CORMAC

MILLBROOK FEASIBILITY STUDY

FEASIBILITY REPORT

Consultancy | AECOM Limited

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Issue & Revision Record

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1 Introduction

1.1 Overview

In late 2021, AECOM was commissioned by Millbrook Parish Council through the Cormac Framework, to carry out a Feasibility Study to investigate issues caused by HGVs in Millbrook, Cornwall. These issues mainly comprise of vehicle strikes to private properties due to space constraints on West Street. There have also been incidents reported to the Council and Police of vehicle collisions with pedestrians, prompting serious concerns for non-motorised user's (NMU's) safety, particularly in and around the area of West Street.

This report builds upon a previous Feasibility Study, "Rame Peninsula Traffic Management", which was undertaken by Cormac in 2014, and broadly focused on the wider road network. In contrast, the current study solely focuses on the issues in Millbrook. Prior to, and following the initial study, several mitigation measures were implemented and trialled. However, to date, none of them have achieved the desired results. This included trialling a give and take priority working system with traffic signals to control the single lane narrow section on West Street. This was later removed following concerns raised in a Road Safety Audit.

In this Feasibility Study, AECOM will assess the existing issues and will identify and evaluate potential solutions that can be introduced in Millbrook, or to the surrounding road network to eliminate or mitigate the issue. In addition to this, the study will also put forward recommendations and high-level indicative costings for all viable measures based on typically comparable scheme costs.

1.2 Main Objectives

The Feasibility Study has the following main objectives to fulfil:

- Review the findings of the previous Feasibility Study undertaken by Cormac in 2014 (ref: Rame Peninsula Traffic Management Feasibility Study - EDG0205/F1), specifically, Section 9 of the study which focuses on Millbrook.
- Identify options to eliminate or reduce HGV strikes to existing properties and pedestrians on West Street, as well as speeding vehicles in the immediate area.
- Inform Millbrook Parish Council of the viability to implement the identified options under the given constraints and potential effectiveness of these measures, through a high-level assessment. This includes informing Millbrook Parish Council of the initial benefits and detriments for each option.
- Provide recommendations for implementation and/or further work to be undertaken.

1.3 Assumptions and Exclusions

The following assumptions have been made:

- The existing topographical survey is assumed to be accurate for kerbs, centrelines, walls, buildings, and the back of footway. Key road markings, gullies, posts, and signs have had their indicative locations recorded manually on site.
- The schematic plan produced as part of the existing review is based on the existing topographical survey.
- Engineering judgement was used to position the automatic traffic counters and camera equipment in the best place for the traffic surveys, to achieve the data required to inform the study.
- Swept path analysis was undertaken along the B3247 between the junctions of St Andrews Street to the north-west and Millpool Head to the east.
- Swept path analysis was undertaken for three vehicle types – a 16.5m articulated HGV, a 10m ridged HGV and a standard coach.
- The options assessment is of a high-level nature and additional work is likely required to further inform and detail any viable options prior to implementation.

The following exclusions apply to the Feasibility Study:

- Production of design drawings for any measures featured or considered in the Feasibility Report.
- Preparation of detailed Bill of Quantities (BoQs)/cost estimates.
- Scoping or undertaking of further surveys, although the requirement for any surveys will be identified and recommended within the Feasibility Report.
- The drafting of any TRO required as part of any measure identified, although the need for TRO(s) will be identified and recommended within the Feasibility Report.

1.4 Previous Feasibility Study

The previous Feasibility Study, "Rame Peninsula Traffic Management" (reference EDG0205/F1) was undertaken by Cormac Solutions Ltd on behalf of Cornwall Council (CC) in 2014. This study reviewed the traffic management and traffic conditions on the Rame Peninsula. The key locations covered were the Rame Peninsula, Antony, St John, Millbrook and Crafthole. The study was high-level, and not specifically focused on Millbrook.

The Millbrook section of the report, Section 9, primarily focused on alleviating the traffic congestion problems and vehicle conflict on West Street. Three proposed traffic light layouts were analysed:

1. A 3-way traffic light system.
2. A 2-way traffic light system with a reversal of the one-way system on West Street.
3. A 2-way traffic light system with West Street either blocked off, or the existing one-way system reversed.

All three proposals enabled vehicles to pass through the narrow section of West Street. It ensured vehicles did not meet each other in the narrow section, causing one to reverse to let the other through, thereby alleviating traffic congestion caused by the vehicle conflict. Additional mitigation measures were proposed to generally improve the traffic situation. These included introducing a yellow box opposite Millmoor House and outside of property numbers 53 to 55. These proposals will prevent vehicles blocking the road for oncoming traffic when the signals show red. A stop line was proposed between property numbers 57 and 58 to allow the signalisation at the Radford Lane junction. An all-red loop is proposed to ensure the blind area is clear of all traffic before a signal change. A traffic signal assessment report informed of acceptable queuing lengths, however there were challenges identified which compromised the successful workability of the signals. These included considerations required to manage larger vehicles, driver behaviour and pollution generation.

It is noted in the recommendations that due to the nature of the existing situation with the narrow road and limited footpath, it is difficult to produce a completely viable solution only using traffic signals. It was therefore recommended to undertake further work in the form of detailed traffic surveys, to confirm the amount and size distribution of the vehicles utilising the narrow section of the road. In addition, the previous feasibility study recommends examining traffic flows using automatic traffic counters if signalised options are progressed. The overall recommendation was to introduce an HGV circulation system and to monitor the traffic to assess if traffic signals are required.

2 Existing Conditions

2.1 Location

The site is located within Millbrook, Cornwall; a small, quiet, typically residential village, situated on the Rame Peninsula near Plymouth. A key link road, the B3247, passes through Millbrook facilitating a connection to the south of the Rame Peninsula (see Figure 1). This road is typically very busy and joins Hounster Hill to West Street in a residential area of the village.

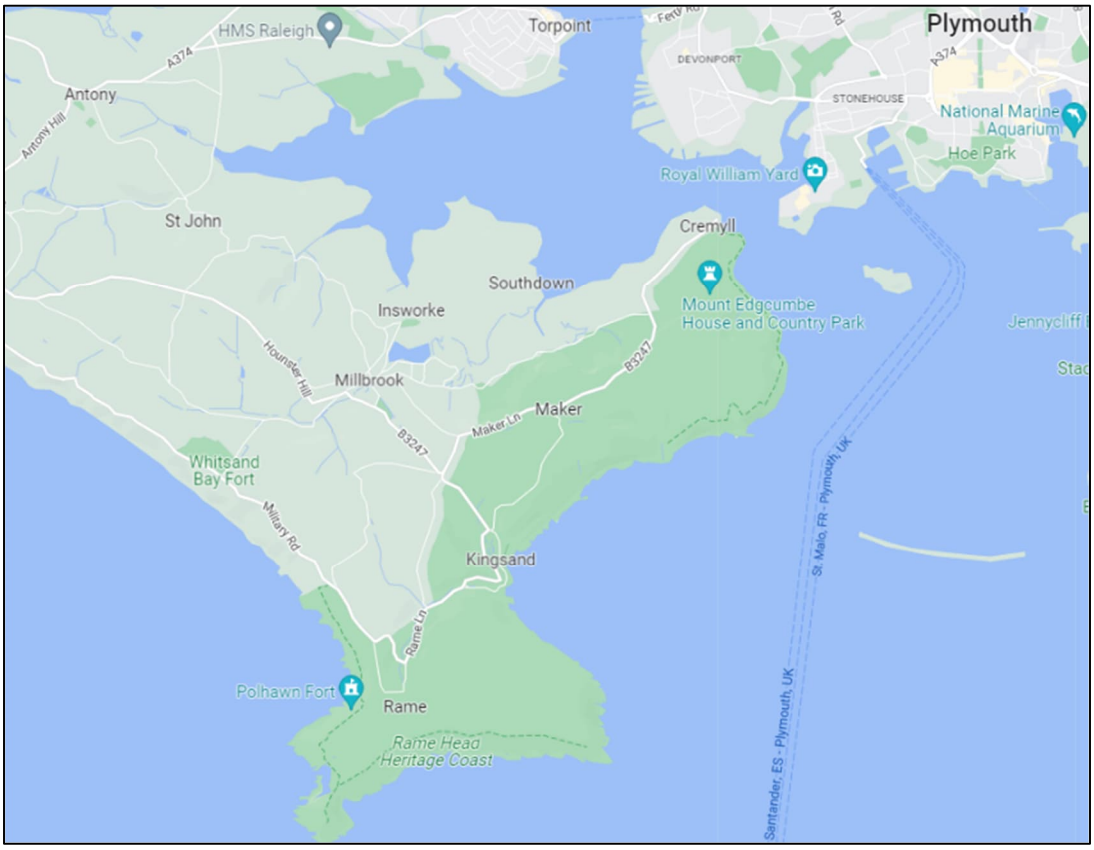


Figure 1 Map of Site Location on the Rame Peninsula (Google Maps 2022)

There are several key areas of interest south of Millbrook on the Rame Peninsula. These include: the hamlet of Rame; the twin villages of Kingsand and Cawsand and the villages of Maker and Cremyll. These are shown in Figure 1, with all being inhabited areas of the Rame Peninsula. They are also frequented by tourists, especially in the summer months due to their coastal locations. In addition, Mount Edgcumbe House and Country Park, listed as Grade 1 on the National Register of Historic Parks and Gardens, attracts visitors throughout the year.

2.2 Study Area

The focus of the study covers the B3247 at Hounster Hill, to the B3247 at the south of Millbrook, joining West Street. The study will focus on an area with an approximate length of 100m off West Street, the B3247 - West Street junction and the B3247 approach to West Street. This is where the issues are located. The methodology of this Feasibility Study will however cover a much greater area, encompassing the surrounding road network, to ensure all potential options are investigated and assessed, to attempt to solve the issues in Millbrook.

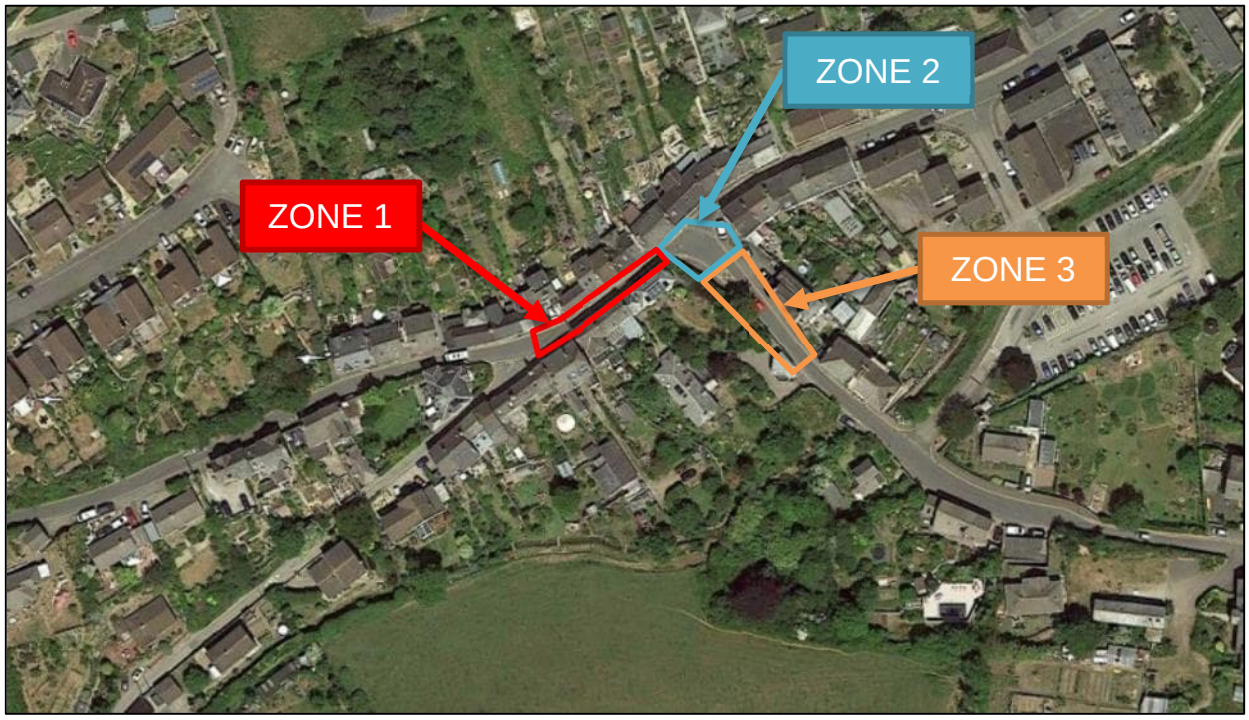


Figure 2 Focus Area of the Study

The area to focus on in the study can be divided into three defined elements (shown in Figure 2 and outlined as follows):

2.2.1 Zone 1: Narrow Section of West Street to Junction with B3247

West Street is a narrow residential street. This zone spans from the B3247 West Street and Radford Lane junction to the B3247 and West Street junction. Due to the reduced space between private properties, the space available in the street is asphalted and predominantly utilised as carriageway. There are painted virtual footways at carriageway level on either side of the street with variable widths of approximately 1.2m. This has been designed to provide pedestrians with enough space to navigate West Street without being forced onto the main carriageway (see Figure 3).

