*Reviewers,*

*Some of the changes in this file are small, so we have combined these Chapters 1600, 1610, and 740 as they all relate to barrier type subjects.*

*Keep in mind that in combining these sections into one file makes the formatting and numbering of the sections look incorrect. Do not worry about the formatting or the section numbers. We will fix all the formatting and section numbers before we publish in September.*

*Please set your MS Word to “Review”, “All Markup” to see all track changes and comments. And do not worry if your changes/comments go into new pages. We will take care of it.*

*Please review these changes as you would any other Design Manual review using MS Word’s Track Changes and please add a comment about each of your changes to help us understand why you are suggesting your changes.*

*Every chapter starts on a new page.*

***Thank you*** *for helping us improve the Design Manual for users like yourself.*

Chapter 1600 Roadside Safety

# 1600.01 General

Roadside safety addresses the area outside the roadway and is an important component of total highway design. There are numerous reasons why a vehicle leaves the roadway, including driver error and behaviors. Regardless of the reason, a roadside design can reduce the severity and subsequent consequences of a roadside encroachment. From a crash reduction and severity perspective, the ideal highway has roadsides and median areas that are relatively flat and unobstructed by objects. It is also recognized that different facilities have different needs and considerations, and these issues are considered in any final design.

It is not possible to provide a clear zone free of objects at all locations and under all circumstances. The engineer faces many tradeoffs in design decision-making such as balancing needs of the environment, right of way, and various modes of transportation. The fact that recommended design values related to the installation of barrier and other mitigation countermeasures are presented in this chapter, does not mean that WSDOT is required to modify or upgrade existing locations to meet current criteria.

Roadside safety may be addressed by projects identified through priority programming, during certain preservation project activities (See [Chapter 1120](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1120.pdf)), or may be considered by projects as part of a safety analysis (See [Chapter 321](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/321.pdf)). Elements such as sideslopes, fixed objects, and water are all features that a vehicle might encounter when it leaves the roadway and become part of such an analysis. Roadside safety devices; such as a traffic barriers, bridge barriers, transitions, impact attenuators, or breakaway devices, are all features that may be installed specifically to mitigate a roadside condition.

On projects where the need to mitigate objects is determined based on location related to Design Clear Zone, consider the following mitigation measures in this order: (See [1600.02](#_1600.02 Clear_Zone) Clear Zone)

1. Remove
2. Relocate
3. Redesign a fixed object by using breakaway features or making the fixed object traversable (See Section [1600.03](#_1600.03 Mitigation_Guidance))
4. Shield with a traffic barrier
5. Delineate (To only delineate requires a Design Analysis. If this seems to be your only option, consult your Region traffic barrier expert or your Region’s ASDE.)

Factors for selecting a mitigation measure include, but may not be limited to:

* Crash severity potential
* Maintenance needs
* Cost (initial and life cycle costs)

Rumble strips can be employed to reduce the potential for lane departure or roadside encroachment in certain contexts (see [Section 1600.05(1)](#_1600.05(1) Rumble_Strips)). Use traffic barriers when other measures cannot reasonably be accomplished and conditions are appropriate based on an engineering analysis (See [Chapter 1610](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1610.pdf)).

# 1600.02 Clear Zone

A clear roadside border area beginning at the edge of the traveled way is a primary consideration with existing or new roadside and median features (see [Section 1600.03](#_1600.03 Mitigation_Guidance)). The intent is to provide a clear, traversable area for a vehicle driver or bicyclist to recover when their path is altered due to environmental, human, or vehicle or bicycle factors.

The Design Clear Zone indicates the target value for the clear roadside area (clear zone) and the level of documentation associated with roadside design. Compile an inventory of roadside and median features when they are located entirely or partially inside the Design Clear Zone, whether they are existing or proposed by the project. Document each inventoried feature location, the corrective actions considered, estimated cost to correct, and if the correction is planned or not using the Design Clear Zone Inventory Form (<https://wsdot.wa.gov/Design/Support.htm>). In cases where no action is taken, provide the reason(s) on the back of the form.

In situations where the Design Clear Zone is beyond WSDOT right of way, evaluate options on a case-by-case basis. Consider the nature of the objects within the Design Clear Zone, the roadway geometry, traffic volume, and crash history. Coordinate with adjacent property owners when proposed options include any work beyond WSDOT right of way. At a minimum, provide clear zone to the limits of the WSDOT right of way.

