8 NOISE WALL

8.1 Definitions

A noise wall is constructed of steel, concrete, and other materials to provide traffic noise abatement to property near or adjacent to the road right-of-way.

Exclusions

Noise walls measuring less than 4 feet from grade at the highest point shall not be inspected and inventoried as part of the Program. Noise barriers which are constructed as earthen berms shall not be inventoried or inspected as part of the Program, as they do not fit the definition of a Noise Wall. Jersey barriers, Jersey walls, or other types of barriers under 4 feet in height are not considered noise walls.

Noise wall structures owned by agencies other than MDOT (private, local cities, etc.) that meet the definition of a noise wall are not included in the Program unless included at the determination of the Program Manager.

8.1.1 INVENTORY ITEMS

The inspector shall identify the noise wall facing type. A variety of noise wall types are present in Michigan, including post and panel, brick and masonry, concrete masonry unit (CMU), cantilevered free-standing, and cast-in-place concrete. Other material types may be present such as concrete fiberglass, plastics, or other composites. It is recommended the noise wall be inspected as two separate walls if there is a change in type such as a different wall face type.

The inspector shall confirm the noise wall maximum height as measured from the maximum wall height to the ground elevation or supporting structure such as a bridge. The wall shall be greater than 4 feet at its highest point to be considered a noise wall. The noise wall total height includes the coping, wall facing and a horizontal member, if present.

The inspector shall record the noise wall length to the nearest tenth of a foot, excluding features such as concrete barriers. If the wall curves or bends, the wall should be considered as one wall.

The inspector shall also identify the wall batter (typically vertical for noise walls). Identify the slope in front of the wall. Note if the noise wall is attached to a retaining wall or bridge. Note noise walls which have bench or crash barrier attachments. It is recommended the noise wall be inspected as two separate walls if there is a change in support structure type such as transitioning from foundation supported to retaining wall supported.

Appurtenances and attachments, such as signs or electrical boxes, should be observed and work recommendations or requests for action should be created to address issues, failure, or safety concerns. Appurtenances and attachments are not rated as part of the noise wall.

Take photos of the required inventory items listed in Section 8.2.2. A complete list of inventory items is provided in the Ancillary Structures Data Dictionary.

8.1.2 ELEMENTS

The Noise Wall is evaluated using six elements: Wall Facing, Vertical Support Column, Horizontal Member, Joints, Foundation, and Bridge or Structure Attachment. All six elements may be considered to compose the Noise Wall Structure component.

As the noise wall facing elements are similar to retaining wall facings elements with the same materials similar condition states and defects should be expected to those noted in Section 3 for retaining walls. Vertical support columns and foundations should all have similar condition states to those noted for retaining walls in Section 3.

Units measured in linear feet includes the length along the top of the exposed height of the noise wall element. The exposed area should be inspected and evaluated for distress and the element quantified under the appropriate noise wall defects. The wall facing quantity is only calculated for a single wall side. Wall facing or wall panel area excludes the horizontal members if present.

Table 8-1: Noise Wall Components and Elements

Component	Element	Element Code	Unit of Measure
Noise Wall Structure	Wall Facing	18101	Area, Square Feet
Noise Wall Structure	Vertical Support Column	18102	Each
Noise Wall Structure	Horizontal Member	18103	Length, feet
Noise Wall Structure	Joints	18104	Each
Noise Wall Structure	Foundation	18105	Each
Noise Wall Structure	Bridge or Structure Attachment	18106	Each
Noise Wall Structure	Wall Cap	18107	Length, feet

8.1.3 COMPONENTS

The noise wall shall be evaluated with a single component rating which describes the overall rating of the structure: Noise Wall Structure. The Noise Wall Structure component rating is based on the following:

- Noise Wall Structure – The wall's overall rating is based on its structural condition, ability to perform its function, and possible negative impact to the roadway or structures on either side or below the wall. The noise wall facing, vertical columns, horizontal members, joints, foundation and/or attachment of the wall to a support structure may all affect the component rating.

A representation of the rating structure for Noise Walls is provided in Figure 8-1. A graphic indicating component and elements is in Figure 8-2.

Figure 8-1: Rating structure for Noise Wall

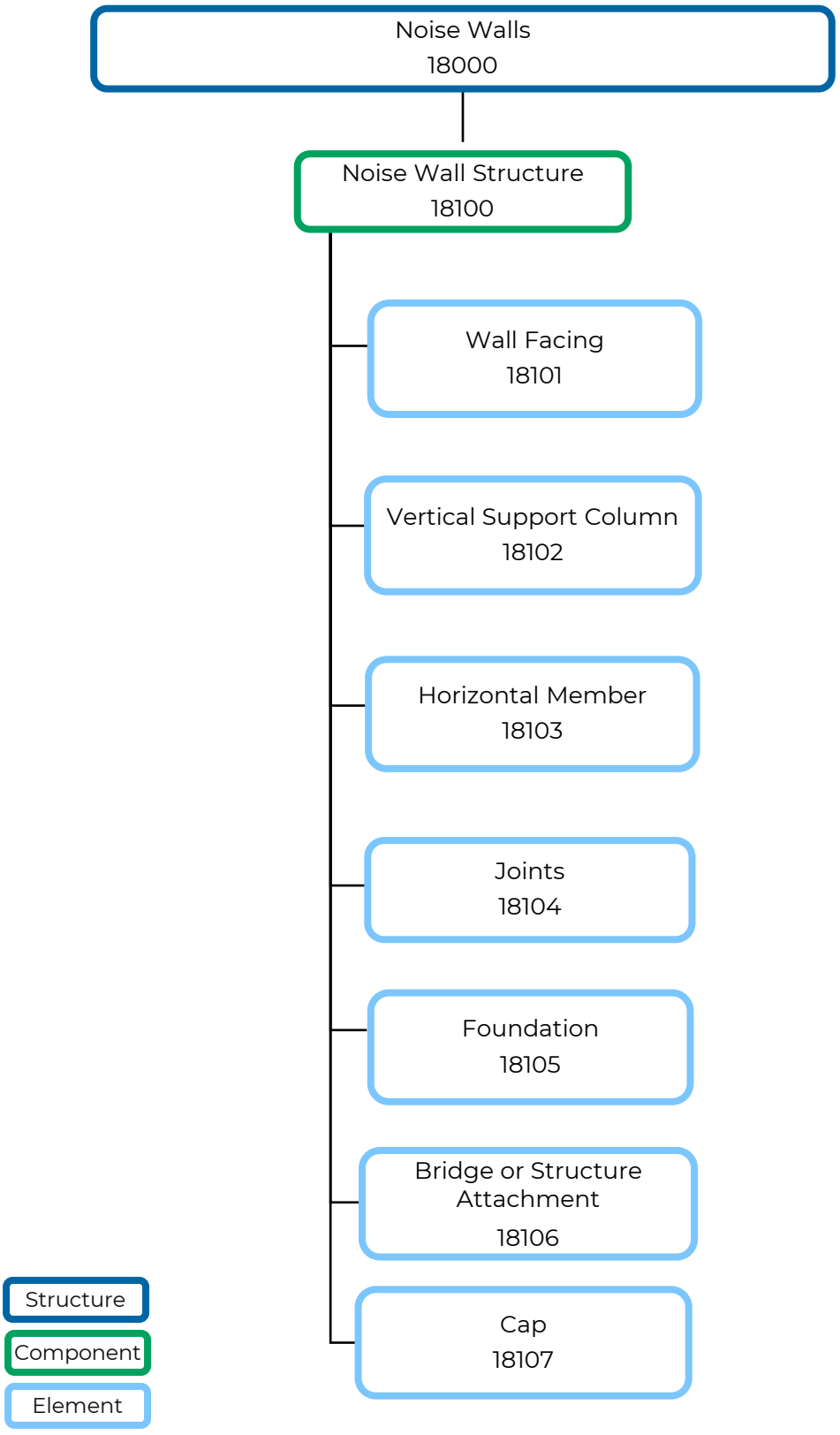
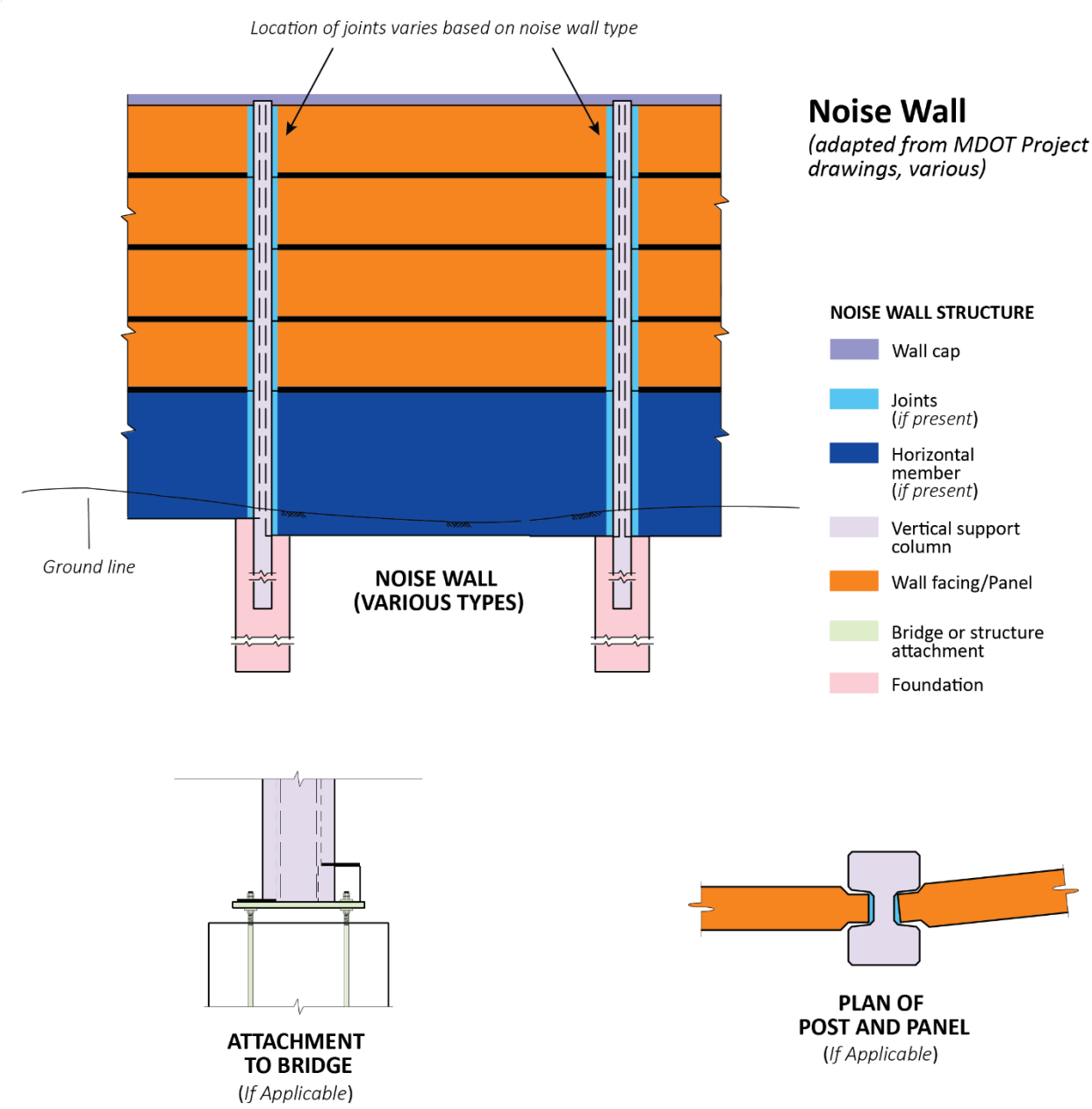