Figure 3 West Street Narrow Section with Virtual Footways (Site visit 17/02/2022)

There are no waiting at any time restrictions along this section for vehicles travelling in both directions, and the existing speed limit is 20mph. An existing lighting column is located on the south side at the west end of West Street, located in the virtual footway. There is an existing unofficial sign located on the corner of Radford Lane and Hounster Hill with a notice of prohibition for wide vehicles, due to the narrow lanes. This was placed by the residents of Millbrook in response to the incidents encountered on the road, including large vehicles getting blocked and property strikes.

2.2.2 Zone 2: West Street Junction with the B3247

This area is located adjacent to Zone 1 at the east end of the narrow section of West Street. The visibility on this junction is reduced for motorists due to the existing property boundary lines and the sharp horizontal curvature of the road alignment. The junction has a mix of kerbed and painted footways. A yellow box is also located on the west B3247 west to the junction. No waiting at any time restrictions are in place over the whole junction. There is an existing lighting column located between property numbers 67 and 68 on West Street (see Figure 4).

Figure 4 West Street Junction with the B3247, Northbound (Site visit 17/02/2022)

2.2.3 Zone 3: Approach to West Street Junction with the B3247

The northbound approach to the West Street junction along the B3247, south of the yellow box markings is narrow up to the edge of the existing wall on the west side, after which it widens allowing two-way traffic. There is a variable width kerbed footway on one side of the carriageway. No waiting at any time restrictions are in place along the whole study area, and there are no lighting columns in this zone. There is a bus stop near Dodbook House and a yellow box at the end of the junction (see Figure 5).

Figure 5 Approach to West Street Junction with the B3247, Southbound (Site visit 17/02/2022)

2.3 Site Constraints

2.3.1 Existing properties on West Street

The existing terraced private properties located either side of West Street are the main physical constraint to this study, as the proximity of the properties forms a very narrow passage. This means any widening of the carriageway is not feasible. As stated in Zone 3 of the study area overview, the B3247 road narrows on the approach to the West Street and B3247 junction and later widens just prior to the yellow box. Following the turning onto West Street, the road reaches its narrowest point of approximately 3.9m width measured from building to building (see Figure 6). The street widens slightly, however remains narrow, exiting onto Hounster Hill. On the exit, the distance from building to building widens to 4.1m (see Figure 7). As outlined in Chapter 3, the properties on the approach to West Street from Hounster Hill also create visibility issues. For more information on all site constraints and existing issues, see Appendix A.

Figure 6 Existing Properties on West Street Constraining Width, East End (Site visit 17/02/2022)

Figure 7 Existing Properties on West Street Constraining Width, West End (Site visit 17/02/2022)

2.3.2 Boundary Wall on South Side of West Street at B3247 Junction

In addition to the narrow street, the other key constraint is the existing wall on the south side of the B3247 – West Street junction. This wall acts as a boundary for a property and creates exceptionally limited visibility for vehicles turning onto the B3247 West Street from the B3247 (see Figure 8). A visibility assessment has been undertaken in Chapter 4 to provide insight into the situation for turning traffic.

Figure 8 Boundary Wall on South Side of West Street at B3247 Junction (Site visit 17/02/2022)

2.3.3 Road Network Surrounding Millbrook

It is apparent from the desktop study that the road network surrounding Millbrook village generally consists of narrow lanes, which are not suitable for use by HGVs. In addition, the lanes have sharp bends with limited forward visibility, parked vehicles on the sides of the carriageway and overgrown vegetation. These roads include: Military Road, Donkey Lane, Forder Hill, Hat Lane and Rame Lane. Examples are shown in Figure 9 and Figure 10. This has been investigated further in Chapter 4.

Figure 9 Military Road; Parked Vehicles and Narrow Width (Google Streetview, 2011)

Figure 10 Forder Hill (left); Steep, Overgrown Vegetation and Narrow Width. Hat Lane (right); Narrow Width (Google Streetview, 2009)

2.4 Issues

Traffic congestion is a key issue in Millbrook. The terraced houses situated along the B3247 in Millbrook generate a long 50m narrow section of carriageway, which is found to be the cause for most of the significant traffic problems in the area. Vehicles are unable to pass each other along this section and the problem is aggravated by a sharp bend with limited visibility in both directions. There is no opportunity to widen the road due to existing physical constraints.

Identified issues in the area are presented in Figure 11 and are discussed in more detail:

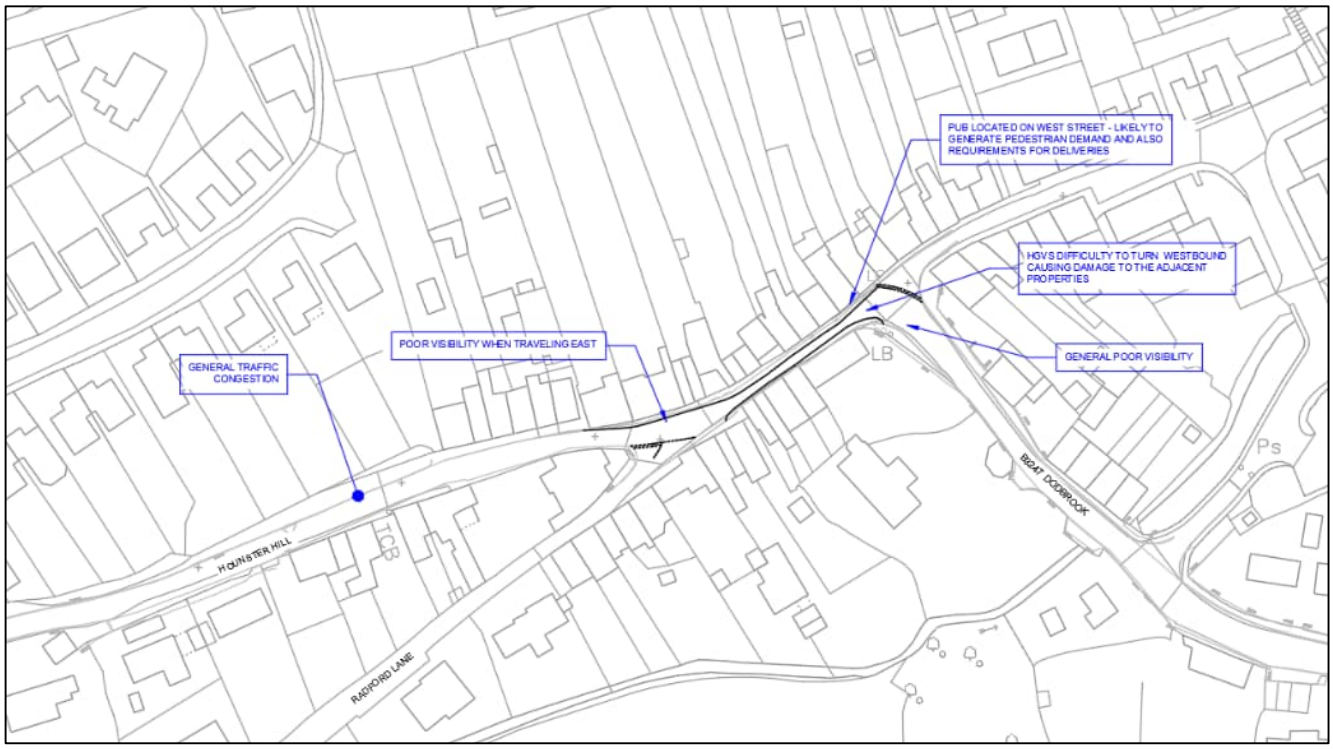


Figure 11 Issue identification in Millbrook

2.4.1 General Traffic Congestion at Hounster Hill

Whilst there isn't any solid evidence to suggest that congestion at Hounster Hill is an issue, there are various points which vehicles must give way to oncoming traffic when navigating through this section. Therefore, it is expected that congestion may occur during peak times both in and around this location.

2.4.2 Poor Visibility at West Street Junction with Radford Lane

Travelling eastbound from Hounster Hill to West Street, clear visibility cannot be achieved. This is due to the curvature and narrowness of the road, in addition to the residential properties restricting the view around the bend.

Figure 12 Visibility Towards West Street from Hounster Hill (Site visit 17/02/2022)

2.4.3 General Poor Visibility at West Street Junction

As discussed previously, the junction is a near 90° bend, with adjacent properties and existing features such as walls that restrict visibility.

2.4.4 Unsafe Situation for Pedestrians

'Bar Tusker' is located on the B3247 – West Street junction, as well as shops and businesses being based further east of the junction. Along with residential properties on the street, this generates pedestrian flows in the area. The current condition of the NMU facilities is not sufficient at providing a safe environment for walking or cycling. The virtual footways along West Street's narrowest section are intended to provide NMUs with a safe space. However, it provides a false sense of security, as large vehicles such as the HGVs still encroach over footways (see Figure 14). There are no protective features provided to ensure a safe environment. In addition, there are no crossing facilities where pedestrians can safely cross the carriageway.

Figure 13 Virtual Footways on West Street are Narrow and in Poor Condition (Site visit 17/02/2022)

2.4.5 HGV Turning Property Damage

Adjacent properties have been damaged by passing HGVs. An example of an HGV turning is shown in Figure 14, and see Figure 15 for property damage caused by an HGV, which was reported to Millbrook Parish Council by local residents.

Figure 14 Westbound Articulated HGV of Max UK Length (16.5m) Turning at Bend on B3247 - West Street Junction

Figure 15 - Property Damage Caused by HGVs on West Street

3 Methodology

The proposed methodology comprises of five distinct elements:

1. A site assessment to determine the existing problems (Chapter 4).
2. Automatic Traffic Count (ATC) surveys to provide insight into traffic flows (Chapter 5).
3. Camera surveys to observe the issues on West Street and at the West Street and B3247 junction, including the HGV turning issues (Chapter 6).
4. Study of options to improve the existing situation (Chapter 7). Includes eliminating the hazard (the HGVs) and mitigation measures.
5. Overview of viable options, including ranking of their effectiveness and high-level costings (Chapter 7.3).

Additional details of the methodology for the five elements above can be found in their individually referenced sections. The Feasibility Study concludes by recommending options to be taken forward for further work (Chapter 8).

4 Site Assessment

4.1 Introduction

A site assessment has been carried out to understand the existing constraints in the study area. Several locals raised that with the existing road layout, HGVs cannot easily make the turning manoeuvre and, consequently, private properties have been damaged.

4.2 Swept Path Analysis

Swept path analysis of vehicle turning movements has been conducted for the junction and the approaches to understand the physical constraints for turning HGVs. The vehicles used are as follows:

- Standard Rigid Bus
- Max UK Length (16.5m) Articulated Vehicle
- FTA Design Rigid Vehicle (1998).

Vehicle tracking at the West Street and B3247 junction have been produced for 5mph, 10mph, 15mph and 20mph (excluding the articulated vehicle, which was only tracked at 5 and 10mph) for eastbound and westbound movements. See following Figures 16 to 25.