Clear zone is measured from the edge of the through traveled way, representing the intended lane of travel by any and all vehicles using the facility, and in both directions of travel on two way facilities (see Exhibit 1600-X). All projects that alter the relationship between the through lane and the roadside by widening or realignment have altered the existing clear zone, and require an evaluation of objects in the clear zone. Auxiliary lanes longer than 400 feet generally operate the same as a through lane and should be considered through lanes for the purpose of determining Design Clear Zone.

Exhibit 1600-X Existing and Design Clear Zone Plan View

##

# 1600.03 Mitigation Guidance

## 1600.03(2) Fixed Objects

### 1600.03(2)(e) Traffic Signal Standards/Posts/Supports

Breakaway supports for overhead signals generally are not feasible or desirable, and barrier is not generally an option at intersections due to geometric constraints. To reduce potential for drivers making contact with posts, and to avoid impeding the movement of pedestrian or bicyclist traffic in the vicinity, locate posts in accordance withSection 1330.04(5). Although supports for overhead ramp meter signals are not breakaway, traffic barrier is an available option in most cases.

Shorter vertical signal supports are available with breakaway features. Vertical poles greater than 10-feet in height require additional grading for the breakaway features to function properly. This additional grading is the same as that required for breakaway light standards (See Section 1600.03(2)(h)).

### 1600.03(2)(h) Light Standards

Provide breakaway light standards unless fixed light standards can be justified, even if outside of the Design Clear Zone. Fixed light standards may be justified if one of the following criteria are met:

* Posted speed is below 35 MPH (See [1600.02(1)](#_1600.02(1) Design_Clear_Zone) for Design Clear Zone in urbanized and urbanizing areas, and [1600.02(2)](#_1600.02(2) Design_Clear_Zone) in cities).
* Mounted on barrier (top or elbow mount).
* Behind traffic barrier, beyond the barrier’s deflection design value (see [Chapter 1610](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1610.pdf)).
* Within a parking lot.
* Along isolated walkways and shared-use paths that are outside of Design Clear Zone.

Breakaway light standards require additional embankment widening to ensure proper operation, as shown in the [*Standard Plans*](http://www.wsdot.wa.gov/Publications/Manuals/M21-01.htm)*, and provided in the contract plans (see WSDOT Plans Preparation Manual Section 700.08(3))*. For cut sections, a culvert may be required in front-of or behind the foundation to maintain a ditch line. If this additional embankment widening cannot be constructed, such as in cases where the toe of slope will extend beyond right of way or into a water body or other sensitive area, fixed bases and traffic barrier may be considered. Document the decision to use fixed bases in the Design Documentation Package.

Breakaway poles outside of the Design Clear Zone do not require additional embankment widening if the grade is constant within a 15-foot radius of the pole.

# 1600.04 Medians

Median barriers are normally used on limited access, multilane, high-volume highways. These highways generally have posted speeds of 45 mph or higher. Median barrier is normally placed on limited access state highways. Where median barrier is used on managed access highways where bicyclists, pedestrians, and transit users are present, consider providing accessible barrier openings at crossing locations. Install end treatments where median barrier openings are provided.

Provide median barrier on full access control multilane highways with median widths of 50 feet or less and posted speeds of 45 mph or higher. Consider median barrier on highways with wider medians or lower posted speeds when there is a history of cross-median crashes. Contact the HQ Design Office for more information. In diverging diamond interchanges that involve a single bridge structure, or in which travel directions share a continuous surface, regardless of the posted speed or median width, provide a barrier in order to separate the travel directions or to separate vehicles from a pedestrian facility in the median. Barrier type and design may be either project specific or selected from standard plans. Contact the HQ Design Office for more information.

Provide a left-side shoulder when installing median barrier using width criteria given in [Chapter 1230](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1230.pdf). Consider a wider shoulder area where the barrier might cast a shadow on the roadway and hinder the melting of ice. (See [Chapter 1239](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1239.pdf) for additional criteria for placement of median barrier, [Chapter 1610](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1610.pdf) for information on the types of barriers that can be used, and [Chapter 1260](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1260.pdf) for lateral clearance on the inside of a curve to provide the needed stopping sight distance.) Consider the need to accommodate drainage as a result of the addition of median barrier treatments.

