Installation Manual

Next Generation Terminal

NextGen Safety, LLC

2298 Attala Road 2202

Kosciusko, MS 39090

CONTENTS

1. General Information

The Next Generation Terminal (NGT) is a tangent, redirective and non-gating W-beam end terminal system. Installers must strictly adhere to the installation instructions contained herein. The NGT is tension-based and requires that the cable be inserted through the terminal head and attached to the anchor post so that the system will not loosen or disengage when struck by a vehicle.

The NGT is a system comprised of numerous parts, including standard and specialized guardrail, plug-welded posts, a terminal head, an anchor post, and connecting hardware. All these parts have been designed or specified to fulfill a specific purpose. Therefore, they must all be installed according to the instructions herein to facilitate proper functionality. Until further testing proves otherwise, it is critical that the supplied posts, guardrail, and terminal head be assembled in accordance with the instructions provided herein. If they are not, the system may not work properly, and serious injury or death may occur if the system is impacted.

The NGT has been successfully crash tested in accordance with the American Association of State and Highway Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH) criteria Test Level 3 (100 km/hr). All crash test reports, videos, photos, data, and other supporting documentation can be found at the following website:

https://www.nextgensafety.net

It is the responsibility of the installer to utilize a design approved by the State DOT and to follow all required State procedures and these instructions when installing the NGT.

2. Bill of Materials

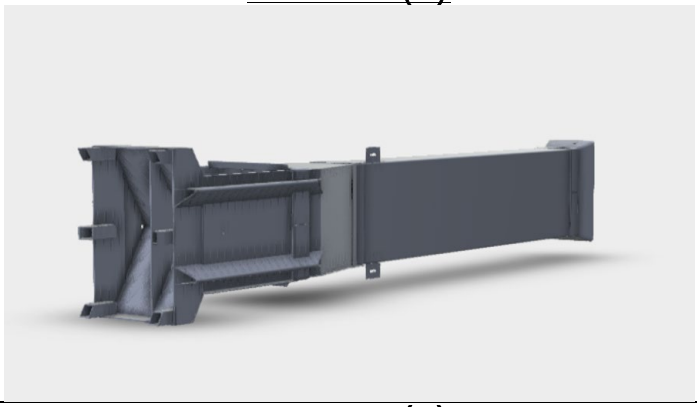
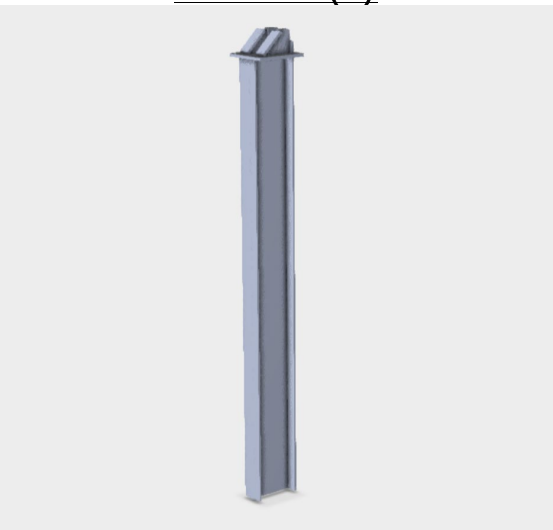
PROPRIETARY PARTS	
FIGURE 2(A) 	**NGT Impact Head – 1EA** [Part No. NGT-1000]
FIGURE 2(B) 	**NGT Anchor Rail – 1EA** [Part No. NGT-2000]
FIGURE 2(C) 	**NGT Anchor Post – 1EA (w/pre-assembled Anchor Cap)** [Part No. NGT-3000]

