transport
Department:
Transport
Province of KwaZulu-Natal

KWAZULU-NATAL DEPARTMENT OF TRANSPORT

SAFETY ROLLER BARRIER INSTALLATION MANUAL

Approved by:

Signed by:Sibusiso Simphiwe Nkosi
Signed at:2024-05-12 15:54:48 +02:00
Reason:Witnessing Sibusiso Simphiwe N

KWAZULU-NATAL PROVINCE
TRANSPORT
REPUBLIC OF SOUTH AFRICA

Deputy Director General: TIDS
KwaZulu-Natal Department of Transport
Private Bag X9043
PIETERMARITZBURG
3200

172 Burger Street
Private Bag X9043,
Pietermaritzburg, 3200
Tel: (27)(33)3558897
Fax: (27)(33)3558076

May 2024

IMPORTANT NOTES

1. This Manual contains information relating to methods of installation with optimal installation conditions (as present during the testing for relevant approvals for use). The users of the safety roller barrier system (described throughout this installation manual as “KwaZulu-Natal Department of Transport Safety Roller Barrier” or “Safety Roller Barrier System” or “Safety Roller”) and as described herein, must design their site-specific installation plan, with specific risk assessment and traffic management plan for the site using applicable standards of installation, engineering and relevant laws, regulations, and standards to ensure both compliance as well as maximizing the effectiveness of the product.

2. KwaZulu-Natal Department of Transport Safety Roller Barrier System is not warranted to prevent, all or any injury or loss arising from or related to traffic or other accidents howsoever caused; however, the pilot project has shown that the Safety Roller Barriers may significantly reduce the consequences of such accidents.

3. KwaZulu-Natal Department of Transport takes safety seriously and is continuing to improve and refine the Safety Roller Barrier System, incorporating learning’s from use of the Product around the world.

4. The KwaZulu-Natal Department of Transport shall review this manual on an annual basis and as SANS standards applicable are accordingly updated, such that the latest design standards are applied.

Contents

List of Figures:

1. INTRODUCTION

The KwaZulu-Natal Department of Transport have piloted the used of safety roller barriers in the KwaZulu-Natal Road network on hazardous locations. The roller barriers were strategically placed in hazardous locations to reduce the severity of accidents that lead to fatalities and to minimise the costs of road maintenance or replacement.

1.1. Purpose

The basic purpose of this manual is to provide understanding of the safety roller barrier system, provide guidelines and instructions for the implementation, use and maintenance of safety roller barriers as road restraint. The safety roller barriers minimize the impact of car crashes or accidents by redirecting vehicles and absorbing impact energy. This manual aims to ensure that these safety roller barriers are installed correctly, maintained properly and serve their purpose effectively to enhance road safety for all road users.

1.2. Background

The safety roller barrier system is an innovative road restraint system and safety fixture, for roads, designed to be installed onto roadway, medians, and verges on ramps, and off ramps and in high-risk locations. The system works by translating shock absorption and impact energy generated in vehicle crashes into rotational energy and resulting in increased protection to drivers and passengers. It is the only roller-type road barrier in the world that has been tested to MASH TL4.

Current approvals include both length of need and transition and H1, H2 of EN1317-2 for certificate adopted by European countries. Letter of Eligibility Federal Highways USA; AUSTRO- ADS approved; Korea Approved; South African Technical Audit Services Approved.

2. SAFETY ROLLER BARRIER SYSTEM

The KwaZulu-Natal Safety roller barrier system consists of vertical steel posts which supports a series of horizontal rollers. The two top rails and two bottom rails run horizontal along the length of the barrier system to provide vertical support for the rollers, lateral stability for the post, and allow the barrier to generate ribbon tension when impacted. The steel line posts are driven 1235 mm into AASHTO M147-65 Standard Soil at 1330 mm centres. Intermediate posts, placed centrally between the line posts, are support by the top and bottom rail members only.

The finished nominal rail height of the system was 890 mm, with all steel line posts finishing 80 mm above the top of the rail, as shown in Figure 1 below.

Figure 1: Image showing the safety barrier roller system.

3. COMPONENTS OF THE KWAZULU-NATAL DEPARTMENT OF TRANSPORT SAFETY ROLLER SYSTEM

The KwaZulu-Natal Department of Transport safety roller barrier system is a steel rail and ethylene vinyl acetate roller safety barrier consisting of the following components:

a) Steel Line Posts: with an Inner Post welded inside of each hot dipped galvanised Line Post to provide additional strength.
b) Intermediate Posts: suspended between the upper and lower rails.
c) Post Sleeve: prevent the bolts being over tightened and deforming the post structure.
d) Shock Absorbing Roller: two shock absorbing rollers, with associated bushing & reflective band are placed on each Steel Line Post and Intermediate Post.
e) Top and Bottom Rail: bolted to either side of the steel lined posts and intermediate Posts at both top and bottom of the posts.
f) Top and Bottom Rail Sleeve: fabricated with a series of slotted and round holes for placement of bolts to join the rail section to the Line Posts and Intermediate Posts.
g) Stopper Board: two stopper boards are placed on the top and bottom of each series of rollers to reduce the free-spinning potential of the roller sections by introducing a degree of rolling friction.

Figure 2 overleaf outlines the basic make-up of the safety roller barrier.

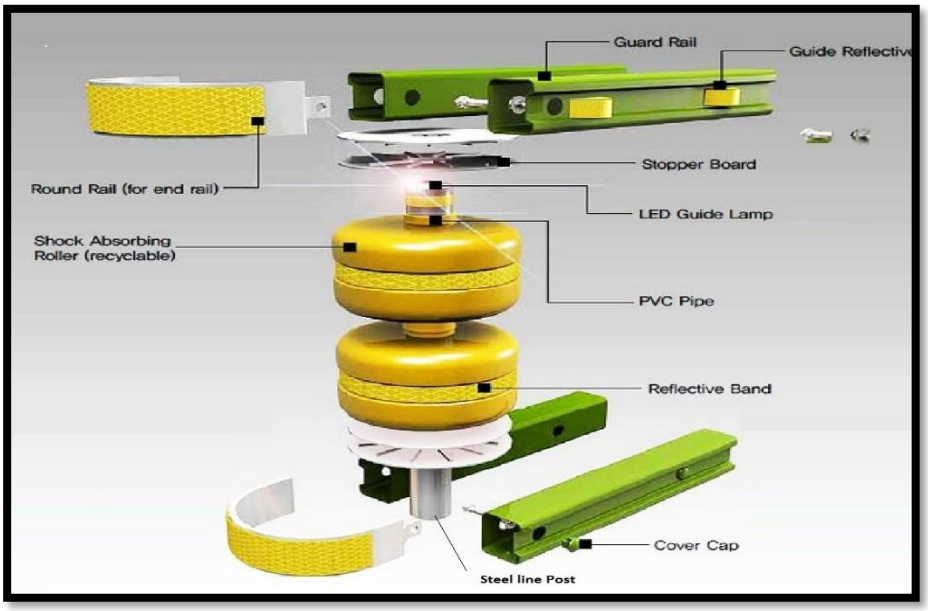


Figure 2: Basic make-up of the safety roller barrier.

