Rother Valley Railway
LIMITED
IN ASSOCIATION WITH THE KENT & EAST SUSSEX RAILWAY
ROBERTSBRIDGE (RVR) STATION, STATION ROAD,
ROBERTSBRIDGE, EAST SUSSEX. TN32 5DG

Mike Hart Tel: 07768 536100
Email: mikehartrwb@gmail.com

Eur Ing Ian Raxton
HM Principal Inspector of Railways
Office of Rail & Road
25 Cabot Square
Canary Wharf
E14 4QZ

12th February 2021

Dear Mr Raxton,

EXTENSION of KENT & EAST SUSSEX RAILWAY:
BODIAM TO ROBERTSBRIDGE - RAILWAY LEVEL CROSSINGS

The Rother Valley Railway limited (RVRL) submitted proposals to ORR in relation to the proposed level crossings on the section of railway between Robertsbridge and Bodiam in 2019 resulting in the ORR Statement of Case dated 31 January 2020 that you provided for the benefit of the Planning Inspector who will oversee the Public Inquiry in July 2021.

Since that time RVRL has continuously worked on the detail design of the crossing in the light of technological developments and changes in policy. Highways England in particular have removed the previous requirement of the Highways Agency to have the full barrier crossing over the A21 manually controlled by a level crossing attendant.

I have attached a further suite of documents for your consideration that will hopefully enable you to be able to provide the forthcoming public inquiry with a revised Statement of Case in the light of the revised crossing designs and further information contained within this submission relating to the Bridleway and Occupation crossings.

RVRL believe that we have demonstrated that the risks associated with the introduction of new level crossings have been controlled to level as low as reasonably practicable. Furthermore, we believe we have demonstrated that all reasonable efforts have been made to design bridges or underpasses. Such designs have been thoroughly assessed and deemed to be either grossly disproportionate in terms of cost or not possible to construct due to the topography of the River Rother and the flood plain and/or the planning constraints within an Area of Outstanding Natural Beauty.

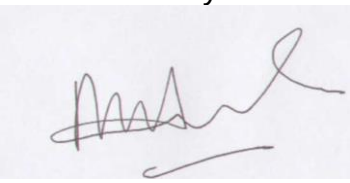
I trust that you should now have suitable and sufficient information to enable you to revise paragraphs 35 onwards of the ORR Statement of Case, thereby not leaving any unanswered questions and qualifications for the Inquiry.

RVRL would like you to send a revised Statement of Case to the TWA unit of the DfT and the Planning Inspector responsible for the public inquiry. RVRL would however very much appreciate the ability to discuss your proposed amendments before you share them with the DfT and the Inspector.

Happy to provide further clarifications should you need them.

Kind regards etc.

Yours sincerely



Mike Hart OBE.
Director. Rother Valley Railway Ltd

Rother Valley Railway

New Build Level Crossing Narrative Risk Analysis (NBLC-NRA) – Update 10.02.2021

Contents

1 Introduction

The Rother Valley Railway will provide a Full Barrier Automatic Level Crossing, Locally Monitored (AFBCL) incorporating the latest technology for the operation and protective equipment. The crossing will be fully compliant with what is widely used on Network Rail infrastructure today, thus, ensuring the crossing would not require any product approvals, derogations or changes to standards. The maintenance regime would also be standard and no bespoke parts would need to be produced or stocked specifically for the crossing. For the above reasons, the crossing presents a very low reliability and risk concern and would most likely incur the lowest maintenance costs.

A level crossing does not currently exist on the A21 Robertsbridge, therefore a Quantitative Risk Assessment would not provide sufficient evidence to demonstrate that possible risk has been assessed and managed accordingly. However, it is important to establish possible risk from the introduction of a level crossing and possible mitigation measures at an early stage of development.

This NBLC-NRA analyses all relevant data as well as expert opinion to demonstrate that all possible risk has been addressed as well as embroidering new technology to further enhance the safety of the level crossing, for example;

- CCTV for improved safety & security,
- Obstacle Detection
- Home Office Approved Red Light Cameras
- Evaluate the risks at the level crossing.
- Early engagement with stakeholders from different sectors, local authorities, communities and 'users' associations.
- Take engineering measures and find innovative solutions
- Take educational and awareness measures and collaborate with the rail and road sectors.

The level crossing will be carefully assessed via this analysis in collaboration with railways and the road infrastructure managers, local authorities and industry experts to make it more visible and easier to cross particularly for long, heavy and oversized vehicles.

All stakeholders will be in a position to cooperate and design the best level crossing environment.

Narrative Risk Assessments currently used by Network Rail are enabling better targeting of risk reduction measures; blending quantitative modelled risk with structured observation and judgement from competent staff. The NRA process is considered as part of this analysis to encompass the whole level crossing asset system and assess wider aspects of level crossing risk.

This analysis builds upon excellent safety initiatives which were introduced for the first Automatic Full Barrier level crossing by Network Rail including the safety benefits provided, however, RVR intend to introduce additional safety measures such as the use of Red-light safety equipment (RLSE), which has currently been

installed at 31 public road level Crossings on the National Railway Network to improve user behaviour, deterring deliberate misuse. Trials have demonstrated that these Home Office Type Approved (HOTA) cameras have reduced deliberate misuse by approximately 90 per cent at some locations.

RVR will install an automatic level crossing including an object detection system (AFBCL) at the A21 Robertsbridge level crossing. Crossing obstacle detection systems utilise a combination of RADAR and LIDAR technology to scan the crossing before allowing for trains to safely manoeuvre through. In combination these systems detect obstacles on the ground and around the edge of the barrier lines and deliver unique small object detection protecting children and adults as well as vehicles and other large objects. RVR will monitor and review the installation of the obstacle detection system after the first 12 months of operation to determine if additional safety features could be added to further enhance safety of the level crossing.

2 Level Crossing Overview

This is a risk analysis for the A21 Robertsbridge Road level crossing. However, it should be noted that at present a level crossing does not exist, therefore, the analysis is based on the probability of risk if a level crossing was in place. It is imperative that a full Quantitative (and Narrative) Risk Assessment (QRA) is completed before any trains operate over the crossing and that the QRA is presented to the ORR.

Crossing Details	
Name	A21 Robertsbridge Bypass
Type	AFBCL
Crossing status	Public Highway
Overall crossing status	Design Stage
Engineers Lin Reference	N/A
OS grid reference	
Number of lines crossed	1
Line speed (mph)	10
Electrification	No
Signal box	Yes (A21 level crossing)

3 Information Sources

The table below shows the stakeholder consultation that was undertaken as part of the risk analysis.

- Office of Rail and Road (ORR)
- Kent and East Sussex Railway (K&ESR)
- Bakerail (Track site/project management specialists)
- East Sussex County Council (ESCC)
- Rother District Council (RDC)
- I-Transport (Specialist Planning Transport Consultancy)
- ARUP (Design, Engineering, Architecture and Business consultation Group)
- Level Crossing Risk Management Tool (LXRMT).

Reference sources used during the risk analysis;

- ARUP A21 Options Report
- ARUP Road Safety Audit
- Mott Macdonald road survey report
- Network Rail QRA information
- GG19 Road Safety Report
- ORR Documentation
- GPR219-IDF- Level Crossing Safety
- EU SAFER-LC Project
- Level Crossing Risk Management Tool (LXRMT).

4 Level Crossing Diagrammatic Scheme

The new level crossing to be constructed is a Full Barrier Automatic Level Crossing, Locally Monitored (AFBCL) on the A21 (T) Robertsbridge Bypass.

The road approach speed is 40 mph. the profile of the railway in the vicinity of the crossing has been provided below, as well as the appropriateness of the proposed warning signs in this regard.

Diagram of the proposed railway Alignment

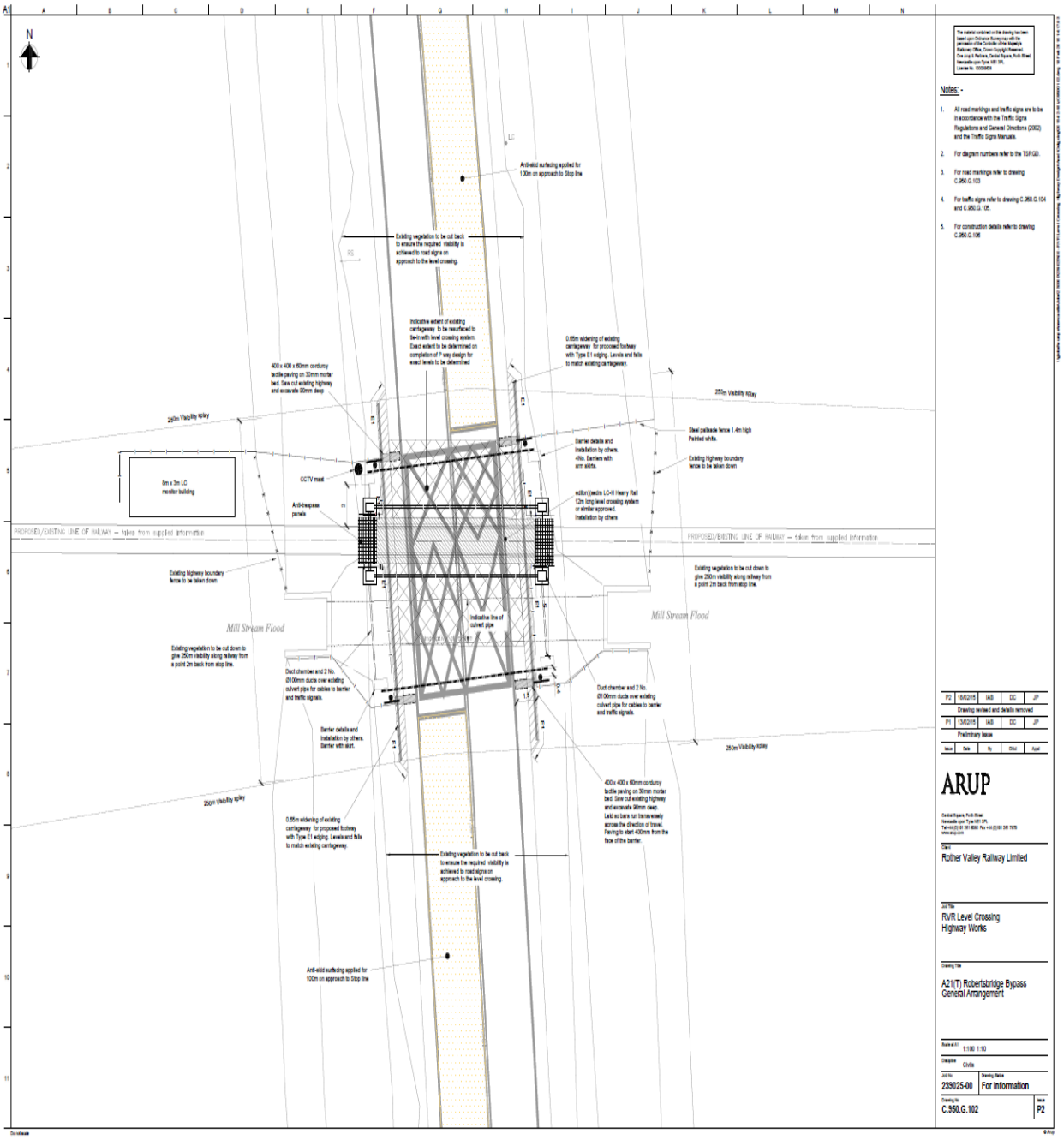
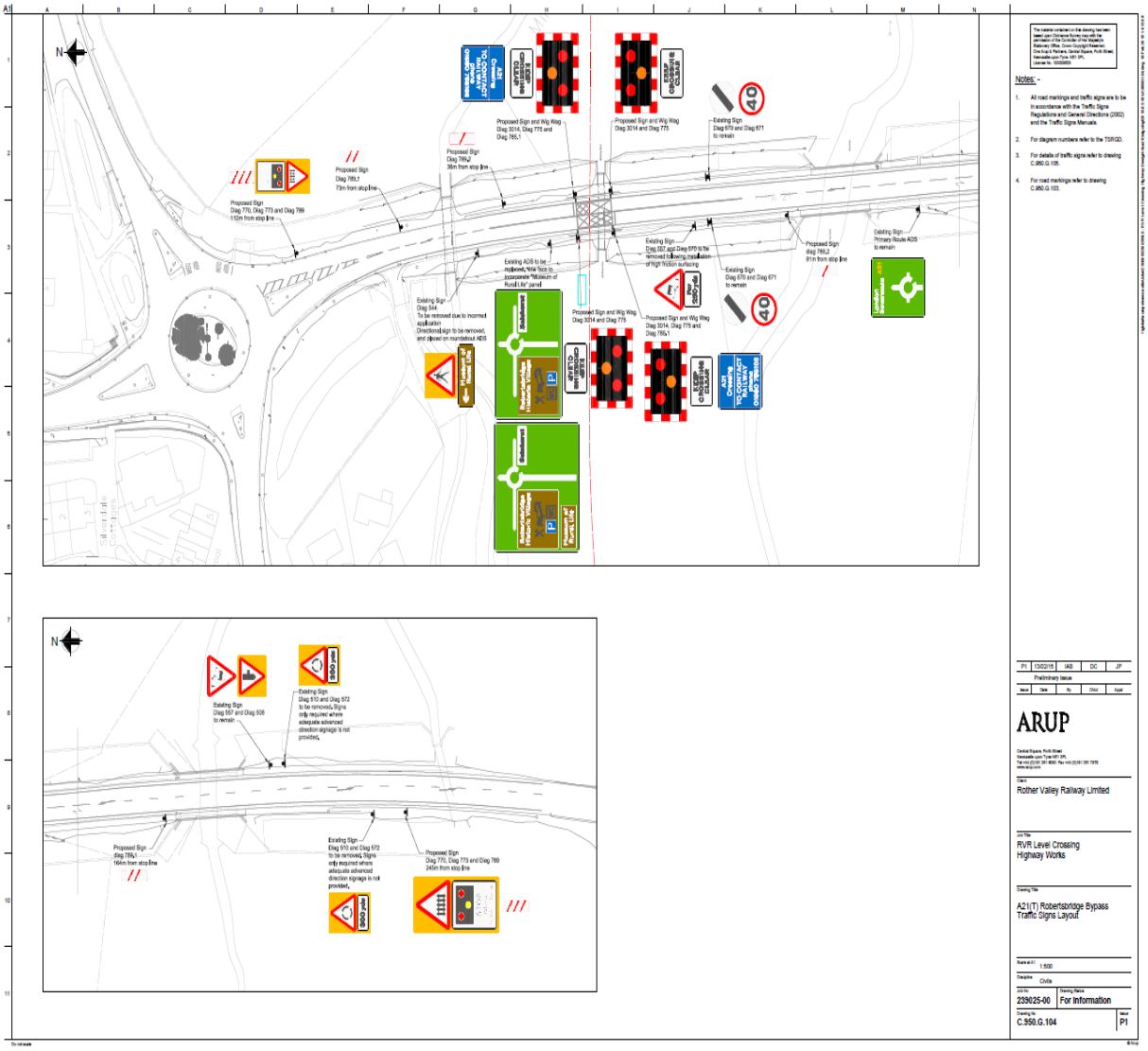
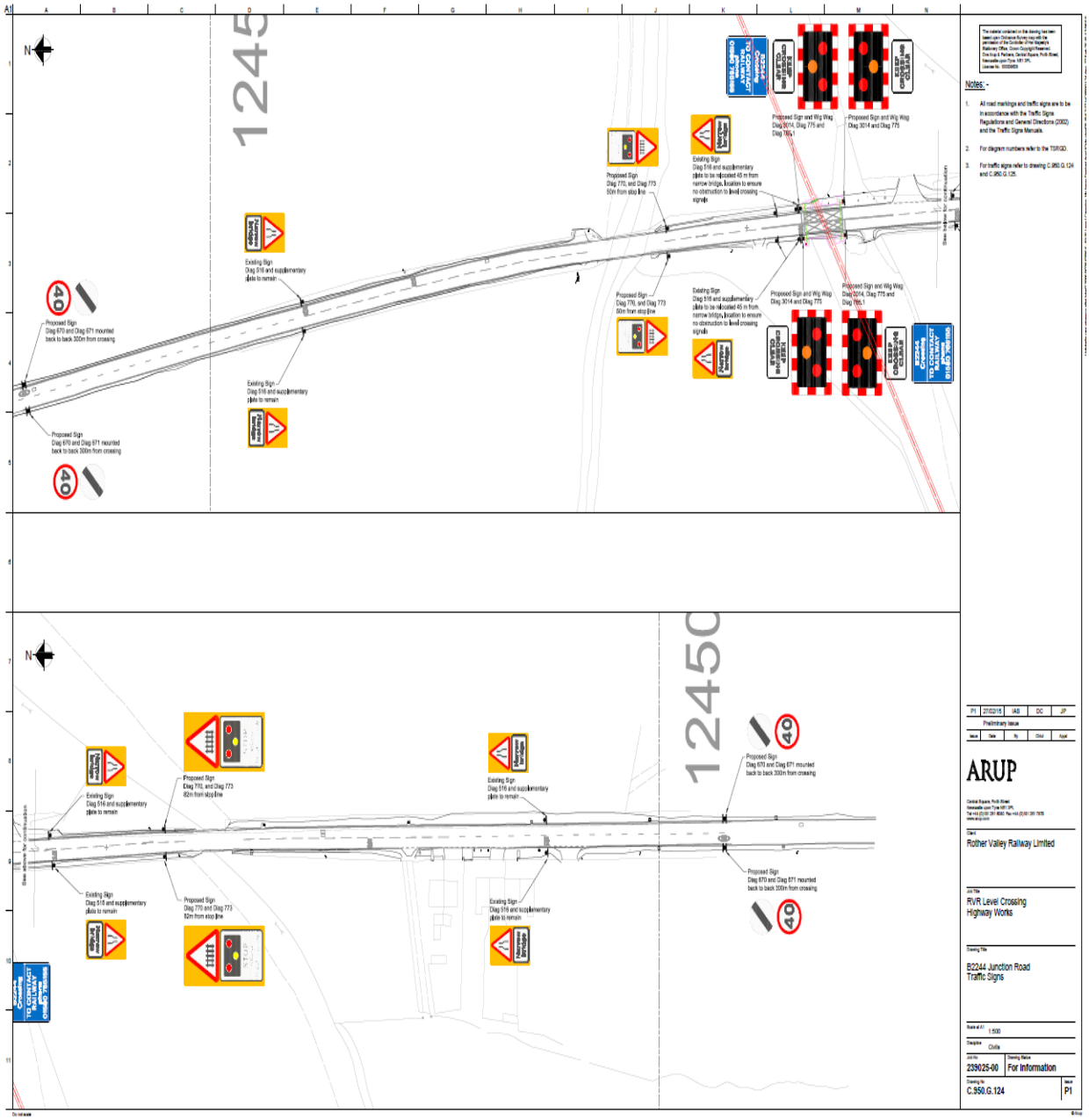


Diagram of the proposed traffic signs

Rother Valley Railway



Rother Valley Railway



5 Site Visit General Observations

The A21(T) Robertsbridge Bypass Stage 1 Road Safety Audit report identified possible road distractions which are considered as part of this analysis, for example,

- Blocking on the circulatory carriageway of a roundabout can lead to significant frustration for drivers on the side roads, not included in the main queue. This can lead to drivers trying to force their way around the junction, resulting in circulatory collisions.

To remove this concern, it is advised to reduce the speed limit over this length of road.

Photograph 1

- The proposed level crossing layout does not consider the existing traffic signing or the effect of the proposed level crossing signing on the existing signing. This could lead to drivers missing some signs and the warnings they portray leading to a range of conflicts and/or collision types, photographs 2 (a), (b) below.

To avoid the risk of confusion between signage a comprehensive review will be conducted as part of detailed design of the level crossing.

Photograph 2(a)

Photograph 2b

- The level crossing is proposed some 40m from the end of the existing street lighting system on the approach to the A21(T) Northbridge Street roundabout. It is not proposed to light the level crossing. Some drivers' eyes can take several seconds to adjust from lit to unlit conditions, and vice versa. A hazard such as a level crossing or queue located within that transition distance could result in shunt type collisions or a collision at the crossing itself.

To remove this concern, it is advised to extend the street lighting system to the south side of the level crossing in order to adequately light the hazard.

