

OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

CS: Statewide

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

Design Guidance Preamble

The proceeding design guidance serves as an aid to administrative, engineering, and technical staff. Engineering practice requires that professionals use a combination of technical skills and judgment in decision making. Engineering judgment is necessary to allow decisions to account for unique site-specific conditions and considerations to provide high quality products, within budget, and to protect the public health, safety, and welfare. This manual provides the general operational guidelines; however, it is understood that adaptation, adjustments, and deviations are sometimes necessary. Innovation is a key foundational element to advance the state of engineering practice and develop more effective and efficient engineering solutions and materials. As such, it is essential that our engineering manuals provide a vehicle to promote, pilot, or implement technologies or practices that provide efficiencies and quality products, while maintaining the safety, health, and welfare of the public. It is expected when making significant or impactful deviations from the technical information from these guidance materials, that reasonable consultations with experts, technical committees, and/or policy setting bodies occur prior to actions within the timeframes allowed. It is also expected that these consultations will eliminate any potential conflicts of interest, perceived or otherwise. MDOT Leadership is committed to a culture of innovation to optimize engineering solutions.

The National Society of Professional Engineers Code of Ethics for Engineering is founded on six fundamental canons. Those canons are provided below.

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, reasonably, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

INDEX

3.01 INTRODUCTION

- 3.01.01 References
- 3.01.02 Abbreviations & Definition of Terms

3.02 OVERHEAD SIGN STRUCTURE SITE PLANNING

- 3.02.01 Project Scoping and Survey
- 3.02.02 Overhead Sign Structure Use Cases
 - A. General Use Cases
- 3.02.03 Overhead Sign Considerations
 - A. Considerations
 - B. Requirements
- 3.02.04 Selection Criteria
 - A. Truss
 - B. Bridge-Mounted
 - C. Cantilever
- 3.02.05 Aesthetics
- 3.02.06 Appurtenances
 - A. Signs
 - B. Dynamic Message Signs
 - C. Others

3.03 OVERHEAD SIGN STRUCTURE PLACEMENT

- 3.03.01 Placement
- 3.03.02 Clear Zone
- 3.03.03 Utility Coordination
- 3.03.04 Right-of-Way Coordination

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3.04 STRUCTURAL DESIGN

3.04.01 Foundation Types

- A. Drilled Shafts
- B. Spread Footings

3.04.02 Bridge-Mounted Signs

- A. Beams - Steel
- B. Beams - Concrete
- C. 4-Bolt Pattern
- D. 6-Bolt Pattern
- E. Re-Use of Steel Beam Connections

3.04.03 Salvaging Existing Structures and Foundations

3.04.04 Overhead Sign Structures Mounted to Other Structures

3.05 FABRICATION

3.05.01 Shop Drawing Review Process

3.05.02 Fabrication Schedule

Appendix A – MDOT Bridge Sign Connection Cheat Sheet

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3.01

INTRODUCTION

This guidance text addresses procedures involved in the design and plan preparation of overhead sign structures on the interstate/freeway, arterial, collector, and local road system governed by the Michigan Department of Transportation (MDOT). It includes cantilever and truss supported signs and bridge-mounted signs.

A major portion of this text is devoted to structure type design and placement considerations. Other sections provide guidance on foundation types and fabrication process. In general, the Overhead Sign Structures Design Guidelines is intended to be a single source reference for the MDOT Design Engineers and consultants responsible for incorporating overhead sign structures on highway design projects.

The design of overhead sign structures in Michigan is based on the **MDOT Standard Specifications for Construction** and **AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (AASHTO LRFDLTS)**. However, it is understood that sometimes adaptations and deviations may be necessary as these publications can be vague or leave decisions up to the judgement of the Engineer.

As procedures and guidelines change, the Overhead Sign Structures Design Guidelines will be continually updated to keep the text as current as possible. These updates will describe the revision, explain the reason, serve as commentary, and assign the date of its implementation.