Figure 8-2: Elements and component for post and panel Noise Wall (adapted from MDOT Project drawings, various)



8.2 Inventory Record Photographs

Inventory photos are captured during a routine inspection, saved as part of the inventory database, and follow the naming convention in Table 8-2.

Noise Wall Required Photos:

- General view of the full noise wall (may require several sequential photos)

- General view at the top of noise wall (may require several sequential photos)
- Typical joint photo
- Photo of attachment to bridge or retaining wall (if applicable)

Table 8-2: Noise Wall Photograph Naming Convention

Photo Name	Description
Wall_Entire_Front	General View of entire wall
Wall_Entire_Back	General View of entire wall
Wall_Top	General view of top of wall
Wall_Joint	Typical joint photo
Wall_Attachment	Typical attachment

Note: Photo sequence should coincide with inspection direction for the walls.

8.3 Inspector Minimum Technical Qualifications

At least one member of the field inspection crew shall possess the following:

- A minimum experience of ten structures combined concrete inspection, steel inspection, or design experience (bridge inspection qualifies). At least three of the ten inspected structures shall be concrete structures.
- Ancillary structures inspection procedures training.
- Working knowledge of inspection tools, their use, application, and limitations for the structure type being inspected.
- Experience with anticipated material types such as concrete, timber, masonry, or steel. Internal training will address inspection procedures for all anticipated material types.
- In-depth inspection and activities for prestressed structures may require PCI Certification.

8.4 Routine Inspection

These inspections shall include the assessment of noise wall structures. Noise walls are also referred to as sound walls, noise abatement walls, or noise barrier walls. The purpose of a noise wall is to alter the noise travel along a corridor. Noise walls may be designed to either absorb or reflect noise. Minor damage to the wall may decrease its effectiveness in reducing traffic noise.

In many cases, noise walls or portions of a noise wall are installed on other structure types, such as bridge railings or retaining walls. Structure-Mounted noise walls may be attached to that structure or integral to that structure. When a noise wall is installed in either manner, the inspector of the bridge or retaining wall may conduct a cursory inspection of

the noise wall as part of that inspection; this inspection is not considered a Noise Wall Inspection.

Noise wall standard inspection frequency is once every 5 years, unless otherwise identified for more frequent inspection.

The acceptable tolerance for intervals of less than 24 months for the next inspection is up to two (2) months after the month in which the inspection was due. The acceptable tolerance for intervals of 24 months or greater for the next inspection is up to three (3) months after the month in which the inspection was due. Exceptions to the inspection interval tolerance due to rare and unusual circumstances should be approved by MDOT's Ancillary Structures Program Manager in advance of the inspection due date plus the above tolerances.

It is recognized that severe weather, inspector safety, inspection quality, resource optimization, technological difficulties, or other unique situations may be a reason to adjust the scheduled inspection date. In these situations, the adjusted inspection date should not extend more than two (2) months after the month the inspection was due for any inspection interval less than 24 months and not extend more than three (3) months after the month the inspection was due for any inspection interval 24 months or greater. Inspection interval tolerances are intended to provide some flexibility. When tolerances are applied, the longest time period prescribed between inspections is the applicable interval plus the prescribed tolerance. For example, a routine inspection on a 12-month interval could be performed during the 14th month if the tolerance is applied. Repeatedly applying the tolerance to the next inspection will create inspection date creep and may impact an owner's ability to perform future inspections in a timely manner due to other limitations (e.g. available resources, inspection workload, schedule, seasonal weather conditions, technological difficulties, etc.). Exceptions to inspection interval tolerances due to rare and unusual circumstances should be approved by MDOT's Ancillary Structures Program Manager in advance of the inspection due date, plus the tolerance. For example, if an inspection with an interval of 24 months is due on June 17, an exception request should be approved by MDOT's Ancillary Structures Program Manager before the end of the 3-month tolerance (i.e. September 30). However, a request for exception should be made when the potential for not meeting the tolerance becomes known to provide MDOT's Ancillary Structures Program Manager with adequate time for review and approval.

Figure 8-3: Noise wall mounted on soil

Figure 8-4: Noise wall mounted on crash barrier

Figure 8-5: Noise wall attached to retaining wall

The routine inspection assesses the noise wall's ability to safely perform, transfer of all loads to the surrounding soil or subsurface material, or through attachments to a structure such as a bridge or retaining wall. If safety concerns such as significant erosion, settlement or lateral displacement are noted, initiate an RFA. The routine inspection is performed on a regularly scheduled basis, with frequency determined by AS type, and includes the element condition ratings of the foundation, attachment to bridge or structure (if applicable), joints, horizontal and vertical members, and wall facing. Walls are typically inspected either from south to north or west to east, similar to bridge inspection procedures.

It consists of observations and measurements needed to determine the physical and functional condition of the noise wall, to identify any changes from initial or previously recorded conditions, and to ensure that the noise wall continues to satisfy present service requirements. All elements of the component shall be visually inspected to determine the overall condition and to detect deficiencies.

A sample noise wall routine inspection shall consist of:

- Verify set elevations along the face of the wall for signs of settlement.
- Inspect the vertical alignment (batter) of the wall with a plumb-bob. Most noise barrier walls are vertical (verify with plans or inventory).
- Examine the opening of the construction joints between sections of the wall.
- Inspect joints near ground line for any fill material washing out from between or below the panels.
- Inspect panel joints for differential movement or rotation. Sight down panel face to note individual rotation or tipping out of plane.
- Inspect for erosion of the embankment material in front and behind the wall (if ground mounted).
- Inspect for heaving of the embankment material in front and behind the wall.
- Inspect for settlement of the fill material along the wall.
- Examine site grading for any locations that may prohibit proper drainage along the wall. Note the slope in front or behind the wall, for example if 3 horizontal to 1 vertical (3H:1V).
- Examine and probe drains within the vicinity of the wall for signs of clogging.

- Examine the wall for deterioration of the material, such as cracking, spalling, corrosion, discoloration, etc. noting the width, length, depth, and/or orientation of the deterioration.
- Check wall for evidence of efflorescence or rust staining.
- Examine panel connections & frame, if applicable.
- Examine post base and anchorage systems if present. Fasteners and connections should be checked for tightness and distress.
- Note any holes around foundation or footing base which are the result of animal activity.
- Note condition of fire hydrant holes or access holes, if applicable.
- Inspect sidewalk or roadway along the wall for signs of joint separation, potholes and areas of settlement which may indicate a more global impact on the noise wall system.
- Examine vegetation growth along the wall. Root infiltration may create undesirable stresses on the wall and may induce cracking or failure if left untreated.
- Rate Component.
- Rate Elements.
- Provide photographs for all Poor or Severe condition state defects and submit the applicable Work Recs or RFAs.

Table 8-3 provides guidance for inspecting reinforced and prestressed concrete cracking.

Table 8-3: Standard Cracking Widths

Description	Reinforced Concrete	Prestressed Concrete
Hairline (HL)	<1/16” (0.0625”)	< (0.004”)
Narrow (N)	1/16” to 1/8” (0.0625” to 0.125”)	(0” to 0.009”)
Medium (M)	1/8” to 3/16” (0.125” to 0.1875”)	(0.010” to 0.030”)
Wide (W)	>3/16” > (0.1875”)	> (0.03”)

Source: FHWA Bridge Inspector’s Reference Manual (Publication No. FHWA NHI 03-001, October 2002)

8.4.1 NOISE WALL STRUCTURE COMPONENT RATING

The noise wall’s overall characteristics are rated on its structural condition, ability to perform its function, and possible negative impact to the entire wall or nearby roadway. The wall facing, joints, vertical supports and horizontal members, foundation, or attachment, are all considered as part of the component rating. When evaluating facing

distresses consider that different distresses are not of equal importance to the wall function.

The predominant characteristic determining overall condition is stability. Consider if the wall is unstable due to soil movement, foundation, or attachment issues. Also consider if scour or erosion has created wall instability. A guideline for component rating for noise walls is provided in the following table.