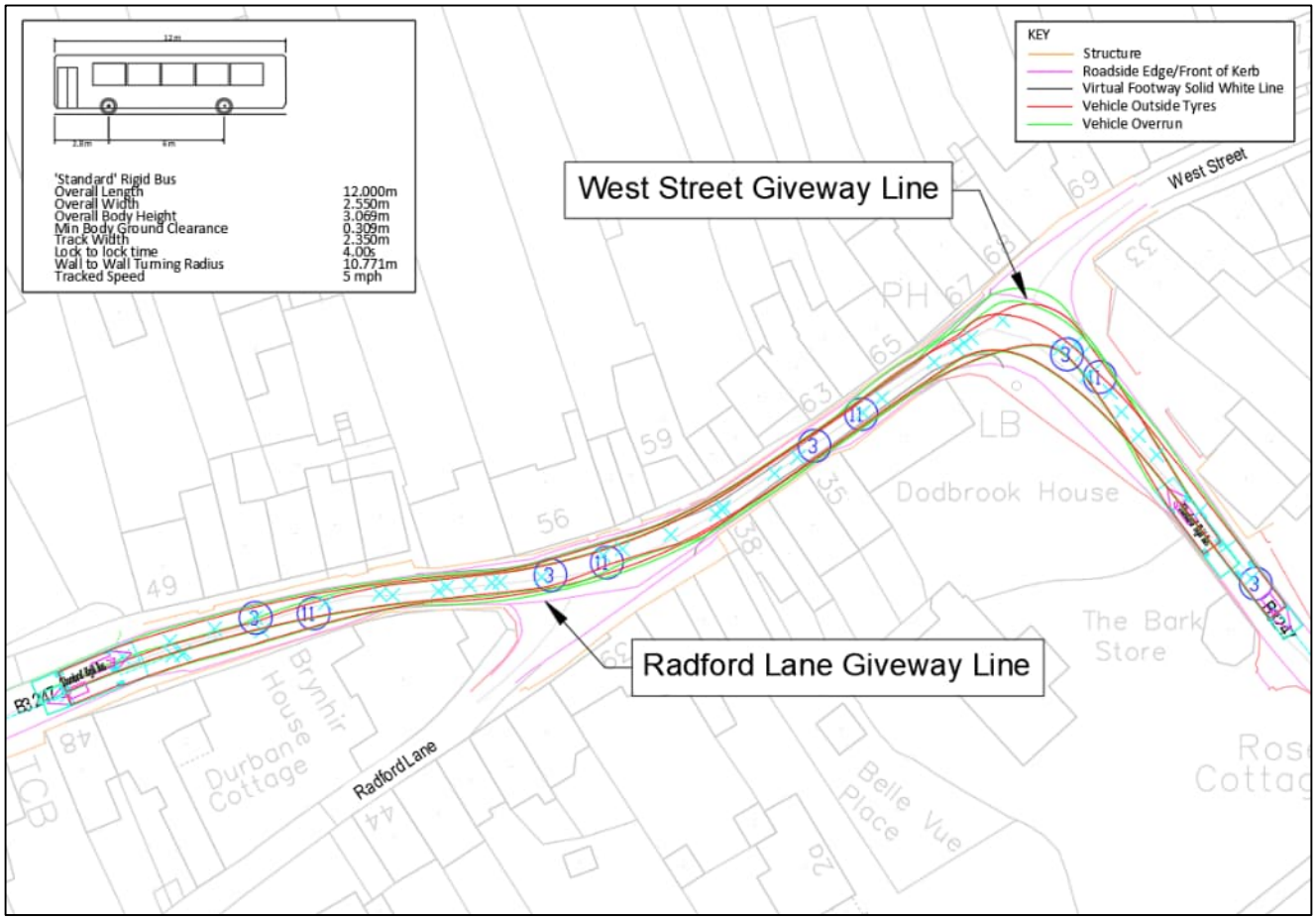


Figure 16 Standard Rigid Bus Tracked at 5mph

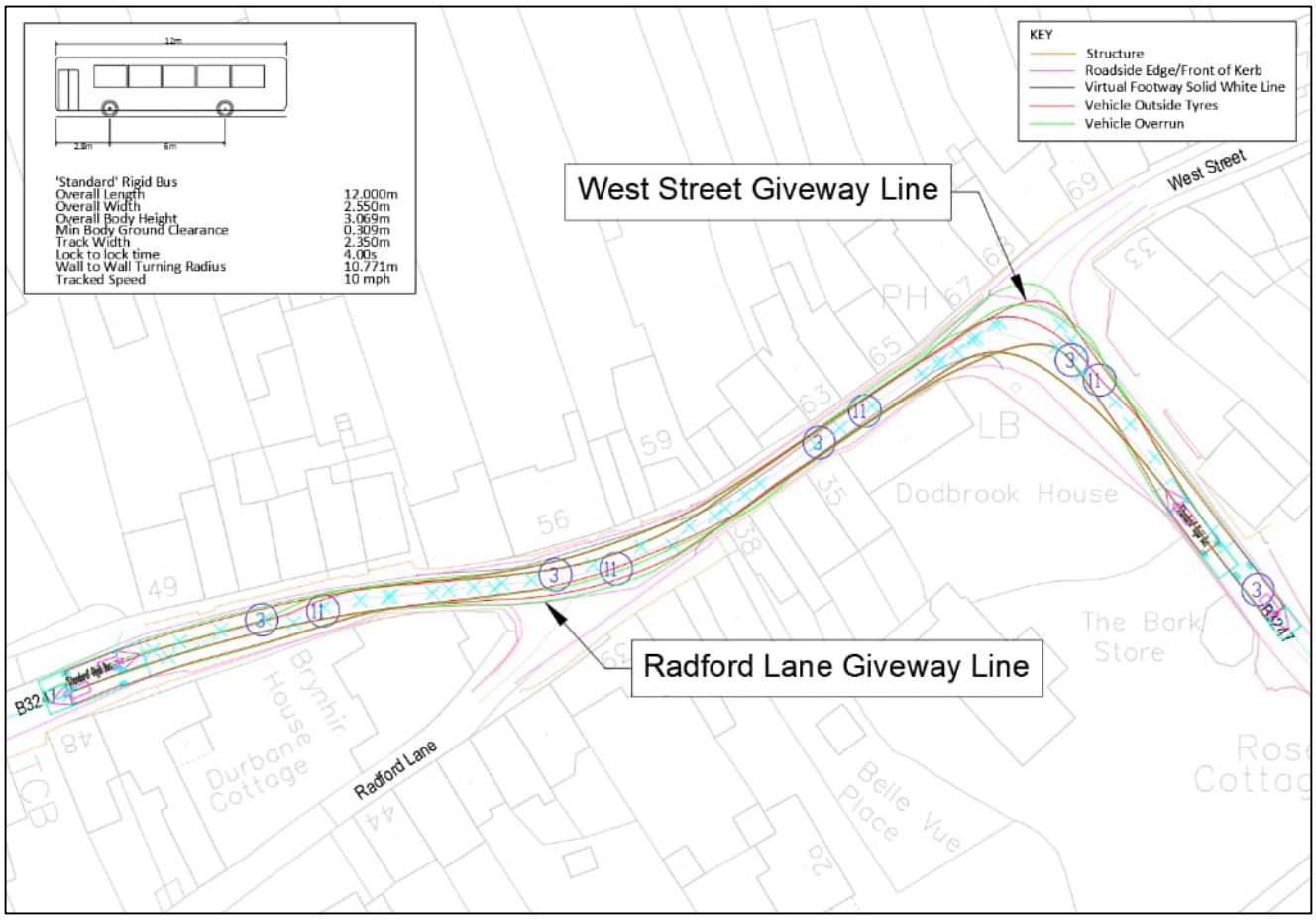


Figure 17 Standard Rigid Bus Tracked at 10mph

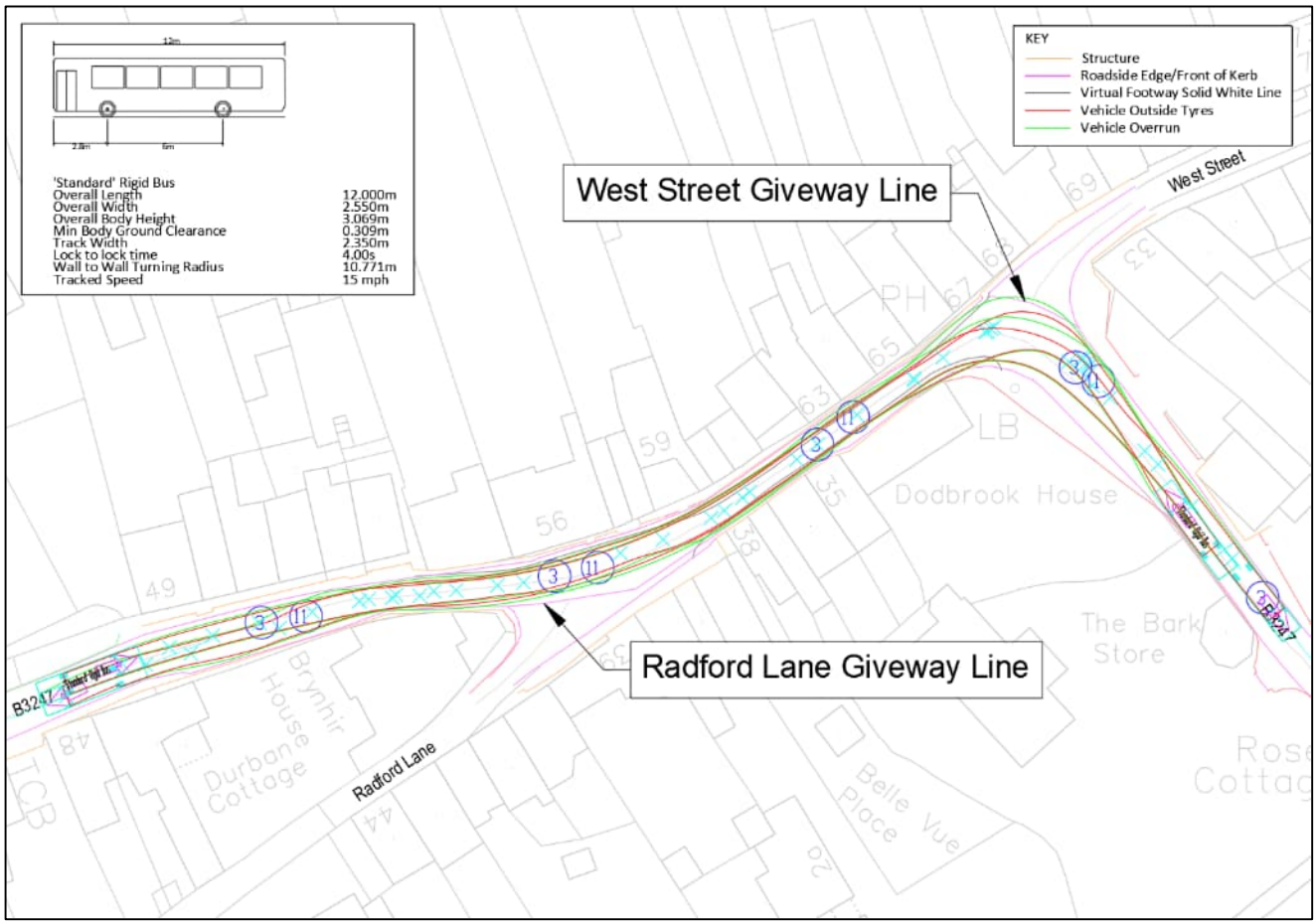


Figure 18 Standard Rigid Bus Tracked at 15mph

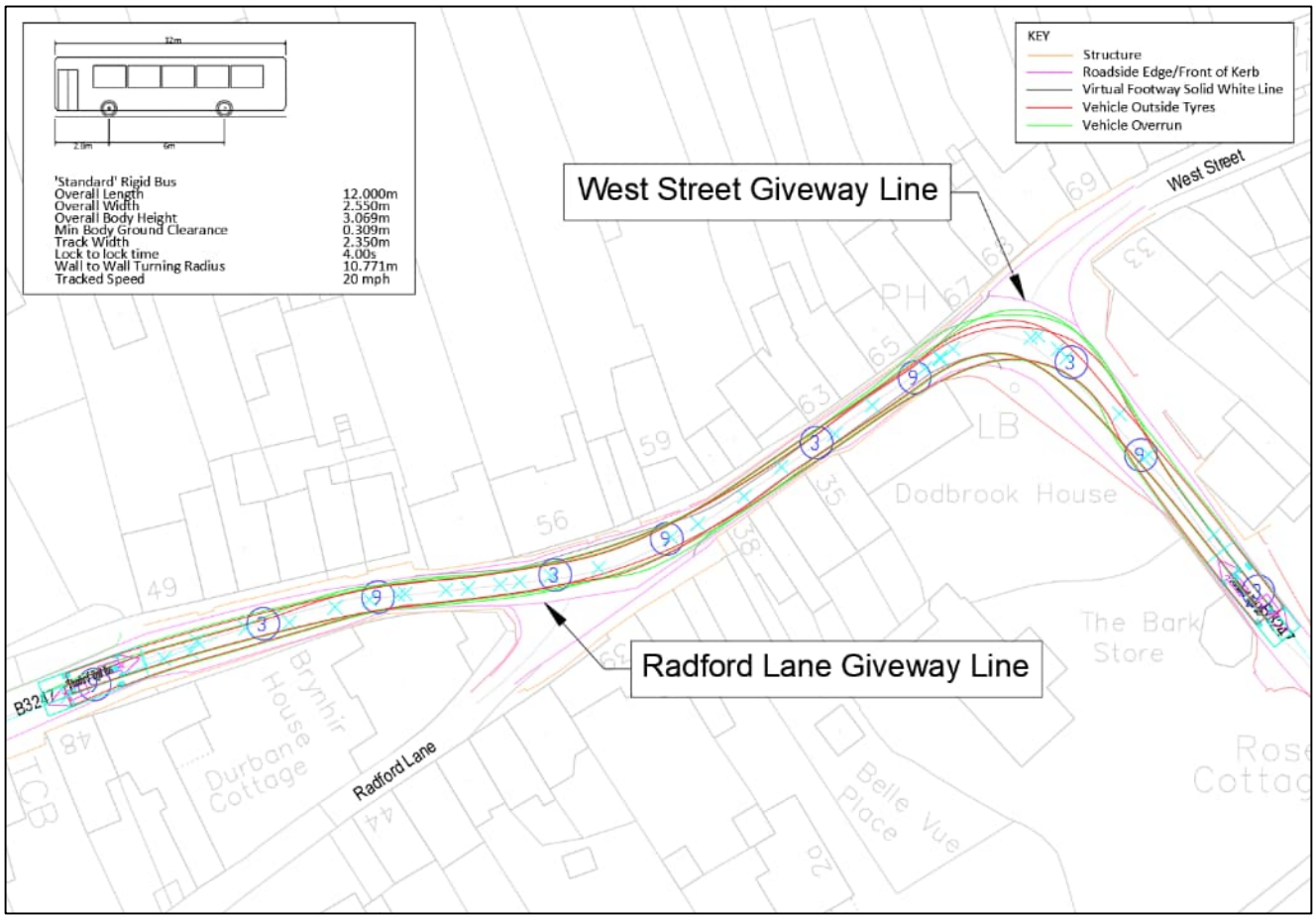


Figure 19 Standard Rigid Bus Tracked at 20mph

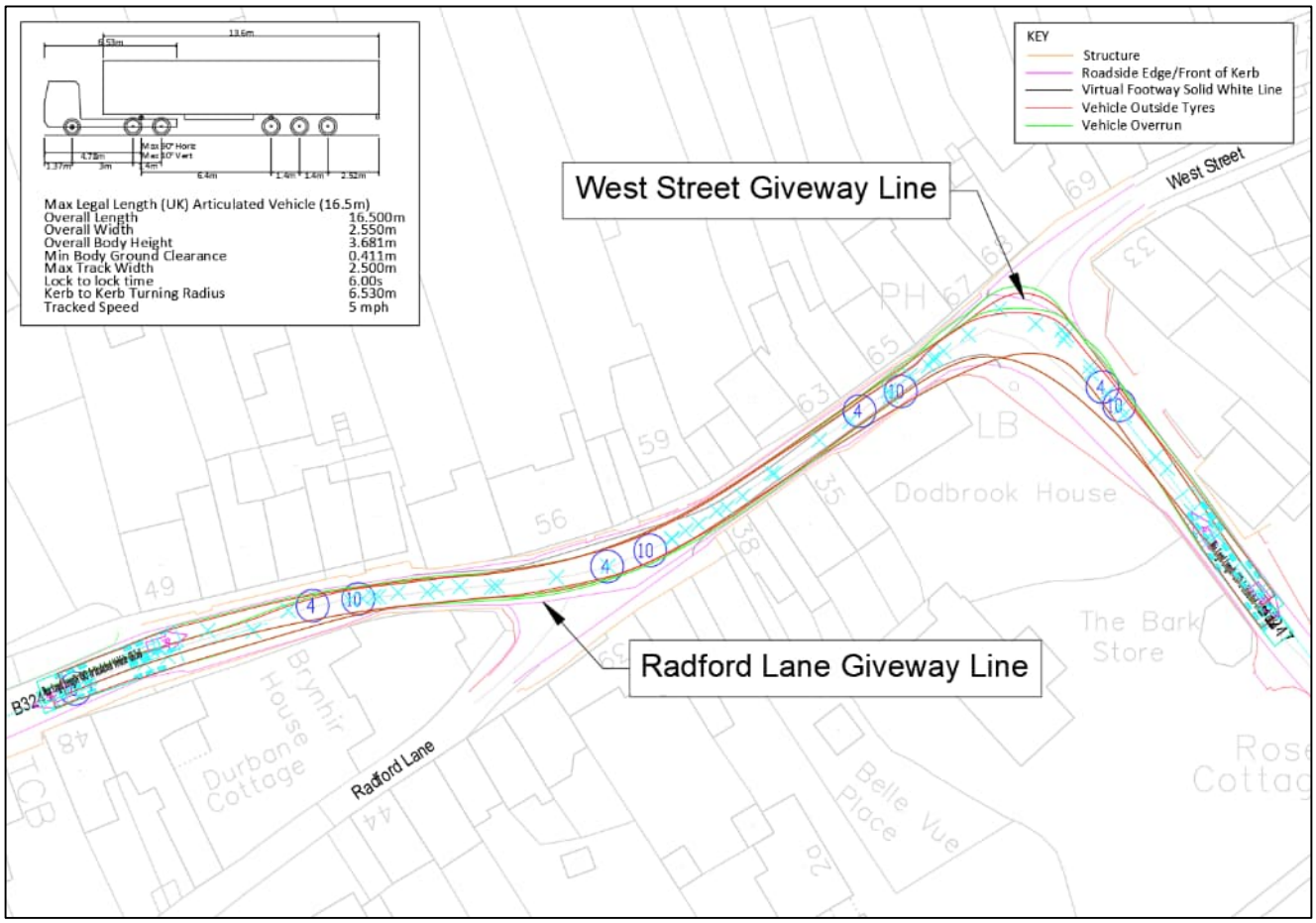


Figure 20 Articulated HGV of Max UK Length (16.5m) Tracked at 5mph

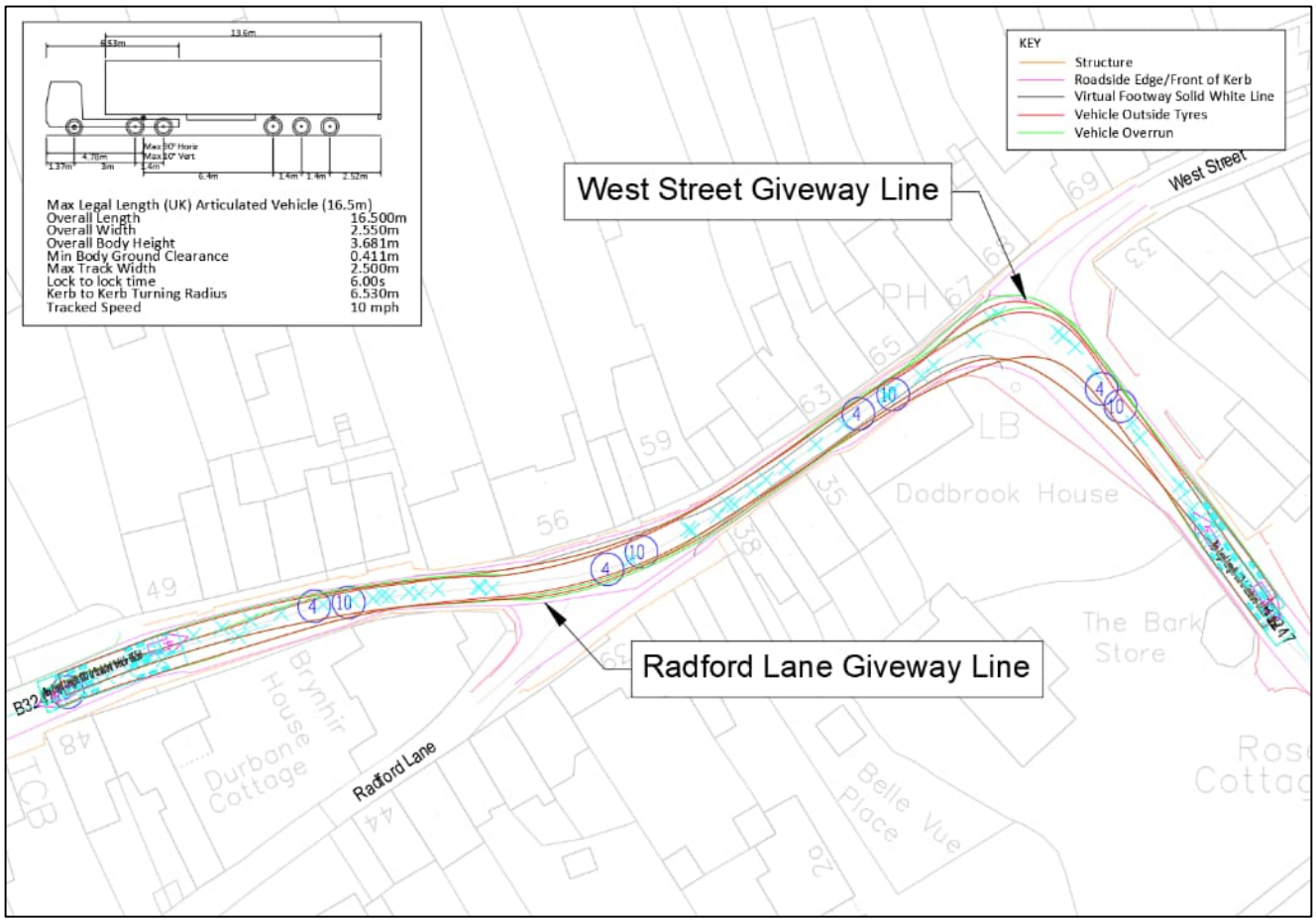


Figure 21 Articulated HGV of Max UK Length (16.5m) Tracked at 10mph

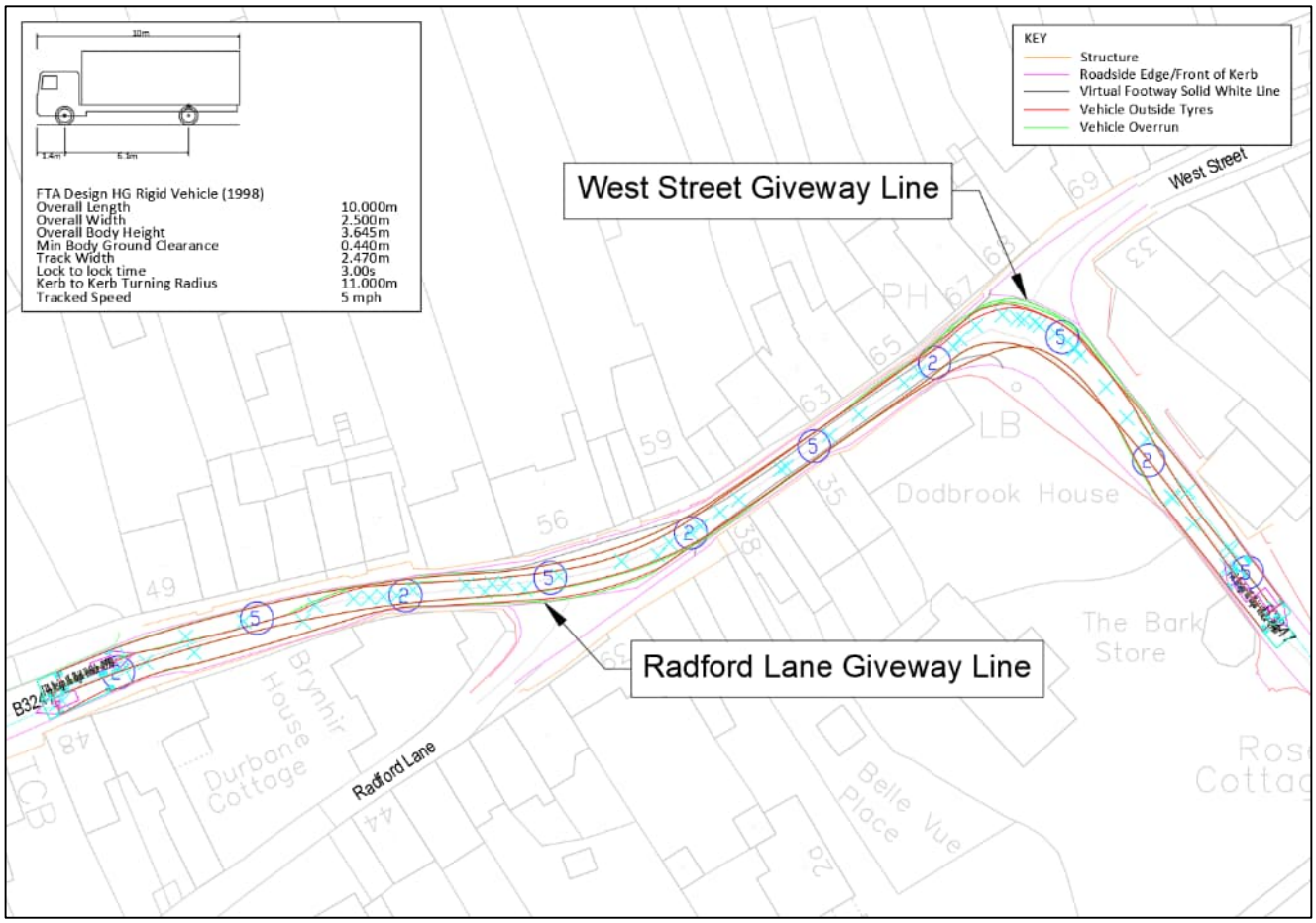


Figure 22 Rigid HGV Tracked at 5mph

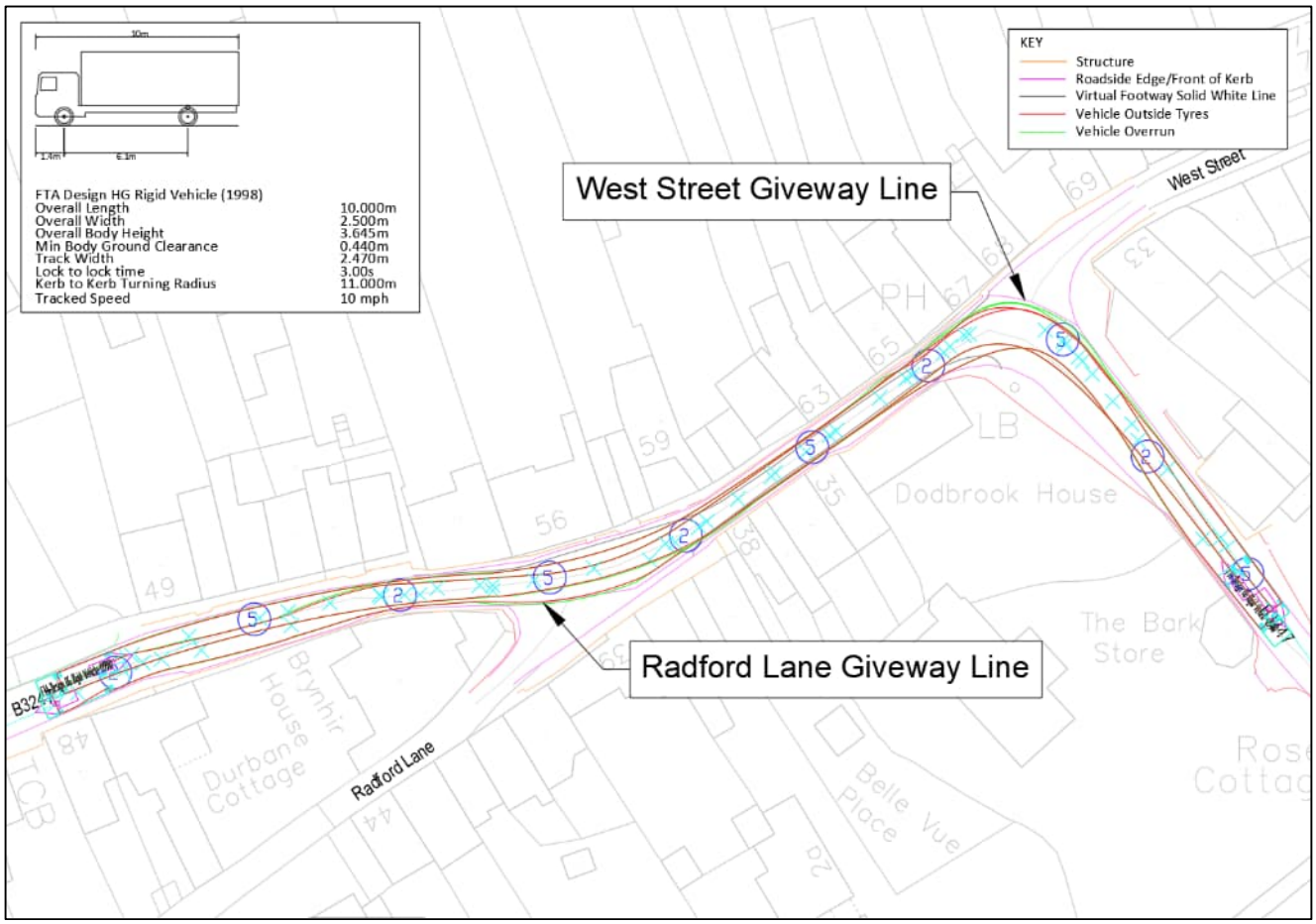


Figure 23 Rigid HGV Tracked at 10mph

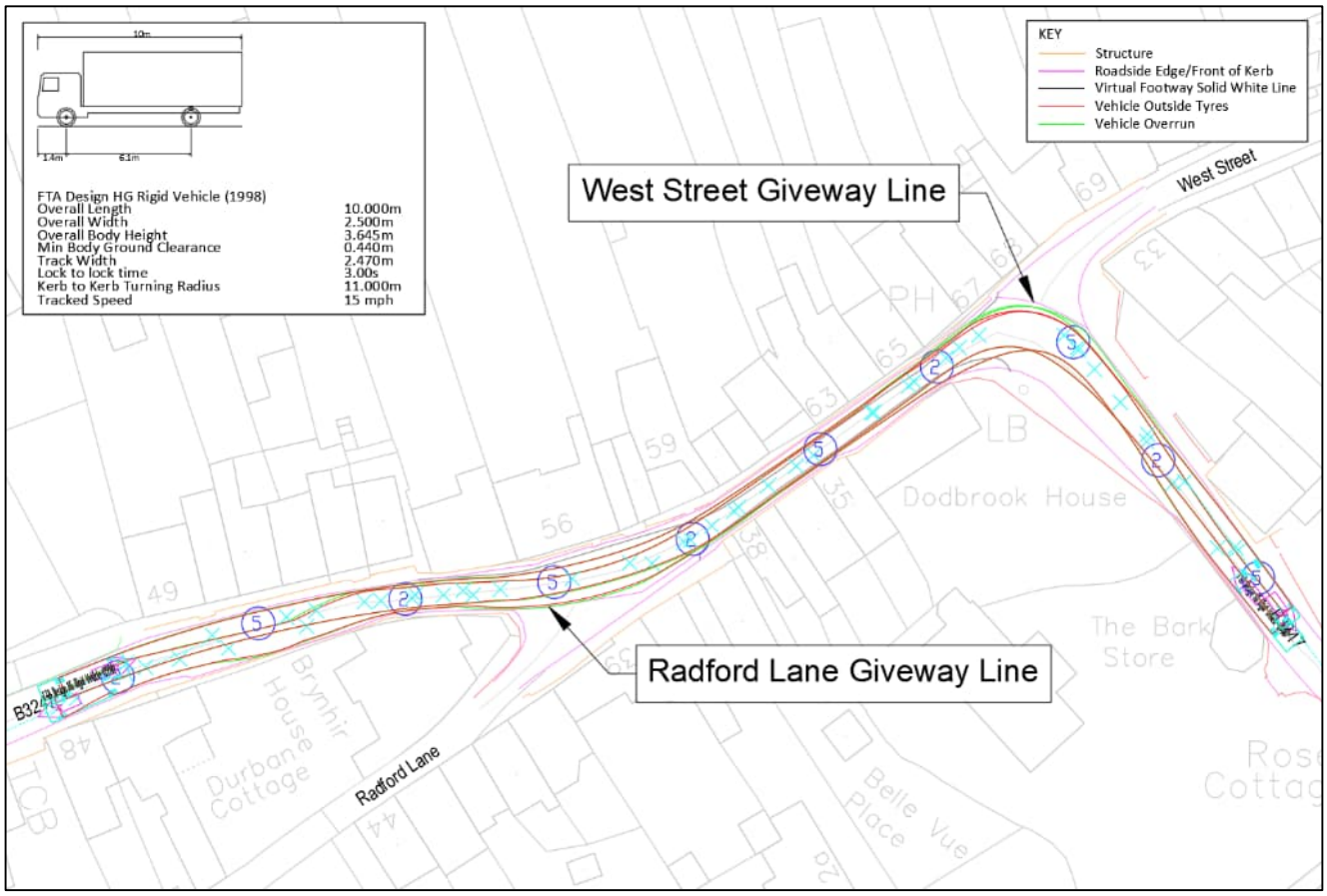


Figure 24 Rigid HGV Tracked at 15mph

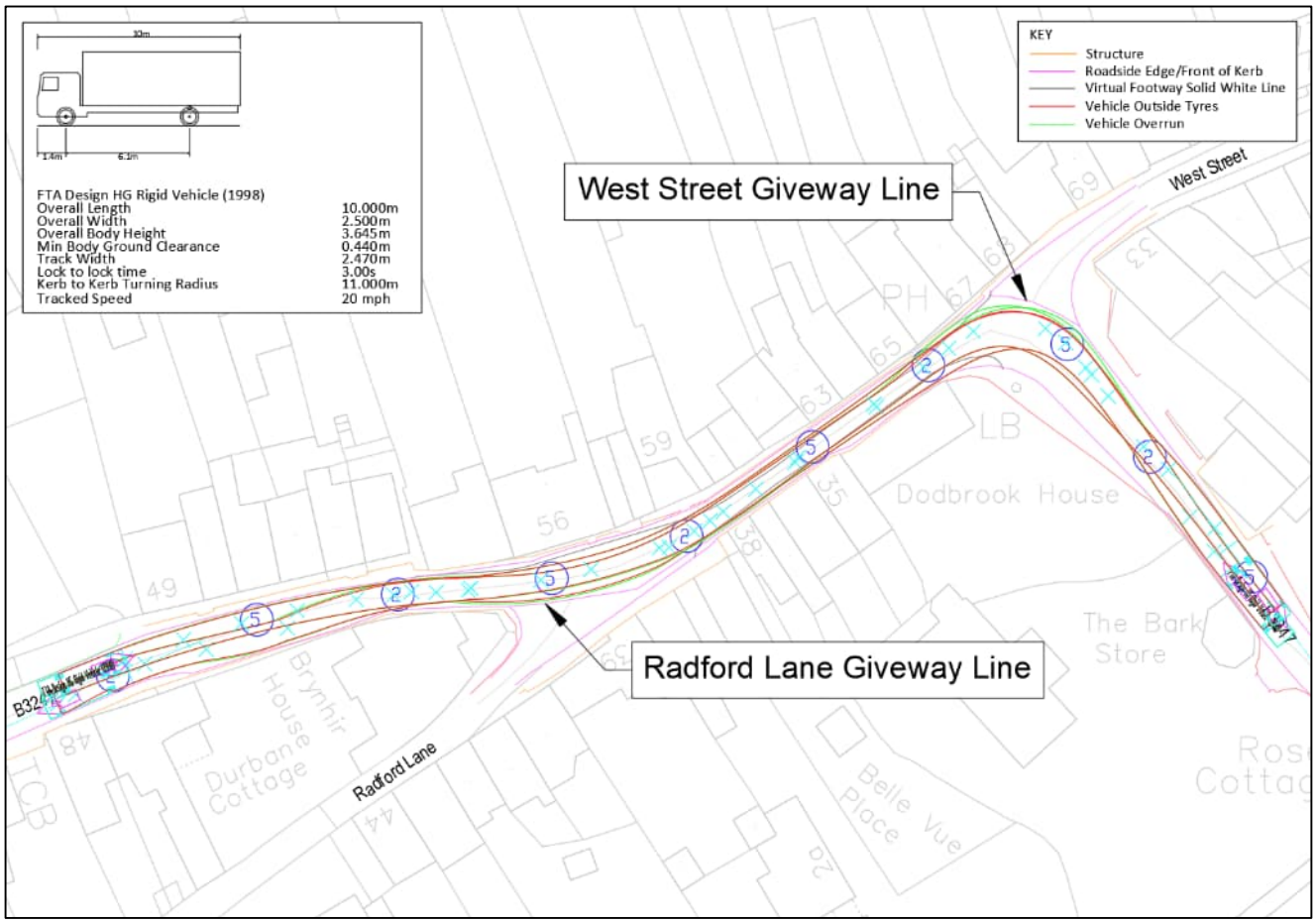


Figure 25 Rigid HGV Tracked at 20mph

The 10m standard rigid bus appears to have issues navigating the B3247 – West Street in the westbound direction. At 5mph (see Figure 16) it comes close to mounting the kerb by the property wall and comes very close to the surrounding properties at the entrance of B3247 West Street, as well as property number 67 and 'Bar Tusker', which are facing the westbound approach to the bend. At a speed of 10mph (Figure 17), the westbound bus overruns the West Street give way line at the junction, which possibly risks a collision with a stationary vehicle. At speeds above 10mph (see Figure 18 and Figure 19), the westbound bus appears to likely mount the footway and strike a structure at the entrance of the B3247 West Street. Compared to the westbound, the eastbound bus at 5mph (see Figure 16), 10mph (see Figure 17 and 15mph (see Figure 18), appears to be able to make the turn at the B3247 – West Street junction without any issues. At 20mph (see Figure 19) and even possibly at 15mph, it appears likely the westbound bus may mount the kerb on the south-east side of the junction. Along the whole section in both directions, the total clearance of the bus appears to be inadequate and risks harm to virtual footway users and damage to structures, where higher speed limits above 10mph would appear to possibly result in damage to property.

