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ENGINEERED SOLUTIONS

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Recommendations for the Inspection and Maintenance of CONTINENTAL® Pedestrian Truss Steel Structures STEADFAST® Vehicular Truss Steel Structures EXPRESS® Continental Pedestrian Truss Steel Structures BIG R BRIDGE® Rolled Girder Steel Structures

The purpose of this set of recommendations is to suggest some minimum guidelines for inspection and maintenance of CONTINENTAL pedestrian truss structures, EXPRESS pedestrian truss structures, BIG R BRIDGE rolled girder structures and STEADFAST vehicular truss structures, in order to maintain the overall structural integrity and user safety throughout the Design Life of the structure. When the AASHTO Specifications are followed, the Design Life is defined as the "Period of time on which the statistical derivation of transient loads is based, which is 75-years." These procedures are not all inclusive and more detailed procedures may be warranted depending upon bridge location, environment, and usage. Establishing the requirements for, and verifying the performance of, all field inspection and maintenance is the responsibility of the owner.

INSPECTION

I. User Safety (Inspection by others)

A. Each bridge should be inspected at regular intervals (at least once per year) to ensure that all items of user safety are accounted for and performing properly. Those areas of special concern should be as follows:

1. All safety rails, handrails, rub rails, guard rails, fencing, or other types of safety features should be in place with complete structural integrity and capacity. There shall be no sharp edges or protrusions on any feature that could produce bodily or vehicular harm or be a hazard to the user.

2. All deck surfaces should be without gaps, cracks or projections that could create a trip hazard, impede vehicular traffic, or interfere with the user in any way. Special consideration should be given to any smooth deck surface that could also create a possible slip hazard. Contech Engineered Solutions LLC recommends some form of broom finish or grooved finish for concrete decks, or other means of providing a non-skid surface.

NOTE:	**The owner and/or specifier should be aware that most pedestrian bridge liability claims are statistically slip and fall claims.**

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II. Structural Integrity (Inspection by others)

A. Each bridge should be inspected at regular intervals (once a year is recommended, but at least every other year). The following documents shall be referenced during inspection of the bridge:

   a. All local and state (DOT) jurisdictional documents and handbooks relating to the inspection of bridges
   b. NCHRP Report 333 "Guidelines for Evaluating Corrosion Effects in Existing Steel Bridges"
   c. "Bridge Inspector's Reference Manual" by FHWA
   d. "The Manual for Bridge Evaluation" by AASHTO
   e. NCHRP Report 314 "Guidelines for the Use of Weathering Steel in Bridges", Chapter 11 Inspection & Maintenance
   f. "Inspection of Hot-Dip Galvanized Steel Products" by American Galvanizers Association

B. The inspection should include, but not be limited to, the following:
   a. Check the decking to ensure it is in satisfactory condition. Pay special attention to decks at their contact surfaces where they bear on steel support members.
   b. All steel surfaces should be inspected to ensure that they are performing satisfactorily. Check for any corrosion on steel bridges, paying special attention to the following areas:
      i. All steel below the deck, particularly the tops of girders, stringers, and floor beams supporting the deck.
      ii. Steel structural system joints where debris or water may accumulate.
      iii. Scupper, curb, floor drains, and other drainage systems
      iv. Anywhere vegetation or other material may have come in contact with the steel.
      v. Check all steel surfaces and welded and bolted connections for cracks. Pay special attention to the welded connections subject to fatigue stresses.
      vi. Check the ends of the bridge for any damage which may have been caused by vehicular impact.
      vii. Check the integrity of concrete abutments and/or piers-per AASHTO's Manual for Maintenance Inspection or the foundation engineer's recommendations. Pay special attention to scour due to water flow, if applicable.
      viii. Check anchor bolts for damage and see that they are secure. Examine all bearings to ascertain that they are functioning properly. Expansion bearings and the expansion joints at the ends of the bridge must be checked to see that they can move freely and are clear of all foreign material.
      ix. Check the bolted splices for any excessive corrosion or cracking of the steel or fasteners.
      x. Make sure all weep holes are open and clear of debris to allow for complete drainage of any moisture which may collect on the interior of HSS members (see project-specific engineering drawings for location of weep holes.
      xi. For galvanized steel surfaces, check for the following:
         1. Crevices
         2. Dissimilar Metals in Contact
         3. Areas where water may pond
         4. Previously touched-up areas

