

PASS & CO UK Ltd.



PASSCO N2, H1 AND H2 VEHICLE RESTRIANT SYSTEMS

INSTALLATION MANUAL

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1. GENERAL

1.1 Scope

This manual sets out the procedures for the installation, repair, inspection and maintenance of all PASS & CO vehicle restraint systems supplied by PASS & CO. PASS & CO has been designed and impact tested in accordance with the performance specification laid down in EN 1317 for classes N2, H1 and H2. The product range has been developed to suit the requirements of the UK highways network and is compatible with all Non-proprietary Safety barrier Systems (NPSBS) and all EN 1317 proprietary systems.

1.2 Quality Assurance

PASS & CO are fully compliant with BS EN ISO 9001:2008, NHSS 2B and have procedures in place to ensure compliance with EN 1317. PASS & CO are committed to providing quality products and services which fully comply with the specification.

1.3 Product Design, Warranty and Liability

The product assurances given by PASS & CO for design, warranty and liability for the PASS & CO family of products will be invalidated if it is demonstrated that components have been used from an unapproved source in installation, maintenance or repair and if the VRS does not comply with PASS & CO's specifications. When connecting to another safety barrier system we recommend that the screws in the joint or beam lap should be supplied by PASS & CO unless the other promoter gives express permission to use their fasteners in which instance PASS & CO will accept the connection as long as the system being connected to is fully tested and approved to EN 1317 or is an NPSBS safety barrier.

1.4 Training

PASS & CO's policy is that all works to install, repair, inspect and maintain PASS & CO VRS on UK roads must be undertaken by fully trained and properly qualified personnel in accordance with the mandatory requirements of Sector Scheme 2B and as specified in DMRB volume 2 section 2 part 8, TD 19/06 and the Specification for Highway works Volume 1. Sector 2B training is available from PASS & CO's Lantra Awards approved training centre. PASS & CO's training policy extends to anyone installing PASS & CO outside of the UK and for details of available training contact PASS & CO.

1.5 Health and Safety

It is the installers responsibility to ensure that all necessary safety procedures are in place and implemented at all times. The site specific conditions and restrictions should be assessed and a risk assessment produced by the installer for the specific site. All endeavours must be used to ensure that no one is injured or put at risk during the installation, repair inspection or maintenance of the PASS & CO VRS systems.

2. DESIGN REQUIREMENTS

The installation inspection and repair of the PASS & CO family of products must comply with the requirements of The Specification for Highways Works series 400, TD 19/06, TD 27/05, EN 1317 and PASS & CO specifications.

2.1 Set Back

Set Back should normally be as described in Table 1 below, the Design organisation may use further relaxations in accordance with the notes on table 4-1 TD 27/05 chapter 4.

If both set back and working width cannot be achieved we recommend that set back should be reduced and working width maintained.

In central reserves where there are two single sided safety barriers it must be ensured that the working width is maintained between the two.

Note : When setback and or working width can not be maintained, a departure from standard must be obtained from the overseeing authority.

TABLE 1

Location	Desirable minimum setback value (mm)
In verges with no adjacent hard shoulder or hard strip	1200
In verges with an adjacent hard shoulder or hard strip	600
Central reserves	1200

2.2 System Selection

The Design Organisation must specify the required Performance Class for each safety barrier installation in terms of Containment Level (e.g. N1, N2, H1, H2 or H4a), Impact Severity Level (ISL) (e.g. ISL Class B) and the Working Width Class (W1 to W8).

Normal Containment Level = N2

Higher Containment Level = H1 or H2

The minimum working width is the distance between the traffic face of the VRS and the obstruction proposed for protection, and therefore a safety barrier should be selected to suit the location. For details of the available systems, post centres and post sections please see table 2 below.