Table 8-4: Component Rating Guidelines for Noise Walls

Component Rating	Condition	Material	Description
9	NEW	All	No deficiencies in any of the structural components that will affect long term performance.
8	VERY GOOD	All	All structural elements are sound and functioning as designed. There may be superficial cracking or weathering and/or dirt contamination of structural elements.
7	GOOD	Concrete	Insignificant cracks or moderate cracks that are sealed.
		Timber	Checks or shakes penetrate less than 5% of the member thickness.
		Steel	Protective coating failure in very small and scattered locations.
		Masonry	Minor weathering or cracking (joints have little or no deterioration)
		All	All elements retain full section properties and function as designed.
6	SATISFACTORY	Concrete	Unsealed moderate-width or map cracks. Minor delamination, spalling, or efflorescence without build-up or rust staining.
		Timber	Decay or section loss affecting less than 5% of the member section. Splits arrested and concerns mitigated.
		Steel	Protective coating failures is limited to less than 2% of the surface area with no loss of section.
		Masonry	Moderate weathering or cracking (joints may have minor deterioration). Evidence of slight freeze-thaw.
		All	Minor deterioration affecting structural elements. Scour effects have been arrested with countermeasures.
5	FAIR	Concrete	Moderate delamination, spalling, or efflorescence. Reinforcement exposure without section loss.
		Timber	Decay or section loss affecting 5% to 10% of the member section. Checks, shakes, and splits have no effect on capacity.
		Steel	Protective coating failure is limited to less than 5% of the surface area with minor loss of section. Loose

Component Rating	Condition	Material	Description
			fasteners or broken welds present but the connection is in place and functioning as intended.
		Masonry	Extensive weathering or cracking (joints may have slight separation or offset). Evidence of minor freeze-thaw. Exposed steel reinforcement.
		All	Moderate deterioration affecting structural elements including minor settlement, shallow scour, or impact damage. Structure continues to function as designed.
4	POOR	Concrete	Considerable cracking, spalling, and efflorescence with heavy build-up or rust staining.
		Timber	Extensive decay, section loss, checks, shakes, or splits that do not warrant structural review.
		Steel	Protective coating failure affecting between 5% and 10% of the surface area with some loss of section. Cracks that have not been arrested but do not require structural review.
		Masonry	Advanced weathering or cracking (joints may have separation or offset). Evidence of moderate freeze-thaw. Exposed steel reinforcement.
		All	Considerable deterioration affecting structural elements including partial settlement or scour. Structure continues to function as designed.
3	SERIOUS	Concrete	Considerable areas of spalling, exposed reinforcement with section loss, or heavy rust staining.
		Timber	Decay or section loss that affects more than 10% of the member section. Checks, shakes, splits warrant action.
		Steel	Protective coating failure affecting more than 10% of the surface area with measurable loss of section. Missing fasteners or adjacent broken welds may be present.
		Masonry	Severe cracking, offset or misalignment. Evidence of severe freeze-thaw. Exposed steel reinforcement with section loss, or heavy rust staining.
		All	Considerable deterioration or damage affecting structural elements. Structural evaluation, hydraulic, and/or load analysis may be necessary to determine if the structure can continue to function without restrictions or immediate repairs.
2	CRITICAL	All	Deterioration has progressed to the point where the structure is not stable and emergency repairs or shoring with structurally engineered temporary supports is required.

Component Rating	Condition	Material	Description
1	IMMINENT FAILURE	All	Road is closed to traffic due to noise wall failure, but corrective action may put the noise wall back in service.
0	FAILED	All	Road is closed due to noise wall condition.

8.4.1.1 Wall Facing Element Condition States

Start by identifying the noise wall facing type, as the noise wall type identification is used to identify the applicable condition states distresses.

The noise wall facing is exposed on both sides. Noise wall facings can be reinforced concrete, timber, masonry, metal, plastic, fiberglass, or other types of composite material. Noise walls may be precast or composed of modular units such as concrete panels/blocks or masonry blocks. The facing may be referred to as wall panel or panel for post and panel noise walls.

Some noise wall types have multiple defects associated with the facing material, such as reinforced concrete walls require assessment for the concrete cracking, spalling, delamination, and efflorescence. All noise wall types may have distresses associated with impact damage, typically from vehicles.

The noise wall facing inspection shall identify the facing type of material and the associated distresses with the facing type. Inspect the wall facing from the top of the wall (below any copings) to the top of the horizontal member, foundation, or to the top of finished grade, as applicable. Both sides of the wall should be inspected, if accessible. Embedded and buried portions of walls are not subject to condition inspection since they are not visible.

Reinforced Concrete Facing

The reinforced concrete wall face includes all types and shapes of reinforced concrete. Reinforced concrete exhibits several different types of deterioration and defects including concrete cracking, spalling and delamination, concrete abrasion and wear, protective coating loss, and efflorescence.

Table 8-5: Noise Wall Facing Element, Reinforced Concrete Distresses

Unit of Measure: Area, square feet measured or estimated using average facing height (excluding horizontal members) multiplied by length.

Element No.	Element Name	Description	Applicable Distresses
18101	Wall Facing	Noise wall facing exposed above ground.	Concrete Cracking
			Concrete Spalling, Delamination
			Concrete Abrasion/Wear
			Concrete Protective Coatings
			Other Concrete Defects
			Efflorescence
			Impact Damage

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Concrete Cracking

Concrete cracking can be either nonstructural or structural and can be caused by many different factors. Nonstructural cracking is most often related to volumetric changes in concrete caused by fluctuations in moisture content and/or temperature during curing or while in service. Nonstructural cracking is typically less than 1/8 inch wide. Structural related cracking is often related to loading on the concrete being beyond its tensile capacity. Concrete can also crack if the embedded reinforcing bars are corroding.

Inspect the wall face for cracking and investigate whether any observed cracking is non-structural or structural in nature. Document the approximate location, orientation, width, and spacing of the cracking.

Inspect and document the extent and location of exposed reinforcing bar corrosion. Estimate the extent of any section loss.

Concrete Spalling and Delamination

Concrete spalling is a surface failure in which concrete breaks off from the underlying concrete substrate. Like cracking, the spalling typically occurs when the steel reinforcing embedded within the concrete member undergoes corrosion. Spalling can also occur at expansion and contraction joints, at rustication and other ornamental non-structural features. It can also occur at cracks that have propagated due to wall deflection or impact damage.

Concrete delamination can be identified as a thin layer of concrete separation from its substrate. Unlike spalling, delaminated concrete does not break away but remains attached to the structure.

Inspect the wall for delamination and spalling. With a sounding hammer or other device, sound any areas that are exhibiting signs of distress to determine the limits of

deterioration. Document the approximate location of delamination or spalling while indicating if reinforcement is exposed.

Abrasion/Wear

Damage occurs when the surface of concrete is unable to resist wear caused by rubbing and friction. As the outer paste of concrete wears on wall face, the fine and coarse aggregate are exposed, and abrasion and impact will cause additional degradation that is related to aggregate-to-paste bond strength and hardness of the aggregate. Abrasion of noise wall faces is most often the result of wind or water-borne particles along the face of the wall.

Inspect the wall for signs of concrete abrasion, including the loss of cement paste and the exposure of the underlying aggregate. Document on the location and extent of any abrasion on the surface of the wall face.

Concrete Protective Coatings

Inspect concrete surfaces for protective coating failure. Document the approximate location and extent of coating failure. Inspect concrete coating systems for wear due to UV exposure and other deterioration. Some failures are specific to the coating system, i.e., epoxy systems are subject to chalking, cracking, and flaking. Note the degree of effectiveness to which the concrete protection system is functioning.

Other Concrete Defects

Includes distresses otherwise not noted, and which may indicate that the wall facing is not functioning as intended or designed. Identify, inspect, and document the type and extent of any problematic deterioration or conditions.

Efflorescence

Efflorescence is caused when soluble salts and other dispersible water materials come to the surface of concrete and mortars. Efflorescence can be identified by the presence of a white powdery solid which appears on the surface of the concrete.

Inspect the wall for the presence of efflorescence, including surface white with built up or heavy build up with rust staining.

Impact Damage

Inspect the wall system for vehicular impact damage. Document the location and degree of damage.

Timber Facing

Timber noise walls include many types and shapes, including timber lagging, slats, stacked beams, and plywood.

Wood is a natural engineering material that is prone to deterioration caused by decay, fungi, and insect attack, and through mechanical damage. Typically, areas of high moisture content in timber elements create conditions suitable for biological damage.

Timber members are also susceptible to distresses such as checks/shakes and splitting/delamination/cracking.

Table 8-6: Wall Facing Element, Timber Distresses

Unit of Measure: Area, square feet measured or estimated using average facing height (excluding horizontal members) multiplied by length.

Element No.	Element Name	Description	Applicable Distresses
18101	Wall Facing	Noise wall facing exposed above ground.	Timber Decay/Section Loss/ Abrasion
			Timber Checks/Shakes
			Timber Splitting/ Delamination/Cracking
			Timber Other
			Impact Damage

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Decay/Section Loss/Abrasion

Inspect the wall for insect damage, decay, and section loss or abrasion. Surfaces exposed to drainage and other moisture is also documented. Use an awl or sharp knife to penetrate suspected areas to check for decay. When section loss or abrasion is measurable, evaluate the area to determine if an in-depth inspection and subsequent load analysis is warranted. Document the approximate location and estimated amount of section loss, and the location, type of defects, and other deterioration.

Checks/Shakes

Checks and Shakes are natural and are present in most timber members. Inspect the wall for check or shakes. Document the approximate location and the length in respect to member depth.

Splits/Delaminations/Cracking

Inspect the wall for splits and delaminations. Document the approximate location and length in respect to the member depth.

Timber Other

Inspect the timber walls for loose or failed connections, and other problem areas not noted above. Document the location, and extent of deterioration or damage if present.

Masonry Facing

Masonry noise walls are typically brick masonry or concrete masonry units (CMU). Stone masonry is seldomly used in new construction today except as facing or ornamentation.

Condition state distresses such as splits/spalls/delamination and exposed reinforcement in the masonry, breakdown and cracking of mortar, patches in the masonry, displacement or misalignment of the masonry, or efflorescence are anticipated for noise walls with masonry facing. In some cases, a simulated stone masonry coating may be applied to the facing of the noise wall; the simulated stone masonry coating should not be inspected for masonry distresses.

Table 8-7: Noise Wall Facing Element, Masonry Distresses

Unit of Measure: Area, square feet measured or estimated using average facing height (excluding horizontal members) multiplied by length.

Element No.	Element Name	Description	Applicable Distresses
18101	Wall Facing	Noise wall facing exposed above ground.	Masonry Wall Splits/Spalls/ Delamination
			Masonry exposed reinforcement
			Mortar Breakdown/Cracking
			Masonry Patches
			Masonry Displacement/ Misalignment
			Masonry Other
			Efflorescence
			Impact Damage

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Masonry Splits/Spalls/Delaminations

Inspect the wall face for evidence of splitting, spalling and delaminated areas. Document the extent and location of any noted deterioration.