Photograph 3

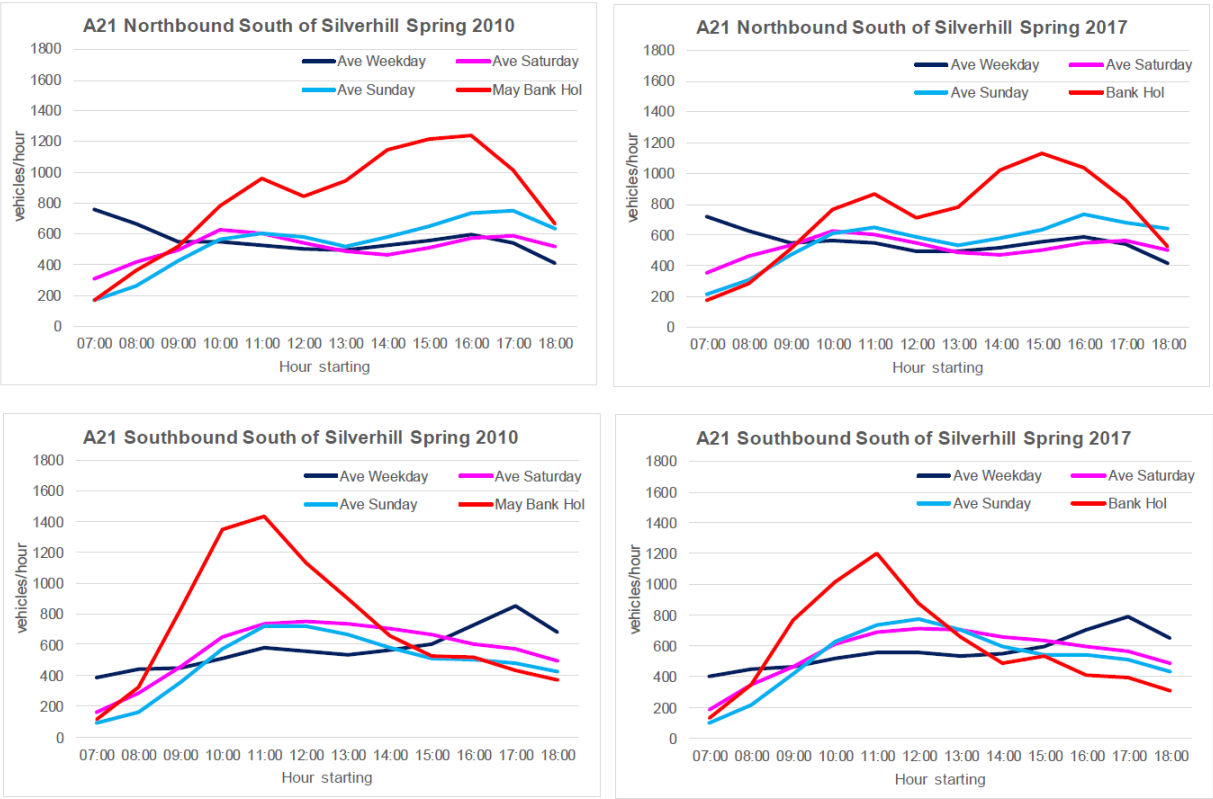
6 A21 Robertsbridge Bypass Traffic Flows

The chart below compares traffic flows on A21(T) Robertsbridge Bypass, for Spring and Summer months, based on ATC data provided by Mott McDonald Addendum to traffic impact study report (2018).

On the A21 at Robertsbridge the changes in traffic demand between 2010 and 2017 are limited with minimal changes on weekdays, some increases on Sundays and on the August Bank Holiday but reduced flow on the May Bank Holiday.

The predicted maximum queue lengths on the A21 are 60m-70m on weekdays, Saturdays and Sundays, increasing to 100m-120m on the Bank Holidays, using 2017 traffic demand. With traffic growth, these queue lengths increase to 2027 although the southbound queue length is only predicted to exceed 140m (the length from the level crossing back to the roundabout) on the May Bank Holiday in 2027 and even then, it is only just exceeded at 143m.
(Mott Macdonald Addendum report 2018).

Figure 4: A21 Traffic Flows South of Silverhill in Spring 2010 and 2017



Queue length results with a 110-second closure.

For the A21, maximum queue lengths of 100m-150m are predicted for weekdays, Saturdays and Sundays, increasing to 160m-240m on the Bank Holidays. With traffic growth, these corresponding queue lengths increase to 120m-180m and 190m-290m by 2027.

For the August Bank Holiday, the average northbound queue lengths are a little higher in 2017 and 2021, when compared to the previous results, and maximum queue lengths are higher by 10m-13m. For the southbound direction, the new results are higher by up to 18m but the maximum queue length in 2021 is 85m, still well below the 140m back to the A21 roundabout.

Traffic Growth Factors 2017 – 2021 – 2027

Table 3: Predicted Queue Lengths at A21 Level Crossing

	2017 Northbound		2017 Southbound		2021 Northbound		2021 Southbound		2027 Northbound		2027 Southbound	
	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average
Spring/Autumn												
Weekday	51	45	60	49	55	49	65	53	60	53	71	57
Saturday	50	45	61	56	54	48	66	60	59	52	72	66
Sunday	62	52	66	54	67	56	71	58	73	61	78	64
May BH	99	75	121	62	106	81	131	66	116	89	143	72
Summer												
Weekday	50	45	74	54	54	49	80	58	59	53	88	63
Saturday	55	47	65	59	59	51	70	64	65	56	76	70
Sunday	70	60	67	57	75	64	72	61	82	70	79	67
Aug BH	96	70	79	67	103	76	85	72	113	83	93	79

Source: Mott MacDonald analysis of existing and predicted traffic volumes, queue lengths in metres assuming 5.75m/vehicle

Table 6: Predicted Queue Lengths at A21 Level Crossing with 110 Second Closure

	2017 Northbound		2017 Southbound		2021 Northbound		2021 Southbound		2027 Northbound		2027 Southbound	
	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average
Spring/Autumn												
Weekday	101	90	120	98	109	97	130	105	119	106	141	115
Saturday	101	89	122	112	108	96	131	121	118	105	143	132
Sunday	125	104	132	108	134	112	142	117	147	122	155	127
May BH	197	151	243	123	213	162	261	133	232	177	285	145
Summer												
Weekday	100	90	149	108	108	97	161	116	117	106	175	127
Saturday	110	95	129	118	118	102	139	127	129	111	152	139
Sunday	140	119	134	114	150	129	144	122	164	140	158	134
Aug BH	192	141	158	134	206	152	170	145	225	165	186	158

Source: Mott MacDonald analysis of existing and predicted traffic volumes, queue lengths in metres assuming 5.75m/vehicle

Conclusion;

On the A21 at Robertsbridge the changes in traffic demand between 2010 and 2017 are limited with minimal changes on weekdays, some increases on Sundays and on the August Bank Holiday, however, reduced flow on the May Bank Holiday.

Comparison with the queue length predictions reported in October 2011 shows the new 2017 and 2021 results are generally similar to the previous results for 2016 and 2021 on the A21. The major difference is

that long queues are no longer predicted for the A21 Southbound on the May Bank Holiday. This is because the traffic demand recorded in 2017 is significantly lower than that in 2010 (reduced from around 1,600 vehicles/hour to 1,400 vehicles/hour).

7 The Railway

The train service over the A21 Robertsbridge level crossing will consist of passenger trains only. There will be approximately 10 trains per day. The highest permissible line speed of trains over the crossing will be 10 mph. Trains are timetabled to run for 10 hours per day.

The RVR Level Crossing Operational Management Plan (LCOMP) sets out the strategy for operational management of the A21 Robertsbridge level crossing to be installed on the Rother Valley Railway (RVR) where it interfaces with the road at level grade, so requiring control of road vehicles to enable a train to cross.

The LCOMP describes the principles of how the level crossing is to be operated under normal conditions and in the event of failure.

This shall be the basis for developing operational procedures for the railways operation when services commence to which staff shall be trained and assessed on an ongoing basis.

Compliance with Industry guidelines;

The design for the level crossings, developed from this document, shall be compliant with industry guidelines, e.g. The Office of Rail Regulation: A Guide for Managers, Designers and Operators (Railway Safety Publication 7 December 2011) and approved by a suitably independent person before installation.

A21 Robertsbridge Level Crossing Operation;

It shall be noted that a signaller will be on duty at all times of normal operation. The signaller will monitor operation of the crossings at the A21 via a Closed-Circuit Television link.

Normal operation to and from Robertsbridge

The train will approach the level crossing at a maximum speed of 10 mph, thus ensuring that the train has the ability to stop in 30m. The AFBCL (Automatic Full Barrier Crossing, Locally Monitored) crossing area is equipped with obstacle detection technology that scans the crossing area at various stages during the closure sequence. The crossings are provided with crossing illumination (for night visibility) and a drivers' flashing red and white light indicator in each direction on final approach for local monitoring by the train crew. The speed approaching the AFBCL crossing is limited to 10mph, so the approaching train is able stop under all railhead conditions before the road if the crossing is either visibly blocked or the flashing indicator hasn't changed from red to white. The approach of a train automatically begins the crossing closure sequence. This commences with the road traffic wig-wag signals and audible warnings to indicate to road traffic to stop. Obstacle detection technology prevents

to lowering of the crossing entrance barriers until the crossing is clear. Once the entrance barriers are down and the crossing surface is scanned to continue to be clear the lowering of the exit barriers can commence. If the equipment is proven to be fully functional and the OD sensors have confirmed clearance of the road surface between the fully down barriers then the indicator for the train driver will be showing flashing white light before the train reaches the crossing speed board.

The Drivers White Light is only given if all the barriers are fully down and in the unlikely event of a trapped user (vehicle or pedestrian) the train driver is able to raise and re-lower the exit barriers using a Drivers Release Unit (DRU).

The barriers will rise as soon as practicable after trains for which the lower sequence has been initiated or maintained, have passed clear of the crossing. The sequence of events to open the crossing to road traffic, once the raising cycle has been initiated or maintained is, all the barriers begin to rise simultaneously and should normally rise in 4 to 6 seconds; and the intermittent wig wag red lights should be extinguished as the barriers rise.

Railway signalling and control

Railway signalling will be provided to ensure the level crossing is fully protected on all railway approaches. The railway approach signals are interlocked with the lifting barriers so that it is not possible to clear the signals unless the road is fully closed by the barriers, additionally, it will not be possible to raise the barriers unless the signals are set at Stop and free of approach locking, or the train has passed the signal and traversed the crossings. It will not be possible to clear any protecting signals until 'crossing clear' is confirmed either automatically by obstacle detection equipment, or manually when that equipment is not being used. Discrete function controls will be provided at the control point for authorised railway staff use when obstacle detection equipment is not being used.

If a train passes a protecting signal at Stop, the road traffic light signals will immediately show an intermittent red light (omitting the steady amber phase) and the audible warning will start. The barriers will not be lowered as this may strike or trap crossing users.

To ensure that the crossing operates safely when the railway line is open to traffic, indicators at the control point will confirm that the equipment is powered and functioning correctly.

Level Crossing barriers & CCTV Systems Maintenance Plan

The maintenance plan for the three-level crossings shall be based on that recommended by the supplier of the equipment. It shall comprise:

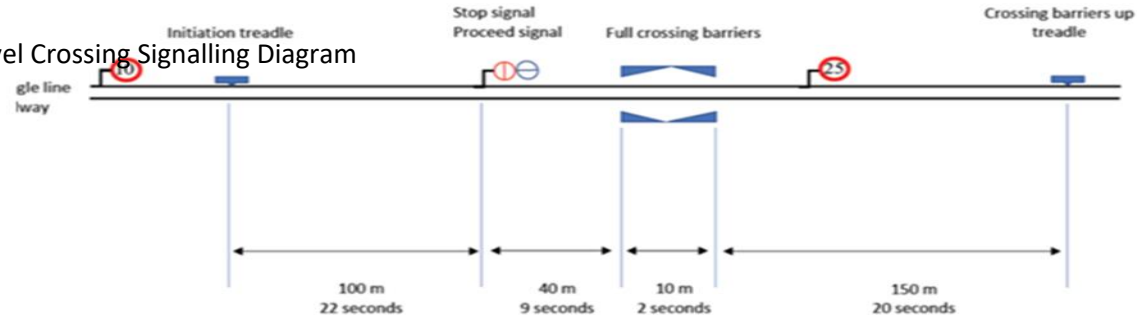
- Regular planned maintenance at the required intervals.
- Work arising from planned maintenance, within the required timescales
- Fault response, within specified timescales.
- Work arising from fault responses, within the required timescales.

- Work arising due to other parties planned work.

Road Crossing Design and Construction

The construction of the road crossings comprise concrete units designed to meet the requirements of a high friction skid resistant road surface through the crossing. This has been tested for the proposed installation and passed the test level requirement as set by The Highways Agency, reference document RD/GN/009 dated September 1989.

Level Crossing Signalling Diagram



Rother Valley Railway
Level crossing signalling schematic for manually operated full barriers
Northbridge Street, A21 & Junction Road

Not to scale

Notes:

1 Equipment shown for up direction only, treadles, signals and signs replicated for down direction

2 Transit times assume full line speed

8 5 X 5 Risk Assessment

Hazards are identified, listing possible causes if appropriate and assessed for severity. These are then multiplied by the frequency or likeliness of an incident occurring if no controls were applied. This produces the risk factor; the numerical assessment table gives guidelines on how to assess severity and frequency.

The risk assessments for the crossings are based on generic issues and then modified to reflect the specific issues at the individual crossing to reflect that risk can change significantly from one site to another. The generic risk assessment will be reviewed by the appointed Project Manager and then modified as required to reflect the

hazards and the necessary controls identified during site visits (pre-works) or through information passed to them by stakeholders and any other third party.

Update 10.02.2021

A21 Risk Assessment

Numerical Assessment			
Severity (S)		**Likelihood of Occurrence (L)**	
1	No Injuries / Minor Damage	1	Remote
2	Single Minor Injury	2	Unlikely
3	Single Major Injury / Minor Pollution	3	Occasional
4	Single Fatality / Major Pollution	4	Likely
5	Multiple Fatalities	5	Highly Likely

Risk Factor

		Likelihood of Occurrence (L)				
		5	4	3	2	1
Severity	5	25	20	15	10	5
	4	20	16	12	8	4
	3	15	12	9	6	3
	2	10	8	6	4	2
	1	5	4	3	2	1

Risk Factors between 16 to 25 = Unacceptable Risk. Risk Factors > 8 will be strictly monitored. Hazards Identified with a Severity Assessed at 3 or above will also be strictly monitored.

Hazards and possible causes identified for Robertsbridge AFBCL	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
SIGNALLING								
Relative to previous signals: Will the signal be in a different position, or does it have a different configuration?	Signal position is not consistent with the spacing between preceding signals Signal is of a different design to preceding signals Potential for, Death, Serious injury or injury	4	3	12	The KESR signalling arrangement will have consistent signal design. All staff will receive training before operation commences	3	2	6

Could the signal be confused with other signals on an adjacent line or on the same gantry	Signal is on a post and could be confused with other signals Signal has an identical profile / outline to adjacent signals Death Serious injury Injury	4	3	12	Ensure signals for all lines are visible Shield nearby signals from view Appropriate signal should be clearly associable with its line Driver training	3	2	6
Could the signal be obscured from the driver's view?	Signal reading time is inadequate. Signal is positioned round a curve and the reading angle is inadequate Signal is positioned round a curve and there is an obstruction blocking the signal's line of sight Signal can be obscured by vegetation Signal can be obscured (intermittently or otherwise) by a bridge or other structure, for example station structures edge of signal back plate is less than 100 mm from edge of aspect	3	3	9	Increase backboard size (by 50%) Manage vegetation Maximum train speed is 10 mph Remove / shield potential distractions in stations Reposition signal on straight track Make signal post more conspicuous Driver training	3	2	6
TRACK								
Will the track on approach to the signal suffer from adhesion problems?	Signal is located in an area which suffers from ice, frost, leaf fall, dampness or other adhesion problems	4	3	12	Lineside fencing / netting Railhead conditioning Management of lineside vegetation	2	2	4

	Death Serious injury Injury				Low adhesion warning signs Driver training			
Is there a reduction in permissible speed on the approach to the signal?	There is a reduction in permissible speed on the approach to the signal Death Serious injury Injury	2	2	4	Permissible speed on approach to the level crossing is maximum 10 mph Driver training On site staff monitoring	2	2	4
Is there a falling gradient on approach to the signal?	There is a falling gradient on the approach to the signal	4	3	12	Countdown markers Driver training	3	2	6
COLLISION								
Road Vehicle and train collision risk	Insufficient train warning time for all vehicle types known to be exacerbated by the driving position e.g. Tractor. Level crossing equipment and signage is not conspicuous or optimally positioned. Instructions for safe use may be misunderstood e.g., signage, clutter detracts from key messages, conflicting information given. High volume of unfamiliar users e.g. irregular visitors, migrant workers. Known user complacency leading to high levels of indiscipline. Type of vehicle unsuitable for level crossing; - Large, low, slow, making	4	3	12	Optimising position of equipment at the design stage removing any conflicting or redundant signs. Strike in times optimised. Sighting lines enhanced. Latest technology in place for user-based warning systems including wig-wag lights, sirens, full road barriers, RTL. (AFBCL) Maximum train speed 10 mph implemented. Superior quality crossing surface construction material. De-vegetation programme in place	3	2	6

	access or egress difficult and or vehicle is too heavy for the crossing surface – risk of grounding and or severity of gradient adversely affects ability to traverse. Users experience a long waiting time.							
Pedestrian and train collision risk	Ineffective whistle boards, warning inaudible, insufficient train warning time. Level crossing equipment and signage is not conspicuous or optimally positioned. Instructions for safe use may be misunderstood. Surface condition could lead to slip/trip risk. High volume of unfamiliar users i.e. irregular visitors/ramblers/equestrian. Complacency leading to high levels of indiscipline e.g. users are known to rely on knowledge of timetable. High level of use by vulnerable people. High usage of cyclists.	4	3	12	Optimising position of equipment at the design stage removing any conflicting or redundant signs. Latest technology in place for user-based warning systems including wig-wag lights, sirens, full road barriers, RTL. AFBCL, obstacle detection Maximum train speed 10 mph implemented. Superior quality crossing surface construction material. De-vegetation programme in place. Regular engagement with stakeholders/authorised users reinforcing safe crossing protocol, legal responsibilities and promoting collaborative working.	2	2	4
Hazards and possible causes	Potential Risk or consequences	S	L	RF	Control Measures	S	L	RF

identified	associated with the Hazard							
SPAD OCCURRENCE								
Train driver passes protecting signal without authority	Collision with road vehicle (see above). Collision with member of public (See above). Death Serious injury Injury	4	3	12	If a train passes a protecting signal at Stop, the road traffic light signals will immediately show an intermittent red light (omitting the steady amber phase) and the audible warning will start. The barriers will not be lowered as this may strike or trap crossing users. Driver training. Maximum speed of train 10 mph.	2	2	4
Hazards and possible causes identified	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
Additional Risk Influencing factors								
Distraction								
Can the driver be distracted by something outside the cab?	Driver could be distracted by trespassers	4	3	12	Signal reminder sign	3	2	6
Could the driver be distracted by other tasks at or on approach to the signal?	There is a level crossing in the vicinity of the signal	4	3	12	Position signal where driver not distracted by other duties Driver training	3	2	6
Distractions while using the level crossing might impair the user's ability to cross quickly and safely.	If a user is distracted, there is an increased likelihood that they will not see the crossing warning signs, for example; Other persons in the car (e.g. children) Thoughts on personal matters, work stresses etc. Using the telephone, Behaviour of other crossing users, In car entertainment Seasonal events (e.g. fun fairs, fireworks) Mobile phones, iPads, handheld	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Staff training. Traffic calming measures. Train maximum speed 10 mph. New modern full barrier crossing. AFBCL Education campaign.	2	2	4

	computers etc. Signage (e.g. speed limit signs). Distractions might be more likely for users who frequently use the crossing (e.g. delivery drivers), due to them potentially having a lower level of concentration than those who use it infrequently. A change in speed limit and the associated speed limit signs This proximity of the speed limit signs to the crossing might reduce the attention given to the crossing, or remove attention away from it completely. The signs might also draw a car driver's attention to the vehicle speedometer to check vehicle speed and away from maintaining vision out of the vehicle's windscreen. Other signs in the vicinity of a level crossing that are not related to that crossing could also have been a potential distraction.							
High vehicle approach speeds	The vehicle speed over a level crossing is a factor in vehicle driver errors. Risk factors include, the speed limit(s) in the surround areas, driver's perception and attitude to risk, visibility of warning signs and visibility of the level crossing e.g. rural winding roads. High risk behaviour such as high vehicle speeds and late, heavy braking will result in a higher	4	3	12	Reduced road speed on approach to level crossing. Traffic calming measures. Enhanced signage. New modern full barrier crossing. AFBCL Education campaign.	2	2	4

	frequency of collisions due to driver error.							
Large, slow and low vehicles	Drivers of large vehicles are involved in a disproportionately high number of incidents at level crossings. The size of the vehicles - they have less room for error when compared to cars. They may not be responding to the activation of the crossing warning system in sufficient time. Studies have proposed that large (HGV) vehicles may attempt to traverse the crossing once the barriers have already started to descent, suggesting that it could be to do with the driver's awareness of their vehicle's poorer braking performance, and therefore considering it safer to continue. Other contributory factors might include: The slower acceleration speed of HGVs causing the total time to cross a level crossing from standstill to increase Sightlines from a higher driving position.	4	3	12	Reduced road speed on approach to level crossing. Traffic calming measures. Enhanced signage Yellow box marking Level crossing road surface well maintained Power operated level crossing barriers AFBCL	2	2	4
Ice conditions	Icy weather conditions on the approach and exit to the crossing might affect the behaviour of the crossing, for	3	3	9	Provision of CCTV surveillance cameras. Level crossings local training plans, training and briefing signallersreceive on	2	2	4

	example, prevent vehicles from stopping in a position of safety at the crossing. Encourage vehicle drivers to ignore the initial warning activation when they are close to the train line because of the risk of sliding forward onto the tracks. Cause pedestrians to concentrate on their footing, rather than looking for trains or observing warning signs. Result in pedestrian slips, trips and falls. This is a particular risk for elderly, or mobility impaired, users. Level crossings on 'B' roads might present a particular hazard to vehicle drivers as these roads are not normally gritted in icy conditions.				communications skills, hazards associated with a particular crossing (icy conditions), how to check whether a crossing is clear. Improved crossing surface. Regular monitoring. Tactile surfaces.			
Foliage obscuring warning signs and approaching trains	The visibility (and hence effectiveness) of information on the approach to and at the level crossing is reduced by overgrown foliage. Overgrown foliage on the approach to a level crossing can obscure signs and signals located at the crossing, and also restrict	4	3	12	Cutting back vegetation and removing obstructions the sighting distances for users up and down the track and to signs / warning lights are lengthened. Staff training i.e. HRA Guidance document HGR – A0720 Control of Vegetation (Management plan). Improved sighting distances.	2	2	4

	the visibility of approaching trains. This could result in the user either not seeing the sign or train (complete or partial) or the user not seeing the sign or train in time to sufficiently interpret the information and respond appropriately. This issue can be exacerbated when the visibility of the level crossing is reduced, either due to its type or its location e.g. on the bend in a road or on a high-speed road, as the vehicle driver has even less time to respond. foliage is also applicable to train drivers. Foliage on the lineside might impact on the train driver's ability to see information, objects or people on the crossing.				Train speed max 10 mph. CCTV monitoring. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Reduced road speed on approach to level crossing. Traffic calming measures. Enhanced signage.			
Crossing utilisation or traffic moment	High crossing utilisation by users is associated with a greater chance of user risk taking behaviour.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Level crossings local training plans, training and briefing signallers receive on communications skills, hazards associated with a particular crossing (icy conditions), how to check whether a crossing is clear. Reducing the road approach speed to the level crossing to reduce the risk of collision between vehicles and gates / trains.	2	2	4