The reason why the 16.5m articulated HGV was not tracked above 10mph, is that at both 5mph and 10mph, it can be observed that in the eastbound and westbound directions, the vehicle is already in close proximity to the structures along the B3247 West Street. This also includes property number 67 and 'Bar Tusker', where there is no room to keep a suitable distance away from the structures. It has been identified for where the articulated HGV is travelling westbound at 5mph (see Figure 20) and 10mph (see Figure 21) that there is not enough space in the road to make the turn in one movement. On the other hand, the eastbound HGV traffic

appears to have less difficulty to make the manoeuvre in one movement at both 5mph and 10mph. However, in both directions, the total clearance of the vehicle is inadequate and risks potential harm to virtual footway users and potential damage to structures, where higher speeds above 10mph would appear to result in damage to property. It is important to mention that while the 16.5m articulated HGV could not be successfully tracked in the westbound direction without issues, there is evidence that suggests these types of HGVs can make the manoeuvre (see Figure 14), while showing close contact with structures.

Compared to the 16.5m articulated HGV and bus, the 10m rigid HGV appears to have no issue with navigating the bend at the B3247 – West Street junction in both directions. At 5mph (see Figure 22), 10mph (see Figure 23) and 15mph (Figure 24), the vehicle appears to have far less trouble navigating the bend at the B3247. On the other hand, like the other two vehicles; at all speeds, the westbound vehicle comes very close to property number 67 and 'Bar Tusker'. While it appears that at 20mph (see Figure 25), the vehicle can make the turning manoeuvre at the junction, it appears to come very close to the surrounding structures which is by no means acceptable.

