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5 LEVEL CROSSINGS

5.1. THE PRINCIPLES

Principle 5.1 Safe for users and trains

Where a right of way crosses the railway at track level, safety arrangements commensurate with the level of risk at that place should be determined and provided.

Principle 5.2 Information to users

Sufficient and appropriate information to enable crossing in safety should be presented to users.

Principle 5.3 Safe crossing place

The actual crossing place should be of adequate width, surface quality and profile for all reasonably foreseeable users to cross in safety.

5.2. GENERAL GUIDANCE

5.2.1. General description

- 5.2.1.1. This section gives general guidance on the positioning of, and equipment that applies at, all types of level crossings.
- 5.2.1.2. The guidance is applicable when alterations are made to the protection arrangements at existing crossings. When alterations are made at a public road level crossing, the protection arrangements are described in and authorised by a Regulation Order made under the relevant sections of the appropriate level crossing transport act.
- 5.2.1.3. Each level crossing should have a unique reference number (see Figure 13 of section 5.20-Road Signs), normally displayed on each side of the crossing. The crossing name may also be added.

5.2.2. Structure of the guidance

- 5.2.2.1. This level crossings section:
 - a) establishes the crossing types and the conditions for suitability;
 - b) provides general guidance applicable to each type of crossing;
 - c) gives specific details of signalling and crossing controls for each type of crossing; and
 - d) provides guidance on carriageway aspects and crossing equipment and signs.

5.2.3. Positioning of level crossings

- 5.2.3.1. The positioning of a crossing and its associated signalling arrangements should ensure that, during normal working, no part of a stationary train should stand obstructing the crossing. The proximity of a station to a level crossing may mean special arrangements are necessary.
- 5.2.3.2. A risk assessment should be made to determine the relative positioning of a crossing and its associated protecting signals, if provided. It should take into consideration the likelihood and consequences of a train passing the signals without authority. If it is not reasonably practicable to achieve the optimum positions, appropriate measures should be provided to reduce the potential risk to an acceptable level.
- 5.2.3.3. Where a crossing traverses electrified lines, additional measures are needed to protect road users. See section 5.19 for the positioning of the appropriate warning signs and section 3 Electric Traction Systems.

5.2.4. Equipment at level crossings

- 5.2.4.1. All equipment and controls used for the operation of crossing equipment should be designed and documented to appropriate safety standards. All crossing equipment should be installed clear of the railway structure gauge and at least 450mm clear of the edge of the carriageway.
- 5.2.4.2. At all automatic crossings, an alternative power supply should be provided to allow the crossing equipment to function fully under normal operating conditions in the event of the failure of the main power supply for a period of up to 12 hours. This will ensure the safe operation of the crossing until the main power supply is restored or an alternative arrangement is put in place.
- 5.2.4.3. Where trains run after dark, illumination of the crossing may be provided to ensure its safe operation. If the road approaches to a crossing are lit, the crossing should be illuminated to at least the same standard. Any lighting should not cause glare to either road users or train drivers, interfere with the visibility of railway signals nor cause avoidable annoyance to local householders.

At crossings which are locally monitored by the driver of an approaching train, additional lighting may be necessary to enable the train driver to see that the crossing is unobstructed from the point at which the driver may have to brake the train.

- 5.2.4.4. Any failure or damage to the equipment at a level crossing, which may lead to incorrect or unsafe operation, should be evident to the control or monitoring point or the user of the level crossing within a reasonable time of the occurrence.
- 5.2.4.5. References to regulations or directions in this section are to the Traffic Signs Manual (TSM). The legal framework for traffic signage (including signs, devices, notices and markings) is contained in the Road Traffic Acts. Where references in this document to the Road Traffic (Signs) Regulations, 1997 and 1998 they will be quoted as being included in the Traffic Signs Manual (TSM) issued by the Department of Transport (DoT). References to sign figure numbers are to figures in this Manual.

Note: Some Iarnród Eireann specific signs are referenced in this guidance and included as examples in Section 5.20. A review of the TSM and associated regulations is due to be completed in 2003. This guidance will be updated following that review.

5.2.5. Effects on existing level crossings

- 5.2.5.1. Where new or altered level crossings might introduce incompatibilities or inconsistencies with adjacent or nearby crossings, appropriate arrangements should be made to address any safety implications which may include modifications to the existing level crossings.

5.2.6. Operating conditions

- 5.2.6.1. The choice and design of the level crossings will depend not only on the guidance expressed in this document but also on the operational requirements of the railway.
- 5.2.6.2. To ensure that the level of protection afforded by the crossing is adequate and appropriate, an assessment of the suitability of the type of crossing at the location concerned should be made:
- a) whenever circumstances at the crossing are to change (e.g. rolling stock, signalling, electrification, speed etc);
 - b) whenever circumstances at the crossing are found to have altered (e.g. housing or industrial developments etc); or
 - c) at a periodicity agreed and authorised by the RSC.
- 5.2.6.3. In assessing the suitability of any proposed safety measures or arrangements, it is important to take into account:
- a) normal operating conditions;
 - b) degraded conditions where any component or part of the railway system has failed;
 - c) foreseeable abnormal conditions to which the system may be subjected; and
 - d) emergency situations.

5.3. TYPES OF CROSSINGS

5.3.1. Types of crossing

5.3.1.1. The various types of crossing may be classified as in Figure 1.

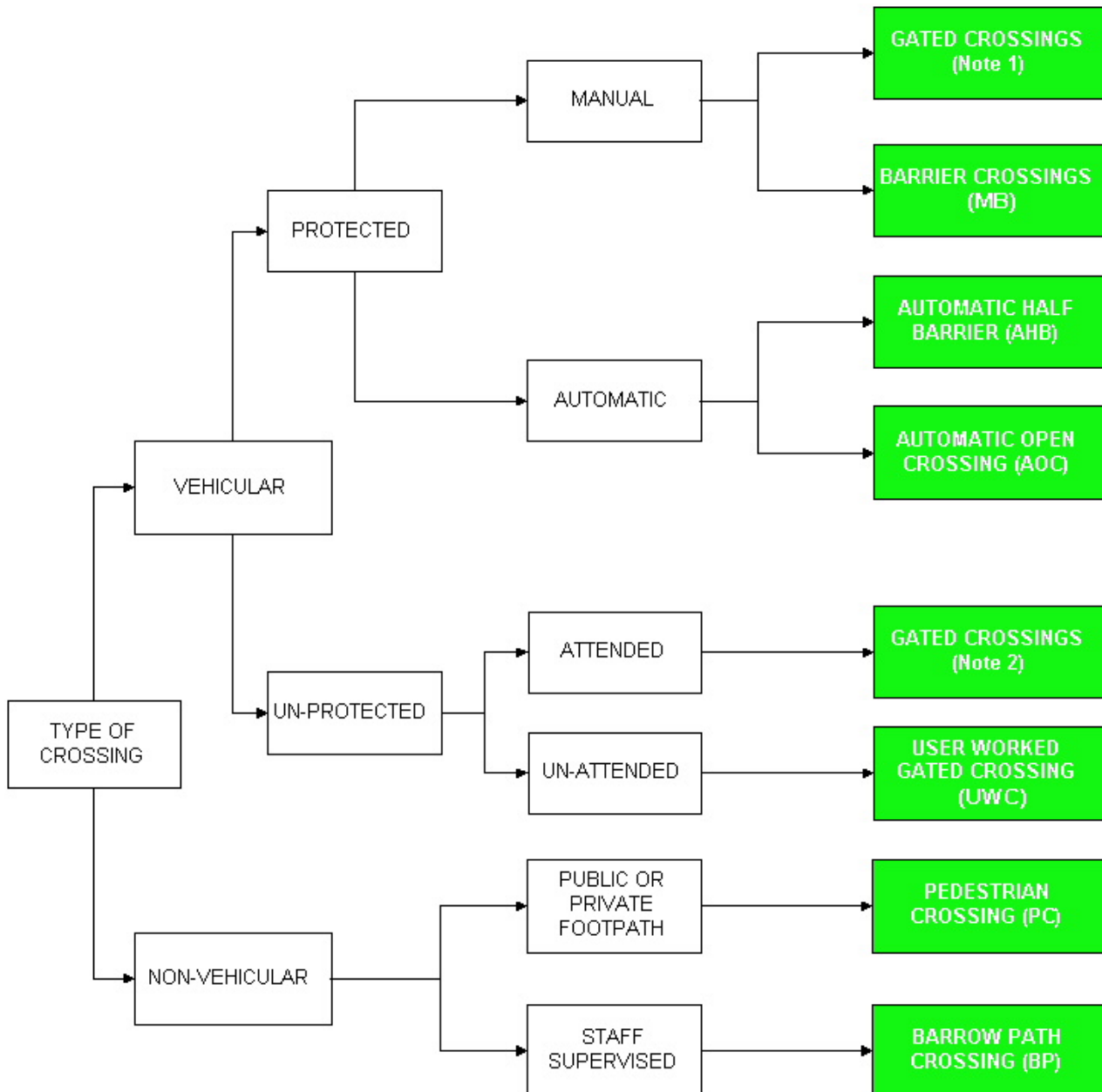


Figure 1: Types of Crossing

Note 1: Gated crossings operated by railway staff with protecting railway signals (see section 5.4.3).

Note 2: Gated crossings operated by railway staff without protecting railway signals (see section 5.4.3).

Note 3: A crossing is “protected” when a railway operated warning system is provided to crossing users or approaching trains e.g. road lights or railway protecting signals.

Note 4: Crossings equipped with Miniature Warning Lights or White Lights can be classed as protected.

Note5: Automatic Crossings may be locally monitored by drivers of trains (see section 5.11).

Note 6: For manual and attended crossings. Railway staff includes “train crew”. The term “supervising point” is used when referring to the point of train regulation (e.g. controlling signal box). The term “crossing keeper” is used where duties include operation of the crossing and associated railway protecting signals. The term “attendant” is used where duties include only the operation of the gates i.e. no protecting railway signals.

Note 7: The following are examples of level crossing designations currently in use on Iarnród Éireann (for information purposes only):

- a. For attended gated crossings (with protecting railway signals):**
 - *Type C* has gates normally across the road, except when required to pass road traffic.
 - *Type CN* has gates normally across the road, except when required to pass road traffic and during night-time.
 - *Type CD* has gates normally across the road, except when required to pass road traffic and during daytime.
 - *Type CX* has gates normally across the railway, except when required to pass rail traffic.
- b. For attended gated crossings (without protecting railway signals):**
 - *Type A* has gates normally across the road, operated by an attendant with telephone communication to a railway supervising point.
- c. For manual barrier crossings (MB):**
 - *Type MB* is an attended barrier crossing controlled by railway staff or train crew at the crossing.
 - *Type MB (CCTV)* is an attended barrier crossing controlled by railway staff with the aid of closed circuit television.
 - *Type M or EWB* is a mechanically or electrically operated barrier crossing with protecting signals operated by a crossing keeper or train crew.
- d. For automatic half barrier crossings (AHB):**
 - *Type AHB* is an Automatic Half Barrier crossing
- e. For automatic open crossings (AOC):**
 - *Type LB* is an automatic open crossing controlled by road traffic lights & warning bells.
- f. For unattended user worked crossings (UWC):**
 - *Type OP* has gates normally across a public road, operated by road users.
 - *Type F* is a gated private user field crossing.
- g. For private or public pedestrian crossings (PC):**
 - *Type P* is a pedestrian crossing.
- h. For staff supervised barrow path crossings (BP):**
 - *Type BP* is a barrow path.

5.3.2. Conditions for suitability

- 5.3.2.1. The decision to introduce a level crossing or upgrade an existing level crossing should follow a suitable risk assessment and after all possibilities for a grade separated crossing have been evaluated and discounted as not reasonably practicable.
- 5.3.2.2. The suitability of the types of protection for new or altered crossings depends on various factors, one of which may be traffic volume. This document gives guidance on the factors to be considered for any given location. The choice of level crossings should avoid causing unnecessary delay to road users and should consider local plans and developments which may affect the use of the crossing in the future (e.g. housing development).
- 5.3.2.3. An important aspect in the safety of level crossings is providing, in so far as specific locations and types of crossing permit, arrangements, which provide a consistent appearance to the users of any crossing. In order to achieve this several standard level crossing types have been developed over a number of years. This document sets out the detailed protection arrangements for each of these 'standard' types.
- 5.3.2.4. Level crossing types not included within this guidance which are currently in use on Iarnród Éireann should be assessed and upgraded so far as reasonably practicable with due consideration of the guidance and the conditions of suitability.

Table 1: CONDITIONS FOR SUITABILITY

Section	Type of Crossing	Conditions for Suitability
5.4	Gated crossings operated by railway staff (with protecting railway signals)	The traffic moment and annual average daily traffic usage should be low (see Table 4 section 5.14.2). Railway stop signals interlocked with the gates are required so that it is not possible to clear the signals unless the road is fully closed by the gates, nor is it possible to open the road unless the warning signals are at stop. <i>Note: The sole use of distant signals at service braking distance from the gates should not be considered for new or altered crossings.</i>
	Gated crossings operated by railway staff (without protecting railway signals)	This type of crossing should not be considered for new or altered crossings. For existing crossings the traffic moment and line speed and the annual average daily traffic usage should be low (see Table 4 section 5.14.2). The attendant should be in contact with the supervising point to ascertain that there is no train approaching before the gates can be open to road traffic and the gates should be closed to road traffic before a train is allowed to proceed towards the crossing.