					New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Traffic calming measures. Enhanced signage.			
Vulnerable of unfamiliar users, for example, people with dogs on leads, young people, people visiting the area etc.	Vulnerable users and those who are not familiar with the level crossing procedure might apply an incorrect mental model when traversing the crossing. Other risks include, crossing users who are possibly subject to slips, trips and falls, Dog/s might hold user back on tracks, preventing them from completing their traverse. Horses can present additional challenges if it is startled or distracted. Animals might try to run down tracks, especially if startled or skittish or if it smells an animal to chase etc, pulling the user with it. Young people may be distracted by friends, using mobile telephones, headphones and so on. Visiting people may not be familiar with the level crossing operation, distracted by looking for directions' signs etc.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Level crossings local training plans, training and briefing signallers receive on communications skills, hazards associated with a particular crossing (icy conditions), how to check whether a crossing is clear. Reducing the road approach speed to the level crossing to reduce the risk of collision between vehicles and gates / trains. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Traffic calming measures. Enhanced signage	2	2	4

Traffic calming systems Road traffic calming systems on either side of a level crossing might increase the risk of blocking back.	Traffic calming systems, such as road width restrictions/ build-outs, positioned on either side of a level crossing might increase the risk of vehicle drivers blocking back over the crossing. When the crossing is closed to road traffic, queues form along the road. This issue might be exacerbated due to factors such as the time of day (rush hour) and 'herd mentality'. Discomfort for cyclists on the road. Potentially more noisy approach to the crossing leading to possible complaints. If overused in conjunction with changes in speed the mitigation might lose its impact upon behaviour.	3	3	9	Note: The obstacle detection will prevent crossing closure in these circumstances. Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Reducing the road approach speed to a level crossing to reduce the risk of collision between vehicles and gates / trains. A range of enhancements to improve conspicuity, comprehension of and user response to level crossing warning signs.	2	2	4
Multiple traffic signs leading to distraction, missed warnings and road user collisions.	There are a number of existing traffic signs on both the northbound and southbound in the vicinity of the level crossing, notably, direction signing, warning signing, and tourist signs.	3	3	9	Traffic calming measures including a comprehensive review of the existing signing to be incorporated into the detailed design of the level crossing including visibility splays to the various signs to demonstrate there will be no masking. Education campaign.	2	2	4

	The level crossing layout could lead to drivers missing some signs and the warnings they portray leading to a range of conflicts and/or collision types.				Enhanced signage.			
Queuing at the level crossing could block the roundabout leading to injudicious manoeuvres and road user conflicts.	Queue lengths at the level crossing leading to, blocking turning movements. Blocking on the circulatory carriageway of a roundabout can lead to significant frustration for drivers on the side roads, not included in the main queue. This can lead to drivers trying to force their way around the junction, resulting in circulatory collisions	3	3	9	Traffic calming measures. - Introduce yellow box markings to, as far as possible, maintain the turning movements at the roundabout. Education campaign. Enhanced signage	2	2	4
Limited forward visibility. Adjacent features increase the risk of blocking back at the level crossing. Unlit hazard in lighting transition leading to shunt or crossing collisions.	Lack of good visibility at the level crossing leading to shunt type collisions. The level crossing is in close proximity to the end of the existing street lighting system. Some drivers' eyes can take several seconds to adjust from lit to unlit conditions, and vice versa. A hazard such as a level crossing or queue located within that transition distance could result in shunt type collisions or a collision at the crossing itself.	3	3	9	Extend the street lighting system to the south side of the level crossing in order to adequately light the hazard. Introduce a yellow box marking. Traffic calming measures.	2	2	4

Single train line Greater risk-taking behaviour in both vehicle drivers and pedestrians is reported on single train lines. .	This user behaviour is in line with risk compensation theory - the user, perceiving there to be less of a risk to him/herself, behaves less cautiously	2	2	4	AFBCL Provision of CCTV surveillance cameras to deter misuse at a particular crossing and to capture evidence of violations when they arise. Staff Training. Maximum train speed 10 mph. Enhanced signage.	1	1	2
Farming vehicles Farm traffic might influence the speed and behaviour of other vehicles traversing the crossing.	Farm traffic tends to move at a much slower speed and, being much larger, reduce the visibility of other vehicle drivers. This can cause distraction and frustration and change other road user's behaviour; resulting in risk taking actions such as overtaking and not observing the level crossing warning signs.	4	4	16	Power operated barrier. AFBCL CCTV monitoring. Training/Competence. Education campaign. Enhanced signage	2	2	4
Commercial driver	Commercial drivers might have increased risk taking behaviour at level crossings. Commercial vehicle drivers, such as salespersons, work to strict timescales and therefore their driving behaviour is often influenced by having to reach destinations on time. Commercial drivers using a level crossing might be inclined to 'beat the lights' to avoid having	4	4	16	A range of enhancements to improve conspicuity, comprehension of and user response to level crossing warning signs: Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Training/Competence. Education campaign. Enhanced signage.	2	2	4

	to wait at the crossing, or they might fail to follow the correct crossing procedure at unprotected crossings.							
Adverse weather impacting visual information.	The effectiveness of visual information at crossings can be impaired by adverse weather conditions (e.g. fog and snow). The ability of vehicle drivers or other crossing users to detect the presence of level crossings, hazard information, warning lights or approaching trains might be impaired by adverse weather conditions, e.g. fog and snow. This might result in users failing to see warning information or oncoming trains, which could lead to users unintentionally adopting risky behaviour. In addition, in heavy snow users might not be able to see the tracks and inadvertently stand in a position of danger. Visibility in and around the crossing might also be impaired by banks of snow. An example where foggy conditions have been identified	3	3	9	CCTV monitoring. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Reduced road speed on approach to level crossing. Train speed maximum 10 mph Traffic calming measures. Enhanced signage.	2	2	4

	as a causal factor in a level crossing incident investigation is the fatality at Barratt's Lane No.1 footpath crossing.							
Alcohol and drugs	The effects of drink and/or drugs can radically alter user behaviours. Motor and cognitive function might be impaired and users might also have a reduced perception of risk. Users under the influence of alcohol or drugs might exhibit the following behaviours: be more inclined to ignore normal crossing procedures be physically unstable and prone to slips, trips and falls be unable to focus, cognitively and visually have a lower perception of risk.	3	3	9	CCTV monitoring (staff training initiatives). Anti-trespass and cattle guard panels are designed to deter people or animals from crossing the track at unauthorised places. Do not trespass signs. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures. Enhanced signage.	2	2	4
Disabilities.	Disabilities (e.g. reduced mobility, reduced levels of vision/hearing) will influence the behaviour of users at level crossings. Visually impaired users might be unable to see warning lights and signs clearly, or scan for trains before crossing.	3	3	9	CCTV monitoring (staff training initiatives). Increase the volume of the audible warning up to the maximum permitted level to make the alarm more conspicuous and potentially deter pedestrian violations. Additionally, Intelligent auditory alarm – takes account of ambient noise levels and produces alarm 5dB louder so it can	2	2	4

	Hearing impaired users might be unable to hear crossing alarms, train whistles, warnings from people or the sound of approaching trains. Cognitively impaired users might have difficulty understanding and following the correct crossing procedure, or interpreting warning signs. Users with physical impairments (permanent or temporary) might encounter difficulties using level crossings of all types, but especially user worked crossings. Potential difficulties include struggling to cross within the warning time provided; being more prone to slips, trips and falls on the crossing, especially if the crossing surface is uneven or missing. Similarly, mobility scooter users might encounter problems with uneven crossing surfaces and the opening and closing gates or barriers.				always be heard clearly. AFBCL Power operated barriers. Provision of flange gap filler to improve crossing surface. Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). Education campaign. Traffic calming measures. Enhanced signage.			
Incorrect mental model Incidents at level crossings could occur if the user adopts the incorrect mental model of how the crossing works.	Mental models are internal mental representations of an external reality.	3	3	9	CCTV monitoring (staff training initiatives).	2	2	4

	People develop a mental model of how to use a level crossing from their prior experience of using similar or comparable crossings (or road junctions), from instructions or by observing the behaviour of other users. Users familiar with the operation of one type of crossing might apply their mental model at other types of level crossing.				Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures. Enhanced signage.			
Fatigue	Fatigued users will be more susceptible to making errors or to taking shortcuts when crossing. Fatigue has a significant effect on human performance and the likelihood of errors. Level crossing users suffering from fatigue might miss important information (crossing warning signs, lights, etc), or be more inclined to take shortcuts in the crossing procedure (fail to use the telephone, fail to close the gates at user worked crossings, etc).	4	3	12	CCTV monitoring (staff training initiatives). Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures. Enhanced signage.	2	2	4
						2	2	4
Work in or adjacent to public roadways.	Plant, equipment materials striking traffic/members of	3	3	9	Authorised road closures and traffic management.	1	1	2

	public. Traffic colliding with staff.				Implement pedestrian walkways. Plant to be suitable for access to public roads. Comply with New Roads and Street Works Act and Traffic Signs Regulations.			

Rother Valley Railway (Bodiam to Robertsbridge Junction)

Bridleway Crossing 36b at Salehurst, Robertsbridge risk Assessment, including Management arrangements for User Worked Crossings

Prepared for:
The Office of Rail and Road

Update 10.02.2021

Summary

The completion of the Missing Link will bring significant benefits to the local economy and there is no question that a grade level crossing solution at Salehurst is capable of being self-operated safely for horses and pedestrians. The cost differential between the costs of the proposed bridleway crossing (£30K) and implementing and constructing and thereafter maintaining a bridge (approximately £400K) at this location is grossly disproportionate. A tunnel under option is not practical as it would be subject to flooding from the nearby River Rother and would require almost constant pumping to keep it safe for use by pedestrians.

RVR requested Rother District Council (RDC) to review the use of a bridleway bridge at Salehurst, illustrating the type of structure that would be constructed to form a bridge for horses and riders over the approved line of the heritage railway (RR/2014/1608/P). RDC responded to the request on (13 August 2020) stating that:

‘RDC would not support a planning application for a bridge to take the bridleway over RVR at Salehurst, and that a proposed bridge to accommodate a bridleway/footpath crossing is a disproportionate response to an issue that is addressed by alternative and rather more sympathetic solutions at other locations along the route of the existing heritage railway line and they appear to function satisfactorily. Additionally, a principal planning issue in considering the proposal would be the impact of the development on the appearance and character of the countryside landscape, which is within the designated High Weald Area of Outstanding Natural Beauty. The Government's planning policies and how they should be applied are set out in the National Planning Policy Framework (NPPF), which states at paragraph 172 that great weight should be given to conserving and enhancing landscape in Areas of Outstanding Natural Beauty, which have the highest status of protection in relation to these issues. The Council's own development plan policies as contained in the Core Strategy (2014) at EN1 and the adopted Development and Sites Allocation Plan (2019) at DEN2 accord with the NPPF and are consistent with this approach. With respect to the proposed development, the railway sits within the broad flat landscape of the Rother Valley at this point and there are long views over the Weald. It is a very attractive rural landscape. The significant scale of the proposed bridge, combined with its very urban character and appearance, would result in it appearing an intrusive and incongruous feature in the countryside landscape. It would be harmful to the character and appearance of the AONB and contrary to the afore-mentioned national and local planning policies. In the circumstances, it is RDC’s informal view that a planning application would not be supported by the local planning authority.

I feel as though the proposed bridge to accommodate a bridleway/footpath crossing is a disproportionate response and I would therefore ask that you investigate alternative proposals for a bridleway crossing that would be more appropriate to conserving the AONB countryside setting of the railway’.

Therefore, the only alternative for RVR is to provide an at grade bridleway crossing suitable for all users and local residents (See options below).

1. Introduction

The former railway line between Robertsbridge and Tenterden was closed in 1961. Much of the trackbed remained in place for many years and, in 1974, the line between Tenterden and Rolvenden was re-opened as the Kent and East Sussex Railway (K&ESR). The line was further reinstated to Bodiam (the site of the National Trust's Bodiam Castle) in 2000 and K&ESR has become a successful heritage railway and major tourist attraction. Reinstatement work to date on the K&ESR and the Missing Link has been undertaken mainly by volunteers and local contractors who have developed cost-effective and quality methods for the work.

The "Missing Link" is the section of former railway corridor 3.42km long running from Junction Road (the B2244) in Bodiam to the terminus at Robertsbridge. Policy EM 8 of the Rother District Plan expressly supports the reinstatement of RVR. The local plan was the subject of a Public Inquiry and the Inspector's report gave full support to completing the Missing Link, subject to meeting the following criteria:
"(i) it must not compromise the integrity of the floodplain and the flood protection measures at Robertsbridge;
(ii) it has an acceptable impact on the High Weald Area of Outstanding Natural Beauty;
(iii) it incorporates appropriate arrangements for crossing the A21, B2244 at Udiam, Northbridge Street and the River Rother."
These criteria were all resolved and approved with full Planning approval given by Rother District Council in March 2017. Once completed, visitors will travel on a well-regarded Heritage Railway on the historic route within the Rother Valley between Tenterden and the mainline at Robertsbridge, with stops at a number of attractive tourist destinations.

Over the course of a number of years, planning permission has been obtained for the re-instatement of the railway between Bodiam and Junction Road in 2011, from Robertsbridge to Northbridge Street in 2013 and the construction of Robertsbridge Junction Station. Re-construction of the railway within those sections has now been completed (utilising volunteer professionals and local subcontractors). The connection to the main line was completed in late 2016 with the support of Network Rail.

Following consultation over a period of 6 years, including discussions with all relevant statutory bodies and the local planning authority – as reported in the Consultation Report accompanying the TWAO application - planning consent for the Missing Link was unanimously approved by the Rother District Planning Committee on 17 March 2017. (RR/2014//1608/P). Letters of support for the project from Kent CC, East Sussex CC, Rother DC, Ashford BC, Network Rail, National Trust, and 1066 Country are included in the Consultation Report. The planning consent was accompanied by planning conditions to ensure the safety and effectiveness of the road crossings.

The Missing Link will comprise a simple single-track railway with straightforward construction, utilising the same local contractors and volunteers (qualified and experienced, as appropriate) as on the sections already completed.

This document relates to the proposed level crossing at Bridleway S&R36b at Salehurst as well as management arrangements for user worked crossings.

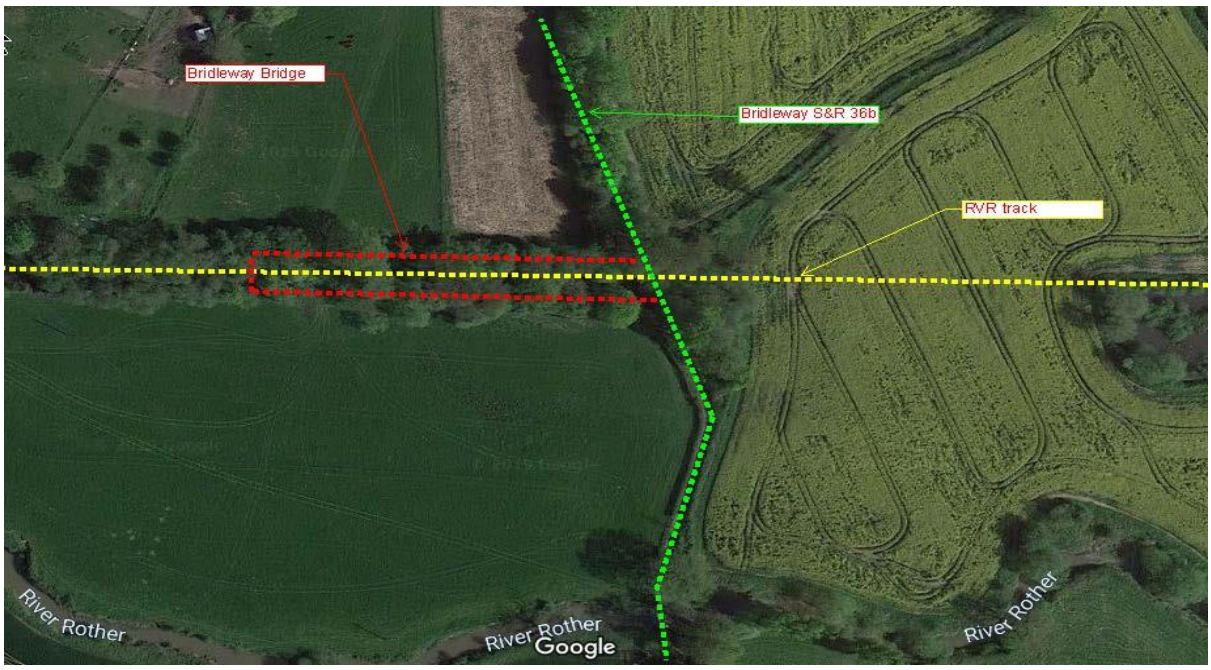


Figure 1 - Proposed location of Bridleway S&R36b crossing at Salehurst

2. Economic Benefits

A comprehensive Economic Benefits Report by Steer, leading UK specialist consultant, in 2018, forecast that the RVR will generate local economic benefits of up to £35 million over a two-year construction period and the first ten years of operation, and up to £4.6 million per annum of local economic benefits from 2030. It will generate approximately 34 jobs in the construction phase and up to 85 in the operational phase. Additional rail revenues of approximately £355,000 per annum are forecast to accrue to the main line operator.

3. Traffic Studies

In respect of the Bridleway Crossing (S&R 36b) at Salehurst, a crossing design similar to that used on the West Highland Railway was proposed and included in the planning documentation that was approved by Rother District Council. (RDC). During the course of the preparation of the planning documentation, extensive discussions and site visits to the location of the bridleway crossing were held with the local representative of the horse riders, the East Sussex County Council Senior Rights of way Officer, the Ramblers Association, and the Horse Society Access Field Officer for London and the South East.

4. Crossing Survey

There are a number of bridleway crossings on the existing Kent and East Sussex Railway that operate safely, effectively and without difficulty. Crossing Surveys were held at the Salehurst site over a period of a week in mid-summer. These showed an average of 4 pedestrians crossing on weekdays, and up to 20 a day at weekends. Whilst no horses were recorded, the local horse representative advised that normally around 4 horses would use the crossing each way at weekends, and less frequently on weekdays and in the winter. The Ramblers Association and the Horse Society advised us that their members are familiar with the bridleway crossing proposed and did not envisage any problems with them, particularly as there would be a maximum of only 10 train crossings a day in the summer months and none in the winter. Additionally, RVR will continue to collaborate with the Horse Society, Ramblers Association and local residents during the design, build and operational stages of the bridleway crossing ensuring we satisfy all concerns by building a robust and safe bridleway crossing that meets the needs of all users.

5. The Crossing Options

At the time of the Planning preparations no other options for the crossing were considered. However, the options considered are: -

(a) Option one, involving an “at grade” level crossing introduces no engineering challenges and would cause minimal disruption during construction. The RVR estimated cost (taking account of preliminary work and advance purchases of materials already completed etc.) is approximately £30,000.

(b) Option 2, considered the feasibility of taking the bridleway beneath the railway either parallel to or at right angles to the railway. Principal engineering and approval challenges are around the bridleway being below the level of the River Rother which is nearby. The tunnel would flood in a 5-year flood and above to a depth of 10 feet and would-be significant risk to local children and pedestrians in wet weather. The estimated cost is £6.8m. Option 2 is therefore unsuitable as an alternative arrangement to Option 1.

(c) Option 3, considers taking the rail over the bridleway. This scheme involves a sizable length of elevated viaduct structure with a significant impact on cost and would involve significant visual intrusion within the AONB. The viaduct would be adjacent to the existing houses in Salehurst and be particularly visible and intrusive to a quiet and most pleasant village. The estimated cost would be similar to that calculated by Arup for the A21 crossing at £20.2m. RDC have informed RVR that they would not support a planning application for a bridleway bridge, therefore taking the

rail over the bridleway would not be supported by RDC as RDC's reasons for not supporting a bridleway bridge would apply equally to rail over the bridleway.

