	*Foundation Type:* Concrete or asphalt Unanchored installation. Dynamic Deflection (TL-1): 8.9 ft; Test Length: 100 ft. Dynamic Deflection (TL-2): 12.8 ft.; Test Length: 325 ft. Dynamic Deflection (TL-3): 22.6'; Test Length: 195 ft.	Segments are made of a lightweight polyethylene plastic shells designed to accept water ballast. The plastic barrier shell is supplemented by internal steel framework with a cable along the top connecting the joints between barrier segments. The cable provides the barrier's tensile capacity during impacts. Certified as its own end treatment. Triton TL-1 modules do not have an internal steel framework. Triton TL-2 modules were tested with lights and a plastic mesh mounted atop of the barrier. Triton TL-3 modules are set on two 7" high plastic pedestal to raise its center of gravity. Pedestals are strapped to each individual unit and are also tethered together with a braided polyester cord.

Work Zone Barrier - Plastic Water Filled

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
Yodock Barrier Model 2001M (B97, B97A) Trinity Highways, Inc https://trinityhighway.com/product/water-filled-barrier/	 **Photo of TL-3 System**	TL-2, TL-3	*Section Dimensions:* Height (TL-2): 2'-8" Width (TL-2): 1'-6"(base), 8" (Top) Length (TL-2): 6' Liquid (TL-2): 80 gal. water ballast Weight (TL-2): 75 lbs. (empty) Weight (TL-2): 750 lbs. (full) Height (TL-3): 3'-10" Width (TL-3): 2' (base), 11" (Top) Length (TL-3): 6' Liquid (TL-3): 170 gal. water ballast Weight (TL-3): 130 lbs. (empty) Weight (TL-3): 1530 lbs. (full) Color: Ivory and orange *Section Connections:* Connected with polyethylene couplers and rail kit connections.	*Foundation Type:* Concrete Unanchored installation. Dynamic Deflection (TL-2): 12 ft.; Test Length:150 ft. Dynamic Deflection (TL-3): 14 ft.; Test Length: 148 ft.	Yoduck Barrier is a made of a high-density polyethylene water-filled barriers with steel tubing side rails.
Rhino Barrier (B101) Rhino Safety Barriers, LLC		TL-2	*Section Dimensions:* Height: 2'-11" Width: 2'-3"(base) Length: 6' 7" Liquid: 111 gal. water Weight: xx lbs. (empty) Weight: 925 lbs. (full) Color: White and orange *Section Connections:* Connected with polyethylene pins.	*Foundation Type:* Concrete Unanchored installation. Dynamic Deflection: 13.1 ft.; Test Length:223 ft.	Rhino barrier is a polyethylene water-filled shell, reinforced with front and backside deflector strips and connected with steel-reinforced polyethylene pins and a galvanized steel "bridging strips".

Work Zone Barrier - Plastic Water Filled

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
TrafFix Water-Wall (B130) TrafFix Devices, Inc.		TL-1	*Section Dimensions:* Height: 2'-8" Width: 18" Length: 5' 11" Liquid: 120 gal. water Weight: 77 lbs. (empty) Weight: 1100 lbs. (full) Color: White and orange/red *Section Connections:* Connected with steel rod.	*Foundation Type:* Concrete Unanchored installation. Dynamic Deflection: 15.5 ft.; Test Length:124 ft.	TrafFix Water-wall is a freestanding series of units made from medium-density polyethylene filled with water. These units are pinned together with 1.25-inch diameter steel rod inserted through lugs formed into the ends of each segment.
Sentry Water-Cable Barrier (B196) TrafFix Devices, Inc.	 **Photo of TL-3 System**	TL-1, TL-2, TL-3	*Section Dimensions:* Height: 3'-10" Length: 7' Liquid: 220 gal. water Weight: 165 lbs. (empty) Weight: 2150 lbs. (full) Color: White or orange *Section Connections:* Connected with T-pin and a T-pin clip.	*Foundation Type:* Concrete or compacted dirt. Dynamic Deflection (TL-2): 5.9 ft.; Test Length:158 ft. Dynamic Deflection (TL-3): 9 ft.; Test Length:158 ft.	The shell of each section is made up of high density polyethylene (HDPE). Sentry Water-Cable barrier has 11 connecting lugs, 5 on one end, and 6 on the opposite end. The four upper lugs on each barrier section contain one each independent corrosion resistant steel wire rope molded into the barrier. The wire ropes act similarly to a cable barrier when impacted.