3.01.01

References

Where national standards or specifications (e.g., AASHTO, MUTCD) are referenced herein, the designer shall utilize the current edition, including all interim revisions, as formally adopted by the Federal Highway Administration (FHWA) in 23 CFR 625 (Design Standards for Highways) at the time of project scoping, unless otherwise directed by MDOT.

- A. Standard Specifications for Construction (SSC), MDOT**
- B. Sign Support Standard Plans and Special Details, MDOT**
- C. AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (AASHTO LRFDLTS)**
- D. Michigan Manual on Uniform Traffic Control Devices (MMUTCD)**
- E. Guidelines for Signing on State Trunkline Highways, MDOT**
- F. Road Design Manual, MDOT**
- G. Geotechnical Manual, MDOT**
- H. Bridge Design Manual, MDOT**
- I. Traffic Sign Design, Placement, and Application Guidelines, MDOT**
- J. Real Estate Procedure Manual, MDOT**

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3.01.02

Abbreviations and Definition of Terms

When the following abbreviations are used in the guidance text, they have the meanings listed below.

AASHTO	American Association of State Highway and Transportation Officials
BOBS	Bureau of Bridges and Structures (MDOT)
DMS	Dynamic Message Sign
FHWA.....	Federal Highway Administration
LRFD.....	Load and Resistance Factor Design
MASH.....	Manual for Assessing Safety Hardware
MDOT.....	Michigan Department of Transportation
MMUTCD.....	Michigan Manual on Uniform Traffic Control Devices
PPDM.....	Preconstruction Process Documentation Manual
ROW	Right-of-Way

Appurtenances - A miscellaneous device or attachment mounted to a structure that can include signs, antennas, and other devices.

Cantilever - A cantilever structure consists of a rigid structural element extending above the roadway supported only at one end.

Clear Zone - The unobstructed, traversable roadside area provided beyond the edge of the through traveled way that allows a driver to

stop safely or regain control of a vehicle that has left the roadway.

Deflection - The degree to which a part of a structural element is displaced (typically under a load).

Ground Mounted - Supported directly on foundations extending into the soil (not mounted on a bridge, retaining wall or other type of structure).

Right-of-Way (ROW) - The entire area reserved for the construction, operation, and maintenance of the roadway and the improvement of the roadside such as landscaping, sidewalks, pathways, or transit stops. ROW will either be free access or limited access. Limited access ROW is when the inherent right of access to a public highway by the abutting owner or occupant is acquired along with the title to the ROW.

Roadside - Portion of the right-of-way outside of the footprint of the roadway.

Truss - A truss structure consists of a rigid structural element spanning across the roadway with supporting columns at both ends.

Bridge-Mounted – Supported by brackets directly mounted to the sides of grade separated highway bridges over the underpass roadway.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3.02

OVERHEAD SIGN STRUCTURE SITE PLANNING

Site planning of overhead sign structures must follow and account for specifications outlined in the **MDOT Road Design Manual**, **MMUTCD**, **MDOT Guidelines for Signing on State Trunkline Highways**, and the **MDOT Traffic Sign Design, Placement, and Application Guidelines**.

Specifications for the design and construction of structural supports for signs have been standardized by **AASHTO**. Bridges in sufficient condition often serve as the support structure for overhead signs. In some cases, they may be the only practical location that will provide adequate sight distance. Use bridge structures as sign supports to eliminate the need for additional sign supports and foundations along the roadside. The designer must conduct a field review with the **MDOT Signing Unit** and the **Region Bridge Engineer** to evaluate the selection and use of bridge-mounted signing. Refer to **Section 3.04.02** for details regarding bridge-mounted signs.

Determine if roadside signs will serve traffic needs before considering the use of overhead signs. Clear zone guidelines must be considered when evaluating the need for overhead signing. Factors justifying the installation of overhead signs are given in **Section 3.02.03**.

3.02.01

Project Scoping and Survey

Understanding the project scope is critical for the Engineer to establish what deliverables (e.g., permits, easement acquisition, design exceptions, etc.) are required. To ensure consistency across projects, the Engineer must follow the scoping process provided by the **MDOT PPDM Task Series 2100 – EPE Scoping Analysis through Series 2800 – Contamination Investigation**.