4. FUNCTIONS OF SAFETY ROLLER BARRIER COMPONENTS

4.1. Safety Roller

The safety roller is made from a highly polymerized chemical compound called Ethylene Vinyl Acetate (EVA). The Roller has high durability and strength and in testing has withstood rigorous Laboratory Tests by the Korean Testing and Research Institute.

Apart from the KwaZulu-Natal Department of Transport safety roller (Standard Type), the outer surface of the roller is UV coated to protect it from continuous exposure to sunlight, preventing it from cracking and fading. Its size is 370 mm (Diameter) x 210 mm (Height). The centre hole of the Safety Roller is 150 mm in diameter. Each Safety Roller weighs approximately 3 kg. The safety roller comes in a choice of two colours, yellow and orange.

The safety roller functions to absorb or reduce the first collision shock from motor vehicles crashing into the safety roller Barrier. Upon impact, the rollers spin and thereby convert the collision shock into rotational energy. This reduces the collision energy and results in the vehicle being redirected back to its intended lane.

4.2. Stopper Board (Clutch Plate)

The stopper board or “clutch plate” is disc-shaped and made from a durable, long-lasting material called Polyvinyl Chloride (PVC). On each surface of the stopper board, there are

14 protrusion ridges, which use friction to reduce the spinning movement of the safety rollers. There are four (4) stopper boards on each safety roller column. The stopper boards are inserted inside the supported ding posts together with the safety rollers and positioned in the space or gap between the upper and lower Safety Rails.

Two stopper boards are placed directly underneath the base of each safety roller. The roller rests on the top surfaces of the front and rear lower safety rails that run horizontally. If there are two safety rollers inside each supported ding post placed on top of each other (top and bottom), then the other two stopper boards are installed on the up- per surface of the top roller. This roller with the stopper boards is positioned directly underneath the bases of the upper Safety rails. The size of the stopper board is 250 mm (Diameter) x 9 mm (Thickness). The centre hole of the stopper board has the diameter of 150 mm. Figure 3 below depicts the stopper board.

Figure 3: Location of the stopper board on the safety roller barrier.

4.3. Safety Rail

There are four (4) safety rails or guard rails running horizontally that provide the framework structure to the barrier system. The safety rails run parallel, two are positioned on the up- per portion (front and back) and the other two at the lower portion (front and back) of the barrier system. The safety rollers are assembled in several rows inside the gap between the upper and lower safety rails.

The material used for the safety roller barrier (MASH Type) – GS-G505 is stainless steel SS400 (equivalent to ASTM A36), a commonly used hot rolled general structural steel. The safety rail material for KSI safety roller barrier (Standard Type) GS-G401 is KSD3503 (structural galvanized roller steel). The size of the safety rail is 123mm (height) X 100mm

(width) X 5,995 mm (length) X 3.0 mm (thickness). The linear design of the safety rail can be customized to suit specific site requirements. The design will usually follow the road contour at the installation site.

The safety rails are supported or buoyed by steel supported posts. These supporting posts are firmly inserted right through the safety rollers and erected in between the upper and lower safety rails. The supporting post bases are firmly embedded into the ground to provide a strong foundation for the safety rails and the whole barrier system in general. Besides providing the framework structure to the safety roller barrier, the safety rails also act as a shock absorber during a motor vehicle impact. As a result, the shock energy is largely absorbed or reduced by the safety rollers; enabling drivers to regain control of the vehicle and to drive it back safely to the intended lane.

Figure 4: Safety rail required for the roller barrier.

4.4. Supporting Posts

Steel Line Posts: The steel line posts are manufactured from 140 mm diameter x 4.5 mm thickness CHS sections, 2200 mm long. The posts are fabricated from SS400-KS D 3503 steel for general structures (Korean Standard). All steel line posts are hot dipped galvanized. Each post is manufactured with the bolt holes for the attachment of the upper and lower rail sections.

Inner posts: An inner post section is plug welded to the inside of each steel line post. The inner post sections are fabricated from 127 mm diameter x 4.3 mm thick CHS sections, 1000 mm long. Each inner post is welded to be 435 mm from the ground embedment end of the steel line Posts. When installed, the inner post provides additional stiffness and strength to the steel line posts at ground level. Figure 5 depicts the structure required for the supporting posts.

Figure 5: Supporting posts required for the safety roller barrier.

4.5. Round Rail

The “C” shaped round rails cover openings at the terminal ends of the safety rails to minimize risk to approaching vehicles and occupants in the event of an accident. Whilst there are potentially serious consequences if an out-of-control vehicle at high speed directly hits the exposed openings at the terminal ends of the safety rails, the round rails function to help reduce this risk. Two round rails are provided to 1 terminal end of the safety rails (upper and lower portions). They are screwed securely to the safety rails by means of heat-treated bolts, nuts, and washers. Another two round nails are installed at the other terminal end of the safety rail, making the total number of the round rails needed for both terminal ends of the safety rail to be found. The outer surface of the round rail is provided with luminous reflective band to improve visibility of the safety roller barrier at night for approaching vehicles. The material for the round nail is hot dipped galvanized steel SS400 (ASTM 36). It is 1.6 mm thick.

Figure 6: C-shaped round rail**.**

4.6. Inner Post / Pipe Assembly

The inner post / pipe acts to further strengthen the supported post. It is inserted inside the supported post and the ground. The KwaZulu-Natal Department of Transport safety roller barrier (MASH Type) – GS-G505, the material for the inner post / pipe is stainless steel SS400 (ASTM A36). This post-assembly is spot welded at the factory.

Likewise, the inner post / pipe material for the safety roller barrier (standard type) GS-G401 is KSD3566 (structural galvanized steel pipe). The size of the Inner post / pipe is 125 mm (diameter), 1000 mm (length) and 4.3 mm (thick).

Figure 7: Image depicting the inner post of the safety roller barrier.

Intermediate Post: The intermediate line posts are manufactured from 140mm diameter x 4.5 mm thickness CHS sections, 780 mm long. They are fabricated from SS400-KS D 3503 steel for general structures (Korean Standard), hot dipped galvanised. They are also fabricated with bolt attachment holes located near either end to allow attachment to the top and bottom rails. All intermediate line posts are suspended between the top and bottom rails and do not extend down to the ground level.

4.7. Reflective Band

A luminous Reflective Band is wrapped around the groove of each KSI Safety Roller. The width of the Reflective Band is 50mm.

