



CONCRETE ROAD BARRIER CS BETON

AREA LAYOUT

TECHNICAL CONDITIONS OF THE MANUFACTURER (TCM)

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1 Technical conditions of the manufacturer (TCM)

These TCM 239/2018 CS BETON are the revision of TC 239/2012, which became effective on 1. 6. 2012 and are terminated.

This revision includes all barriers defined in the original TC 239 and one new barrier – double sided concrete, height 0.80 m.

In compliance with CPR 305/2011 and ČSN EN 1317-5+A2 all barriers were subject to issue “certification on the stability of the properties” authorising the use of CE marking.

The barriers were introduced on the market by CS BETON, s. r. o., Velké Žernoseky 184, 412 01 Litoměřice
Contact person Ing. Josef Matějka csbeton@csbeton.cz, www.csbeton.cz

The barriers were produced on the production plant: CS BETON, s. r. o., Velké Žernoseky 184, 412 01 Litoměřice

TCM subject - see tab. 1.

Table 1 – TCM subject

No.	Abbreviation	Name
1	BSJT08ZA400	Concrete barrier - H3 holding level - for roads
2	BSOT08ZA400	Concrete barrier - H3 holding level - for roads
3	BSJT10ZA400	Concrete barrier - H3 holding level - for roads
4	BSOT10ZA400	Concrete barrier - H4b holding level - for roads
5	BSJT12ZA400	Concrete barrier - H4b holding level - for roads
6	BSOT12ZA400	Concrete barrier - H4b holding level - for roads
Under the conditions defined in chapter 5, some barriers can be used also on bridges		

Technical conditions apply for the roads, motorways, and local roads (further referred to as roads) and the bridges as per regulation 1, 2 and 3 and adequately also for the purpose roads.

ATTENTION – the use of all barriers defined in these TCM is subjected to the compliance with TC 114 and TC 139. It means that if TC 114 or TC 139 changes the requirements to the level of holding or any other requirements, the requirements and the use of TCM must be adapted.

1.1 Related regulations and standards

See TC 114

2 The designed parameters of individual barriers and their use

Table 2 – Designed parameters













No.	Marking of the barrier	Level of holding	Coefficient of ASI impact sharpness Movement dynam. [m]	Operating width w [m] Vehicle overlap VI [m]	Application
1	BSJT08ZA400 Concrete barrier single sided height 0.80 m 	H3	1.8	2.5 (W7)	Shoulder Width as per ČSN 73 6101 up to holding level H1 Central division lanes Not used
			2.0	3.56 (VI9)	
2	BSOT08ZA400 Concrete barrier double sided height 0.80 m 	H3	1.4	1.9 (W6)	Shoulder Width as per ČSN 73 6101 up to holding level H3 Central division lanes Not used
			1.2	2.9 (VI8)	
3	SJT10ZA400 Concrete barrier single sided height 1.00 m 	H3	1.8	2.1 (W6)	Shoulder Width as per ČSN 73 6101 up to holding level H2 Central division lanes As two parallel barriers as per TC 139
			1.6	2.9 (VI8)	
4	BSOT10ZA400 Concrete barrier double sided height 1.00 m 	H4b	1.4	2.2 (W7)	Shoulder Width as per ČSN 73 6101 up to holding level H3 Central division lanes Width at least 2.70 m for the holding level H4 Width at least 2.10 m for the holding level H3 Width at least 1.70 m for the holding level H2
			1.5	2.9 (VI8)	
5	BSJT12ZA400 Concrete barrier single sided height 1.20 m 	H4b	1.8	1.9 (W6)	Shoulder Width as per ČSN 73 6101 up to holding level H3 Central division lanes As two parallel barriers as per TC 139
			1.4	2.1 (VI6)	
6	BSOT12ZA400 Concrete barrier double sided height 1.20 m 	H4b	1.4	2.0 (W6)	Shoulder Width as per ČSN 73 6101 for all holding levels up to H4 Central division lanes Width at least 2.20 m for the holding level H4 Width at least 1.70 m for the holding level H2 and H3
			1.3	2.2 (VI7)	

Table 3 – Distance of the barrier front from solid obstacle

No.	Marking of the barrier	Level of holding	Distance of the barrier front from solid obstacle [m]
1	BSJT08ZA400 Concrete barrier single sided height 0.80 m 	N2	0.85*
		H1	1.40*
		H2	2.00*
		H3	2.50
2	BSOT08ZA400 Concrete barrier double sided height 0.80 m 	N2	0.80*
		H1	1.10*
		H2	1.40*
3	BSJT10ZA400 Concrete barrier single sided height 1.00 m 	N2	0.80*
		H1	1.30*
		H2	1.70*
4	BSOT10ZA400 Concrete barrier double sided height 1.00 m 	H3	2.10
		N2	0.80*
		H1	1.20*
		H2	1.60*
5	BSJT12ZA400 Concrete barrier single sided height 1.20 m 	H3	1.90*
		H4b	2.20
		N2	0.80*
5	BSJT12ZA400 Concrete barrier single sided height 1.20 m 	H1	1.10*
		H2	1.40*
		H3	1.60*
		H4b	1.90

3 Description of individual barriers

3.1 The bearing systems and locks of the barriers CS BETON

All concrete barriers CS BETON have a unified bearing system – see fig. 1. It is a bar \varnothing 35 mm from steel 42CrMo4+QT. The rod is placed in the barrier head, axial 87 mm from the upper edge.

The rod ends include a thread for screwing the connection nuts. The barrier is concreted (rod with nuts).

The front part of the barrier includes a pocket in the rod location. Prior to the connection of two parts, screw is connected to the connection nuts in the front with loosely set nut 1 or nut 2. After fitting two parts together, nut 2 is screwed to nut 1. This results in the joint lock. A cover is fitted on the lock from the polypropylene plastic material.

The advantage of the lock is the impossibility to remove any of its parts (stealing) without dismantling the parts. Every part contains a concrete reinforcement. The stirrups are around the bearing rod.

DETAIL OF THE CONNECTION

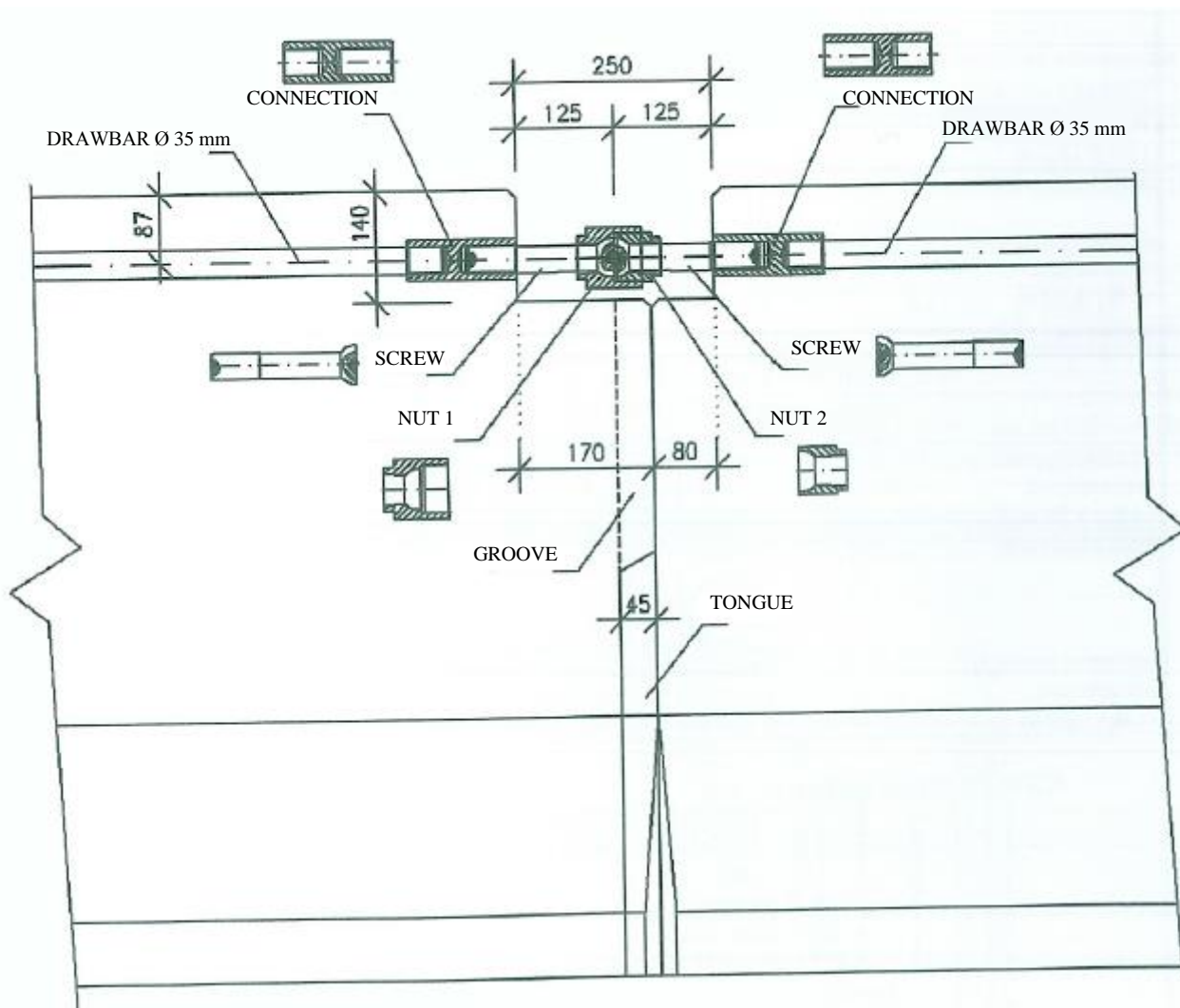


Figure 1 – Lock of the barriers - connection

The barrier is assembled to prevent any tolerance in the connection. The reason is to limit the dynamic impact which could cause the connection disruption.