Masonry Exposed Reinforcement

Inspect the wall face for evidence exposed steel reinforcement. Note any section loss or corrosion on exposed steel.

Mortar Breakdown/Cracking

Inspect the masonry mortar for cracks, loose, or missing mortar, vegetation, and water seepage. Mortar between masonry blocks is assessed as part of the facing and not as a joint element, however the contact between blocks is often referred to as a joint.

Masonry Patches

Inspect any patched areas of masonry for cracking and or spalling. Sound previous patches with a hammer to evaluate the condition of the repair.

Masonry Displacement or Misalignment

Check overall configuration of the wall for vertical or horizontal misalignment, signs of settlement, and bulging or warping of the wall.

Metal Facing

The Metal Facing element includes steel sheet piling, corrugated metal panels, and other constructions.

Sheeting piling noise walls are structural units which, that when connected to one another, will form a continuous wall.

Steel facing shall be inspected for cracking and fatigue, corrosion, coating failures, and other defects. Steel noise walls located in saturated soils are also susceptible to advanced section loss near the groundline.

Table 8-8: Noise Wall Facing Element, Metal/Steel Distresses

Unit of Measure: Area, square feet measured or estimated using average facing height (excluding horizontal members) multiplied by length.

Element No.	Element Name	Description	Applicable Distresses
18101	Wall Facing	Noise wall facing exposed above ground.	Steel Wall Cracking/Fatigue
			Steel Wall Corrosion/Section Loss
			Steel Protective Coatings
			Steel Other
			Impact Damage

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Steel walls shall be inspected for corrosion, cracking, collision, coating failures, and other defects. Steel walls located in water or saturated soils are also susceptible to advanced section loss near the waterline.

Sheet pile walls, typical composed of steel, which are located along shorelines are not required to have inspection performed from the water. Water-side inspection would necessitate the use of boat, kayak, or other conveyance. Visual inspection for distresses and the associated condition state defects from the shoreline shall be conducted. Steel sheet piling not visible below the waterline will not be assessed.

Steel Wall Cracking/Fatigue

Inspect the wall for cracking. When cracking has been previously arrested or repairs have been installed observe the surrounding surface area to verify that further propagation is not occurring. Document the approximate location and estimated length of the cracking.

Steel Wall Corrosion/Section Loss

Inspect the wall for corrosion and section loss. Inspect surfaces that are exposed to drainage or other moisture for additional corrosion and section loss. Document the approximate location, type of defect, and cause of the damage and estimate the extent of any section loss.

Steel Protective Coatings

Inspect steel surfaces for protective coating failure. Note whether the failure is limited to the top application coat or to bare steel. Create Work Rec and document the approximate location, percentage, and extent of coating failure. Coating failure may be indicated by

surface dulling, loss of pigment, exposure of bare metal, oxidation indicated by darkening of the coating, or peeling and curling of the protective coating.

Steel protective coatings are for steel elements that have a protective coating such as paint, galvanization, or other top-coat steel corrosion inhibitor. This element describes all coating systems, including but not limited to paint systems, oxide on weathering steel, metallizing, and galvanization.

Inspect steel coating systems for chalking, peeling, curling, and oxide color. Document on the location and extent of any observed deterioration to coating systems present.

Steel Other

Inspect the wall for defects such as distortion or buckling of the wall or lagging. Check for horizontal or vertical misalignment between sheeting or other panels. Document the location, length of area affected, and estimated extent of damage.

Other Facing Types

Other materials may be introduced for use in the construction of noise walls. These include plastic, fiberglass, and other composite materials.

Table 8-9: Noise Wall Facing Element, Plastic, Fiberglass, or other Composites Distresses

Unit of Measure: Area, square feet measured or estimated using average facing height (excluding horizontal members) multiplied by length.

Element No.	Element Name	Description	Applicable Distresses
18101	Wall Facing	Noise wall facing exposed above ground.	Other Defect
			Impact Damage

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Plastic/Vinyl Lumber

Composites come in a variety of forms including plastic lumber, which is typically formed from recycled high-density polyethylene (HDPE) plastic, vinyl sheet piling, and integrated hybrid composites of plastic and steel. Plastics can exhibit ultraviolet deterioration, material incompatibility, corrosion damage, and overstress damage. Plastics will typically exhibit discoloration when undergoing ultraviolet deterioration. The material may also begin to fray when under constant sunlight.

Connections for securing, supporting, or bracing other material components are inspected for corrosion or other similar material deficiencies. For instance, the tie rod or nuts anchoring a whaler to the outer face of a vinyl sheet piling wall are inspected to ensure they are properly tightened with no signs of corrosion.

8.4.1.2 Vertical Support Column Element Condition States

The Vertical Support/Columns element includes metal, prestressed or reinforced concrete, timber, masonry or other columns or posts that provide structural support to the cantilevered noise wall facing element.

The Vertical Support/Columns transfer loads from the wall facing elements to the ground, to connected foundation elements, or through attachments to a bridge or other structure. The Vertical Support/Column elements shall be inspected for material specific deterioration and other defects. This element can occur with any noise wall facing type. This element is like the Vertical Support/Column element for the Retaining Wall ancillary structure.

Inspect each of the vertical supports or columns based on the typical defects for the material they are constructed from. In addition, document the location and extent of any misalignment or displacement of the elements, broken connections, erosion at the base of the support, impact damage, and other defects.

Table 8-10: Noise Wall Vertical Support/Column Element Distresses

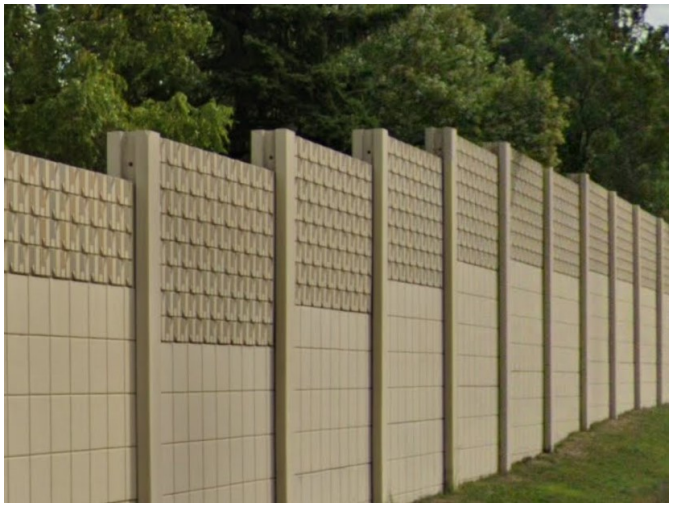
Unit of Measure: Each support

Element No.	Element Name	Description	Applicable Distresses
18102	Vertical Support/ Columns	Vertical Support/Columns provides structural support to the wall facing and includes any connection hardware present between the vertical supports and adjacent elements.	Vertical Support/Column Steel Defects
			Vertical Support/Column Concrete Defects
			Vertical Support/ Column Timber Defects
			Vertical Support/Column Masonry Defects
			Vertical Support/Column Other Defects

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Figure 8-6*:* Noise wall with vertical support columns



Vertical Support/Column Steel

Vertical Support/Column Steel includes all steel columns or vertical supports regardless of size, shape, or protective system. Inspect steel elements for evidence of corrosion and section loss, fatigue cracking, distortion or buckling and misalignment including but not limited to rotation.

Vertical Support/Column Concrete

Vertical Support/Column Concrete includes all prestressed and reinforced concrete columns/posts regardless of size, shape, or protective system. Inspect concrete elements for delamination, spalling, cracking, efflorescence, exposed reinforcing or prestressing strands and other deterioration. Additionally, inspect the element for evidence of distortion or buckling and misalignment including but not limited to rotation.

Vertical Support/Column Timber

Vertical Support/Column Timber includes all timber columns/posts regardless of size, shape, or protective system. Inspect timber element for evidence of decay and section loss, checks and shakes, splits and delamination, and other types of deterioration. Additionally, inspect the element for evidence of distortion or buckling and misalignment including but not limited to rotation.

Vertical Support/Column Masonry

Vertical Support/Column Masonry includes all masonry and stone columns/posts regardless of size, shape, or protective system. The block or stone may be placed with or without mortar. Inspect the masonry/ stone elements for delamination, spalling, cracking, efflorescence, exposed reinforcing, mortar deterioration, masonry displacement and other deterioration. Note exposed reinforcing steel as CMU block walls contain vertical steel reinforcement bars. Additionally, inspect the element for evidence of distortion or buckling and misalignment including but not limited to rotation.

Vertical Support/Column Other

Vertical Support/Column Other includes all other material columns/posts regardless of size, shape, or protective system. Inspect other vertical support or column elements for deterioration related to the specific materials used. Additionally, inspect the element for evidence of distortion or buckling and misalignment including but not limited to rotation.

8.4.1.3 Horizontal Member Element Condition States

The Horizontal Member element includes metal, prestressed or reinforced concrete, timber, masonry, or other horizontal supports that provide structural support to the cantilevered noise wall facing element. Where noise walls are constructed above a concrete stem extending into a foundation, the concrete stem portion of a noise wall is rated as a horizontal member.

The Horizontal Members transfer loads from the wall facing elements to the ground or to connected foundation elements. The Horizontal Member elements shall be inspected for material specific deterioration and other defects. This element can occur with any noise wall facing type.

Inspect each of the horizontal supports based on the typical defects for the material they are constructed from. In addition, document the location and extent of any misalignment or displacement of the elements, broken connections, impact damage, and other defects.

Joint material, if present, between horizontal members shall be rated as part of the horizontal member element. Contacts between panels within post and panel walls are not considered joints.

Condition state distresses for horizontal members are like those for vertical support columns of the same material type. Descriptions of the condition state distresses are detailed above for Vertical Support Column Element Condition States.