(d) Option 4, would be a bridge carrying the bridleway over the railway. This would involve two long approach ramps either parallel to or at right angles to the railway due to the required maximum gradient for horses of 1 in 16, and the need for intermediate "level landings" to meet normal health and safety requirements. Obviously, the presence of a bridge and ramps directly on the bridleway alignment will prevent its use by farm vehicles, so the bridge has to have sufficient load bearing capacity to carry those vehicles. The Bridge would appear intrusive to the residents of Salehurst and several houses would lose the privacy of their rear gardens. The estimated cost for this option based on similar schemes by Network Rail elsewhere (e.g., over the main line railway at Kings Mill), and pro rata for this more straight forward location, is around £400,000. A recent new pedestrian crossing bridge at Wool Station by Network Rail cost £825,000. This option would also require a significant additional compulsory land take, above that required for option one, the "at grade" crossing. Additionally, RDC have informed RVR that they would not support a planning application for a bridleway bridge.

6. Timing

The majority of the construction materials for Option one would be delivered by rail, the fill material and track ballast via the Network Rail connection at Robertsbridge (from stock piles that RVR are already holding at several south coast ports), and track materials by rail from those already held for the project by Kent and East Sussex Railway (K&ESR) at Northiam Station. Upon gaining access to the land, it is anticipated that there will be 12 months of surveys in order to discharge the relevant planning conditions, with subsequent construction taking approximately 12 months. Commissioning and trials by K&ESR will take approximately 3 months. The reinstated railway will be operated by K&ESR as an integral part of its successful heritage undertaking. (K&ESR has been operating trains since 1974.)

7. Bridleway Design and Build

The bridleway crossing will be constructed from sections of revolutionary lightweight panels and edge beams. Every component weighs less than 60kg so it can be fitted manually by two people without the need for expensive machinery.

It is simple to fit and, unlike timber and heavier rubber systems they, can easily be removed and replaced during routine track maintenance.

The system shares the high grip surface of the heavy-duty steel framed polymer panel, so performs in the wet. It can be painted on in the same way as a road surface and the paint does not wear off easily as it does on other systems.

The surface is integral so does not peel off or need replacing like the expensive surface used on timber decks. The bridleway system is ideal wherever pedestrians or horses cross the track.

The lightweight nature also makes it ideal for remote or difficult to access installations such as rambling routes. Although rated as bridleway level crossing system, it has been tested way in excess of this using concrete blocks and vehicles.

Figure 2 Pedestrian and Bridleway Panels

8. Meerkat System

RVR will install the Meerkat warning device system to reduce user risk at the crossing to as low as reasonably practicable.

The new warning device can detect an oncoming train and provide an audible and visible warning to alert users that a train is approaching, therefore, have a significant impact on public safety at level crossings.

The entrance or decision point to the bridleway, which includes both sides of the railway will be protected by a self-closing wicket gate. Additionally, the wicket gate to be used will be designed to ensure it is possible for a mounted horse rider to open the gates without dismounting. RVR will follow in its entirety the ORR guidelines and current BHS specifications.

When cyclists use the crossing, notices will be sighted encouraging cyclists to dismount.

A sign explaining how to cross safely will also be displayed at the decision point on each side of the crossing. Instructions to users will be placed at appropriate points.

The minimum width between fences guiding users to the decision point or safe waiting area will be a minimum width of 3m. However, these widths may need to be increased depending on user requirements as part of the consultation process.

9. Railway Operation

The nature of the railway operation is an infrequent heritage railway, travelling at a maximum speed of 25mph. The intended design of the Bridleway crossing will incorporate the most recent crossing technology including a maximum speed of 10mph reducing risks to level as low as reasonably practicable.

The reinstated railway will be operated by Kent and East Sussex Railway (K&ESR) as an integral part of its successful heritage undertaking. (K&ESR has been operating trains since 1974). K&ESR have existing operating rules that safely manage these crossing types and which will be used, additionally, this crossing will have much improved safety systems.

10. Risk Assessment

The “Risk Assessment” documentation (Annex A) shows how the risks of a Bridleway crossing would be managed in accordance with ORR guidance.

11. User Worked Crossings

RVR is required to provide private user worked crossings over the line where property is severed by the reinstated railway. None of those proposed crossings are on the route of public rights of way. While the proposed TWAO Deposited Plans include for the provision of up to nine user worked crossing the draft Order does not seek specific detailed powers for accommodation crossings. Detailed design and operation would therefore be by way of subsequent negotiation following the making of an Order at which time we would approach ORR with proposed fully detailed solutions for each location.

The design and operation of those fully gated user worked crossings would be all as outlined in ORR Level Crossings – a Guide for Mangers, Designers & Operators (latest issue) with associated signage, protection and any other necessary measures to provide a safe solution as detailed in that document. Nevertheless, while the described minimum warning time of trains is achievable at all the proposed user worked crossing locations (ref guidance document 2.145) the crossings would nevertheless be enhanced by way of the provision of visual signal display to the crew of an approaching train indicating that the associated crossing gates are in the closed position.

The maximum line speed for the railway will be 25 mph. Local reduced speed limits will be incorporated where necessary at each user worked crossing set by way of sight line assessment - all as detailed in the Heritage Railway Association HGR-A0458 guidance document endorsed by the ORR for the assessment of user worked crossings.

RVR will enter into consultation with land owners to discuss options for removal of crossings wherever possible and where this is not possible RVR will provide a

variety of control measures to protect users as mentioned above, including providing the minimum safe distance to see an approaching train,

RVR will provide instructions for the safe use of level crossings for authorised users. The instructions will ensure the method of working for each crossing are adequate and suitable to ensure the safety of trains and crossing users. This may include employees, contractors, postal staff, drivers of delivery vehicles and visitors. The safety of those who use private level crossings on farms and other business premises in the course of their work.

The authorised user also has responsibilities for ensuring that everyone who uses the crossing has been properly instructed in how to do this safely. RVR will liaise with the authorised user and jointly prepare a specific joint risk assessment to ensure that a safe method of using the crossing is agreed and adopted. Particular attention will focus on the robustness of any agreed method of work between the two parties for periods of intensive use. The Heritage Railway Association HGR-A0458 guidance document will provide additional guidance and support.

- Provisions to be made available at the crossings include;
- Single gates that open away from the railway and kept closed across the roadway.
- The crossing surface and adequate approaches, suitable for the location and use.
- Vehicular gates may be locked to prevent unauthorised use.
- It is not envisaged that telephones and warning lights are required, however, this will form part of the consideration of the potential control measures identified within each specific crossing risk assessment.
- Instructions will be posted near every access point to the crossing, on a statutory sign.
- Adequate sighting in either direction will be maintained for crossing users
- Crossing with vehicles or livestock: The correct procedure is detailed in the instructions provided at each crossing;

Users will be encouraged to report any deficiencies or problems in using the crossing to the train operator and contact details will be made available at each crossing location.

Hazards and possible causes identified – **Bridleway Risk Assessment**	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
Regular users are more likely to undertake risk taking behaviour at crossings with a low frequency of trains.	The regularity of trains is a risk factor for crossing users, due to "the rarity of them encountering a train and the reduced vigilance that they might therefore demonstrate in crossing". Accidents are associated with lines that have low frequencies of trains.	4	2	8	The introduction of an audible alarm to provide users with a warning that a train is approaching. RVR intend to install the most relevant up to date safety equipment i.e., Meerkat. Use of new signage	2	1	2
Regular users and those living close to level crossings are more likely to undertake risk taking behaviour when using the crossing.	Potential behaviour traits of frequent users might include: Expectation by the user that there will not be any trains in the area. Familiar users apply prior knowledge of train times / frequencies. User believes he / she has enough time to beat the train. User has a low level of concentration and is easily distracted. User does not look in both directions. User has low perception of risk. User thinks he / she understands procedure without reading instructions User unaware of risks to subsequent users. User assumes that the train is stopping at the station (based on	4	2	8	The introduction of an audible alarm to provide users with a warning that a train is approaching. RVR intend to install the most relevant up to date safety equipment i.e., Meerkat. Use of Bridleway crossing is primarily covered in Local Training Plans and educational material to cover; Hazards associated with the crossing, How to make decisions about whether requests to cross can be granted. how to check whether a crossing is clear.	2	1	2

	prior experience) and chooses to cross in front of the train.							
Low train speeds might increase the risk-taking behaviour of users	It has been established that users might perceive the crossing to be safer to cross when trains are moving more slowly. This might result in them behaving less cautiously e.g. by crossing while a train is in view, crossing more slowly, or checking the line less often while crossing.	4	3	12	The introduction of an audible alarm to provide users with a warning that a train is approaching. RVR intend to install the most relevant up to date safety equipment i.e., Meerkat. Eyes watching signs to encourage users to behave safely e.g., put dogs on leads, close gates etc. Education Awareness Self-closing gates	3	2	6
Young children who are not old enough to understand safe crossing procedure might cross unsafely.	Young children might not fully understand the risks associated with level crossings or the correct crossing procedure and therefore traverse in an unsafe manner. This issue might be particularly prevalent in locations where it is likely that unaccompanied children use the crossing, such as near residential areas, schools, playgrounds and youth clubs.	4	3	12	The introduction of an audible alarm to provide users with a warning that a train is approaching. RVR intend to install the most relevant up to date safety equipment i.e., Meerkat. Use of level crossings is primarily covered in Local Training Plan and educational material to cover; Hazards associated with the crossing, How to make decisions about whether requests to cross can be granted. how to check whether a crossing is clear. Ensure signage is appropriate for the status and specific risks at, and on the approaches to, a crossing.	3	2	6

					Education Campaign.			
Errors by crossing users might increase at crossings without warning signs or lights in the hours of darkness.	Poor lighting conditions at and around the crossing can affect a user's behaviour in several ways: Failure to see the crossing / crossing equipment and signs. Deviation from the crossing Inability to read crossing instructions. Misjudgement of train speed.	3	2	6	The introduction of an audible alarm to provide users with a warning that a train is approaching. RVR intend to install the most relevant up to date safety equipment i.e., Meerkat. Use of level crossings is primarily covered in Local Training Plans and educational material to cover; Hazards associated with the crossing, How to make decisions about whether requests to cross can be granted. how to check whether a crossing is clear. Ensure signage is appropriate for the status and specific risks at, and on the approaches to, a crossing. Education Campaign.	2	1	2
The visibility (and hence effectiveness) of information on the approach to and at the crossing is reduced by overgrown foliage.	Overgrown foliage on the approach to a level crossing can obscure signs at the crossing, and also restrict the visibility of approaching trains. This could result in the user either not seeing the sign or train (complete or partial) or the user not seeing the sign or train in time to sufficiently interpret the information and respond appropriately.	3	2	6	Foliage Management System in place. The introduction of an audible alarm to provide users with a warning that a train is approaching. RVR intend to install the most relevant up to date safety equipment i.e., Meerkat.	2	1	2
An uneven and/or slippery crossing surface might present a potential hazard to those using the crossing.	Poor surfaces might present particular problems for cyclists (especially those wearing cycling shoes with slippery soles), horse riders, mobility scooter users,	3	3	9	Foliage Management System in place which ensures that all crossing surfaces are maintained, including the approach to the crossing, not just the area between the gates	3	2	6

	wheelchair users, the elderly, visually or physically impaired crossing users, and users with encumbrances such as luggage or pushchairs. The crossing surface might also present a hazard to road vehicles in general as well as a hazard to trains. Reasons for uneven/slippery crossing surfaces include: Missing, partial, worn or damaged crossing deck Poor decking panel alignment / position on skewed crossing Wet or icy weather conditions Uneven ballast distribution				and signs. Th Bridleway will allow sufficient space to provide a position of safety before/after the crossing for all users. Additionally, ensuring that the Bridleway crossing surface is profiled as the user moves through the entrance/exit to reduce the risk of slips, trips and fall thus preventing risk of personal injury. The Bridleway crossing will be constructed from sections of revolutionary lightweight panels and edge beams and a high-grip surface.			
User Worked Crossings - Additional								
Unreliable crossing equipment (telephones, warning lights, gates, means to secure gates including toe catches, and signs) due to poor maintenance, vandalism or general deterioration;	Damaged or missing signs can prevent a user understanding the crossing instructions / procedure Damaged equipment can affect its likelihood of use Damaged/difficult to use gates can affect a user's adherence to the correct gate crossing procedure Poorly maintained equipment can create a perception that the level crossing is not in use/ infrequently used and therefore reduce the perceived importance of following	4	3	12	Regular monitoring of the crossing, maintenance program in place Enhanced communication reporting arrangements between user and operator Installation of trespass guards on one or both sides of the crossing, together with any fencing as deemed necessary.	2	2	4

	the correct procedure Poorly maintained level crossing equipment can influence a user's behaviour in a variety of ways: Damaged or missing signs can prevent a user understanding the crossing instructions / procedure.							
Poor, worn or damaged crossing surfaces or cattle guards that cause difficulty in moving vehicles or livestock across the tracks;	Poor crossing surfaces make it more difficult for users to traverse the level crossing by distracting the user and causing them to look at their footing, by increasing user crossing time, and by increasing the potential for slips, trips and falls. In addition, footpath surfaces in a poor condition increase the likelihood of users diverting from the designated footpath or slipping / tripping into the carriageway.	3	2	6	Regular monitoring of the crossing, maintenance program in place Enhanced communication reporting arrangements between user and operator Installation of trespass guards on one or both sides of the crossing, together with any fencing as deemed necessary.	2	2	4
The type of level crossing might be unsuitable for a number of reasons, including its location, train service, line speed and/or user type	UWCs might become unsuitable due to a chance in land use (e.g. farming land diversification) or a new housing development nearby, which results in a higher number of crossing users and a change in user types. Another example might include an industrial estate being developed near to a rural crossing that is unsuitable for HGV use.	3	2	6	Review Signage. Involve users in the RA process Consider is current level crossing is correctly graded.	2	2	4
Restricted sighting of approaching trains caused by;	lineside development, erection of fences, or growth of vegetation, at a user worked crossing without additional protection measures,	3	2	6	Review Signage. Involve users in the RA process Consider is current level crossing is correctly graded. Vegetation clearance	2	2	4

Rother Valley Railway

New Build Level Crossing Narrative Risk Analysis (NBLC-NRA) - Update 10.02.2021

Contents

1 Introduction

The Rother Valley Railway will provide a Full Barrier Automatic Level Crossing, Locally Monitored (AFBCL) incorporating the latest technology for the operation and protective equipment. The crossing will be fully compliant with that is widely used on Network Rail infrastructure today, thus, ensuring the crossing would not require any product approvals, derogations or changes to standards. The maintenance regime would also be standard and no bespoke parts would need to be produced or stocked specifically for the crossing. For the above reasons, the crossing presents a very low reliability and risk concern and would most likely incur the lowest maintenance costs.

A level crossing does not currently exist at Junction Road; therefore, a Quantitative Risk Assessment would not provide sufficient evidence to demonstrate that possible risk has been assessed and managed accordingly. However, it is important to establish possible risk from the introduction of a level crossing and possible mitigation measures at an early stage of development.

This NBLC-NRA analyses all relevant data as well as expert opinion to demonstrate that all possible risk has been addressed as well as embroidering new technology to further enhance the safety of the level crossing, for example;

- CCTV for improved safety & security,
- Obstacle Detection
- Home Office Approved Red Light Cameras
- Evaluate the risks at the level crossing.
- Early engagement with stakeholders from different sectors, local authorities, communities and 'users' associations.
- Take engineering measures and find innovative solutions
- Take educational and awareness measures and collaborate with the rail and road sectors.

The level crossing will be carefully assessed via this analysis in conjunction with the railways, and together with the road infrastructure managers, local authorities and industry experts to make it more visible and easier to cross particularly for long, heavy and oversized vehicles.

All stakeholders will be in a position to cooperate and design the best level crossing environment.

Narrative Risk Assessments currently used by Network Rail are enabling better targeting of risk reduction measures; blending quantitative modelled risk with structured observation and judgement from competent staff. The NRA process is considered as part of this analysis to encompass the whole level crossing asset system and assess wider aspects of level crossing risk.

This analysis builds upon excellent safety initiatives which were introduced for the first Automatic Full Barrier level crossing by Network Rail including the safety benefits provided, however, RVR intend to introduce additional safety measures such as the use of Red-light safety equipment (RLSE), which has currently been installed at 31 public road level Crossings on the National Railway Network to improve user behaviour, deterring deliberate misuse. Trials

have demonstrated that these Home Office Type Approved (HOTA) cameras have reduced deliberate misuse by approximately 90 per cent at some locations.

RVR will install an automatic level crossing including an object detection system (AFBCL) at Junction Road level crossing. Crossing obstacle detection systems utilise a combination of RADAR and LIDAR technology to scan the crossing before allowing for trains to safely manoeuvre through. In combination these systems detect obstacles on the ground and around the edge of the barrier lines and deliver unique small object detection protecting children and adults as well as vehicles and other large objects. RVR will monitor and review the installation of the obstacle detection system after the first 12 months of operation to determine if additional safety features could be added to further enhance safety of the level crossing.

2 Level Crossing Overview

This is a risk analysis for Junction Road level crossing. However, it should be noted that at present a level crossing does not exist, therefore, this assessment is based on the probability of risk if a level crossing was in place. It is imperative that a full Quantitative (and Narrative) Risk Assessment (QRA) is completed before any trains operate over the crossing and that the QRA is presented to the ORR.

Crossing Details	
Name	Junction Road
Type	AFBCL
Crossing status	Public Highway
Overall crossing status	Design Stage
Engineers Lin Reference	N/A
OS grid reference	
Number of lines crossed	1
Line speed (mph)	10
Electrification	No
Signal box	Yes (A21 level crossing)

3 Information Sources

The table below shows the stakeholder consultation that was undertaken as part of the risk analysis.

- Office of Rail and Road (ORR)
- Kent and East Sussex Railway (K&ESR)
- Bakerail (Track site/project management specialists)
- East Sussex County Council (ESCC)
- Rother District Council (RDC)

- I-Transport (Specialist Planning Transport Consultancy)
- ARUP (Design, Engineering, Architecture and Business consultation Group)

Reference sources used during the risk analysis;

- ARUP A21 Options Report
- ARUP Road Safety Audit
- Mott Macdonald road survey report
- Network Rail QRA information
- GG19 Road Safety Report
- ORR Documentation
- GPR219-IDF- Level Crossing Safety
- EU SAFER-LC Project
- Level Crossing Risk Management Tool (LXRMT).

4 Level Crossing Diagrammatic Scheme

The new level crossing to be constructed is a Full Barrier Automatic Level Crossing, Locally Monitored (AFBCL) on B2244 Junction Road, East Sussex. The road approach speed is 40 mph. The profile of the railway line in the vicinity of the crossing has been provided (below), as well as the appropriateness of the proposed warning signs in this regard.