3.2 The diameters where the barrier can be fitted

Barriers CS BETON it is possible to fit up to diameter larger or equal to 36 m.

3.3 Double sided concrete barriers CS BETON

Prefabricated concrete barriers sliding, double sided, are produced with height 0.80 m, 1.00 m a 1.20 m – see fig. 3, 5 and 7. The barriers are assembled from individual parts of the component length 4 m. The parts are reinforced with concrete reinforcement comprising from the stirrups and longitudinal reinforcement. On one side, every part includes tongue and second groove which enables simpler assembly. For all parts, concrete C 45/55 - XF4 is used.

The lower part of every part includes drainage openings. It is possible to order parts also without drainage opening.

If required, non-systematically (during the composition it may not always be possible to use only 4 m length), it is possible to produce parts shorter – see 3.5. The bridge closures enable ordering the pocket in the lower part as per the closure size. All three types of double sided barriers have the same width – 0.695 m in the footing.

The lower part of the components is bevelled by 25 mm at the front. This enables reaching lower diameter during the fitting of the barrier and during the impact in the barrier the front parts seizing is limited which contributes to better impact process.

The manufacturer commonly offers the parts as per table 4:

- **Common part.** On one side there is a groove, tongue on the other. It does not matter how the barriers are fitted, by pushing the grooves to the left or to the right because the double sided barriers are the same from both sides.

- **The end left and right part.** The left end part includes the tongue front, the end right part includes groove in the front. Figure 3, 5 and 7 includes the marking scheme of the parts providing the parts are commonly placed with the groove on the left. If common parts are fitted, the groove is on the right, the end left part is fitted on the right and the end right part is fitted on the left (the tongue must fit in the groove).

- **The transfer left and right part** for the transfer on steel barrier with direct connection – see fig. 9. If it is a left and right part, the same applies as for the end parts, the tongue must always fit in the groove. The transfer part includes additional drilling of the openings for anchors onsite and the reducer is fitted of any steel barrier if supplied by the steel barrier supplier.

The transfer between various heights of the barriers CS BETON it is possible to order transfer parts as per fig. 8.

After handling the parts, the head (top) of every part includes the casing for screwing the hinge drawbars. The parts can be assembled using drainage openings for passing the hinge rope.

3.4 Single sided concrete barriers CS BETON

Prefabricated concrete barriers sliding, single sided, are produced with height 0.80 m, 1.00 m a 1.20 m – see fig. 2, 4 and 6. The barriers are assembled from individual composition parts of 4 m length.

The article 3.3 also applies, but considering that the single sided barrier cannot turn and used considering the second (reverse) side, it is important to know which part is right and left.

3.5 Principles for the treatment of all types

It is permitted to use solely the adjustments which do not affect the barrier bearing system.

Every adjustment must be agreed with the barrier manufacturer.

The adjustments can be divided as a whole barrier adjustment or partial adjustments.

3.5.1 Description of the barrier as a whole set

This relates to:

- a) The adjustments caused by transverse base tilt where the barrier is fitted (and the change of transverse tilt).
- b) The adjustments caused by fitting the barrier on elevated frame.
- c) Adjustments caused by the requirement for the adjustment or the drainage of drainage openings, potentially the reduction of common part (e.g. in relation to the bridge closures where 4 m module is sufficient).

Attention – it is impossible to reduce the parts in the system, e.g. due to the provision of smaller diameter for the barrier assembly.

Adjustments a) and b) type must comply with TC 139 and in such case it is not necessary to ask the manufacturer for the consent, it is necessary to specify the adjustments in the order.

Adjustments c) can be commonly required; however it must be agreed with the manufacturer in advance.

3.5.2 The adjustments of some specific part

It relates particularly to the end and transfer parts and parts in the bridge closure. The adjustments are not considered the barrier adjustment because they relate to the barrier as a whole, as the system, but solely the local locations which may require atypical adjustment (e.g. during the transfer from the frame to the surface without frame).

It is also possible to order the transfer part for branching from one barrier to two parallel barriers (e.g. pass the bridge pillar in the central division belt). This part is atypical because it depends if the barrier is in the central dividing belt or it is out of axis, and the required branching length is also important.

Every such adjustment must be agreed with the manufacturer because it can be limited by the production options of the mould or the bearing system, and agree with the client/manager of the construction.

3.6 Designing the barrier adjustment in the construction implementation documentation (RDS)

The barriers are "defined" products within full responsibility of the manufacturer. Therefore the PK designer solely provides the barrier manufacturer with the materials for adjustments.

The materials include the drawing of the barrier parts (particularly on the bridge) which can indicate the need of atypical length of some part. It is also the notification of the dilating movement size and the width of the bridge closure in the bridge and the connection to the steel type of the steel barrier, etc.

The barrier manufacturer provides the production-technical documentation at its costs (if required).

BARRIER BSJT08ZA400

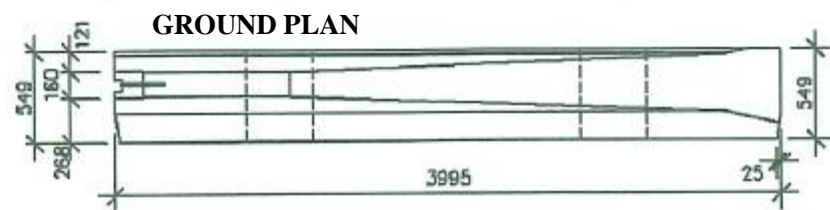
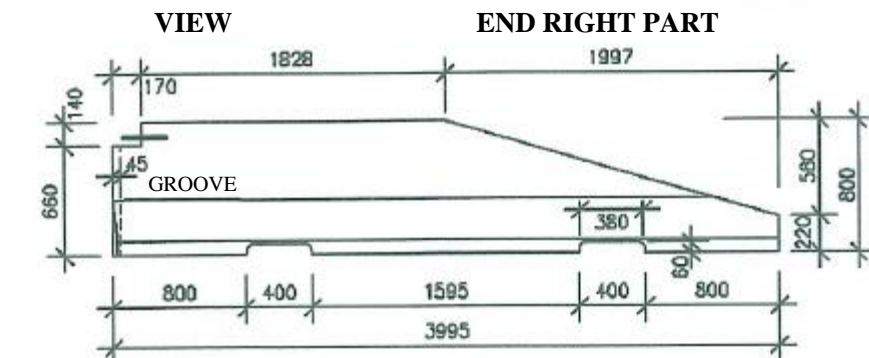
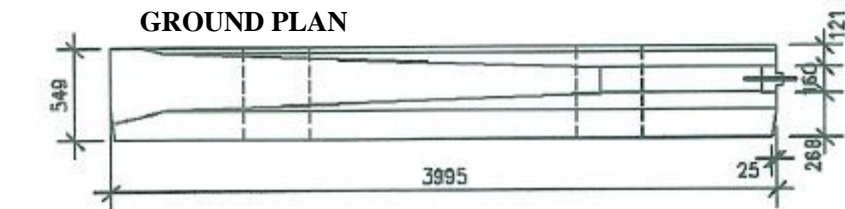
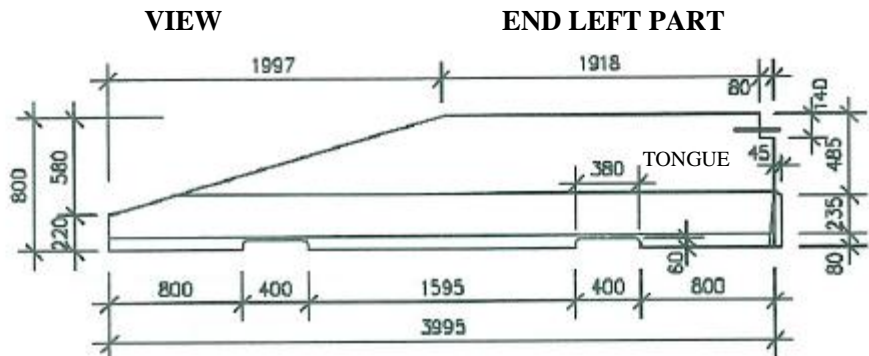
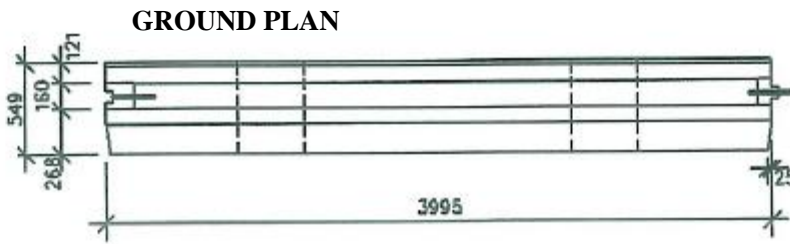
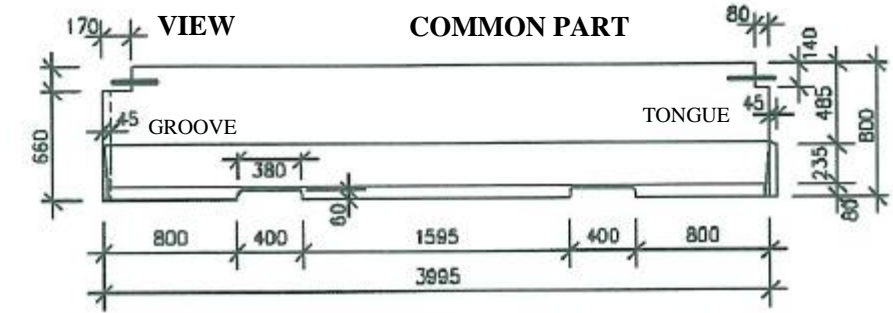
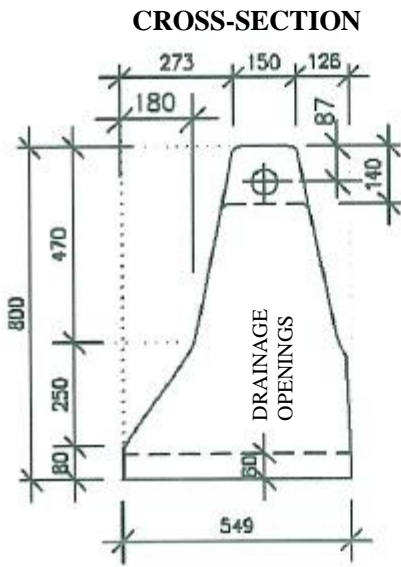