Table 8-11: Noise Wall Horizontal Member Element Distresses

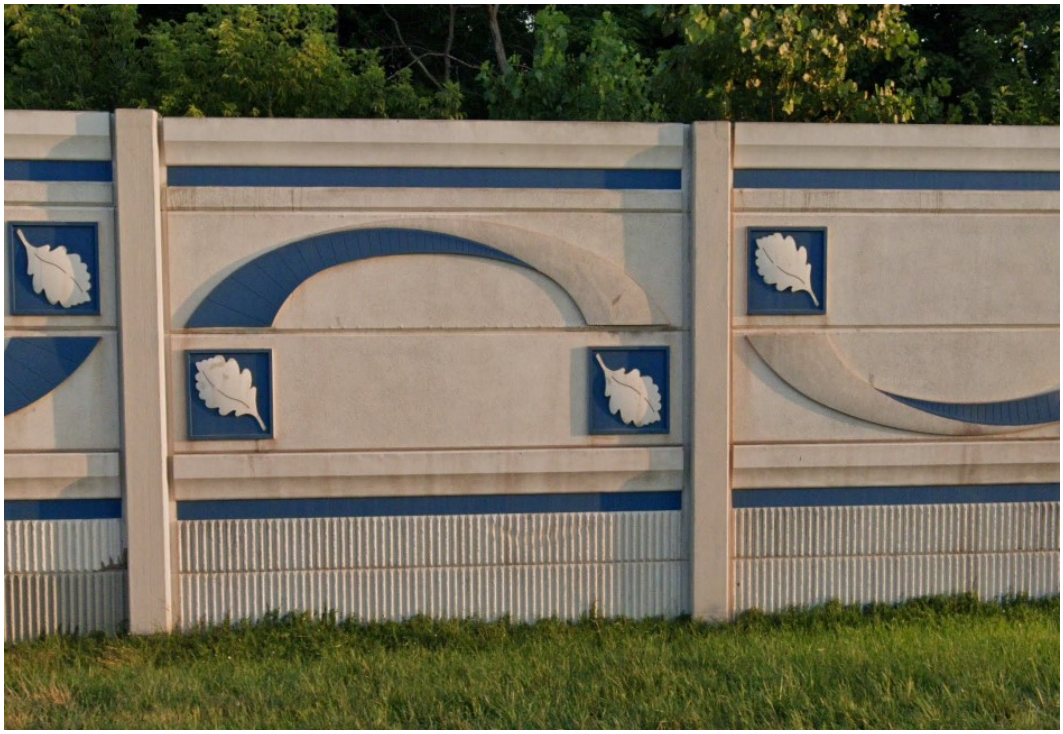
Unit of Measure: Length, ft of all horizontal members. Measure total or estimate using average horizontal length of members multiplied by number of horizontal members.

Element No.	Element Name	Description	Applicable Distresses
18103	Horizontal Member	Horizontal Member provides structural support to the wall facing and includes any connection hardware present between the horizontal supports and adjacent elements.	Horizontal Member Steel Defects
			Horizontal Member Concrete Defects
			Horizontal Member Timber Defects
			Horizontal Member Masonry Defects
			Horizontal Member Other Defects

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Figure 8-7: Noise wall with architectural features with vertical supports and horizontal members



8.4.1.4 Joint Element Condition States

The purpose of the joint inspection is to identify distressed joints between noise wall panels that could affect the performance of the noise wall. Joints may be sealed and distresses to seals should also be captured. Joints may be expansion joints, compression joints, strip seal expansion joints which use a waterproof gland, or some other joint type. Noise walls with expansion joints in the center of masonry panels are considered “T-types” and those with expansion joints in columns are considered “H-types.” Joints present at post and panel noise walls are typically not exposed to view and are interior to the post. The horizontal contact between panels of a noise wall is not considered a joint as there is no material present to define the element such as joint compound or filler.

Table 8-12: Noise Wall Joint Element Distresses

Unit of Measure: Each. Record quantity of each joint.

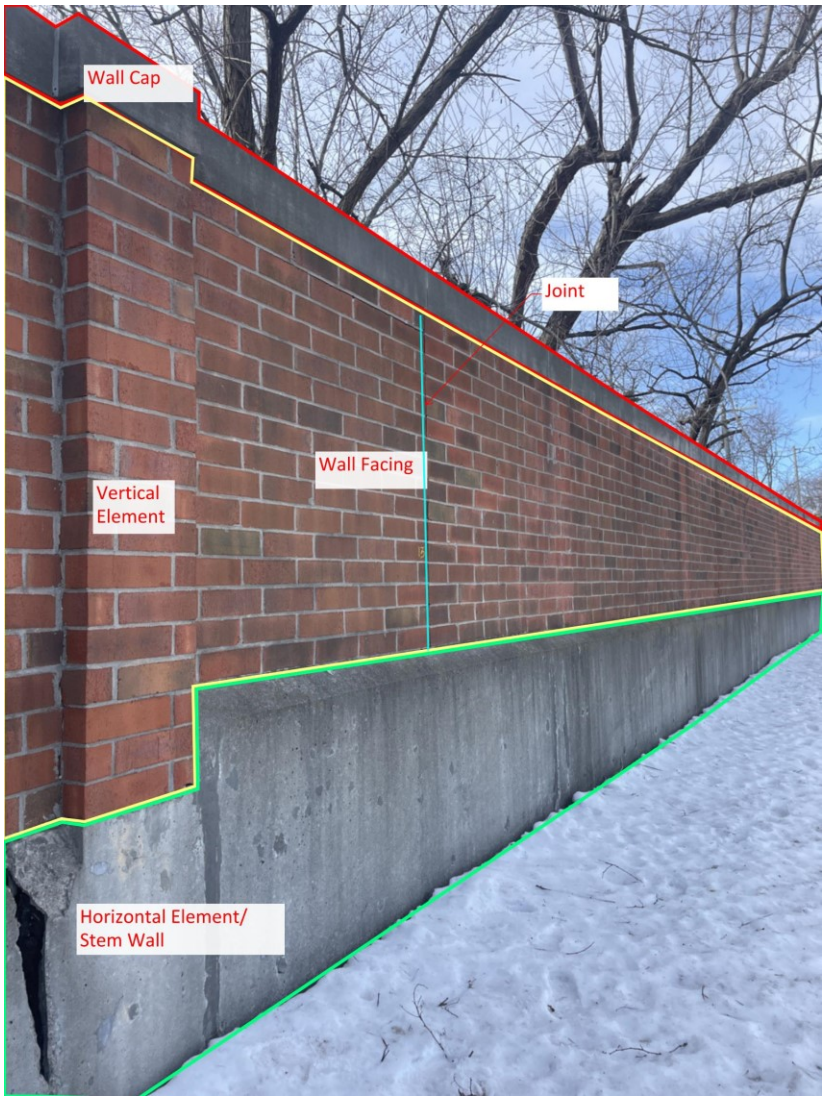
Element No.	Element Name	Description	Applicable Distresses
18104	Joints	Joints present along a noise wall	Joint Separation, Offset, and Rotation
			Joint Infiltration
			Joint Cracking (Concrete)
			Joint closed/crushing

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Figure 8-8: Noise wall with vertical joints at posts and horizontal contacts between panels

Figure 8-9: Noise Wall with masonry block indicating T-wall joint element



Joint Separation, Offset, and Rotation

Vertical movement can occur in the forms of uniform settlement or differential settlement. Depending on the magnitude of the settlement realized, uniform settlement will have limited impact on the structural stability of the noise wall. Differential settlements, on the other hand, may lead to serious problems in the noise wall. Differential settlements may cause the opening of joints or cause noise wall cracking or transverse tipping. The most common causes of vertical movement consist of soil bearing failure; soil consolidation; erosion; and material deterioration.

Inspect the noise wall for evidence of vertical differential settlement, offset, or rotation as evidenced in joints.

Joint Infiltration

Joint distresses may be identified by infiltration of soil or water through joints which are intended to be tight. This infiltration will usually only occur near the transition between the noise wall facing to the foundation or structure attachment. In severe cases, distresses to the noise wall facing, foundation, or bridge or structure attachment will result from the soil and/or water infiltration.

Joint Cracking (Concrete)

Longitudinal cracking in concrete joints is also an indication of distress. Spalling, exposed reinforcing or exposed joint sealing would all be indications of poor joint condition.

Joint Closed/Crushing

Horizontal forces such as wind, vertical movements such as differential settlement or material issues may also cause the joints to close with or without crushing. Depending on the magnitude of forces or movement experienced by the walls, noise walls such as masonry and concrete are more likely to experience crushing when joints are closed.

8.4.1.5 Foundation Element Condition States

Noise walls are either founded on soil or attached to a bridge or other structure. This subsection discusses noise walls founded on and in soil.

Noise wall foundations may fail when the bearing capacity of the soil supporting the foundation is exceeded. The bearing capacity of soil depends upon the type and consistency of soil. Soft soils comprised of clay or silt, or loose sands are the most prone to bearing capacity failure.

Foundations are critical to maintain the stability of the noise wall since the foundation supports the entire structure. The foundation component provides load bearing capacity to the base of the noise wall by transferring vertical and lateral forces from the wall to soil below. The foundation element can be comprised of shallow or deep foundations including spread footings, piles, and drilled shafts or caissons. Shallow and deep foundations are described in Section 3.4.1.6. The foundation element supports the vertical support column element and the attached facing and horizontal members.

The noise wall foundation includes all the wall elements below the bottom of the facing or horizontal member element if present. The wall foundation element is most often not visible. Rate only the visible portions of the foundation. Often the foundations are only visible when distresses are present. In some cases, a base plate may be present between

the vertical support column and the foundation. The base plate and anchor bolts should be assessed as part of the Bridge or Structure Attachment element.

Evaluate the base of the noise wall perimeter to determine if the foundation is exposed or undermining has occurred due to erosion or other cause. Document the location of foundation exposure. Visual evidence of foundation defects such as bearing failure may include heaving of the soil at the base of the wall or vertical settlement of the wall or tilting of the wall originating from the foundation.

Consider the external evidence of the foundation's adequacy to support the noise wall. This may include vegetation growth along the wall, as root infiltration may create undesirable stresses on the wall and may induce cracking or failure if left untreated. Identify if holes created as the result of animal activity may impact the foundation element.

Table 8-13: Noise Wall Foundation Element Distresses

Unit of Measure: Length, ft measured along the noise wall face

Element No.	Element Name	Description	Applicable Distresses
18105	Foundation	Noise wall foundation conditions	Foundation Defects

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

8.4.1.6 Bridge or Structure Element Condition States

The support for the noise wall may be a foundation, bridge, or other structure. The bridge or other structure such as a retaining wall are assessed as part of the NBIS or the Retaining Wall ancillary structure.

