

## BRIDGE DESIGN STANDARD PRACTICES

The following standard practices have been established by the Bridge Design Standard Practices Committee.

### DESIGN PRACTICE FOR RETAINING WALLS

#### GENERAL

Retaining walls should be used where the construction of a roadway or facility cannot be accomplished with slopes. The following is a listing of appropriate retaining wall types that may be considered:

Non-Proprietary: Cast-In-Place Reinforced Concrete

Proprietary: Prefabricated Modular Wall Systems  
Mechanically Stabilized Earth Walls (precast concrete)  
Mechanically Stabilized Earth Embankment Walls (dry-cast block)

A design is required for the non-proprietary walls only. The Contractor shall be responsible for the design of the proprietary walls. The design drawings shall be signed, sealed and dated by a qualified Professional Engineer, licensed to practice in the State of Connecticut. For projects where proprietary retaining walls are included, the walls will be bid as a lump sum for each site. The designer shall clearly define the horizontal, vertical, and transverse pay limits on the plans.

The Department maintains a list of approved proprietary retaining walls for each category listed above. No other proprietary retaining walls will be allowed.

#### WALL SELECTION CRITERIA

The designer shall select the appropriate retaining wall types for each site. The designer may need to contact wall manufacturers to insure that each wall type will be suitable at each site, and fit within the available right-of-way. The following general criteria should be followed for the selection of appropriate retaining walls:

##### **1. Walls less than 2.5 m High (measured from front grade to back grade)**

###### *a.) Embankment Walls*

Embankment walls are defined as mechanically stabilized earth structures, faced with dry cast concrete block, that are less than 2.5 meters high that support an embankment. Embankment walls are typically used to support earth only, not roadways where there is a potential for future underground utilities or drainage structures. The mechanical strength of the wall comes from soil reinforcements comprised of either geogrids or welded wire mesh.

Embankment walls are proprietary wall systems and there are several approved manufacturers

of these types of walls. It is not necessary to design a cast-in-place retaining wall as an alternate, however, the designer shall lay out the embankment wall on the plans with at least the following information:

- Retaining wall plan views with all required dimensions, contours, property lines, utilities, etc.
- Retaining wall elevation views showing top and bottom elevations, approximate step locations, existing and finished grade, etc.
- Typical sections (schematic) of the wall showing pay limits and minimum drainage requirements
- Borings and soils information including the maximum allowable bearing pressure
- Temporary Sheet piling required for excavation

In general, embankment walls should not be used directly adjacent to high volume roadways where there is a high potential for damage due to errant vehicles. For this situation, the minimum distance from the gutterline to the face of the wall should be kept to greater than 2400 mm.

*b.) Cast-in-place Walls*

For locations where embankment walls are not appropriate (in accordance with 1.a above), a cast-in-place wall should be designed and detailed.

If the appearance of stone is desired, architectural form liners should be used. These liners are significantly less costly than stone veneer. If there are multiple walls on the project, the surface treatment shall be similar for each wall.

**2. Walls over 2.5 m High (measured from front slope to back slope)**

*a.) Walls with less than 500 square meters of vertical face area  
(measured to bottom of footing):*

For this situation, a cast-in-place wall should be designed to be bid against the proprietary walls. The Contractor may be able to build the cast-in-place wall with his own forces at a lower cost. For these situations, the designer shall completely design and detail the cast-in-place wall.

For the proprietary retaining wall, schematic typical cross sections combined with the cast-in-place details should be enough for the proprietary wall manufacturers to design their walls.

For mechanically stabilized earth walls with metallic soil reinforcements that are to be built in areas of potential stray currents within 60 m of the structure, (for example: an electrified railroad), a corrosion expert shall evaluate the potential need for corrosion control requirements.

If the wall is required to be designed for seismic loads, it shall be stated in the notes for the wall.