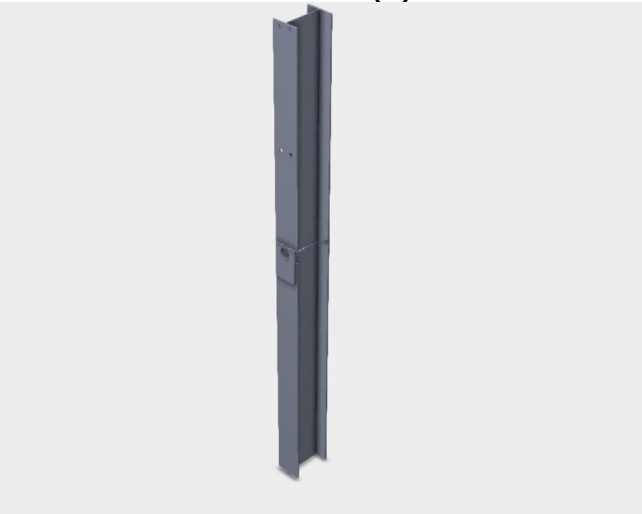
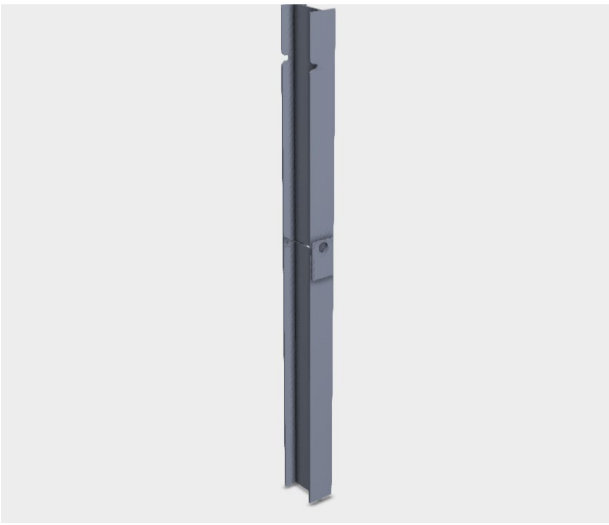
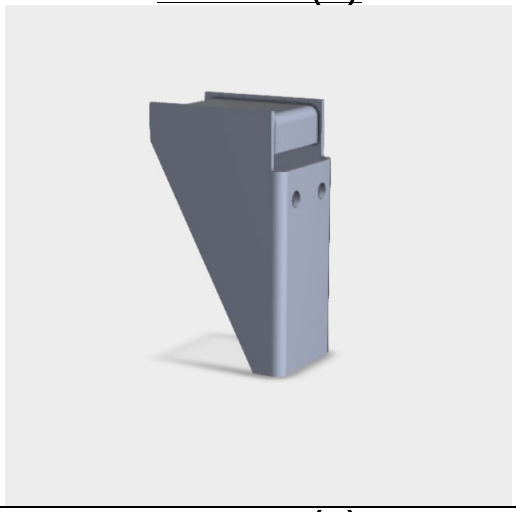
FIGURE 2(E) 	**NGT First Post – 1EA** **(no tapered slots)** [Part No. NGT-4000]
FIGURE 2(F) 	**NGT Plug-Welded Posts – 8EA** **(tapered slots)** [Part No. NGT-4100]

FIGURE 2(G) 	**NGT Shelf Bracket – 1EA** [Part No. NGT-5000]
FIGURE 2(H) 	**NGT Notched Blockouts – 2EA** [Part No. NGT-6000]
STANDARD (Non-Proprietary) PARTS	
Standard 6x8x12 Wood Blockouts (6ea)	
Splice Bolts and Nuts (16ea, two sets)	
Post Bolts and Nuts (8ea)	
Anchor Nut and Washer (1ea)	
Anchor Cap Bolts/Nuts/Washers (Pre-Assembled)	

3. Site Preparation and Required Tools

3.1 Site Preparation / Grading

The NGT is a tangent terminal and no offset is required. However, a flare rate of no greater than 25:1 is allowable under the guidelines published in the *Roadside Design Guide*. If the NGT is intended to attach to a rigid barrier, a transition to gradually increase the stiffness in the W-Beam shall be required. If the installation is offset from the edge of the pavement, it is recommended to grade the soil prior to installation to provide a flat surface adjacent to the pavement. Any portion of the system that is in the ground, or left in the ground after a break away event, should be less than 4 inches above grade.