When median barrier is being placed in an existing median, identify the existing crossovers and enforcement observation points. Provide the needed median crossovers in accordance with [Chapter 1370](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1370.pdf), considering enforcement needs. [Chapter 1410](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1410.pdf) provides guidance on HOV enforcement.

# 1600.05 Other Roadside Safety Features

## 1600.05(1) Rumble Strips and Rumble Stripes

Rumble strips are milled grooves or rows of raised pavement markers placed perpendicular to the direction of travel, or a continuous sinusoidal pattern milled longitudinal to the direction of travel, intended to alert inattentive drivers to a potential lane departure. A sinusoidal pattern can be used when a low noise design is desired.

The pavement receiving rumble strips needs to be in good condition and thick enough to support the rumble strips. Certain pavement types, such as open graded pavements, are not suitable for rumble strip installation. Grinding rumble strips into inadequate pavement will lead to premature deterioration of the surrounding pavement. Areas where the pavement is inadequate for rumble strip installation require removal and replacement of the existing pavement at and adjacent to the location of the rumble strip. Consult with the Region Materials Engineer to determine whether the existing pavement is adequate for rumble strip installation. The Region Materials Engineer will provide a pavement design for removing and replacing the existing pavement near the rumble strip if needed. When installing both rumble strips and recessed lane markers, follow the Standard Plan to avoid overlapping the grindings.

Contact HQ Bridge to confirm if rumble strips are appropriate to be installed on bridges included in the project.

Installing rumble strips in bituminous surface treatment (or BST) or other thin surface treatments can expose pavement structure and lead to delamination. In new rumble strip locations where a BST will be applied on top of Hot Mix Asphalt (HMA) pavement, install the rumble strips in the HMA pavement before placing the BST. Increase the milling depth of the rumble strips in order to maintain the plan rumble depth by accounting for the BST thickness (see WSDOT Standard Plans).

See guidance in Chapter 1120.03(9) when applying a BST (chip seal) on top of an existing rumble strip.

Provide an offset to the longitudinal paving joint so that rumble strips are not ground into the joint where practicable. For additional guidance on surface preparation and pavement stability, refer to the [*WSDOT Pavement Policy*](https://wsdot.wa.gov/sites/default/files/2013/07/08/Establishing-A-Uniform-Policy-for-Selecting-Pavement-Type.pdf).

The noise created when vehicle tires contact a rumble strip may adversely impact nearby residences and other land uses. Left-turning or passing vehicles, frequent passing maneuvers on two lane highways, and off-tracking of vehicles or trailers in tight radius curves, are examples of situations where incidental contact can happen. Noise impacts may be anticipated and a low noise rumble strip design may be appropriate for use at these locations when installing rumble strips in urban growth areas, and/or within 600 feet of a residence, school, church, or campground. In situations where a low noise rumble strip is desired but is not feasible, measures can still be taken to reduce incidental contact, including discontinuing the rumble strip through frequently used road approaches, through passing zones, and in tight radius curves. Contact HQ Design for more information about low noise rumble strip designs, noise mitigation strategies, and the criteria for employing them.

There are three types of rumble strip functions: transverse, shoulder, and centerline, and each are described in the following sections.

### 1600.05(1)(a) Transverse Rumble Strips

Transverse rumble strips are placed transversely in the traveled way to alert drivers who are approaching a change of roadway condition or object that requires substantial speed reduction or other maneuvering. Some locations where advance transverse rumble strips may be placed include:

* Stop-controlled intersections
* Port of entry/customs stations
* Lane reductions where crash history shows a pattern of driver inattention, and
* Horizontal alignment changes where crash history shows a pattern of driver inattention.

Transverse rumble strips may also be placed at locations where the character of the roadway changes, such as at the end of a freeway.

Contact the HQ Design Office for additional guidance on the design and placement of transverse rumble strips.

Document decisions to use transverse rumble strips in the Design Documentation Package.

### 1600.05(1)(b) Shoulder Rumble Strips and Rumble Stripes

Shoulder rumble strips (SRS) are placed parallel to the traveled way just beyond the edge line to warn drivers they are entering a part of the roadway not intended for routine traffic use. Shoulder rumble stripes are rumble strips placed immediately under the shoulder delineation paint, with any excess width milled or placed outward towards the shoulder. Shoulder rumble stripes are only installed where there is insufficient space to install shoulder rumble strips per one of the standard configurations (see Section 1600.05(1)(b)(2), Undivided Highways).