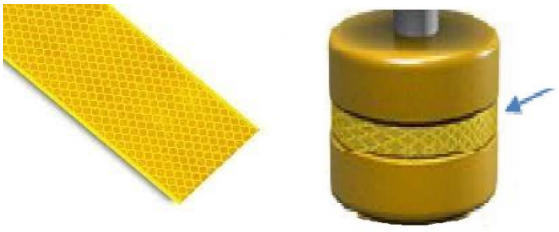


Figure 8: Reflective band on the safety roller barrier.

4.8. Rail Cover Cap

The rail cover caps fix inside the holes of the out- er groove surface of the safety rail and are used to shield bolts, nuts and washers and the safety rails from weather exposure. The holes along the groove of the safety rails are dedicated for the rail cover caps as well as the guide reflective devices. The material for the rail cover cap is Polyethylene Plastic (PE). The size of the rail cover cap is 80 mm X 45 mm.

Figure 9: Rail cover cap for the safety roller barrier.

4.9. Guide Reflector

The semi-circle shaped Guide Reflector is a luminous reflector. The purpose is to enhance KwaZulu-Natal Department of Transport safety roller barrier visibility at night and to serve as a warning to approaching vehicles of the barrier presence. The reflector is glued at the base onto the groove surface along the upper and lower front of the safety rails.

Figure 10: Guide reflectors to be used on safety roller barrier.

4.10. Post Cap

The post cap is designed to conceal the opening on the top end of the supporting post. It prevents water from penetrating into and collecting inside the supporting posts, as shown in Figure 11. The material for the post cap is hot dipped galvanized steel. The diameter of the post cap is 139.8 mm.

Figure 11: Post cap to be used on safety roller barrier.

4.11. Sleeve Rail

The sleeve rail is a joint connector between two terminal ends of the safety rail. It is inserted inside the safety rail. The two rails (sleeve and safety rails) are fastened securely by bolts, nuts and washers. The material for the sleeve rail is hot dipped galvanized steel. The size of the sleeve rail is 108 mm (height) X 75 mm (width) X 900 mm (length) X 5.0 mm (thickness).

Figure 12: Sleeve rail to be used on safety roller barrier.

5. MATERIAL GRADES AND QUALITY

5.1. Top and Bottom Rail Material

The top and bottom rails sections are 123 mm x 100 mm x 3.0 mm thick, custom manufactured. Each rail section is 5995 mm in length. These rails are bolted at both top and bottom on either side of the steel line and intermediate posts.

The rail section is manufactured from SS400-KS D 3503 steel for general structures (Korean Standard) and then hot dipped galvanized.

A series of slots and grooves is placed in each rail section to allow placement of the bolts securing the rail to the posts. Each bolt is placed inside of the rail section, securing the inside face of the rail to the posts only, ensuring that all bolt heads and nuts are located on the inside of the rail elements.

5.2. Intermediate Line Posts

The intermediate line posts are manufactured from 140mm diameter x 4.5 mm thickness CHS sections, 780 mm long and fabricated from SS400-KS D 3503 steel for general structures (Korean Standard) and hot dip galvanized. Each intermediate line post is fabricated with bolt attachment holes located near either end to allow attachment to the top and bottom rails.

All intermediate line posts are suspended between the top and bottom rails and do not extend down to the ground level.

5.3. Drawing of Steel Line Post and Inner Post

Figure 13 indicated below outlines the basic structure of the inner post as well as the steel line post.

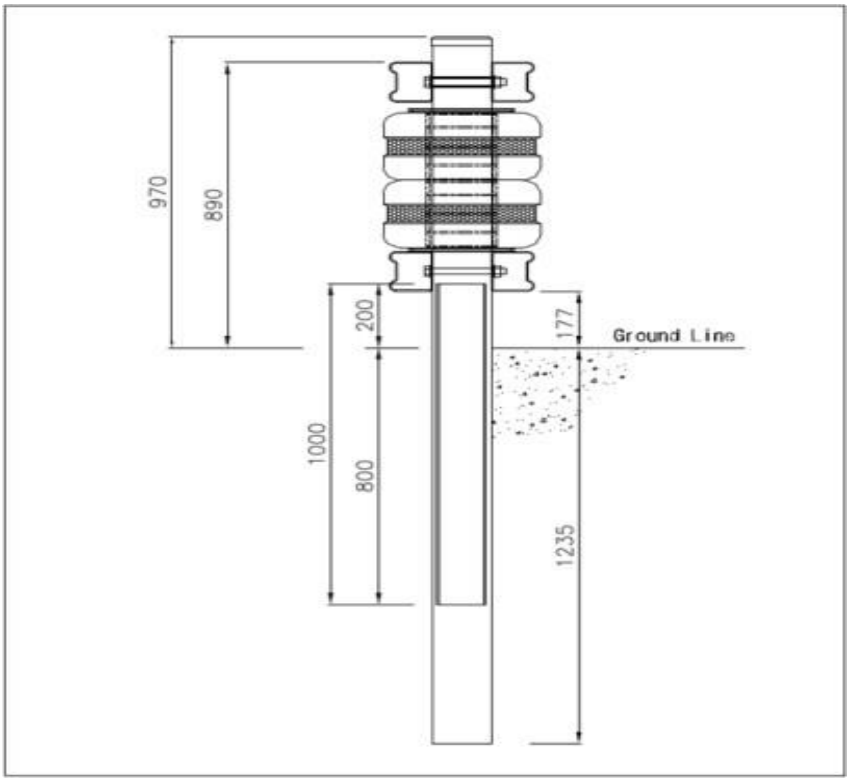


Figure 13: Safety Roller Assembly Detail measurements.

5.4. Rail Cap

A series of injection moulded plastic caps are inserted into all slotted holes on the outside surfaces of the top and bottom rail members. The plastic caps are manufactured from polyethylene and are approximately 0.8 mm thick. The caps are held in place with a barbed detail that locks onto the inside. Edge of the slots in the steel rail sections.

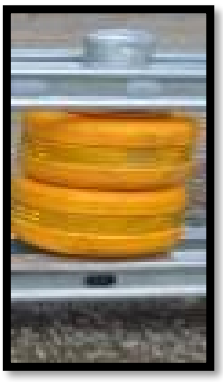


Figure 14: Rail cap for the safety roller barrier.

5.5. Post Cap

As referred to earlier on page 16 can been seen here with each steel line post and intermediate post is installed with a 139.8 mm diameter galvanized steel cap. The steel caps are a manufactured as a friction fit onto the main and intermediate posts.

5.6. Fasteners

A series of grade 8.8 fasteners are used to assemble the safety roller barrier system. The top and bottom rail sections are secured using a M20 x 200 mm long galvanized bolt. The M20 x 40 mm long galvanized bolts are used to secure the bottom rail sleeve and for 2 bolts (those not coinciding with a post) in the top rail sleeve. Always check you have the correct grade and use minimum Torque Settings. Figure 15 outlines the various fasteners that can be used for installation.