3.2 Recommended Materials and Tools

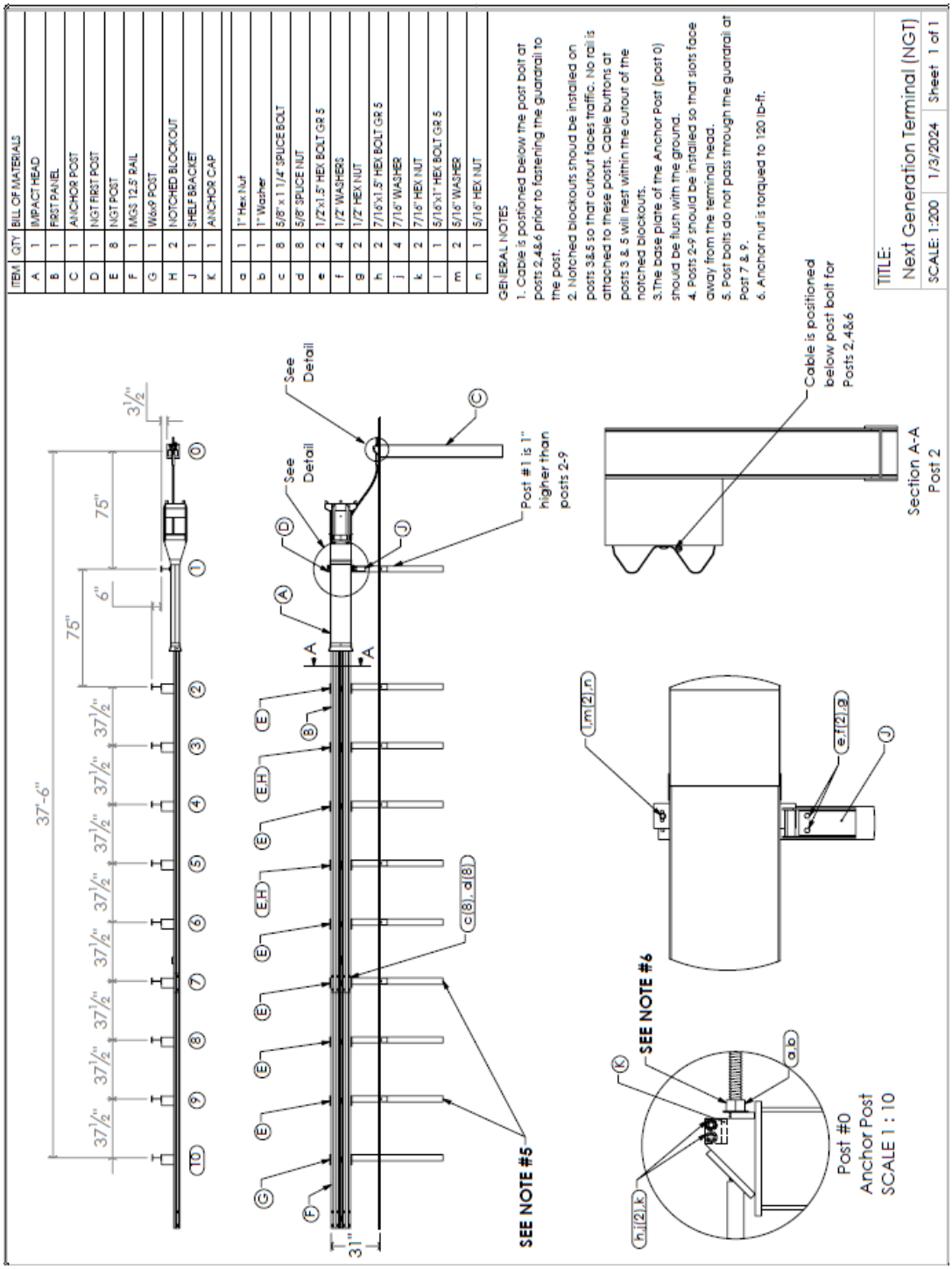
The NGT comes with all necessary components and hardware, as listed in the bill of materials. The terminal head, anchor panel, anchor post, and plug-welded posts are all prefabricated with holes and slots placed in the appropriate locations. ***Field modifications to the NGT system (drilling or cutting any holes or slots) is strictly prohibited***. Doing so may compromise the structural integrity of the system.