Figure 2 – Single sided concrete barrier 0.8 m height – common and end part

BARRIER BS0T08ZA400

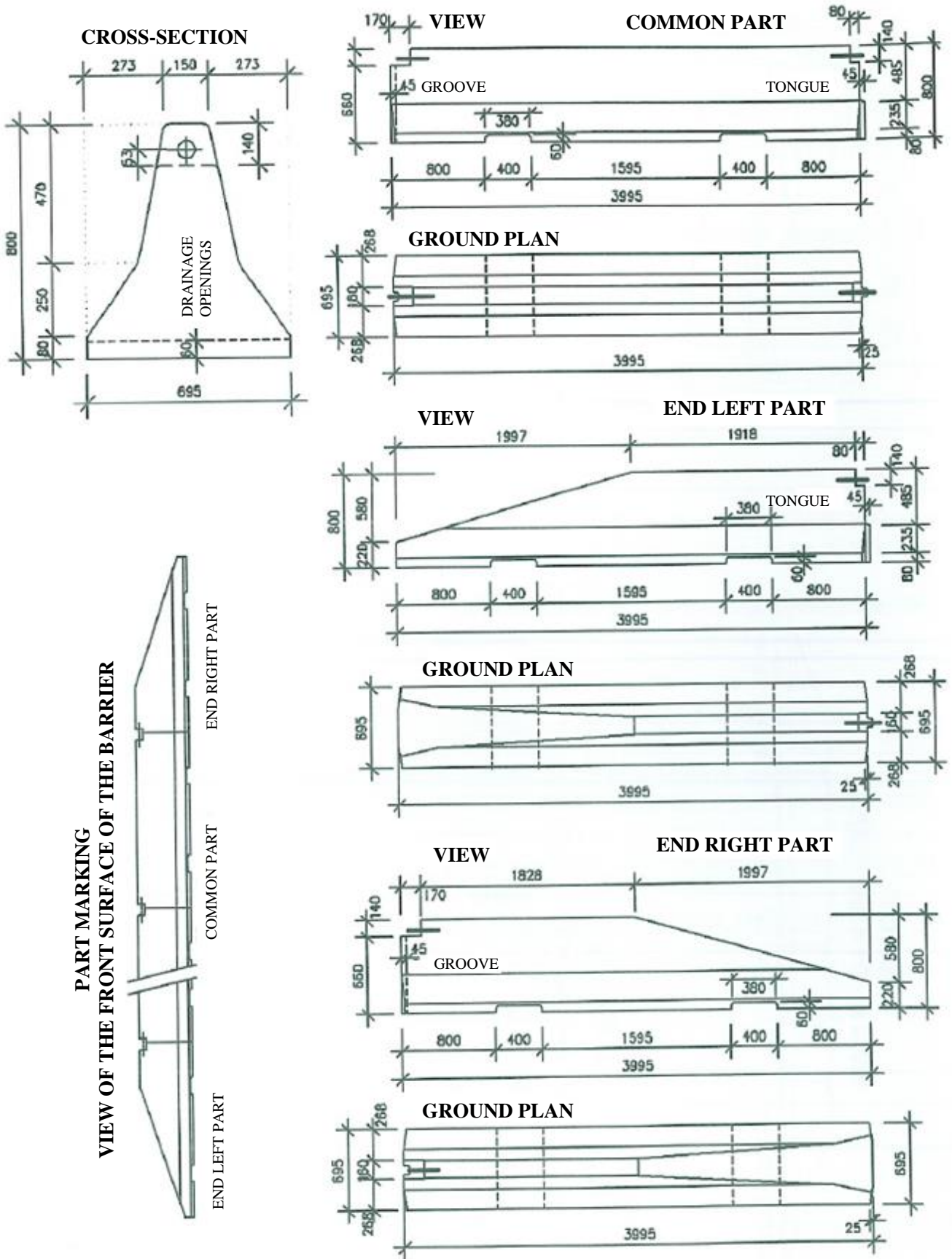


Figure 3 – Double sided concrete barrier 0.8 m height – common and end part

BARRIER BSJT10ZA400

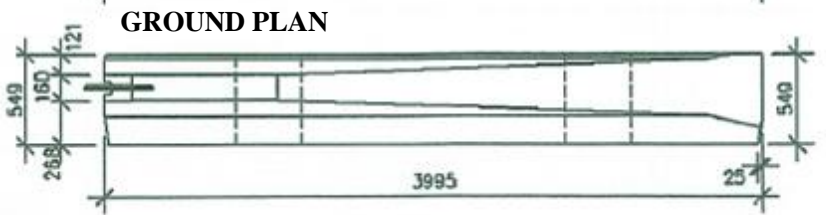
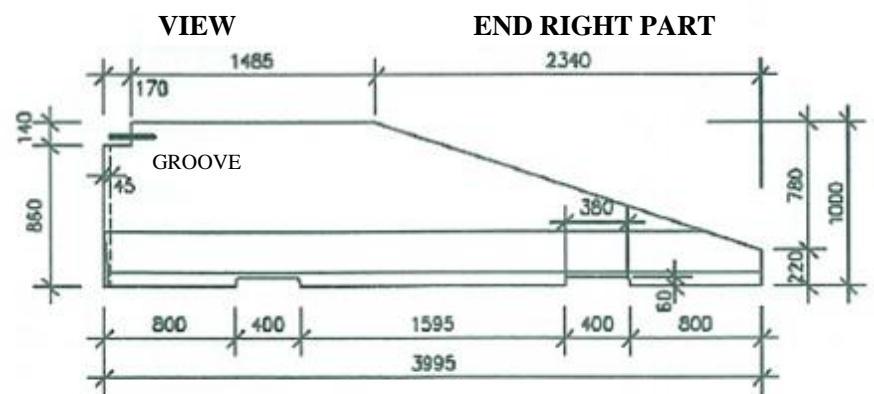
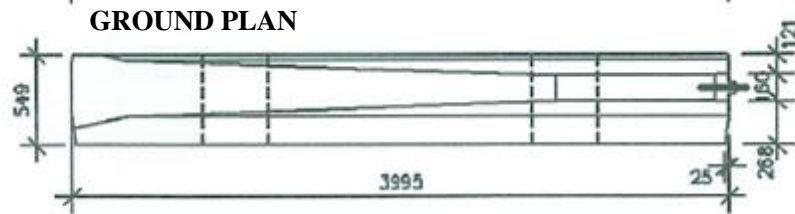
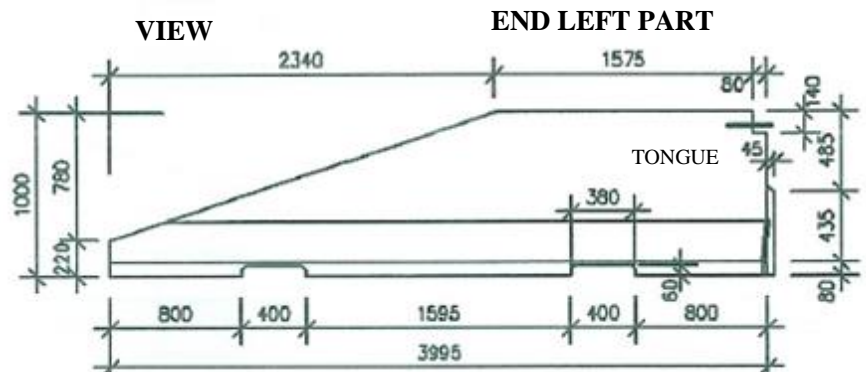
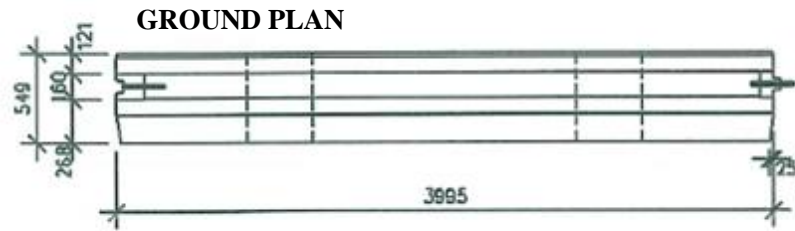
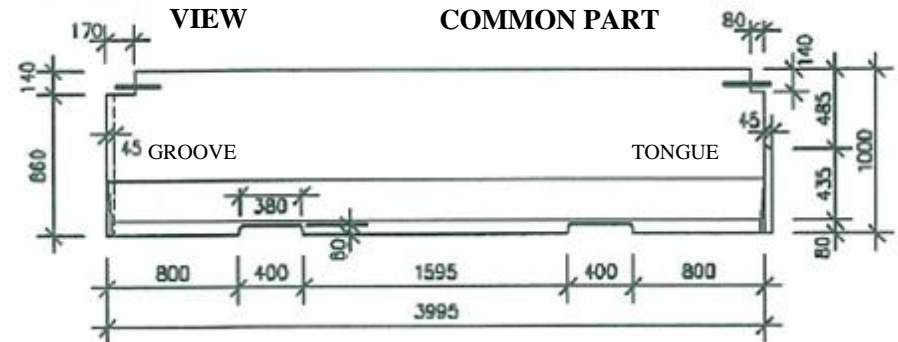
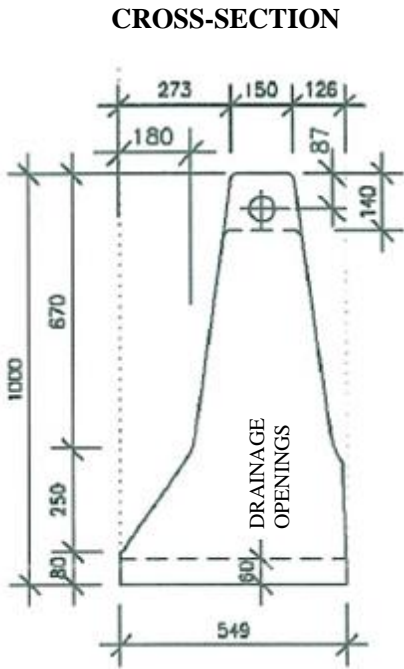