Whilst the situation worsens at higher speeds for all vehicles swept path tracking, the tracking highlights an unacceptable level of clearance between vehicles and the virtual footways and properties. This appears to be unavoidable for all the tracked vehicles but is the least-worst for most vehicles tracked at speeds of 10mph or less, which possibly allows for adequate time to make the turn and react to the various hazards which exist in this section.

4.3 Visibility Assessment

The constrained horizontal geometry is the key reason for the poor visibility at the B3247 and West Street junction. The wall that is part of an existing property generates a large obstruction, whereby westbound road users are unable to see if any eastbound vehicles are passing through the narrow section of West Street.

The lack of visibility when approaching the junction from the east causes a potential vehicle conflict in the centre of the B3247 – West Street junction, where, after making the turning manoeuvre, vehicles are having to reverse back around the bend to allow the eastbound vehicle to pass.

Figure 26 Visibility Splays Turning onto West Street at Junction with B3247; Immediate Junction (left) and Approach to Junction (right)

The achievable forward visibility is 12m from the immediate junction and 16m on the approach to the junction (see Figure 26), while the visibility requirement for the existing 20mph speed limit is 45m in accordance with Manual for Streets. There is no other external element to assist the visibility of approaching vehicles.

4.4 Constraints in the Area for HGVs

As part of the site assessment, a study of the existing HGV constraints has been carried out. Some non-standard signs have been identified, which states the limitation of HGVs due to very narrow lanes. Also, some standard signs have been identified stating width restrictions or roads being unsuitable for HGVs.