*b.) Walls with over 500 square meters of vertical face area:*

For this situation, proprietary retaining walls will most likely be more economical, therefore, a cast-in-place wall design should generally not be done. The designer shall determine which proprietary retaining walls are appropriate for each site. The designer shall also lay out the proprietary retaining walls on the plans with at least the following information:

- A list of the specific walls allowed for each site. For instance, the designer may limit the selections based on the available right of way at a site.
- Retaining wall plan view with all required dimensions, contours, property lines, utilities, etc.
- Retaining wall elevation view showing top and bottom elevations, approximate footing step locations, existing and finished grade, etc.
- Typical sections (schematic) of the wall showing pay limits and minimum drainage requirements. Specific details are not required for each wall manufacturer.
- All soils information normally used for the design of a cast-in-place wall shall be shown on the plans including but not limited to borings, and allowable soil bearing pressures.
- Temporary Sheet piling required for excavation
- If the wall is required to be designed for seismic loads, it shall be stated in the notes for the wall.

For mechanically stabilized earth walls with metallic soil reinforcements that are to be built in areas of potential stray currents within 60 m of the structure, (for example: an electrified railroad), a corrosion expert shall evaluate the potential need for corrosion control requirements.

*c.) Architectural Treatments:*

If the appearance of stone is desired, architectural form liners should be used. These liners are significantly less costly than stone veneer. Several of the proprietary retaining walls can be built with form liners resembling stone. The designer should contact the approved wall manufacturers for specifics about available form liners. Every effort should be made to keep the surface treatment similar for all the wall types specified.

*d.) Large Anticipated Settlements:*

Proprietary retaining walls should not be used if large settlements are anticipated that require a wall supported on piles. Even though these walls can accommodate some settlement, the opening and closing of the joints would produce an undesirable appearance. For these situations, a cast-in-place wall should be designed supported on piles, or the proprietary retaining walls shall be detailed with pile supported full width footings.

*e.) Walls Supporting Roadways:*

If the wall supports a roadway where there is a possibility of future underground utilities and drainage structures, mechanically stabilized earth walls should not be used. This would not be the case for walls supporting limited access highways. If the utilities are extensive or deep, it may not be possible to use the modular wall options.

*f.) Multiple Walls in Same Project*

If there are several retaining walls within the same project, the designer may wish to require that all walls selected by the Contractor for the project be manufactured by the same wall supplier. This is especially true for walls that are close together.

*g.) Pre-construction procedures:*

The designer should contact the wall companies for tall walls or walls with unusual geometry to be sure that the proprietary walls will function at each site. This should be done during the preliminary design phase of the project.

Prior to construction advertising, the designer should inform in writing each proprietary wall company, that they are listed as acceptable alternates on the contract plans. This will allow them to obtain plans and specifications in order to accomplish preliminary design during advertising for the project. Part of this submission should include the anticipated advertising date.

## **DESIGN PRACTICE FOR SURFACE TREATMENTS FOR RETAINING WALLS**

In general, retaining walls shall be faced with standard formed concrete. Other surface treatments should only be considered in the following situations:

- When the structure has been determined by the Department to be architecturally or historically significant.
- If there is a desire expressed for special surface treatments during the public involvement process of the project. The basis for surface treatments should involve the character of the area in which the wall is to be built. The use of special surface treatments should be coordinated with the town, or city administration.
- Where the structure is to be built on a designated State scenic highway.
- The structure is part of the Merritt Parkway. For these structures, every attempt should be made to replicate the appearance and structure type that was originally built.
- The treatment of the structure is part of a right-of-way settlement with a property owner. For instance, if a property has an existing stone wall that is to be removed and relocated, the owner may request that the replacement wall also have a stone surface.

### **1. Form Liners**

When the use of surface treatments has been determined to be appropriate, the preferred method is the use of concrete form liners. Form liners offer a lower cost alternative to stone veneer. There is a wide variety of form liners available for different architectural treatments. Linear corrugated form liners should be avoided since it is difficult to hide joint lines and form tie holes. Form liners that replicate stone are preferred since the random nature of the surface make it easy to hide form tie holes.

## **2. Simulated Stone Masonry**

In more sensitive areas, where the look of real stone is required, the use of simulated stone masonry may be considered. Simulated stone masonry utilizes a flexible form liner system and color stains to provide the aesthetic appeal of natural stone with the durability of reinforced concrete.

## **3. Stone Veneer**

The use of stone veneer on concrete should only be considered in very sensitive areas where the increased cost can be justified. Stone veneer shall only be used with approval from the Department.