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Fabricators in Aluminium and Steel to the Construction and Engineering Industries



ALUMINIUM PASSIVE SIGN SUPPORT SYSTEM







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SECTION 'A' - SPECIFICATION MANUAL.







1.0 List of Drawings.

1.1 System Drawings. (Attached.)

DRAWING DRAWING TITLE.

- APM H500-01.B: STANDARD ARRANGEMENT DRAWINGS OF HIMAST H500 ALUMINIUM PASSIVE MAST.
- APM H1000-01.B: STANDARD ARRANGEMENT DRAWINGS OF HIMAST H1000 ALUMINIUM PASSIVE MAST.
- APM H2000-01.B: STANDARD ARRANGEMENT DRAWINGS OF HIMAST H2000 ALUMINIUM PASSIVE MAST.
- APM H3000-01.B: STANDARD ARRANGEMENT DRAWINGS OF HIMAST H3000 ALUMINIUM PASSIVE MAST.
 - APM CLIP-01.C: STANDARD ARRANGEMENT DRAWINGS OF SIGN CLIP TYPE 1.
 - APM CLIP-02.B: STANDARD ARRANGEMENT DRAWINGS OF SIGN CLIP TYPE 2.



































Varley and Gulliver Ltd.



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2.0 List of Varley and Gulliver Limited Company Procedures for Production.

All procedure references relate to Varley and Gulliver Limited Quality Assurance manual in accordance with **ISO 9001:2008** approved procedures.

Name of procedure:	Procedure Reference Number:		
Product Realisation (Inspection of Raw Materials):	7.1		
Inspection of Components and Fasteners:	7.1		
Routine inspections carried out during manufacture:	7.1		
Handling and Storage of Materials:	7.1		
Control of measuring equipment:	4.2.4 and 7.1		
Assessment of Personnel:	6.2		
Control of Specification Manual:	4.2.4		
Control on incoming Materials:	7.1 and 7.4.2		
Traceability of Materials:	7.1		
Corrective and preventive actions to be taken:	8.5.2 and 8.5.3		
Continuous surveillance via Internal Audits:	8.2.2		
Appointment and control of suppliers and subcontractors:	7.4.1		

Table 1.





3.0 Product Description:

The HiMAST series aluminium sign support masts are designed for use either individually or combined to provide passive support for road equipment which is primarily signage.

The masts are passive is accordance with **BS.EN.12899-1:2007** and **BS.EN.12767:2007** after crash test validation.

The mast consists of a uniquely shaped symmetrical aluminium extrusion that ensures that the mast can function if impacted in any direction and is attached to the baseplates via M12 threaded fixings for **H3000** masts, M10 threaded fixings for **H2000** masts or M8 threaded fixings for **H1000** and **H500** masts which pass through the baseplate into threads in the end of the extrusion.

The masts via the baseplates are attached to the foundation with 4No. M24 stainless steel holding down studs for **H3000** masts, 4No. M20 stainless steel holding down studs for **H2000** and **H1000** masts and 4No. M16 stainless steel holding down studs for **H500** masts into approved cast-in anchorage units or resin fixed drilled anchorages. The holding down studs and washers are isolated from the galvanised steel washers and baseplates with nylon flat and top hat washers

Once the masts have been installed the signs are attached to the supporting masts with 2No. M8x38mm long Square head stainless steel captive fixings (per channel / per post) located and secured in the rear of the sign channel via sign clips **Type 1** for **H3000** and **H2000** masts or **Type 2** for **H1000** and **H500** masts.





4.0 Durability:

The durability of a product is dependent upon numerous factors such as weather conditions, air pollution, location, handling, repair and routine maintenance.

Aluminium weathers to a dull grey finish due to the formation of an impervious oxide layer which is integral with the base metal on exposed surfaces, which is highly resistant to atmospheric corrosion. The rapid forming of the oxide layer and reforming of the layer when scratched is a main reason for the good corrosion characteristics of aluminium and an **almost unlimited life expectancy**.

The use of stainless steel fixings in aluminium can raise concern of bi-metallic corrosion (Galvanic corrosion).