Figure 4 – Single sided concrete barrier 1 m height – common and end part

BARRIER BS0T10ZA400

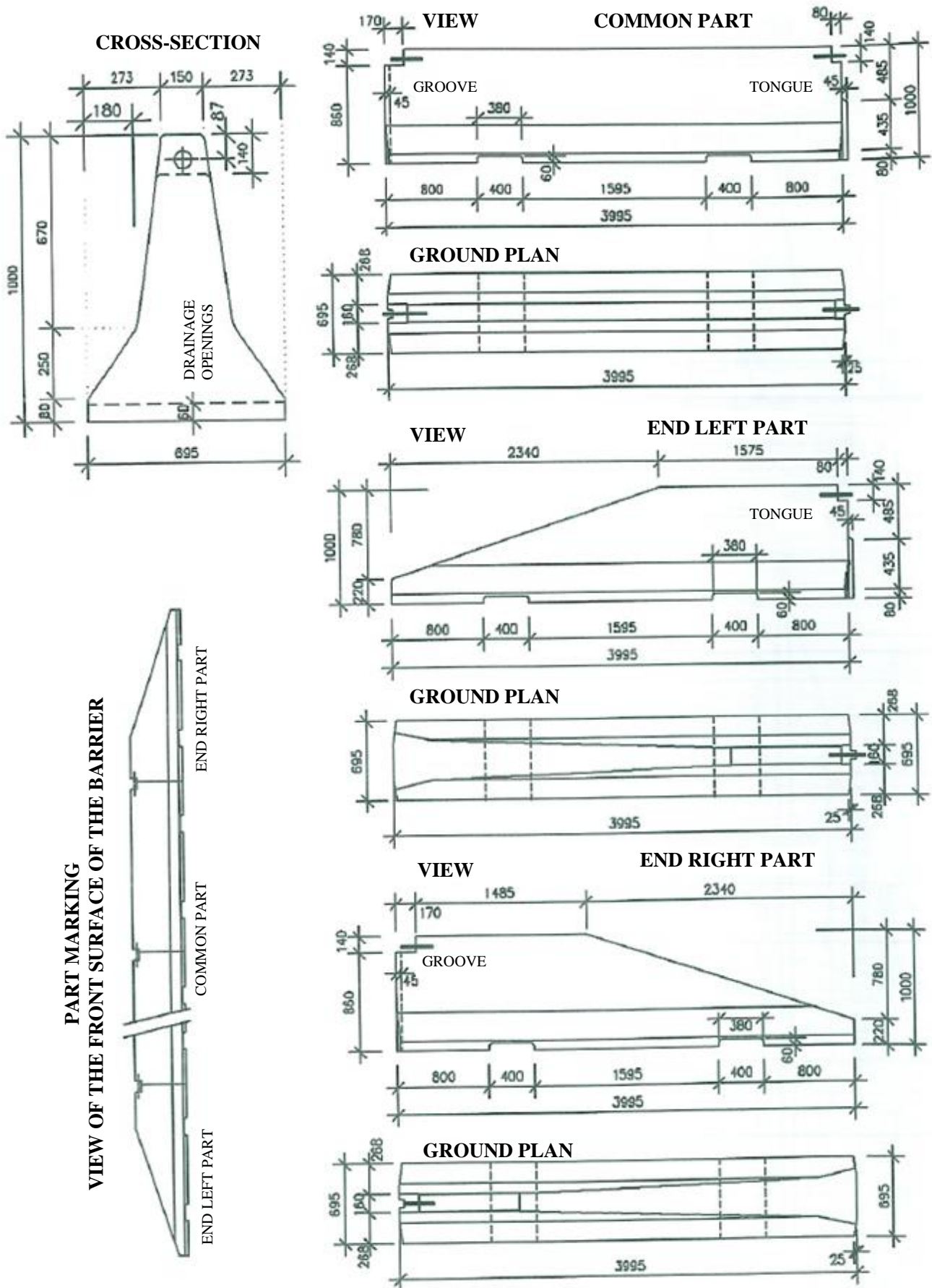


Figure 5 – Double sided concrete barrier 1 m height – common and end part

BARRIER BSJT12ZA400

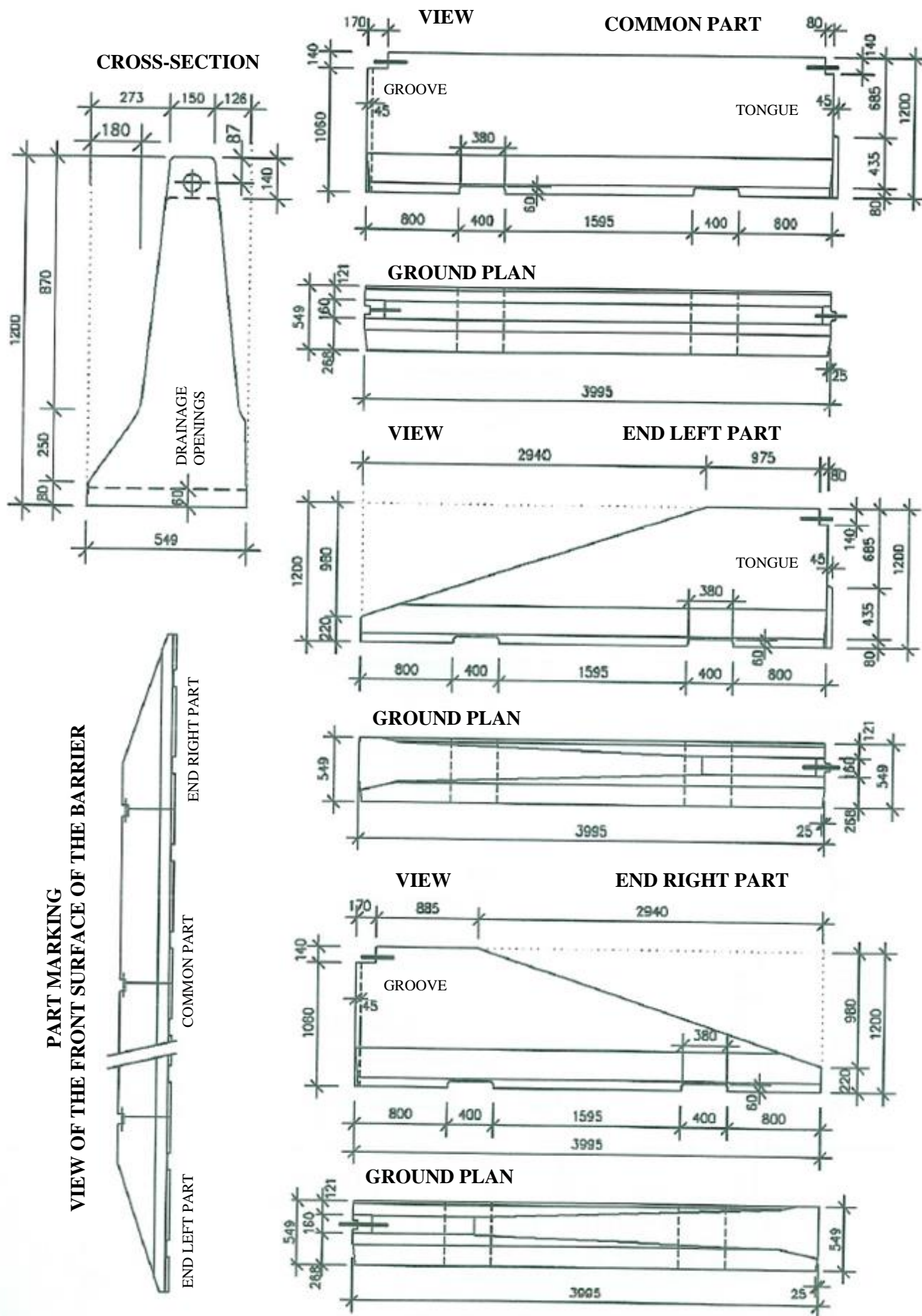


Figure 6 – Single sided concrete barrier 1.2 m height – common and end part

BARRIER BS0T12ZA400

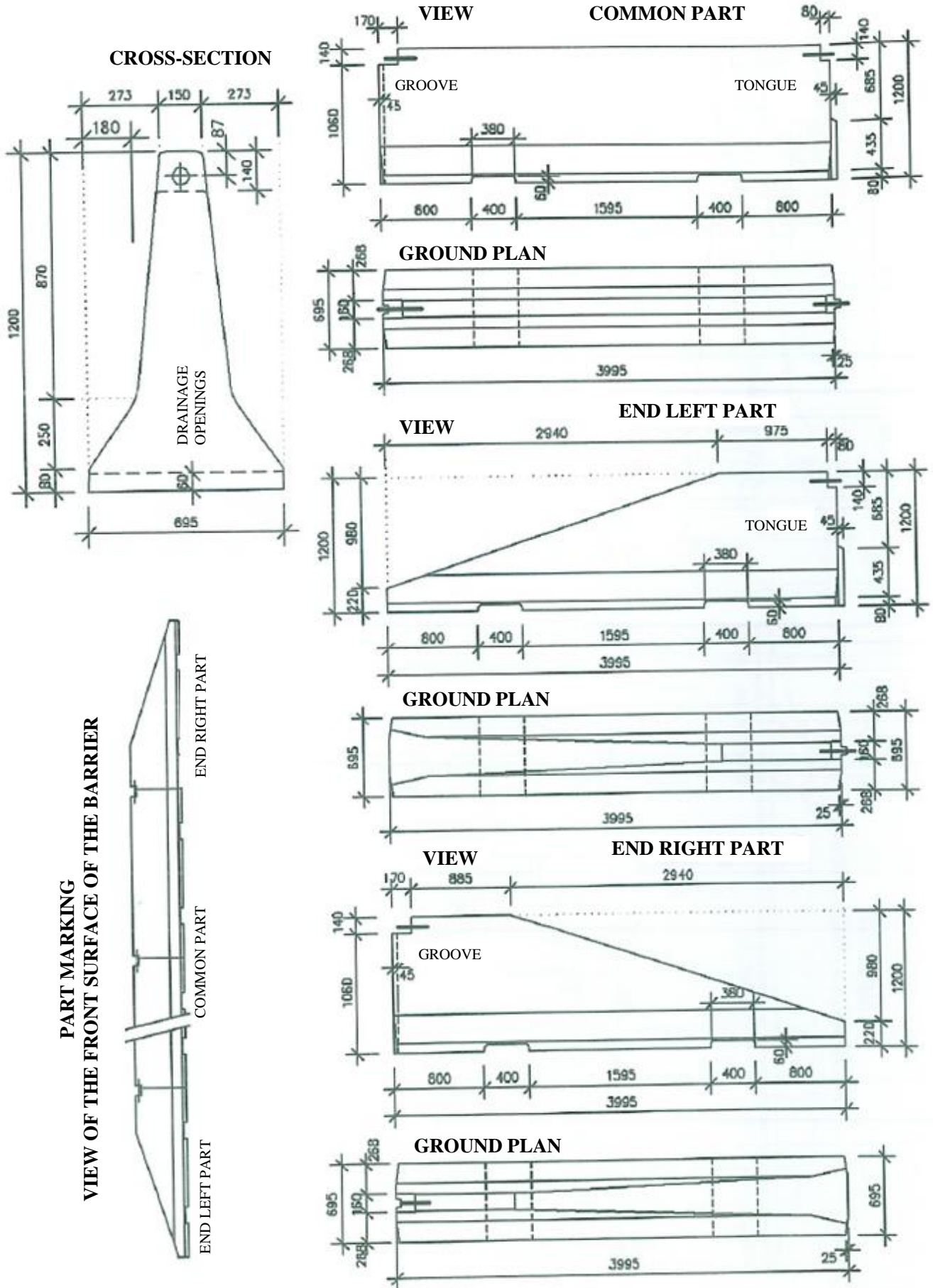


Figure 7 – Double sided concrete barrier 1.2 m height – common and end part

PART MARKING
