Level crossings - the train coming is at line speed!

Andrew Allen, Senior Engineer, AEGIS, explains level crossing risk assessment from a user's perpective.

On the face of it, level crossings provide a straightforward means for the public crossing the railway. In reality though, they are much more complex locations than that - because there is a train coming and it is coming at line speed! So, whatever controls are in place at a level crossing, the appropriate action is to assume a train is coming.

Uffington and Barnack Level Crossing.

Types of crossing and protection arrangements

Crossings take many different forms depending if they are public or private, or whether they are for vehicles, pedestrians or equestrian use. There are different operations and protection arrangements for the many different users.

Protected crossings are shielded from movements by trains not being authorised to pass over the crossing until it is closed and the crossing area has been checked to be clear.

Unprotected crossings depend on a warning being given to crossing-users of an approaching train so that they can be clear before the train arrives. It is unlikely that the train can be stopped if the crossing is not clear.

Protected crossing

Manually-Controlled Gates (MCGs) are crossings operated by a signaller or crossing keeper. There will be a protecting signal that the crossing keeper has to clear to allow rail traffic over the crossing. The normal position of the gates is open to road traffic, although there are a small number that are kept closed to road traffic.

Manually-Controlled Barriers (MCBs) extend across the full width of the road. The barrier is operated by a signaller or crossing keeper before clearing a protecting signal. The signalling is interlocked with the road traffic light signals (also known as Wig Wags). A MCB crossing can be operated by a signaller viewing the crossing directly from a signal box overlooking the crossing or remotely via CCTV images (MCB-CCTV).

Obstacle Detection (MCB-OD) are similar to MCB-CCTV in they have barriers that extend the full width of the carriageway. They have a means of detecting obstacles on the crossing via radar and lidar scanning technology. The obstacle detector will scan to check the crossing is clear before lowering the vehicle barriers and releasing the protecting signal. The signaller will typically not have any interaction with the crossing, but will receive indication of the state of the crossing and can manually intervene if required.

Unprotected crossings

Automatic Half-Barrier (AHB) crossings have Road Traffic Light Signals (RTLS) or Wig Wags and barriers that extend over the nearside of the carriageway leaving only the exit clear. A train will automatically activate the RTLS and barriers by contacting a treadle. The barriers will raise automatically once the train has passed the crossing. AHB crossings will typically not need any interaction from a signaller although a telephone is provided in the case of emergencies.

Automatic Barrier Crossings Locally monitored (ABCL) crossings appear similar to the AHB in that there is a half-barrier over the nearside carriageway. However, locally monitored means the train driver must ensure the crossing is clear before moving over. Typically, the train speed is lower at ABCL crossings. Telephones are provided to contact the signaller in an emergency.

Automatic Open Crossings (AOCLs) are operated automatically by an approaching train. There is no barrier for road vehicles or pedestrians. Typically, telephones are not provided. There is an indication to the train driver that the crossing RTLS has operated correctly and the train driver must ensure the crossing is clear, approaching at low speed. There are some crossings of this type that have an additional barrier.

User-Worked Crossings (UWCs) have gates or full lifting barriers that are operated by the user prior to traversing. The user is required to check the crossing is clear of rail traffic before traversing. UWCs are usually private and have good sighting.

If a user is crossing with a vehicle, they would need to traverse five times, as they have to open the nearside gate: (1) traverse to open the far side gate; (2) traverse back and return to the vehicle; (3) traverse with the vehicle; (4) then traverse to close the original gate and (5) traverse again to return to the vehicle. There are various types of these crossings, both with and without telephones, to contact the signaller. Even if the signaller has been contacted, the crossing remains unprotected as there is no protecting signal.

Open Crossings (OCs) are completely open - there are no RTLS, barriers or telephones. Vehicle use is low and rail speed is less than 10mph. Road-users are provided warning signs only.

Footpath crossings (FPs) are for pedestrians and have a plethora of types including styles, wicket gates and open crossings. Some have whistle boards where the approaching train is required to sound the horn to warn pedestrians, some have miniature stop lights with a red/green aspect to give an indication to pedestrians if a train is approaching. However, it is still the user's responsibility to ensure the crossing is clear.

Wig Wag at Marsh Lane Level Crossing.

Suitable and sufficient level crossing risk assessment

The ORR states, 'level crossings account for almost half of the catastrophic train accidents on Britain's railways.' Through safe design, management and operation of level crossings, user behaviour can be influenced and the risk reduced at these locations.

Understanding the risks at any given crossing is the first step in developing a safe crossing. Obviously, the safest

Automatic Half-Barrier crossing at Woodsford No: 37 Level Crossing.

crossing is the one that is not there, through the provision of an alternative means of crossing the railway i.e. a bridge or diversion. Network Rail has an ongoing programme of level crossing removals although, in some locations, it may never be possible to do away with the crossing - hence understanding the risk and how to manage it to acceptable levels is critical.