Proper survey, specifically those related to the structures and roadway, is critical to ensure a project can provide what has been scoped. The Engineer must review **MDOT PPDM Task Series 3100 – Scope Verification through Series 3600 – Utilities/Railroad** before survey takes place so that consistent and thorough survey can be prescribed.

3.02.02

Overhead Sign Use Cases

Use overhead sign structures to support guide signs on freeways and expressways depending on traffic control needs, the size of sign required, roadway location, and many other considerations. Refer to the **MMUTCD** for a list of conditions that require an overhead sign.

The principal applications for overhead sign structures are on multilane heavily traveled highways. Place signs directly over the travel lanes to which they apply to assist in increasing communications with the driver. Use overhead signs on freeways, at locations where some degree of lane use control is desirable, and at locations where space is not available on the roadside. Before placing a W-series post-mounted sign in an overhead position, consider the upstream configuration of signing and a ground mounted placement. If ground mounting of the W-series cannot be done at an upstream location, please contact the **MDOT Signing Unit**.

A. General Use Cases:

1. Where the message is applicable to a particular lane(s) over which the sign is placed and where lane use can be made significantly more effective.
2. Where traffic or roadway conditions are such that an overhead mounting is necessary for adequate visibility (e.g., vertical or horizontal curvature, closely spaced interchanges, three or more through lanes in one direction etc.).

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3. At, or just in advance of, a divergence from a heavily traveled roadway (e.g., at a ramp exit where the roadway becomes wider, and a sign on the right side is usually not in the line of sight for the driver).
4. Where there is no space for signs at the side of the roadway (e.g., where narrow right-of-way does not provide adequate width for a sign installation).
5. Where ground-mounted placement would create an undue roadside hazard.
6. Where, because of hazardous conditions, particularly effective guidance is needed for the unfamiliar driver.
5. Three or more lanes in each direction
6. Restricted sight distance (ramp deceleration lanes located over crest vertical curves)
7. Closely spaced interchanges
8. Multi-lane exits
9. Large percentage of trucks
10. Street lighting background
11. High speed traffic
12. Consistency of sign message location through a series of interchanges
13. Insufficient space for ground mounted signs
14. Junction of an Interstate route with another freeway (lane assignments)
15. Deficient Bridges (see **MDOT Highway Bridge Safety website**) for bridge-mounted signs.

3.02.03

Overhead Sign Considerations and Requirements

The following sections describe situations to consider overhead signs and cases where their use is required. Subsequent sections outline which types of overhead signs to use.

A. Considerations

The operational requirements of our present highway system are such that overhead signs will have value at many locations. The factors justifying the erection of overhead sign displays are not definable in specific numerical terms, but the following conditions may be considered:

1. Exit only lanes
2. Left exit ramps
3. Traffic volume at or near capacity
4. Complex interchange design (double exits)

B. Requirements

Other than what is a standard in the **MMUTCD**, the existence of any one or more of the factors does not automatically justify the use of overhead signs. Some of the factors listed above can be made less critical by close coordination between design and operation.

Overhead signing is required per the **MMUTCD** for the following situations/sign types:

1. Overhead Arrow per Lane or Diagrammatic Guide Signs at Major Interchanges
2. Pull Through Signs
3. Interchange Lane Drops
4. Interchange Sequence Signs in the Median

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

5. Freeway to Freeway – 1 Mile Advance and at theoretical gore
6. Cloverleaf – At theoretical gore for first exit ramp and Advance Guide sign for second ramp

If a Region/TSC Traffic and Safety Representative desires to pursue overhead signing for a specific location(s), conduct a joint field investigation with **MDOT Signing Unit** and Region/TSC personnel to determine final signing requirements.

3.02.04

Design Considerations

If it has been determined that an overhead sign installation is required, then criteria for overhead sign structure selection may include cost, sign layout, roadway characteristics, site-specific factors, and more.