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5. The time to first maintenance of galvanized steel is dependent upon the steel thickness, the average thickness of zinc and the environment to which the steel is exposed. First maintenance would be defined as when 5% of the galvanized area is experiencing rusting.

xii. For weathering steel bridges, pay special attention to the following:

1. Assurance that the patina surface of the weathering steel has formed properly and is hard and intact. The protective patina is to be considered achieved when the color is dark and uniform (chocolate brown to purple brown) and it is capable of withstanding hammering or vigorous wire brushing. Some dusty and granular deposits are to be expected during the early stages of the development of the patina. It will typically take anywhere from 2 to 5 years for the patina to develop. Patina development only occurs after several wet-dry cycles.
2. The following is an indication that the patina may be in distress:
   a. Small flakes ¼" in diameter indicate the initial development of a nonprotective oxide.
   b. Large flakes (1/2" in diameter or greater) indicate that the steel has lost its nonprotective oxide.
   c. Laminar sheets or modules indicates the total loss of the nonprotective oxide, and that severe corrosion is occurring.
   d. Any weathering steel surface not "boldly exposed" to the atmosphere should be checked to ensure it has formed its protective oxide layer.

C. If problems are seen during the inspection procedure, cleaning and repair or replacement of steel bridge components may be necessary. Painted bridges may require cleaning and repainting or replacement of some or all members. Remedial recommendations by the individual performing the inspection, in consultation with the project foundation engineer and/or Contech Engineered Solutions LLC should be performed.

GENERAL MAINTENANCE

Inspection and Maintenance Records must be submitted to Contech Engineered Solutions LLC with any warranty issue or claim.

I. Soil Clearance

Soil or dirt must not be left in contact with any steel surfaces. Adequate clearance for ventilation must be maintained between the ground and the steel. Weathering steel surfaces need to allow drying to occur after wetting, to provide for the formation of its protective patina.

If the initial construction of abutments and back slopes did not allow for adequate ventilation (approximately 18"-24"), enough soil, debris, and/or vegetation should be removed and kept cut back to allow for adequate airflow. If this is not possible, a coating designed for "ground contact" protection of steel may be applied to the members in the affected area.

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II. Snow Removal

Because of possible accumulation of chlorides at truss joints, in the gaps between planks on structures with timber decks, on below deck members, and/or along the edges of decks where runoff occurs, the use of de-icing salts should be avoided on these structures, especially on weathering steel bridges (see Item A in the "Maintenance for Weathering Bridges" section of this document).

The best and safest way to remove snow from these bridges, as far as the issue of steel corrosion is concerned, is by shoveling or plowing snow from the bridge deck. Non-corrosive traction aids such as sand may be used on the deck surfaces; however, if corrosive de-icing agents are used on the structure; accelerated corrosion of members which are exposed to the agent will take place, voiding the bridge warranty and necessitating repair or replacement of affected members.

De-icing salts have been used on structures where more aggressive measures were taken to protect the steel, such as galvanizing the steel members or utilizing a concrete deck with curbs to channel water away from steel surfaces. In the latter case, care must still be taken to protect, or maintain by cleaning or rinsing, areas where water drains or salt gets thrown onto un-galvanized steel surfaces by wheel traffic, spreading, etc. If not, the warranty shall be voided and replacement of some members or possibly the entire structure may be required. However even measures like galvanization and concrete curbs can be damaged with persistent usage of de-icing salts.