When shoulder rumble strips and shoulder rumble stripes are used, discontinue them where no edge stripe is present, such as at intersections and where curb and gutter are present. Discontinue shoulder rumble strips and rumble stripes where shoulder driving is allowed. Note: Continue shoulder rumble strips and rumble stripes through residential road approaches and driveways.

Shoulder rumble strip and rumble stripe patterns vary depending on whether bicyclists are expected to use the highway shoulder, and whether they are placed on divided or undivided highways. Rumble strip patterns for undivided highways are shallower and may be narrower than patterns used on divided highways. Rumble strips and rumble stripes installed on undivided highways also provide gaps in the pattern, providing opportunities for bicycles to move across the pattern without having to ride across the grooves. There are four shoulder rumble strip and four shoulder rumble stripe patterns. Consult the [*Standard Plans*](http://www.wsdot.wa.gov/Publications/Manuals/M21-01.htm) (rumble strips) or [*Plan Sheet Library*](http://www.wsdot.wa.gov/Design/Standards/PlanSheet/) (rumble stripes) for patterns and construction details.

1. **Divided Highways**

Install shoulder rumble strips on both the right and left shoulders of rural Interstate highways. Consider them on both shoulders of rural divided highways. Use the Shoulder Rumble Strip or rumble stripe Type 1 pattern on divided highways.

Omit shoulder rumble strips or rumble stripes along highway segments where any of the following conditions occur:

* When another project scheduled within two years of the proposed project will overlay or reconstruct the shoulders or will use the shoulders for detours.
* At locations where the overall shoulder width is:
	+ Less than 4-feet wide on the left (median) side of the roadway.
	+ Less than 6-feet wide on the right side of the roadway (5-feet wide where rumble stripes are used).
* At locations where it’s been determined that noise is an issue and a low noise design is not appropriate (see Section 1600.05(1)).
1. **Undivided Highways**

Shoulder rumble strips or rumble stripes are typically considered on undivided highways during centerline rumble strip installation or pavement rehabilitation. A list of prospective locations are provided to regions by HQ Design as a starting point in their development of a final list. The final list is compiled based on a field review of the prospective locations.

Omit shoulder rumble strips or rumble stripes along highway segments where any of the following conditions occur:

* Where usable shoulder for bicycles will be reduced to less than 4-feet (5-feet where barrier is present). Field-verify these dimensions.
* Where downhill grades exceed 4% for more than 500 feet in length along routes where bicyclists are frequently present.
* At locations where it’s been determined that noise is an issue and a low noise design is not appropriate (see Section [1600.05(1)](#_1600.05(1) Rumble_Strips)).

Document decisions to omit prospective rumble strip or rumble stripe locations in the final list of locations.

When selecting a rumble strip or rumble stripe design, consult the [*Standard Plans*](http://www.wsdot.wa.gov/Publications/Manuals/M21-01.htm) and [*Plan Sheet Library*](http://www.wsdot.wa.gov/Design/Standards/PlanSheet/) for the patterns and construction details, and apply the following criteria:

* Consider using a low noise pattern, or employ measures to reduce incidental contact, in areas where noise impacts are anticipated (apply criteria in Section [1600.05(1)](#_1600.05(1) Rumble_Strips)).
* Consider using a rumble stripe in narrower sections where they can help provide the required 4-feet of usable shoulder (5-feet where guardrail is present).
* Use Shoulder Rumble Strip Type 2 or Type 3 pattern on highways with minimal bicycle traffic.
* Use the Shoulder Rumble Strip Type 4 pattern where the bicycle traffic level on the shoulder is determined to be high. Consult the region and Headquarters Bicycle and Pedestrian Coordinators to determine the bicycle traffic level, and engage them in decision-making processes related to the use of rumble strips or rumble stripes on bike touring routes, and/or on other routes where bicycle events are regularly held.