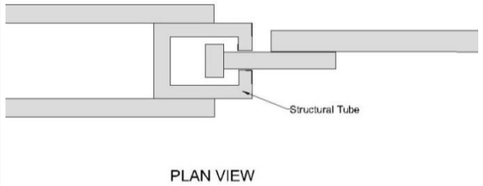
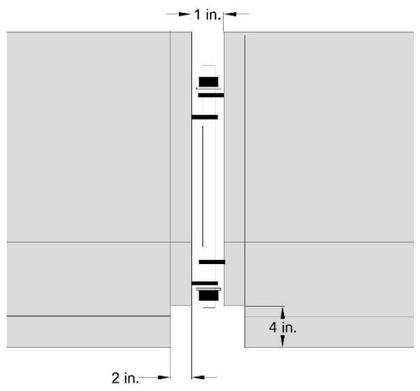
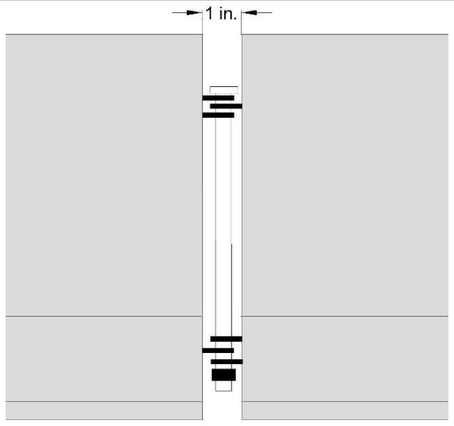
Work Zone Barrier - Plastic Water Filled

RELATED SYSTEMS

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
ArmorZone (B223) Lindsay Transportation Solutions		TL-2	*Section Dimensions:* Height: 2'-10" Width: 18" Length: 6' - 7" Liquid: 116 gals.of water. Weight: 128 lbs. (empty) Weight: 1100 lbs. (full) Color: Orange *Section Connections:* Twin pin connectors consisting of two long steel steel pipes	*Foundation Type:* Concrete Unanchored installation. Dynamic Deflection (TL-2): 13.5'; Test Length: 164'	Each ArmorZone™ unit is made from High Density Polyethylene (HDPE) modules filled with water. Each unit is fitted with a internal steel bar that runs approximately 5" from the top of barrier and has 2 holes at either end which line up with the connection holes of each unit.
ArmorZone End Treatment (CC119)		TL-2	*Section Dimensions:* Height: 2'-10" Width: 18" Length: 6' - 7" Liquid: Not filled Weight: 128 lbs. (empty) Color: Orange *Section Connections:* Twin pin connectors consisting of two long steel steel pipes	*Foundation Type:* Concrete Unanchored installation.	ArmorZone end treatment is similar in appearance to the barrier segments, but it is not filled with water and does not include the steel bar. It has additional holes and slots which reduce the strenght of the unit to ensure crashworthiness.