Attachments such as anchors or other connections are used to connect the noise wall to a structure which in turn supports the noise wall. This subsection discusses the attachment joining the noise wall to a foundation, bridge, retaining wall, concrete barrier, or other structure.

Figure 8-10: Noise wall attachment to concrete barrier

The support for the noise wall may be a foundation, bridge, or other structure. The bridge or other structure (such as a retaining wall) are inspected as described in the MiSIM for bridges or Section 3 for retaining walls. The noise wall is typically attached to a foundation or retaining wall. A noise wall may wrap around a bridge and have both foundation and bridge support. In these cases, rate both elements of foundation and bridge or structure attachment element.

Figure 8-11: Noise wall attached to retaining wall

Inspectors shall record any hardware that is missing, damaged, or not in its proper location. Examine anchorage systems, including anchor seals or other fasteners, at connection to the wall for material distress. Signs of distress may include distortion, areas of cracking, spalling, leakage stains, and loss of seal adhesion. Rotations of anchored noise walls are often preceded by punching shear or cracking around the area of the anchor attachment to the structure.

Corrosion protection for attachments includes either one or more physical barrier layers which protect the anchor and bolts from the corrosive environment. The barrier layers include anchorage covers, corrosion inhibiting compounds, sheaths, encapsulations, epoxy coatings, galvanization, and grouts. Inspect the visible portions of the anchors, including tie rods, bolts, or nuts for signs of corrosion and section loss and document the location and extent of corrosion and section loss.

Table 8-14: Noise Wall Bridge or Structure Attachment Element Distresses

Unit of Measure: Each, Total number of attachments

Element No.	Element Name	Description	Applicable Distresses
18106	Bridge or Structure Attachment	Attachment such as anchors or other connections, when present, which are used to connect the noise wall to a bridge, retaining wall, concrete barrier, foundation, or other structure.	Anchor/Connection Defects

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

8.4.1.7 Wall Cap Element Condition States

Some noise walls have caps fixed to the top of the wall to protect the top of the wall from damages. The cap could be made of concrete, timber, masonry, metal (steel), plastic, sheetrock, or other components. Inspect wall caps based on the typical defects for the material they are constructed from. The material defects are similar to the same material defects of wall facing element. The wall cap inspection shall identify the cap material and the associated distresses with the cap type. Use binoculars are used as a visual aid if arm's length access from a ladder is not available. Post and panel walls may not have wall caps present or the top- most panel may be architecturally different in order to give the appearance of a wall cap.

Table 8-15: Noise Wall Cap Element Distresses

Unit of Measure: Length, feet measured along the wall facing

Element No.	Element Name	Description	Applicable Distresses
18107	Wall Cap	Noise wall cap conditions	Wall Cap Concrete Defects
			Wall Cap Timber Defects
			Wall Cap Masonry Defects
			Wall Cap Metal Defects
			Wall Cap Plastic, Sheetrock, Other Defects

Details on the condition state rating schema are in Section 8.7, linked below:

Noise Wall Condition State Tables

Wall Cap Concrete

Members are susceptible to distresses such as delamination, spalling, abrasion, efflorescence, and cracking. They also experience misalignment.

Wall Cap Timber

Members are susceptible to distresses such as splitting, delamination, abrasion, and cracking. They also experience misalignment.

Wall Cap Masonry

Masonry noise caps are typically brick masonry or concrete masonry units (CMU). Stone masonry is seldomly used in new wall cap construction. Like wall facing element, condition state distresses such as splits/spalls/and delamination in the masonry, breakdown and cracking of mortar, patches in the masonry, displacement or misalignment of the masonry, or efflorescence are anticipated for masonry cap.

Wall Cap Metal

The metal cap element should be inspected for cracking and fatigue, corrosion, coating failures, and cap misalignment.

Wall Cap Plastic, Sheetrock, Other Composite

Plastic, sheetrock, and other materials may be introduced for use in the construction of wall caps. The cap should be inspected for distress including cracking, peeling, and cap misalignment.

8.4.2 REFERENCES

- None Noted

8.5 Work Recommendation Guidance

Noise wall Work Recs are recorded to initiate preventive maintenance actions. Preventive maintenance needs are determined for each ancillary structure and the corresponding actions are identified on the Work Recs documentation.

Work Recs include maintenance to facing such as cleaning off graffiti, painting, or re-sealing with protective coatings or paint. Tree or brush removal may be a Work Rec. Removal of drainage blockages may be a Work Rec; ponding or indications of water movement towards the wall do not require a work recommendation unless it is creating a condition state distress. Recommendations may consist of filling erosion or scour holes around the base of wall, foundation, or vertical supports. Repair procedures include patching of concrete or repair of concrete coping or pilasters. Work Recs for joints may consist of tightening of expansion joints, replacing expansion joints and seals, or sealing open joints (which are non-expansion joints). Other repairs of facing, joints, foundation(s), vertical supports, horizontal members, or attachments may be recommended.

The Work Recs are not meant to be all-inclusive and other Work Recs may be added to supplement those noted.

Photographs should include sufficient information to determine the relationship of the defect to the element or component or entire structure. Close-up photos of each defect with deficiencies marked on the photo should be provided.

Table 8-16: Work Recommendations for Noise Wall

Number	Description of Work Recommendation	Material involved	Quantity/Unit of Measure
1	Clean and/or paint re-seal wall, remove graffiti	Concrete	Square Foot
2	Tighten/repair timber wall facing	Wood	Square Foot
3	Repair/monitor foundation	Concrete	Cubic Feet
4	Remove vegetation growth	N/A	N/A
5	Patch Spalls: Patch delamination or spalls on concrete or masonry	Concrete	Square Foot
6	Repair damaged wall facing	Concrete	Square Foot
7	Remove corrosion and overlay protective coating for steel facing or vertical supports or horizontal members	Metal Coating system	Square Foot
8	Fill erosion/scour holes around wall	Earth/stone fill	Cubic Feet
9	Repair concrete foundation	Concrete	Cubic Feet
10	Paint Vertical Supports clean and/or paint vertical support members	Paint	Square Foot
11	Repair Vertical Support member	Concrete/Steel	Lineal Foot
12	Paint coping clean and/or paint coping/pilaster	Paint	Square Foot
13	Replace coping/pilaster	Concrete	Square Foot
14	Repair concrete coping/pilaster	Concrete	Square Foot
15	Repair and monitor the berms	Soil	Cubic Feet
16	Masonry Noise Wall Joint Repair – T Type with expansion joint in middle of panel	Joint Seal	Lineal Foot
17	Masonry Noise Wall Joint Repair – H type with expansion joint in the column	Joint Seal	Lineal Foot

8.6 Request for Action Guidance

Examples of applicable priority level items include, but are not limited to:

Priority 1 Level Items

a. Undermining of the foundation through major erosion or other severe ground loss that threatens the integrity of the noise wall

b. Wall connection to a bridge, retaining wall or other structure type with multiple loose, missing, or failing hardware, major deterioration, or damage which impacts the capacity or short-term resiliency of the element or structure

c. Major wall movement evident, whether vertical, rotational, or horizontal, observed in joints, panels, or vertical connections

d. Wall materials showing deterioration that would impact the strength of the structure causing failure of the wall, which may be observed as concrete fractures, reinforcement loss, timber cracking, or metal corrosion or deflection

e. Major structural damage to foundation, panels, or posts, which impacts safety or short-term resiliency of the structure

f. Loose/shifted cap(s) with fall potential in close proximity to public or private land-use

g. Multiple loose, missing, or damaged parts, or major deterioration, related to attachments or appurtenances that results in major impact to capacity or durability

Priority 2 Level Items

a. Undermining of the foundation through significant erosion or other significant ground loss

b. Wall connection to a bridge, retaining wall or other structure, with loose, missing, or failing hardware, significant deterioration, or damage which significantly impacts the capacity or short-term resiliency of the element or structure

c. Significant wall movement evident, whether rotational or horizontal, whether in joints, panels, or vertical connections

d. Wall materials showing significant deterioration that impacts the capacity or durability of the structure leading to failure of the wall, which could consist of concrete fractures, reinforcement loss, timber cracking, or metal corrosion or deflection

e. Structural damage to foundation, panels, or posts, which significantly impacts capacity or function, clearance, safety, or durability of the structure

f. Loose/shifted cap(s) with fall potential remote from public or private land-use, yet hazardous to anyone in close proximity

g. Significantly loose parts, or significant deterioration or wear, related to attachments or appurtenances that results in significant impact to capacity or durability

Priority 3 Level Items

a. Undermining of the foundation through moderate erosion or other ground loss

b. Wall connection to a bridge, retaining wall or other structure, with loose, missing, or failing hardware, moderate deterioration, or damage, with adequate redundancy and moderate impact to structural capacity or durability

c. Wall materials showing moderate deterioration that impacts the capacity or durability of the structure leading to failure of the wall, which could consist of concrete fractures, reinforcement loss, timber cracking, or metal corrosion or deflection

d. Loose or misaligned parts, or moderate deterioration or wear, related to attachments or appurtenances that results in moderate impact to capacity or durability

8.7 Element Condition States

Element Number	Element	Condition States Defects Note	Link to Discussion in Section 8
18101	Noise Wall Facing	Use the appropriate condition state table based on material (Reinforced Concrete, MSE, Timber, Masonry, Metal/Steel, or Other).	Wall Facing Element Condition States
18102	Vertical Supports/Columns	Use the appropriate condition state based on material (Reinforced Concrete, Timber, Masonry, Metal/Steel, or Other).	Vertical Support Columns Element Condition States
18103	Horizontal Member	Use the appropriate condition state based on material (Reinforced Concrete, Timber, Masonry, Metal/Steel, or Other).	Horizontal Member Element Condition States
18104	Joints	Use the appropriate condition state table.	Joint Element Condition States
18105	Foundation	Use the appropriate condition state based on foundation type.	Foundation Element Condition States
18106	Bridge or Structure Attachment	Use the appropriate condition state table.	Bridge or Structure Element Condition States
18107	Noise Wall Cap	Use the appropriate condition state table.	Wall Cap Element Condition States

Element 18101 (Noise Wall Facing, Reinforced Concrete)