Galvanic corrosion takes place when two different metals have contact with each other in the presence of an electrolyte and is also dependent upon the relative masses of the two materials and the level of current density in the sacrificial anode which would be the aluminium extrusions. The high relative mass of the aluminium compared with the stainless steel fixings would result in a low current density. The extent of isolation between stainless steel fixings in aluminium components, in our opinion, is over specified and the use of stainless steel in contact with aluminium in several existing parapet systems used for over 30 years in the UK would verify.

The main area of concern would be the holding down bolts and the baseplate which would be prone to standing water and road salts and for this reason a nylon isolation washer is utilised.

Splashes of alkaline building materials like grout and concrete cause visible spots on the surface of the Aluminium. These are difficult to remove and for this reason Aluminium should be protected on site.

Pitting corrosion can occur on aluminium surfaces frequently in contact with a humid environment. In general, the consequence is only aesthetical. Accumulation of dirt and debris on surfaces can cause a reduced durability due to the

consequence of long-term moisture. Dirt and debris should be removed during routine inspections.

Based on an EAA report on the average depth of weathering of a 0.91mm aluminium sheet exposed for 20 years in a tropical, industrial and marine environment resulted in a loss of thickness of 0.02mm, 0.05mm and 0.08mm respectively with 85% of reduction occurring within the first 3 years of exposure.

Therefore to specify exact working life duration is virtually impossible but based on the above would predict durability of <u>**30 years**</u> or more dependent upon routine inspection, repair and maintenance.





5.0 Compliance with Standards.

5.1 BS.EN.12767:2007.

The **HiMAST** aluminium passive masts as shown on drawing **APM H3000-01** has been crash tested and certified reports prepared in compliance with **BS.EN.12767: 2007**. MIRA Limited undertook a **35km/h** Occupant Severity crash test on a single mast on **16 May 2008** and subsequently prepared report number **MIRA-08-1019597-G0032** which certifies the product as Impact Class **100**, Energy Absorbing Category **NE** and Occupant Safety Category **2**.

MIRA Limited undertook a **100km/h** Impact Class crash test on a single mast on **11 July 2008** and subsequently prepared report number **MIRA-08-1020096-G0053** which certifies the product as Impact Class **100**, Energy Absorbing Category **NE** and Occupant Safety Category **2**.

Category Designation = **100:NE:2**.

MIRA Limited undertook a **35km/h** Occupant Severity crash test on a dual mast configuration on **14 July 2008** and subsequently prepared report number **MIRA-08-1020097-G0054** which certifies the product as Impact Class **100**, Energy Absorbing Category **NE** and Occupant Safety Category **2**.

MIRA Limited undertook a **100km/h** Impact Class crash test on a dual mast configuration on **14 July 2008** and subsequently prepared report number **MIRA-08-1020099-G0055** which certifies the product as Impact Class **100**, Energy Absorbing Category **NE** and Occupant Safety Category **2**.

Category Designation = **100:NE:2**.

5.2 BS.EN.12899-1:2007.

The HiMAST aluminium passive masts have been assessed in accordance with **BS.EN.12899-1:2007 – Fixed, vertical road traffic sign – Part 1: Fixed signs** and issued with a Certificate of Constancy of Performance No. **038/CPR/20120008/B.**