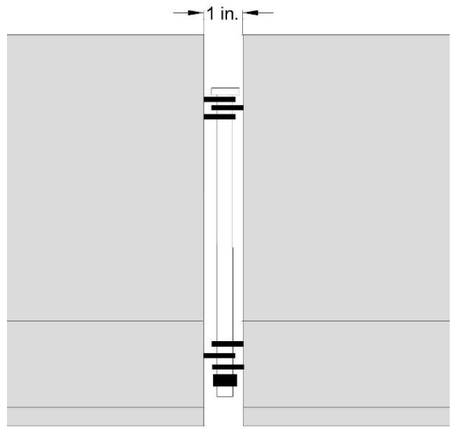
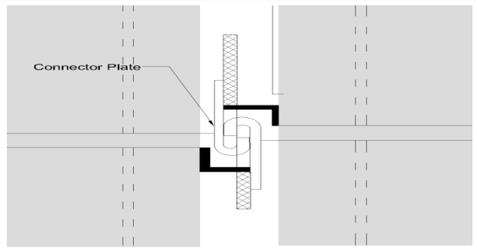
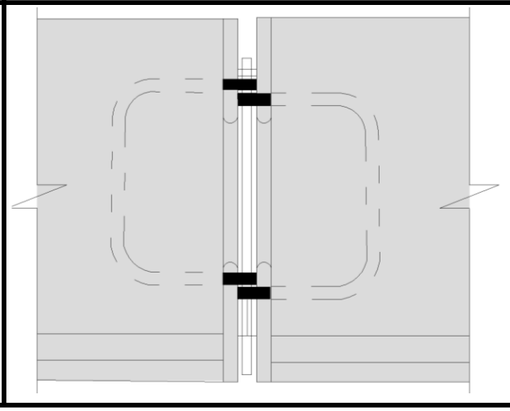
Work Zone Barrier - Concrete Barrier

Recent NCHRP Research includes NCHRP Project 20-7 (257) Synthesis Crash Tested Concrete Barrier Designs and Anchoring Methods

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
F- Shape Pre-Cast Concrete Barrier					
Rockingham Precast (B42)	 PLAN VIEW	TL-3	*Section Dimensions:* Height: 2'-7" Width: 2' Length: 12' *Section Connections* "T" shaped steel plate and slotted steel tube.	*Foundation Type:* Asphalt and concrete *Unanchored Installation:* Must have a minimum of 59' of barrier in advance of the BLON and 59' of barrier at the trailing end of the system, when used on high-speed routes. Dynamic Deflection: 3.77'; Test Length: 156'	The Rockingham precast concrete barrier uses standard F shape concrete units with an integrated connection. The connection consist of a "T" shaped steel plate cast into the concrete and the opposite end contain a slotted steel tube. The units are connected togther by lifting one and lowering it so that the T end slides into the slot in the tube of the other end.
Virginia DOT - Modified MB-7D Portable Concrete Barrier (B54, B151, B164)		TL-3	*Section Dimensions:* Height: 2'-7" Width: 2' Length: 10' or 20' *Section Connections* Pin and loop connection	*Foundation Type:* Asphalt and concrete *Unanchored Installation:* Must have a minimum of 20' of barrier in advance of the BLON and 20' of barrier at the trailing end of the system. Dynamic Deflection (20' section): 6'; Test Length: 142'	The modified Virginia DOT portable concrete barrier uses F-shaped concrete barrier with a pin and loop connection. Steel pin passes throught two fabricated loops at the top and bottom of the barrier and is secured with a washer and a hex nut.
Oregon DOT Standard Precast Concrete Barrier (B86)		TL-3	*Section Dimensions:* Height: 2'-7" Width: 2' Length: 12.5' *Section Connections* Pin and loop connection	*Foundation Type:* Asphalt and concrete Dynamic Deflection: 2.5'; Test Length: 12.5'	Standard Precast concrete barrier consist of precast concrete F-shape segments connected together with a pin and loop. The pin and loop connection consists of two steel loops near the top of one segment and a single loop at the bottom of the segement. When segments connect together they form three loops on each end. The steel pin in placed in the loops to connect, no washers or nuts are used.

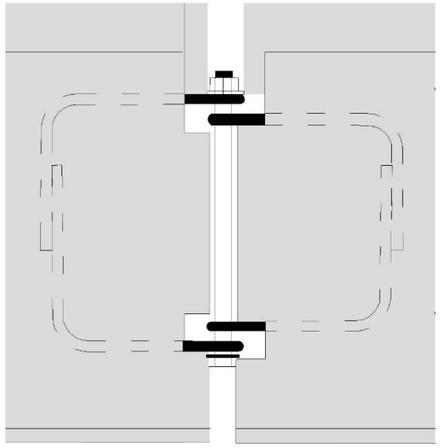
Work Zone Barrier - Concrete Barrier

Recent NCHRP Research includes NCHRP Project 20-7 (257) Synthesis Crash Tested Concrete Barrier Designs and Anchoring Methods