Most bridge-mounted sign connections are significantly lower in cost than standalone overhead sign structures. Design and placement of a truss or cantilever in front of a bridge structure is least desirable but are options based on deficient bridge conditions.

The size and number of guide signs are the principal factors that determine the type of overhead sign structures to choose from. The following is a list of common structures for consideration based on in-depth field review and location availability:

A. Truss

Used for more than one sign per location. Use **Type E (Type C and D are for maintenance use only, not permitted in new projects)**.

B. Bridge-Mounted

Used if there is a suitable structure available in approximate location for sign replacement. See **Section 3.04.02** for information on bridge-mounted sign structures.

C. Cantilever

Used when previous alternatives are cost prohibitive (trusses) or are not applicable. Use **Type E**, (**Type J** for special conditions, ex. poor soil conditions, if multiple signs needed, but truss is not possible, or other adverse conditions).

3.02.05

Aesthetics

In order to limit confusion for roadway users, signage is specifically designed for simplicity and uniformity, as outlined in the **MMUTCD** and the **MDOT Guidelines for Signing on State Trunkline Highways**. No coatings or painting of sign structures, except for hot dip galvanizing, are allowed. Refer to **MDOT Standard Specifications of Construction** to determine allowed sign support material and **MDOT Sign Support Standard Plans and Special Details** to determine the appropriate sign structure design.

3.02.06

Appurtenances

A. Signs

Refer to the current **MDOT Sign Support Standard Plan SIGN-700-Series** for connection details.

B. Dynamic Message Signs

Consider the attachment of small dynamic message signs to overhead sign structures for specific purposes such as flex lane assignments. Typically, the standard **Truss, Type E** trusses are used for this purpose. The designer must consult with the **MDOT Signing Unit** to determine the appropriate support for these signs. Minor sign attachment modifications and additional electrical requirements will be necessary. Refer to Chapter 6 of these guidelines for information regarding design of dynamic message sign structures.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

C. Others

Although not common practice, several additional appurtenances may be added to sign structures such as cameras, sensors, and radios. Any appurtenances not shown on the **MDOT Standard Plans** and **MDOT Special Details** have not been accounted for in design. The designer must submit structural calculations sealed by a Professional Engineer who is licensed in the State of Michigan addressing the extra weight and effective projected area of the appurtenances.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3.03

OVERHEAD SIGN STRUCTURE PLACEMENT

3.03.01

Placement

The placement and clearance of sign structures must follow what is outlined in the **MMUTCD**. If the placement requires attachment to an existing structure, the feasibility of this placement must be discussed with the **MDOT Ancillary Structures Program**, the **MDOT Signing Unit**, and **MDOT BOBS** if attaching to a bridge. Special permission must be obtained for any deviations.

3.03.02

Clear Zone

It is desirable to place structures outside of the clear zone if possible, however this is typically not feasible for overhead sign structures. Install protective measures such as barrier or guardrail when placing overhead sign structures within the clear zone. Refer to Chapter 7 of the **MDOT Road Design Manual** for current clear zone criteria and more information regarding barrier and guardrail placement.

Coordinate with MDOT on the future changes in the clear zone for highway expansion before finalizing sign structure placement.

3.03.03

Utility Coordination

Compile existing utility information as part of the base plan phase. Avoid utility impacts when possible. If signing work will impact site utilities, additional coordination with utility owners will be needed.

Include notes in the design plans to emphasize the contractor's responsibility to locate utilities and provide the preferred clearances of the utility owner prior to construction.