TABLE 2

Product Name	Performance Class	Severity Index Class	Normalised Working Width Class	Normalised Vehicle Intrusion Class	Post Type	Post Centres	System Type	General Arrangement Drawing Reference
ESP PLUS W1	N2	B	W1	N/A	SIGMA	660/670	Single	ESP.PLUS-PCGA-001
PASSCO L1 UK (ES1.0)	N2	B	W1	N/A	C100	1000	Single	L1UK-PCGA-01
PASSCO L1 UK (ES2.0)	N2 / H1	B	W2 / W4	VI7	C100	2000	Single	L1UK-PCGA-02
PASSCO L1 UK (ES3.0)	N2	B	W3	N/A	C100	3000	Single	L1UK-PCGA-03
PASSCO L1 (ES4.0)	N2	A	W4	N/A	C100	4000	Single	L1UK-PCGA-04
PASSCO L1 (ES1.33)	H1	A	W3	VI6	C100	1333	Single	L1UK-PCGA-05
PASSCO T-RAIL	H1	A	W4	VI6	SIGMA	2000	Double	T.RAIL-PCGA-01
SUPER RAIL ECO 1A	H2	A	W4	N/A	C125	2000	Single	SR-PCGA-003

2.3 Visibility

The design layout of the PASS & CO shall comply with the sight distance requirements set out in TD 9. (DMRB 6.1)

2.4 Sloping Ground

The ground below the PASS & CO shall be near level within the set back and working width as shown in TD 19/06 figures 3-1 and 3-2 Chapter 3.

2.5 PASSCO System Installation Height

The PASS & CO systems should be set to the heights shown on the drawings with a tolerance of plus or minus 30mm for all systems.

Where the distance between the face of the beam and the edge of the adjacent paved area is less than 1.5m the height should be measured from the edge of the paved area. Where the distance between the face of the beam and the edge of the adjacent paved area is greater than 1.5m the height should be measured from the ground beneath the beam.

2.6 Minimum Lengths for Passco Systems

The minimum length of PASSCO V.R.S. required to meet the length of need are as shown in Table 3 below. Where physical site constraints do not allow the minimum lengths to be achieved, advice should be sought from the design organisation and PASS & CO consulted if required.

TABLE 3

Containment Level	Minimum FULL HEIGHT lengths of VRS	
	In advance of hazard	Beyond hazard
N2	30m	7.5m
H1 or H2	30m	10.5m

2.7 Post Foundations

The type of post foundation used will be dictated by the ground conditions on the site. As a general rule, soil type ground properly compacted will allow the use of driven posts. The suitability of driven posts must be established by following the PASS & CO testing procedure for PASS & CO driven posts.

Where site conditions preclude the use of driven posts, the posts may be surface mounted or set in concrete foundations.

When using surface mounted posts, the anchors must be proven by applying the test loads set out in the PASS & CO testing procedure for surface mounted PASS & CO posts. The contractor must also satisfy themselves by calculation that the foundation will resist the overturning moment and that the posts will become plastic before any movement in the foundation occurs.

For posts set in concrete foundation, the risk of foundation displacement should be mitigated by designing foundations which will comply with the procedure set out in the PASS & CO testing procedure for PASS & CO posts set in concrete foundations.

3. LIMITATIONS ON USE

PASS & CO VRS must be installed in accordance with BS EN 1317, series 400 MCHW, TD 19/06, TD 9 and TD 27/05.

- Please refer to 2.6 for minimum lengths.
- Radii less than 30 meters must be factory formed.
- Half Length beams (2000mm effective) can be utilised to achieve a radius between 30 and 50 metres.
- Factory formed radii must not be less than 6m.

4. INSTALLATION

4.1 Setting Out

Establish the length of need both in advance and on departure from the hazard excluding terminal lengths. Set out the post pitches ensuring that the length of need is covered. If there are any obstructions on the fence line, these may be circumvented using the permissible deviations as per system drawings. Or in certain cases an offset post may be used. Where system progression is required follow the guide lines set out in the general arrangement drawings. The tolerance on the post pitch is dictated by the slot.

4.2 Driven Posts

Before any post driving is considered the area should be thoroughly checked for the presence of services. Wherever it is practicable, the installation of VRS over services should be avoided. We would recommend a minimum of 1000mm safe working distance between driven posts and adjacent services.

Ensure the correct post is used and that on the verge the closed side of the post faces the oncoming traffic with the exception of the C100 post where the closed side sits against the beam. In the central reserve the closed side should face the oncoming traffic on the carriageway nearest the VRS with the exception of the C100 post. Drive the posts to the correct height and line. Excessive driving times indicate that the ground conditions are too hard. Excessive damage may occur to the posts and therefore in these circumstances concrete foundations should be used as an alternative to driven posts.

4.3 Concrete Foundations

Before any mechanical excavation is considered the area should be thoroughly checked for the presence of services. Wherever it is practicable the installation of VRS over services should be avoided. We would recommend a minimum of 1000mm safe working distance between adjacent services and mechanical excavation by auger or an excavator with a bucket.