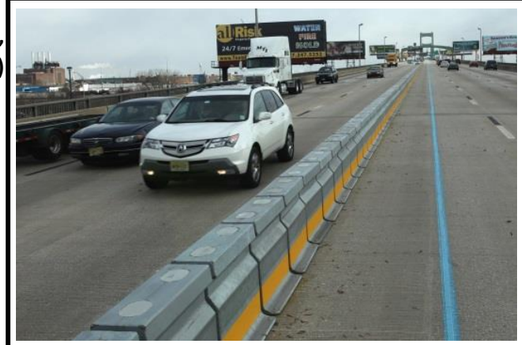
NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
F- Shape Pre-Cast Concrete Barrier					
Oregon DOT Precast Concrete Tall Barrier (B86, B86A)		TL-3, TL-4	*Section Dimensions:* Height: 3'-6" Width: 2'-2" Length: 10' *Section Connections* Pin and C-channel connection	*Foundation Type:* Asphalt and concrete Dynamic Deflection (TL-3): 2.6'; Test Length: 200' Dynamic Deflection (TL-4): 2.7'; Test Length: 200'	Precast concrete tall barrier consist of precast concrete F-shape segments connected together with two sets of perforated C-shaped steel channels. The connections of the C-channel fits together with a bolt holding the segments together attached with a nut welded to the bottom.
New Jersey Shape Pre-Cast Concrete Barrier					
J-J Hooks Temporary Barrier Connection (B52, B52B, B52C, B169)		TL-3	*Section Dimensions:* Height: 2'-8" Width: 2' Length: 12' and 20' *Section Connections* J-J Hooks connection	*Foundation Type:* Asphalt and concrete Dynamic Deflection: 4.27'; Test Length: 192'	J-J hooks connection can be used with: F-shape concrete barriers with a 2 ft. wide base, New Jersey shaped concrete barriers with a 2 ft. wide base, and 20-ft. long Kentucky Precast Barrier. These "hooks" are formed with steel plates which are connected through the barrier by reinforcing bars.
Caltrans K-rail (B61)		TL-3	*Section Dimensions:* Height: 2'-8" Width: 2' Length: 20' *Section Connections* Pin and loop connection.	*Foundation Type:* Asphalt and concrete *Anchored Installation:* Each section are staked to the ground with four steel stakes, driven through holes cast in the lower sloped section of the k-rail near each corner. Dynamic Deflection: 0.8'; Test Length: 160'	The K-rail is a New Jersey profile concrete barrier connected with a steel pin through four steel loops.

Work Zone Barrier - Concrete Barrier

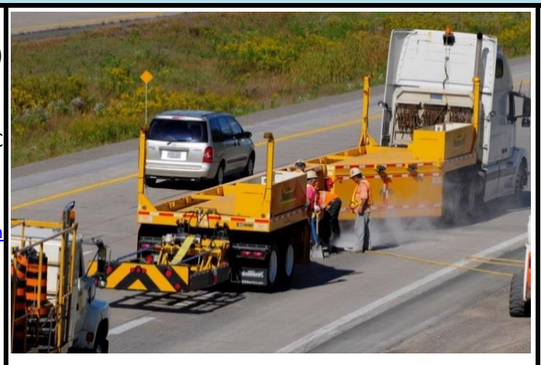
Recent NCHRP Research includes NCHRP Project 20-7 (257) Synthesis Crash Tested Concrete Barrier Designs and Anchoring Methods

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
New Jersey Shape Pre-Cast Concrete Barrier					
Ohio DOT NJ-Shape Portable Concrete Barrier (B93)		TL-3	*Section Dimensions:* Height: 2'-8" Width: 2' Length: 10' *Section Connections* Pin and loop connection.	*Foundation Type:* Asphalt and concrete *Unanchored Installation:* Must have a minimum of 37.5' of barrier in advance of the BLON and 112.5' of barrier at the trailing end of the system. Dynamic Deflection: 5.5'; Test Length: 244'	The Ohio DOT portable concrete barrier uses New Jersey shaped concrete barrier with a pin and loop connection. The pin is secured at the bottom with a plate washer and a hex nut.