### 1600.05(1)(c) Centerline Rumble Strips

Centerline rumble strips are installed on the centerline of undivided highways to alert drivers that they are entering the opposing lane. Centerline rumble strips are installed with no differentiation between passing permitted and no passing areas. See WSDOT Standard Plans that show when to continue or discontinue centerline rumble strip installation at certain roadway locations (i.e. intersections, road approaches, etc.). Refresh pavement markings when removed by centerline rumble strips.

Centerline rumble strips are typically installed on rural highways where the posted speed is 45 mph or higher. They may also be installed on urban routes with posted speeds as low as 35 mph. A list of prospective centerline rumble strip installation locations are provided to regions by HQ Design as a starting point in their development of a final list. The final list is compiled based on a detailed review of the prospective locations using the following criteria.

* Field verify lane and shoulder widths. See [Chapter 1230](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/1230.pdf) for guidance on lane and shoulder widths. Centerline rumble strips are only installed where the combined lane and shoulder width in either direction is greater than 12 feet.
* In locations where the combined lane and shoulder width in either direction is 14 feet or less, consider the level of bicyclist and pedestrian use along the route before installing centerline rumble strips. When drivers shift their lane position away from centerline to avoid the rumble strips, they are moving closer to pedestrians and bicyclists on the shoulder.
* Consider using a low noise rumble strip design in locations where noise is an issue, or employ measures for reducing incidental contact where a low noise design is not feasible (apply criteria in Section 1600.05(1)).
* In urban areas, do not consider installing rumble strips where the need to interrupt the rumble strip pattern to accommodate left-turning vehicles is very frequent, or where the posted speed is 35 mph and below.
* Do not use centerline rumble strips where two way left-turn lanes exist.

Document the decision to omit centerline rumble strips in a Design Analysis, when that decision is outside of the policy provided in this section (see [Chapter 300](http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/300.pdf).)

Chapter 1610 Traffic Barriers

**Chapter Organization:** The first sections (Introduction and Barrier Impacts) present information to consider when deciding whether to install a barrier. The next section (General Barrier Design Considerations) contains guidance common to ALL barrier types, such as deflection distance, length of need and sight distance. The remaining sections present design information organized by specific barrier type (beam guardrail, cable barrier, etc.).

Refer to the *Design Manual* [Glossary](https://www.wsdot.wa.gov/publications/manuals/fulltext/M22-01/glossary.pdf) for many of the terms used in this chapter.

Refer to Chapter 300 and 1610.01(1) for design documentation requirements.

# 1610.01 Introduction

WSDOT uses traffic barriers to reduce the overall severity of crashes. Consideration is given as to whether a barrier is preferable to the recovery area it may replace. In some cases, installation of a traffic barrier may result in more crashes as it presents an object that can be struck. Barriers are designed so that such encounters might be less severe and not lead to secondary or tertiary crashes. However, traffic barriers are not guaranteed to redirect an impacting vehicle without resulting injury to its occupants or triggering additional crashes. Barrier performance is affected by the characteristics of the vehicles that collide with them. Different vehicles will react differently given the characteristics and dynamics of the crash. Therefore, vehicles will be decelerated and redirected differently given the size, weight and direction of force imparted from the vehicle to the barrier.

Barriers are not placed with the assumption that the system will restrain or redirect all vehicles in all conditions. It is recognized that the designer cannot design a system that will address every potential crash situation. Instead, barriers are placed with the assumption that, under typical crash conditions, they might decrease the potential for excessive vehicular deceleration or excessive vehicle redirection when compared to the location without the barrier.

Traffic barriers do not prevent crashes or injuries from occurring. They often lower the potential severity for crash outcomes. Consequently, barriers should not be used unless a reduced crash severity potential is likely. No matter how well a barrier system is designed, optimal performance is dependent on drivers’ proper maintenance and operation of their vehicles and the proper use of passenger restraint systems. Site constraints play a major role in decisions regarding barrier selection and placement. Depending on the location, these constraints may include environmental considerations, topographic challenges, restricted right-of-way, geologic concerns, or conflicts with other infrastructure.

Barrier systems and vehicle fleets continue to evolve. The choice of a barrier is based on the characteristics of today’s vehicle fleet and testing criteria, not on speculative assumptions of future vehicle designs. This continuum of change does not allow engineers to predict the future with any degree of certainty. Consequently, engineering decisions need to be made based on the most reliable and current information.