Table 1: CONDITIONS FOR SUITABILITY

Section	Type of Crossing	Conditions for Suitability
5.5	Barrier crossings operated by railway staff (MB)	<p>Generally suitable for most road and rail traffic arrangements (see section 5.3.2.1).</p> <p>Railway signals interlocked with the barriers are required so that it is not possible to clear the signals unless the road is fully closed by the barriers, nor is it possible to open the road unless the signals are at Stop.</p> <p>The crossing keeper or signalman has a clear view of the crossing, including the stop lines, from the control point. This may be achieved with the aid of closed circuit television (CCTV).</p>
5.6	Automatic half barrier crossings (AHB)	<p>The speed of trains over the crossing should be determined by an appropriate risk assessment and should not normally exceed 130 km/h.</p> <p>There should not generally be more than two running lines over the crossing.</p> <p>The carriageway on the approaches to the crossing should be sufficiently wide to enable vehicles to pass safely.</p> <p>Road traffic should not be excessive and use in suburban areas or areas of heavy traffic should be avoided. The road layout, profile and traffic conditions should be such that road vehicles are not likely to become grounded or block back obstructing the railway.</p> <p>Trains should arrive at the crossing in not less than 37 seconds after the amber lights first show.</p> <p>Appropriate means to stop any train approaching the crossing in an emergency or abnormal situation are required. This may include the provision of an indication to train drivers that the crossing barriers and warning lights are in operation (see section 5.8).</p>
5.7	Automatic open crossings (AOC)	<p>The speed of trains over the crossing should be determined by an appropriate risk assessment and should not normally exceed 130 km/h.</p> <p>There should not generally be more than two running lines over the crossing.</p> <p>The carriageway on the approaches to the crossing should be sufficiently wide to enable vehicles to pass safely.</p> <p>Road traffic should not be excessive and use in suburban areas or areas of heavy traffic should be avoided. The road layout, profile and traffic conditions should be such that road vehicles are not likely to become grounded or block back obstructing the railway.</p> <p>Trains should arrive at the crossing in not less than 29 seconds after the amber lights first show.</p> <p>Appropriate means to stop any train approaching the crossing in an emergency or abnormal situation are required. This may include the provision of an indication to train drivers that the crossing warning lights are in operation (see section 5.8).</p>

Table 1: CONDITIONS FOR SUITABILITY

Section	Type of Crossing	Conditions for Suitability
5.8	User-worked crossings (UWC)	<p>This type of crossing should not be considered for new or altered crossings and should only be used on roads where the user(s) are familiar with the operating conditions.</p> <p>The speed of trains over the crossing should be determined by an appropriate risk assessment and should not normally exceed 130 km/h.</p> <p>There should not normally be more than two lines over the crossing.</p> <p>The time required by reasonably foreseeable users to traverse the crossing length should be at least 5 seconds greater than the available warning period of the approach of a train.</p> <p>Additional protection may be required in order to provide an adequate warning period.</p> <p>The provision of additional protection may require the warning period to increase and the relevant sections of this guidance should be observed.</p>
5.9	Pedestrian crossings (private or public footpath crossing) (PC)	<p>Suitable for private or public access.</p> <p>The speed of trains over the crossing should be determined by an appropriate risk assessment and should not normally exceed 130 km/h.</p> <p>There should not normally be more that two lines over the crossing.</p> <p>The warning period should be greater than the time required by users to traverse the crossing surface between the decision points at either end of a pedestrian crossing on foot.</p> <p>Additional protection may be required to provide an adequate warning period.</p> <p>The provision of additional protection may require the warning period to increase and the relevant sections of this guidance should be observed.</p>
5.10	Barrow path crossings (staff supervised footpath crossing within a station area) (BP)	<p>This type of crossing should not be considered for new or altered crossings and should only be used within station areas where station staff will supervise their use.</p> <p>The speed of trains over the crossing should be determined by an appropriate risk assessment and should not normally exceed 130 km/h.</p> <p>There should not normally be more that two lines over the crossing.</p> <p>The warning period should be not less than 30 seconds. Additional protection may be required to provide an adequate warning period.</p> <p>The provision of additional protection may require the warning period to increase and the relevant sections of this guidance should be observed.</p>

5.4. GATED CROSSINGS OPERATED BY RAILWAY STAFF

5.4.1. General description (for user worked gates see section 5.8)

- 5.4.1.1. This type of crossing is protected by gates, on both sides of the railway, which complete the fencing of the railway when closed across the road or the railway. The crossing is manually operated by railway staff who open and close the gates.
- 5.4.1.2. The gates, painted white and red, are normally kept closed across the road. Alternatively, where rail traffic is much less frequent than road traffic, the gates may be closed across the railway. Dependent on road and rail traffic patterns the usual position of the gates may be altered on a regular daily basis (under formal authorisation by the RSC), e.g. for the road or railway closed during the daytime or night-time.
- 5.4.1.3. Red lamps and red retroreflective targets mounted on the gates, which show towards approaching road traffic when the gates are across the road, should be provided.

5.4.2. Method of operation

- 5.4.2.1. The gates are operated by train crew or competent railway staff who are permanently stationed at a control point adjacent (within 50m) to the level crossing when the line is open to rail traffic.
- 5.4.2.2. The person operating the gates should have a good view of approaching road traffic and the whole of the crossing area.
- 5.4.2.3. Where the crossing is operated by competent railway staff, the person should have an appropriate indication of the approach of trains and clear instructions as to when the gates should be closed to road traffic. The arrangements should be agreed with and authorised by the RSC.

5.4.3. Railway signalling and control

- 5.4.3.1. Railway signals, which provide full protection to the crossing, should be provided on both railway approaches to the crossing. Alternatively, (under formal authorisation by the RSC) railway caution signals may be provided on both railway approaches at normal train braking distance from the crossing gates. Red lamps and red retroreflective targets mounted on the gates, which show towards approaching railway traffic when the gates are across the railway, should be provided in this instance. In either instance the signals are required to be interlocked with the gates so that it is not possible to clear the signals unless the road is fully closed by the gates, nor should it be possible to open the gates unless the signals are set at their most restrictive position.
- 5.4.3.2. Where crossings have no protecting signals the attendant and the signaller should have a means to communicate with each other. The attendant should ascertain that there is no train approaching the crossing before opening the gates to road traffic. The signaller should ascertain that the gates are closed to road traffic before allowing a train to approach the crossing.

Note: Gated crossing operated by railway staff which have no lineside protecting signals should not be considered for new or altered crossings unless specifically authorised by the RSC.

5.5. BARRIER CROSSINGS OPERATED BY RAILWAY STAFF (MB)

5.5.1. General description

- 5.5.1.1. This type of crossing is protected by road traffic light signals and lifting barriers on both sides of the railway. Where the width of the roadway permits, individual barriers are provided for both the nearside and offside of the roadway on each side of the crossing to facilitate the release of any user who may have become trapped during the lowering sequence. An audible warning to pedestrians is also provided. The barriers are normally kept in the raised position, and when lowered, extend across the whole width of the roadway on each approach.
- 5.5.1.2. The crossing is operated by competent railway staff who initiate the display of the road traffic light signals towards approaching road traffic followed by the lowering of the barriers. The lowering and raising cycles may be initiated manually or automatically by approaching trains.

Note: Road traffic light signals may only be omitted where the barriers are normally in the lowered position, the number of road vehicles during the peak hour does not exceed 20 and the line speed of the railway does not exceed 130 km/h.

- 5.5.1.3. Telephones, connected to the controlling point, are provided for the use of the public. A telephone is provided adjacent to the nearside barrier, on each side of the crossing, facing outwards from the crossing. A telephone is also provided adjacent to the offside barrier, on each side of the crossing, facing inwards to the crossing.
- 5.5.1.4. This type of crossing may be operated by one of the following methods:
- a) by competent railway staff who are permanently stationed at a control point adjacent (within 50m) to the crossing when the line is open to rail traffic;
 - b) by competent railway staff who are permanently stationed at a control point remote from the crossing, with the use of closed-circuit television (CCTV), whenever the line is open to rail traffic.
- 5.5.1.5. For all methods of operation, the person operating the crossing equipment should have a clear and full view of the crossing, including the barriers, from the control point either directly or via the closed-circuit television.

5.5.2. Method of operation

- 5.5.2.1. Where the barriers are normally in the raised position, the sequence of events to close the crossing to road traffic, once the lowering cycle has been initiated either manually or automatically, should be as follows:
- a) The amber lights of the road traffic light signals immediately show and the audible warning for pedestrians begins. The amber lights should show for approximately 5 seconds;
 - b) Immediately the amber lights are extinguished, the intermittent red lights should show;
 - c) Approximately 6 to 8 seconds later the nearside barriers should begin to descend. Approximately 5 seconds after the nearside barriers begin to descend, the offside barriers begin to descend. The time for each barrier to reach the lowered position should normally be 6 to 8 seconds.
 - d) the audible warning should stop when all the barriers are fully lowered; and
 - e) the intermittent red lights should continue to show.
- 5.5.2.2. The sequence of events to open the crossing to road traffic, once the raising cycle has been initiated either manually or automatically, should be as follows:
- a) All barriers begin to rise simultaneously and should normally rise in 6 to 8 seconds; and
 - b) The intermittent red lights should continue to show until the barriers have fully raised.
 - c) In emergency or abnormal situations (see section 5.5.3.4) with manual raise initiated the offside barriers should be allowed to fully rise before the nearside barriers are allowed to rise. This will

allow the controlled release of any vehicle or person that may have become trapped on the crossing.

- 5.5.2.3. Where automatic lowering of barriers is to be employed, the lowering of the barriers should not take place unless, at least, one red light in all the red road traffic light signals facing in each direction is working. If closed circuit television monitoring is provided, initiation of automatic lowering should switch on the CCTV monitor and give an audible indication at the control point.
- 5.5.2.4. Automatic lowering should be inhibited unless the barriers have been raised after the passage of a preceding train.
- 5.5.2.5. Where automatic raising of barriers is provided, the barriers should rise as soon as practicable after all trains, for which the lower sequence has been initiated, have passed clear of the crossing.
- 5.5.2.6. When the lowering cycle has been initiated and the barriers have started to descend, the lowering cycle should be completed in the normal sequence even if all the red road traffic light signals facing in one direction fail. The barriers may then be raised when it is safe to do so. Where the barriers have not started to descend, they should remain in the raised position.
- 5.5.3. **Railway signalling and control**
- 5.5.3.1. Railway signals, which provide full protection to the crossing, are required on all railway approaches. These signals are required to be interlocked with the lifting barriers so that it is not possible to clear the signals unless the road is fully closed by the barriers, nor should it be possible to raise the barriers unless the signals are set at Stop.
- 5.5.3.2. Where the barriers are power operated, there should be discrete function controls to command the barriers to be raised, stopped or lowered from the operating position. It should not be possible to clear any protecting signals until a further function control to confirm the 'Crossing Clear' has been operated with the barriers down.
- 5.5.3.3. If a train passes a protecting signal at Stop, the road traffic light signals should immediately show an intermittent red light, omitting the steady amber phase, and the audible warning should start. The barriers should not be caused to lower.
- 5.5.3.4. The crossing operator should be provided with a device to operate the crossing in emergency or abnormal situations. The operation of the device should:
 - a) With the crossing closed to road traffic, place the level crossing protecting signals to Stop, the road traffic light signals should continue to show an intermittent red light and the barriers should remain lowered. In this instance the barriers may be raised manually, after a suitable time interval to ensure rail traffic has been brought to a stand, the offside barriers raising first before the nearside barriers are raised.
 - b) With the crossing open to road traffic, immediately show intermittent red lights on the road traffic signals, omitting the amber phase, and the audible warning should start. The barriers should not be caused to lower unless under the manual control of the operator. The level crossing protecting signals should also be prevented from clearing with the device operated.
- 5.5.3.5. The status of the crossing equipment, including the road traffic light bulb filaments and mains power supply, should be indicated at the control point to ensure it operates safely when the railway line is open to traffic.

5.6. AUTOMATIC HALF BARRIER CROSSINGS (AHB)

5.6.1. General description

- 5.6.1.1. This type of crossing is protected by road traffic light signals and a lifting barrier on the nearside of the roadway on both sides of the railway. Audible warning to pedestrians is also provided. Lifting barriers are normally kept in the raised position and pivoted on the left-hand side of the road. When lowered, the barriers only extend across the entrances to the crossing leaving the exits clear.
- 5.6.1.2. The crossing equipment is initiated automatically by an approaching train. The lowering of the barriers is preceded by the display of road traffic light signals. The period between the initial display of the red road traffic light signals and the arrival of the fastest train should be sufficiently long (normally 32 seconds) to enable road vehicles and pedestrians to clear the crossing.
- 5.6.1.3. The barriers rise immediately the train has passed unless another approaching train is so close that the minimum road open time (normally 9 seconds) cannot be achieved. In this situation the barriers remain lowered and the intermittent red lights continue to flash but signs indicating the words "Second Train Coming" (Figure 21Error! Reference source not found.) should be illuminated as soon as the first train has passed the crossing.
- 5.6.1.4. Telephones for use by the public and those who are required to phone for permission to cross are normally provided near each road traffic light signal on the right-hand side of the road. The telephones are connected to a supervising point, which is always open when the railway line is open. An indication comprising of a yellow light and an appropriate instruction notice should be provided inside or adjacent to each telephone to inform users, if illuminated when there is no reply to the telephone, that the railway line is closed to railway traffic.
- 5.6.1.5. A supervising point should have the appropriate means to stop any train approaching the crossing, and means of communicating with any competent railway staff operating the crossing equipment locally at the crossing in an emergency or abnormal situation.