4.4.1 Standard Restriction Signs

The roads seen in Figure 27 have official restrictions and/or recommendations for long or wide vehicles in the area.

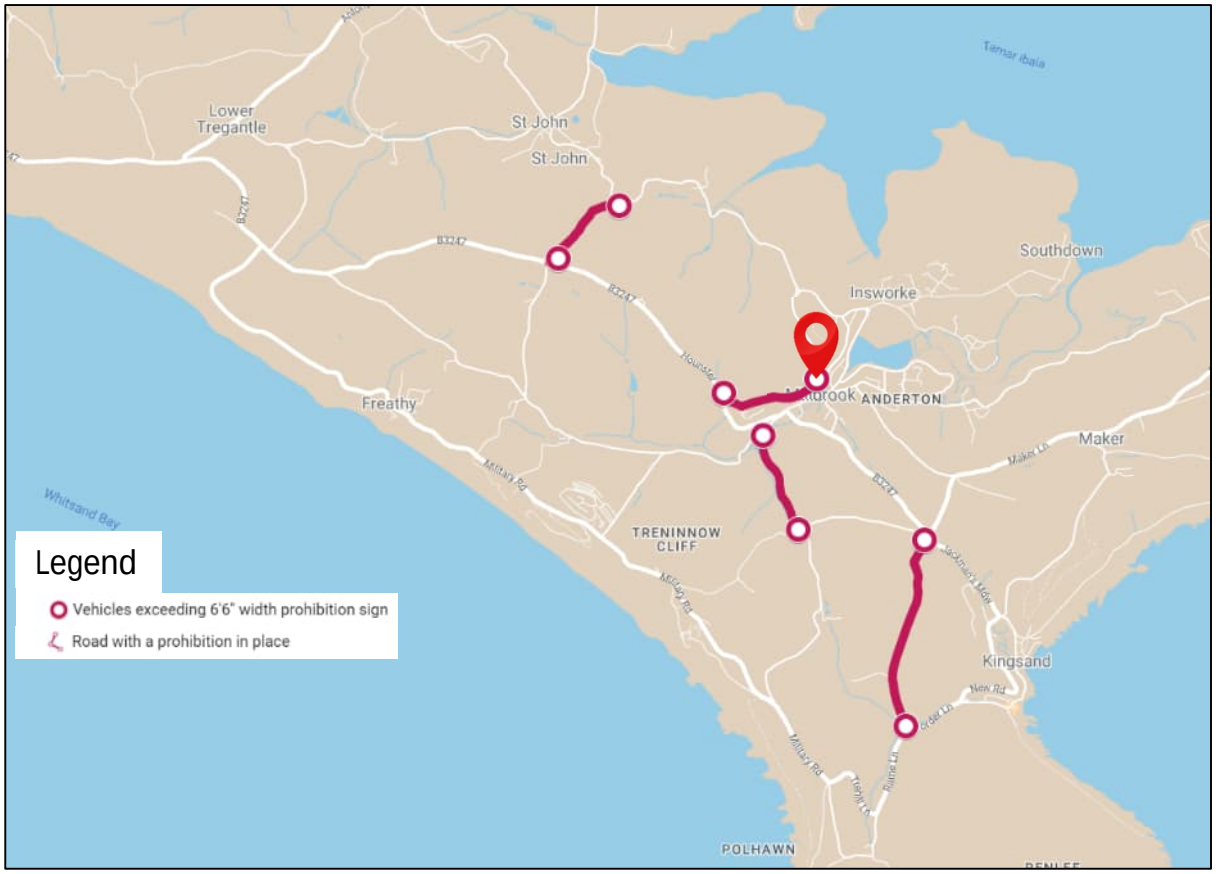


Figure 27 HGVs Prohibition Map (Google Maps)

There are existing width restrictions at Withnoe Lane junction with the B3247 and St Andrews Street (see Figure 28).

Figure 28 Width restrictions. Withnoe Lane 2017 (left) St Andrews Street 2018 (right) (Google Maps - Street View)

Other "Unsuitable for HGVs" signs have also been identified on the surrounding routes, which provide evidence of the routes being unsuitable for HGVs traffic (see Figure 29).

Figure 29 Sign Informing of Road Unsuitable for HGVs (Google Maps - Street View)

4.4.2 Non-Standard Signs and Unsuitable Roads

Non-standard signs have been found along the route responding to local's concerns to the current situation. The signs are located at three junctions along the B3247 road with Radford Road and Withnoe Lane.

A study has been carried out to estimate the suitability of routes for HGVs in the surrounding area. As shown in Figure 30, the findings demonstrates that most of routes are not fit for purpose.

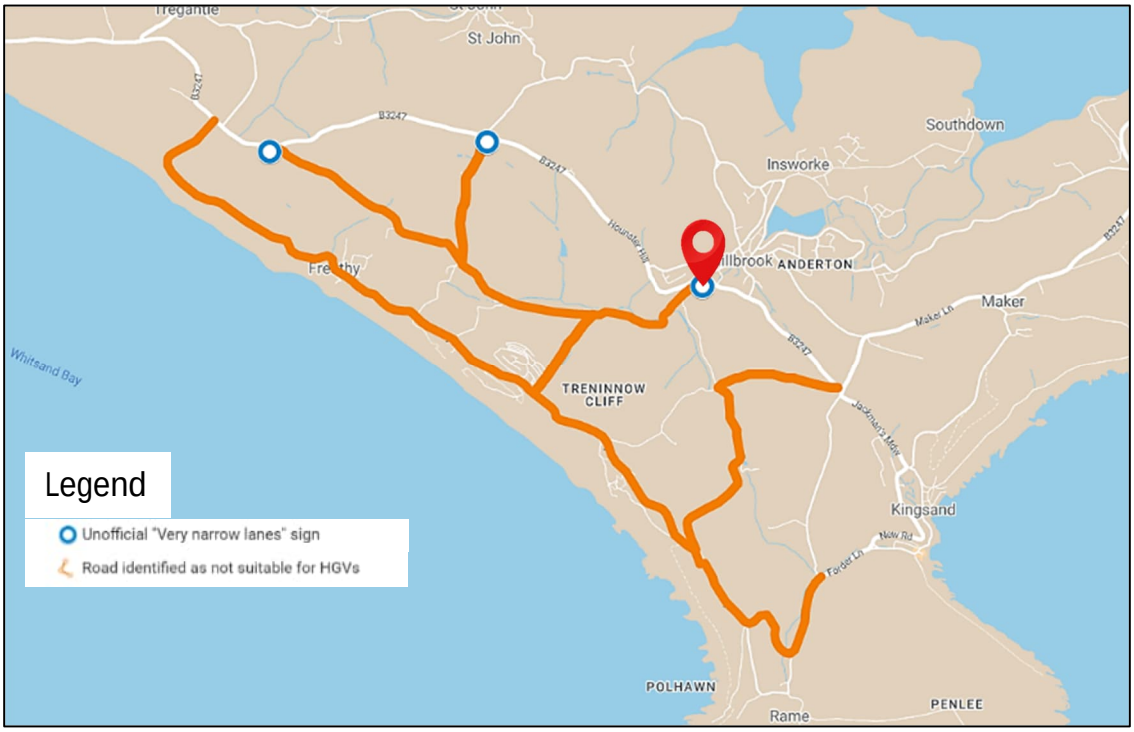


Figure 30 HGVs Road Suitability Map (Google Maps)

Withnoe Lane has been identified as a route that is not suitable for HGVs, as it is a single-track road with existing vegetation that's in very close proximity to the roadside (see Figure 31).

Figure 31 Withnoe Lane (Google Maps - Street View 2009)

Non-standard signs have been placed at some points to deter wide vehicles from accessing (see Figure 32).

Figure 32 Identified Non-Standard Sign at Radford Lane (Site visit 17/02/2022)

4.5 Collision Data

Collision reports (STATS 19) obtained for the area (as shown in Appendix C), which date back from 2016 to 2021, identify a total of six recorded incidents that occurred on the B3247 in the Millbrook area. Out of the six incidents recorded, three were reported as 'Serious' injury severity and occurred outside the study area. The remaining three were reported as 'Slight' injury severity, of which two occurred within the study area. Locations of the incidents are indicatively shown in Figure 33.

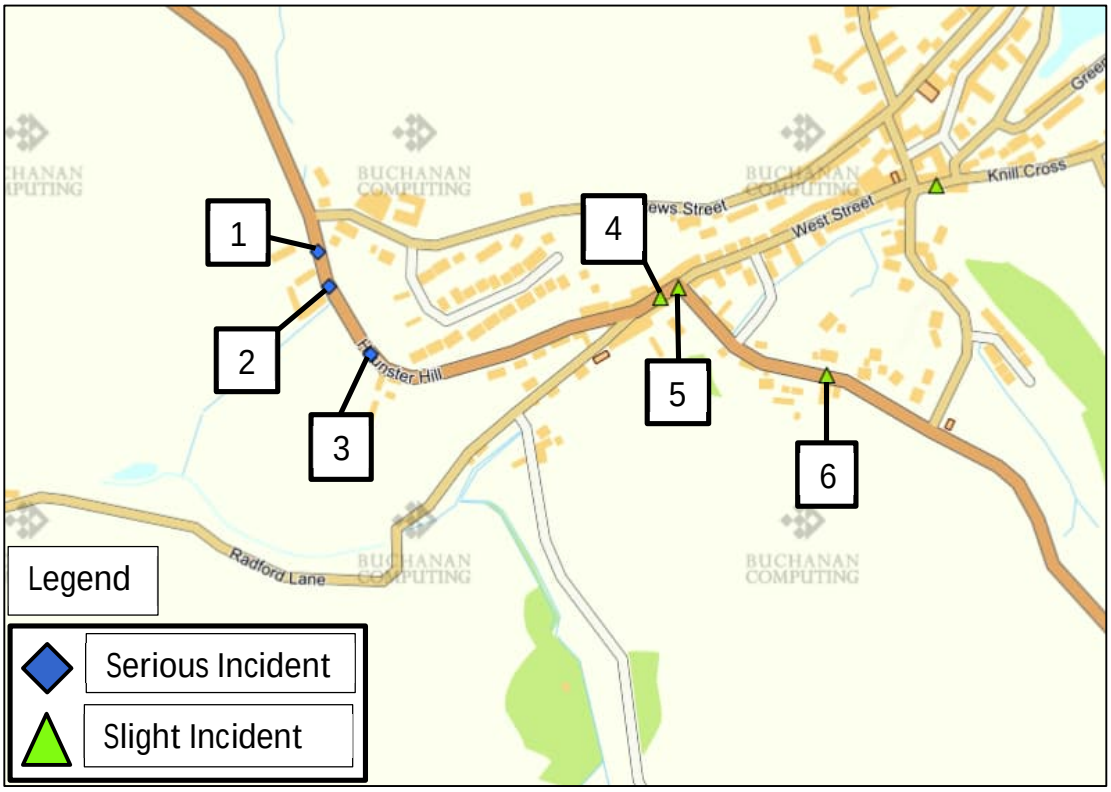


Figure 33 Locations of Incidents Recorded from 2016 to 2021

4.5.1 Collision Details

1. The earliest incident was recorded on the 19th June 2016 at 13:17pm in light conditions, where the weather was reported to be raining without high winds, and the road conditions were wet/damp. The incident occurred when a vehicle heading south-east on the B3247 swerved and hit a hedge on the nearside, which led to the vehicle overturning into the path of another vehicle, resulting in a collision. The contributing factors recorded for this incident was exceeding the speed limit of 30mph and swerving/losing control of the vehicle. This incident was recorded as 'Serious' injury severity.

2. The second incident was recorded on the 24th July 2017 at 14:52pm in light conditions, where the weather was fine without high winds, and the road conditions were dry. The incident occurred when a vehicle heading south-east on the B3247 was overtaking slower moving vehicles and the driver did not notice a stationary vehicle in the carriageway. This caused the driver to brake heavily, which resulted in the vehicle skidding and colliding with another vehicle who was heading in the opposite direction. The second vehicle was then impacted by another vehicle from the rear. The contributing factors recorded for this incident was exceeding the speed limit (of 20mph), careless/reckless driving, failing to judge another person's path or speed and being impaired by drugs (illicit or medicinal). This incident was recorded as 'Serious' injury severity.

3. The third 'serious' incident was recorded on the 25th August 2019 at 09:15am in light conditions, where the weather was reported to be fine without high winds, and the road conditions were wet/damp. The incident occurred when a motorbike heading northeast around a bend on the B3247 collided with a hedge on the nearside and rebounded, resulting in the overturning of the motorbike. The contributing factors recorded for this incident was failing to look, loss of control and having an illness or disability, mental or physical. This incident was recorded as 'Serious' injury severity.

4. The fourth incident was recorded on the 29th January 2019 at 17:45pm in dark conditions, where the weather was reported to be fine without high winds, and the road conditions were dry. The incident occurred on the B3247 West Street, 23 meters from the B3247 – West Street junction and occurred when a vehicle crossed the solid white line of the virtual footway and struck a pedestrian from the back. The contributing factors recorded for this incident was the driver's careless/reckless behaviour and failing to look properly. This incident was recorded as 'Slight' injury severity.