Diagram of the proposed railway Alignment

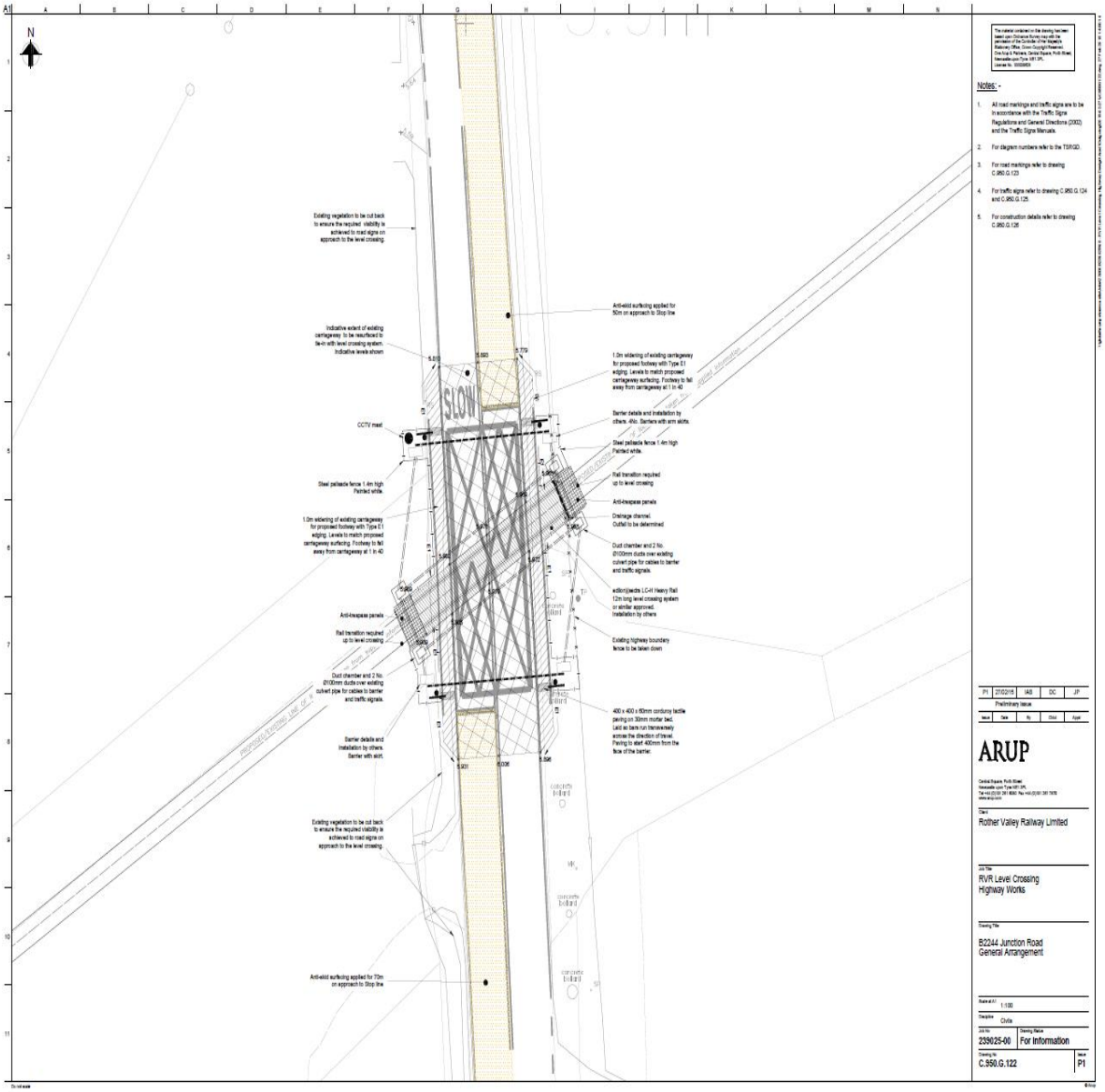
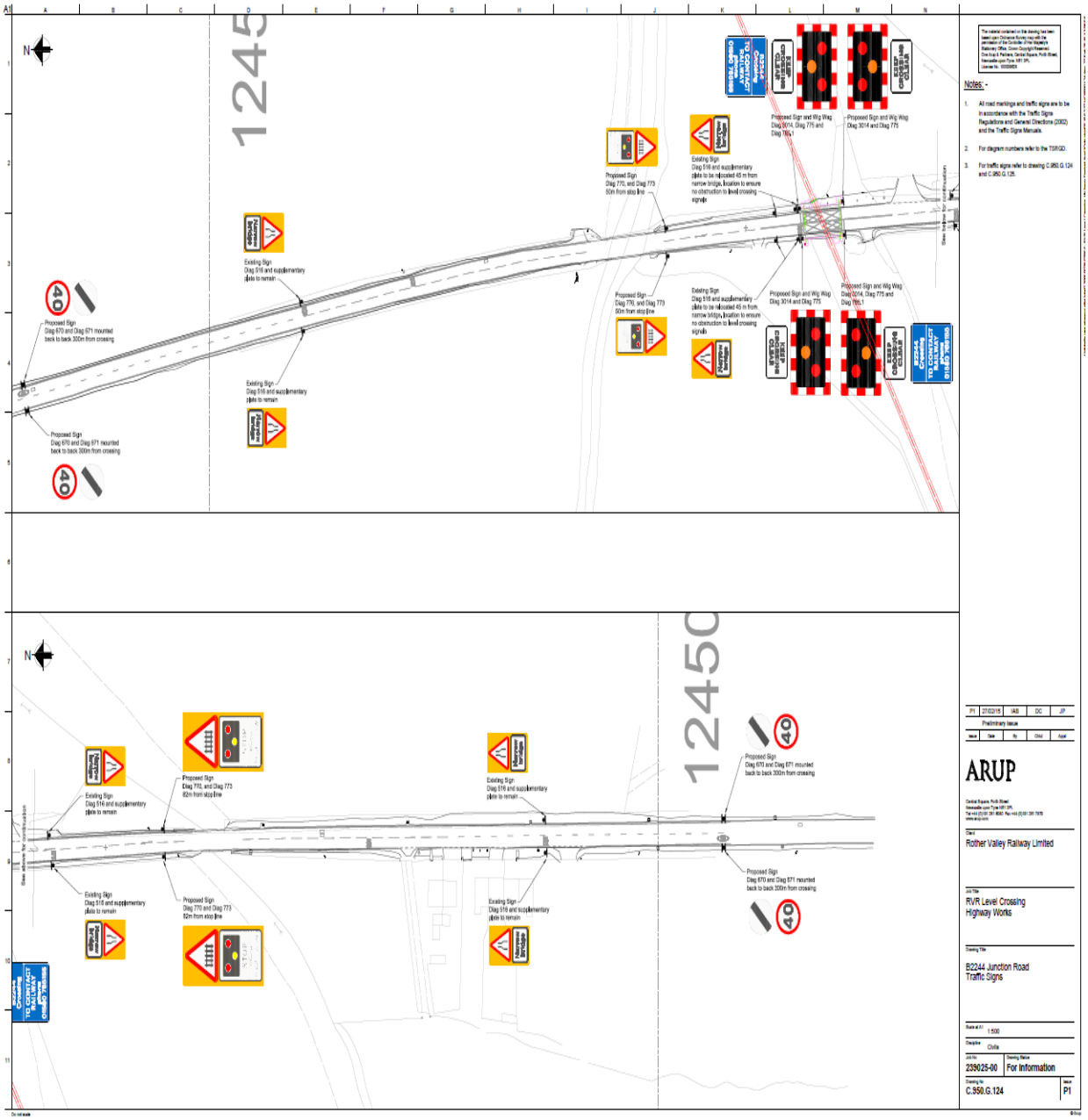


Diagram of the proposed traffic signs



5 Site Visit General Observations

The B2244 Junction Road, Stage 1 Road Safety Audit report (appendix A) identified possible road distractions which are considered as part of this analysis, for example,

- Speeding vehicles pose a threat to other road users along with a high frequency of heavy braking on the approaches to the narrow bridges which could result in higher frequency of collisions due to driver error.

To remove this concern, it is advised to reduce the speed limit over this length of road.

- The adjacent features see in photograph 1 (below) increase the risk of blocking back at the proposed level crossing, additionally, there is a private access road located close to the proposed level crossing location as well as the narrow bridges to the north and south. Turning traffic waiting on the carriageway by the proposed level crossing will increase the risk of blocking back over the crossing leading to potential vehicle/train conflict.

To remove this concern, it is advised to introduce a yellow box marking to deter blocking back at the crossing

Photograph 1

- There are a number of existing traffic signs both north and southbound B2244 in the vicinity of the proposed level crossing, hence, multiple traffic signs could lead to distraction, missing warning signs and possible road user collision as seen in Photograph 2(a) (b) below.

To avoid the risk of confusion between signage a comprehensive review will be conducted as part of detailed design of the level crossing.

Photograph 2(a)

Photograph 2b

- There are two narrow bridges situated either side of the proposed level crossing site. The bridges are too narrow for large vehicles to pass without forcing oncoming traffic to stop leading to the crossing being obstructed and potential vehicle/train conflict, see photographs 3(a) (b) below.

To remove this concern, it is advised to establish priority at the narrowing's for vehicles driving away from the level crossings.

Photograph 3(a)

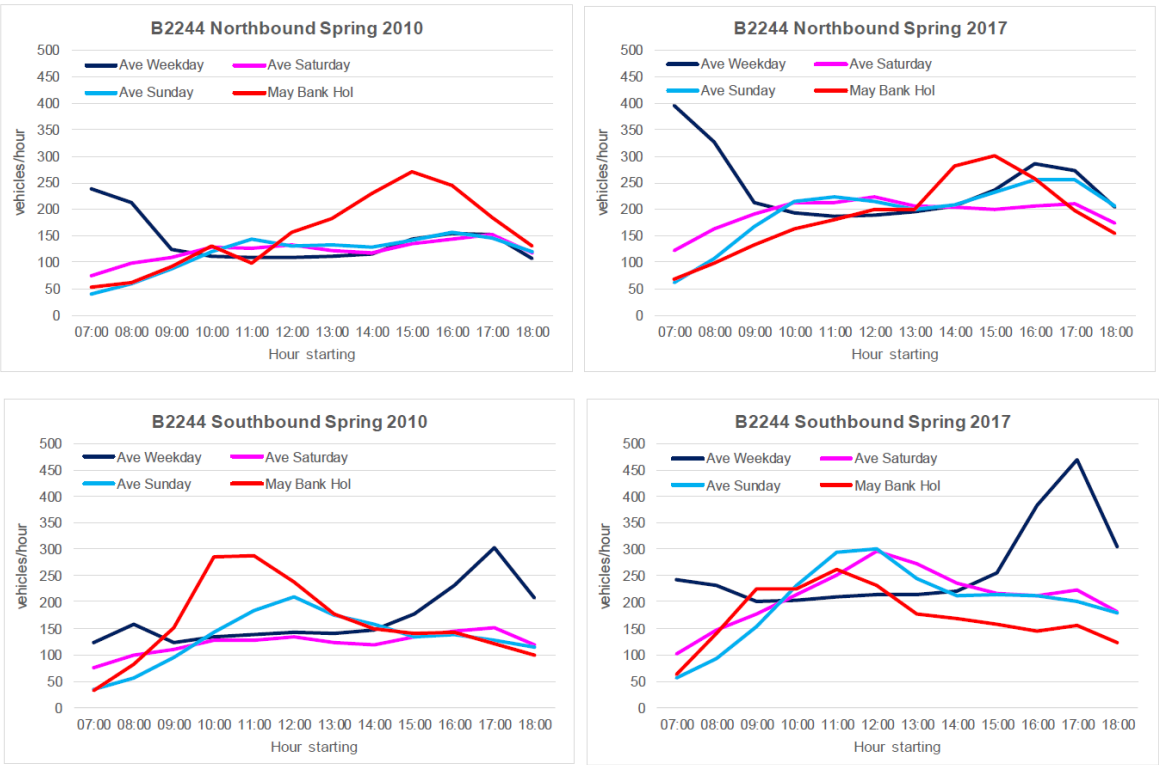
Photograph 3(b)

6 Junction Road Traffic Flows

The chart below compares traffic flows on B2244 Junction Road, for Spring and Summer months, based on ATC data provided Mott McDonald Addendum to traffic impact study report (2018).

For most days and periods, there have been large proportional increases in flow, but volumes remain much lower than on the A21. Increases are highest for the weekday AM and PM peak periods (northbound 07:00-09:00 and southbound 16:00-18:00), as well as on the August Bank Holiday. (Mott Macdonald Addendum report 2018 (Appendix B)

Figure 9: B2244 Traffic Flows in Spring 2010 and 2017



Source: ESCC ATC Site 021

Queuing at the level crossing has been estimated, based upon average vehicle demand per minute during the hour of each barrier closure, as well as length of time that the barrier is down. A barrier close time of 55 seconds has been assumed, with sensitivity testing with a 110-second closure.

Queue lengths have been estimated with 2018 traffic demands and predicted demand in 2021 and 2027.

Traffic Growth for future years;

Traffic forecasts have been produced for 2021 and 2027 using TEMPRO version 7.2 with National Transport Model (NTM) factors (NTM datasheet AF15). To calculate growth factors for Junction Road LC data for Rother District has been used.

For Bank Holidays, it has been assumed that growth will be the same as for Sundays.

Table 1 Traffic Growth Factors; 2017 - 2021

Road Name	Region	Road Type	Average Weekday	Average Saturday	Average Sunday	May Bank Holiday	August Bank Holiday

B2244 Junction Road	East Sussex	Rural Minor	1.063	1.061	1.061	1.061	1.061

Table 2 Traffic Growth Factors 2017 – 2027

Road Name	Region	Road Type	Average Weekday	Average Saturday	Average Sunday	May Bank Holiday	August Bank Holiday
B2244 Junction Road	East Sussex	Rural Minor	1.150	1.149	1.150	1.150	1.150

Predicted Queue Lengths;

Table 3 (below) shows the predicted queue lengths for Junction Road Level Crossing with a 55 second closure.

Table 3: Predicted Queue Lengths at Junction Road Level Crossing

	2017 Northbound		2017 Southbound		2021 Northbound		2021 Southbound		2027 Northbound		2027 Southbound	
	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average
Spring/Autumn												
Weekday	25	19	34	21	27	20	36	22	29	21	39	24
Saturday	20	18	26	21	21	19	28	23	23	21	30	25
Sunday	23	20	26	21	24	21	28	22	26	22	30	24
May BH	26	20	23	16	28	21	24	17	30	23	26	19
Summer												
Weekday	21	17	33	21	23	18	35	23	25	19	37	25
Saturday	18	17	22	20	19	18	23	21	21	19	25	23
Sunday	21	18	27	22	22	19	29	24	24	21	31	26
Aug BH	25	21	32	26	27	22	34	28	29	24	37	30

Source: Mott MacDonald analysis of existing and predicted traffic volumes, queue lengths in metres assuming 5.75m/vehicle

For the B2244, predicted maximum queue lengths are 20m-30m in 2017, increasing to around 30m-40m in 2027

Queue lengths with a 110-second closure (below) are shown as sensitivity tests. Predicted maximum queue lengths for Junction road are 40m-70m in 2017, increasing to around 40m-80m in 2017.

Table 4 Predicted Queue Lengths at Junction Road Level Crossing with 110 Second Closure

	2017 Northbound		2017 Southbound		2021 Northbound		2021 Southbound		2027 Northbound		2027 Southbound	
	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average
Spring/Autumn												
Weekday	50	37	67	42	54	39	71	44	58	43	77	48
Saturday	39	37	52	43	42	39	55	45	45	42	60	49
Sunday	45	39	53	42	48	42	56	45	52	45	61	48
May BH	53	39	46	33	56	42	49	35	61	45	53	38
Summer												
Weekday	43	33	65	43	46	35	69	46	49	38	75	49
Saturday	36	33	44	40	38	35	46	43	41	38	50	46
Sunday	41	37	55	45	44	39	58	47	48	42	63	51
Aug BH	50	42	64	52	54	44	68	55	58	48	73	60

Source: Mott MacDonald analysis of existing and predicted traffic volumes, queue lengths in metres assuming 5.75m/vehicle

Conclusion;

On the B2244, there have been large proportional increases in flow for most days and periods, however,

volumes remain much lower than on the A21. Increases are highest for the weekday AM and PM peak periods (northbound 07:00-09:00 and southbound 16:00-18:00, as well as on the August Bank Holiday. Predicted maximum queue lengths are 20m-30m in 2017, increasing to around 30m-40m in 2027.

7 The Railway

The train service over Junction Road level crossing will consist of passenger trains only. There will be approximately 10 trains per day. The highest permissible line speed of trains over the crossing will be 10 mph. Trains are timetabled to run for 10 hours per day.

The RVR Level Crossing Operational Management Plan (LCOMP) sets out the strategy for operational management of the Junction Road level crossing to be installed on the Rother Valley Railway (RVR) where it interfaces with the road at level grade, so requiring control of road vehicles to enable a train to cross.

The LCOMP describes the principles of how the level crossing is to be operated under normal conditions and in the event of failure.

This shall be the basis for developing operational procedures for the railways operation when services commence to which staff shall be trained and assessed on an ongoing basis.

Compliance with Industry guidelines;

The design for the level crossings, developed from this document, shall be compliant with industry guidelines, e.g. The Office of Rail Regulation: A Guide for Managers, Designers and Operators Railway Safety Publication 7 December 2011 and approved by a suitably independent person before installation.

Junction Road Level Crossing Operation;

It shall be noted that a signaller will be on duty at all times of normal operation. The signaller will monitor operation of the crossing via a Closed-Circuit Television link.

Normal operation to from Robertsbridge

The train will approach the level crossing at a maximum speed of 10 mph, thus ensuring that the train has the ability to stop in 30m. The AFBCL (Automatic Full Barrier Crossing, Locally Monitored) crossing area is equipped with obstacle detection technology that scans the crossing area at various stages during the closure sequence. The crossings are provided with crossing illumination (for night visibility) and a drivers' flashing red and white light indicator in each direction on final approach for local monitoring by the train crew. The speed approaching the AFBCL crossing is limited to 10mph, so the approaching train is able stop under all railhead conditions before the road if the crossing is either visibly blocked or the flashing indicator hasn't changed from red to white. The approach of a train automatically begins the crossing closure sequence. This commences with the road traffic wig-wag signals and audible warnings to indicate to road traffic to stop. Obstacle detection technology prevents to lowering of the crossing entrance barriers until the crossing is clear. Once the entrance barriers are down and the crossing surface is scanned to continue to be clear the lowering of the exit barriers can commence. If the equipment is proven to be fully functional and the OD sensors have confirmed clearance of the road surface between the fully down barriers then the indicator for the train driver will be showing flashing white light before the train reaches the crossing speed board.

The barriers will rise as soon as practicable after trains for which the lower sequence has been initiated or maintained, have passed clear of the crossing. The sequence of events to open the crossing to road traffic, once the raising cycle has been initiated or maintained is, all the barriers begin to rise simultaneously and should normally rise in 4 to 6 seconds; and the intermittent wig wag red lights should be extinguished as the barriers rise.

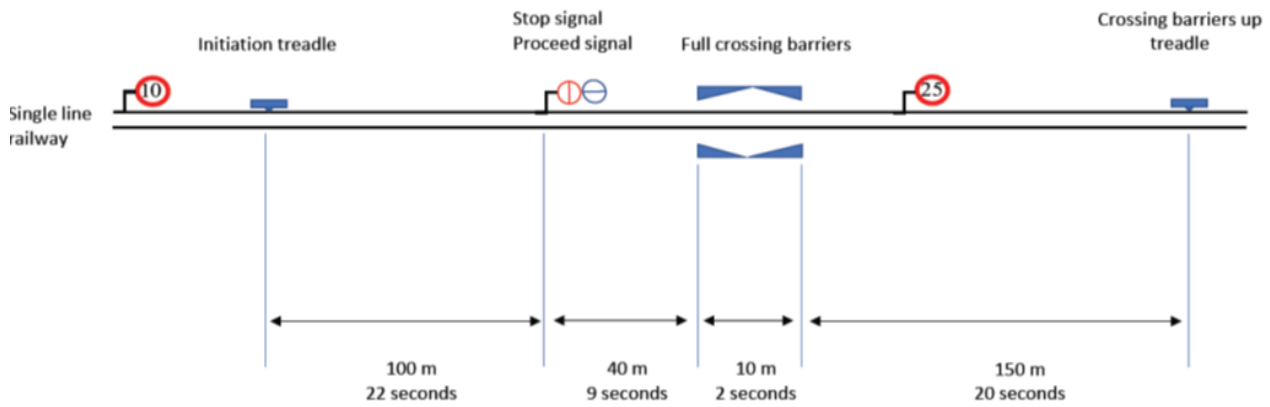
Railway signalling and control

Railway signalling will be provided to ensure the level crossing is fully protected on all railway approaches. The railway approach signals are interlocked with the lifting barriers so that it is not possible to clear the signals unless the road is fully closed by the barriers, additionally, it will not be possible to raise the barriers unless the signals are set at Stop and free of approach locking, or the train has passed the signal and traversed the crossings. It will not be possible to clear any protecting signals until 'crossing clear' is confirmed either automatically by obstacle detection equipment, or manually when that equipment is not being used. Discrete function controls will be provided at the control point for authorised railway staff use when obstacle detection equipment is not being used.

If a train passes a protecting signal at Stop, the road traffic light signals will immediately show an intermittent red light (omitting the steady amber phase) and the audible warning will start. The barriers will not be lowered as this may strike or trap crossing users.

To ensure that the crossing operates safely when the railway line is open to traffic, indicators at the control point will confirm that the equipment is powered and functioning correctly.

Level Crossing Signalling Design



Rother Valley Railway
Level crossing signalling schematic for
manually operated full barriers
Northbridge Street, A21 & Junction Road

Not to scale

Notes:

1 Equipment shown for up direction only, treadles, signals and signs replicated for down direction

2 Transit times assume full line speed

Level Crossing barriers & CCTV Systems Maintenance Plan

The maintenance plan for the three-level crossings shall be based on that recommended by the supplier of the equipment. It shall comprise:

- Regular planned maintenance at the required intervals.
- Work arising from planned maintenance, within the required timescales
- Fault response, within specified timescales.
- Work arising from fault responses, within the required timescales.
- Work arising due to other parties planned work.

Road Crossing Design and Construction

The construction of the road crossings comprise concrete units designed to meet the requirements of a high friction skid resistant road surface through the crossing. This has been tested for the proposed installation and passed the test level requirement as set by The Highways Agency, reference document RD/GN/009 dated September 1989.

8 5 X 5 Risk Assessment

Hazards are identified, listing possible causes if appropriate and assessed for severity. These are then multiplied by the frequency or likeliness of an incident occurring if no controls were applied. This produces the risk factor; the numerical assessment table gives guidelines on how to assess severity and frequency.

The risk assessments for the crossings are based on generic issues and then modified to reflect the specific issues at the individual crossing to reflect that risk can change significantly from one site to another. The generic risk assessment will be reviewed by the appointed Project Manager and then modified as required to reflect the hazards and the necessary controls identified during site visits (pre-works) or through information passed to them by stakeholders and any other third party.

Hazards are identified, listing possible causes if appropriate and assessed for severity. These are then multiplied by the frequency or likeliness of an incident occurring if no controls were applied. This produces the risk factor; the numerical assessment table gives guidelines on how to assess severity and frequency.

This risk assessment is generic and whereas the basic principles will always apply, it is acknowledged risk can change significantly from one site to another. Generic risk assessments will always be reviewed by the appointed Project Manager and then expanded upon if required to nullify or apply the necessary controls to hazards identified during site visits (pre-works) or through information passed to them by a third party.

