**INTERIM ADVICE NOTE 24 (IAN 24)**

**USE OF TEMPORARY SAFETY BARRIERS AT ROAD WORKS**
**TD 19/85 (DMRB volume 2 section 2)**

## 1. INTRODUCTION

### Scope

1. This Interim Advice Note (IAN) provides guidance on the Highways Agency's requirements for the use of temporary barriers at road works. While any systems meeting the specific performance and installation criteria given in Table 1 are acceptable for use on the trunk road network this IAN provides guidance specifically for the temporary concrete barrier systems described in the table.

| Type of Barrier | Reference | Criteria | | | | Mandatory speed limit Km/h (mph) |
|---|---|---|---|---|---|---|
| | | Vehicle Mass Kg | Vehicle impact speed Km/hr | Angle of impact degrees | Impact severity level | |
| Temporary Vertical Concrete Safety Barrier | TVCB(**80**) | 1500 | 80 | 20 | B | 80(50) |
| Temporary Vertical Concrete Safety Barrier | TVCB(**110**) | 1500 | 113 | 20 | B | 113(70) |
| Temporary Higher Vertical Concrete Safety Barrier | THVCB | 30000 | 65 | 20 | B | 113(70) |
| Temporary Higher Vertical Concrete Safety Barrier (Free-standing) | THVCB(**f**) | 30000 | 65 | 20 | B | 113(70) |

**Table 1.**

### Traffic Management

2. The Specification for Highway Works (SHW) requires that traffic management at road works be in accordance with Chapter 8 of the Traffic Signs Manual. The basis of Chapter 8 is on directing traffic through road works using delineators and safety zones rather than the use of restraint systems. No advice is thus given on the provision of temporary safety barriers and their use is therefore a departure from standards requiring approval by the Overseeing Organisation.

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**Use of Safety Barriers at Road Works**

3. The safety of the workforce has with the introduction of the Construction (Design and Management) Regulations (CDM) become the responsibility of all parties involved in a project not just the contractor. In particular the designer has a duty to ensure that the design can be constructed, maintained and demolished safely. For road works this is interpreted as a need to ensure that the workforce and the road user can interact safely. In some circumstances the designer may therefore include temporary safety barriers in the contract documents while for other projects any provision will be for the contractor to decide depending on his assessment of risk and the methods of working to be adopted.

4. The traffic management layouts in Chapter 8 of the Traffic Signs Manual do not indicate the use of temporary safety barriers in contra-flow working. The installation and operation of the barriers themselves can cause difficulties and their use should only be considered where contra-flow working is expected to be in place unchanged for periods in excess of 28 days. This will enable the risks arising from the installation to be balanced out by the protection provided to road users from cross over accidents. However where features such as sharp bends or adverse camber are encountered that could increase the likelihood of cross over accidents their use should be considered for shorter operational periods.

**Implementation**

5. The requirements and guidance given in this IAN shall apply to all road works where TVCB or THVCB are to be used whether included in the contract documents or proposed by the contractor. The use of a particular barrier system must take into account the prevailing mandatory speed restriction, the permissible deflection and the appropriate vehicular impact load and angle.

## 2. TEMPORARY VERTICAL CONCRETE BARRIERS

**Use of TVCB to protect the works/workforce**

1. Where a works site is adjacent to a carriageway open to traffic the use of TVCB can provide both the works and the work force with a level of protection from errant vehicles which cones are not able or intended to provide.

2. TVCB are an expensive form of protection and are not easy or quick to install. Situations where their use should be given serious consideration, subject to a risk assessment (see Chapter 4 below) being undertaken, are:

   - where there is a high risk of injury to the travelling public if they run into the work zone (such as a traffic lane adjacent to excavations more than 300mm deep);
   - wherever a substandard highway feature, such as a sharp bend, would suggest an additional risk of an errant vehicle running into the work zone;
   - adjacent to scaffolding or temporary access works where workers would be unable to take evasive action; and