VIEW OF THE FRONT SURFACE OF THE BARRIER

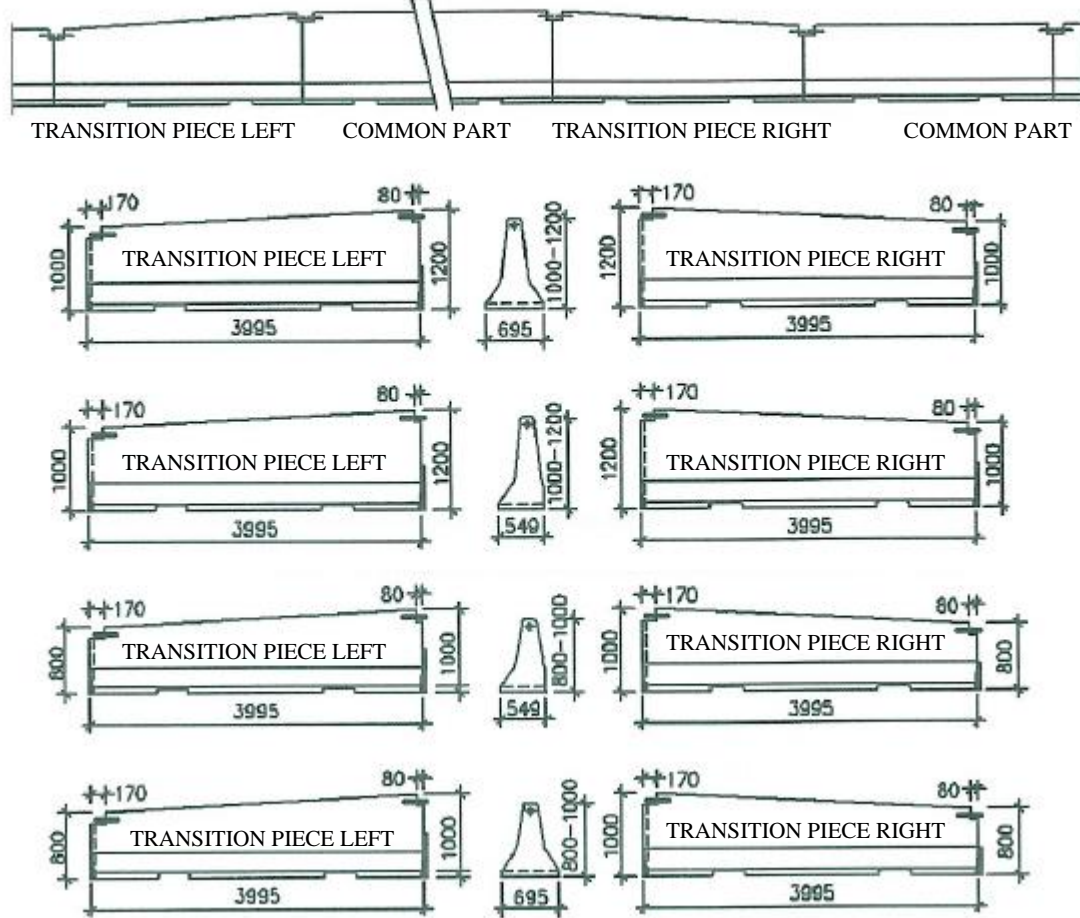
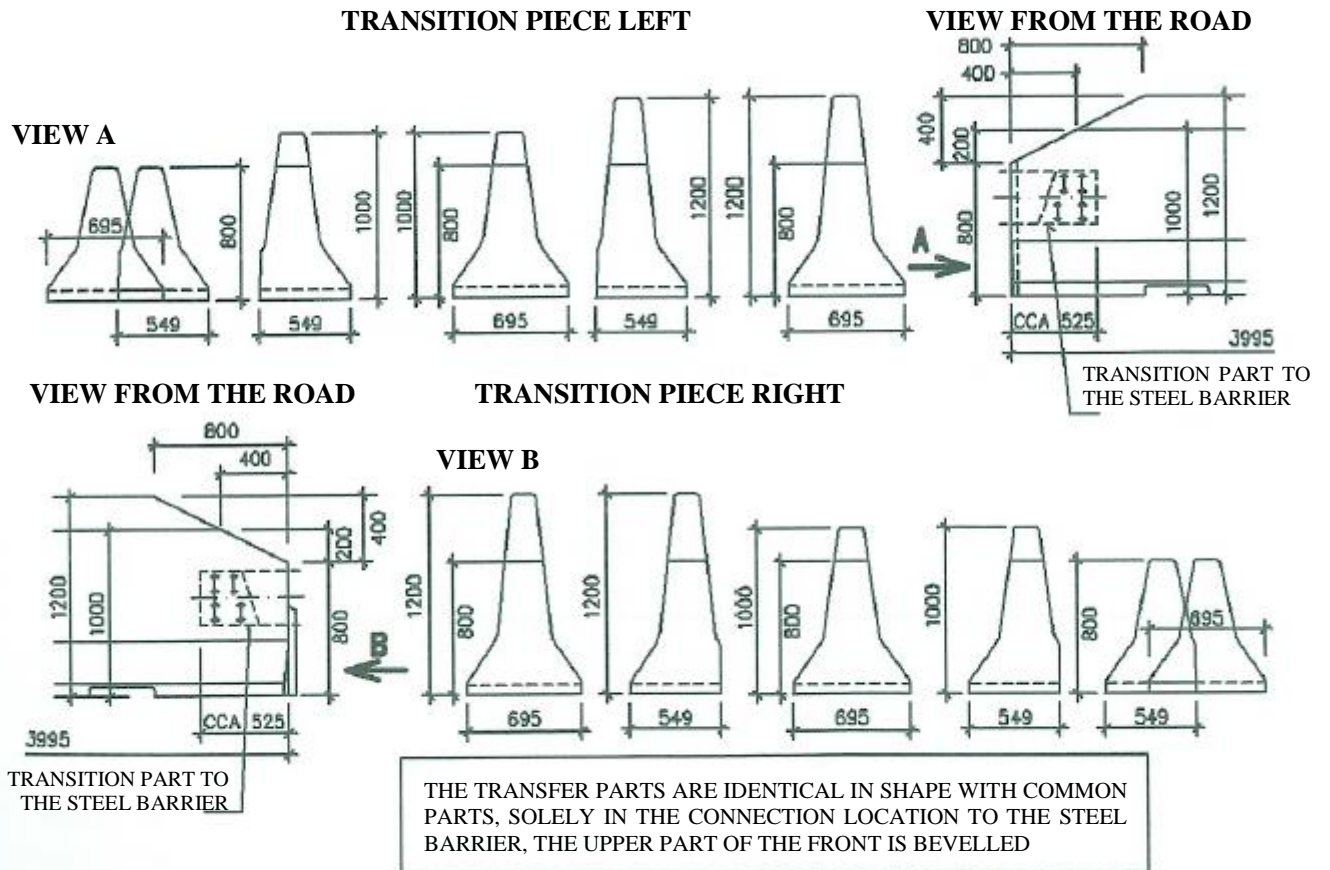


Figure 8 – Height transfer between barriers CS BETON



THE TRANSFER PARTS ARE IDENTICAL IN SHAPE WITH COMMON PARTS, SOLELY IN THE CONNECTION LOCATION TO THE STEEL BARRIER, THE UPPER PART OF THE FRONT IS BEVELLED

Figure 9 - Transfer parts to the steel barrier

4 Barriers on the roads

4.1 General

TC 114 defines the smallest possible height of the concrete barrier in some locations.