3.03.04

Right-of-Way Coordination

Place overhead sign structures within the ROW wherever possible. Coordinate with **MDOT Region Real Estate** staff early in the project schedule to determine real estate needs and impacts to the project schedule. Any temporary work outside the ROW requires a legal agreement such as a Consent or Temporary Construction Easement. The **Real Estate Services Section** of the **Development Services Division** or **Region Real Estate** will determine just compensation for the agreement which is offered to the property owner. Permanent ROW acquisition may also need to be considered. Review Chapter 16 of the **MDOT Real Estate Procedure Manual** for more details on ROW considerations during design.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3.04

STRUCTURAL DESIGN

Early in the design process, determine if any deviation from the **MDOT Standard Plans** and **MDOT Special Details** may be necessary. The current cantilever and truss support structures are designed in accordance with **AASHTO LRFDLTS** for infinite fatigue life and any modifications must meet these requirements. Any modifications must be approved by the **MDOT Signing Unit** and **MDOT Ancillary Structures Program**. This includes any new structures as well as any modifications to existing structures.

3.04.01

Foundation Types

Review historic structure borings before new borings are obtained. New soil borings must be obtained in accordance with the requirements in the **MDOT Geotechnical Manual**.

A. Drilled Shafts

Drilled shafts serve as the standard foundation type for overhead sign structures. Standard designs are provided in the **MDOT Standard Plans** and **MDOT Special Details**.

B. Spread Footings

Spread footings may be used when utility conflicts exist or when other site considerations may dictate. The designer must coordinate with the **MDOT Signing Unit**.

3.04.02

Bridge-Mounted Sign Structures

A field review is required for all bridge-mounted signs and the designer must coordinate with the **MDOT Signing Unit**, the **MDOT Region Bridge Engineer**, and **MDOT BOBS**.

Use bridge-mounted signs if there is a suitable structure available in approximate location for sign replacement. The primary selection factor is the beam type and material. The following bridge beams call for specific bridge sign connection types for upgrades (see **Appendix A – MDOT Bridge Sign Connection Cheat Sheet**).

A. Beams- Steel

1. **SIGN-800-Series** (Type B)
2. **SIGN-820-Series** (Types F & G)
3. **SIGN-830-Series** (Types H, I & J)

B. Beams- Concrete

1. **SIGN-800-Series** (Types A1 & A2)
2. **SIGN-810-Series** (Types C, D, & E)
3. **SIGN-850-Series** (Types K, L & M)
4. **SIGN-870-Series** (Types O, P & Q)
5. **SIGN-880-Series** (Types R, S & T)
6. **SIGN-890-Series** (Types U, V & W)

The principal design application for the bridge sign connections listed above is to replace the existing supports to accommodate larger signs, based on the new sign sizes. Newly built bridges with beams greater than 36 inches are excellent structures for considering new-style bridge sign connections.

Existing steel beam bridges with bridge sign connections must be carefully inspected for maintenance replacement. Ideally, the beam has been determined sufficient to receive a new set of bolt holes to replace the existing bridge sign connection. In some cases, a new set of bolt holes is not desirable per MDOT policy specifically for railroad and pedestrian structures. Replace the existing bridge sign connections on these structures utilizing existing bolt holes.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

The following bridge sign connections are for Maintenance purposes only:

C. 4-Bolt Pattern

1. **SIGN-821-Series** (Types C & D)
2. **SIGN-831-Series** (Types E & F)

D. 6-Bolt Pattern

1. **SIGN-898-Series** (Types C & D)
2. **SIGN-899-Series** (Types E & F)

Existing Concrete beam bridges with bridge sign connections must be carefully inspected. Non-standard concrete bridge sign connections must be replaced with the current design standards, which utilizes concrete railings and fascia in good condition. Where a concrete bridge is being considered for a bridge sign connection, the concrete surface must be free of defects, deformation, missing chunks or other undesirable characteristics. In some circumstances, the existing bridge sign connection may be retained. The use of existing concrete holes is not permitted.

E. Re-Use of Steel Bridge Beam Connections

Where there is a need to reuse the bolt holes from a bridge mounted sign in a steel bridge girder, use the **AASHTO LRFDLTS** compliant standards, **SIGN-820-Series** and **SIGN-830-Series** in select cases with some modifications. The modifications have been published as **SIGN-825-Series** and **SIGN-835-Series**

The designer must first verify that the capacity of the existing beam is sufficient to support the new sign. Consult with the **MDOT Signing Unit**, the **MDOT Ancillary Structures Program**, and **MDOT BOBS** in these cases. Where applicable, use the following standards to reuse bridge girder bolt holes with **AASHTO LRFDLTS** compliant standards.

