



**CONSTRUCTION SPECIFICATION FOR
GUIDE RAIL END TREATMENT - STEEL BEAM
ENERGY ATTENUATING TERMINAL SYSTEMS**

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732.01 SCOPE

This specification covers the requirements for the installation of steel beam energy attenuating terminal (SBEAT) systems.

732.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

732.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

732.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Ontario Ministry of Transportation Publications

Ontario Traffic Manual (OTM):
Book 6 - Warning Signs

ASTM International

A 123/A 123M-17	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 780/A 780M-09(R2015)	Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings

732.04 DESIGN AND SUBMISSION REQUIREMENTS

732.04.01 Submission Requirements

One copy of the manufacturer's installation instructions and Working Drawings for each type of SBEAT system to be installed shall be submitted to the Contract Administrator.

Installation of the SBEAT system shall not commence until the Contract Administrator has received the copy of the installation instructions and Working Drawings.

732.05 MATERIALS

732.05.01 General

All supplied system components shall be according to the manufacturer's specifications.

732.05.02 U Channel Posts

Posts shall be 2.44 m long perforated steel U channel with 11 mm diameter holes spaced on 50 mm centres, minimum weight of 4.46 kg/m, and hot dip galvanized according to ASTM A 123.

732.07 CONSTRUCTION

732.07.01 General

SBEAT systems shall be installed according to manufacturer's instructions at locations specified in the Contract Documents.

When a SBEAT system is specified in the Contract Documents, the Contractor has the option of using one of the following systems:

- a) MASH SoftStop Terminal System
- b) MASH Max-Tension Terminal System
- c) MASH Sequential Kinking Terminal System

When a specific SBEAT system is specified in the Contract Documents, there shall be no option of substitution for the SBEAT system.

SBEAT systems with steel posts shall be installed to steel beam guide rail systems with steel posts.

SBEAT systems shall be installed according to the manufacturer's instructions at locations specified in the Contract Documents using only the components supplied for a particular SBEAT system unit.

A minimum 2 m wide area behind the posts, measured from the back of the posts shall be clear of all obstacles for the entire length of the SBEAT system.

732.07.02 Posts and Steel Foundation Tubes

All posts and steel foundation tubes shall be set to the depth and alignment at locations specified in the Contract Documents, regardless of the material encountered.

All lower hinge break away posts, steel foundation tubes, and soil plates shall be installed so that no more than 100 mm is exposed above finished grade.

732.07.03 Steel Beam Guide Rails

SBEAT systems shall be connected to new or existing steel beam guide rail as specified in the Contract Documents.

SBEAT system mounting heights shall be measured vertically from the top of the steel beam guide rail to the ground or gutter line. SBEAT system mounting heights shall be within the ranges in Table 1.

Where curb with gutter is required, steel beam guide rail mounting height shall be measured:

- a) Vertically at face of steel beam guide rail, when face of steel beam guide rail is more than 300 mm beyond gutter line.
- b) Vertically at gutter line, when face of steel beam guide rail is 300 mm or less beyond the gutter line.

Channel shall not be used within the SBEAT system.

732.07.04 Damage to Galvanizing

Precautions shall be taken to protect galvanizing against damage. Minor abrasions shall be repaired according to ASTM A 780. Components with major abrasions shall be replaced.

The method of repair for any damage shall be approved by the Contract Administrator prior to the commencement of such work.

732.07.05 Object Markers and Oversize Plow Markers

A Wa-33 object marker according to OTM Book 6, a Wz-2 oversize snow plow marker, and galvanized mounting hardware shall be installed at each energy attenuator.

When installed on a paved surface, the object marker and oversize snow plow marker shall be integrally attached to a surface mounted flexible post. The signs and post shall be supplied by the manufacturer as a complete unit. The post shall have the ability to bend 90 degrees from vertical and self-restore after impacts. The minimum outside diameter of the post shall be 60 mm. The post shall be anchored to the pavement according to the manufacturer's recommendations.

When installed on a granular surface, the Wa-33 object marker and Wz-2 oversize snow plow marker shall be securely fastened to a U channel post and the post shall be direct buried to a minimum embedment depth of 900 mm.

Posts shall be installed at locations as specified in the Contract Documents.

732.07.06 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

732.09 MEASUREMENT FOR PAYMENT

732.09.01 Actual Measurement

732.09.01.01 Steel Beam Energy Attenuating Terminal System

For measurement purposes, a count shall be made of each complete steel beam energy attenuating terminal system installed, regardless of the type of steel beam energy attenuating terminal system placed.

732.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the unit shown in the clause under Actual Measurement.

732.10

BASIS OF PAYMENT

732.10.01

Steel Beam Energy Attenuating Terminal System - Item

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

Costs associated with any required removals and replacement or repairs of defective work and materials shall be the Contractor's responsibility at no additional cost to the Owner.

TABLE 1
SBEAT System Mounting Heights

System	Height During Construction and Seasonal Shutdown mm	Height for Completion of the Work mm
MASH SoftStop Terminal	760 to 810	760 to 810
MASH Max-Tension Terminal	760 to 810	760 to 810
MASH Sequential Kinking Terminal	760 to 810	760 to 810

Appendix 732-A, November 2019 FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Steel beam energy attenuating terminal system locations. (732.07.01)
- Depth and alignment of system. (732.07.02)

For Type M steel beam guide rail, use only MASH Terminal Systems.

The steel beam energy attenuating terminal system should be installed flared; however, the system may be installed tangent to the roadway, if grading requirements cannot be met.

The steel beam energy attenuating terminal system should not be installed on roadway with centreline curves less than 250 m radius.

Each steel beam energy attenuating terminal system unit comes from the supplier with all components required for its installation, including posts and steel beam guide rail elements for the length of the system.

Reflective sheeting is normally supplied with each steel beam energy attenuating terminal system. The designer should determine if the sheeting is not required and, if so, specify it in the Contract Documents.

Wherever possible, the designer should eliminate the use of curb with gutter, in advance of and along the length of end treatments and crash cushions. See MTO Roadside Design Manual for additional information.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

OPSD 202.031	Roadway Widening For Steel Beam Energy Attenuating Terminal, Approach End
OPSD 202.032	Roadway Widening For Steel Beam Energy Attenuating Terminal, Leaving End And Constrained Approach End
OPSD 912.124	Guide Rail System, Steel Beam, Type M Transition Rail, Component
OPSD 912.125	Guide Rail System, Steel Beam, Type M Rail, Component
OPSD 912.127	Guide Rail System, Steel Beam, M20 Steel Post With Offset Block, Component
OPSD 912.130	Guide Rail System, Steel Beam, Steel Post With Offset Block Assembly, Installation - Single Rail
OPSD 912.140	Guide Rail System, Wooden Post Assembly, Installation - Single Rail
OPSD 922.165	Energy Attenuator, End Treatment, Steel Beam Energy Attenuating Terminal, MASH SoftStop Terminal System, Installation
OPSD 922.171	Energy Attenuator, End Treatment, Steel Beam Energy Attenuating Terminal, MASH Max-Tension Terminal System, Installation
OPSD 922.186	Energy Attenuator, End Treatment, Steel Beam Energy Attenuating Terminal, MASH Sequential Kinking Terminal System, Installation

OPSD 984.201 Energy Attenuator, End Treatment, Delineation, Installation - Approach End
OPSD 984.202 Energy Attenuator, End Treatment, Delineation, Installation - Leaving End