Work Zone Barrier - Moveable Barrier

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
Moveable Barrier					
Quickchange Moveable Barrier (QMB) (B63, CC66B) Lindsay Transportation Solutions http://www.barriersystemsinc.com/applications		TL-3	*Section Dimensions* Height: 2.67' Length: 3.28' Width: 1' (top), 2'(base) Weight: 1,433 lbs. *Section Connections* Pin connections.	*Anchored Installation* Physical crash testing was conducted on an anchored system. Contact manufacturer for description of system. Dynamic deflection (TL-3): 4.42''; Test Length: 246'.	*Quickchange Moveable Barrier and Reactive Tension Systems* Barriers have a "T" top which acts as a lifting surface for the Barrier Transfer Machine (BTM). BTM lifts the barrier through a conveyor system, transferring the barrier laterally while keeping the system in tension. Variable Length Barrier (VLB) consist of two steel shells equipped with a hydraulic mechanism which allows it to change length when unlock by transfer machine, ensuring the barrier installation remains in tension. VLB sections are always located in the transfer machine during repositing of the barrier. The end of the barrier should be protected. A system designed for use with this barrier is the ABSORB 350 crash cushion that is pinned together and consists of a "T" top so it can articulate. Contact the manufacturer for further details.
RELATED SYSTEMS **Steel Reactive Tension System (B40, B69, B69A, CC66B)**		TL-3	*Section Dimensions* Height: 2.67' Length: 3.25' Width: 1' (top), 2'(base) Weight: 1,499 lbs. *Section Connections* Spring-loaded hinges with pin connections.	*Anchored Installation* Tethered to a ground anchor capable of supporting 100,000 lbs. barrier load or an additional 80 SRTS elements. Dynamic deflection (TL-3): 2.3'; Test Length: 246'.	*Steel Reactive Tension System* Each section is made from a steel casing filled with concrete.
Concrete Reactive Tension System (B69, B69A, B69B, B69D)		TL-3, TL-4	*Section Dimensions* Height: 2.67' Length: 3.28' Width: 13.5" (top), 18" (base) Weight: 1,433 lbs. *Section Connections* Spring loaded hinges with pin connections.	*Anchored Installation* Tethered to a ground anchor capable of supporting 100,000 lbs. barrier load or an additional 80 SRTS elements at each end. Dynamic Deflection (TL-3): 2'; Test Length: 246'. Dynamic Deflection (TL-4): 5.58'; Test Length: 325' *Limited Deflection* The addition of a steel angle iron bolted to the road surface 12 inches behind the field side of the barrier (opposite the traffic side). Dynamic Deflection (TL-3): 2'; Test Length; 243'.	*Concrete Reactive Tension System* Internal reinforcement has change to accommodate to achieve a higher level performance (TL-4).

Work Zone Barrier - Moveable Barrier

NAME/MANUFACTURER	ILLUSTRATION	NCHRP 350	SECTION DETAILS	ANCHORAGE DETAILS	DISTINGUISHING CHARACTERISTICS
Moveable Barrier					
Mobile Barriers MBT-1 (B178) Mobile Barriers, LLC http://www.mobilebarriers.com		TL-2, TL-3	*Trailer Details* Comprises of 2 platforms and up to 3 wall sections. Platform Dim: 21' (L), 100" (W), 5' (Top height) with 1' of ground clearance. Wall Dim: 20'(L), 24" (W), 5' (Top height) with 1' of ground clearance.	System is connected with a crash attenuator at the rear and a semi-tractor at the front. Dynamic Deflection: 2 ft.	Mobile Barriers MBT-1 is an integrated, rigid wall, semi-trailer that is used in conjunction with a standard semi-tractor with an integrated crash attenuator at the rear. It is an extended, mobile, longitudinal barrier that provides a physical and visual wall between passing traffic and the maintenance and construction personnel providing approximately 100' of barrier and protected work area from impacts in either direction.