6.0 Conditions for Use.

- **6.1** Sign structures are checked against BS.EN.12899-1 for wind loading and the most suitable masts are proposed for an individual sign application.
- **6.2** The wind loads applied to the sign structures are either in accordance with BS.EN.1991-1-4 Eurocodes, the recommended wind load classification as detailed in the National Annex to BS.EN.12899-1 or as specified by the customer.
- **6.3** If the edge of the sign is closer than 1200mm from the edge of carriageway, the next highest WL classification to that recommended in the national annex of BS.EN.12899-1 is used in the design, as stated in BS.EN.12767. NA.4.
- **6.4** Unless stated otherwise it is assumed that all signs are mounted centrally on the Varley and Gulliver Passive Mast(s) and therefore no allowance is made within the wind loading calculations for offsetting the sign face. If an offset of the sign face is required, please contact Varley & Gulliver technical department for more assistance.
- **6.5** As a guideline, foundation details used with a Varley and Gulliver Passive Masts should generally be as per equivalent steel post foundations.
- **6.6** The Varley and Gulliver Passive Masts recommended for use have been designed in accordance with the stated sign parameters and current National Standards. If alternative signage parameters are at any time required, please contact Varley and Gulliver Ltd as this may adversely affect the performance of the stated masts. Under no circumstance are any additional signs to be fitted to the supplied masts after installation without recourse to Varley and Gulliver Ltd for checking and verification.
- **6.7** Multi-leg sign supports are normally impact crash tested against one leg with a clear opening between the legs of not less than 1.5m at the impact angle of 20°. Therefore to ensure that two or more posts cannot be impacted at the same time the following minimum post centres should be adhered too:
 - **6.7.1** H500 = 1.750m
 - **6.7.2** H1000 = 1.800m
 - **6.7.3** H2000 = 1.875m
 - **6.7.4** H3000 = 1.920m
- **6.8** Varley and Gulliver Ltd are not responsible for the completion of BD2/05 Certification; this is the responsibility of the scheme designer to instigate this approval procedure (Applicable to structures over 7 metres in height generally).
- **6.9** The responsibility for ensuring sign sizes / details are correct is that of the customer. Varley and Gulliver Ltd cannot be held responsible for any errors due to misinterpretation.
- **6.10** The definition of a sign mounting height is the vertical distance from the bottom of the sign, to road level, at the edge of the sign closest to the carriageway. Please note that BS.EN.12767. Clause 5.5.1 states that the minimum sign mounting height recommendation is 2.0m.





NA.5.2 of BS.EN.12767 recommends that the lower edge of any sign plate should not be lower than 1.8m above ground level, and that any significant structural elements such as stiffening channels should not be lower than 2.0m. BS.EN.12767 also states that 'Lower installations may be used, but risk of windscreen penetration shall be evaluated'. This is to be undertaken **by others**.

HiMAST sign supports have been verified with a sign mounting height of 1.5m.

- **6.11** The placement of passive masts is to be in accordance with the requirements of the following documents:
 - TD 19/06 Requirements for Road Restraint Systems.
 - NA of BS.EN.12767:2007 Recommendations for passively safe support structures for road equipment.
 - NA of BS.EN.12899-1:2007 Fixed, vertical road traffic signs Part 1: Fixed signs.





7.0 <u>Technical Information.</u>

7.1 Mast Information.

		HiMAST H500	HiMAST H1000	HiMAST H2000	HiMAST H3000
Unfactored Moment of Resistance	kNm	11.7	17.5	35	64
Equivalent Bending Stiffness (El)	kNm ²	164	301	625	1040
Unfactored Shear Resistance	kN	61	45	55.5	91
Unfactored Torsional Resistance	kNm	13.6	11.4	18.1	25.6
Equivalent Torsional Stiffness (GJ)	kNm ²	63.88	91.44	162.36	277.49
Equivalent Torsional Stiffness (GJ)	kNm/°/m	1.12	1.6	2.9	4.9

Table 2.

- 7.2 Mast Weights:
 - 7.2.1 H500 Passive Mast

Weight per metre = **5.61 kg/m**. Weight of Baseplate = **7.20 kg**.

- 7.2.2 H1000 Passive Mast Weight per metre = 6.61 kg/m. Weight of Baseplate = 9.20 kg.
- 7.2.3 H2000 Passive Mast Weight per metre = 10.68 kg/m. Weight of Baseplate = 13.30 kg.
- 7.2.4 H3000 Passive Mast Weight per metre = 14.50 kg/m. Weight of Baseplate = 24.00 kg.

The stated values could vary due to material, fabrication and installation tolerances, however, these values should be utilised for any design purposes.





8.0 Certification.

8.1 BS.EN.ISO 9001:2008 Quality Management Certificate.



CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Varley & Gulliver Ltd

57-70 Alfred Street, Sparkbrook, Birmingham, West Midlands United Kingdom

has been approved by Lloyd's Register Quality Assurance to the following Quality Management System Standards:

ISO 9001:2008

And National Highway Sector Schemes -

2B - for the supply, installation, maintenance and repair of Vehicle Restraint Systems

5A - for the Manufacture of Parapets for Road Restraint Systems

5B - for the Installation of Parapets for Road Restraint Systems

The Quality Management System is applicable to:

The manufacture, supply and installation of aluminium and steel parapets including collision damage repairs and refurbishment. The management of installation of parapets for road restraint systems:

a) Vehicle parapets for bridges and other highway structures

b) Pedestrian parapets for bridges and other highway structures The manufacture and supply of passively safe sign support posts.