5.6.2. Method of operation

- 5.6.2.1. The operation of the crossing equipment is initiated automatically by a train as it approaches the crossing.
- 5.6.2.2. The time elapsed between the amber lights of the road traffic light signals starting to show and the train arriving at the crossing should not be less than 37 seconds. The train should pass as soon after 37 seconds as possible. Where the crossing length is longer than 15m, the 37 seconds should be increased by 1 second for every additional 3m of crossing length.
- 5.6.2.3. The sequence of events to close the crossing to road traffic is as follows:
 - a) The amber lights of the road traffic light signals immediately show and an audible warning for pedestrians begins. The lights should show for approximately 5 seconds.
 - b) Immediately the amber lights are extinguished the intermittent red lights should show; and
 - c) Approximately 6 to 8 seconds later the barriers should start to descend and take a further 6 to 8 seconds to reach the lowered position.
- 5.6.2.4. If the barriers remain down for another train, the second train coming warning sign should be illuminated when the first train has passed the crossing and should remain illuminated until the second train has passed clear of the crossing. The character of the audible warning to pedestrians may also be changed by either increasing the intensity or ringing rate.

- 5.6.2.5. Both barriers should begin to rise simultaneously and should take normally 6 to 8 seconds to reach the raised position after a train has passed clear of the crossing. The intermittent red lights of the road traffic light signals should not be extinguished and the audible warning should not stop until the barriers have fully raised.
- 5.6.2.6. If both intermittent red lights in any of the road traffic light signals fail, the barriers should remain lowered. If there is a total power failure, the barriers should fall and remain lowered. If either barrier fails to reach the lowered position, neither barrier should rise until both have been fully lowered. If either barrier fails to rise from the lowered position, the intermittent red lights of the road traffic light signals should continue to show.
- 5.6.3. **Railway signalling and control**
- 5.6.3.1. Appropriate means are required to stop any train approaching the crossing in an emergency situation. The nearest worked signal on each rail approach capable of being placed at Stop under instruction from the supervising point should be at a distance of not more than the equivalent of 10 minutes running time from the crossing for the fastest train. If there is a railway signal on each approach, in the normal direction of working, it should preferably be located at a distance from the crossing not less than the longest service braking distance for any train.
- Alternatively an arrangement as described in section 5.11 may be provided to inform train drivers approaching the crossing that the barriers and road traffic lights are correctly operating.
- On a double-track line, bi-directional control to initiate the crossing equipment is required.
- 5.6.3.2. If a train passes a signal at Stop located between a strike-in point and the crossing, the road traffic light signals should immediately show an intermittent red light, omitting the steady amber phase, the audible warning for pedestrians should begin and the barriers start to lower in the normal sequence.
- 5.6.3.3. Where trains may be required to stop because railway signals or stations lie within or close to the strike-in points, the sequence of events to close the crossing to road traffic may be initiated:
- a) automatically by an approaching train where stopping times of trains at a station can be predicted reasonably accurately;
 - b) by a means that is only effective when the presence of a train is detected, e.g. a train crew-operated plunger linked with the train detection system (This may be used where stopping times of trains cannot be reasonably predicted); or
 - c) Automatically by an approaching train where a Stop signal is provided between the strike-in point and the crossing, and is interlocked with the signalling system using a 'stopping/non-stopping' control.
- Note: To comply with the timings, the clearance of the signal may need to be delayed.*
- 5.6.3.4. Facilities should be provided for manual operation of the crossing equipment and effective means are required to prevent its unauthorised operation.
- 5.6.3.5. The status of the crossing equipment, including the mains power supply and the availability of the road traffic lights, e.g. bulb filaments, should be indicated at the control point to ensure it operates safely when the railway line is open to traffic.

5.7. AUTOMATIC OPEN CROSSING (AOC)

5.7.1. General description

- 5.7.1.1. This type of crossing has no barriers but is protected by road traffic light signals and an audible warning is provided for pedestrians.
- 5.7.1.2. The crossing equipment is initiated automatically by an approaching train. The period between the initial display of the red road traffic lights and the arrival of the fastest permissible train should be sufficiently long (normally 24 seconds) to enable road vehicles and pedestrians to clear the crossing.
- 5.7.1.3. The road traffic light signals cease to show and the audible warning to pedestrians stop immediately the train has passed clear of the crossing unless another approaching train is so close that the minimum road open time (normally 9 seconds) cannot be achieved. In this situation the road traffic signals continue to show, the audible warning to pedestrians continues to sound and signs indicating the words "Second Train Coming" (Figure 21) are displayed as soon as the first train arrives at the crossing.
- 5.7.1.4. Telephones for use by the public and those who are required to phone for permission to cross are provided adjacent to each nearside road traffic light. The telephones are connected to a supervising point, which is always open, when the line is open. An indication comprising of a yellow light and an appropriate instruction notice should be provided inside or adjacent to each telephone to inform users, if illuminated when there is no reply to the telephone, that the railway line is closed to railway traffic.
- 5.7.1.5. A Supervising point should have the appropriate means to stop any train approaching the crossing, and means of communicating with any competent railway staff operating the crossing equipment locally in an emergency or abnormal situation.

5.7.2. Method of operation

- 5.7.2.1. The operation of the crossing equipment is initiated automatically by a train as it approaches the crossing.
- 5.7.2.2. The time lapse between the amber lights of the road traffic light signals starting to show and the train arriving at the crossing should not be less than 29 seconds. The train should pass as soon after the 29 seconds as possible. Where the crossing length is longer than 15m, the 29 seconds should be increased by 1 second for every 3m of crossing length.
- 5.7.2.3. The sequence of events to close the crossing to road traffic is as follows:
 - a) The amber lights of the road traffic light signals immediately show and an audible warning for pedestrians begins. The lights should show for approximately 5 seconds; and
 - b) Immediately the amber lights are extinguished the intermittent red lights should show.
 - c) The intermittent red lights of the road traffic light signals should be extinguished and the audible warning stopped as soon as possible after a train has cleared the crossing. If, however, another train is approaching the crossing, the lights should continue to show unless a minimum road open time (normally 9 seconds) cannot be achieved.
- 5.7.2.4. If the intermittent red lights continue to show for another train, as soon as the first train arrives at the crossing, the "Second Train Coming" signs should be illuminated. The character of the audible warning to pedestrians may also be changed by either increasing the intensity or ringing rate.

5.7.3. Railway signalling and control

- 5.7.3.1. Appropriate means are required to stop any train approaching the crossing in an emergency situation. The nearest worked signal on each rail approach capable of being placed at Stop under instruction from the supervising point should be at a distance of not more than the equivalent of 10 minutes running time from the crossing for the fastest train. If there is a railway signal on each approach, in the normal direction of working, it should preferably be located at a distance from the crossing not less than the longest service braking distance for any train.
- Alternatively an arrangement as described in section 5.11 may be provided to inform train drivers that the road traffic lights are correctly operating.
- On a double-track line, bi-directional control to initiate the crossing equipment is required.
- 5.7.3.2. If a train passes a signal at Stop located between a strike-in point and the crossing, the road traffic light signals should immediately show an intermittent red light, omitting the steady amber phase, the audible warning for pedestrians should begin.
- 5.7.3.3. Where trains may be required to stop because railway signals or stations lie within or close to the strike-in points, the sequence of events to close the crossing to road traffic may be initiated:
- a) automatically by an approaching train where stopping times of trains at a station can be predicted reasonably accurately;
 - b) By a means that is only effective when the presence of a train is detected, e.g. a train crew-operated plunger linked with the train detection system. (This may be used where stopping times of trains cannot be reasonably predicted); or
 - c) Automatically by an approaching train where a Stop signal is provided between the strike-in point and the crossing, and is interlocked with the signalling system using a 'stopping/non-stopping' control.
- 5.7.3.4. Facilities should be provided for manual operation of the crossing equipment and effective means are required to prevent its unauthorised operation.
- 5.7.3.5. The status of the crossing equipment, including the road traffic light bulb filaments and mains power supply, should be indicated at the control point to ensure it operates safely when the railway line is open to traffic.

5.8. USER-WORKED CROSSINGS (UWC) WITH GATES OR LIFTING BARRIERS

5.8.1. General description

- 5.8.1.1. This type of crossing is only applicable where the railway crosses a private road or field access or a public road which has a low Daily Traffic Moment (see Table 4 section 5.14.2). It is normally protected by iron gates, or lifting barriers (only when authorised by the RSC), on both sides of the railway. The gates, normally closed across the road and hung so as to open away from the railway, are operated by the road users. Barriers are normally closed across the road or field. A sign(s) is displayed on each side of the crossing describing the correct method of operating the gates, including the use of any telephones, if provided, to the road or access users.
- 5.8.1.2. Black and yellow marker posts may be provided to indicate the safe point (decision point) where it is safe to stop clear of the railway, while checking the view along the track.
- 5.8.1.3. Users should have sufficient time from first seeing an approaching train from the decision point, or otherwise being made aware of the approach of a train with the aid of additional protective equipment, to cross safely.
- 5.8.1.4. A safe waiting place should be provided, where practicable, within the railway boundary to allow a road vehicle to stop clear of moving trains. The size and arrangements of the safe waiting place should be determined for each crossing based on the proximity of the railway boundary and the private users vehicular requirements.

5.8.2. Method of operation

- 5.8.2.1. Additional protective equipment should be provided if the warning time is less than 5 seconds greater than the time required by the reasonably foreseeable users to traverse the crossing. A suitable study should be undertaken to determine the time for the normal user to traverse the crossing under reasonably foreseeable worst case conditions. Where the 5 seconds warning time is not achievable the study should evaluate and identify the additional protective equipment to be provided.
- 5.8.2.2. In assessing the time required to traverse the crossing, consideration should be given to:
- the type of vehicles or equipment likely to go over the crossing;
 - the surface provided on the crossing and its immediate approaches;
 - the position at which the vehicle, after going over the crossing, would be clear of the railway or gate on the far side; and
 - movement of animals.
- 5.8.2.3. Additional protective equipment that should be considered is as follows:
- audible warnings from the trains - where train speeds are low and the service infrequent, whistle boards positioned not more than 400m from the crossing may be acceptable;
 - telephones - connected to a supervising point, which is always open when the railway line is open, should be provided on both sides of the crossing where:
 - the minimum warning time of trains cannot be obtained;
 - there is known regular use by animals on the hoof;
 - fog is prevalent;
 - the actual daily road vehicle user exceeds 50;
 - there are more than two running lines; or
 - the line speed exceeds 130 km/h
 - miniature warning lights - miniature warning lights, as described in section 5.17 should be provided on both sides of the crossing where:
 - the minimum warning time of trains cannot be obtained and the actual daily road

vehicle user exceeds 100; or

- (ii) the provision of a telephone is impractical because it is difficult to provide reliable information concerning the whereabouts of trains, or the information supplied would be so restrictive that it would be likely to cause the user to become unduly impatient and to cross without permission.

5.8.2.4. To achieve the required warning time, it may be necessary to reduce the train speed over the crossing.

5.8.2.5. Where telephones are provided, users are expected to telephone the supervising point to seek permission to cross.

5.9. PEDESTRIAN CROSSINGS (PC) PRIVATE OR PUBLIC FOOTPATH

5.9.1. General description

- 5.9.1.1. This type of crossing is applicable where the railway crosses a footpath which exists as a public or private right of way or a roadway which has segregated pedestrian traffic.
- 5.9.1.2. Users are expected to use reasonable vigilance to satisfy themselves that no trains are approaching the crossing before they start to cross the line, and to cross as quickly as possible. Users should have sufficient time from first seeing or being warned of an approaching train to cross safely.
- 5.9.1.3. Pedestrian crossings should be protected by a stile or self-closing wicket gate (normally the decision point) on both sides of the railway. They should not have a gate on one side and a stile on the other, nor different widths or types of gates.
- 5.9.1.4. A sign(s) should be displayed at an appropriate position at or before the decision point on either side of the pedestrian crossing explaining the way to proceed safely over the crossing.
- 5.9.1.5. Where the type of crossing passes over multiple railway tracks and an interval between tracks exists so that a fenced, safe waiting place can be created for users, the crossing on each side of the interval should be treated as a separate crossing. A chicane may be provided on the crossing to make the position of the safe waiting place clear.
- 5.9.1.6. The minimum width between fences at the decision point or safe waiting area should be 1m for pedestrian crossings. This should be increased or a larger waiting area provided if there is foreseeable use by those with prams or in wheelchairs etc.
- 5.9.1.7. Care should be taken not to provide misleading displays to crossing users. Where, for instance, miniature warning lights are provided on one part of a divided crossing, they should be provided on all parts of the crossing.
- 5.9.1.8. At a user-worked crossing, which is subject to additional footpath rights, stiles for pedestrians or separate gates for use by the pedestrians should be provided. The guidance in this section should be applied in conjunction with that for the vehicular use of such combined crossings.

5.9.2. Method of operation

- 5.9.2.1. The warning time should be greater than the time required by users to traverse the crossing surface between the decision points at either end of a crossing. In assessing the speed at which users will traverse the crossing, allowance should be made for the mobility of the reasonably foreseeable users and the type of crossing surface.
- 5.9.2.2. A speed of 1.2 metres per second (m/s) should be used where the surface is at or near to rail level and 1 m/s where the surface is at the standard profile of the ballast. The calculated time in traversing the crossing should be increased to take account of foreseeable circumstances such as impaired mobility of users, numbers of prams and bicycles or where there is a slope or step up from the decision point.
- 5.9.2.3. Where the warning time is insufficient, additional protective equipment may be provided as follows:
 - a) audible warnings from trains - whistle boards positioned not more than 400m from the crossing;
 - b) telephones;
 - c) miniature warning lights as described in section 5.17.