Description	This element defines noise wall facing, regardless of facing material type.			
Quantity Calculation	Area, square feet measured or estimated using maximum height minus minimum height multiplied by length. Noise walls which are supported by both foundations and by bridge or structure attachments should be considered two separate structures, with the separation at the nearest joint where the support type changes.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Concrete Cracking	Insignificant cracks or moderate-width cracks that have been sealed. No exposed reinforcing.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking. Reinforcement may be exposed with no measurable section loss.	Wide cracks (>3/16" or 0.1875 inches) or heavy pattern (map) cracking. Some reinforcing may be exposed. Incidental loss of section of reinforcing may be present but does not affect the function.	Major deterioration due to extensive cracking. Substantial amounts of water or backfill may be leaking through cracks or joints. Major corrosion of exposed reinforcing.
Concrete Spalling, Delamination, Patching	No evidence of concrete spalling, delamination, or patching.	Minor delamination is present. Patched areas are sound.	Moderate delamination and spalling is present. Patches are partially functioning or showing distress. Moderate cracks may be present.	Major deterioration due to spalling, or delamination impacting function of wall. Failed patches.
Concrete Abrasion/Wear	No evidence of concrete abrasion or wear.	Abrasion or wearing has exposed coarse aggregate.	Abrasion or wearing has caused coarse aggregate to be loose and/or lost from the concrete matrix.	Major deterioration of concrete due to abrasion or wear.
Other Concrete Defects	Other Concrete is present and does not exhibit deterioration or distress.	Minor deterioration or distress of Other Concrete.	Moderate deterioration or distress of Other Concrete.	Major deterioration or distress of Other Concrete.
Concrete Protective Coatings	Protective coatings functioning.	Minor peeling/ bubbling/cracking present.	Protective coatings partially effective. Major peeling, bubbling, or cracking is present.	Does not create a severe condition.

Description	This element defines noise wall facing, regardless of facing material type.			
Quantity Calculation	Area, square feet measured or estimated using maximum height minus minimum height multiplied by length. Noise walls which are supported by both foundations and by bridge or structure attachments should be considered two separate structures, with the separation at the nearest joint where the support type changes.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Efflorescence	Free of efflorescence.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining present.	Does not create a severe condition.
Impact Damage	No damage caused by vehicular impact.	The element has minor damage caused by vehicular impact.	The element has moderate damage caused by vehicular impact.	Major impact damage from vehicular or vessel collision.

Element 18101 (Noise Wall Facing, Timber)

Description	This element defines noise wall facing, regardless of facing material type.			
Quantity Calculation	Area, square feet measured or estimated using maximum height minus min height multiplied by length. Noise walls which are supported by both foundations and by bridge or structure attachments should be considered two separate structures, with the separation at the nearest joint where the support type changes.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Timber Decay/ Section Loss/ Abrasion	No indication of decay, section loss or abrasion	Minor decay, section loss or abrasion.	Moderate decay, section loss or abrasion	Major decay, section loss, or abrasion of wall.
Timber Checks/ Shakes	Checks and Shakes are not present.	Checks and shakes affect less than 5% of the member thickness.	Checks and shakes affect 5% to 50% of the member thickness. Larger checks/shakes have been repaired.	Checks and shakes of timber affect more than 50% of member thickness.
Timber Splitting/ Delamination/ Cracking	No splitting or delamination present. Sealed cracks may exist.	Minor delamination or cracking is present.	Delamination or splitting length equal to or greater than the total member depth, but only present away from connections. Evidence of moderate cracking. Larger cracks have been repaired.	Delamination or splitting near connections. Severe deterioration due to cracking.
Other Timber Defects	None present.	Minor deterioration or distress of other timber defects.	Moderate deterioration or distress of other timber defects.	Major deterioration or distress of other timber defects.
Impact Damage	No damage caused by vehicular impact.	The element has minor damage caused by vehicular impact.	The element has moderate damage caused by vehicular impact.	Major damage from vehicular impact.

Element 18101 (Noise Wall Facing, Masonry)

Description	This element defines noise wall facing, regardless of facing material type.			
Quantity Calculation	Area, square feet measured or estimated using maximum height minus min height multiplied by length. Noise walls which are supported by both foundations and by bridge or structure attachments should be considered two separate structures, with the separation at the nearest joint where the support type changes.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Masonry Splits/Spalls/ Delamination	No splits, spalls, or delamination.	Minor delamination or spalls is present. Hairline cracks may be present. Block or stone has split or spalled with no shifting.	Moderate delamination or spalls is present. Minor cracks may be present. Block or stone has split or spalled with shifting.	Major deterioration such as spalling/delamination or splitting.
Masonry Exposed Reinforcement	No exposed reinforcing.	Reinforcement may be exposed with no measurable section loss.	Incidental loss of section of reinforcing may be present but does not affect the function.	Major corrosion of exposed reinforcing.
Mortar Breakdown/ Cracking	No mortar breakdown.	Cracking or voids in less than 10% of the mortar joints.	Cracking or voids in 10% to 50% of the mortar joints.	Mortar joints with cracks or voids in more than 50% of the mortar joints. Substantial amounts of water or backfill may be leaking or migrating through cracks.
Masonry Patches	Free of patches.	Patch is present and functioning as intended to arrest original deterioration.	Unsound patches or patch showing distress.	Patch has failed.
Masonry Displacement/ Misalignment	None present. No displacement or misalignment	Block or stone has shifted slightly out of alignment.	Block or stone has shifted moderately out of alignment or is missing.	Major displacement of block or stone with missing blocks and stones.
Other Masonry Defects	None present.	Minor deterioration or distress of Other Masonry Defects.	Moderate deterioration or distress of Other Masonry Defects.	Major deterioration or distress of Other Masonry Defects.

Description	This element defines noise wall facing, regardless of facing material type.			
Quantity Calculation	Area, square feet measured or estimated using maximum height minus min height multiplied by length. Noise walls which are supported by both foundations and by bridge or structure attachments should be considered two separate structures, with the separation at the nearest joint where the support type changes.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Efflorescence	Free of efflorescence.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining present.	Does not create a severe condition.
Impact Damage	No damage caused by vehicular impact.	The element has minor damage caused by vehicular impact.	The element has moderate damage caused by vehicular impact.	Major impact damage from vehicular or vessel collision.

Element 18101 (Noise Wall Facing, Metal/Steel)

Description	This element defines noise wall facing, regardless of facing material type.			
Quantity Calculation	Area, square feet measured or estimated using maximum height minus min height multiplied by length. Noise walls which are supported by both foundations and by bridge or structure attachments should be considered two separate structures, with the separation at the nearest joint where the support type changes.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Steel Wall Cracking/ Fatigue	No evidence of wall cracking/fatigue.	Steel cracking is self-arrested or arrested with holes, doubling plates, or similar. Fasteners are performing as intended.	Steel cracking is progressing.	Major deterioration due to extensive. Substantial amounts of water or backfill may be leaking through cracks or joints.
Steel Wall Corrosion/ Section Loss	Free of corrosion/section loss	Minor surface corrosion.	Moderate section loss due to corrosion.	Major wall section loss due to excessive corrosion.
Steel Wall Protective Coatings	Protective coatings functioning.	Minor peeling/bubbling/ cracking present.	Protective coatings on steel partially effective. Major peeling, bubbling, or cracking is present. Chalking or oxide films may be present.	Does not create a severe condition.
Impact Damage	No damage caused by vehicular impact.	The element has minor damage caused by vehicular impact.	The element has moderate damage caused by vehicular impact.	Major damage from vehicular impact.

Element 18101 (Noise Wall Facing – Plastic, Sheetrock, Other Composite)

Description	This element defines noise wall facing, regardless of facing material type.			
Quantity Calculation	Area, square feet measured or estimated using maximum height minus min height multiplied by length. Noise walls which are supported by both foundations and by bridge or structure attachments should be considered two separate structures, with the separation at the nearest joint where the support type changes.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Plastic, Vinyl, Composite, Other Wall Defect	Plastic, Vinyl, Composite, or Other Wall does not exhibit deterioration or distress.	Minor deterioration or distress of Plastic, Vinyl, Composite, or Other Wall.	Moderate deterioration or distress of Plastic, Vinyl, Composite, or Other Wall.	Major deterioration or distress of Plastic, Sheetrock, or Other Composite material.
Plastic, Vinyl, Composite, Other Protective Coatings	Protective coatings functioning.	Minor peeling/bubbling/ cracking present.	Protective coatings partially effective. Major peeling, bubbling, or cracking is present.	Does not create a severe condition.
Impact Damage	No damage caused by vehicular impact.	The element has minor damage caused by vehicular impact.	The element has moderate damage caused by vehicular impact.	Major damage from vehicular impact.

Element 18102 (Vertical Support/Column)

Description	This element is defined by vertical supports and connection hardware which provide structural support to the wall facing and adjacent elements such as horizontal members. It includes base plates present at the connection of the vertical column and the attachment element.			
Quantity Calculation	The quantity is measured in each.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Vertical Support/ Column Steel Defects	No deterioration present.	Steel cracking is self-arrested or arrested with holes, doubling plates, or similar. Fasteners are performing as intended. Minor surface corrosion. Minor wall movement may be occurring with signs of bending, misalignment, distortion, or deflection of vertical support.	Steel cracking is progressing. Moderate section loss due to corrosion. Moderate wall movement may be occurring with signs of bending, misalignment, distortion, or deflection of vertical support.	Major deterioration due to cracking, corrosion, section loss or misalignment. Wall movement may be active with major wall bending, misalignment, distortion, or deflection of vertical support.
Vertical Support/ Column Concrete Defects	Hairline cracks may be present. Minor cracks or moderate-width cracks that have been sealed. No exposed reinforcement.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking. Minor delamination or spalls is present. Reinforcement exposed without measurable section loss. Minor wall movement may be occurring with deflection of vertical support.	Wide cracks (>3/16” or 0.1875 inches) or heavy pattern (map) cracking. Moderate delamination or spall is present. Exposed reinforcement with measurable section loss. Moderate wall movement may be occurring with deflection of vertical support. Exposed prestressing strand without section loss.	Major deterioration due to cracking, spalling, reinforcement corrosion, section loss or other deterioration impacting strength of wall. Exposed prestressing strand with section loss. Wall movement may be active with major deflection of vertical support.