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- adjacent to temporary bridge or other supports more than 4.5 metres from the edge of the traffic lane which may have a low resistance to impact and where the consequences of such an impact would be severe; **where temporary bridge supports are 4.5 metres or less from the traffic lane, a 1.2 metre higher containment vertical barrier (THVCB) must be used (see Fig 1).**

3. **TVCB(80) must only be used where there is a mandatory speed limit (permanent or temporary) of 50mph or less. It must not be used on roads with a permanent speed limit greater than 50mph to protect short sections of work that can be carried out without closure or restriction of any of the running lanes as the imposition of a 50mph limit in such circumstances is contrary to Chapter 8 of the Traffic Signs Manual and against police advice. If, in these circumstances after undertaking a risk assessment, it is considered necessary to provide protection over a short length, e.g. for the replacement of a bridge parapet, then TVCB(110) or THVCB must be used so that no temporary speed restriction is required.**

**Installation requirements**

4. The foundation shown in the draft HCD must be provided for TVCB to function safely.

5. Tests on TVCB show that an impacting vehicle causes some lateral movement of the precast units at 50mph with a significantly greater movement at 70mph. The HCD require, with a 50mph speed limit in operation, a safety zone clearance at the rear of the TVCB of 500mm to the edge of the work area on a level hardened surface. This should be maintained and clearly defined, for example, by a white line painted on the ground or by cones/cylinders with intermediate marker tape. Where a 70mph speed limit will operate the safety zone clearance should be increased to not less than 600mm. The appropriate safety zone clearance must always be retained.

6. With a 50mph speed limit the desirable speed limit setback between all types of TVCB and the adjacent traffic lane is 600mm, although this may be reduced to not less than 375mm minimum. Where there is a 70mph limit the desirable setback is 1000mm, which may be reduced to not less than 600mm minimum.

7. The TVCB installation must commence not less than 39m before the work zone to be protected and extend at least 21m beyond the end of the work zone. Where two way traffic flows occur the TVCB installation should extend at least 39m each side of the work zone. Where adjacent to two way traffic, both ends of the TVCB installation shall be flared away from approaching traffic to reduce the chance of vehicles impacting with the end of the barrier or getting behind it and entering the works area.

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8. Precast TVCB(80) units are 0.8 metres high, 3 metres long and weigh about 2.5 tonnes each and must be connected together as shown in the drawings. They should not be placed so that they create a hazard e.g. an “approach” end of the barrier that is not flared off presents a square end for errant traffic to hit. A series of short lengths increases the risk of an errant vehicle colliding with the end of a barrier.

9. TVCB(110) is a specially strengthened version of TVCB(80) which utilises the normal precast concrete units. It requires the use of M24 Grade 8.8 fasteners with special 10mm thick washers in the scarf joints in place of the normal bolts used with TVCB(80). In addition 20mm thick shear keys must be used in the tops of the units to join them together.

10. Where a series of lengths of TVCB are in close proximity, each length should be either flared off at the approach end(s) or the gaps closed to form a continuous length. The full layout for approach coning, etc is required but cones must not be placed in front of the traffic face of TVCB, except where they are located more than 2m from the edge of the adjacent traffic lane.

11. The TVCB layout must be designed to take into account works vehicle access-egress arrangements while avoiding the problems described above. Works entrances and/or exits should be a least 500m apart.

12. Where circumstances are such that the ends of the TVCB cannot be flared away from the approaching traffic they must be protected by 4m of shoulder to shoulder cones. The cones should be placed so that the base of the conical section is 150mm proud of the face of the TVCB on the traffic side.

13. It may be necessary to attach small reflectors to TVCB units to increase their visibility in poor light conditions. These can be attached either to the top of the units by means of flexible wands or near to the top on the traffic face.

14. TVCB(110) is not particularly flexible and is therefore only suitable for use where there is a relatively straight horizontal and/or vertical alignment

**TVCB in contra-flow buffer zones**

15. TVCB can be used in the 1.2m wide contra-flow buffer zone, instead of the usual cylinders, between lanes of traffic travelling in opposite directions. The benefits of this arrangement are a reduced requirement for maintenance of the buffer zone and a possible reduction in injury from cross over accidents. These benefits, however, must be weighed against the increased risks to road users during installation, the costs of delays and the high cost of providing TVCB throughout long lengths of contra-flow.