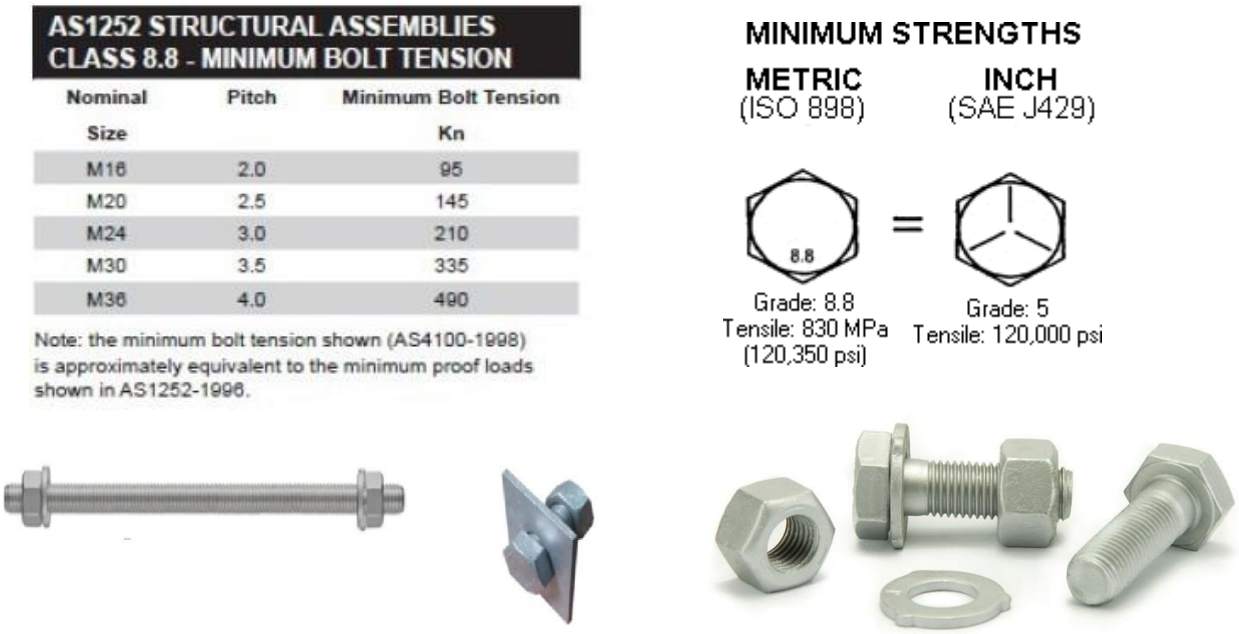


Figure 15: Fasteners to be used for installation of safety roller barrier.

6. TERMINOLOGY FOR ZONES OF THE BARRIER SYSTEM

a) Point of Entry: The area where the vehicle enters the “point of need”.

Figure 16: Point of entry.

b) Point of impact: The actual position along the “length of need” that the vehicle impacts with.

Figure 17: Point of impact.

The energy is absorbed into the barrier system.

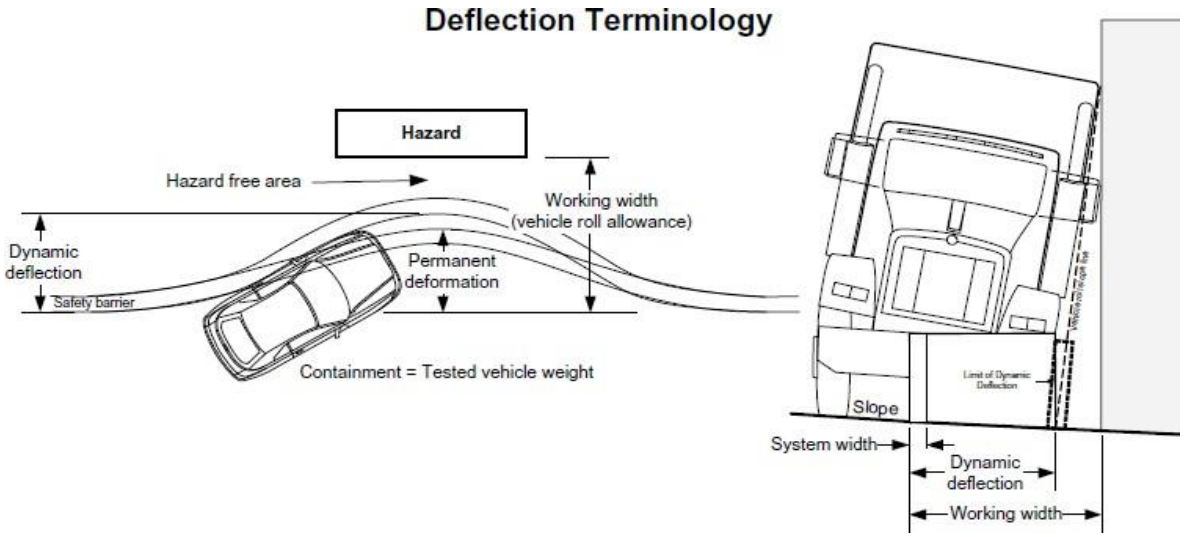


Figure 18: Image depicting absorption of energy and deflection of vehicle.

c) **“**Length of need”: The total length of the complete rail system, with the minimum length being 60 metres.

Figure 19: Length of need for safety roller barrier.

d) Exit Point: Where the Vehicle is returned to the road.

Figure 20: Vehicle being returned to the road.

HEX BOLTS - MINIMUM ULTIMATE TENSILE LOAD (KN)

Nominal Size	Pitch mm	Stress Area mm²	Class 4.6	Class 8.8	AS1252	Class 10.9
M3	0.5	5.03	2.01	4.02	-	5.23
M4	0.7	8.78	3.51	7.02	-	9.13
M5	0.8	14.20	5.68	11.36	-	14.77
M6	1	20.10	8.04	16.08	-	20.90
M8	1.25	36.60	14.60	29.28	-	38.06
M10	1.5	58.00	23.20	46.40	-	60.30
M12	1.75	84.30	33.70	67.40	67.40	87.70
M14	2	115.00	46.00	92.00	92.00	119.60
M16	2	157.00	62.80	125.60	125.60	163.30
M18	2.5	192.00	76.80	159.40	159.40	199.70
M20	2.5	245.00	98.00	203.30	203.30	254.80
M22	2.5	303.00	121.20	251.50	251.50	315.10
M24	3	353.00	141.20	293.00	293.00	367.10
M27	3	459.00	183.60	381.00	381.00	477.40
M30	3.5	561.00	224.40	465.60	465.60	583.40
M33	3.5	694.00	277.60	576.00	576.00	721.80
M36	4	817.00	326.80	678.10	678.10	849.70
M39	4	976.00	390.40	810.10	-	1015.00
M42	4.5	1121.00	448.40	930.40	-	1165.80