Numerical Assessment			
Severity (S)		**Likelihood of Occurrence (L)**	
1	No Injuries / Minor Damage	1	Remote
2	Single Minor Injury	2	Unlikely
3	Single Major Injury / Minor Pollution	3	Occasional
4	Single Fatality / Major Pollution	4	Likely
5	Multiple Fatalities	5	Highly Likely

Risk Factor

		Likelihood of Occurrence (L)				
		5	4	3	2	1
Severity	5	25	20	15	10	5
	4	20	16	12	8	4
	3	15	12	9	6	3
	2	10	8	6	4	2
	1	5	4	3	2	1

Risk Factors between 16 to 25 = Unacceptable Risk. Risk Factors > 8 will be strictly monitored.
Hazards Identified with a Severity Assessed at 3 or above will also be strictly monitored.

Junction Road Risk Assessment

Hazards and possible causes identified for Junction Road AFBCL	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
SIGNALLING								
Relative to previous signals: Will the signal be in a different position, or does it have a different configuration?	Signal position is not consistent with the spacing between preceding signals Signal is of a different design to preceding signals Potential for, Death, Serious injury or injury	4	3	12	The KESR signalling arrangement will have consistent signal design. All staff will receive training before operation commences	3	2	6

Could the signal be confused with other signals on an adjacent line or on the same gantry	Signal is on a post and could be confused with other signals Signal has an identical profile / outline to adjacent signals Death Serious injury Injury	4	3	12	Ensure signals for all lines are visible Shield nearby signals from view Appropriate signal should be clearly associable with its line Driver training	3	2	6
Could the signal be obscured from the driver's view?	Signal reading time is inadequate. Signal is positioned round a curve and the reading angle is inadequate Signal is positioned round a curve and there is an obstruction blocking the signal's line of sight Signal can be obscured by vegetation Signal can be obscured (intermittently or otherwise) by a bridge or other structure, for example station structures edge of signal back plate is less than 100 mm from edge of aspect	3	3	9	Increase backboard size (by 50%) Manage vegetation Maximum train speed is 10 mph Remove / shield potential distractions in stations Reposition signal on straight track Make signal post more conspicuous Driver training	3	2	6
TRACK								
Will the track on approach to the signal suffer from adhesion	Signal is located in an area which suffers from ice, frost,	4	3	12	Lineside fencing / netting	2	2	4

problems?	leaf fall, dampness or other adhesion problems Death Serious injury Injury				Railhead conditioning Management of lineside vegetation Low adhesion warning signs Driver training			
Is there a reduction in permissible speed on the approach to the signal?	There is a reduction in permissible speed on the approach to the signal Death Serious injury Injury	2	2	4	Permissible speed on approach to the level crossing is maximum 10 mph Driver training On site staff monitoring	2	2	4
Is there a falling gradient on approach to the signal?	There is a falling gradient on the approach to the signal	4	3	12	Countdown markers Driver training	3	2	6
COLLISION								
Road Vehicle and train collision risk	Insufficient train warning time for all vehicle types known to be exacerbated by the driving position e.g. Tractor. Level crossing equipment and signage is not conspicuous or optimally positioned. Instructions for safe use may be misunderstood e.g., signage, clutter detracts from key messages, conflicting information given. High volume of unfamiliar users e.g. irregular visitors, migrant workers.	4	3	12	Optimising position of equipment at the design stage removing any conflicting or redundant signs. Strike in times optimised. Sighting lines enhanced. Latest technology in place for user-based warning systems including wig-wag lights, sirens, full road barriers, RTL. AFBCL Maximum train speed 10 mph implemented. Superior quality crossing surface construction material. De-vegetation programme in place	3	2	6

	Known user complacency leading to high levels of indiscipline. Type of vehicle unsuitable for level crossing; - Large, low, slow, making access or egress difficult and or vehicle is too heavy for the crossing surface – risk of grounding and or severity of gradient adversely affects ability to traverse. Users experience a long waiting time.							
Pedestrian and train collision risk	Ineffective whistle boards, warning inaudible, insufficient train warning time. Level crossing equipment and signage is not conspicuous or optimally positioned. Instructions for safe use may be misunderstood. Surface condition could lead to slip/trip risk. High volume of unfamiliar users i.e. irregular visitors/ramblers/equestrian.	4	3	12	Optimising position of equipment at the design stage removing any conflicting or redundant signs. Latest technology in place for user-based warning systems including wig-wag lights, sirens, full road barriers, RTL. AFBCL, obstacle detection Maximum train speed 10 mph implemented. Superior quality crossing surface construction material. De-vegetation programme in place. Regular engagement with stakeholders/authorised users reinforcing safe crossing protocol, legal responsibilities and	3	2	6

	Complacency leading to high levels of indiscipline e.g. users are known to rely on knowledge of timetable. High level of use by vulnerable people. High usage of cyclists.				promoting collaborative working.			
Hazards and possible causes identified	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
SPAD OCCURRENCE								
Train driver passes protecting signal without authority	Collision with road vehicle (see above). Collision with member of public (See above). Death Serious injury Injury	4	3	12	If a train passes a protecting signal at Stop, the road traffic light signals will immediately show an intermittent red light (omitting the steady amber phase) and the audible warning will start. The barriers will not be lowered as this may strike or trap crossing users. Driver training. Maximum speed of train 10 mph.	2	2	4

Hazards and possible causes identified	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
Additional Risk Influencing factors								
Distraction								
Can the driver be distracted by something outside the cab?	Driver could be distracted by trespassers	4	3	12	Signal reminder sign	3	2	6
Could the driver be distracted by other tasks at or on approach to the signal?	There is a level crossing in the vicinity of the signal	4	3	12	Position signal where driver not distracted by other duties Driver training	3	2	6
Distractions while using the level crossing might impair the user's ability to cross quickly and safely.	If a user is distracted, there is an increased likelihood that they will not see the crossing, warning signs, for example; Other persons in the car (e.g. children) Thoughts on personal matters, work stresses etc. Using the telephone, Behaviour of other crossing users, In car entertainment Seasonal events (e.g. fun fairs, fireworks) Mobile phones, iPads, handheld computers etc. Signage (e.g. speed limit signs). Distractions might be more likely for users who frequently use the crossing (e.g. delivery drivers), due to them potentially having a lower level of concentration than those who use it infrequently.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Staff training. Traffic calming measures. Train maximum speed 10 mph. New modern full barrier crossing. AFBCL Education campaign.	2	2	4

	A change in speed limit and the associated speed limit signs This proximity of the speed limit signs to the crossing might reduce the attention given to the crossing, or remove attention away from it completely. The signs might also draw a car driver's attention to the vehicle speedometer to check vehicle speed and away from maintaining vision out of the vehicle's windscreen. Other signs in the vicinity of a level crossing that are not related to that crossing could also have been a potential distraction.							
High vehicle approach speeds	The vehicle speed over a level crossing is a factor in vehicle driver errors. Risk factors include, the speed limit(s) in the surround areas, driver's perception and attitude to risk, visibility of warning signs and visibility of the level crossing e.g. rural winding roads. High risk behaviour such as high vehicle speeds and late, heavy braking will result in a higher frequency of collisions due to driver error.	4	3	12	Reduced road speed on approach to level crossing. Traffic calming measures. Enhanced signage. New modern full barrier crossing. AFBCL Education campaign.	2	2	4
Large, slow and low vehicles	Drivers of large vehicles are involved in a	4	3	12	Reduced road speed on approach to level crossing.	2	2	4

	disproportionately high number of incidents at level crossings. The size of the vehicles - they have less room for error when compared to cars. They may not be responding to the activation of the crossing warning system in sufficient time. Studies have proposed that large (HGV) vehicles may attempt to traverse the crossing once the barriers have already started to descent, suggesting that it could be to do with the driver's awareness of their vehicle's poorer braking performance, and therefore considering it safer to continue. Other contributory factors might include: The slower acceleration speed of HGVs causing the total time to cross a level crossing from standstill to increase Sightlines from a higher driving position.				Traffic calming measures. Enhanced signage Yellow box marking Level crossing road surface well maintained Power operated level crossing barriers AFBCL			
Ice conditions	Icy weather conditions on the approach and exit to the crossing might affect the	3	3	9	Provision of CCTV surveillance cameras.	2	3	6

	behaviour of the crossing, for example, prevent vehicles from stopping in a position of safety at the crossing. Encourage vehicle drivers to ignore the initial warning activation when they are close to the train line because of the risk of sliding forward onto the tracks. Cause pedestrians to concentrate on their footing, rather than looking for trains or observing warning signs. Result in pedestrian slips, trips and falls. This is a particular risk for elderly, or mobility impaired, users. Level crossings on 'B' roads might present a particular hazard to vehicle drivers as these roads are not normally gritted in icy conditions.				Level crossings local training plans, on communications skills, hazards associated with a particular crossing (icy conditions). Improved crossing surface. Regular monitoring. Tactile surfaces.			
Foliage obscuring warning signs and approaching trains	The visibility (and hence effectiveness) of information on the approach to and at the level crossing is reduced by overgrown foliage.	4	3	12	Cutting back vegetation and removing obstructions the sighting distances for users up and down the track and to signs / warning lights are lengthened. Staff training i.e. HRA Guidance document HGR – A0720 Control of Vegetation (Management	2	2	4

	Overgrown foliage on the approach to a level crossing can obscure signs and signals located at the crossing, and also restrict the visibility of approaching trains. This could result in the user either not seeing the sign or train (complete or partial) or the user not seeing the sign or train in time to sufficiently interpret the information and respond appropriately. This issue can be exacerbated when the visibility of the level crossing is reduced, either due to its type or its location e.g. on the bend in a road or on a high-speed road, as the vehicle driver has even less time to respond. foliage is also applicable to train drivers. Foliage on the lineside might impact on the train driver's ability to see information, objects or people on the crossing.				plan). Improved sighting distances. Train speed max 10 mph. CCTV monitoring. New modern full barrier crossing (Audible/visual alarms) AFBCL Education campaign. Reduced road speed on approach to level crossing. Traffic calming measures. Enhanced signage.			
Crossing utilisation or traffic moment	High crossing utilisation by users is associated with a greater chance of user risk taking behaviour.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Level crossings local training plans, training	2	2	4

					and briefing on communications skills, hazards associated with a particular crossing (icy conditions)., Reducing the road approach speed to the level crossing to reduce the risk of collision between vehicles and gates / trains. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Traffic calming measures. Enhanced signage.			
Unfamiliar users	Users who are not familiar with the level crossing procedure in the UK might apply an incorrect mental model when traversing the crossing.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Level crossings local training plans, training and briefing on communications skills, hazards associated with a particular crossing (icy conditions)., Reducing the road approach speed to the level crossing to reduce the risk of collision between vehicles and gates / trains. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Traffic calming measures. Enhanced signage	2	2	4

Traffic calming systems Road traffic calming systems on either side of a level crossing might increase the risk of blocking back.	Traffic calming systems, such as road width restrictions/ build-outs, positioned on either side of a level crossing might increase the risk of vehicle drivers blocking back over the crossing. When the crossing is closed to road traffic, queues form along the road. This issue might be exacerbated due to factors such as the time of day (rush hour) and 'herd mentality'. Discomfort for cyclists on the road. Potentially more noisy approach to the crossing leading to possible complaints. If overused in conjunction with changes in speed the mitigation might lose its impact upon behaviour.	3	3	9	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Reducing the road approach speed to a level crossing to reduce the risk of collision between vehicles and gates / trains. A range of enhancements to improve conspicuity, comprehension of and user response to level crossing warning signs:	2	2	4
Multiple traffic signs leading to distraction, missed warnings and road user collisions.	There are a number of existing traffic signs on both the northbound and southbound in the vicinity of the level crossing, notably	3	3	9	Reducing the road approach speed to the level crossing to reduce the risk of collision between vehicles and gates / trains. New modern full barrier crossing (Audible/visual alarms. AFBCL	2	2	4

	those warning drivers of the narrow bridges.				Education campaign. Traffic calming measures. Enhanced signage.			
Pinch points could lead to blocking back at the level crossing.	There are two narrow bridges situated either side of the level crossing site. The bridges are too narrow for large vehicles to pass without forcing oncoming traffic to stop. A platoon of half a dozen vehicles could obstruct the crossing leading to potential vehicle / train conflict	3	3	9	Traffic calming measures. - establish priority at the narrowing's for vehicles driving away from the level crossing. Education campaign. Enhanced signage	2	2	4
Limited forward visibility. Adjacent features increase the risk of blocking back at the level crossing. private access located close to the proposed level crossing location, in addition to the narrow bridges to the north and south.	Lack of good visibility at the level crossing leading to shunt type collisions.	3	3	9	Note: obstacle detection that will prevent crossing closure in these circumstances Introduce a yellow box marking. Traffic calming measures.	2	2	4
Single train line Greater risk-taking behaviour in both vehicle drivers and pedestrians is reported on single train lines. .	This user behaviour is in line with risk compensation theory - the user, perceiving there to be less of a risk to him/herself, behaves less cautiously	2	2	4	AFBCL Staff Training. Maximum train speed 10mph. Enhanced signage.	1	1	2
Farming vehicles Farm traffic might influence the speed and behaviour of	Farm traffic tends to move at a much slower speed	4	4	16	Power operated barrier. AFBCL	2	2	4

other vehicles traversing the crossing.	and, being much larger, reduce the visibility of other vehicle drivers. This can cause distraction and frustration and change other road user's behaviour; resulting in risk taking actions such as overtaking and not observing the level crossing warning signs.				CCTV monitoring. Staff Training/Competence. Education campaign. Enhanced signage			
Commercial driver	Commercial drivers might have increased risk taking behaviour at level crossings. Commercial vehicle drivers, such as salespersons, work to strict timescales and therefore their driving behaviour is often influenced by having to reach destinations on time. Commercial drivers using a level crossing might be inclined to 'beat the lights' to avoid having to wait at the crossing, or they might fail to follow the correct crossing procedure at unprotected crossings.	4	4	16	A range of enhancements to improve conspicuity, comprehension of and user response to level crossing warning signs: AFBCL Staff Training/Competence. Education campaign. Enhanced signage.	2	2	4

Adverse weather impacting visual information.	The effectiveness of visual information at crossings can be impaired by adverse weather conditions (e.g. fog and snow). The ability of vehicle drivers or other crossing users to detect the presence of level crossings, hazard information, warning lights or approaching trains might be impaired by adverse weather conditions, e.g. fog and snow. This might result in users failing to see warning information or oncoming trains, which could lead to users unintentionally adopting risky behaviour. In addition, in heavy snow users might not be able to see the tracks and inadvertently stand in a position of danger. Visibility in and around the crossing might also be impaired by banks of snow. An example where foggy conditions have been identified as a causal factor in a level crossing incident	3	3	9	CCTV monitoring. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Reduced road speed on approach to level crossing. Train speed maximum 10mph Traffic calming measures. Enhanced signage.	2	2	4

	investigation is the fatality at Barratt's Lane No.1 footpath crossing.							
Alcohol and drugs	The effects of drink and/or drugs can radically alter user behaviours. Motor and cognitive function might be impaired and users might also have a reduced perception of risk. Users under the influence of alcohol or drugs might exhibit the following behaviours: be more inclined to ignore normal crossing procedures be physically unstable and prone to slips, trips and falls be unable to focus, cognitively and visually have a lower perception of risk.	3	3	9	Anti-trespass and cattle guard panels are designed to deter people or animals from crossing the track at unauthorised places. Do not trespass signs. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures. Enhanced signage.	2	2	4
Disabilities.	Disabilities (e.g. reduced mobility, reduced levels of vision/hearing) will influence the behaviour of users at level crossings. Visually impaired users might be unable to see warning lights and signs	3	3	9	Increase the volume of the audible warning up to the maximum permitted level to make the alarm more conspicuous and potentially deter pedestrian violations. Additionally, Intelligent auditory alarm – takes account of ambient noise levels and produces alarm 5dB louder so it can always be heard clearly.	2	2	4

	clearly, or scan for trains before crossing. Hearing impaired users might be unable to hear crossing alarms, train whistles, warnings from people or the sound of approaching trains. Cognitively impaired users might have difficulty understanding and following the correct crossing procedure, or interpreting warning signs. Users with physical impairments (permanent or temporary) might encounter difficulties using level crossings of all types, but especially user worked crossings. Potential difficulties include struggling to cross within the warning time provided; being more prone to slips, trips and falls on the crossing, especially if the crossing surface is uneven or missing. Similarly, mobility scooter users might encounter problems with				Provision of flange gap filler to improve crossing surface. Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Crossing attendant (Monitoring). Traffic calming measures. Enhanced signage.			

	uneven crossing surfaces and the opening and closing gates or barriers.							
Incorrect mental model Incidents at level crossings could occur if the user adopts the incorrect mental model of how the crossing works.	Mental models are internal mental representations of an external reality. People develop a mental model of how to use a level crossing from their prior experience of using similar or comparable crossings (or road junctions), from instructions or by observing the behaviour of other users. Users familiar with the operation of one type of crossing might apply their mental model at other types of level crossing.	3	3	9	CCTV monitoring (staff training initiatives). Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures. Enhanced signage.	2	2	4
Fatigue	Fatigued users will be more susceptible to making errors or to taking shortcuts when crossing. Fatigue has a significant effect on human performance and the likelihood of errors. Level crossing users suffering from fatigue might miss	4	3	12	Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures.	2	2	4

	important information (crossing warning signs, lights, etc), or be more inclined to take shortcuts in the crossing procedure (fail to use the telephone, fail to close the gates at user worked crossings, etc).				Enhanced signage.			
Signaller/CCTV Operator:	'Habit intrusion' in CCTV monitoring CCTV operatives follow habituated patterns of behaviour which might result in the entrapment or injury of crossing users at MCB and MCB-CCTV crossings. Use of level crossings is primarily covered in Local Training Plans and by the training and briefing signallers/Operators receive on communications skills. It is important local training plans cover: hazards associated with a particular crossing, how to check whether a crossing is clear. Signaller's/Operators not following the appropriate rules and protocols should	3	3	9	New modern full barrier crossing. AFBCL	2	2	4

	be subject to additional monitoring and development plans. Inefficient CCTV scanning strategy Signaller/Operator uses an inefficient method of scanning CCTV screens. The scanning method employed by a signaller/Operator for monitoring CCTV screens will affect whether they successfully identify information on the CCTV screen. Using an inefficient scanning strategy might result in the signaller/Operator taking a longer time to identify key events, or might result in them missing key events on other CCTV screens. An efficient scanning method is particularly important where there are multiple CCTV screens being monitored by one signaller/Operator, or the signaller/Operator has a							

	high level of workload from other tasks.							
Work in or adjacent to public roadways.	Plant, equipment materials striking traffic/members of public. Traffic colliding with staff.	3	3	9	Authorised road closures and traffic management. Implement pedestrian walkways. Plant to be suitable for access to public roads. Comply with New Roads and Street Works Act and Traffic Signs Regulations.	1	1	2

Road Crossings. Narrative safety report.

New Build Northbridge Street Level Crossing - Narrative Risk Analysis (NBLC-NRA) – Update 10.02.2021

Contents

1 Introduction

The Rother Valley Railway will provide a Full Barrier Automatic Level Crossing, Locally Monitored (AFBCL) incorporating the latest technology for the operation and protective equipment. The crossing will be fully compliant with that is widely used on Network Rail infrastructure today, thus, ensuring the crossing would not require any product approvals, derogations or changes to standards. The maintenance regime would also be standard and no bespoke parts would need to be produced or stocked specifically for the crossing. For the above reasons, the crossing presents a very low reliability and risk concern and would most likely incur the lowest maintenance costs.

A level crossing does not currently exist at Northbridge Street; therefore, a Quantitative Risk Assessment would not provide sufficient evidence to demonstrate that possible risk has been assessed and managed accordingly. However, it is important to establish possible risk from the introduction of a level crossing and possible mitigation measures at an early stage of development.

This NBLC-NRA analyses all relevant data as well as expert opinion to demonstrate that all possible risk has been addressed as well as embroidering new technology to further enhance the safety of the level crossing, for example;

- CCTV for improved safety & security,
- Obstacle Detection
- Home Office Approved Red Light Cameras
- Evaluate the risks at the level crossing.
- Early engagement with stakeholders from different sectors, local authorities, communities and 'users' associations.
- Take engineering measures and find innovative solutions
- Take educational and awareness measures and collaborate with the rail and road sectors.

The level crossing will be carefully assessed via this analysis in collaboration with railway, and the road infrastructure managers, local authorities and industry experts to make it more visible and easier to cross particularly for long, heavy and oversized vehicles.

All stakeholders will be in a position to cooperate and design the best level crossing environment.

Narrative Risk Assessments currently used by Network Rail are enabling better targeting of risk reduction measures; blending quantitative modelled risk with structured observation and judgement from competent staff. The NSA process is considered as part of this analysis to encompass the whole level crossing asset system and assess wider aspects of level crossing risk.

This analysis builds upon excellent safety initiatives which were introduced for the first Automatic Full

Barrier level crossing by Network Rail including the safety benefits provided, however, RVR intend to introduce additional safety measures such as the use of Red-light safety equipment (RLSE), which has currently been installed at 31 public road level Crossings on the National Railway Network to improve user behaviour, deterring deliberate misuse. Trials have demonstrated that these Home Office Type Approved (HOTA) cameras have reduced deliberate misuse by approximately 90 per cent at some locations.