5. The fifth incident was recorded on the 29th August 2019 at 17:54pm in light conditions, where the weather was fine without high winds and the road conditions were dry. The incident occurred on around the B3247 – West Street junction and occurred when a

pedestrian was struck by a vehicle who approached from the opposite direction. The contributing factors recorded for this incident was the driver's careless/reckless behaviour. This incident was recorded as 'Slight' injury severity.

6. The sixth incident was recorded on the 2nd September 2020 at 09:54am in light conditions, where the weather was reported to be fine without high winds and the road conditions were dry. The incident occurred when a vehicle heading west downhill on the B3247 sighted a cyclist emerging out of a driveway, where the driver reacted and hit a wall on the nearside, then hit a wall on the offside further down and collided with another vehicle. The contributing factors recorded for this incident was nervous/uncertain/panic from the first driver and the cyclist entering the road from the pavement. This incident was recorded as 'Slight' injury severity.

The general causation for most of the incidents appears to be a lack of observation by drivers. While this may be more related to the driver's actions, the situation is possibly worsened by the inadequate forward visibility and the consistent narrowness of the carriageway along the B3247 when driving through Millbrook. The area around the B3247 – West Street junction is possibly more affected in this regard, as not only is there poor visibility at this location but the use of virtual footways puts pedestrians more at risk from being struck by drivers who struggle to anticipate the situation. This is due to vehicles overrunning the footway potentially into the path of an NMU. This issue also appears to apply to private accesses in and around the location, where movements out of the private access to gain visibility appear to immediately put users at risk of a collision.

4.6 On Site Notes and Observations

AECOM attended the site on 17th February 2022 to undertake a visual assessment and obtain key measurements. The following notes and observations were made:

- Satellite navigation systems instruct HGVs to travel through Millbrook.
- West Street is too narrow to safely accommodate HGVs passing through.
- Unofficial "Very narrow lane" sign identified at Radford Lane.
- There have been incidents of HGVs using Radford Lane getting stuck due to the narrow width of the lane and blocking traffic.
- There is a 'Do not enter yellow box unless exit is clear' sign located prior to the yellow box. However, it seemed as though this sign did not make sense as it was evident that vehicles did not have visibility from the B3247 onto West Street to check whether the exit is clear or not – they needed to make the manoeuvre first to find out. Vehicles were therefore not obeying the yellow box road marking.
- A public house called 'Bar Tusker' is located at the West Street and B3247 junction, which generates pedestrian demand and requires deliveries. Three beer barrels were blocking the start of the virtual footway on the approach to the public house, therefore forcing pedestrians to enter the carriageway.

- Generally, a lack of hazard signage in the area.
- There is a give way sign located at the start of the yellow box, but it is completely obscured due to overgrown vegetation.
- The West Street side road running east at the West Street and B3247 junction has no entry signs and give way road markings, which are overrun when large vehicles such as HGVs make the turning from the B3247 onto West Street.
- Vehicles are temporarily parking on the footway located on the east side of the B3247 at the West Street and B3247 junction.
- There was evidence of damage to private properties caused by the HGVs along the B3247 West Street.
- A bollard is located on the raised footway on the south side of West Street at the West Street and B3247 junction.
- Virtual footways generate a false sense of security for pedestrians which potentially worsens the safety of NMUs on West Street. The site attendee did not feel safe on the virtual footway when traffic was passing, as most vehicles only just fit in the width of the carriageway and some of those still overrun the virtual footway when travelling through West Street.
- Generally poor visibility from Hounster Hill to West Street and a blind sharp 90° corner from the B3247 onto West Street. Witnessed vehicles making the turn from the B3247 onto B3247 West Street, only to meet oncoming traffic and having to reverse to the wider area to let the eastbound traffic through.
- There are localised pinch points on the approach to West Street, both from Hounster Hill and the B3247.
- Vehicles were generally travelling slowly as they approached the narrows of West Street.

5 Automatic Traffic Count (ATC)

5.1 Introduction

In this chapter, the data obtained from the Automatic Traffic Count (ATC) study will be presented and discussed. The objective of the ATC study is to identify and analyse the volumes of general traffic, volumes of HGV traffic and speed of all traffic that passes through Millbrook along the B3247. This data will inform the study and assist in determining the most appropriate solutions on alleviating the issues caused by HGVs that pass-through Millbrook.

5.2 Methodology

Three pneumatic tube counters were located within the study area to determine the vehicle flow in a 7-day, 24-hour period. The study was undertaken in the 2022 Easter School Holidays to ensure it covers a particularly busy seasonal period of the calendar year and a potential worst-case scenario. It is also important to consider that Friday 15th April and Monday 18th April were bank holidays, and therefore may have experienced higher traffic levels than usual. The data collection points were positioned in the following locations, as shown in Figure 34 to Figure 37 and summarised in Table 1.

Figure 34 - Automatic Traffic Count (ATC) Survey Locations

MILL-01: At B3247 Hounster Hill, midway between the section east of the give-way to oncoming traffic sign and west of the junction with Radford Lane, approximately outside property 48-49 (see Figure 35).

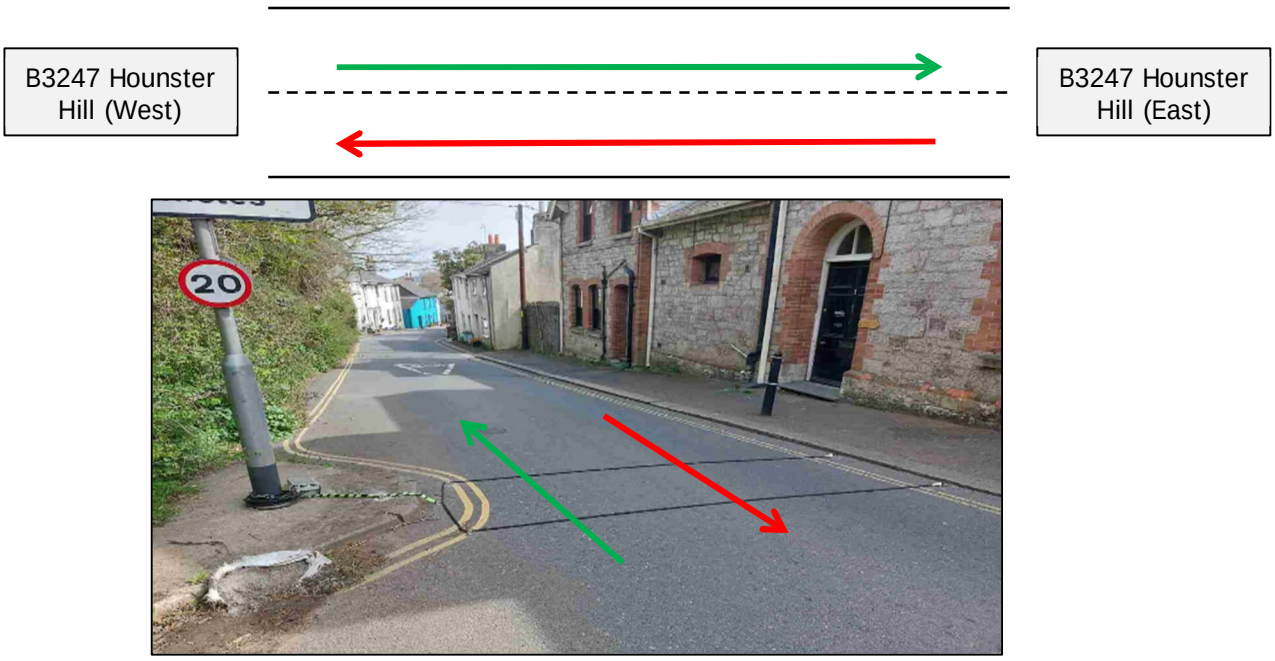


Figure 35 Location of ATC MILL-01 Station

MILL-02: At B3247 West Street, approximately midway between junction with Radford Lane and junction with West Street (see Figure 36).

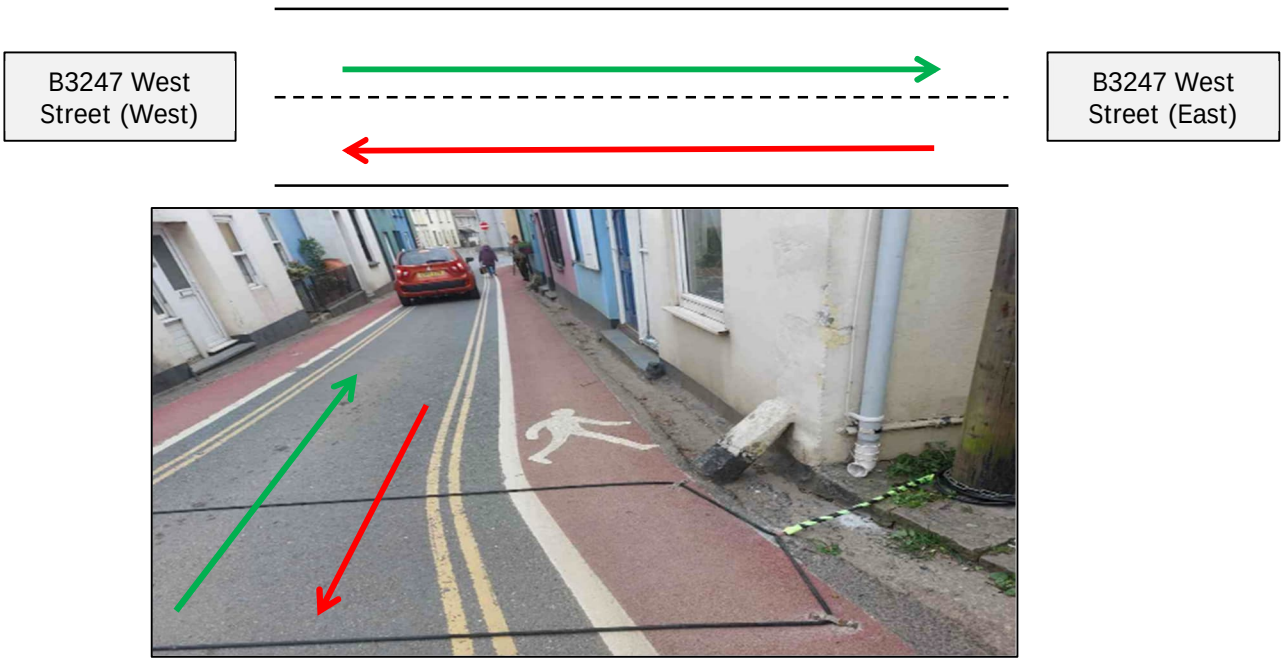


Figure 36 Location of ATC MILL-02 Station

MILL-03: At B3247 West Street, south of junction with West Street and north of bus stop (see Figure 37).

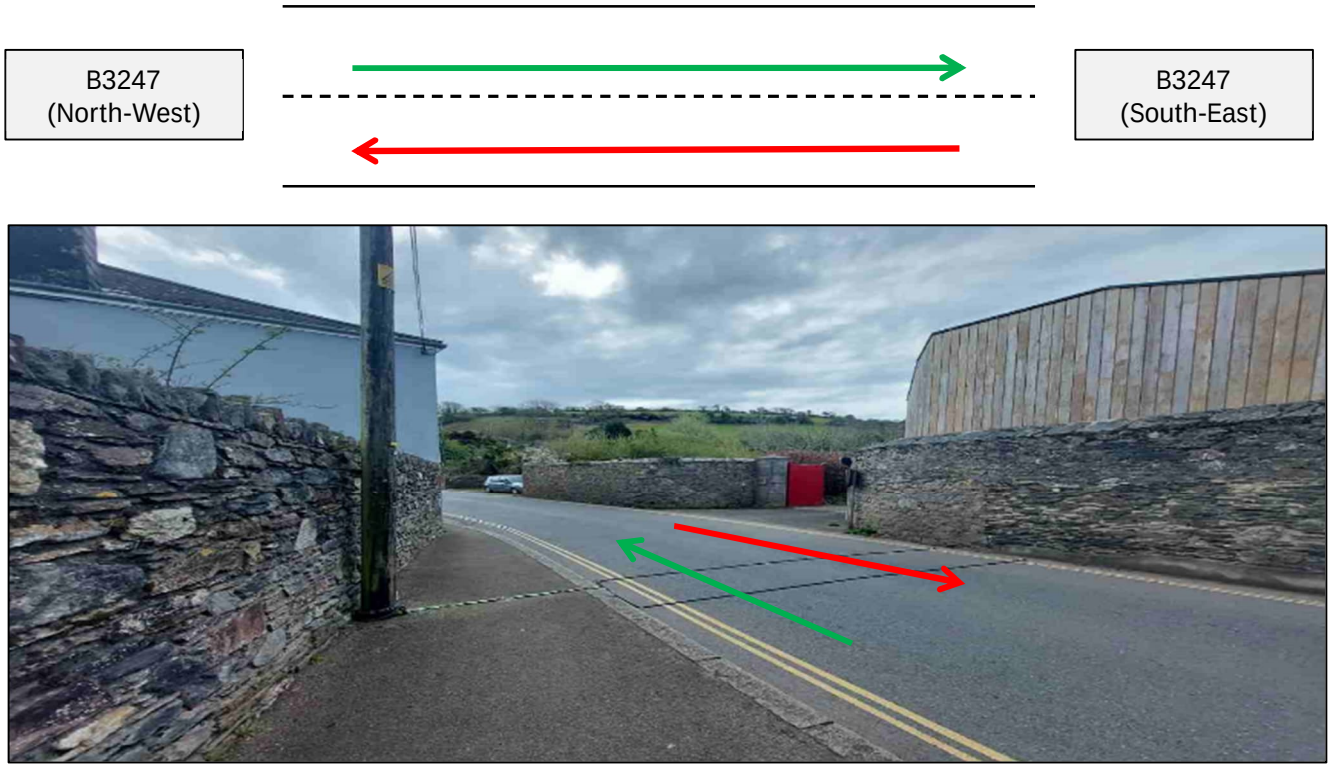


Figure 37 Location of ATC MILL-03 Station

Survey ID	Location	Survey Type	Grid Reference
MILL-01	B3247 Hounster Hill midway between section east of the give-way to oncoming traffic sign and west of the junction with Radford Lane.	ATC	E: 50.346160 N: - 4.222497
MILL-02	B3247 West Street, midway between junction with Radford Lane and junction with West Street.	ATC	E: 50.346422 N: - 4.221128
MILL-03	B3247, south of junction with West Street and north of bus stop.	ATC	E: 50.346365 N: - 4.220239