HEX BOLTS - MINIMUM TENSILE STRESS
(MPa or N/mm²)

Nominal Size	Pitch mm	Stress Area mm²	Class 4.6	Class 8.8	AS1252	Class 10.9
M3	0.50	5.03	400	800	-	1040
M4	0.70	8.78	400	800	-	1040
M5	0.80	14.20	400	800	-	1040
M6	1.00	20.10	400	800	-	1040
M8	1.25	36.60	400	800	-	1040
M10	1.50	58.00	400	800	-	1040
M12	1.75	84.30	400	800	800	1040
M14	2.00	115.00	400	800	800	1040
M16	2.00	157.00	400	800	800	1040
M18	2.50	192.00	400	830	830	1040
M20	2.50	245.00	400	830	830	1040
M22	2.50	303.00	400	830	830	1040
M24	3.00	353.00	400	830	830	1040
M27	3.00	459.00	400	830	830	1040
M30	3.50	561.00	400	830	830	1040
M33	3.50	694.00	400	830	830	1040
M36	4.00	817.00	400	830	830	1040
M39	4.00	976.00	400	830	-	1040
M42	4.50	1121.00	400	830	-	1040

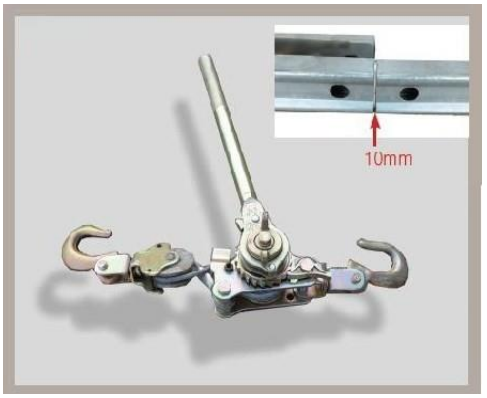
Figure 21: Minimum ultimate tensile load and minimum tensile stress required.

7. TOOLS REQUIRED BY INSTALLERS

Spirit Level and String Line

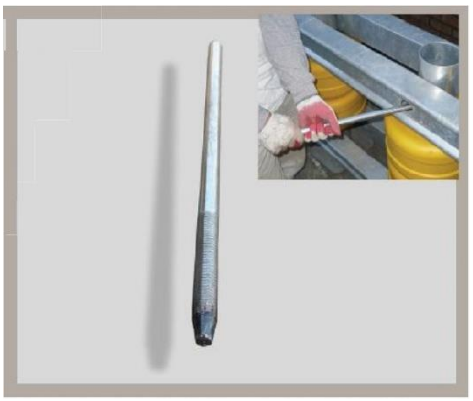
Core Hole Boring Machine

Hammer



Tugger winch

G Clamps



Bar or Rod for Rail and Hole

Post Hammering Machine

Post Insertion Tool for inner sleeve

Steel insertion Rod

Drill – Battery type 13mm

Spanner Metric 20mm Tube sockets and Ratchets

String Line

8. OCCUPATIONAL RISKS: INSTALLING THE BARRIER

The installers should always put safety first and ensure that pedestrians, road users and other persons, and animals are not harmed during the installation of the KwaZulu-Natal Department of Transport Safety Roller. As with all works practices, a full OHS Risk Assessment should be conducted before carrying out any installation work.

9. TRAFFIC MANAGEMENT

Ensure that appropriate steps are taken to ensure safety of road users and if necessary, Implement control measures, with particular attention to gaining necessary approvals for traffic management (if required) to conduct safe work site for workers, road users and others.

10. INSTALLATION & ASSEMBLY INSTRUCTIONS

a) Site Preparation: Dial before you dig and where any services may be affected ensure all cables are located and marked prior to any excavation. The steel line posts are driven 1235mm into AASHTO M147-65 ‘Standard’ Soil at 1333 mm centres. Deliver all materials and tools required for Installation process to the site. Ensure suitable traffic control has been implemented for the work site. Dial before you dig and where any services may be affected ensure all cables are located and marked prior to breaking soil.

Figure 22: Site preparation.

b) Marking of the barrier line

Marking out the Barrier Line

Figure 23: Marking of the barrier lane.

c) Installing the line post: Install a Line Post every Drive Line Posts into soil to depth of 1235mm. Drive the Steel Line Posts into the soil using a Post Driver. The allowed tolerances for post spacing reflect the performance of safety roller at these tolerances.

Figure 24: Line post.

Make sure the distance between each Post is the same. Ensure post holes face front and back to connect the rails. Make sure the height of each post is level to finished surface level.

d) Installing the innersleeve: The performance of the safety roller will be affected if the tolerances are not adhered to.

- The insertion tools must be used or damage to the inner sleeve or the main post will occur.

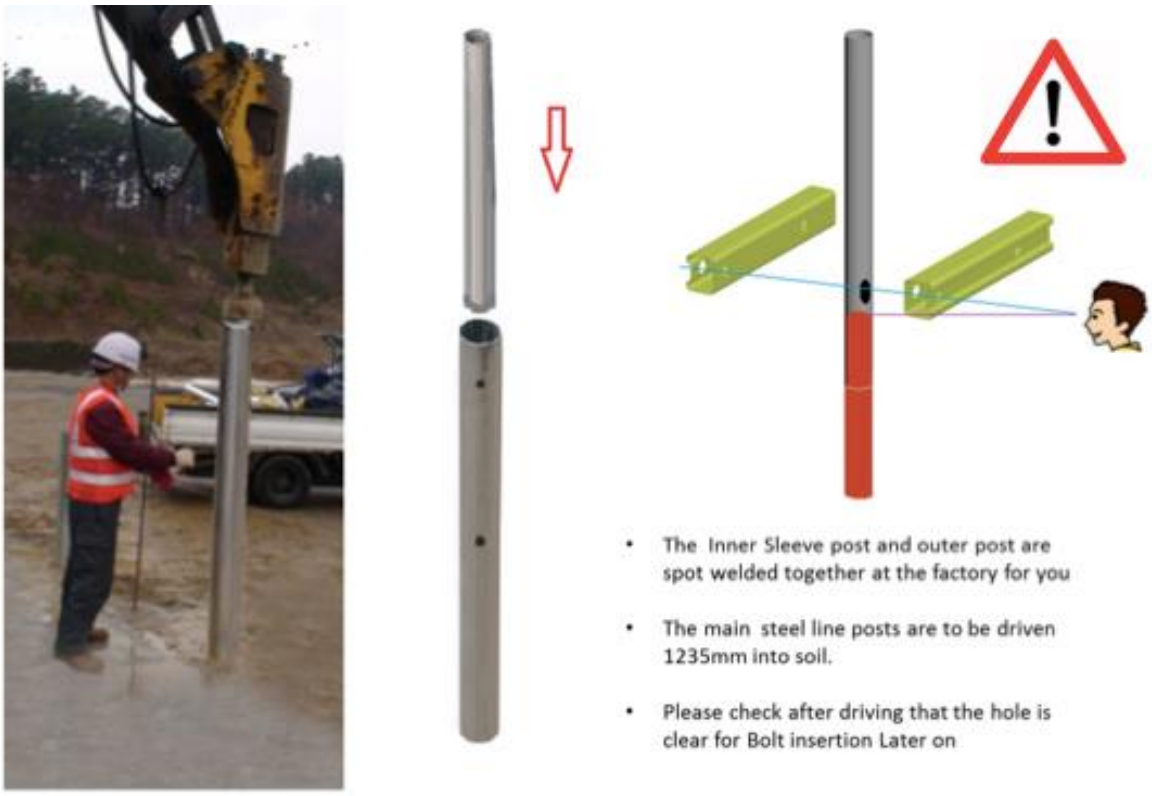


Figure 25: Installation of inner sleeve.