Recommended tools include:

- Cotton string line
- Post driver
- Driving Cap
- Anchor Post driving cap (Available for purchase)
- Impact gun
- Impact socket (1 1/4") with an extension, both with half-inch drives
- Crescent wrenches (1 5/8", 3/4", 9/16")
- Adjustable wrench
- Pipe wrench (2")
- Hammer
- Spud wrench (for aligning guardrail splices)
- Level
- Tape measure
- Torque wrench

4. Installation Instructions

4.1 Overall Layout Drawing and Bill of Materials



4.2 Installation Procedure

Begin the terminal installation at the downstream end of the NGT as described below.

1. Install standard W6x9 guardrail posts (G) at post 10 and beyond
2. Install plug-welded posts 9 to 2 (E)
3. Install plug-welded Post 1 (D) – 6" offset from Post 2 (***see more below)***
4. Install anchor (bootjack) post (C) – 3.5" offset from Post 1 (***see more below)***
5. Bolt wood blockouts to Posts # 7 and #9 (***do not pass bolts through guardrail at these posts***).
6. Hang standard MGS guardrail (F) between posts 10 and 7
7. Bolt Notched wood blockouts to Posts #3 and #5 (***you cannot pass bolts through NGT guardrail at these posts***)
8. Install cable attachment guardrail panel (B) of NGT between posts 7 and 1
9. Install impact head (A) and shelf bracket (I)
10. Fasten cable to anchor (bootjack) post (C) and hand-tighten cable nut to 120 ft-lbs
11. Tighten all splice bolts and post bolts

Step 1: Installing Standard W6x9 Guardrail Posts at Post 10 and Beyond

All posts at locations #10 and beyond should be 6'0" standard W6x9 or W6x8.5 galvanized steel posts spaced at 6'3" on center. Standard 6" x 8" x 14" wooden blockouts are used with this system. The finished post height, measured from the finished grade to the top of the post, should be approximately 31-7/8" ± 1". (Note: the height from the finished grade to the top of the fully assembled guardrail should be 31" ± 1". This is the specification that governs post embedment. The center of the post hole is 7" below the top of the post, and half of the height of standard W-beam is about 6-1/8".)

Set up a string line extending from the guardrail posts beyond Post #10 that runs along the desired line of post installation throughout the installation and past the anchor post location. Using a post driver and a driving cap, pound posts to the required height while keeping the posts vertical (plumb) and the flanges of the post parallel with the string line.

If a post moves out of position during installation such that the post bolt slot does not align with the guardrail slot, the post will need to be pulled and reset. ***Under no circumstance is it permissible to drill a hole in the guardrail.***

Step 2: Installing Plug Welded Posts #9 thru #2

Posts #9 thru #2 are 6'0" W6x9 galvanized steel plug welded posts. They can be distinguished from the standard W6x9 steel posts by identifying the welded assembly on the outside of each flange near the middle of the post. Additionally, the plug welded posts

should differ by having a notched post bolt hole in the upper section of the post. Plug welded posts can be driven with the same equipment as standard posts from Step 1.

Posts #9 thru #2 should be installed with the post bolt notch facing downstream – i.e., the notch in post #2 should be open toward post #3, the notch in post #3 should be open toward post #4, and so on, all of which are on the side of the post opposite of the Impact Head. Posts #9 thru #2 should be spaced at 3'-1.5" on center. See detail in Figure 4 for clarification. The finished post height, measured from the finished grade to the top of the post, should be approximately 31-7/8" ± 1". (Note: the height from the finished grade to the top of the fully assembled guardrail should be 31" ± 1". This is the specification that governs post embedment. The center of the post hole is 7" below the top of the post, and half of the height of standard W-beam is about 6-1/8".)