- 5.9.2.4. Where whistle boards are provided, the following factors should be considered in deciding their location:
- a) the speed of sound (330 m/s) and the speed of the train;
 - b) the sound may be inaudible at the crossing because of ambient noise; and
 - c) there may be objections to the noise of train horns in residential or built-up areas.
- 5.9.2.5. Where whistle boards are provided, they are required on all railway approaches. The difference in warning times should be a maximum of 3 seconds.
- 5.9.2.6. Telephones and their associated signs may be provided where:
- a) the warning time exceeds the time required to traverse the crossing by less than 5 seconds; or
 - b) the highest permissible train speed exceeds 130 km/h; or
 - c) the line speed has been increased.
- 5.9.2.7. At pedestrian crossings, miniature warning lights may be provided where:
- a) the crossing is the only access to houses;
 - b) the highest permissible train speed exceeds 130 km/h; or
 - c) the provision of whistle boards is considered inappropriate.
- 5.9.2.8. An audible warning device should be provided at the crossing if unaccompanied partially sighted or blind people regularly use it.

5.10. BARROW PATH CROSSINGS (BP) STAFF SUPERVISED

5.10.1. General description

- 5.10.1.1. Barrow paths should only be in use for lightly used stations where the line speed does not exceed 130 km/h and no alternative arrangements are reasonably practicable. Where there is unescorted passenger or public use, this crossing arrangement is not suitable and an alternative arrangement such as a bridge or subway should be provided. This may be a public roadway crossing rather than a dedicated route on the station premises.
- 5.10.1.2. The surface of barrow paths should be non-slip, level with the head of the rails either side of the rail head, even across its full extent, securely fixed and have no gaps that could trap either the heel of a shoe or the wheel of any barrow, cycle etc. The crossing should be wide enough for all foreseeable uses and extend far enough back from the nearest rail to allow space for any user to wait while ensuring it is safe to cross.

5.10.2. Method of operation

- 5.10.2.1. Passengers or members of the public using the crossing should be accompanied by competent railway staff.
- 5.10.2.2. Additional protective equipment should be provided when the visibility gives less than 30 seconds warning of an approaching train as follows:
 - a) miniature warning lights as described in section 5.17; or
 - b) a white light extinguished for 40 seconds before the arrival of a train travelling at the maximum permissible line speed with a notice reading 'Caution - Cross only when white light shows'.

5.11. LOCAL MONITORING OF AUTOMATIC CROSSINGS (AHB & AOC)

5.11.1. General description

- 5.11.1.1. In the absence of suitable protecting signals, the operation of the crossing equipment and the absence of obstruction on the automatic crossing may be monitored by the driver of an approaching train.
- 5.11.1.2. Train drivers should be provided with a railway signal indicating the correct operation of the level crossing equipment.
- 5.11.1.3. Train drivers are required to stop their trains short of the crossing unless they have received an indication that the crossing equipment is operating correctly and have observed that the crossing is clear.

5.11.2. Method of operation

- 5.11.2.1. Trains normally approach the crossing at a steady speed, known as the *crossing speed*, so that they can be halted short of the crossing from the point at which it comes clearly into the train driver's view. The highest permissible crossing speed is 90 km/h.

Note: The preferred arrangement is for trains not to stop before passing over a crossing unless it is not practicable to arrange otherwise, e.g. if a crossing lies immediately beyond a station platform.

- 5.11.2.2. The road traffic light signals and barriers (if provided) should continue to operate following a failure of the main power supply, but the indication to the train driver that all the crossing equipment is functioning correctly should not be displayed.

5.11.3. Railway signalling and control

- 5.11.3.1. The indication to the train driver should only be displayed when at least one of the intermittent red lights in each road traffic light signal is lit and the barriers (if provided) have begun to descend and the main power supply has not failed.
- 5.11.3.2. Any railway signals which lie between the strike-in point and the crossing should not give information which conflicts with the indication given to the train driver when the crossing equipment is functioning correctly.
- 5.11.3.3. A special speed restriction board is required at the point from which the crossing speed begins. This board may display two different crossing speeds for different types of train.
- 5.11.3.4. An advance warning board is required at the service braking distance from the special speed restriction board to enable trains to reduce their speed to the crossing speed. If the crossing speed is the same as the line speed the advance warning board should normally be 100m on the approach to the special speed restriction board.
- 5.11.3.5. Where all trains are required to stop at a station between the strike-in point and the crossing, a stop board should be located at least 50m from the crossing and an advance warning board located at service braking distance from the stop board.

5.12. PROVISIONS FOR PEDESTRIANS AT PUBLIC VEHICULAR CROSSINGS

5.12.1. General description

- 5.12.1.1. At all public road level crossings, provisions for pedestrians should be made according to the number and frequency of pedestrians and trains.
- 5.12.1.2. A footpath of adequate width should be provided on both sides of the carriageway.

Note 1: There should be sufficient space, taking into account the volume and nature of the users, for pedestrians to pass each other without the need to use part of the carriageway reserved for road vehicles. Allowance should be made for the needs of those with prams and in wheelchairs.

Note 2: Where there are either narrow or no footpaths on the approaches to a crossing, the width of the footpath should gradually increase to the width of the footpath on the crossing.

Note 3: Where appropriate, access to the footpath over the crossing for wheelchair users should be provided.

- 5.12.1.3. The footpath over the crossing should be made up to the level of the carriageway and maintained in a good and even condition.

5.12.2. Road markings

- 5.12.2.1. The footpath for the safe route for pedestrians to walk over the crossing is delineated between the carriageway Yellow Box marking and the cattle-cum-trespass guards, where provided. Longitudinal road marking may be provided along each edge of each footpath provided they do not conflict with the yellow box markings.
- 5.12.2.2. Transverse road markings for pedestrians to stand behind in a safe place while the crossing is closed to road traffic should be provided over the footpaths at all barrier and open crossings.

5.12.3. Audible warnings

- 5.12.3.1. Audible warning devices are required at all automatic crossings and barrier crossings operated by railway staff, so that pedestrians on or approaching the crossing are given adequate warning of the closure of the crossing.
- 5.12.3.2. Where road traffic light signals are provided at the crossing, the warning sound should begin when the amber lights first show and, at all automatic crossings, continue until the intermittent red lights are extinguished. At barrier crossings operated by railway staff, the warning sound stops when the barriers are fully lowered.
- 5.12.3.3. At automatic crossings where two trains can arrive at the crossing without providing the minimum road open time, the character or tone of the warning sound should change distinctively as soon as the first train arrives at the crossing.
- 5.12.3.4. At unattended crossings, the audible warning may be provided by horns from approaching trains.

Note: Where audible warnings may cause a disturbance to local residents the warning may stop or continue at reduced volume when the barriers are fully lowered.

5.12.4. **Pedestrian signals**

- 5.12.4.1. At automatic crossings, traffic signals for pedestrians should be provided where the volume of pedestrians is high or vulnerable groups of pedestrians use the crossing on a regular basis, e.g. primary school children or people with disabilities whose schools, hospitals or homes are immediately adjacent to the crossing.
- 5.12.4.2. Pedestrian signals should be placed below or adjacent to the road traffic light signals so that they face outwards from the crossing towards pedestrians approaching the crossing, as well as towards those halted at the transverse road markings across the footpaths.

Note: Pedestrian signals are not considered necessary at gated crossings and barrier crossings operated by railway staff.

5.12.5. **Tactile thresholds**

- 5.12.5.1. Where the number of pedestrians using a crossing is high, or a significant number of blind or partially-sighted people use the crossing, a tactile threshold, of an appropriate design, should be provided across each footpath.
- 5.12.5.2. This threshold should not be on the railway side of the transverse road markings across the footpath.

Note: The purpose of this provision is to provide blind and partially-sighted people with an indication of the direction of the footpath as well as the line behind which they should wait while the crossing is closed.

5.12.6. **Means to control the flow of pedestrians**

- 5.12.6.1. Where the number of pedestrians using a crossing is high, or vulnerable groups of pedestrians use the crossing on a regular basis, appropriate means to prevent pedestrians from walking on the carriageway or to control the direction of flow of pedestrians may be provided, e.g. guard rails and road studs. Guard rails should be provided only where the footpath and its approach is wide enough to prevent any bottleneck to pedestrians or encouragement to walk on the carriageway.
- 5.12.6.2. Where pedestrians in significantly large numbers cross from one side of the road to the other while the road is closed to allow a train to pass over the crossing, a double row of non-reflecting road studs to indicate the safe place to cross may be provided.
- 5.12.6.3. Where a crossing lies adjacent to a railway station and the entrance or exit to the station is via the platform ramp, pedestrians should be directed from the platform to the road and vice versa so that they are protected by the crossing after leaving or before joining the train.

5.12.7. **Pedestrian categories**

- 5.12.7.1. The volume of pedestrian and train flow may be determined by the train pedestrian value (TPV) which in turn defines the pedestrian categories. The TPV is the product of the maximum number of pedestrians and the number of trains passing over the crossing within a period of 15 minutes. A detailed method of calculation can be found in section 5.12.9.
- 5.12.7.2. Pedestrian categories are given in Table 2.

Table 2: PEDESTRIAN CATEGORIES	
PEDESTRIAN CATEGORY	TRAIN PEDESTRIAN VALUE (TPV)
A	More than 450
B	151 - 450
C	150 or less

5.12.8. Pedestrian provisions

5.12.8.1. The provisions required for pedestrians at a crossing according to its pedestrian category are defined in Table 3.

Table 3: PEDESTRIAN PROVISIONS						
Pedestrian Category	Width Of Footpath (Metres)	Road Markings	Audible Warnings *	Pedestrian Signals **	Tactile Threshold *	Guard Rails
A	2 or more	YES	YES	YES	YES	‡
B	1.8 or more	YES	YES	‡	YES	‡
C	1.5 or more †	YES	YES	‡	‡	‡
* Not required at gated crossings ** Only at automatic crossings † A reduced width of 1m or lack of approach funnel is normally restricted to those crossings with a daily pedestrian user of less than about 5. ‡ YES if necessary.						

Note: At any crossing where the number of pedestrians or the size of the vulnerable group is exceptionally large, automatic crossings may not be suitable and a barrier crossing operated by railway staff may have to be provided.

5.12.9. Train pedestrian value (TPV) calculation

- 5.12.9.1. TPVs are calculated by multiplying the number of pedestrians who pass over the railway by any route at the crossing within any period of 15 minutes by the number of trains passing over the crossing in the same period.
- 5.12.9.2. Normally a census, over a nine day period, between the hours 06.00 and 24.00, should be taken, particularly where high volumes or vulnerable groups of pedestrians are involved. Where the number of pedestrians is low, the actual number may be determined by an estimate.
- 5.12.9.3. Where the data is obtained from a census, only the maximum number of pedestrians for any period of 15 minutes in the day needs to be established. Where an estimate is accepted, the number of pedestrians used in calculating TPV should be deemed to be 75% of the largest hourly value to obtain an equivalent maximum figure for a period of 15 minutes to cater for the non-uniform distribution of pedestrian flow.
- 5.12.9.4. The number of trains should be deemed to be 25% of those passing over the crossing in a period of one hour. This hour should be either:
- the same hour used to give the estimated hourly value of numbers of pedestrians; or
 - the hour which includes the 15 minutes when the pedestrian number is established by census.
- 5.12.9.5. The number of trains should be rounded up to the next integer and should not normally be less than one.

5.13. ADDITIONAL MEASURES TO PROTECT AGAINST TRESPASS

5.13.1. General description

- 5.13.1.1. Cattle-cum-trespass guards and fencing protection should be provided to discourage trespass by pedestrians and animals straying onto the railway.

5.13.2. Cattle-cum-trespass guards

- 5.13.2.1. The guards should be adjacent to the footpath at the edge of, and level with, the surface of the carriageway. They should extend the full length of the crossing between the boundary fences.
- 5.13.2.2. The guards should consist of arris rails running parallel with the running rails.

Note: Arris rails or similar which are triangular in section with the vertical sides approximately 115mm high, at approximately 150mm pitch, and with a clear space between them not exceeding 35mm are considered to be effective.

- 5.13.2.3. The guards should be at least 2.6m wide measured at right angles to the edge of the carriageway. Where there is insufficient room for a cattle-cum-trespass guard of standard width to be provided immediately adjacent to an existing platform ramp, the toe of the ramp may be cut back, leaving a step not exceeding 300mm high, to accommodate the guard. The guards may have to be extended between the platform ramps. Additional fencing at right angles to the edge of the platform and extending from the back edge to within 750mm of the front edge may be required.

5.13.3. Fencing

- 5.13.3.1. Fencing may be required:

- a) to shield all barrier mechanisms unless protected in other ways; and
- b) to ensure the effectiveness of any cattle-cum-trespass guards.

- 5.13.3.2. At pedestrian crossings, additional fencing may be required between the boundary fence and the decision point. Where the gate or stile is at the decision point rather than in the boundary fence, additional fencing to connect the boundary fence to the decision point should be provided.

- 5.13.3.3. Where the road is unfenced and the adjacent land is used for grazing and crossing gates are not provided, a standard highway-type cattle-grid in the roadway should be provided.

- 5.13.3.4. Details of fencing can be found in section 1, Permanent Way, Earthworks and Structures.

5.14. THE CROSSING

5.14.1. Vertical profile

- 5.14.1.1. The vertical profile over any vehicular crossing should have no sudden changes of vertical curvature. The profile over an automatic crossings or user-worked crossings is critical to safety. At other types of crossings it is less critical because the crossings are manually operated by railway staff.
- 5.14.1.2. The profile over vehicular crossings should not cause a long, low vehicle, e.g. a low-loader, to become grounded and obstruct the railway.