Description	This element is defined by vertical supports and connection hardware which provide structural support to the wall facing and adjacent elements such as horizontal members. It includes base plates present at the connection of the vertical column and the attachment element.			
Quantity Calculation	The quantity is measured in each.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Vertical Support/ Column Timber Defects	No deterioration present	Minor decay, section loss, abrasion, or cracking. Checks affect less than 5% of the member thickness. Minor wall movement may be occurring with deflection of vertical support.	Moderate decay, section loss, abrasion, or cracking. Checks/ shakes/ cracks affect 5% to 50% of the member thickness. Larger checks/shakes/cracks have been repaired. Delamination or splitting length equal to or greater than the total member depth. Moderate wall movement may be occurring with deflection of vertical support.	Major decay, section loss, or abrasion of wall. Checks and shakes of timber affect more than 50% of member thickness. Delamination or splitting near connections. Wall movement may be active with major deflection of vertical support.
Vertical Support/ Column Masonry Defects	No splits or spalls, mortar breakdown present. No displacement or misalignment of stones present. No exposed reinforcing.	Minor delamination or spalls. Hairline cracks in stones may be present. Cracking or voids in less than 10% of the mortar joints. Block or stone has shifted slightly out of alignment. Reinforcement may be exposed with no measurable section loss.	Moderate delamination or spalls. Minor cracks may be present. Cracking or voids in greater than 10% or more of the mortar joints. Block or stone has shifted moderately out of alignment or is missing. Incidental loss of section of reinforcing may be present but does not affect the function.	Major spalling, delamination cracking or splitting of masonry. Mortar joints with cracks or voids in more than 50% of the mortar joints. Major displacement of block or stone with missing blocks and stones. May effect structure strength or performance. Major corrosion of exposed reinforcing.

Description	This element is defined by vertical supports and connection hardware which provide structural support to the wall facing and adjacent elements such as horizontal members. It includes base plates present at the connection of the vertical column and the attachment element.			
Quantity Calculation	The quantity is measured in each.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Vertical Support/ Column Plastic, Other Composite, Defects	Plastic or Other Composite material does not exhibit deterioration or distress.	Minor deterioration or distress of Plastic or Other Composite material. Minor wall movement may be occurring with deflection of vertical support.	Moderate deterioration or distress of Plastic, or Other Composite material. Moderate wall movement may be occurring with deflection of vertical support.	Major deterioration or distress of Plastic, or Other Composite material. Wall movement may be active with major deflection of vertical support.

Element 18103 (Horizontal Member)

Description	This element is defined as a horizontal member provides structural support to the wall facing and includes any connection hardware present between the horizontal supports and adjacent elements.			
Quantity Calculation	This quantity is measured in length in feet of all horizontal members.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Horizontal Member Steel Defects	No deterioration present	Steel cracking is self-arrested or arrested with holes, doubling plates, or similar. Fasteners are performing as intended. Minor surface corrosion. Wall movement may be occurring with signs of deflection of Horizontal Member.	Steel cracking is progressing. Moderate section loss due to corrosion. Moderate wall movement may be occurring with signs of bending, misalignment, distortion, or deflection of Horizontal Member.	Major deterioration due to cracking, corrosion, section loss or misalignment impacting strength of wall. Wall movement may be active.
Horizontal Member Concrete Defects	Hairline cracks may be present. Minor cracks or moderate-width cracks that have been sealed. No exposed reinforcement.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking. Minor delamination or spalls. Reinforcement exposed without measurable section loss. Minor wall movement may be occurring with deflection of Horizontal Member.	Wide cracks (>3/16" or 0.1875 inches) or heavy pattern (map) cracking. Moderate delamination or spalls. Exposed reinforcement with measurable section loss. Moderate wall movement may be occurring with deflection of Horizontal Member.	Major deterioration due to cracking, spalling, reinforcement corrosion, section loss or other deterioration impacting strength of wall. Exposed prestressing strand with corrosion. Wall movement may be active with major deflection of Horizontal Member.

Description	This element is defined as a horizontal member provides structural support to the wall facing and includes any connection hardware present between the horizontal supports and adjacent elements.			
Quantity Calculation	This quantity is measured in length in feet of all horizontal members.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Horizontal Member Timber Defects	No deterioration present	Minor decay, section loss, abrasion, or cracking. Checks affect less than 5% of the member thickness. Minor wall movement may be occurring with deflection of Horizontal Member.	Moderate decay, section loss, abrasion, or cracking. Checks/ shakes/cracks affect 5% to 50% of the member thickness. Larger checks/shakes/cracks have been repaired. Delamination or splitting length equal to or greater than the total member depth. Moderate wall movement may be occurring with deflection of Horizontal Member.	Severe decay, section loss, or abrasion of wall. Checks and shakes of timber affect more than 50% of member thickness. Delamination or splitting near connections; Wall movement may be active with major deflection of Horizontal Member.
Horizontal Member Masonry Defects	No splits or spalls, mortar breakdown present. No displacement or misalignment of stones present.	Minor Delamination or spalls. Hairline cracks in stones may be present. Cracking or voids in less than 10% of the mortar joints. Block or stone has shifted slightly out of alignment.	Moderate delamination or spalls. Minor cracks may be present. Cracking or voids in 10% to 50% of the mortar joints. Block or stone has shifted moderately out of alignment or is missing.	Major spalling, delamination cracking or splitting of masonry. Mortar joints with cracks or voids in more than 50% of the mortar joints. Major displacement of block or stone with missing blocks and stones. May effect structure strength or performance.
Horizontal Member (Plastic, Composite, Other) Defects	Plastic, or Other Composite material does not exhibit deterioration or distress.	Minor deterioration or distress of Plastic or Other Composite material. Minor wall movement may be occurring with deflection of Horizontal Member.	Moderate deterioration or distress of Plastic, or Other Composite material. Moderate wall movement may be occurring with deflection of Horizontal Member.	Major deterioration or distress of Plastic, or Other Composite material. Wall movement may be active with major deflection of Horizontal Member.

Element 18104 (Joints)

Description	This element is for joints which define sections between noise wall facing panels.			
Quantity Calculation	The quantity for this element is measured as “each.”			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Separation, Offset, Rotation, and Cracking	No damage present.	Joints are slightly misaligned and may have irregular spacing between units. Joints with seals show minor damage, cracking, or loss of seal adhesion.	Joints are moderately misaligned and may have irregular spacing between units. Joints with seals show moderate damage, cracking, or loss of seal adhesion.	Joints are extensively misaligned with irregular spacing. Joints with seals are not functioning.
Joint Infiltration	None.	Partially filled, but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
Joint closed/crushing	No damage present.	Localized closure or crushing of the joints but still allowing movement.	Joints are closed and moderate crushing has occurred impacting joint movement.	Joints are closed with significant joint crushing.

Element 18105 (Foundation)

Description	This element defines a foundation, regardless of foundation type.			
Quantity Calculation	The quantity is collected in length of feet measured along the wall face.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Foundation Defects	Wall shows no signs of movement. Wall foundation elements are in place.	Minor wall movement has occurred. Signs of settlement, deflection, or displacement are present. Foundation may be exposed. Wall is still attached to foundation.	Moderate wall settlement, rotation, or movement indicating possible foundation damage. Wall may be partially disconnected from its foundation.	Major loss of wall bearing capacity which is a threat to wall structural capacity and stability. Wall may not be attached to foundation elements.

Element 18106 (Bridge or Structure Attachments)

Description	This element defines an attachment such as anchors or other connections (when present), which are used to connect the noise wall to a bridge, retaining wall, concrete barrier, foundation, or other structure.			
Quantity Calculation	The quantity is measured in each.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Anchor/ Connection Defects	No evidence of damage, wear, or corrosion. Anchor/Connections are fully engaged.	Hairline cracks, minor spall, and minimal corrosion or coating damage may be present. Connection is free of distortion and hardware is engaged with no evidence of loss of seal adhesion or loosing fasteners	Moderate damages including cracks and spalls, or corrosion/coating damage may be present. Signs of distortion and loosening fastener is present.	Major corrosion/section loss is present. Protective coatings are significantly failing. Members may have major cracks or wear. Significant distortion of connections, loss of seal adhesion or loosening of fasteners may be present.

Element 18107 (Noise Wall Cap)

Description	This element is defined by the condition of the wall cap which could be made of timber, masonry, metal (steel), plastic, sheetrock, or other components.			
Quantity Calculation	The quantity is collected in feet along the noise wall facing.			
	Condition State Descriptions			
Defect Type	**Good**	**Fair**	**Poor**	**Severe**
Timber Defects	No indication of decay, splitting, delamination, section loss, abrasion, or unsealed cracks. No evidence of cap misalignment.	Minor evidence of decay, splitting, delamination, section loss, abrasion, or unsealed cracks. Cap may be slightly out of alignment.	Moderate evidence of decay, splitting, delamination, section loss, abrasion, or cracks. Evidence of moderate misalignment may be present.	Evidence of major deterioration due to extensive splitting, delamination, section loss, abrasion, or cracks is present. Major displacement or failure of cap may be present.
Masonry Defects	No split, spall, delamination, crack, or other distress is present. Free of patches. No evidence of cap misalignment.	Minor splits, spalls, delamination, cracks, or other distress is present. Minor patches may be present but are adequately functioning to arrest original deterioration. Cap may be slightly out of alignment.	Moderate splits, spalls, delamination, cracks, or other distress is present. Patches are not adequately functioning. Cap may be loosely fixed.	Major deterioration due to extensive splits, spalls, delamination, cracks, or other distress. Patch has failed. Major displacement of cap may be evident.
Metal/Steel Defects	No evidence of corrosion, coating wear or cap misalignment.	Minor evidence of surface corrosion, coating wear, or crack is present. Cap may be slightly out of alignment.	Moderate evidence of surface corrosion, coating wear, or crack is present. Cap may be loosely aligned.	Extensive surface corrosion, coating wear, or crack is present. Extensive misalignment of cap may be present.
Plastic, Sheetrock, Other Composite Defects	No evidence of deterioration or misalignment.	Minor peelings, cracking or another surface distress may be present. Minor cap misalignment may be present without loss of function.	Moderate peelings, cracking or other distress is present. Evidence of moderate misalignment may be present.	Evidence of major deterioration is present. Major displacement of cap may be present.