Figure 26: Alignment checking with a string line.

Figure 27: Finish with fixing the steel line posts.

REMEMBER

TOLERANCES AFFECT PERFORMANCE

The performance of the safety roller will be affected if tolerances values are not adhered to.

Spacing (+/- 30 mm)

Height (+/- 20 mm)

Figure 28: Spacing and height requirements.

e) Assembly of the Rails: The top Rail Sleeve joins 2 sequential rail members using the bolted fasteners that also secure the rail members to the posts.

Start with the bottom rails, aligning 1 Hole to a Main Post, with 1 hole Empty. This is allowed for in MASH 4 Standard 1 Main Post, 1 Intermediate Post.

Figure 29: Assembly of the rails.

f) Fasteners used to assemble the Safety Roller Barrier System must be Grade 8.8 Hot Dipped Galvanised Type. M20 x 200 mm long galvanised bolt. M20 x 40 mm long galvanised bolts.

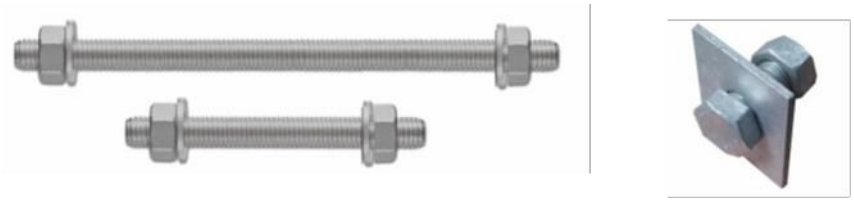


Figure 30: Fasteners to be used.

g) Ensure that you observe the gap on the lower guardrail. If the gap is wider than the post, reduce the gap with a G-clamp.

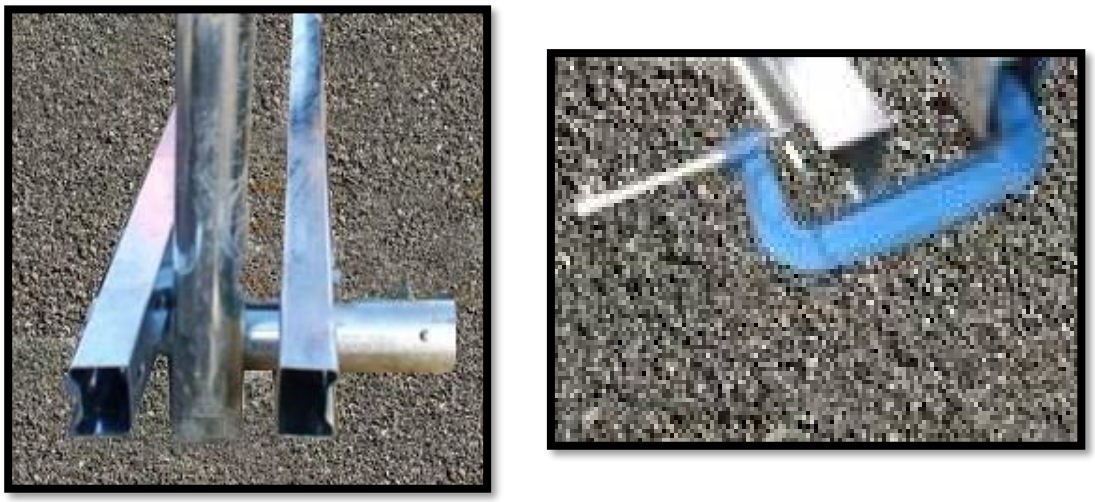


Figure 31: Reducing lower guardrail gap with a G clamp.

h) Assemble the sleeve rail: Top Sleeve size: 900 mm. Bottom sleeve size: 300 mm. Must be assembled with less than a 10 mm interval. Then fasten bolt.