5.14.2. Measurement of safe profiles

- 5.14.2.1. It is the relationship of the wheelbase with the ground clearance of a road vehicle, which is used to determine safe profiles. The profile is measured in terms of the maximum permitted hump of 75mm anywhere on the road surface over a length equal to the wheelbase of a specified nominal road vehicle.
- 5.14.2.2. At any automatic crossing, the safe profile is defined by the vehicle category, which is in turn determined by the road and rail traffic density. It is defined in Table 4.

Table 4: MEASUREMENT OF SAFE PROFILES				
ACTUAL DAILY ROAD VEHICLE USER	OR	DAILY TRAFFIC MOMENT	VEHICLE CATEGORY	THEORETICAL WHEELBASE LENGTH (metres)
More than 2000 (high)		More than 80,000	1	15.3
2000 or less (medium)		80,000 or less	2	9.75
600 or less (low)		25,000 or less	3	8.5

Note 1: The Daily Traffic Moment is the Actual Daily Road Vehicle User x the maximum daily train movements over the crossing.

Note2: The traffic data in Table 4 should be established by census. Any reasonably foreseeable increase in road usage following automation of the crossing should be taken into account. Other factors, such as the proximity of heavy plant operators, which may necessitate a flatter profile, should be taken into account. Vehicle weight or road width limitations may permit a more curved profile than the figures in Table 4 indicate.

- 5.14.2.3. Series of Bumps or Hollows signs as described in TSM figure 6.46 should be provided for crossings with vehicle categories 2 and 3.
- 5.14.2.4. Where a crossing is to be converted to an automatic crossing, the profile should be checked to ensure that it conforms to the appropriate category. The profile should exist across the full width of the carriageway and the approaches. The approaches extend for a minimum of 20m from the nearest rail for category 2 and 3 crossings, and up to 30m for category 1 crossings.
- 5.14.2.5. At user-worked crossings, the type of vehicles or equipment likely to go over the crossing should be determined before the design of the vertical profile of the crossing. Once this is determined, the maximum wheelbase length should be used to design the safe profile based on the same maximum permitted hump of 75mm. The gradient of the approaches to the crossing should be determined in conjunction with the vertical profile commensurate with the type of traffic using it.

Note: The provision of telephones at a user-worked crossing does not preclude the need to adhere to the above profile conditions.

5.14.3. Crossing surface

- 5.14.3.1. The surface of the carriageway over a crossing and on its immediate approaches should be

capable of being maintained in good order and have a skid resistance comparable to that of the road approaches. A higher degree of skid resistance may be needed where road speeds are high, the visibility of a crossing is limited or the road slopes downhill towards the crossing. The surface should be free from potholes, upstanding rails, depressed areas or major undulations. Any timbers or panels used in the surface should be firmly fixed.

- 5.14.3.2. At vehicular crossings with gates which completely fence in the railway when closed to the road or where there is no footpath adjacent to the carriageway, the ground at the edges of the carriageway over the crossing should be made up to the same level as the carriageway for at least 1m.
- 5.14.3.3. At user-worked crossings, a satisfactory road surface, commensurate with the type of traffic using them and adequate approaches should be provided and maintained. Where timbers are used for the crossing surface, they should be securely fixed in position and provide a clear flangeway. Where the surface is predominantly made up of ballast, it should be contained to ensure that the surface is at or almost at rail level and the flangeway is maintained.
- 5.14.3.4. At pedestrian crossings, the surface provided between the decision points should be unobstructed. There should be no movable signalling or track equipment on the surface (such as sets of points) or close by, that might create a hazard. The surface should be maintained in a good and even condition. The rails are not considered to constitute an obstruction or uneven surface.
- 5.14.3.5. The type of surface should be in keeping with, but not necessarily the same as, the surface provided on the right of way on the approaches to the crossing immediately outside the railway boundary.
- 5.14.3.6. Where the track ballast shoulder is high, steps or ramps for pedestrian crossings should be maintained to give access to the surface. On steep slopes, handrails may be needed in addition to steps or ramps.
- 5.14.3.7. Where the surface is other than ballast or stone chipping, a non-slip surface should be provided. Where the surface is made up to rail level and stone is used as in-fill; a means to retain the stone should be provided.
- 5.14.3.8. At pedestrian crossings, the surface should be made up to rail level, where:
- the crossing is in a location where housing, factories, shops etc. adjoin or are close to the railway, and the crossing provides an attractive or convenient link between them;
 - any of the approaches on the right of way are metalled; or
 - there is heavy regular use.
- 5.14.3.9. The surface of all level crossings should have no gaps other than the flangeway that could trap either the heel of a shoe or the wheel of a cycle, pram etc.
- 5.14.3.10. The surface should also be removable to permit occasional inspection of the track where there is a high risk of corrosion due to use of the crossing by animals or road salting.
- 5.14.4. **Crossing width**
- 5.14.4.1. At all crossings, the width of the carriageway over the crossing and on the approaches should be constant.
- 5.14.4.2. At all automatic crossings, open crossings and user-worked crossings, it should be possible for traffic to pass safely on the approaches and the crossing itself should not form an isolated passing place.
- 5.14.4.3. At automatic crossings, the carriageway width over the crossing should be maintained on each approach for the distances shown in Table 5.

Table 5: CROSSING WIDTH				
ACTUAL DAILY ROAD VEHICLE USER	OR	DAILY TRAFFIC MOMENT	DISTANCES MEASURED FROM THE STOP LINE (metres)	
			AHB	AOC

More than 2000		More than 80,000	21	21
2000 or less		80,000 or less	14	14
600 or less		25,000 or less	14	7

Note: It may be necessary to increase these distances commensurate with the type of vehicles which use the crossing.

- 5.14.4.4. The carriageway width over an automatic half barrier crossing should not be less than 6m, but where the actual daily road vehicle user is less than 4000, the width may be reduced to not less than 5m.
- 5.14.4.5. The carriageway width over a automatic open crossing should not be less than 5m where the actual daily road vehicle user is greater than 600 or the peak hour traffic moment is greater than 120.
- 5.14.4.6. At user-worked crossings, the road surface should be at least as wide as the distance between the gateposts. The width of the crossing should normally not exceed 5m to allow the use of single-leaf gates.
- 5.14.4.7. At pedestrian crossings, the width of the surface should not be less than 1m.
- 5.14.5. **Provision of lay-bys**
- 5.14.5.1. Lay-bys may be required at automatic crossings so that large or slow vehicles can wait while drivers telephone the control point. These may be required where sight lines would otherwise be obstructed or where there is risk of blocking to and from the crossing, caused by waiting vehicles.
- 5.14.6. **Crossing alignment**
- 5.14.6.1. At user-worked crossings, the alignment of the crossing over the tracks should enable the time required to traverse the crossing to be kept to a minimum.
- 5.14.6.2. Pedestrian crossings should be at right angles to the railway line.
- 5.14.7. **Crossing approaches**
- 5.14.7.1. At user-worked crossings, the alignment of the immediate approaches to the crossing should be in line with the alignment of the crossing itself. The alignment of the approaches to the crossing should be such that any light source from road vehicles or equipment should not cause confusion with railway signals.

5.15. GATES, WICKET GATES AND BARRIER EQUIPMENT

5.15.1. Gates

- 5.15.1.1. The gateway should be the full width of the carriageway plus at least 450mm clearance on each side. The clearance between gateposts should be of equal width at both sides of the railway. Means should be provided to retain the gates in both open and closed positions.
- 5.15.1.2. When closed, the gates should extend over the full width of the carriageway. Unless specially authorised, the normal position of the gates is across the road. At a user-worked crossing, they should not be closer to the track than the decision point.
- 5.15.1.3. At crossings on public roads, the gates should be painted white and carry red retroreflective targets to face outwards when the gates are across the road. Where there are red lamps mounted on the gates, which show towards approaching road traffic when the gates are across the road, red retroreflective targets may also be appropriate.
- 5.15.1.4. At gated crossings operated by railway staff, the gates should be lockable when closed across the road or railway. They should be conspicuous when closed across the railway to the drivers of approaching trains.

5.15.2. Wicket gates

- 5.15.2.1. Where wicket gates for pedestrians are provided, they should be on the same side of the carriageway and open away from the railway. Wicket gates for pedestrian crossings and gated crossings operated by railway staff should not be less than 1m wide.
- 5.15.2.2. All wicket gates should be easy to open from either side and be self-closing. Latches, which might prevent a wicket gate being opened quickly, should not be used. Where wicket gates are provided across the footpath at gated crossings operated by railway staff, they should be lockable.

5.15.3. Barriers

- 5.15.3.1. The tops of the barriers when lowered should not be less than 840mm above the road surface at the centre of the carriageway. The clearance between the bottom edge of the lowered barrier and the road surface should not exceed 1000mm. When raised, the barriers should be inclined towards the carriageway at an angle of between 5° and 10° from the vertical.
- 5.15.3.2. No part of the barrier equipment, which is less than 5m above the level of the carriageway, should be horizontally displaced from the nearer edge of the carriageway by less than 450mm. Where the barriers cover a footpath, no part of the barrier equipment, which is less than 2m above the level of the footpath, should be horizontally displaced from the edge of the footpath that is furthest from the carriageway, by less than 150mm.
- 5.15.3.3. The barriers should be as close as convenient to the railway, but no part of the equipment should be within the standard structure gauge (see section 1, Permanent Way, Earthworks and Structures).
- 5.15.3.4. Barriers should be at least 125mm deep at their mid-points and at least 75mm deep at their tips. Each barrier should display on both its sides red and white bands about 600mm long to the full depth of the barrier. A strip of retroreflecting material not less than 50mm deep should be provided along the full length of each band.
- 5.15.3.5. The moving parts of the barrier mechanism, excluding the boom and any skirt, should be shielded from the public.

- 5.15.3.6. Two electric lamps of adequate luminous intensity should be fitted to each barrier and, when illuminated, show a red light in each direction along the carriageway. The lamps should be evenly spaced along the barriers with one lamp within 150mm from the barrier tip. The lamps should show except when the barriers are fully raised. At user-worked crossings, these lamps may be omitted by agreement with the RSC.
- 5.15.3.7. At crossings with a high pedestrian usage or where there is a risk of trespass barriers should be designed to inhibit bending or skewing preventing pedestrians traversing the crossing between barriers.
- 5.15.4. **Skew crossings**
- 5.15.4.1. On skew crossings where the tip of the barrier points towards the railway, the point of intersection of the line extended through the barriers and the outer edge of the road, including any footpath, should not be within 1000mm of the nearest rail.
- 5.15.5. **Barrier crossings operated by railway staff**
- 5.15.5.1. At barrier crossings operated by railway staff, each road approach should be protected by barriers which, when lowered, extend across the full width of the carriageway and footpaths.
- 5.15.5.2. At barrier crossings operated by railway staff and user-worked crossings, skirts should be fitted to the barriers. The skirts should be of a light colour, light construction and fence in the space between the lowered barriers and the road surface.

Note: Skirts are not required at automatic crossings with half barriers.

- 5.15.6. **User-worked crossings**
- 5.15.6.1. At user-worked crossings, the barriers should be hand-operated and counter-weighted to fall when released. The barriers should be linked so that they can be raised or lowered together from either side of the crossing.
- 5.15.7. **Single barriers**
- 5.15.7.1. Single barriers should not normally be provided unless authorised by the RSC for use on one-way roads or on two-way roads with central reservations. In such cases special provisions for pedestrians may be required.
- 5.15.8. **Half barriers**
- 5.15.8.1. At automatic crossings with half barriers, the barriers should be pivoted on the left-hand side of the road on each approach.
- 5.15.8.2. When lowered, the half barriers should extend to between 150mm and 450mm from the centre of the carriageway. On carriageways between 5m and 5.7m wide, the barriers should extend to within 800mm of the centre line so as to leave a clear exit of at least 3m in width.
- 5.15.8.3. If the line is electrified on the overhead system and a barrier, if capsized, could come closer than 150mm to the overhead conductors, that barrier should either be made of metal or be provided with a continuous conducting strip. The metal barrier or conducting strip should be connected to earth in such a manner as to ensure that inadvertent contact with the overhead conductor causes controlling circuit-breaker(s) to interrupt the electric traction supply.

5.16. TELEPHONES AND TELEPHONE SIGNS

5.16.1. General

- 5.16.1.1. The power supply to the telephones should be independent of that for the crossing equipment. Faults on individual telephones or the failure of a user to replace the handset on any telephone should not prevent the correct operation of the remaining telephones.
- 5.16.1.2. A symbol depicting a black telephone handset on a yellow background should be displayed on or adjacent to the cabinet. The telephones should be clearly visible from the crossing. If the telephones are not clearly visible to a person at a particular location a similar telephone handset sign with a directional arrow should be provided to direct potential users to the telephones.

5.16.2. At automatic crossings

- 5.16.2.1. Telephones for use by the public at automatic crossings with half barriers should be housed in cabinets and connected directly to the supervising point. A two-way calling facility should be provided.
- 5.16.2.2. Inside or adjacent to the telephone cabinet, clear and simple instructions, which are also legible at night, should be provided to tell users to contact the supervising point. The telephone user should not have to dial a telephone number.
- 5.16.2.3. In case the telephone at the crossing is out of order, the name of the crossing and its unique reference number should also be displayed within the door of each telephone cabinet followed by a public telephone number of a continuously staffed railway location to be used when the line is open.
- 5.16.2.4. When calls are received in the supervising point, a distinctive warning should be sounded, accompanied by a visual indication. These calls should take precedence over any other calls on the telephone system and the warning should sound even if the system is currently in use.
- 5.16.2.5. If the railway is not open for 24 hours a day, a means to notify users of the times between which trains do not travel over the crossing should be provided inside or adjacent to the telephone cabinet. This may be in the form of an indication comprising of a yellow light and an appropriate instruction notice to inform users, if illuminated when there is no reply to the telephone, that the railway line is closed to railway traffic.