All types of barriers CS BETON have their height (and all remaining dimensions) – see fig. 2 to 7. In the implementation documentation (RDS), the PK will select a specific type which fulfils the requirements for the holding level with sufficient height as per TC 114 or as per the requirement of the project, and which is suitable for specific location of as per table 2, column “Use“ and table 3 (the table mutually comply).

4.2 Barrier location on the road side

CS BETON offers sufficient product range for the selection of the barrier in all PK locations.

Considering the holding level, the table 3 of TCM includes the data. The table in column use defines the required holding level for the barrier on the road side with width as per ČSN 73 6101.

The fitting of all barriers CS Beton (considering free road widths, reinforcement, tilts, etc.) is in TC 139.

TC 139 defines the review of concrete barrier fitting on the road side.

Double and single sided barrier can be placed on the road sides. It is impossible to define if single or double sided barrier is ideal. The decisive factor is the price and the barrier parameters, potentially the width in narrow areas.

4.3 The barrier location in the central division lane

The barriers are fitted as per TC 139. Minimum width of the central division belt for individual barriers is defined in column “use“ in table 2 of the TCM.

4.4 Reinforcement under the barrier

Regardless the required holding level, the reinforcement under the barrier is completed on un-reinforced road side and in SDP as per TC 139.

4.5 Full effectiveness and minimum barrier length

Requirements defined in TC 139 apply.

4.6 The barrier in front of the barrier and the hazard location (mountain inlets, passes)

Proceed as per TC 139.

4.7 Start and end of the barrier

The beginning and the end of the barrier must be fitted with end (start) part. The barrier can be terminated using a common part if the ending is covered with another concrete barrier so it prevents impact (e.g. for emergency stations).

4.8 Barrier at emergency station

Proceed as per TC 139.

5 Barriers on the bridges

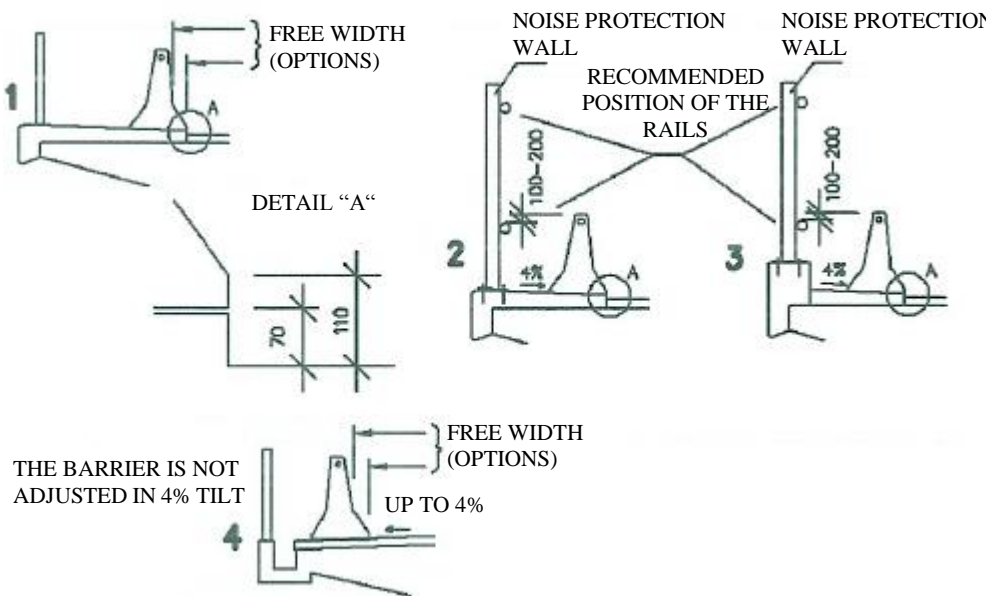

5.1 Barrier location on external bridge side

In compliance with TC 114 for the barrier height on bridges, barrier height 0.80 m is not applied on bridges.

Due to separated parts with weight above 2 kg it is possible using single sided barrier of 1 m height and double sided barrier 1.2 m on the bridges.

In compliance with TC 139, both defined barriers can be used with a gap behind the barrier (revision or public pavement, or simple gap) with the bridge railing behind or noise protection barrier as per TC 139 – see table 5.

Table 5 – The review of the barrier location on external bridge side

MARKING OF THE BARRIER	BARRIER POSITION – EXTERNAL SIDE OF THE BRIDGE
<p>IT IS POSSIBLE TO USE SOLELY BARRIER ON BRIDGES:</p> <p>BSJT10ZA400 BS0T12ZA400</p> <p>THE BARRIERS ARE ADJUSTED AS PER DETAIL “A”</p>	
<p>IT IS IMPOSSIBLE TO USE ANY OF THE BARRIERS DEFINED HEREIN</p>	

The barrier on the moulding with pavement

For the width of the pavement (revision or public) there are no restrictions (as per the railing standards it does not form solid obstacle). No minimum width of the pavement is defined in relation to the use of the barriers.

The barrier on the moulding with noise prevention wall

Proceed as per TC 139.

Barrier for moulding-free top with drainage gutter

This solution is possible solely when the bridge rails are behind the barrier – see fig. 4 in table 5. The distance between the barrier front and the rails must comply with the values defined in table 3.

5.2 The barrier location in the central division lane on a bridge

Proceed as per TC 139.

5.3 The barrier in front and behind the bridge

Proceed as per TC 139. The area just behind the moulding represents a problem considering the transverse moulding tilt (usually 2 - 4 % to the road) and transverse road sides (mostly 6 - 8 % to the road top). In these cases, it is necessary to complete atypical parts 4 - 8 m behind the moulding end, or atypical monolith to ensure continual transfer from the position of the road to the position on the bridge. Atypical part must always include the same bearing system as the produced parts, the same connection and the same reinforcement. Atypical part is processed as per the production technical documentation processed in cooperation with the bridge designer (ensure the processing) by the barrier manufacturer - CS Beton. The conditions is that the bearing system formed by the steel rod to enable the connection with the coupling (see 3.1 of TCM, so the rod ends are facing and enable the coupling assembly). Considering the view from the road, it is impossible to ensure the upper side of the barrier is at the same height as the upper edge of continual barriers on the road. Potential height difference between the barrier on the moulding and the barrier on the road must be made in atypical part, at length 4 - 8 m.

5.4 Dilating contact

The manufacturer commonly provides dilating ± 40 mm, for specially adjusted coupling. Figure 10 is the scheme of dilation. It does not require any pocket adjustment for the connection. The dilating joints in compliance with TC 139 of this type (extended coupling ± 40 mm) do not require overlapping. Dilating above ± 40 mm is resolved as per TC 139. It includes atypical detail which must be documented and provided by the barrier manufacturer within the production technical documentation in cooperation with the bridge designer. This larger dilation overlaps with the cover sheet metal as per TC 139.

**DETAIL OF THE DILATING CONNECTION
 ± 40 mm**

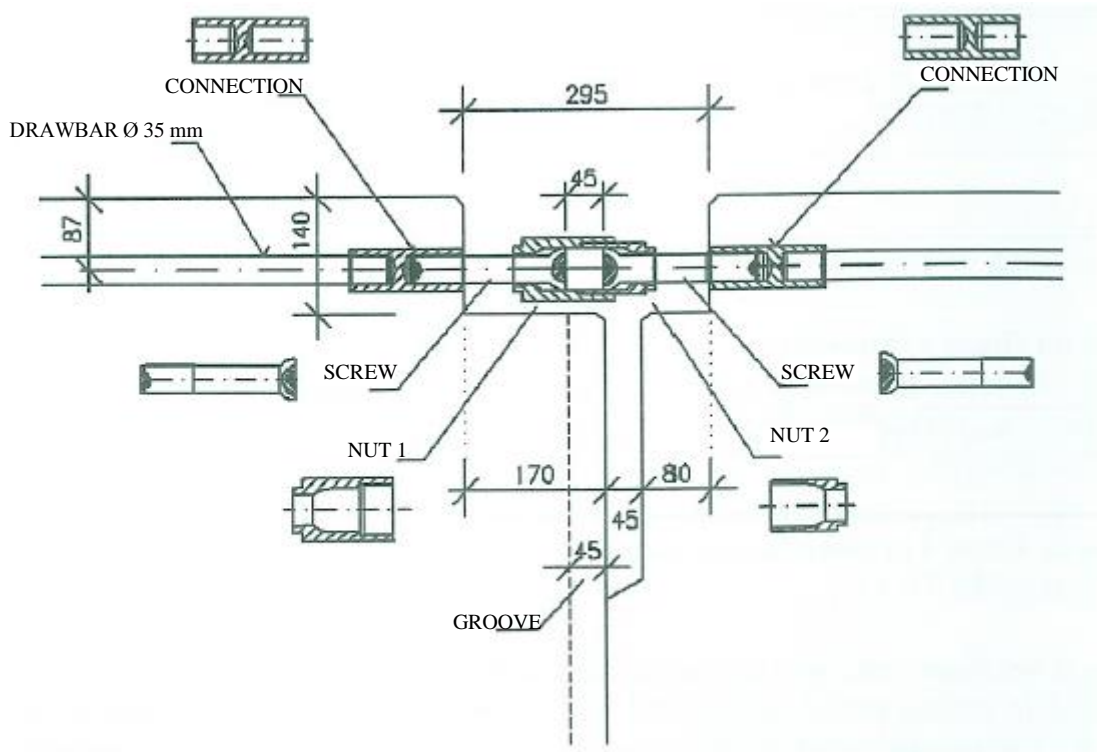


Figure 10 – Lock of the barriers – dilating connection for movement ± 40 mm

5.5 Dilating contact – electrical insulated

Electrical insulating contact at the dilation ± 40 mm (design with adjusted coupling) is performed in such way the screws and nuts 1 and 2 are fitted with electro-insulating coating (spray) - Rilsan. This prevents the current transfer to the bolt and other parts.