RVR will install an automatic level crossing including an object detection system (AFBCL) at Northbridge Street level crossing. Crossing obstacle detection systems utilise a combination of RADAR and LIDAR technology to scan the crossing before allowing for trains to safely manoeuvre through. In combination these systems detect obstacles on the ground and around the edge of the barrier lines and deliver unique small object detection protecting children and adults as well as vehicles and other large objects. RVR will monitor and review the installation of the obstacle detection system after the first 12 months of operation to determine if additional safety features could be added to further enhance safety of the level crossing.

2 Level Crossing Overview

This is a risk analysis for Northbridge Street level crossing. However, it should be noted that at present a level crossing does not exist, therefore, this analysis is based on the probability of risk if a level crossing was in place. It is imperative that a full Quantitative (and Narrative) Risk Assessment (QRA) is completed before any trains operate over the crossing and that the QRA is presented to the ORR.

Crossing Details	
Name	Northbridge Street
Type	AFBCL
Crossing status	Public Highway
Overall crossing status	Design Stage
Engineers Lin Reference	N/A
OS grid reference	coordinates 573819, 124014
Number of lines crossed	1
Line speed (mph)	10
Electrification	No
Signal box	Yes (A21 level crossing)

3 Information Sources

The table below shows the stakeholder consultation that was undertaken as part of the risk analysis.

Consulted	Attended site
ORR K&SR Bakerail ESCC RVDC	
I-Transport	
ARUP	All attended sit visits

Reference sources used during the risk analysis;

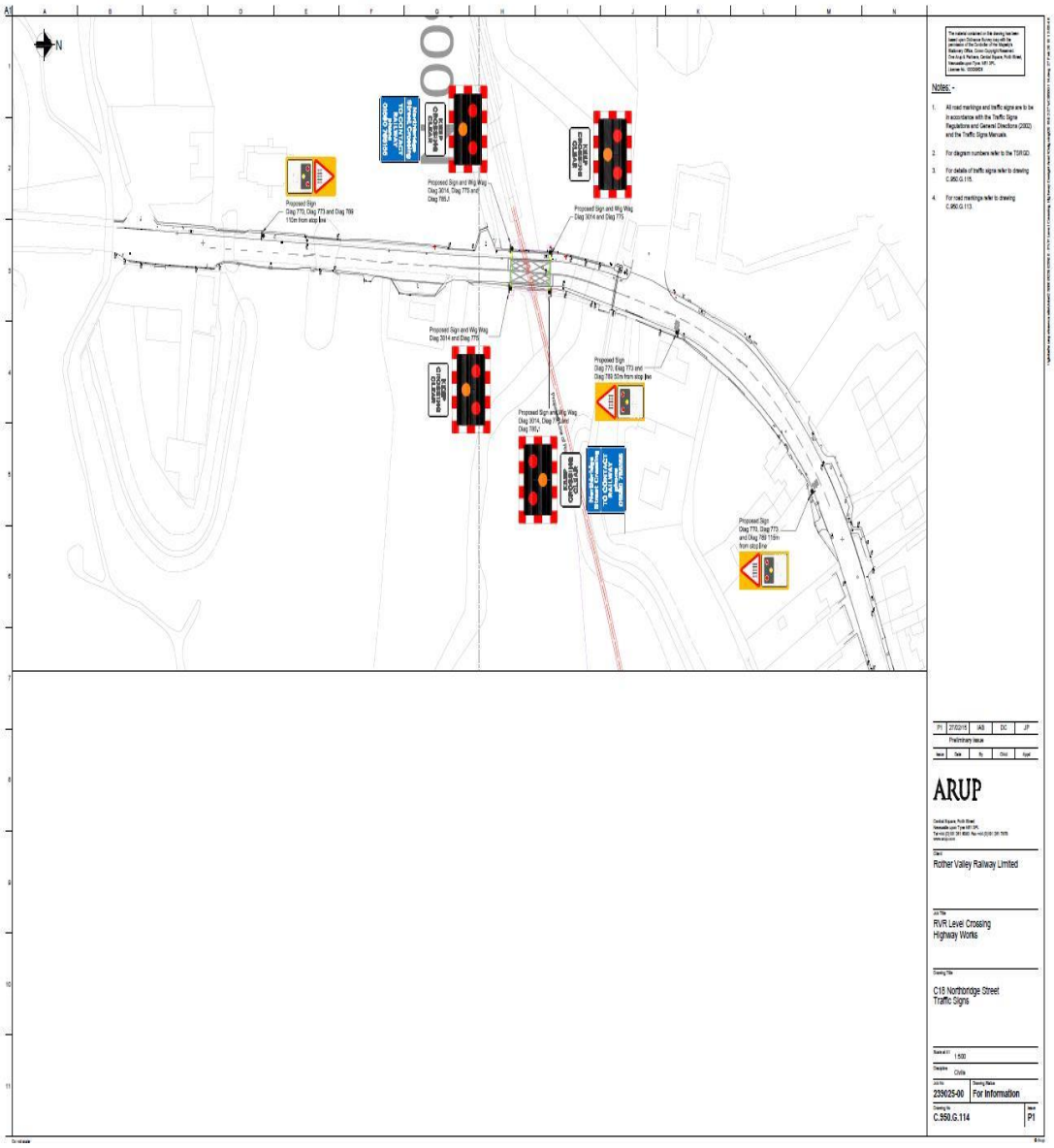
- Office of Rail and Road (ORR)
- Kent and East Sussex Railway (K&ESR)
- Bakerail (Track site/project management specialists)
- East Sussex County Council (ESCC)
- Rother District Council (RDC)
- I-Transport (Specialist Planning Transport Consultancy)
- ARUP (Design, Engineering, Architecture and Business consultation Group)
- Level Crossing Risk Management Tool (LXRMT).

4 Level Crossing Diagrammatic Scheme

The new level crossing to be constructed is an AFBCL level crossing on C18 Northbridge Street, Robertsbridge, East Sussex. The road approach speed is 30 mph. The profile of the railway line in the vicinity of the crossing has been provided (below), as well as the appropriateness of the proposed warning signs in this regard.

Diagram of the proposed railway Alignment

Diagram of the proposed traffic signs



5 Site Visit General Observations

The C18 Northbridge Street, Robertsbridge Stage 1 Road Safety Audit report identified possible road distractions which are considered as part of this analysis, for example,

- Limited forward visibility to level crossing leading to shunt type collisions. The approach to the level crossing is situated on a bend in the road (Photograph 1).

There is a cottage located close to the road limiting drivers' forward visibility on the bend. In the same location there is on-street residents' parking, which requires traffic to cross the carriageway centreline. This could draw drivers' attention away from downstream hazards such as a stationary queue of vehicles at the level crossing, leading to shunt collisions.

To remove this concern, it is advised to move the northern-most warning signs to the northern side of the drainage culvert to provide additional advanced warning.

Photograph 1

- The adjacent access increases the risk of blocking back at the level crossing (Photograph 2a & 2b) below.

There are a number of accesses close to the proposed level crossing location, not least that of a four-hectare industrial development site, which could generate a significant volume of additional traffic movements. A planning proposal has recently been submitted for around 40 houses/flats on the Old Mill site to the North West of the crossing, however it is not anticipated that this small development will affect safety at the crossing other than increased traffic).

The limited carriageway width and on-street parking could result in traffic waiting on the carriageway by the level crossing and will increase the risk of vehicles queuing over the level crossing, leading to potential vehicle / train conflict.

It is intended to Introduce a yellow box marking to deter traffic from queuing over the crossing.

Photograph 2(a)

Photograph 2 (b)

- Insufficient warning for the visually impaired could lead to pedestrian injuries.

Footways are provided along both sides of Northbridge Street in the vicinity of the proposed level crossing (Photograph 3).

The visually impaired use tactile warning surfaces to identify hazards ahead. A visually impaired pedestrian could enter the level crossing zone without realising the hazardous nature of the environment, placing them at risk of being trapped by the barriers.

Tactile warning surfaces will be provided in line with national guidelines on each footway approach to the crossing.

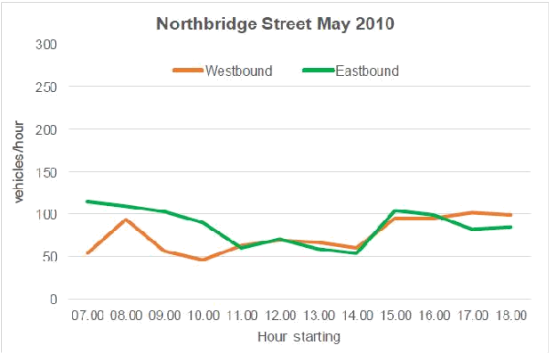
Photograph 3

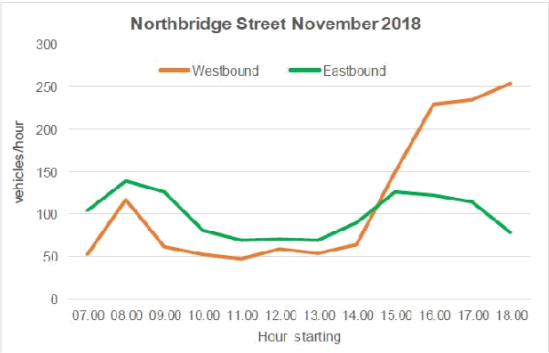
Lighting;

There is currently a system of lighting along the length of Northbridge Street and, due to the proximity of a lighting column at the proposed level crossing in Robertsbridge, it has been deemed necessary to remove that column and introduce a lighting column either side of the crossing at a safe distance. The proposed location of the two columns provides a level of illumination and uniformity consistent with other sections of that road. Consultation has been undertaken with the Parish Council to ensure that their needs are addressed prior to proposing an alteration to the lighting.

6 Northbridge Street Traffic Flows

The chart below compares traffic flows on Northbridge Street to the west of the A21 Roundabout for 2010 and 2018. Flows are generally higher throughout the day but remain relatively low, although large increases are shown for the westbound direction between 16:00-19:00. (Mott Macdonald Addendum report 2018.





Queuing at the level crossing has been estimated, based upon average vehicle demand per minute during the hour of each barrier closure, as well as length of time that the barrier is down. A barrier close time of 55 seconds has been assumed, with sensitivity testing with a 110-second closure.

Queue lengths have been estimated with 2018 traffic demands and predicted demand in 2021 and 2027.

Traffic Growth for future years;

Traffic forecasts have been produced for 2021 and 2027 using TEMPRO version 7.2 with National Transport Model (NTM) factors (NTM datasheet AF15). To calculate growth factors for Northbridge Street LC date for Rother Distract has been used.

For Bank Holidays, it has been assumed that growth will be the same as for Sundays.

Table 1 Traffic Growth Factors 2017 - 2021

Road Name	Region	Road Type	Average Weekday	Average Saturday	Average Sunday	May Bank Holiday	August Bank Holiday
Northbridge Street	Rother District	Rural Minor	1.062	1.060	1.061	1.061	1.061

Table 2 Traffic Growth Factors 2017 –2027

Road Name	Region	Road Type	Average Weekday	Average Saturday	Average Sunday	May Bank Holiday	August Bank Holiday
C18 Northbridge Street	Rother District	Rural Minor	1.151	1.152	1.154	1.154	1.154

Predicted Queue Lengths;

Table 3 (below) shows the predicted queue lengths for Northbridge Street Level Crossing with a 55 second closure.

Table 3: Predicted Queue Lengths at Northbridge Street Level Crossing

	2017 Westbound		2017 Eastbound		2021 Westbound		2021 Eastbound		2027 Westbound		2027 Eastbound	
	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average
Spring/Autumn												
Weekday	20	8	11	8	21	8	12	8	23	9	13	9

Predicted maximum queue lengths are 20m in 2017 and 23m in 2027.

Queue lengths with a 110-second closure (below) are shown as sensitivity tests. Predicted maximum queue lengths for Northbridge Street LC are 20m –30m in 2017 and 30m –40m in 2027.

Table 4 Predicted Queue Lengths at Northbridge Street Level Crossing with 110 Second Closure

	2017 Westbound		2017 Eastbound		2021 Westbound		2021 Eastbound		2027 Westbound		2027 Eastbound	
	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average
Spring/Autumn												
Weekday	40	16	22	16	43	17	24	17	46	18	26	18

Conclusion;

On Northbridge Street to the West of the A21 Roundabout 2018 flows are generally higher throughout the day but still remain relatively low, although larger increases are shown for the westbound direction between 16:00 –19:00. It is not anticipated that the increased queue lengths by 2027 would have any significant impact of the Level Crossing operation.

7 The Railway

The train service over Northbridge Street level crossing will consist of passenger trains only. There will be approximately 10 trains per day. The highest permissible line speed of trains over the crossing will be 10 mph. Trains are timetabled to run for 10 hours per day.

The RVR Level Crossing Operational Management Plan (LCOMP) sets out the strategy for operational management of the Northbridge street level crossing to be installed on the Rother Valley Railway (RVR) between Robertsbridge Junction Station and Bodiam where it interfaces with the road at level grade, so requiring control of road vehicles to enable a train to cross.

The LCOMP describes the principals of how the level crossing is to be operated under normal conditions and in the event of failure.

This shall be the basis for developing operational procedures for the railways operation when services commence to which staff shall be trained and be assessed on an ongoing basis.

Compliance with Industry guidelines;

The design for the level crossings, developed from this document, shall be compliant with industry guidelines, e.g. The Office of Rail Regulation: A Guide for Managers, Designers and Operators Railway Safety Publication 7 December 2011 and approved by a suitably independent person before installation.

Northbridge Street Level Crossing Operation;

It shall be noted that a signaller will be on duty at all times of normal operation. The signaller will monitor operation of the crossing via a Closed-Circuit Television link.

To and from Robertsbridge;

The train will approach the level crossing at a maximum speed of 10 mph, thus ensuring that the train has the ability to stop in 30m. The AFBCL (Automatic Full Barrier Crossing, Locally Monitored) crossing area is equipped with obstacle detection technology that scans the crossing area at various stages during the closure sequence. The crossings are provided with crossing illumination (for night visibility) and a drivers' flashing red and white light indicator in each direction on final approach for local monitoring by the train crew. The speed approaching the AFBCL crossing is limited to 10mph, so the approaching train is able stop under all railhead conditions before the road if the crossing is either visibly blocked or the flashing indicator hasn't changed from red to white. The approach of a train automatically begins the crossing closure sequence. This commences with the road traffic wig-wag signals and audible warnings to indicate to road traffic to stop. Obstacle detection technology prevents to lowering of the crossing entrance barriers until the crossing is clear. Once the entrance barriers are down and the crossing surface is scanned to continue to be clear the lowering of the exit barriers can commence. If the equipment is proven to be fully functional and the OD sensors have confirmed clearance of the road surface between the fully down barriers then the indicator for the train driver will be showing flashing white light before the train reaches the crossing speed board.

The barriers will rise as soon as practicable after trains for which the lower sequence has been initiated or maintained, have passed clear of the crossing. The sequence of events to open the crossing to road traffic, once the raising cycle has been initiated or maintained is, all the barriers begin to rise simultaneously and should normally rise in 4 to 6 seconds; and the intermittent wig wag red lights should be extinguished as the barriers rise.

Railway signalling and control

Railway signalling will be provided to ensure the level crossing is fully protected on all railway approaches. The railway approach signals are interlocked with the lifting barriers so that it is not possible to clear the signals unless the road is fully closed by the barriers, additionally, it will not be possible to raise the barriers unless the signals are set at Stop and free of approach locking, or the train has passed the signal and traversed the crossings. It will not be possible to clear any protecting signals until ‘crossing clear’ is confirmed either automatically by obstacle detection equipment, or manually when that equipment is not being used. Discrete function controls will be provided at the control point for authorised railway staff use when obstacle detection equipment is not being used.

If a train passes a protecting signal at Stop, the road traffic light signals will immediately show an intermittent red light (omitting the steady amber phase) and the audible warning will start. The barriers will not be lowered as this may strike or trap crossing users.

To ensure that the crossing operates safely when the railway line is open to traffic, indicators at the control point will confirm that the equipment is powered and functioning correctly.

Level Crossing Maintenance plan

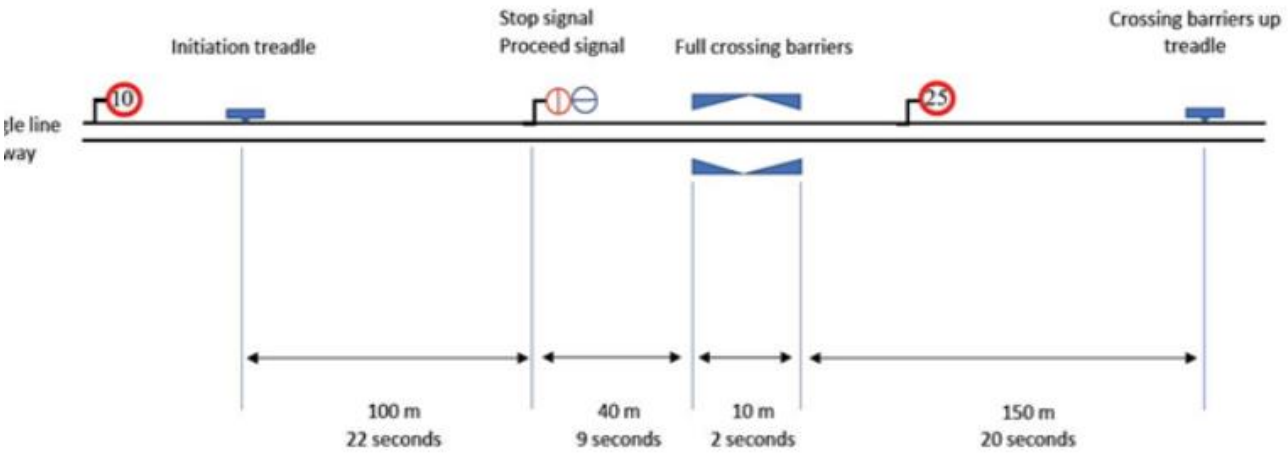
The maintenance plan for the three-level crossings shall be based on that recommended by the supplier of the equipment. It shall comprise:

- Regular planned maintenance at the required intervals.
- Work arising from planned maintenance, within the required timescales
- Fault response, within specified timescales.
- Work arising from fault responses, within the required timescales.
- Work arising due to other parties planned work.

Road Crossing Design and Construction

The construction of the road crossings comprise concrete units designed to meet the requirements of a high friction skid resistant road surface through the crossing. This has been tested for the proposed installation and passed the test level requirement as set by The Highways Agency, reference document RD/GN/009 dated September 1989.

Signalling Diagram Layout



Notes:

1 Equipment shown for up direction only, treadles, signals and signs replicated for down direction

2 Transit times assume full line speed

Rother Valley Railway
Level crossing signalling schematic for manually operated full barriers
Northbridge Street, A21 & Junction Road

Not to scale

8 5 X 5 Risk Assessment

Hazards are identified, listing possible causes if appropriate and assessed for severity. These are then multiplied by the frequency or likeliness of an incident occurring if no controls were applied. This produces the risk factor; the numerical assessment table gives guidelines on how to assess severity and frequency.

The risk assessments for the crossings are based on generic issues and then modified to reflect the specific issues at the individual crossing to reflect that risk can change significantly from one site to another. The generic risk assessment will be reviewed by the appointed Project Manager and then modified as required to reflect the hazards and the necessary controls identified during site visits (pre-works) or through information passed to them by stakeholders and any other third party.

KESR Risk Assessment utilising the 5 X 5 risk assessment table: Severity X Likelihood of occurrence = Risk Factor (S X L = RF)

Signal Overrun Risk Assessment (SPAD) at a level crossing.

The document sets out KESR's approach to the management of signal overrun risk.

Rationale; The hazard of a train passing a stop signal without authority (at a level crossing) shall be evaluated by application of a risk assessment

Hazards are identified, listing possible causes if appropriate and assessed for severity. These are then multiplied by the frequency or likeliness of an incident occurring if no controls were applied. This produces the risk factor; the numerical assessment table gives guidelines on how to assess severity and frequency.

This risk assessment is generic and whereas the basic principles will always apply, it is acknowledged risk can change significantly from one site to another. Generic risk assessments will always be reviewed by the appointed Project Manager and then expanded upon if required to nullify or apply the necessary controls to hazards identified during site visits (pre-works) or through information passed to them by a third party.

Numerical Assessment			
Severity (S)		**Likelihood of Occurrence (L)**	
1	No Injuries / Minor Damage	1	Remote
2	Single Minor Injury	2	Unlikely
3	Single Major Injury / Minor Pollution	3	Occasional
4	Single Fatality / Major Pollution	4	Likely
5	Multiple Fatalities	5	Highly Likely

Risk Factor

		Likelihood of Occurrence (L)				
		5	4	3	2	1
Severity	5	25	20	15	10	5
	4	20	16	12	8	4
	3	15	12	9	6	3
	2	10	8	6	4	2
	1	5	4	3	2	1

Risk Factors between 16 to 25 = Unacceptable Risk. Risk Factors > 8 will be strictly monitored.
Hazards Identified with a Severity Assessed at 3 or above will also be strictly monitored.