1. Establish post centres and excavate foundations to suit the ground conditions. When constructing the foundations ensure there is a minimum of 150mm from the edge of the concrete to the post socket. It is advisable to have some socket length protruding from the finished concrete level and up to 100mm is acceptable, except at maintenance cross overs.
2. Place concrete in the foundation and vibrate to compact. Concrete should be ST5 or equivalent. Higher grades of concrete can be used.
3. Put the post and socket, if required, into the concrete, install the reinforcing ring, if required, and set the post to line and level. Make final adjustments to height and line before the initial set of the concrete. Slope the concrete away from the post and socket to help avoid corrosion where possible.
4. Fill the socket with a filler such as expanding foam to protect the socket from the incursion of detritus.
5. Where the concrete foundations are in filter drains they will always require casings. The outside of the casing should be backfilled with uncontaminated filter media on the line of the filter drain, and backfilled with the excavated spoil elsewhere. A plastic membrane of at least 125 microns thick should be laid at the base to prevent contamination of the filter media. Consideration should be given by all parties on the best method of preventing contamination of the filter media.
6. It is critical when determining the size of all test foundations that the lack of ground support is considered and the foundation is of sufficient volume to support the post and allow it to become plastic before any foundation displacement can occur.

4.4 Surface Mounted Posts

Surface mounted posts should only used in locations where the concrete foundation is of sufficient strength to resist the required tensile loadings as set out in table 4 below. Installation of PASS & CO Cradle anchorages or proprietary resin anchors of sufficient strength are suitable methods of anchoring surface mounted posts. Where the design organisation has deemed existing

construction to be suitable to provide a foundation for surface mounted posts the posts will be installed on drilled anchors.

It is critical when fitting resin anchors that the holes are drilled to the correct diameter and depth then thoroughly cleaned.

When the resin anchor has cured fasteners should be tightened to the correct torque and thread engagement. Posts should be sat on a grout bed of between 10 and 30mm.

Surface mounted posts should be manufactured to the correct height for the location the use of detachable height adjusters is not permitted.

TABLE 4

Post Type	System	Tensile Test Load In Anchorage kN
Sigma	N2 W1	50kN
C100	N2W1 N2W2 N2W3 N2W4 H1W3 H1W4	50kN

5. PASS & CO VRS ASSEMBLY

5.1 N2, H1 and H2 Single Sided Systems

Posts must be set as described in section 4 and the post pitches and positions must be as the system drawings. These may be reduced to avoid an obstruction please see deviation criteria on the relevant system GA drawings.

Beams should be hung on the posts using the correct fasteners and be hand tight only. Beams must be hung in the correct orientation so that the teardrop holes in the beam are over the top of the circular holes in the adjoining beam. The beams are fastened with PASS & CO M16 lap bolts which should be tightened to 70 Nm.

- M10 post bolts should be tightened to 17 Nm.
- M16 post bolts should be tightened to 70 Nm.

NOTE: When securing PASS & CO fasteners, a minimum of one thread must appear through the nut.

Pedestrian or motor cycle protection should be fitted if it is required as the system is assembled.

An inspection of the safety barrier should be carried out using the inspection check list on page 10 taking into account the tolerances detailed in table 5 below.

TABLE 5

PASS & CO Installation and Maintenance Tolerances			
Description	Tolerance In MM Installation	Tolerance In MM Maintenance	Comment
Installation Height	+/- 30mm	+/- 50mm	The maintenance tolerance can be used during installation when the safety barrier height reference is changing from carriageway to verge level or when connecting to an existing VRS.
Deviation in Alignment	+/- 30mm	+/- 30mm	

PASS & CO VRS INSPECTION REPORT

Date:	
Contractor:	
Contract:	
Location:	
Type of System:	

Checks	Within Specification			Comments
	Yes	No	N/A	
Set Back				
Working Width				
Height				
System Progression				
Fasteners				
Terminals				
Beams				
Posts				
Foundations				
ID Markings				

I Confirm that I have checked the Safety Barrier in the above location and confirm that the inspected work has been completed in accordance with the specification.