The manufacture, supply and installation of aluminium and steel guard rails The manufacture of cradle anchorages

Contract management of supply and installation of safety fences (Flex Beam, TCB, DROBB and OBB) and crash cushions

The sub-contract manufacture of general engineering products to client specifications.

This certificate forms part of the approval identified by certificate number LRQ 0860500

Certificate No: LRQ 0860500/A

Current Certificate: 1 February 2016

14 September 2018

14 February 1989

Certificat Expiry: A GUDC

Issued by: Lloyd's Register Quality Assurance Limited Name of Signatory: Andrea Gibbons Job Title: Specialist Products Manager

Original Approval:



Approval



1 Trinity Park, Bickenhill Lane, Birmingham, B37 7ES, United Kingdom

ed, its affiliates and sul









CERTIFICATE SCHEDULE

Varley & Gulliver Ltd 57-70 Alfred Street, Sparkbrook, Birmingham, West Midlands **United Kingdom**

Head Office

57-70 Alfred Street, Sparkbrook, Birmingham United Kingdom

Locations

Varley & Gulliver Limited Marsh Road, Middlesbrough United Kingdom

Approval Certificate No: LRQ 0860500/A



Activities

The manufacture, supply and installation of aluminium and steel parapets including collision damage repairs and refurbishment. The management of installation of parapets for road restraint systems: a) Vehicle parapets for bridges and other highway

structures b) Pedestrian parapets for bridges and other highway structures

The manufacture and supply of passively safe sign support posts.

The manufacture, supply and installation of aluminium and steel guard rails

The manufacture of cradle anchorages Contract management of supply and installation of

safety fences (Flex Beam, TCB, DROBB and OBB) and crash cushions The sub-contract manufacture of general

engineering products to client specifications.

Sales of aluminium and steel parapets including collision damage repairs and refurbishment. The management of installation of parapets for road restraint systems: a) Vehicle parapets for bridges and other highway

structures b) Pedestrian parapets for bridges and other

highway structures

Original Approval:	14 February 1989
Current Certificate:	1 February 2016
Certificate Expiry:	14 September 20

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2018

1 Trinity Park, Bickenhill Lane, Birmingham, B37 7ES, United Kingdom

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8.2 Declaration of Performance.

HiMAST Declaration of Performance August 2015 - Issue 1 Revision 0



Declaration of Performance.

VG-0038-CPR-20120008/B.

1. Unique identification code of the product-type:

HiMAST Aluminium Passive Sign Supports.

2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4) of the CPR:

HiMAST Aluminium Passive Sign Support System.

3. Intended use or uses of the construction product, in accordance with the applicable harmonized technical specification, as foreseen by the manufacturer:

Passive mast support system to support items of road equipment for placing on a rigid foundation adjacent to highway infrastructure.

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5):

Varley and Gulliver Limited Alfred Street, Sparkbrook, Birmingham, B12 8JR United Kingdom.

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12(2):

Not Applicable

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V:

System 1

7. In case of the declaration of performance concerning a construction product covered by a harmonized standard:

EN.12899-1:2007 - Fixed, vertical road traffic signs Part 1: Fixed signs

Lloyd's Register Verification Limited No. 0038 performed the inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control, and issued the certificate of constancy of performance.

Varley and Gulliver Limited.

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DoP VG-0038-CPR-20120008/B







HiMAST Declaration of Performance August 2015 - Issue 1 Revision 0

8. In case of the declaration of performance concerning a construction product for which a European technical Assessment has been issued:

Not Applicable

9. Declared performance:

Essential Characteristics	H500 HiMAST	H1000 HiMAST	H2000 HIMAST	H3000 HIMAST	Harmonised technical specification
Maximum Bending Moment (kNm)	11.7	17.5	35	64	
Stiffness for Bending (kNm²)	164	301	625	1040	2
Maximum Moment for Torsion (kNm)	13.6	11.4	18.1	25.6	1:200
Stiffness for Torsion (kNm²)	63.88	91.44	162.36	277.49	2899-
Performance under Vehicle Impact	100 : NE : 2				EN 1:
Durability	SP2 Mast Section / SP1 Baseplate				-
Resistance to Snow Removal	NPD				

10. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 9.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

Mr. Anthony Everitt (Managing Director.) (Name and function)

Birmingham, UK. August 2015. (Place and date of issue)

(Signature)

Varley and Gulliver Limited.