1. For reuse of bolt holes from **SIGN-820-Series**, use **SIGN-825-Series**.
2. For reuse of bolt holes from **SIGN-830-Series**, use **SIGN-835-Series**.

3.04.03

Salvaging Existing Sign Structures and Foundations

Evaluate overhead sign supports and foundations for salvaging and re-use if certain conditions are met. Typically, this involves evaluation of existing condition, age, structure type, foundation type, specific details, and more.

Due to cost, reuse **Truss, Type E**, and **Cantilever, Type J**, structures whenever possible. If no re-use is possible, evaluate salvaging for maintenance purposes.

Strongly consider the reuse of foundations when part of a road project.

The Engineer must coordinate salvaging and reuse of any overhead sign structure or foundation with the **MDOT Signing Unit** and **MDOT Ancillary Structures Program**.

3.04.04

Overhead Sign Structures Mounted to Other Structures

A unique design is required when mounting overhead signs to retaining walls, noise barriers, or bridges. Consult with the **MDOT Signing Unit**, the **MDOT Ancillary Structures Program**, and **MDOT BOBS** in these cases. In addition, when truss foundations are mounted to walls, barriers, and bridges, consideration must be given to the potential differential movement of the two foundations. Mounting a truss with foundations attached to two separate bridges is not permitted.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

3.05

FABRICATION

3.05.01

Shop Drawing Review Process

MDOT's Shop Drawing Review Process must be followed when the Engineer receives shop drawings from a fabricator. This ensures that responsibilities have been properly coordinated and consistency is provided between all parties performing the reviews.

3.05.02

Fabrication Schedule

The fabrication of overhead sign structures is completed off-site at numerous facilities. Acquisition of materials and fabrication may take six months or more from award to on-site delivery. Consult with the **MDOT Signing Unit** and the **MDOT Structural Fabrication Unit** for questions regarding schedules and progress clauses.