Installer: (Lead Fencer or Supervisor)	Main Contractor: (when applicable)	Client: (when applicable)
Name (Print):	Name (Print):	Name (Print):
Signature:	Signature:	Signature:
Date:	Date:	Date:

One of the above PASS & CO Inspection Reports should be completed for each VRS run and submitted to the client to confirm the system has been inspected and is certified as compliant.

5.1 Connection to N.P.S.B.S.

For connection to either TCB or OBB please see PASS & CO general arrangement drawings. The system requirements for both NPSBS and PASS & CO must be adhered to. When connecting to either TCB or OBB correct system progression must be maintained. If connecting to TCB there must be an adjuster assembly within 35m of the PASS & CO. Connection to OBB should be made using an A06 connection piece.

5.2 Connection to Other Proprietary V.R.S

PASS & CO family of products allow connection in to other EN 1317 systems that have been correctly installed. PASS & CO will guarantee the joint if it has been connected using our fixings and is in specification.

5.3 Installation on Curves

On curves with a radius greater than 50 metres standard beams can be used. Where the radius is between 50 metres and 30 metres, half-length beams (2000mm effective length) can be utilised. Under a 30 metre radius pre-formed beams to suit the required curvature should be used. In any instance all post centres remain the same.

6. INSPECTION, MAINTENANCE AND REPAIR

6.1 Inspection

A PASS & CO inspection certificate on page 11 should be completed for all new installations. The installation must be checked and certified as compliant using the system drawings and specification. The system will not be deemed compliant unless certified by a suitably qualified person who can demonstrate competence. Either through LANTRA training or approval from PASS & CO.

6.2 Maintenance

A correctly installed and certified PASS & CO VRS is maintenance free for the period of its design life. A visual inspection regime is recommended to check for impact damage. Where this is identified repairs must be carried out. The visual inspection should also look at the ground conditions as erosion, slippage or ponding of water can all affect the viability of a VRS product.

6.3 Repair

When repairing PASS & CO VRS only components with plastic deformation need to be replaced. If the component has only minor damage and is localised then no replacement is necessary other than for aesthetic reasons. Small scratches and indentations should be treated with a zinc rich paint. Substantially damaged beams must be replaced as must any bent posts. The bolt holes in adjacent beams should be checked for splitting or distortion and if any are identified those beams should also be replaced. The repaired installation should be checked for compliance and an inspection certificate produced. When replacing damaged components all fasteners that are removed must be replaced with new. Care should be taken to ensure ground conditions are suitable to support the replacement posts and proven by push testing. where the push test fails driven posts may have to be replaced with concrete foundations.

6.3 Site Records

PASS & CO update and amend system drawings regularly so with the passing of time existing installations may not be as per the latest drawings, so manuals and drawings from the time of installation should be kept on file.

7. **SYSTEM PROGRESSION**

As per relevant system GA drawing.

8. **PERMISSABLE DEVIATION**

Obstructions can be circumvented as per relevant system GA drawings by deviation of post centres or the introduction of offset posts or a combination of both.

9. **POST, FOUNDATION AND TESTING REQUIREMENTS**

9.1 Ground Conditions

Foundation testing must be carried out to establish the strength or compaction of the ground in to which the VRS is to be installed. Tests should be carried out in accordance with PASS & CO test procedure.

The frequency of testing should be as described in the contract specific appendix 4/1. As a minimum PASS & CO recommend that at least one test is carried out for each VRS run or one test for every 100m whichever is the greater. There should be further tests if there is a change in ground conditions for example the VRS crosses a cut fill line then each ground condition should be tested.

9.1 Load for Post Tests

Sigma 100

A bending moment of 6.5 kNm (6500Nm) must be achieved before the posts deflection exceeds 100mm.

C100

A bending moment of 8.5 kNm (8500Nm) must be achieved before the posts deflection exceeds 150mm.

Note: For posts in concrete foundations post deflection at full load must not exceed 50mm.

9.2 Recording Foundation Test Results

Foundation test results should be recorded on the post test recording form an example of which is shown on the next page.

Job No.		Sheet of					
Agent Authority/ Consulting Engineer		Site				Date	
Test No	Details of Post/ Foundations and Location (central reserve or other)	Test Mode Push (Ps) / Pull (Pl)	Loading Height (m)	Incremental Loading Value (N)	Deflection (mm)	Bending Moment (Nm)	Remarks (eg. Pass / Fail)

Specification Details

Tested By (Print Name):	Signed:
Clients Rep. (Print Name):	Signed
Date:	