All steel surfaces of the entire bridge (including those in under the deck) are to be power washed every other Spring (April through June). This power washing shall be as follows:

a. Ambient temperatures above 40-degrees Fahrenheit must be maintained until complete drying has occurred.
b. A pump capable of delivering 100 gallons per minute minimum is to be used.
c. Washing shall use a water pressure between 2000psi and 3000psi, with a spray angle of 30-degrees or less, with the wand held 6”-12” from the surface of the steel.
d. Washing shall be done from above the member whenever possible, but no lower than horizontal with the member. Horizontal will be defined as +/- 10-degrees from horizontal. Washing shall move parallel to the surface.
e. If power washing is performed less frequently, the opportunity exists that excessive corrosion of the steel may occur. Excessive corrosion of the steel that materially undermines the structural integrity of the steel due to failure to inspect and maintain the steel in accordance with the maintenance and inspection regime outlined, will void any warranty of the steel by Contech Engineered Solutions LLC.

MAINTENANCE FOR PAINTED BRIDGES

Painted bridges, like any painted structure, require periodic inspections and painting. The following steps should help increase the life span of your bridge:

A. After inspections, or any time loss or damage of the paint coat is noticeable, problem areas should be repaired as follows:

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1. Select a maintenance coating system based on the following:

   a. Inspection report findings
   b. Environment (identify any corrosives)
   c. Degree of surface preparation attainable
   d. Current paint compatibility

   NOTES:

   * Generic type compatibility is a major factor in the selection of a system (some coating systems are not recommended over a particular type of existing material.)
   * Depending upon the surface performance, an upgrade in the coating system may be necessary at this time.

2. Clean all applicable surfaces as dictated by the repair system chosen (i.e. pressure wash, brush off, blast clean, etc.)

3. Apply repair coats per the coating manufacturer's recommendations.

4. Caulk all un-welded seams which need repair with a good quality clear silicone caulk suitable for exterior use.

B. The entire bridge structure will require periodic repainting dependent upon varying factors such as the existing paint system, bridge usage, atmospheric environment, etc. Repainting will typically be required every 2-10 years. The frequency of painting will need to be determined by the inspector. The following steps should be followed when repainting the bridge structures:

1. Remove wood decking or grating, fencing, wood rub rails, and any other non-painted items which will not be receiving new paint. Obviously, concrete and asphalt decked bridges will be painted with the deck in place, unless these decks have deteriorated to the point of replacement. If this is the case, remove the deck prior to painting, if not, special care should be exercised to ensure problem areas below deck are cleaned and painted properly.

2. Select a coating system based on parameters like those outlined in the repair painting section (A, above), paying attention to the following items:

   * Environment, specifically any corrosives identified during inspections
   * Substrate condition
   * Surface preparation limitations

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3. After selecting a system compatible with all existing surface conditions and site limitations, clean all surfaces and apply according to the manufacturer's recommendations.

4. After the coating system has properly cured, caulk all un-welded seams with a good quality clear silicone caulk suitable for exterior use and replace the decking, fencing, etc., which were removed prior to cleaning and repainting the structure. This is also an excellent time to replace the wood rub rail which may have shown excessive deterioration.

MAINTENANCE FOR WEATHERING BRIDGES

Weathering steel is not a maintenance-free material. The following steps should help increase the life span of your bridge:

A. Do not use de-icing salts for snow removal. De-icing salts can severely damage the weathering steel.

B. Avoid retention of debris on the steel surfaces. Flush bridges at areas which accumulate debris (including salt) on a regular basis.

C. Prevent weathering steel from contact with soil, vegetation, masonry, or other materials so that the weathering process can proceed on a natural basis.

D. If excessive corrosion is encountered due to salts from adjacent roadways or roadways beneath an overpass structure, or for any other reason, it may be wise to blast clean and paint the truss joints, steel beneath the deck, or any area which exhibits excessive corrosion.
Steel Structures Painting Council's Report 92-08, Maintenance Coating of Weathering Steel: Field Evaluation and Guidelines provides recommendations for remedial painting of weathering steel bridges.