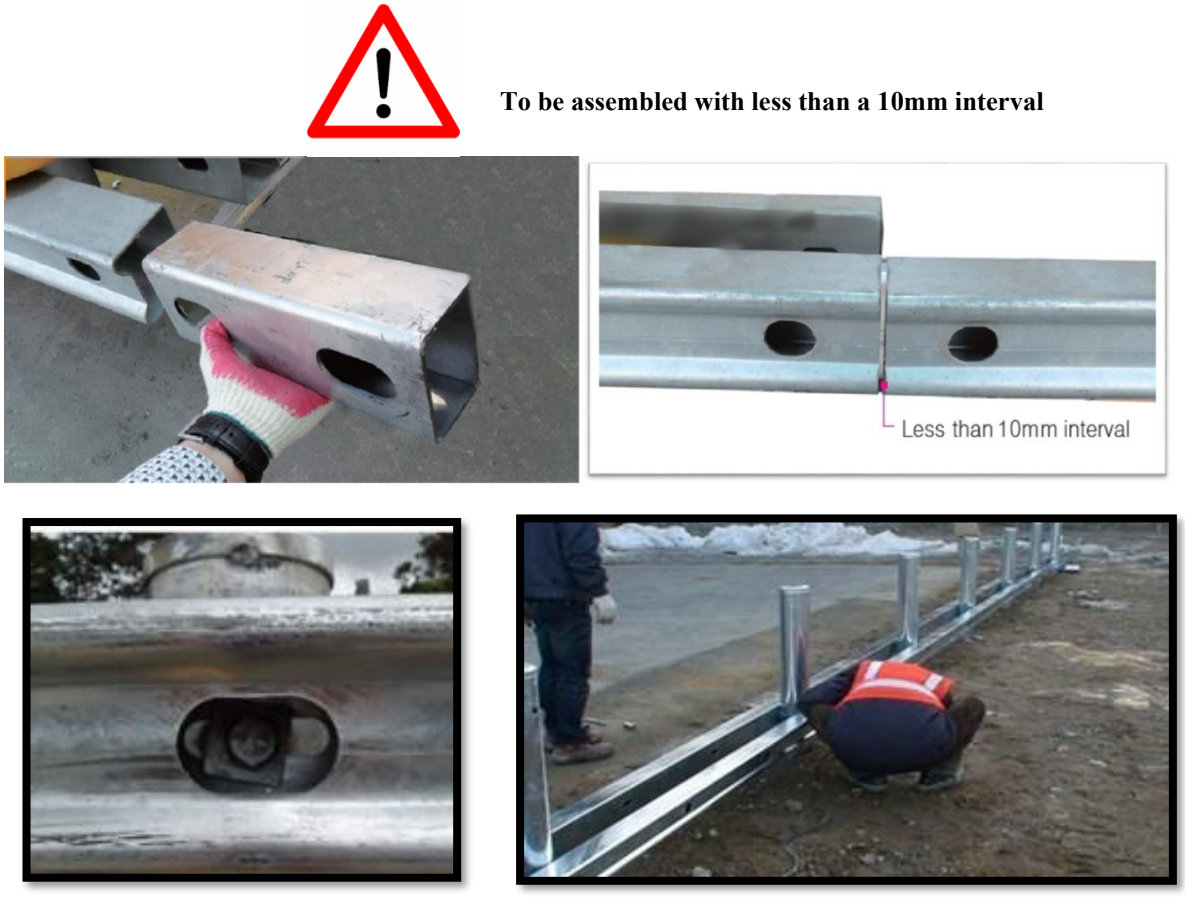


Figure 32: Assembly of the sleeve rail.

i) Finish assembling the lower guardrail along the barrier line. 1 main steel Post every 1333mm then 1 Hole left for an intermediate post.

Figure 33: Finishing assembly of lower guardrail.

The image shows the assembled lower guardrail with 1 Main Post every 1333mm, so there is 1 empty hole for the intermediate post.

Figure 34: Gap indicated on the lower guardrail.

j) Assembly of the intermediate post: Then assemble the intermediate posts matching to the marked position on the guardrail.

Figure 35: Assembly of intermediate post.

k) Fasten bolt and note the required torque setting has a maximum value.

AS1252 STRUCTURAL ASSEMBLIES
CLASS 8.8 - MINIMUM BOLT TENSION

Nominal Size	Pitch	Minimum Bolt Tension Kn
M16	2.0	95
M20	2.5	145
M24	3.0	210
M30	3.5	335
M36	4.0	490

Note: the minimum bolt tension shown (AS4100-1998) is approximately equivalent to the minimum proof loads shown in AS1252-1996.

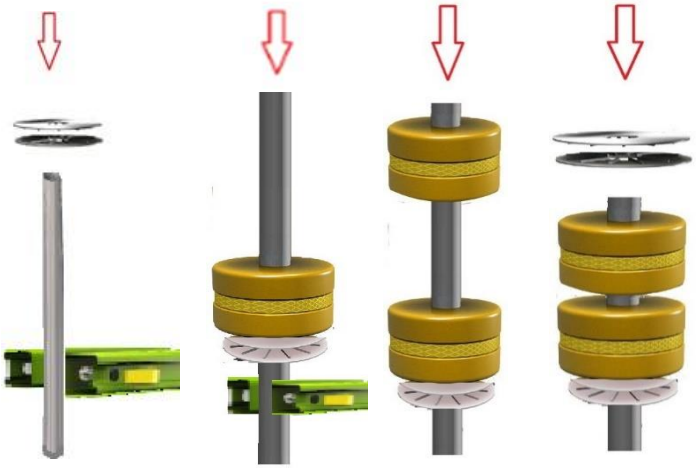
Figure 36: Minimum bolt tension.

l) Ensure the post holes face front and back to connect the rails. Check the entire line.

Figure 37: Pole hole positions.

m) Finish with checking the lower guardrail and posts along the barrier line

n) Assemble the Rollers



Two shock absorbing rollers, with associated plastic bushing and reflective band are placed on each steel line post and intermediate post.

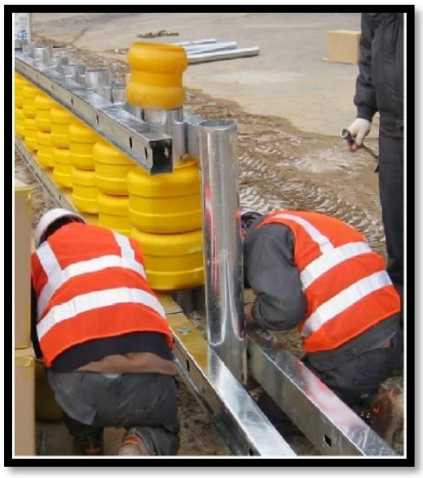


Figure 38: Assembly of the rollers.

When installed, the ribbed side of the two stopper boards are placed in contact and the pair inserted over the steel posts.

Figure 39: Stopper boards.

.

o) Each bolt is placed inside of the rail section, securing the inside face of the rail to the posts only, ensuring that all bolt heads and nuts are located on the inside of the rail elements.