Using a post driver and a driving cap, pound posts to the required height while keeping the posts vertical (plumb) and the flanges of the post parallel with the string line set up in Step 1.

If a post moves out of position during installation such that the post bolt slot does not align with the guardrail slot, the post will need to be pulled and reset. ***Under no circumstance is it permissible to drill a hole in the guardrail.***

Step 3: Installing Plug Welded Post #1

NOTE: The finished post height for Post #1 is 32-7/8", or one inch higher than the other plug welded posts.

Post #1 is a plug welded post that has two 3/8" holes in the flange of the upper section of the post. It also has two 9/16" holes in the flange near the center of the top half. It is also 73" long, one inch longer than the other plug weld posts (Posts 2-9). This post does not have any post bolt notches. Post #1 should be installed with the bolt holes facing the traffic side of the system. These holes will be used to attach the Impact Head and the shelf bracket to Post #1 later. **Post #1 should be installed 6'-3" upstream of Post #2 (center-to-center) with a 6" offset toward the traffic side of the system**. The finished post height for Post #1 is 32-7/8", or one inch higher than the other plug welded posts.

Step 4: Installing the Anchor Post

The anchor post is a 6'6" W8x15 galvanized steel beam with a bootjack assembly welded to a plate at the top of the post. The bootjack assembly requires a special driving cap (not included) and two sets of 1/2" Grade 5 hardware – two bolts, four flat washers, and two nuts.

The anchor post should be installed 6'-3" upstream of Post #1 (center-to-center) with a 3-1/2" offset toward the traffic side of the system. This offset is measured from the non-

traffic-side-flange of Post #1 to the non-traffic-side edge of the baseplate on top of the W8x15 post. This post should be oriented with the web of the W8x15 post parallel to the guardrail and such that the sloped portion of the bootjack assembly faces the Impact Head.

Drive the post until the baseplate of the bootjack assembly is flush with the finished grade. See layout details in Figure 4 for reference. **The anchor post should only be driven with the driving cap that is provided by the manufacturer to prevent damage to the bootjack assembly.**

Step 5: Hang Standard Guardrail Between Post #10 and Post #7

Midwest Guardrail System (MGS) guardrail requires splices to be mid-span between posts that have 6'-3" centers. There is one 12'-6" MGS guardrail panel included in the length of the NGT, and it spans Post #10, 9, and 8. It splices into the NGT first panel at Post #7. See details in Figure 4 to ensure proper installation.

Ensure lapping of each guardrail adheres to the specifications that govern that location. It is recommended that lapping be in the direction of travel in the immediately adjacent lane of travel. Ensure (8) splice bolts and nuts are used to secure each splice. The shoulder of each splice bolt should seat inside the elliptical bolt holes.

Ensure the appropriate length post bolt is selected for the blockouts that are being used in the system. The shoulder of each post bolt should seat inside the elliptical bolt holes. Standard blockouts are used at Post #s 10 thru #7. Do not pass post bolts through the rail at Post #9 and #7 (see red circles in the below figure for reference). Instead, bolt the blockouts at Post #9 and #7 to the post prior to hanging the W-beam.

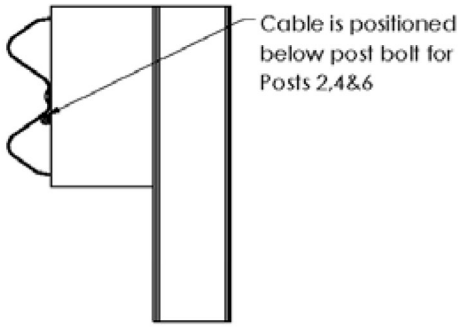
Once the splice and post bolts have been tightened, the height from the finished grade to the top of the rail should be 31" ± 1".