16. To install and remove a length of TVCB may in some situations require a complete closure of the carriageway, but generally it can be installed during off-peak periods with special traffic management procedures.

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17. Reinforced, slip-formed, surface mounted, concrete barrier with a similar profile to the precast TVCB may be an option where a long length is required that is to remain in place for a considerable period. Contractors should not be restrained from this choice without a good justification.

18. In addition to the traffic management necessary for the installation and removal of TVCB used for contra-flow, the following conditions apply:

- 50mph mandatory speed limit to be enforced;
- the buffer zone must not be less than 1.2m wide to allow a minimum of 375mm from the barrier to each adjacent traffic lane;
- the ends of the barrier must be continued beyond the end of the contra-flow into a coned off area where they can be flared away from the approaching traffic so as to reduce the risk of traffic impacting the ends;
- consideration should be given to the means by which the emergency services and recovery vehicles can attend to accidents or breakdowns within the contra-flow. It should be remembered that the extent to which an incident on one side of the barrier can be dealt with by vehicles and personnel on the other will be severely limited.
- where a works site has through traffic passing on both sides there could be a need to retain an emergency access through the works site. It may be desirable to provide emergency openings, at intervals not closer than 500m, from a works area where long work sites are contemplated. Individual barrier ends should be flared away from the approaching traffic or protected by cones where this is not possible;

## 3. TEMPORARY HIGHER VERTICAL CONCRETE BARRIERS

### Use of THVCB

1. THVCB may be slip-formed or precast and are designed to contain and redirect a 30 tonnes vehicle travelling at 40mph (64kph) and at 20$^{o}$ approach angle.

2. THVCB provides temporary protection to vulnerable structures such as bridge supports, which are 4.5m or less from the adjacent traffic lane (see Fig 1). Where there is a clearance of 1m or more, for a vertical height of at least 3m (measured from the adjacent carriageway level) between the temporary support and a line projected vertically from the back of the THVCB, then the temporary support does not need to be designed to resist collision loading (see Fig 2). However with a clearance of less than 1m then the temporary support must be designed to cater for the residual collision load component (see Fig 3) as given in BD 60 Table 1 (DMRB 1.3.5). The bases of the barrier and the temporary support must be at least 200mm apart to minimise the possibility of any collision loading on the barrier being transmitted directly to the temporary support.

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3. Where temporary supports are to be more than 4.5m from the edge of the adjacent traffic lane there are no requirements to provide protection against collision loading. However, in view of the low resistance of many temporary structures to collision loading, consideration should be given to the risk of an impact occurring and to its consequences. Where a risk is identified, but the consequences of impact are not significant, it may be appropriate to provide a reduced level of protection, such as TVCB(110).

**Installation Requirements**

4. The foundations shown in the draft HCD must be provided for THVCB to function safely.

5. THVCB units are 1.4 metres high and must project 1200mm above the carriageway. THVCB requires the use of M24 Grade 8.8 fasteners with special 10mm thick washers in the scarf joints. In addition 30mm thick shear keys must be used in the tops of the units to join them together. The units must be located in a 200mm deep trench in the structural carriageway to provide adequate lateral restraint. The method of locating and securing these must take into account factors such as retaining the integrity of bridge deck waterproofing.

6. An alternative, free standing, surface mounted arrangement, THVCB(f), has been tested which uses a double row of THVCB units with their joints staggered by 1.5m. This may be used where it is undesirable to form a slot in the carriageway or there is insufficient depth to form the 200mm deep groove. The row of units away from the traffic face are not bolted through the scarf joints but they must have shear keys in the tops of them.

7. The THVCB installation must commence not less than 30m before the structure to be protected and extend at least 12m beyond. The THVCB must have TVCB(80) or TVCB(110), depending on the prevailing mandatory speed limit, at the leading and trailing ends in accordance with the HCD. The leading 9m of the barrier must be flared away from the traffic lane and secured to the road surface on the non-trafficked carriageway side of the barrier. It should not present a hazard to vehicles or works, e.g. projecting studding or bolts should not be used.