The definition of what constitutes 'suitable and sufficient' assessment is not clearly defined although, as a specialist risk assessment company, AEGIS knows that risk must be taken seriously. AEGIS produces a Risk Assessment Report for each individual level crossing that it is contracted to risk assess, using Network Rail guidance NR/LX/Risk-Assessment/TSW. In producing a risk assessment, AEGIS will undertake a desk study alongside a site visit prior to holding a risk workshop where interested stakeholders will discuss the crossing and its existing risks and potential solutions.

The Risk Assessment Reports concisely cover all areas of the crossing as it is and will include discussion around risks and potential solutions. Network Rail use a risk modelling tool called the 'All Level Crossing Risk Model' (ALCRM) - this gives a risk score for the individual risk (A-M) and for the collective risk (1-13) to the railway.

ALCRM also highlights key risks at each crossing and calculates a Fatalities Weighted Index (FWI) score which, in effect, takes all the non-fatal injuries and calculates them up using a weighting factor to arrive at a total number of 'fatality equivalents'. AEGIS collates the numbers and equates this FWI figure to the Value for Preventing a Fatality (VPF) that is published by the RSSB each year. The latest figure for 2019 is VPF2019 = £2,017,000. This is then used in a cost-benefit analysis of the different options at any given site.

Close collaboration with Network Rail

AEGIS worked very closely with Network Rail on the CP6 Early Development Project to help Network Rail understand Level Crossing CP6 spending budgets. AEGIS provided suitable and sufficient risk assessments as well as a traffic census for 10 level crossings on the Wessex route, with options to add additional crossings on other routes. A weekly progress call between single points of contact on both sides was critical to maintain close monitoring of the progress of the project against the fixed timescales.

For each phase of the project, a workshop takes place where the Network Rail Level Crossing Manager (LCM) and a number of other knowledgeable people are brought together to discuss a small related group of level crossings. Optioneering is undertaken to discuss current risks and potential solutions for each crossing, being careful to consider residual risks or unintended consequences.

Recognition of outstanding performance

AEGIS' reputation as a provider of repeatably high-quality level crossing risk assessments is growing within the rail industry. Network Rail has implemented many recommendations made in AEGIS' Risk Assessment Reports. In December, Network Rail sent a letter of recognition for the work that AEGIS has undertaken on a series of Level Crossing Risk Assessment projects. The letter praises AEGIS' flexibility and patience in the approach to the evolving nature of the project. It also praised the concise, accurate, thorough and good quality risk assessment reports, delivered on time.

Case study

Matlock Bath footpath level crossing was situated on the Ambergate and Rowsley branch line to the north of Derby. The resignalling of the junction with the main line at Ambergate prompted the risk assessments as the resignalling project could have affected the type and number of trains using the line over the foot crossing.

A token system was used on this section of the track. The token system interlocked with the signalling such that the signaller has to push a button to release the lock on a token box at Ambergate Junction. The exact location of the train on this section was unknown as there are no signalling elements (e.g. treadles) to detect train movements. No other trains can access that section of track until the train with the token has reached Matlock and returned the token or gone back to Ambergate Junction and returned the token. The crossing is unprotected and there is no signalling infrastructure such as treadles or telephone. The signaller does not know where in the section the train may be.

The foot crossing was a private footpath route crossing the line at the southern end of Matlock Bath Station. It provided a route from the station and large car park over the single railway line to the base of the Heights of Abraham cable car, a popular tourist destination. During the peak tourist season, the foot crossing was used by over 3,500 pedestrians a day at the weekend. AEGIS identified a number of risks associated with the crossing including the typically relaxed nature of the tourists as they crossed.

The minimum sighting distance on approach was 240 metres – equivalent to 11 seconds from the first sighting of the train to it arriving at the crossing. There was a huge amount of misuse recorded at the crossing, consisting of tourists taking selfies and pictures while stood in the middle of the railway line. One group in particular was taking it in turns to have pictures taken for almost nine minutes.

AEGIS recommended that Network Rail close the crossing and provide an alternative pedestrian route via an existing underbridge near to the base of the Heights of Abraham cable car. Network Rail has implemented the closure and the alternative pedestrian route is in use today. This is a fantastic result for the railway as it has reduced the level crossing liability risk as well as the maintenance and operational costs of keeping the crossing open. AEGIS is delighted to have undertaken this project for Network Rail and been involved with the closure of this level crossing.

The future

AEGIS hopes to continue its work with Network Rail and other railway undertakings in completing suitable and sufficient risk assessments and reducing risk for level crossing users. There are a number of tenders that are with Network Rail for consideration and, remember, the train is coming and it is coming at line speed!

CCTV image of Matlock Bath foot crossing.