Step 6: Hang NGT First Panel

The first panel of W-beam in the NGT is approximately 24 feet long and includes a cable that is fused to the guardrail at five locations. It is spliced to the end of the previous W-beam segment at Post #7. Ensure lapping of each guardrail adheres to the specifications that govern that location. It is recommended that lapping be in the direction of travel in the immediately adjacent lane of travel. Ensure (8) splice bolts and nuts are used to secure the splice. The shoulder of each splice bolt should seat inside the elliptical bolt holes.

Ensure the appropriate length post bolt is selected for the blockouts that are being used in the system. The shoulder of each post bolt should seat inside the elliptical bolt holes. Standard blockouts are used at Post #s 6, 4, and 2. Notched blockouts are used at Post #s 5 and 3. It is not possible to pass a post bolt through the guardrail at Post #5 and #3 without compromising the rail. Instead, bolt the notched blockouts at Post #5 and #3 to the post prior to hanging the W-beam. See the above photo for reference.

The cable that extends along the length of the Frist Panel should be installed such that the slack in the cable between connection points passes underneath the post bolts at Post #s 2, 4, and 6. The cable will not pass below the blockout, but instead, the cable will rest under the W-beam corrugation. See diagram below.



Once the splice and post bolts have been tightened, the height from the finished grade to the top of the rail should be 31" ± 1".

Step 7: Install NGT Impact Head and Shelf Bracket

The threaded rod on the end of the cable should be passed into the guide chute of the NGT Impact Head. It must go above the bottom ramp and below the bottom of the folder in the center of the Impact head (see photos for reference). ***Care should be taken as this can be a pinch point.***

Push the NGT Impact Head onto the guardrail, pulling the cable through the bottom exit of the head. With the cable properly guided through the head and exiting from the bottom, push the NGT Impact Head as far as it can go onto the guardrail. If the post spacing is correct, the tab on the top of the head should be close to one of the holes in the top of the first post. Adjust the impact head forward or backward to align the slot in the tab with the closest hole in the post. Attach the head to the post using a single 7/16" bolt (1.5 inches long), using washers on both sides and a hex nut. Tighten with a wrench until snug (***do not use an impact gun as this will likely shear the bolt***).

(The bottom tab does not bolt to the first post. It is there for when an installation occurs on the opposite side of the road, and the terminal head must be turned over.)

Attach the shelf bracket to Post 1 underneath the terminal head using two (2) 1/2" bolts (1.5" long) with two washers and a hex nut on each bolt. There should be a small gap between the top of the shelf bracket and the bottom of the terminal head.

Step 8: Fasten Cable to Anchor Post

The boot jack cap should come pre-installed. In this condition, the threaded rod should be passed beneath the cap and through the U-shaped slot on the approach side of the anchor assembly. If it is difficult to maneuver the cable into this position, it is possible to unbolt the cap and set the cable into position. Then bolt the cap back on.

Next, secure the threaded rod with a washer and heavy hex nut. This cable should be tight. Use a deep socket and a large torque wrench to ensure that the torque is between 105 and 300 ft-lbs. It is recommended that a target of 120 ft-lbs be used.

Step 9: Tighten all Splice and Post Bolts

Sometimes, splice and post bolts can come loose during an installation, or they are intentionally left untightened to provide maximum flexibility while installing other panels of W-beam. At this time, each bolt throughout the installation should be tightened in accordance with common practices. The plug welded posts have a notch rather than a hole for the post bolts to rest in. This allows the bolts to evacuate easily on end-on impacts. The corners of the slots are chamfer. This can mean that the nuts do not bite properly, especially if the slot in the rail does not line up properly with the post. Proper post placement is essential. If it is too far out of alignment that the nut cannot bite on the flange of the post, then it should be pulled and reset. **Under no circumstances is it permissible to drill a hole in the W-beam.**

5. Repair Instructions and Checklist

Anytime you are repairing the NGT, ensure proper traffic control is deployed to protect workers and motorists. Follow the requirements shown in the Manual on Uniform Traffic Control Devices (MUTCD).