Electrical insulating contact at the dilation is performed as per and also as per TC 139. This is an atypical detail and the documentation will be provided by the barrier manufacturer CS Beton in cooperation with the bridge designer.

5.6 The load of the moulding and the bearing structure

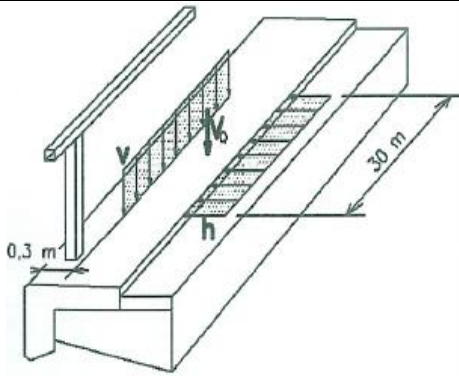






The moulding load is included in table 6. The same load applies directly to the bearing structure. The table defines the load for all barriers from CS Beton. The barriers suitable for bridges – see art. 5.1 of these TCM.

The moulding anchoring is performed based on static calculation. If the anchor is attached from the top to the bearing structure, it must include at least anchors M 20 at 2 m, even if more economic anchoring resulted from the static calculation. We assume the anchoring will be placed at least 0.3 m from the bearing structure side. The moulding anchored in the wings by means of stirrups protruding from the wing requires stirrups \varnothing R 12 at 0.40 m.

Impact on the bearing structure is low. This is extreme load.

The barrier manufacturer CS Beton notifies of the need to focus on safety PHS or the drainage gutter (if the structures are placed behind the barrier) - see TC 114.

Table 6 – Moulding load

MOULDING LOAD	MARKING OF THE BARRIER					
	SINGLE SIDE OF HEIGHT 0.8m	DOUBLE SIDE OF HEIGHT 0.8m	SINGLE SIDE OF HEIGHT 1.0m	DOUBLE SIDE OF HEIGHT 1.0m	SINGLE SIDE OF HEIGHT 1.2m	DOUBLE SIDE OF HEIGHT 1.2m
	 BSJT08ZA400	 BSOT08ZA400	 BSJT10ZA400	 BSOT10ZA400	 BSJT12ZA400	 BSOT12ZA400
HORIZONTAL FORCE h (kN/m)	5.1	5.5	6.0	6.4	6.7	7.2
VERTICAL FORCE FROM OWN WEIGHT OF REPLACED BARRIER V (kN/m)	6.4	6.8	7.5	7.9	8.3	8.9
VERTICAL FORCE FROM THE WHEEL PRESSURE OF VEHICLES V_Q (kN)	SEE TC 114					

6 Transfer to other barriers

6.1 Transfer to the steel barrier

Direct connection of the steel barrier can be completed solely by means of special reducer for direct connection to the concrete barrier. The reducers provide the transfer of vertical cross-drain to the inclined surface of concrete cross-section New Jersey shape. The reducer ends with tilted sheet metal with the same amount of openings as common connection of cross-drains.

CS BETON provides common transition parts of concrete barriers for direct connection of steel cross-drains – see art. 3.3 and 3.4 and figure 9 of TC.

Barriers CS BETON have various surface inclines for anchoring the steel barrier reducers. Sheet metal in contact with the surface must be greased with sealant before screwing. The locations where the sealant thickness exceeds 15 mm, after screwing the steel barrier, the it shapes to continual transfer to the concrete of the barrier to prevent the sharp edge (tilt 1:5 or smaller) - see detail on figure 11.

The second option is to use steel, zinc coated mats or distance rings fitted on screws (sealing or greasing is not performed), the investor must comply with the design.

Figure 11 includes the example of direct connection with steel barrier JSAM-2/H1. All details and thickness of the columns behind the concrete barrier are resolved by the steel barrier manufacturer.

The transfer from the concrete barrier to the steel barrier and vice versa is possible by a common overlap. It still applies that concrete barrier must have full height at the steel barrier height. The concrete barrier can touch the steel barrier, the gap is not required.

6.2 Transfer to concrete barriers from other manufacturers

The transfer from the concrete barrier CS BETON to concrete barrier from another manufacturer, can be completed using two methods:

- Height start overlapping. The condition is the full height of both barriers are parallel, so every PK location include full barrier height.
- Direct connections. The condition is continual height transfer and the provision of the breaking strength in the transfer location comply with the barrier load capacity with lower holding level. It is necessary to produce transfer part with lock on one side from one manufacturer and from another manufacturer on other side, the locks will be mutually connected. The transfer part is atypical and it is production technical documentation of the barrier to be connected. The condition of the solution is the consent of the manufacturers of both barriers to be connected.

7 Anti-corrosion protection

All non-built in steel construction parts are fitted with twice metal coating DELTA PROTEKT KL 100 (zinc-lamella inorganic varnish) as per ČSN EN 13858. The corrosion resistance min. 600 hours until red corrosion occurs is completed by test NSS as per ČSN EN ISO 9227.

**THE CONNECTION OF SINGLE SIDED BARRIER ARCELORMITTAL JSAM-2/H1
TO CONCRETE BARRIER CS BETON**

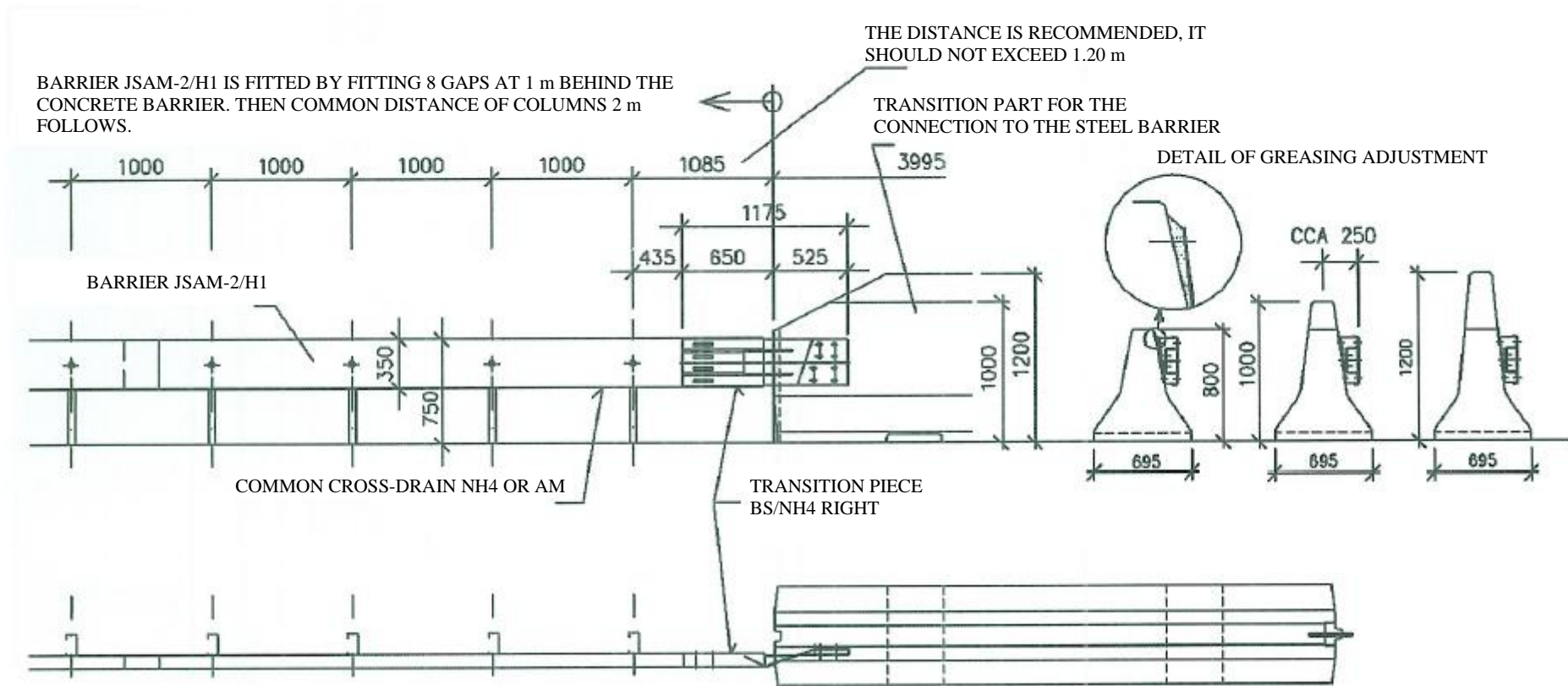


Figure 11 – Connection example of steel cross-drain JSAM-2/H1

8 Design, fitting, and maintenance

Proceed as per TC 139.