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9.0 Approved Anchorage Units.

9.1 H500 Anchorage unit.









9.2 H1000 Anchorage unit.









9.3 H2000 Anchorage Unit.

9.3.1 Drawing Number FCL 601.







9.4 H3000 Anchorage Unit.









9.5 H3000 Holding Down Bolt Arrangement.



9.5.1 Drawing Number FCL 603.





9.6 H2000 and H1000 Holding Down Bolt Arrangement.

9.6.1 Drawing Number FCL 604.







9.7 H500 Holding Down Bolt Arrangement.



9.7.1 Drawing Number FCL 686.





10.0 Design of the Passive Mast System.

The Passive Mast system has been designed following the general principles defined in the following standards:

BS.EN.1317-1:1998 – Road restraint systems. Terminology and general criteria for test methods.

BS.EN.1317-2:1998 – Road restraint systems. Performance classes, impact test acceptance criteria and test methods for safety barriers.

BS.EN.12767:2007 – Passive safety of support structures for road equipment – Requirements, classification and test methods.

BS.**EN.12899-1:2007** – Fixed, vertical road traffic signs – Part 1: Fixed signs.

NA to BS.EN.1991-1-4:2005: UK National Annex to Eurocode 1 – Actions on Structures.







SECTION 'B' - INSTALLATION MANUAL.







1.0 <u>Scope:</u>

1.1 This Method Statement encompasses the work involved to erect **HiMAST H500**, **HiMAST H1000**, **HiMAST H2000** or **HiMAST H3000** Aluminium Sign Support Masts.

2.0 Safety:

- **2.1** All work should comply with the following:
 - **2.1.1** The Health and Safety at Work Act.
 - **2.1.2** Varley and Gulliver associated Method Statement.
 - **2.1.3** Any Site Inductions given by the Main Contractor.
- **2.2** All operatives should comply with Site Safety Procedures as specified by the Customer. All Plant operators should be trained and certified in the safe operation and use of the equipment they are utilising.
- **2.3** All personnel should wear the correct PPE for the task in hand. High Visibility clothing, Safety Footwear and Hard Hats should be worn as a matter of course.
- **2.4** All personnel should be given a copy of this Method Statement prior to commencement of work.
- **2.5** Care to be taken when handling and lifting as the passive masts are **NOT** centrally balanced.

3.0 Foundations:

- 3.1 <u>Design:</u>
 - **3.1.1** The design of the foundation is the responsibility of the Scheme Designer.
 - **3.1.2** The foundation shall be designed as rigid in accordance with **Annex A.2** of **BS.EN.12767:2007**.
 - **3.1.3** Size of foundations to take into account the minimum edge distances required for the anchorage.

For **H500** the minimum edge distance is **250mm** from the <u>centreline</u> of the mast to the edge of the concrete foundation for drilled and resin fixed anchors and <u>185mm</u> for cast-in anchors.

For **H1000** the minimum edge distance is **430mm** from the <u>centreline</u> of the mast to the edge of the concrete foundation for drilled and resin fixed anchors and <u>260mm</u> for cast-in anchors.





For **H2000** the minimum edge distance is **520mm** from the <u>centreline</u> of the mast to the edge of the concrete foundation for drilled and resin fixed anchors and <u>325mm</u> for cast-in anchors.

For **H3000** the minimum edge distance is **600mm** from the <u>centreline</u> of the mast to the edge of the concrete foundation for drilled and resin fixed anchors and <u>375mm</u> for cast-in anchors.

- 3.2 Installation:
 - **3.2.1** A suitable excavation utilising the appropriate plant should be made for each foundation. (By others)
 - 3.2.2 Anchorage units as detailed on drawing number FCL 600, FCL 601, FCL 602 or FCL 685 are to be suspended to the correct level and orientation to the adjacent carriageway.

Please ensure the orientation of the lower plates is perpendicular to the adjacent carriageway.