Northbridge Street Risk Assessment

Hazards and possible causes identified for Northbridge St AFBCL	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
SIGNALLING								
Relative to previous signals: Will the signal be in a different position, or does it have a different configuration?	Signal position is not consistent with the spacing between preceding signals Signal is of a different design to preceding signals Potential for, Death, Serious injury or injury	4	3	12	The KESR signalling arrangement will have consistent signal design. All staff will receive training before operation commences	3	2	6

Could the signal be confused with other signals on an adjacent line or on the same gantry	Signal is on a post and could be confused with other signals Signal has an identical profile / outline to adjacent signals Death Serious injury Injury	4	3	12	Ensure signals for all lines are visible Shield nearby signals from view Appropriate signal should be clearly associable with its line Driver training	3	2	6
Could the signal be obscured from the driver's view?	Signal reading time is inadequate. Signal is positioned round a curve and the reading angle is inadequate Signal is positioned round a curve and there is an obstruction blocking the signal's line of s Signal can be obscured by vegetation Signal can be obscured (intermittently or otherwise) by a bridge or other structure, for example station structures edge of signal back plate is less than 100 mm from edge of aspect	3	3	9	Increase backboard size (by 50%) Manage vegetation Maximum train speed is 10 mph Remove / shield potential distractions in stations Reposition signal on straight track Make signal post more conspicuous Driver training	3	2	6
TRACK								
Will the track on approach to the signal suffer from adhesion	Signal is located in an area which suffers from ice, frost,	4	3	12	Lineside fencing / netting	2	2	4

problems?	leaf fall, dampness or other adhesion problems Death Serious injury Injury				Railhead conditioning Management of lineside vegetation Low adhesion warning signs Driver training			
Is there a reduction in permissible speed on the approach to the signal?	There is a reduction in permissible speed on the approach to the signal Death Serious injury Injury	2	2	4	Permissible speed on approach to the level crossing is maximum 10 mph Driver training On site staff monitoring	2	2	4
Is there a falling gradient on approach to the signal?	There is a falling gradient on the approach to the signal	4	3	12	Countdown markers Driver training	3	2	6
COLLISION								
Road Vehicle and train collision risk	Insufficient train warning time for all vehicle types known to be exasperated by the driving position e.g. Tractor. Level crossing equipment and signage is not conspicuous or optimally positioned. Instructions for safe use may be misunderstood e.g., signage, clutter detracts from key messages, conflicting information given. High volume of unfamiliar users e.g. irregular visitors, migrant workers.	4	3	12	Optimising position of equipment at the design stage removing any conflicting or redundant signs. Strike in times optimised. Sighting lines enhanced. Latest technology in place for user-based warning systems including wig-wag lights, sirens, full road barriers, RTL. AFBCL Maximum train speed 10 mph implemented. Superior quality crossing surface construction material. De-vegetation programme in place	3	2	6

	Known user complacency leading to high levels of indiscipline. Type of vehicle unsuitable for level crossing; - Large, low, slow, making access or egress difficult and or vehicle is too heavy for the crossing surface – risk of grounding and or severity of gradient adversely affects ability to traverse. Users experience a long waiting time.							
Pedestrian and train collision risk	Ineffective whistle boards, warning inaudible, insufficient train warning time. Level crossing equipment and signage is not conspicuous or optimally positioned. Instructions for safe use may be misunderstood. Surface condition could lead to slip/trip risk. High volume of unfamiliar users i.e. irregular visitors/ramblers/equestrian.	4	3	12	Optimising position of equipment at the design stage removing any conflicting or redundant signs. Latest technology in place for user-based warning systems including wig-wag lights, sirens, full road barriers, RTL. AFBCL Maximum train speed 10 mph implemented. Superior quality crossing surface construction material. De-vegetation programme in place. Regular engagement with stakeholders/authorised users reinforcing safe crossing protocol, legal responsibilities and promoting collaborative working.	3	2	6

	Complacency leading to high levels of indiscipline e.g. users are known to rely on knowledge of timetable. High level of use by vulnerable people. High usage of cyclists.				Signage to encourage users to look for approaching trains as well as providing cyclist dismount signs.			
Hazards and possible causes identified	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
SPAD OCCURRENCE								
Train driver passes protecting signal without authority	Collision with road vehicle (see above). Collision with member of public (See above). Death Serious injury Injury	4	3	12	If a train passes a protecting signal at Stop, the road traffic light signals will immediately show an intermittent red light (omitting the steady amber phase) and the audible warning will start. The barriers will not be lowered as this may strike or trap crossing users. Driver training. Maximum speed of train 10 mph.	2	2	4

Hazards and possible causes identified	Potential Risk or consequences associated with the Hazard	S	L	RF	Control Measures	S	L	RF
Additional Risk Influencing factors								
Distraction								
Can the driver be distracted by something outside the cab?	Driver could be distracted by trespassers	4	3	12	Signal reminder sign	3	2	6
Could the driver be distracted by other tasks at or on approach to the signal?	There is a level crossing in the vicinity of the signal	4	3	12	Position signal where driver not distracted by other duties Driver training	3	2	6
Distractions while using the level crossing might impair the user's ability to cross quickly and safely.	If a user is distracted, there is an increased likelihood that they will not see the crossing, train, warning signs, for example; Other persons in the car (e.g. children) Thoughts on personal matters, work stresses etc. Using the telephone, Behaviour of other crossing users, In car entertainment Seasonal events (e.g. fun fairs, fireworks) Mobile phones, iPads, handheld computers etc. Signage (e.g. speed limit signs). Distractions might be more likely for users who frequently use the crossing (e.g. delivery drivers), due to them potentially having a lower level of concentration than those who use it infrequently.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Staff training. Trespass guards. Traffic calming measures. Train maximum speed 10 mph. New modern full barrier crossing. AFBCL Education campaign.	2	2	4

	A change in speed limit and the associated speed limit signs This proximity of the speed limit signs to the crossing might reduce the attention given to the crossing, or remove attention away from it completely. The signs might also draw a car driver's attention to the vehicle speedometer to check vehicle speed and away from maintaining vision out of the vehicle's windscreen. Other signs in the vicinity of a level crossing that are not related to that crossing could also have been a potential distraction.							
Regular users and those living close to level crossings are more likely to undertake risk taking behaviour when using the crossing.	Level crossing users that live or work in close proximity to a crossing can become familiar with the crossing attributes and procedures required for crossing. Regular users are more likely than infrequent users to perceive crossing risk to be low and commit a violation of safe crossing procedure. Potential behaviour traits of frequent users might include: User believes he / she has enough time to beat the	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Staff training. Trespass guards. Traffic calming measures. Train maximum speed 10 mph. New modern full barrier crossing. AFBCL Education campaign.	2	2	4

	train User thinks he / she understands procedure without reading instructions User unaware of risks to subsequent users							
High vehicle approach speeds	The vehicle speed over a level crossing is a factor in vehicle driver errors. Risk factors include, the speed limit(s) in the surround areas, driver's perception and attitude to risk, visibility of warning signs and visibility of the level crossing e.g. rural winding roads.	4	3	12	Reduced road speed on approach to level crossing. Traffic calming measures. Enhanced signage. New modern full barrier crossing. AFBCL Education campaign.	2	2	4
Large, slow and low vehicles	Drivers of large vehicles are involved in a disproportionately high number of incidents at level crossings. The size of the vehicles - they have less room for error when compared to cars. They may not be responding to the activation of the crossing warning system in sufficient time. Studies have proposed that large (HGV) vehicles may attempt to traverse the crossing once the barriers have already started to	4	3	12	Reduced road speed on approach to level crossing. Traffic calming measures. Enhanced signage Yellow box marking Level crossing road surface well maintained Power operated level crossing barriers AFBCL	2	2	4

	descent, suggesting that it could be to do with the driver's awareness of their vehicle's poorer braking performance, and therefore considering it safer to continue. Other contributory factors might include: The slower acceleration speed of HGVs causing the total time to cross a level crossing from standstill to increase Sightlines from a higher driving position.							
Ice conditions	Icy weather conditions on the approach and exit to the crossing might affect the behaviour of the crossing, for example, prevent vehicles from stopping in a position of safety at the crossing. Encourage vehicle drivers to ignore the initial warning activation when they are close to the train line because of the risk of sliding forward onto the tracks. Cause pedestrians to concentrate on their footing,	3	3	9	Provision of CCTV surveillance cameras. Level crossings local training plans, training and briefing on communications skills, hazards associated with a particular crossing (icy conditions), Improved crossing surface. Regular monitoring. Tactile surfaces.	2	3	6

	rather than looking for trains or observing warning signs. Result in pedestrian slips, trips and falls. This is a particular risk for elderly, or mobility impaired, users. Level crossings on 'B' roads might present a particular hazard to vehicle drivers as these roads are not normally gritted in icy conditions.							
Foliage obscuring warning signs and approaching trains	The visibility (and hence effectiveness) of information on the approach to and at the level crossing is reduced by overgrown foliage. Overgrown foliage on the approach to a level crossing can obscure signs and signals located at the crossing, and also restrict the visibility of approaching trains. This could result in the user either not seeing the sign or train (complete or partial) or the user not seeing the sign or train in time to sufficiently interpret the information and respond appropriately.	4	3	12	Cutting back vegetation and removing obstructions the sighting distances for users up and down the track and to signs / warning lights are lengthened. Staff training i.e. HRA Guidance document HGR – A0720 Control of Vegetation (Management plan). Improved sighting distances. Train speed max 10 mph. CCTV monitoring. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Reduced road speed on approach to level crossing. Traffic calming measures.	2	2	4

	This issue can be exacerbated when the visibility of the level crossing is reduced, either due to its type or its location e.g. on the bend in a road or on a high-speed road, as the vehicle driver has even less time to respond. foliage is also applicable to train drivers. Foliage on the lineside might impact on the train driver's ability to see information, objects or people on the crossing.				Enhanced signage.			
Dogs on leads. (crossing located in urban area in proximity to housing)	Users with dogs, even if crossing in accordance with instructions to put their dog on a lead, face particular crossing risks during their traverse. Crossing users walking dogs on leads over crossings are subject to the following risk factors: Dog/s might pull the user over the crossing, making slips, trips and falls more likely.	4	3	12	CCTV monitoring. Pedestrian walkway – defining, Painting of road markings on the crossing that clearly show the area in which pedestrians should walk when traversing the crossing. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Reduced road speed on approach to level crossing. Traffic calming measures.	2	2	4

	Dog/s on lead might become a trip hazard to user. Dog/s might hold user back on tracks, preventing them from completing their traverse. The dog/s can present additional challenges if it is startled or distracted. Dog/s might try to run down tracks, especially if startled or skittish or if it smells an animal to chase etc, pulling the user with it.				Enhanced signage.			
Parked vehicles in close proximity to the crossing. (crossing located in urban area in proximity to housing)	Vehicles parked close to crossing entry and exit points might increase the risk and crossing time of other users. Vehicle drivers who stop or park near a level crossing (e.g. close to the entry and exit points) might create issues for other level crossing users. Potential issues include: Diverted attention from the level crossing and associated warning signs while	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Painting of road markings on the crossing that clearly show the area in which pedestrians should walk when traversing the crossing. Paint yellow box markings on the crossing. Yellow lines (double) on the road approaches to the crossing. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign.	2	2	4

	concentrating on avoiding and manoeuvring around the parked vehicles (or associated pedestrians e.g. school children). Having to drive around the vehicles and onto the other side of the road/down the centre of the road, resulting in conflicts with oncoming vehicles. Parked vehicles obscuring the visibility of signs and signals to other crossing users. Traffic flow problems, such as 'blocking back'. Examples of situations where vehicles might stop or park near a level crossing include: Vehicle drivers dropping off their passengers. Residents without off-street parking (e.g. owners of railway cottages) choosing to park on the approach and exit roads to level crossing.				Traffic calming measures. Enhanced signage.			

	Customers parking to visit the local shops that have limited or no parking. Level crossings in the vicinity of schools might be used by parents as drop-off and collection points for their children. ‘Visitors’ (crossing inspectors and maintainers) parking in the 'long/slow' vehicle lay by, which is used by long/slow vehicle drivers to stop and contact the signaller. This might prevent drivers of long or slow vehicles from stopping and cause them to drive over the crossing without informing the signaller. ‘Visitors’ might also park on the immediate approach or exit to the crossing.							
Crossing utilisation or traffic moment	High crossing utilisation by users is associated with a greater chance of user risk taking behaviour.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Level crossings local training plans, training and briefing on communications skills, hazards associated with a particular crossing (icy conditions	2	2	4

					Reducing the road approach speed to the level crossing to reduce the risk of collision between vehicles and gates / trains. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Traffic calming measures. Enhanced signage.			
Unfamiliar users	Users who are not familiar with the level crossing procedure in the UK might apply an incorrect mental model when traversing the crossing.	4	3	12	Provision of CCTV surveillance cameras and signage to deter misuse at a particular crossing and to capture evidence of violations when they arise. Level crossings local training plans, training and briefing on communications skills, hazards associated with a particular crossing (icy conditions Reducing the road approach speed to the level crossing to reduce the risk of collision between vehicles and gates / trains. New modern full barrier crossing (Audible/visual alarms. AFBCL Education campaign. Traffic calming measures. Enhanced signage	2	2	4
Traffic calming systems Road traffic calming systems on either side of a	Traffic calming systems, such as road width	3	3	9	Provision of CCTV surveillance cameras and signage to deter misuse at a particular	2	2	4

level crossing might increase the risk of blocking back.	restrictions/ build-outs, positioned on either side of a level crossing might increase the risk of vehicle drivers blocking back over the crossing. When the crossing is closed to road traffic, queues form along the road. This issue might be exacerbated due to factors such as the time of day (rush hour) and 'herd mentality'. Discomfort for cyclists on the road. Potentially more noisy approach to the crossing leading to possible complaints. If overused in conjunction with changes in speed the mitigation might lose its impact upon behaviour.				crossing and to capture evidence of violations when they arise. Reducing the road approach speed to a level crossing to reduce the risk of collision between vehicles and gates / trains. A range of enhancements to improve conspicuity, comprehension of and user response to level crossing warning signs:			
Housing developments Housing developments increase road traffic, level crossing use and therefore the potential for risk taking behaviour.	With an increase in traffic within the local area, vehicle drivers might be less inclined to stop at a level crossing if their overall journey time has increased since the development of	3	3	9	CCTV monitoring. Staff Training/Competence. Train speed maximum 10mph. Education campaign. Enhanced signage	2	2	4

	new housing and the influx of new residents; thus, increasing the potential for risky behaviour. The level crossing might not be designed to accommodate the increased number of users; therefore information, walkway/ road widths etc. might require updating.				Education campaign. Traffic calming measures. Introduce a yellow box marking.			
Limited forward visibility. The approach to the level crossing is situated on a bend in the road	Lack of good visibility at the level crossing leading to shunt type collisions.	3	3	9	Introduce a yellow box marking. Traffic calming measures.	2	2	4
Single train line Greater risk-taking behaviour in both vehicle drivers and pedestrians is reported on single train lines. .	This user behaviour is in line with risk compensation theory - the user, perceiving there to be less of a risk to him/herself, behaves less cautiously	2	2	4	AFBCL Staff Training. Maximum train speed 10mph. Enhanced signage.	1	1	2
Farming vehicles Farm traffic might influence the speed and behaviour of other vehicles traversing the crossing.	Farm traffic tends to move at a much slower speed and, being much larger, reduce the visibility of other vehicle drivers. This can cause distraction and frustration and change other road user's behaviour; resulting in risk taking actions such as overtaking and not observing the level crossing warning signs.	4	4	16	Power operated barrier. AFBCL CCTV monitoring. Staff Training/Competence. Education campaign. Enhanced signage	2	2	4

Commercial driver	Commercial drivers might have increased risk taking behaviour at level crossings. Commercial vehicle drivers, such as salespersons, work to strict timescales and therefore their driving behaviour is often influenced by having to reach destinations on time. Commercial drivers using a level crossing might be inclined to 'beat the lights' to avoid having to wait at the crossing, or they might fail to follow the correct crossing procedure at unprotected crossings.	4	4	16	A range of enhancements to improve conspicuity, comprehension of and user response to level crossing warning signs: Staff Training/Competence. Education campaign. Enhanced signage. AFBCL	2	2	4
Adverse weather impacting visual information.	The effectiveness of visual information at crossings can be impaired by adverse weather conditions (e.g. fog and snow). The ability of vehicle drivers or other crossing users to detect the presence of level crossings, hazard information, warning lights	3	3	9	CCTV monitoring. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Reduced road speed on approach to level crossing. Train speed maximum 10mph	2	2	4

	or approaching trains might be impaired by adverse weather conditions, e.g. fog and snow. This might result in users failing to see warning information or oncoming trains, which could lead to users unintentionally adopting risky behaviour. In addition, in heavy snow users might not be able to see the tracks and inadvertently stand in a position of danger. Visibility in and around the crossing might also be impaired by banks of snow. An example where foggy conditions have been identified as a causal factor in a level crossing incident investigation is the fatality at Barratt's Lane No.1 footpath crossing.				Traffic calming measures. Enhanced signage.			
Alcohol and drugs	The effects of drink and/or drugs can radically alter user behaviours. Motor and cognitive function might be impaired and users might also have a reduced perception of risk.	3	3	9	CCTV monitoring (staff training initiatives). Anti-trespass and cattle guard panels are designed to deter people or animals from crossing the track at unauthorised places. Do not trespass signs. New modern full barrier crossing (Audible/visual alarms). AFBCL	2	2	4

	Users under the influence of alcohol or drugs might exhibit the following behaviours: be more inclined to ignore normal crossing procedures be physically unstable and prone to slips, trips and falls be unable to focus, cognitively and visually have a lower perception of risk.				Education campaign. Traffic calming measures. Enhanced signage.			
Disabilities.	Disabilities (e.g. reduced mobility, reduced levels of vision/hearing) will influence the behaviour of users at level crossings. Visually impaired users might be unable to see warning lights and signs clearly, or scan for trains before crossing. Hearing impaired users might be unable to hear crossing alarms, train whistles, warnings from people or the sound of approaching trains.	3	3	9	CCTV monitoring (staff training initiatives). Increase the volume of the audible warning up to the maximum permitted level to make the alarm more conspicuous and potentially deter pedestrian violations. Additionally, Intelligent auditory alarm – takes account of ambient noise levels and produces alarm 5dB louder so it can always be heard clearly. Provision of flange gap filler to improve crossing surface. Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign.	2	2	4

	Cognitively impaired users might have difficulty understanding and following the correct crossing procedure, or interpreting warning signs. Users with physical impairments (permanent or temporary) might encounter difficulties using level crossings of all types, but especially user worked crossings. Potential difficulties include struggling to cross within the warning time provided; being more prone to slips, trips and falls on the crossing, especially if the crossing surface is uneven or missing. Similarly, mobility scooter users might encounter problems with uneven crossing surfaces and the opening and closing gates or barriers.				Traffic calming measures. Enhanced signage.			
Incorrect mental model Incidents at level crossings could occur if the user adopts the incorrect mental model of how the crossing works.	Mental models are internal mental representations of an external reality.	3	3	9	CCTV monitoring (staff training initiatives). Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings.	2	2	4

	People develop a mental model of how to use a level crossing from their prior experience of using similar or comparable crossings (or road junctions), from instructions or by observing the behaviour of other users. Users familiar with the operation of one type of crossing might apply their mental model at other types of level crossing.				New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures. Enhanced signage.			
Fatigue	Fatigued users will be more susceptible to making errors or to taking shortcuts when crossing. Fatigue has a significant effect on human performance and the likelihood of errors. Level crossing users suffering from fatigue might miss important information (crossing warning signs, lights, etc), or be more inclined to take shortcuts in the crossing procedure (fail to use the telephone, fail to close the gates at user worked crossings, etc).	4	3	12	CCTV monitoring (staff training initiatives). Provision of tactile edges (and stop lines) and clear delineation of the footway at public vehicular crossings. New modern full barrier crossing (Audible/visual alarms). AFBCL Education campaign. Traffic calming measures. Enhanced signage.	2	2	4

Signaller/CCTV Operator:	'Habit intrusion' in CCTV monitoring CCTV operatives follow habituated patterns of behaviour which might result in the entrapment or injury of crossing users at MCB and MCB-CCTV crossings. Use of level crossings is primarily covered in Local Training Plans and by the training and briefing signallers/Operators receive on communications skills. It is important local training plans cover: hazards associated with a particular crossing, how to check whether a crossing is clear. Signaller's/Operators not following the appropriate rules and protocols should be subject to additional monitoring and development plans. Inefficient CCTV scanning strategy Signaller/Operator uses an inefficient method of scanning CCTV screens.	3	3	9	CCTV monitoring (staff training initiatives). New modern full barrier crossing. AFBCL	2	2	4

	The scanning method employed by a signaller/Oprator for monitoring CCTV screens will affect whether they successfully identify information on the CCTV screen. Using an inefficient scanning strategy might result in the signaller/Operator taking a longer time to identify key events, or might result in them missing key events on other CCTV screens. An efficient scanning method is particularly important where there are multiple CCTV screens being monitored by one signaller/Operator, or the signaller/Operator has a high level of workload from other tasks.							
Work in or adjacent to public roadways.	Plant, equipment materials striking traffic/members of public. Traffic colliding with staff.	3	3	9	Authorised road closures and traffic management. Implement pedestrian walkways. Plant to be suitable for access to public roads. Comply with New Roads and Street Works Act and Traffic Signs Regulations.	1	1	2