All barriers CS Beton are products as per Act no. 22/1997 Coll., and government decree no. 163/2002 Coll., therefore they are designed and it is not permitted to adjust them with the exception of adjustments as per these TCM, or enforced local adjustments - see 3.5 of these TCM. Every adjustment can be completed solely with the consent of the manufacturer.

The manufacturer supplies the assembly manual with the concrete barrier.

9 Marking

The manufacturer fits every part of the concrete barrier with identification label concreted in the front side part – see figure 12. The label size is 40 mm x 80 mm and it is made from brass.

General method is defined on the label in table 7, table 9 includes the example.

CE label – see figure 12 is a label (paper) which does not require location on the barrier but must be some accompanying documentation. The content is defined in ČSN EN 1317-5+A2.

Every part includes colour marking on one front – see figure 13 and 15.

The coupling parts are marked with stamped C letters of 5 mm height, 1 mm depth – see figure 14.

Table 7 – Marking method on the label

dd	mm	rr
CSB		
D AA BB Y		
XXXX RR		

dd mm rr (dd mm yy) – date of production, e.g. 21 04 17 means 21. 4. 2017

CSB - Producer title.

Explanation of number series marking - D AA BB XXXX RR – see table 8

Table 8 – Explanation of the number series marking

D	Type of barrier	J	Single sided
		O	Double sided
AA	Type of the barrier	12	Barrier height 1.20 m
		10	Barrier height 1.00 m
		08	Barrier height 0.80 m
BB	Type of part	ZA	Common length part 4 m
		KO	End part
		PO	Transfer part to the steel barrier
		VP	1 height transfer from 1 m to 1.2 m 2 height transfer from 0.8 m to 1.0 m
Y	Level of holding		
X	Series production number		
RR	End two-digit of the production year		

Table 9 – Marking example on the label

01	01	12
CSB		
O 12 ZA H4		
125 12		

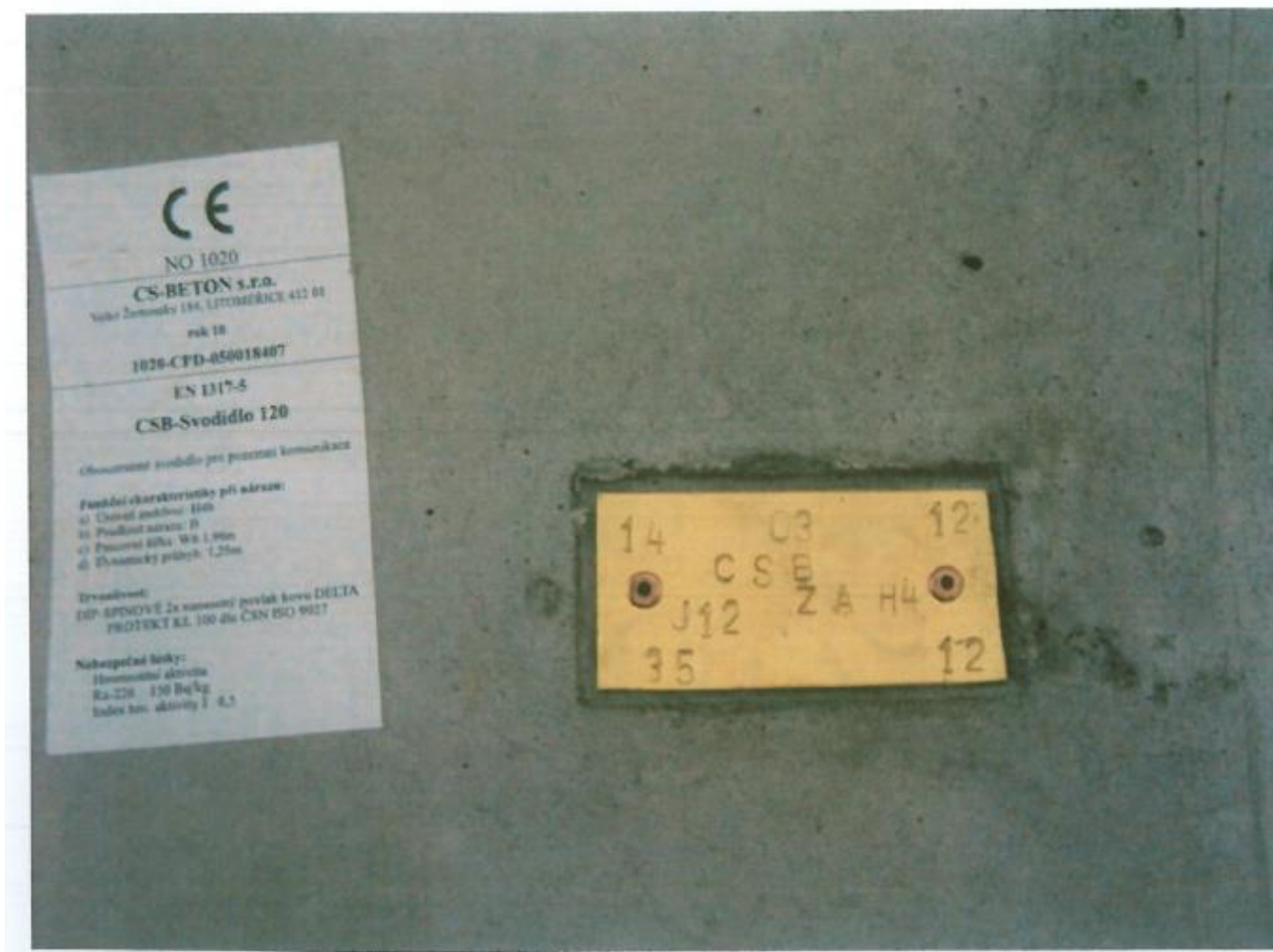


Figure 12 - CE label and brass label for concrete barrier marking CS BETON

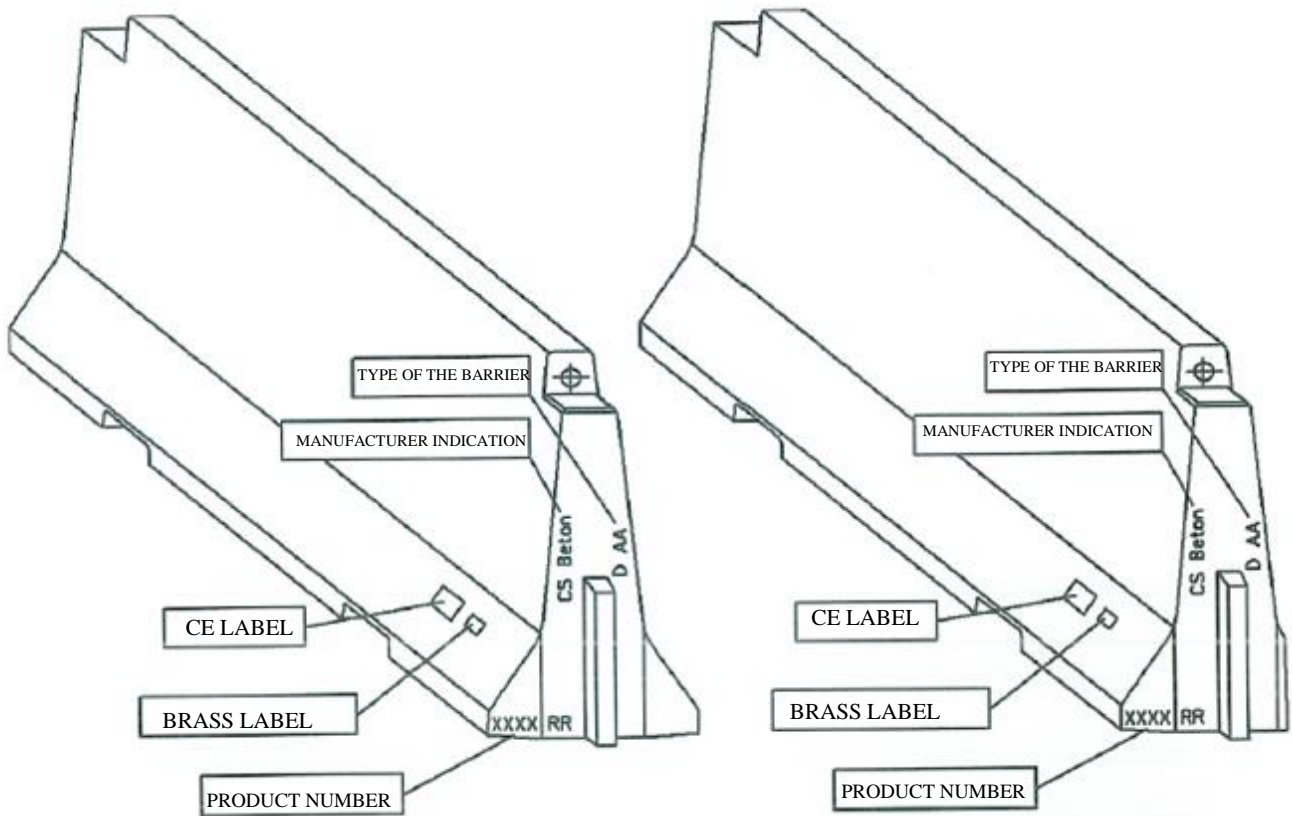


Figure 13 – Label location and barrier marking with paint on every part



Figure 14 – Marking of coupling



Figure 15 – Marking with paint on every part front

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Title: Concrete barriers CS BETON

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