Note: This may be in the form of a recorded announcement or a notice, which is also legible at night and could read:

'Railway normally closed (followed by appropriate times).

At such times only you may cross if

there is a yellow light showing and

there is no reply after two minutes'.

- 5.16.2.6. The telephone system should have a facility which records that calls have been made from the crossing during periods when the supervising point is closed. When the supervising point reopens, a visual and audible indication should be given that calls from the crossing have been made during the period of closure.

5.16.3. At barrier crossings operated by railway staff

- 5.16.3.1. Telephones for use by the public should be provided at each entrance to and exit from the crossing. The phones at the entrance to the crossing should be located adjacent to the nearside primary road traffic signal and face outwards from the crossing. The phones at the exits from the crossing should be located adjacent to the offside barrier, face into the crossing and be accessible to users who may be trapped within the crossing. They should be housed in cabinets and connected directly to the supervising point. A two-way calling facility should be provided.

5.16.4. At gated crossings operated by railway staff

- 5.16.4.1. Telephones for public use are not normally provided at gated crossings operated by railway staff. Where the gates are normally closed across the road a device should be provided on each road approach to the gates to alert the crossing operator of the requirement to open the carriageway. The devices should be accessible and clearly visible to road and pedestrian users and provided with clear operating instructions.
- 5.16.4.2. Gated crossing without protecting signals should have a dedicated telephone for the sole use of the attendant to communicate with the signalman.

5.16.5. At user-worked crossings

- 5.16.5.1. Telephones, where provided, should be positioned adjacent to the gates or barriers on each side of the crossing. The telephones should be housed in cabinets and connected directly to a supervising point. A two-way calling facility should be provided.
- 5.16.5.2. Inside the cabinet, clear and simple instructions, which are also legible at night, should be provided to direct users to contact the supervising point. The telephone user should not have to dial a telephone number.
- 5.16.5.3. The name of the crossing and its unique reference number should be displayed within or adjacent to the door of each telephone cabinet followed by a telephone number of a continuously staffed railway location to be used when the line is open, in case the telephone at the crossing is out of order.

5.17. MINIATURE WARNING LIGHTS (MWL)

5.17.1. General description

- 5.17.1.1. Miniature warning lights consist of red and green lights. They can be used at user-worked crossings and pedestrian crossings. The green light normally shows, but an approaching train automatically changes the lights to red. Signs instructing users to cross only when the green light shows should be provided.

Note: MWL may not be suitable at crossings where movement of cattle or heavy farm equipment is involved. Alternative arrangements may need to be made.

5.17.2. Positioning of MWL

- 5.17.2.1. The MWL should be located so that they face towards an approaching user. They should be clearly visible to the crossing users when operating the gates or barriers. MWL are mounted in the sign to Figure 30 at a crossing with a telephone or in the sign to Figure 31 at a crossing without a telephone.
- 5.17.2.2. At pedestrian crossings, the MWL should be placed on the far side of the crossing from an approaching user and face inwards towards the railway.
- 5.17.2.3. At user-worked crossings, the MWL should be placed on the approach side of the crossing facing towards approaching road users. This should still apply where there is an adjacent pedestrian crossing.

5.17.3. Equipment of MWL

- 5.17.3.1. The red and green lights should be of adequate luminous intensity to convey the safety message to users at the decision point. The distance between the edges of the lenses should not be less than 40mm. Each lamp should be fitted with a hood against sunlight.
- 5.17.3.2. Consideration should be given to the use of standard highway pedestrian signals (TSM section 9.7).

5.17.4. Associated signs

- 5.17.4.1. Traffic signs associated with the use of MWL are shown in Figure 30 to Figure 36. These signs are in addition to those required at user-worked crossings and pedestrian crossings.
- 5.17.4.2. At user-worked crossings the signs to Figure 32 or Figure 33 should be mounted with the MWL on the approach side of the crossing facing towards approaching users.
- 5.17.4.3. At pedestrian crossings the signs to Figure 36 should be mounted with the MWL on the far side of the crossing from an approaching user and facing inwards. Duplicate signs without the red/green lamps should be mounted on the approach side of the crossing facing towards approaching users.

5.17.5. Railway signalling and control equipment

- 5.17.5.1. The MWL should be operated automatically by trains in accordance with the warning period required by the particular type of crossing as listed in Table 6.

Table 6: MINIMUM WARNING PERIODS	
TYPE OF CROSSING	MINIMUM WARNING PERIOD (seconds)
User-worked crossings	40
Pedestrian crossings	20

- 5.17.5.2. The minimum warning periods should be at least 5 seconds longer than the time required to traverse the crossing.
- 5.17.5.3. The green light should show until the red light appears. As soon as the train is clear of the crossing, the red light should be extinguished and the green light should appear unless the red light is required to show for another train.
- 5.17.5.4. Bi-directional controls should be provided.
- 5.17.5.5. Where signals or station platforms lie between the strike-in point and the crossing, special controls may be required.

Note: A standby power supply is not considered necessary.

5.18. TRAFFIC SIGNALS, TRAFFIC SIGNS AND ROAD MARKINGS

- 5.18.1.1. References to regulations or directions in this section are to the Traffic Signs Manual (TSM). The legal framework for traffic signage (including signs, devices, notices and markings) is contained in the Road Traffic Acts. Where references in this document to the Road Traffic (Signs) Regulations, 1997 and 1998 they will be quoted as being included in the Traffic Signs Manual (TSM) issued by the Department of Transport (DoT).
- 5.18.1.2. Signs should be positioned so as not to be a hazard to road users and pedestrians using the crossing e.g. 2100 mm headroom clearance may be required where the sign is positioned adjacent to a footpath.
- 5.18.1.3. Minimum clearances between road traffic light signals and level crossing signs and the road edge should be maintained in accordance with those specified in the TSM section 10.3.

Note: Some Iarnród Éireann specific signs are referenced in this guidance and included as examples in Section 5.20. A review of the TSM and associated regulations is due to be completed in 2003. This guidance will be updated following that review.

5.18.2. Road traffic light signals

- 5.18.2.1. Figure 8 shows the lens layout of the traffic light signal. The light board will be black, sized 1320mm x 860mm with a 100mm white border. The lens diameter will be a minimum of 200mm. The reverse of the light board should be coloured gray.
- 5.18.2.2. A primary road traffic light signal should be located on the left-hand side of the carriageway, on each road approach, as close as possible to the crossing. At crossings where there are barriers, it should be located not more than 2m before the barrier and adjacent to the barrier machine where this is on the left-hand side.
- 5.18.2.3. A duplicate primary road traffic light signal should be located on the right-hand side of the carriageway on each approach. An additional road traffic light signal may be required where neither the primary nor the duplicate primary signal can be seen from a side approach. Secondary road traffic light signals, located on the far side of the crossing, should not be used at crossings.
- 5.18.2.4. Advance warning road traffic signal consisting of two flashing amber lights aligned horizontally may be located on the approach to crossing if the primary and duplicate primary signals cannot be viewed from the distance required by Table 7. The advance lights should be located not more than 300 metres from the crossing and there should be continuous sighting of the level crossing lights from the advance traffic light signal.
- 5.18.2.5. No road traffic light signal should be located on the approach side of the vehicular stop line or an extension from it.
- 5.18.2.6. At acute skew crossings, the duplicate primary signal may be placed in line with the vehicular stop line to shorten the length of the crossing.
- 5.18.2.7. At obtuse skew automatic crossings, the duplicate primary signal may be placed closer to the railway than normal, provided that a vehicle stopped in line with the signal is not foul of the railway structure gauge. Special arrangements for pedestrians may be necessary (see section 5.11 and Figure 7).
- 5.18.2.8. Where the normal post mounting of a road traffic light signal is impracticable, it may be mounted over the carriageway provided that no part of the horizontal structure or the signal is less than 5.5m above the road surface.
- 5.18.2.9. Where a road traffic light signal is mounted over the carriageway and the line is electrified on the overhead system and the structure and signal, if capsized, could come closer than 150mm to the overhead conductors, the structure and the signal should either be made of metal or be provided with a continuous conducting strip. The metal structure and signal or the conducting strip should be connected to earth in such a manner as to ensure that inadvertent contact with the overhead conductors causes controlling circuit-breaker(s) to interrupt the electric traction supply.
- 5.18.2.10. The road traffic light signals, if mounted at the side of the road, should be positioned so that the

centre of the lens nearest the carriageway is not less than 810mm and not more than 1500mm from the carriageway edge.

- 5.18.2.11. Where the signals are above a footpath, minimum headroom from the lower edge of the signal backing board of 2100mm should be maintained.
- 5.18.2.12. The distance from which it is desirable that the intermittent red lights and amber lights can be seen varies according to the speed value of the road. Recommended minimum visibility distances are shown in Table 7. If these minimum visibility distances cannot be achieved, further measures may be necessary, e.g. the provision of additional advance warning signs, count-down markers etc.

Table 7: RECOMMENDED MINIMUM VISIBILITY DISTANCES	
85%ILE SPEED OF ROAD VEHICLES (km/h)	MINIMUM VISIBILITY DISTANCE (metres)
40	40
60	80
80	130
100	190
120	270

- 5.18.2.13. Where a crossing is situated close to a road junction equipped with road traffic light signals, the two sets of road traffic light signals may need to be linked. Where they are linked, the connection between them requires special authorisation.

5.18.3. Pedestrian signals

- 5.18.3.1. The construction and specification of pedestrian signals used at level crossings are required to comply with TSM section 9.7.
- 5.18.3.2. The red figure on the pedestrian signal should be illuminated internally by an intermittent light while the intermittent red lights of the road traffic light signals are lit. The rate of flashing should be the same as one of the intermittent red lights in the road traffic light signal.

5.18.4. Traffic signs

- 5.18.4.1. Appropriate traffic signs should be provided on each road approach. Examples of the layouts are given in Figure 2 to Figure 7.

Note: The TSM states that sign (Figure 17 - Level Crossing Ahead With Lights and Barriers) should be used at automatic level crossings equipped with barriers and lights. It should be noted that this sign should also be used at CCTV level crossings equipped with barriers and lights.

- 5.18.4.2. Details of the signs for use with MWL are shown in Figure 30 to Figure 36.
- 5.18.4.3. At automatic crossings, signs to Figure 22 should be positioned as close as possible to the crossing, commensurate with the likely approach speed of the vehicles to which they refer.

Note: The sign may be altered to exclude "or of HERDS OF ANIMALS" as necessary e.g. suburban areas.

- 5.18.4.4. At automatic crossings on double-track lines, where two trains can arrive at the crossing without providing the minimum road open time, signs to Figure 21 **Error! Reference source not found.** reading 'Second Train Coming' should be provided adjacent to each duplicate primary road traffic light signal. The sign should be approximately 540mm square with not less than 90mm high internally illuminated white letters on a black background. The post should be painted alternatively with approximately 480mm black and white bands and positioned to give maximum visibility to vehicles standing at the stop line.

Note: The height and position of the second train coming sign may require to be adjusted to give maximum visibility to vehicles standing at the stop line. In some circumstances this may require the sign to be positioned under the duplicate primary road traffic light signal.

- 5.18.4.5. At automatic crossings and open crossings, where the road crosses the railway at a skew angle or there are bends on one or both approaches, bend and chevron signs and count-down markers may be required. Additional reflecting road studs along the edges of the carriageway to direct drivers along the road may be required.
- 5.18.4.6. At user-worked crossings and pedestrian crossings, a sign(s) explaining to the user how to proceed safely over the crossing should be provided facing the user at, or on the approach to, the decision point (e.g. I.E. publication "The safe use of unattended railway level crossings").
- 5.18.5. **Related to electrified lines (see section 3 Electric traction systems)**
- 5.18.5.1. Where the line is electrified on the overhead line system, signs to TSM figure 6.36 should be provided with an appropriate plate. At user-worked crossings, suitable signs warning of the danger from bare electrical conductors e.g. 'Danger, overhead live wires' should be provided and face towards the user approaching the decision point.
- 5.18.5.2. Where the minimum wire height over a public crossing cannot be achieved, advance warning signs to TSM figures 6.36 and 6.37 should be provided at the last available diversion before the crossing.
- 5.18.5.3. The signs to TSM figure 6.37 should show a 'safe height' which is at least 300mm below the height of the overhead conductor for 1.5 kV d.c. systems.
- 5.18.5.4. At any crossing where the height of the overhead conductor is below that normally required for a public crossing, additional measures should be provided along with signs to TSM figures 6.36 and 6.37 showing a 'safe height' which is at least 300mm below the height of the overhead conductor for 1.5 kV d.c. systems.

Note: In calculating the 'safe height', allowance should be made for the effect of the vertical profile of the carriageway on a road vehicle and its load.