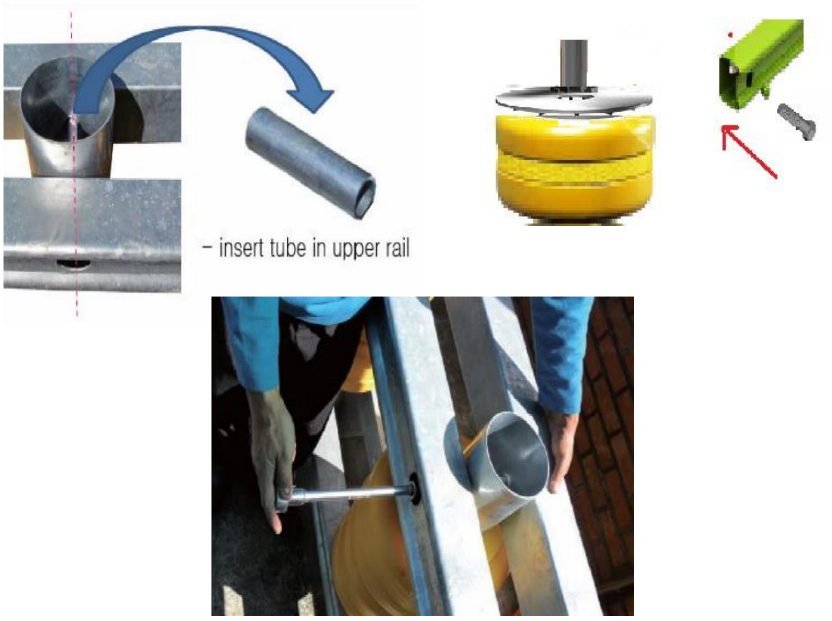
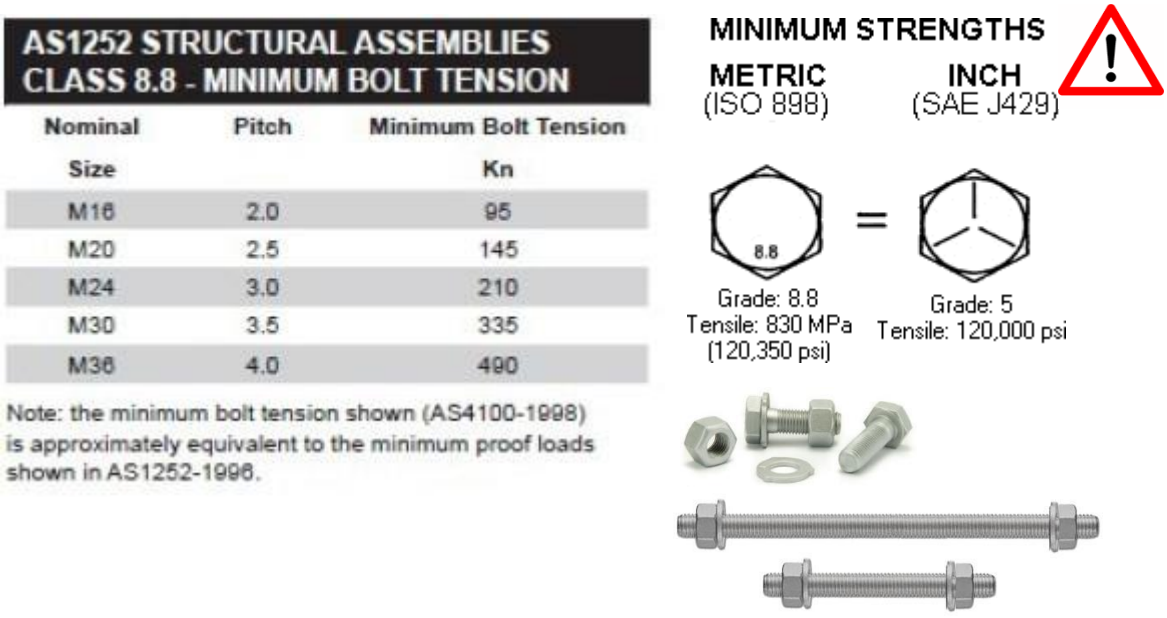


Figure 40: Placement of bolts.

p) Fasten bolt and note the required Torque setting has a minimum value.



AS1252 STRUCTURAL ASSEMBLIES
CLASS 8.8 - MINIMUM BOLT TENSION

Nominal Size	Pitch	Minimum Bolt Tension Kn
M16	2.0	95
M20	2.5	145
M24	3.0	210
M30	3.5	335
M36	4.0	490

Note: the minimum bolt tension shown (AS4100-1998) is approximately equivalent to the minimum proof loads shown in AS1252-1996.

Figure 41: Minimum bolt tension.

q) Check posts are straight and insert all barrier Caps. Check all bolts and nuts are set to the required Torque Setting

Figure 42: Checking poles and inserting barrier caps.

Figure 43: Safety roller barriers.

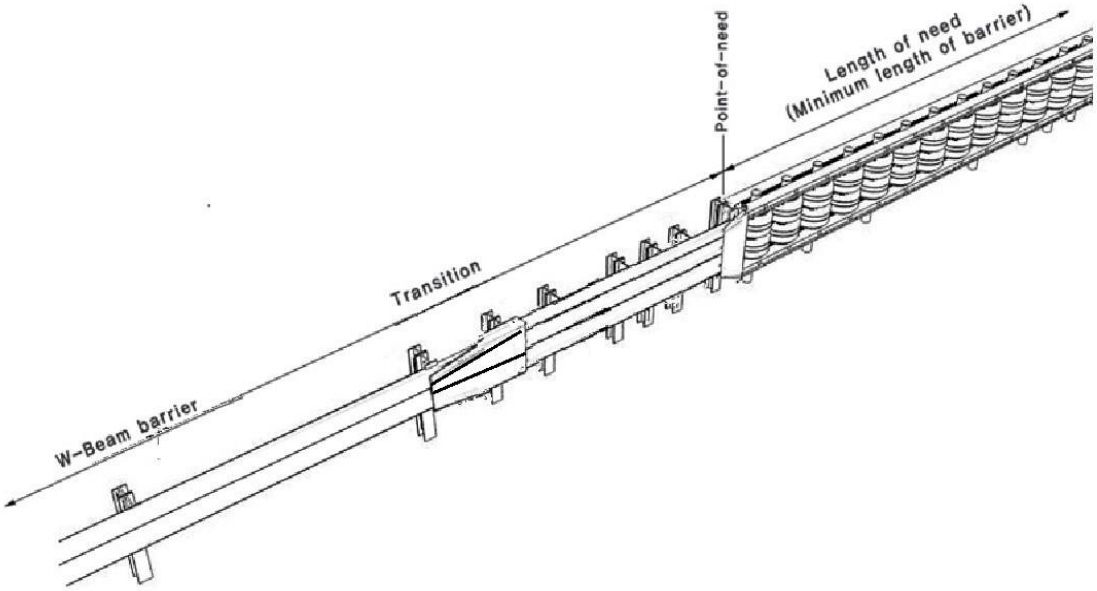


Figure 44: Transition to w– beam barrier.

r) All safety roller guard barrier materials used are non-combustible. In the event of a bushfire, a maintenance review on the guard barrier is recommended. While covering all the listed issues, cover the safe and compliant removal and replacement of damaged components after an incident.

s) Stopper boards and rollers should be checked regularly. If you have any doubts, replace them - especially after a bush fire or other source of flame.

Figure 45: Stopper boards and rollers.

11. INSPECTION AFTER INSTALLATION

After the completion of construction, check the following:

a) The attachment of supports and rotation blocking plate to ensure appropriately installed.
b) Subsidence slope and bending of support for compliance with installation instructions.
c) The existence of corrosion and coating condition.
d) Rotation of shock absorbing roller.
e) For any deformation and damage of safety fence.
f) For any damage to fixing and connecting bolts and fixing and connecting nuts.
g) All main posts are 1333mm into the ground.
h) All main posts are plump and positioned correctly.
i) Inner posts are placed inside all main posts.

j) A pair of bottom and top rails are fastened to main posts by means of size 30 bolts and nuts.
k) All intermediate posts (middle posts) are placed correctly and fastened to both top and bottom rails by means of size 30 bolts and nuts.
l) Each post has on it two safety rollers.
m) A set of two stopper boards placed before and after safety rollers are placed.
n) Bottom rails are joined end-to-end by means of short sleeves, fastened to rails by size 24 bolts and nuts.
o) Top rails are joined end-to-end by means of long sleeves, fastened to rails by size 24mm bolts and nuts.
p) Transition rails correctly at either end of the system.
q) Rail cover caps placed on all openings.
r) Post caps are placed on all posts.