Engineers are constantly striving to develop more effective design features to improve highway safety. However, economics, asset management and maintenance needs, and feasibility do not permit the deployment of new designs as soon as they become available on the market or are invented by a manufacturer. Further, most new designs only make marginal changes to systems and do not imply that old designs are unsafe or need modification.

Solutions may consider crash frequency and severity. As discussed previously, performance of the system relies on the interaction of the vehicle, driver, and system design at any given location. Additionally, the ability to safely access, maintain and operate over time is incorporated into the final barrier decision.

When barriers are crash-tested, it is impossible to replicate the innumerable variations in highway conditions under which the barrier applications occur. Therefore, barriers are crash-tested under standardized conditions. These standard conditions were previously documented in National Cooperative Highway Research Program (NCHRP) Reports 230 and 350. These guidelines have been updated and are now presented in the AASHTO publication, *Manual for Assessing Safety Hardware* (MASH).

The MASH criteria is implemented by WSDOT product category. Implementation takes place as designs and products are successfully tested or otherwise evaluated, become available and/or can be specified and are accepted by WSDOT for use. Following acceptance, implementation is documented through modifications to the corresponding standard specification(s), standard plan(s), and/or are accepted to the Qualified Products List (in the case of proprietary hardware). When a hardware category is converted to MASH, existing hardware may remain in service and be repaired as needed. However, if a full replacement is needed during the course of repair, a MASH compliant device is used if at least one suitable model or design has been accepted for use. The policy on work zone devices is described in Chapter 1010. To learn more about WSDOT’s plan for implementing MASH-compliant hardware see the following website: 🖰 <http://www.wsdot.wa.gov/Design/Policy/RoadsideSafety.htm>

## 1610.01(1) Documentation

Document barrier location decisions, including any site constraints encountered that influenced those decisions. A decision to install barrier using criteria outside the guidance provided in this chapter requires a Design Analysis, unless otherwise directed by the ASDE.

Chapter 740 Noise Barriers

# 740.02 Design

## 740.02(2) Noise Wall

When feasible, to encourage competitive bidding, include several alternate noise wall designs in the contract and permit the contractor to submit alternate designs under the value engineering specification.

There are noise wall designs in the [*Standard Plans*](http://www.wsdot.wa.gov/Publications/Manuals/M21-01.htm). Additional designs are in various stages of development to become standard plans. The draft-standard design sheets and other preapproved plans are available from the Headquarters (HQ) Bridge and Structures Office. The HQ Bridge and Structures Office also works with the regions to facilitate the use of other designs as bidding options.

When a noise wall has ground elevations that are independent of the roadway elevations, a survey of ground breaks (or cross sections at 25 foot intervals) along the entire length of the wall is needed for evaluation of constructability and to assure accurate determination of panel heights.

Size of openings (whether lapped, door, or gated) depends on the intended users. Agencies such as the local fire department can provide the necessary requirements. Unless an appropriate standard plan is available, such openings are designed and detailed for the project.

When a noise wall is inside the Design Clear Zone, design its horizontal and vertical (ground elevation) alignment as if it were a rigid concrete traffic barrier. (See Chapter 1610 for maximum flare rates.) See Chapter 1600 for more information about Design Clear Zone.

Provide a traffic barrier when a new noise wall is constructed within the Design Clear Zone. Installation of a traffic barrier is optional for a new wall when an existing wall is being extended (or the existing wall may be retrofitted with a barrier for continuity). For flare rates and approach slopes for concrete barriers see Chapter 1610. Noise walls that provide a traffic barrier integrated in the design are available; contact HQ Design for more information.

To designate a standard noise wall, select the appropriate general special provisions (GSPs) and state the standard plan number, type, and foundation type.

Wall type is a function of exposure and wind speed (see Exhibit 740-1).

A geotechnical report identifying the angle of internal friction “f” and the allowable bearing pressure is needed for selection of a standard foundation. The standard spread footing designs require an allowable bearing pressure of 1 Tsf. The standard trench and shaft footing designs require an “f” of at least 32° for D1 and 38° for D2.

A special design of the substructure is required for noise walls on substandard soil, where winds exceed 90 mph, and for exposures other than B1 and B2 as defined in Exhibit 740-1.

For maintenance of the surface of a tall wall (10 feet or more), consider harness tie offs for the fall protection required by the Department of Labor and Industries.