- 5.18.5.5. At crossings where the gradient of the approaches is such that vehicles with large overhangs or conveying a large overhanging load could touch or come dangerously close to the overhead line equipment, even though they are lower than the 'safe height' shown on the signs to TSM figures 6.36 and 6.37, an additional sign depicting the hazard, e.g. 'Danger, overhanging load may foul live wires' should also be provided.
- 5.18.6. **Related to risk of grounding**
- 5.18.6.1. Where there is a risk that vehicles may become grounded on the crossing, signs to TSM figure 6.46 should be erected on the immediate approaches. Advance warning signs to TSM figure 6.46 with distance information at the last available diversion before the crossing. See sections 5.14.2.1 to 5.14.3.2 for the details of which crossings require signing.
- 5.18.6.2. Where telephones are provided at the crossing, signs to Figure 11 should be mounted beneath signs to TSM figure 6.46 on the approaches. Where telephones are not provided signs to Figure 12 should be provided.
- 5.18.7. **Road markings**
- 5.18.7.1. Transverse road markings are not normally provided at gated crossings operated by railway staff, but where they are, they should conform to guidance in this section.
- 5.18.7.2. Road markings should be provided at user-worked crossings, except where the road surface is unsuitable.
- 5.18.8. **Transverse and associated road markings**
- 5.18.8.1. Where road traffic light signals are installed, transverse stop lines to TSM figure 7.1 should be provided on the left-hand side of the carriageway. The lines should be at right angles to the

carriageway approximately 1m in front of the primary road traffic light signal. At automatic open crossings this may be increased to 2m. The lines should also extend across the adjacent footpath and be 300mm wide.

- 5.18.8.2. Where road traffic light signals are installed transverse pedestrian road markings are required to extend across the right-hand side of each carriageway. The lines should be at right angles to the carriageway approximately 1m in front of the secondary road traffic light signal. At automatic open crossings this may be increased to 2m. The lines should also extend across adjacent footpath on each crossing approach. The lines should be located in accordance with TSM figure 7.14 and be 300mm wide, 900mm long with a 450mm space.
- 5.18.8.3. At user-worked crossings, if a stop sign to TSM Figure 5.2 is provided, then a transverse stop line to TSM Figure 7.1 should be provided unless the road surface is unsuitable.
- 5.18.9. **Longitudinal road markings**
- 5.18.9.1. The type and arrangement of longitudinal road marking is shown in the TSM section 7.5.
- 5.18.9.2. Where the width of the carriageway over the crossing is less than 5m, a centre of carriageway marking is not normally required.
- 5.18.9.3. Where the width of the carriageway over the crossing is 5m or over, but less than 6m, the centre of the carriageway, between the stop lines, should be marked with the appropriate longitudinal lines to TSM section 7.5. The lines should continue for a minimum of 15m beyond the stop line or, alternatively, for at least 6m beyond this distance the carriageway is less than 6m in width.
- 5.18.9.4. Both edges of the footpaths over the crossing should be marked with a continuous longitudinal marking to TSM section 7.5. Discretion should be used when positioning the edge of carriageway lines so as not to conflict with yellow box markings.
- 5.18.10. **Double white Lines**
- 5.18.10.1. Where the width of the carriageway over the crossing and on the immediate approaches is 6m or over and there is a risk of overtaking, the centre of the carriageway over the crossing should be marked with a double line system to TSM section 7.6. The lines should continue along the approaches to the crossing where justified by the visibility for oncoming traffic.
- 5.18.10.2. At automatic barrier crossings, where the carriageway width permits, a central traffic island may be provided on the approach to the stop lines as an additional form of protection against vehicles attempting to "zigzag" the crossing.
- 5.18.11. **Yellow box markings**
- 5.18.11.1. Yellow box markings to TSM Figure 7.18 should be provided on the carriageway over the crossing area at all controlled barrier and automatic crossings. Typical arrangements of the markings are depicted on TSM Figure 7.14.
- 5.18.12. **Road studs**
- 5.18.12.1. Reflecting road studs may be laid on the centre line of the roadway over the crossing and on the approaches to the crossing. The studs should be white bi-directional reflecting and positioned at 6m intervals. Any studs laid within 2m of a running rail should be of plastic construction.

5.19. TYPICAL ROAD LAYOUTS

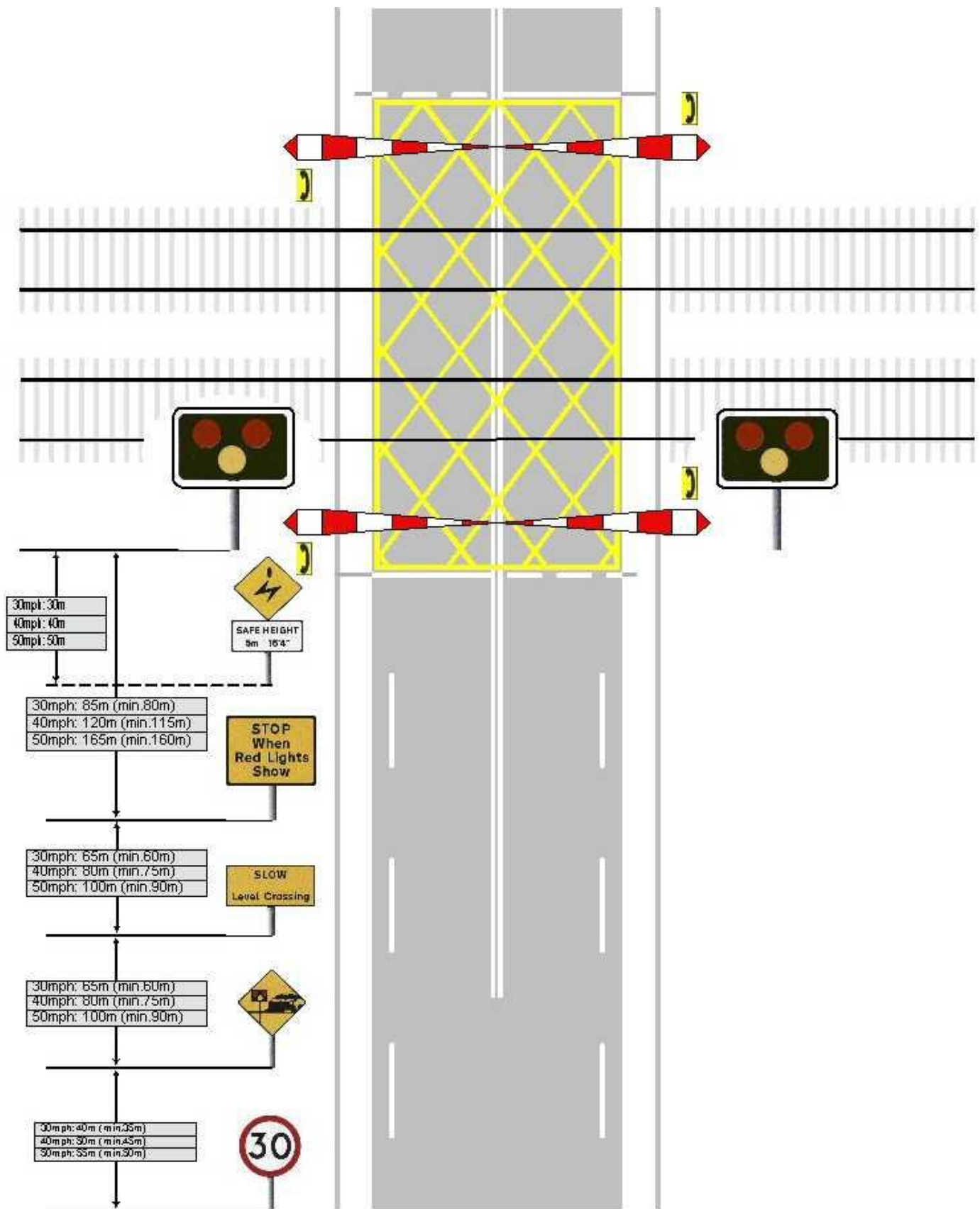


Figure 2: Typical Layout of CCTV Barrier Crossing (with additional risks from overhead traction system)



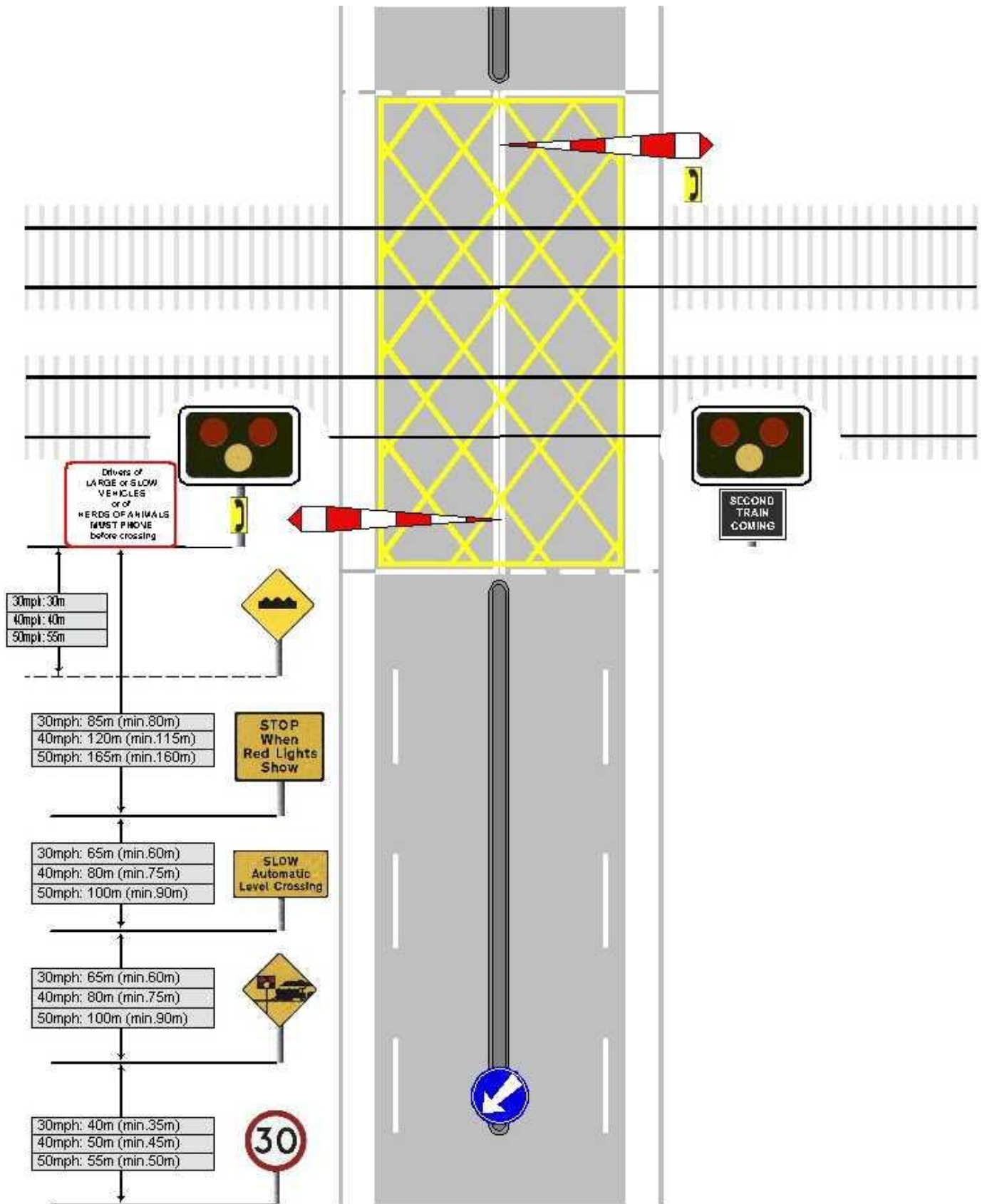


Figure 4: Typical Layout of Automatic Half Barrier (with additional risks from uneven crossing surface and drivers zig zagging)