8. THVCB is not particularly flexible and is therefore only suitable for use where there is a relatively straight horizontal and/or vertical alignment.

## 4. JUSTIFICATION FOR USE OF TVCB AND THVCB

1. The use of TVCB (and/or THVCB) can contribute to the overall safety of both the workforce and the road user. However such provision may be at a significant cost and before designers decide to include barriers in the contract documents a risk assessment and cost benefit analysis must be undertaken. This should consider the following:

   - cost of providing, maintaining and removal of the barrier over and above the cost of normal traffic management using cones and traffic delineators;

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- where THVCB is to be used whether it should be surface mounted or inset into the carriageway;

- delays and accident risk to road users from the installation and removal of the barrier over that of normal traffic management;

- in a contra-flow situation the extra delays to road users from the additional time taken to remove broken down or damaged vehicles due to restricted access;

- reduced cost of maintenance over normal traffic management using cones and/or traffic delineators;

- savings in personal injury accidents to road users from the use of TVCB;

- savings in possible injuries to the workforce;

- savings in the cost of disruption and repair where a structure may be impacted;

2. In addition to the above the time the barrier will be in place, the availability of precast units, the road cross section, alignment and drainage, traffic speed and flows need to be considered. The use of barriers may also add to the construction cost by making access to the works more difficult or restricting the way in which the works can be built, particularly if an emergency lane has to be kept clear. In all cases it may be helpful to obtain the views of the police and possibly the other emergency services.

3. Where it is considered that the provision of a TVCB (and/or THVCB) is justified the requirement to provide the barriers should be written into the contract documents. Where barriers have not been included in the contract they can still be provided by the contractor at his expense subject to the approval of the Overseeing Organisation.

## 5. MONITORING

1. In order to gain more data on the benefits or otherwise of providing temporary barriers project managers are asked to monitor the numbers of accidents/injuries in relation to traffic flows for schemes where it is used. On completion of the works the results should be forwarded to QS TSE Room 4/34 St Christopher House.

## 6. CHECK LISTS

1. The following are the main factors that need to be considered when using temporary barriers at road works:

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- Speed limits both existing and proposed.
- Containment level required.
- Type of barrier and construction.
- Length of barrier.
- Road cross section – pinch points, set back, clearance, headroom etc.
- Sight lines.
- Drainage of carriageway.
- Ground support.
- Clearances for operation and construction.
- Other vehicle restraint systems in vicinity of the works.
- Access arrangements for works vehicles
- End of barrier details to ensure vehicles cannot pass behind into the work zone.
- Traffic movements approaching the barrier.
- Where applicable the effect of a barrier on movement of pedestrians, cyclists etc.
- Obstructions that could effect barrier – lighting columns, signposts etc.
- Access arrangements for emergency vehicles.
- Requirements for temporary signing.
- Traffic management for installation of barriers.
- Compliance with HCD details.

2. The following information should be included in submissions for a departure from standards for the use of temporary safety barriers:

- General arrangement drawings showing the proposed layout of the barriers including a location plan, dimensioned cross section of the road, direction of traffic flow, highway obstructions, other vehicle restraint systems in locality and access arrangements.

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- Speed limits – permanent and temporary during duration of the works.
- Justification for use of barriers.
- Other relevant factors.
- Copy of Form 277 (if available) for barriers protecting structures.
- Relevant site photographs if available.