Tools Needed

- Acetylene torch or metal saw cut or burn off the damaged rail
- Heavy duty chain to remove the impact head may be required
- Standard tools used to install highway guardrails
- Vice grip or channel lock pliers
- Sledge hammer

The following are ***general guidelines*** for repair of the Next Generation Terminal ™ system. Ultimately, it is the responsibility and determination of the state/specifying agency and the state/specifying agency's selected contractor performing the assembly or repair of the system to determine whether repairs or replacement are necessary. NextGen Safety, LLC expressly disclaims any responsibility for the choices and actions of the state/specifying agency and the state/specifying agency's selected contractor performing the assembly or repair of the system.

1.	Ensure only Next Generation Terminal ™ parts are used for the assembly of the Next Generation Terminal ™ and that all parts are free of damage.
2.	Check the impact head for damage (both outside and inside). If it is damaged it must be replaced.
3.	Check the NGT Anchor Post and ensure it is firmly embedded and not damaged (including the Anchor Cap and Anchor Cap Hardware). If loose or damaged, it must be replaced.
4.	Check the anchor rail assembly for damage. The anchor rail, shelf bracket, and hardware may be reusable. If any part of the anchor rail or cable attachment is damaged, it must be replaced.
5.	Check the number of broken posts and blockouts that need to be replaced, along with any damaged bolts. Inventory and pick up the reusable parts.
6.	Disconnect and remove any damaged rail from the posts
7.	Remove any damaged posts from the length of the system.
8.	Reinstall the system following the procedures listed in this manual.

6. Inspection Checklist

- ☐ Guardrail height is 31" ± 1" above finished grade.
- ☐ Guardrails are lapped in the proper direction.
- ☐ All splice bolts are securely fastened. Ensure the shoulder of each bolt is properly recessed into the face of the guardrail.
- ☐ All post bolts are securely fastened. Ensure the shoulder of each bolt is properly recessed into the face of the guardrail.
- ☐ Blockouts are 8" deep.
- ☐ Posts #1 through #9 are plug-welded posts and installed properly. All post bolts are installed on the side of the post opposite of the Impact Head.
- ☐ Standard steel W6x9# or W6x8.5# x 6'-0" posts are installed at post #10 and beyond.
- ☐ The Impact Head does not encroach on the shoulder.
- ☐ Posts 1 and 2 are spaced at 6'-3" on center along the direction of the guardrail.
- ☐ Posts 2 thru 9 are spaced at 3'-1.5" on center along the direction of the guardrail.
- ☐ Posts 9 and 10 are spaced at 6'-3" on center along the direction of the guardrail.
- ☐ The center of post #1 is offset from post #2 6" towards the traffic side.
- ☐ The center of the anchor post is 6'-3" from the center of post #1 and offset 3-1/2" from the field side of post #1 to the field side of the anchor base plate.
- ☐ The Impact Head is oriented correctly and securely fastened to post #1 with (1) 5/16"-16 grade 5 hex bolt at the top tab, SAE flat washers, and nuts. The feeder chute of the Impact Head should be parallel to the ground when the terminal is installed properly.
- ☐ The shelf bracket is securely fastened to post #1 below the terminal head with (2) ½"-13 grade 5 hex bolts, SAE flat washers, and nuts. The feeder chute does not need to touch the shelf bracket.
- ☐ The Impact Head is properly seated on the Anchor Rail with the folder touching the upstream valley of the Anchor Rail.
- ☐ The wire rope on the anchor rail is fed through the bottom opening of the Impact Head with no snags or entanglements that would prevent proper tensioning.
- ☐ The anchor stud is installed correctly on the Anchor Post with a 1"-8 grade 5 heavy hex nut, and SAE flat washer. This nut should be torqued to 120 ft-lb.
- ☐ The Anchor Post is installed correctly. The base plate of the anchor post should be flush with the finished grade. A cap should be installed with (2) 7/16"-14 x 2" hex bolts, SAE flat washers, and nuts.
- ☐ Any augered posts were properly backfilled and compacted.
- ☐ Posts, guardrails, impact heads, anchor rails, and cables are noticeably undamaged from installation.