Where multiple masts are required care to be taken that the mast to mast centres are correct to the scheme schedule and in line.

- **3.2.3** It is recommended that if the foundation protrudes above ground level this should be limited to a maximum of 50mm.
- **3.2.4** HiMAST sign supports should only be fitted once the foundation has cured.

4.0 <u>Sequence of Erection:</u>

- 4.1 Installation of Passive Masts:
 - **4.1.1** Ensure the area around the plywood location boards and temporary holding down bolts is clear and free of debris. Remove the temporary bolts and plywood board. Check that the anchorage sockets are clean and free of debris.
 - **4.1.2** It is recommended that a high creep resistance grease (copper slip or similar) is applied to the internal thread before inserting the stud. Screw the threaded stud into the anchor socket by hand (**see 4.1.3**.) M24 stud for H3000 masts, M20 studs for H2000 and H1000 masts and M16 studs for H500 masts. To ensure there is not an excessive length of stud above the top of the mast baseplate after final erection the following stub protruding lengths after screwing into the sockets should be:

H3000 = 145mm, H2000 = 120mm, H1000 = 120mm, H500 = 110mm.

- **4.1.3** When Passive Masts are attached to Varley and Gulliver Limited anchorage units the length of stud engagement needs to be as follows:
 - H3000 = <u>minimum</u> of 30mm. H2000 = <u>minimum</u> of 25mm.

H1000 = **minimum** of 25mm.







H500 = <u>minimum</u> of 20mm.

When passive masts are attached to anchorages provided **<u>by others</u>** the following equation should be checked and satisfied:

LE = 0.7 x 0.2% Proof Stress of Anchorage Socket

хD

Where:

LE = Length of Engagement

D = Bolt Diameter.

- **4.1.4** Place a stainless steel washer over the stud. Screw a hexagon nut down the stud until the washer is in contact with the concrete surface. Tighten the connection but do not over torque.
- **4.1.5** Thread a second hexagon nut onto the stud and screw down to the lower part but <u>do not</u> tighten.
- **4.1.6** Place a stainless steel washer followed by a nylon **flat** isolator washer and finally a galvanised washer over the nut. Ensure that this sequence is strictly followed.
- **4.1.7** Place a spirit level across the washers to check that the washers are level. If washers are not level adjust the top nuts until this is achieved.
- **4.1.8** When all studs are fitted in the anchors following the above sequence the passive mast with baseplate can be placed over the projecting studs. Again check the vertical level of the column and adjust using the hexagon nut below the baseplate is necessary.
- **4.1.9** When the vertical level is satisfactory place the second galvanised washer over the stud. Next position the nylon **top hat** isolator washer on the stud ensuring that the shank passes through the oversize hole in the galvanised washer and into the hole or slot of the baseplate. Finally place the stainless steel washer over the nylon top hat washer.
- **4.1.10** Screw the third hexagonal nut onto the stud and tighten to a torque within the following ranges:

H3000 = 155 to 180Nm. H2000 = 130 to 150Nm. H1000 = 130 to 150Nm. H500 = 25 to 40Nm.

Screw the fourth hexagonal nut and lock onto the third nut using a spanner.

- 4.2 Installation of Sign Plates:
 - **4.2.1** Sign plates to be installed as per the manufacturer's specifications and scheme requirements.







5.0 <u>Routine Inspections:</u>

5.1 It is recommended that a general inspection of the passive mast is carried out during routine maintenance and inspections of the sign plates.

5.2 <u>Guidance for Inspection:</u>

The following items should be reviewed as part of the inspection:

- Absence or looseness of bolts or nuts.
- Build up of debris and dirt around baseplates.
- Adequate attachment of sign fixing clips.

5.3 Accident Damage Inspection:

Depending upon the level of impact the following items should be reviewed as part of the inspection:

- Absence or looseness of bolts or nuts.
- Build up of debris and dirt.
- Detachment of sign fixing clips.
- Fracture of the mast material, special attention to be given to the opening at the top of the cut out at the bottom of the mast.
- If the mast is partially or completely detached, care to be taken when handling material with sharp or serrated edges.
- In all instances it is recommended that new holding down studs and washers are supplied and fitted with a new mast installation.

If in any doubt contact Varley and Gulliver Limited who can offer advice or arrange a site visit.