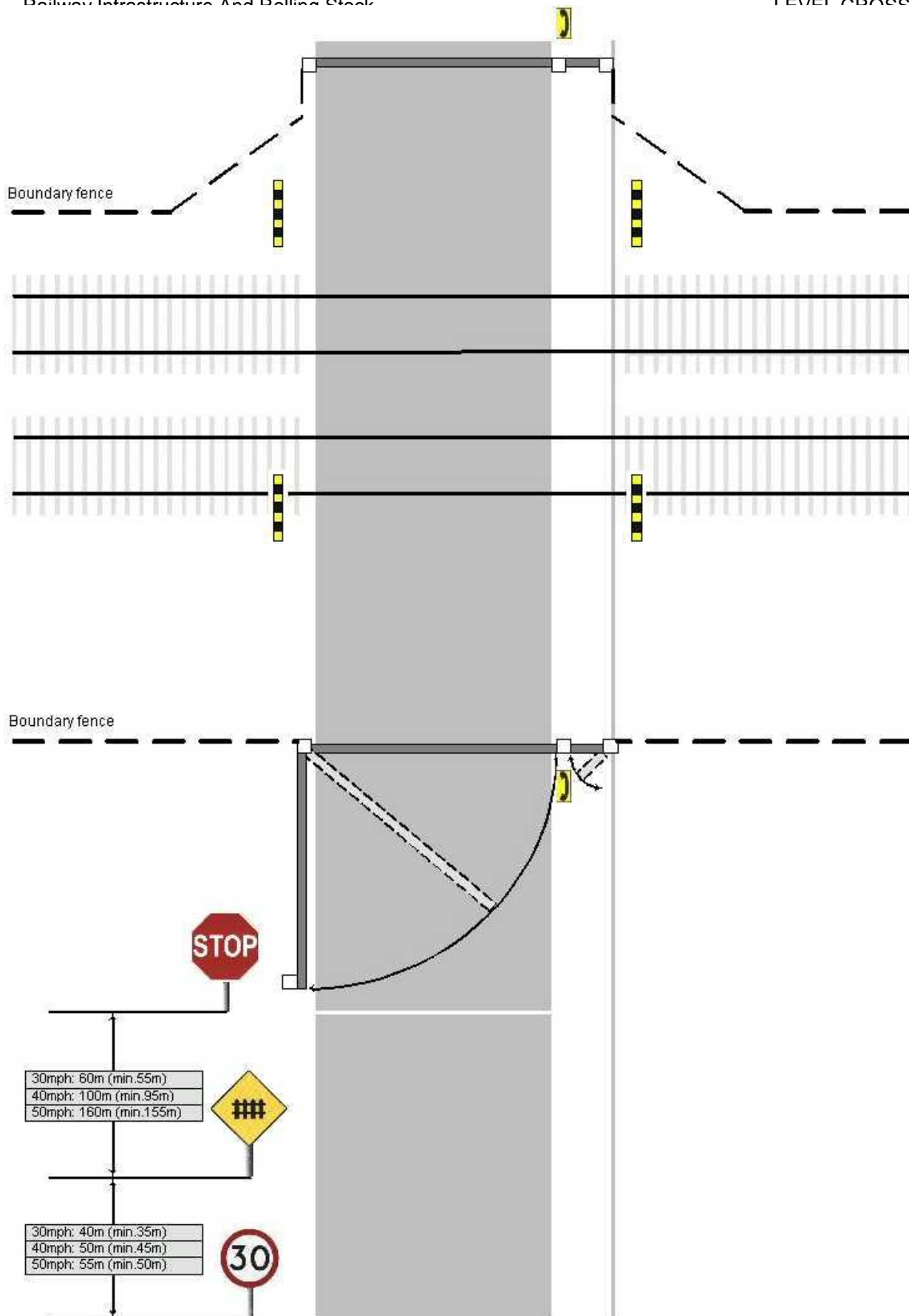


Figure 6: Typical Layout of user worked crossing with adjacent footpath

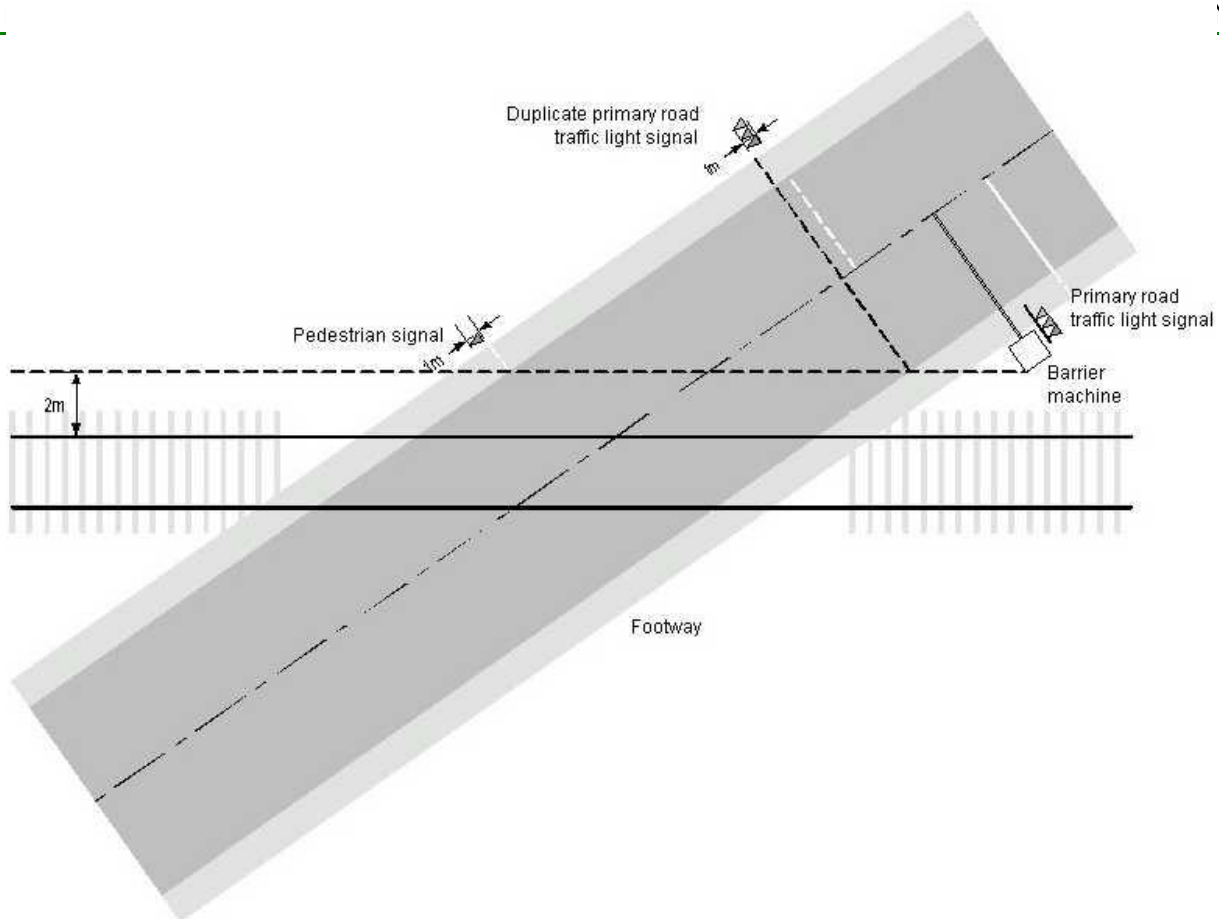


Figure 7: Typical layout of an obtuse skew crossing

Note 1: A pedestrian stop line should be provided across the footpath whenever a pedestrian signal is provided. The pedestrian stop line should be approximately 1m in advance of the pedestrian signal. This pedestrian stop line should be positioned in such a manner that the end of the line at the edge of the carriageway is not less than 2m from the nearest running rail.

Note 2: The use of a pedestrian signal may depend on the following factors:

- a. number of lines of track;
- b. visibility problem;
- c. level of pedestrian usage;
- d. economic fact; or
- e. degree of skew.

Note 3: In the case of an extremely obtuse skew crossing, similar to the one in Figure 7, the RSC may consider the following arrangement as an alternative:

- a. the omission of the pedestrian stop line and the pedestrian signal on the right-hand side footpath; and
- b. the duplicate primary road traffic light signal and the pedestrian stop line across the footpath and across the right-hand side of the carriageway may be positioned closer than the minimum 2m from the nearest running rail.

5.20. ROAD SIGNS

Note 1: Regulatory, mandatory and warning signs which apply to level crossings are included in the TSM section 6. Some Iarnród Éireann specific signs and other examples are included in this section to provide an illustration of additional information and warnings that may be presented to level crossing users. A review of the TSM and associated regulations is due to be completed in 2003. This guidance will be updated following that review.

Note 2: Example signs and road traffic light signals within this section have the following identifiers;

- a. regulatory, mandatory and warning signs and signals (TSM);
- b. Iarnród Éireann signs (IE);
- c. DoT "Pink Booklet" (PB);
- d. other example signs (EG).

5.20.1. Level crossing road traffic light signals

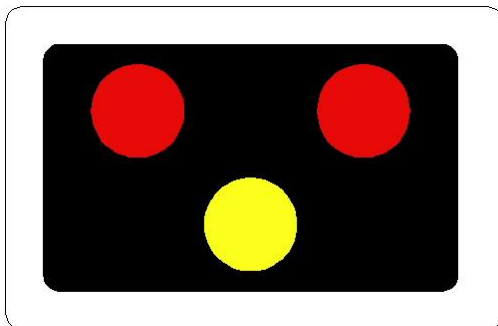


Figure 8: Road Traffic Light Signal (TSM)

5.20.2. General level crossing signs



Figure 9: Warning-Crossing Ahead (IE)



Figure 10: Accident Black Spot (IE)



Figure 11: Risk of Grounding (EG)



Figure 12: Contact Signaller (EG)



Figure 13: Level Crossing Number (IE)



Figure 14: Stop When Red Lights Show (TSM)

5.20.3. Manually controlled level crossings



Figure 15: Slow-Level Crossing (EG)

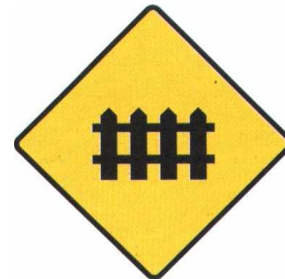


Figure 16: Level Crossing Ahead, Guarded by Gates or Lifting Barriers (TSM)



Figure 17: Level Crossing Ahead With Lights and Barriers (TSM)

Note: Sign(Figure 17) should be used at CCTV level crossings equipped with barriers and lights.

5.20.4. **Automatic level crossings**



Figure 18: Slow- Automatic Level Crossing (TSM)



Figure 19: Level Crossing Ahead With Lights and Barriers (TSM)



Figure 20: Level Crossing Ahead, Unguarded By Gates Or Lifting Barriers (TSM)

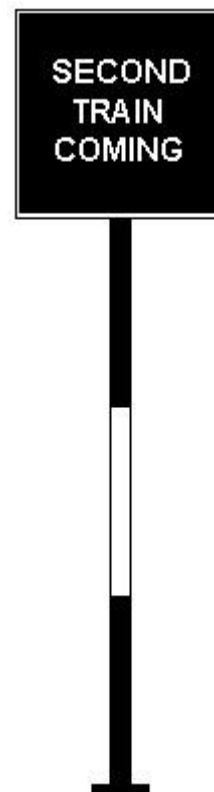


Figure 21: Second Train Coming (PB)



Figure 22: Drivers of Large & Slow Vehicles (EG)

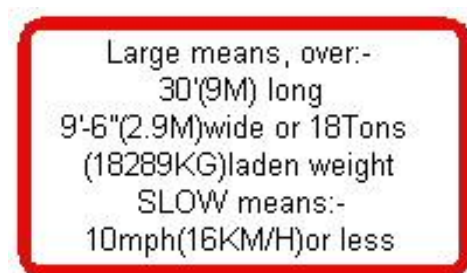


Figure 23: Definition of Large & Slow Vehicles (EG)

5.20.5. User worked crossings



Figure 24: Pedestrian Warning Sign (IE)

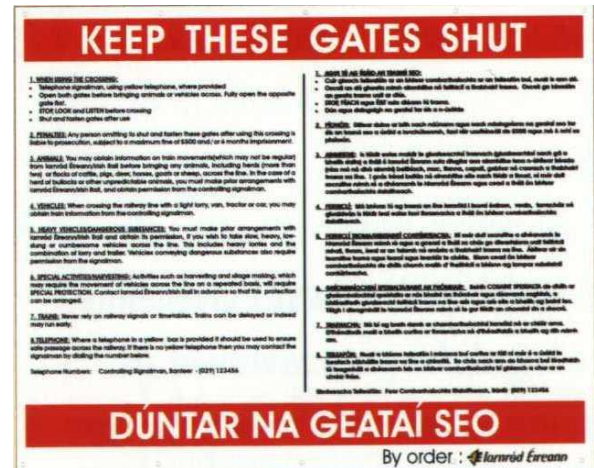


Figure 25: Keep gates shut (IE)



Figure 26: Danger-Level Crossing (IE)

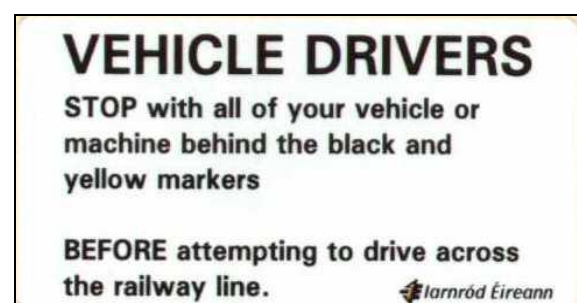


Figure 27: Vehicle Drivers (IE)



Figure 28: No Trespass (IE)

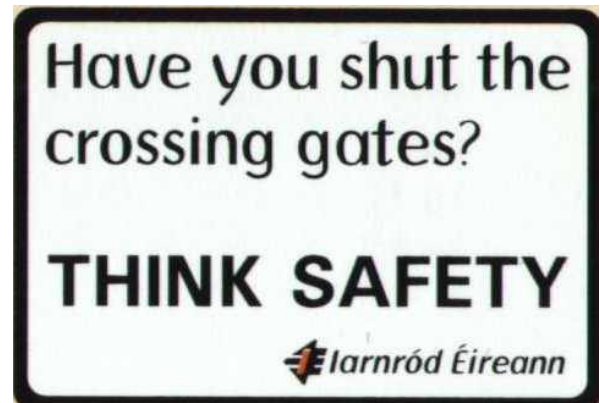


Figure 29: Shut Gates (IE)

5.20.6. **Miniature warning lights.**



Figure 30: (EG)



Figure 31: (EG)

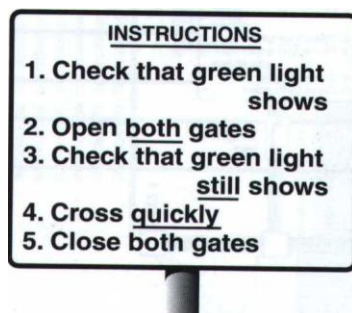


Figure 32: (EG)

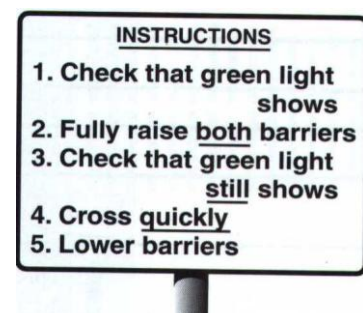


Figure 33: (EG)



Figure 34: (EG)



Figure 35: (EG)

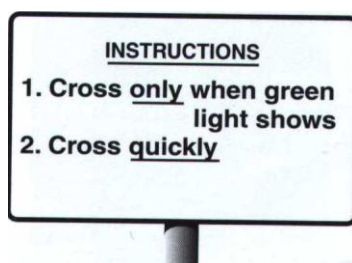


Figure 36: (EG)