## 7. FURTHER INFORMATION

1. Draft drawings giving details and layouts of TVCB and THVCB are available from QS TSE Room 4/30 St Christopher House.

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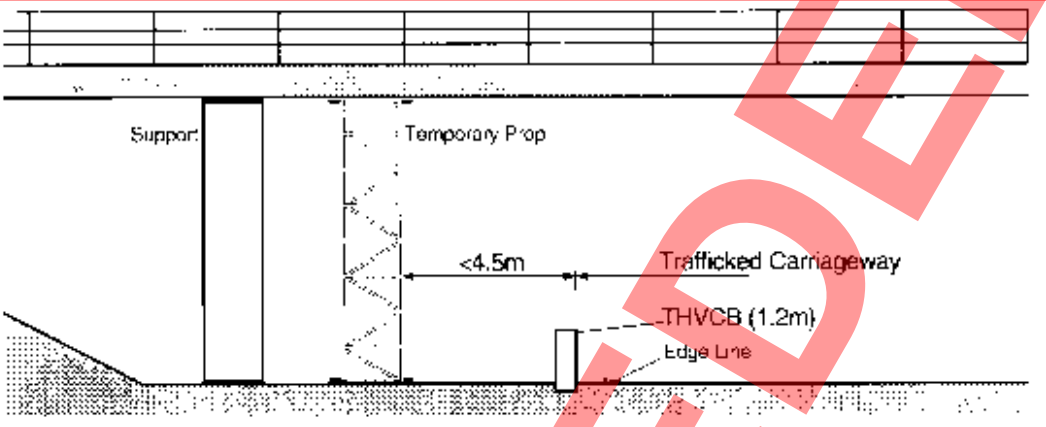



FIG 1 - TEMPORARY SUPPORT LESS THAN 4.5m FROM EDGE OF TRAFFICKED CARRIAGEWAY

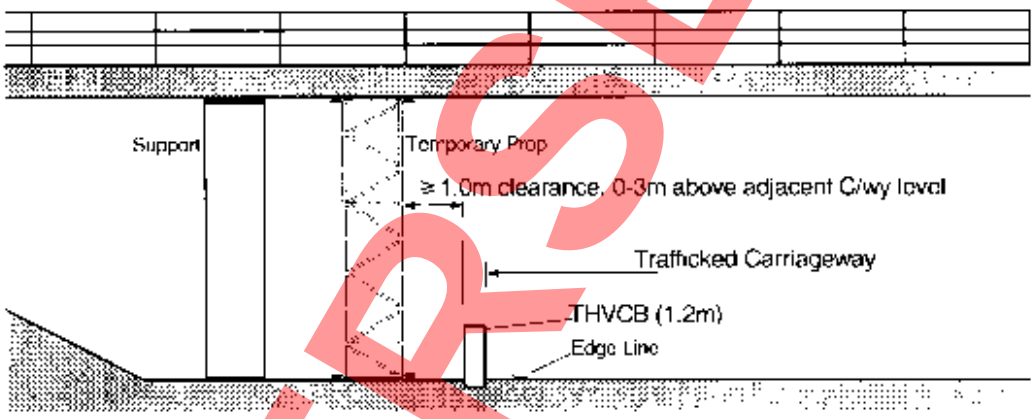
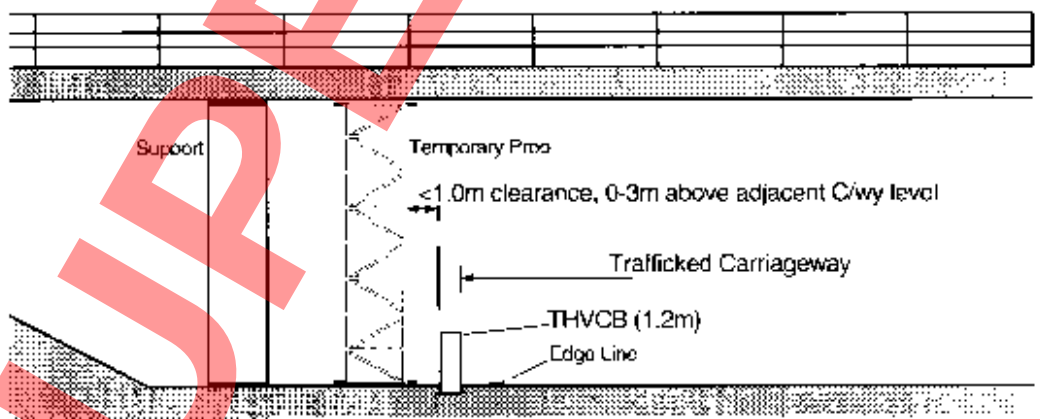



FIG 2 - TEMPORARY PROPPING - NO COLLISION LOADING REQUIREMENT




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