MICHIGAN OVERHEAD SIGN STRUCTURES DESIGN GUIDELINES

APPENDIX A – MDOT BRIDGE SIGN CONNECTION CHEAT SHEET

	Pay Item	Description	Standard	Width	Height	Angle	# of Columns	Comments	Connection Surface
	8100020	Bridge Sign Connection, Bolt Replacement							
Concrete Surface	8100031	Bridge Sign Connection, Conc, Type A1	800	6 - 12	0 - 2.5	0 - 40	n/a		Deck Fascia
	8100032	Bridge Sign Connection, Conc, Type A2	800	6 - 12	0 - 2.5	0 - 40	n/a		T-Beams or Conc Barriers
	8100033	Bridge Sign Connection, Conc, Type C	810	0 - 22	0 - 20	0 - 40	2 Columns		Prestressed Conc I-beam
	8100034	Bridge Sign Connection, Conc, Type D	810	0 - 40	0 - 20	0 - 40	3 Columns		Prestressed Conc I-beam
	8100035	Bridge Sign Connection, Conc, Type E	810	0 - 40	0 - 20	0 - 40	4 Columns		Prestressed Conc I-beam
	8100037	Bridge Sign Connection, Conc, Type K	850	0 - 22	0 - 20	0 - 40	2 Columns	Area<190	Conc T-beam
	8100038	Bridge Sign Connection, Conc, Type L	850	0 - 40	0 - 20	0 - 40	3 Columns	Area<300	Conc T-beam
	8100039	Bridge Sign Connection, Conc, Type M	850	0 - 40	0 - 20	0 - 40	4 Columns	Area<370	Conc T-beam
	8100040	Bridge Sign Connection, Conc, Type O	870	0 - 22	0 - 10	0 - 40	2 Columns	Area<200	Prestressed I-beam
	8100041	Bridge Sign Connection, Conc, Type P	870	0 - 40	0 - 10	0 - 40	3 Columns	Area<300	Prestressed I-beam
	8100042	Bridge Sign Connection, Conc, Type Q	870	0 - 40	0 - 10	0 - 40	4 Columns	Area<380	Prestressed I-beam
	8100043	Bridge Sign Connection, Conc, Type R	880	0 - 22	0 - 10	0 - 40	2 Columns	Area<200	Side by Side Box Beam
	8100044	Bridge Sign Connection, Conc, Type S	880	0 - 40	0 - 10	0 - 40	3 Columns	Area<340	Side by Side Box Beam
	8100045	Bridge Sign Connection, Conc, Type T	880	0 - 40	0 - 10	0 - 40	4 Columns	Area<380	Side by Side Box Beam
	8100046	Bridge Sign Connection, Conc, Type U	890	0 - 22	0 - 10	0 - 40	2 Columns	Area<200	Spread Box Beam
	8100047	Bridge Sign Connection, Conc, Type V	890	0 - 40	0 - 10	0 - 40	3 Columns	Area<300	Spread Box Beam
	8100048	Bridge Sign Connection, Conc, Type W	890	0 - 40	0 - 10	0 - 40	4 Columns	Area<380	Spread Box Beam
Steel Surface	8100061	Bridge Sign Connection, Steel, Type B	800	6 - 12	0 - 2.5	0	n/a		
	8100062	Bridge Sign Connection, Steel, Type C (old type)	821	0 - 22	0 - 20	0	2 Columns	4 bolts on top	
	8100063	Bridge Sign Connection, Steel, Type D (old type)	821	0 - 40	0 - 20	0	3 Columns	4 bolts on top	
	8100062	Bridge Sign Connection, Steel, Type C (old type)	898	0 - 22	0 - 20	0	2 Columns	6 bolts on top	
	8100063	Bridge Sign Connection, Steel, Type D (old type)	898	0 - 40	0 - 20	0	3 Columns	6 bolts on top	
	8100064	Bridge Sign Connection, Steel, Type E (old type)	831	0 - 22	0 - 20	5 - 40	2 Columns	4 bolts on top	
	8100065	Bridge Sign Connection, Steel, Type F (old type)	831	0 - 40	0 - 20	5 - 40	3 Columns	4 bolts on top	
	8100064	Bridge Sign Connection, Steel, Type E (old type)	899	0 - 22	0 - 20	5 - 40	2 Columns	6 bolts on top	
	8100065	Bridge Sign Connection, Steel, Type F (old type)	899	0 - 40	0 - 20	5 - 40	3 Columns	6 bolts on top	
	12SPB10(H)	Bridge Sign Connection, Steel, Modified, Type F	820	0 - 22	0 - 20	0 - 40	2 Columns	New Type F	Web less than 36"
	8100326	Bridge Sign Connection, Steel, Type G	820	0 - 40	0 - 20	0 - 40	3 Columns		Web less than 36"
	8100327	Bridge Sign Connection, Steel, Type H	830	0 - 22	0 - 20	0 - 40	2 Columns		Web greater than 36"
	8100328	Bridge Sign Connection, Steel, Type I	830	0 - 40	0 - 20	0 - 40	3 Columns		Web greater than 36"
	8100329	Bridge Sign Connection, Steel, Type J	830	0 - 40	0 - 20	0 - 40	4 Columns		Web greater than 36"
Removals	8100015	Bridge Sign Connection, Type A, Rem					n/a		
	8100016	Bridge Sign Connection, Type B, Rem					n/a		Steel Web Connection
	8100017	Bridge Sign Connection, Type C, Rem				0	2 Columns		
	8100018	Bridge Sign Connection, Type D, Rem				0	3 Columns		
	8100019	Bridge Sign Connection, Type E, Rem				5 - 40	2 Columns		
	8100020	Bridge Sign Connection, Type F, Rem				5 - 40	3 Columns		
							4 Columns	Pay for with 2 Type C or Type E Removals	