MAINTENANCE FOR DECKING

I. Wood Decks on Pedestrian Structures

At the time of installation of the wood decking, Contech Engineered Solutions LLC personnel take great strides to assure that the edges of each plank are in contact with each other so that no gaps appear between planks. All wood is stored inside, protected from the weather, prior to installation.

However, wood is a natural material that exhibits large volume changes with variations in moisture content and time, particularly in the width direction, which can cause gaps to form between the planks. Cupping and splits may also occur which need to be repaired.

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Contech Engineered Solutions LLC recommends an assessment of these hazards during the User Safety Inspection with remedial action as follows:

A. Replace all planks that have deteriorated past a useful and safe life.

B. Eliminate gaps between the planks which might be large enough for a high-heeled shoe to become lodged. Eliminating the gaps should be done as follows:

1. Remove all deck bolts.
2. Remove plank hold down angles. Be sure to mark their locations for ease of reinstallation.
3. Slide wood planks together.
4. Add new plank or planks to fill up the excess space.
5. Reinstall plank hold down angles.
6. Drill new holes in wood planks.
7. Install new deck bolts (see shop drawings for size and material).

C. Replacement planks may be purchased through Contech Engineered Solutions LLC.

D. Over time and with exposure to the environment, wood may become smooth, particularly when wet with rain, dew, snow, sleet, ice, etc. Periodically it may be necessary to "roughen" the surface of the decking with large grit sandpaper. There are also commercially available non-skid coatings which may be applied.

Note: It is the owner's responsibility to keep the wood deck free from cupping, splits, gaps, and smooth surfaces. Remember, most pedestrian bridge liability claims are statistically slip and falls.

II. Grating Decks

A. Repair or replace any grating that shows damage or deterioration to the main bearing bars.

B. If galvanized, inspect to see if corrosion has occurred. Wire brush any spots exhibiting corrosion and repair. We recommend the use of either sprayed zinc metalizing or the use of organic zinc rich paint for repairing galvanized surfaces.

C. For weathering steel grating, if excessive corrosion is encountered due to salts from adjacent roadways or roadways beneath an overpass structure, or for any other reason, it may be wise to blast clean and paint the grating.

D. For gratings of other materials, such as fiberglass, refer to the manufacturer's recommended maintenance instructions.

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III. Concrete and Asphalt

For most concrete decks, Contech Engineered Solutions LLC supplies a steel corrugated form decking to aid in the placement of the concrete. This steel form may or may not be integral to the deck design (as in a composite deck).

For asphalt decks, steel Bridge Plank is the main load carrying member. A wearing surface is placed on top of the Bridge Plank to provide a drivable deck.

During inspection, the asphalt (or other types of wearing surfaces) or concrete covering should be checked for excessive cracking and deterioration. At the same time, the steel decks should be checked for excessive rusting and/or damage. If the coverings are deemed to require replacement, the steel decks may be reused if they are not damaged or do not show excessive corrosion. Structural Bridge Plank for asphalt decks and steel form decks for composite concrete decks, may require replacement even when the deck surface itself is sound.

Concrete and asphalt decks on pedestrian structures are usually not designed to accept the added dead weight of an overlay. Therefore, the only remedy is repair of the cracking or replacement of the concrete or asphalt covering. However concrete and asphalt decks on vehicular structures usually have an additional future wearing surface allowed in the design. Check the project-specific engineering drawings for indication as to the amount of this allowance.

See the project-specific shop drawings for recommended concrete strength, reinforcing size, slab and asphalt thickness, control joint location, and surface finish. If there are any questions, please contact Contech Engineered Solutions LLC for consultation.

Remember: **Maintenance of the bridge decking, including keeping it free from slip or trip hazards, is the owner's responsibility. Most pedestrian bridge liability claims are statistically slip and falls.**