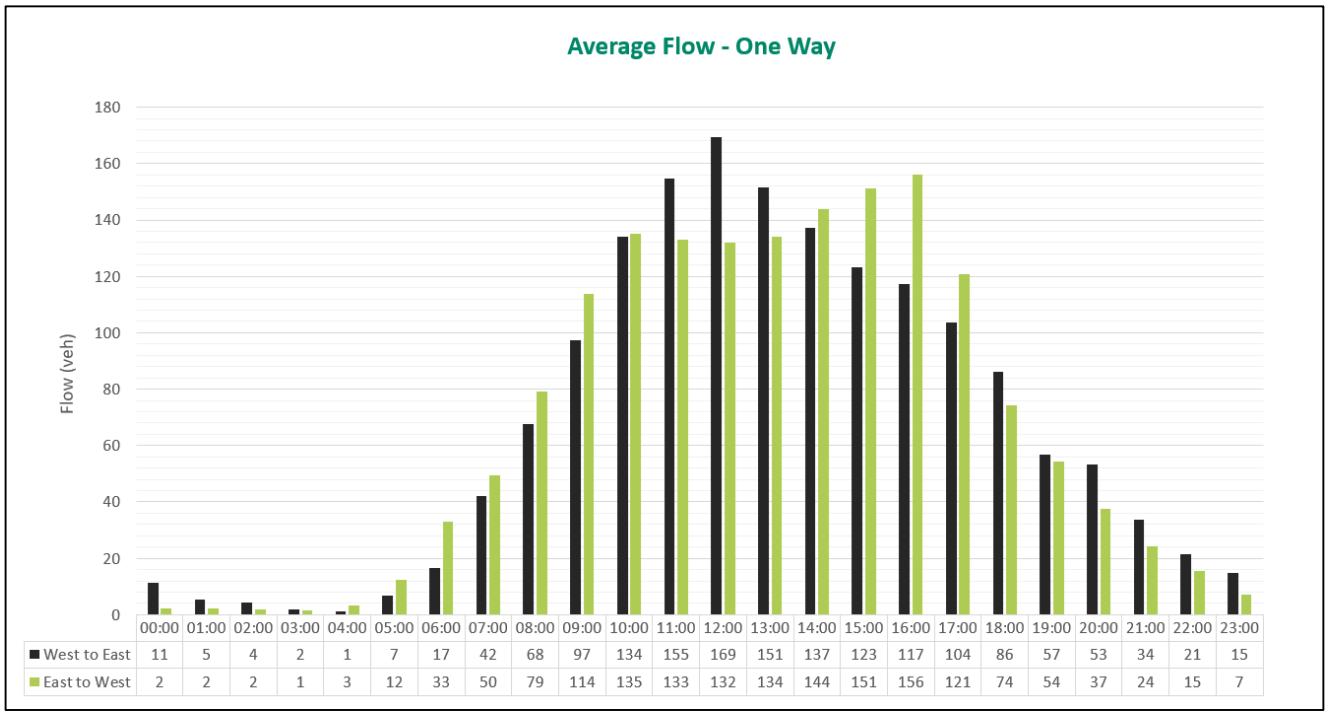
Table 1 Location for ATC Surveys

To understand the flow and behaviour of the traffic, the second element involves post-processing, analysis and interpretation of the ATC data.

5.3 Results

5.3.1 MILL-01

The following graphs provides the 7-day average flow recorded in each direction (see Figure 38) and in both directions (see Figure 39) at station MILL-01.



	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
West to East	11	5	4	2	1	7	17	42	68	97	134	155	169	151	137	123	117	104	86	57	53	34	21	15
East to West	2	2	2	1	3	12	33	50	79	114	135	133	132	134	144	151	156	121	74	54	37	24	15	7

Figure 38 MILL-01 7-day Average Flow - One Way

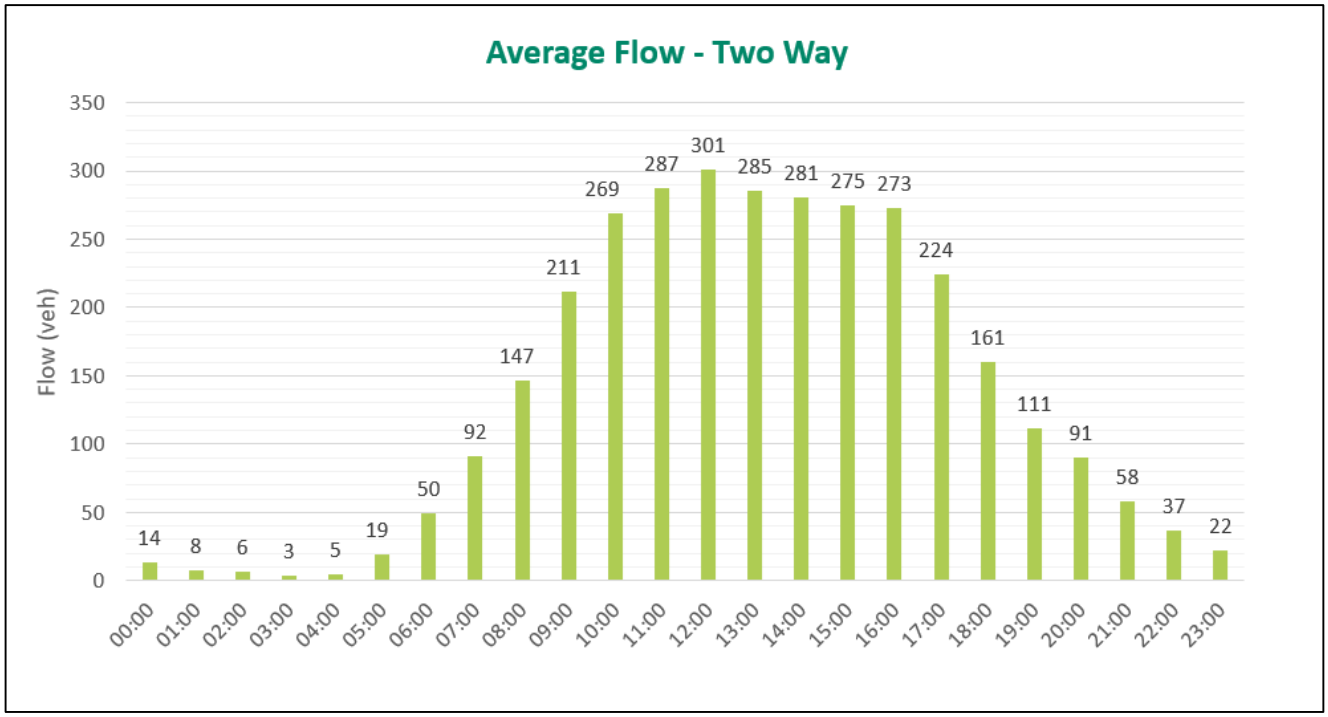


Figure 39 MILL-01 7-day Average Flow - Two Way

The following graphs show the average speed in each direction across a single day (see Figure 40), and the mean speed and average 85%ile speed recorded in each direction across the 7-days (see Figure 41) at station MILL-01 for each direction.

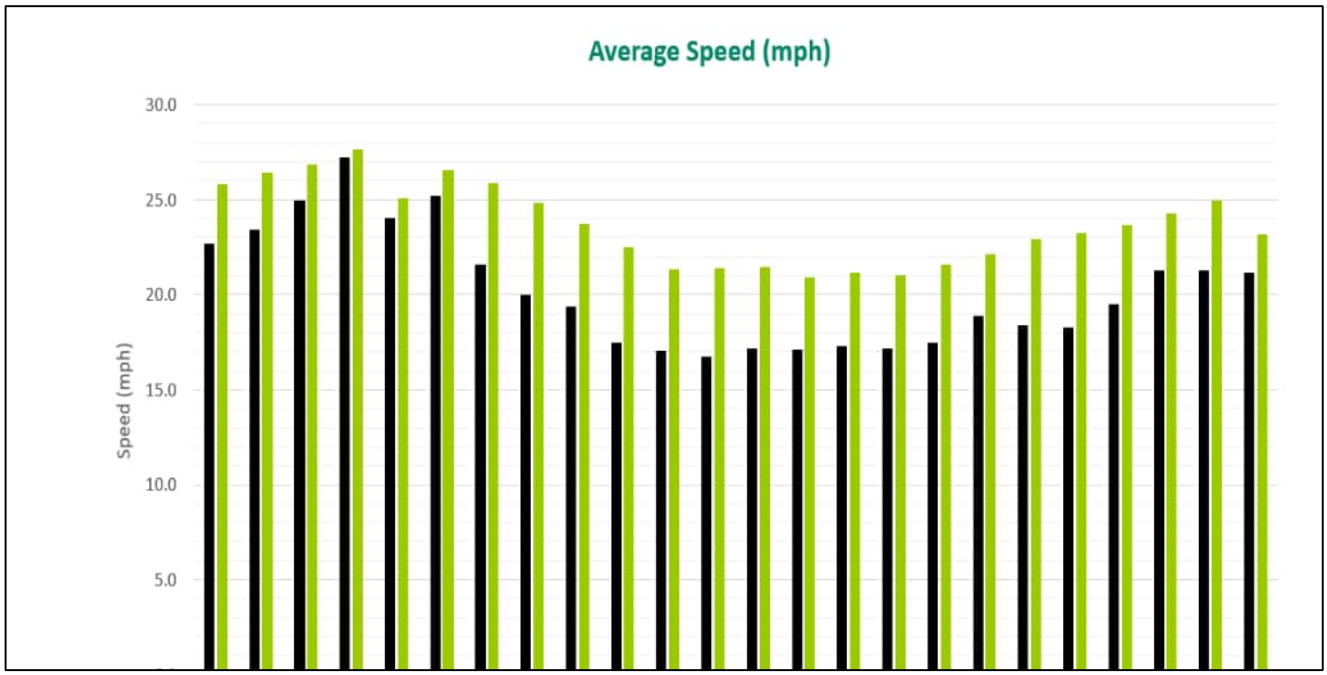
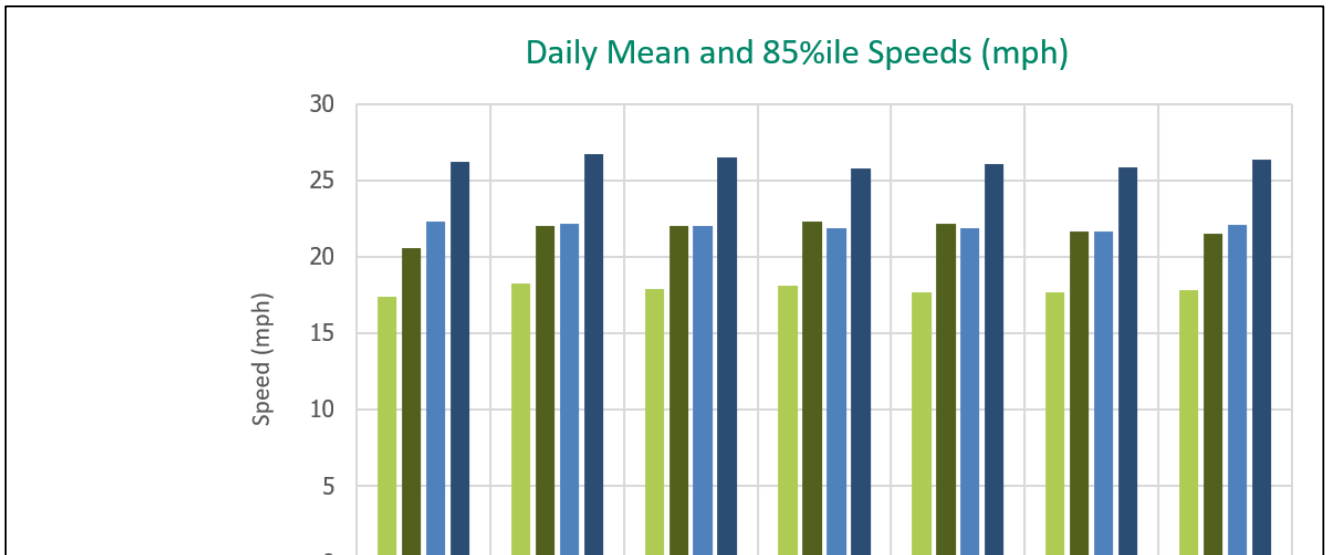


Figure 40 MILL-01 Average Speed (mph)

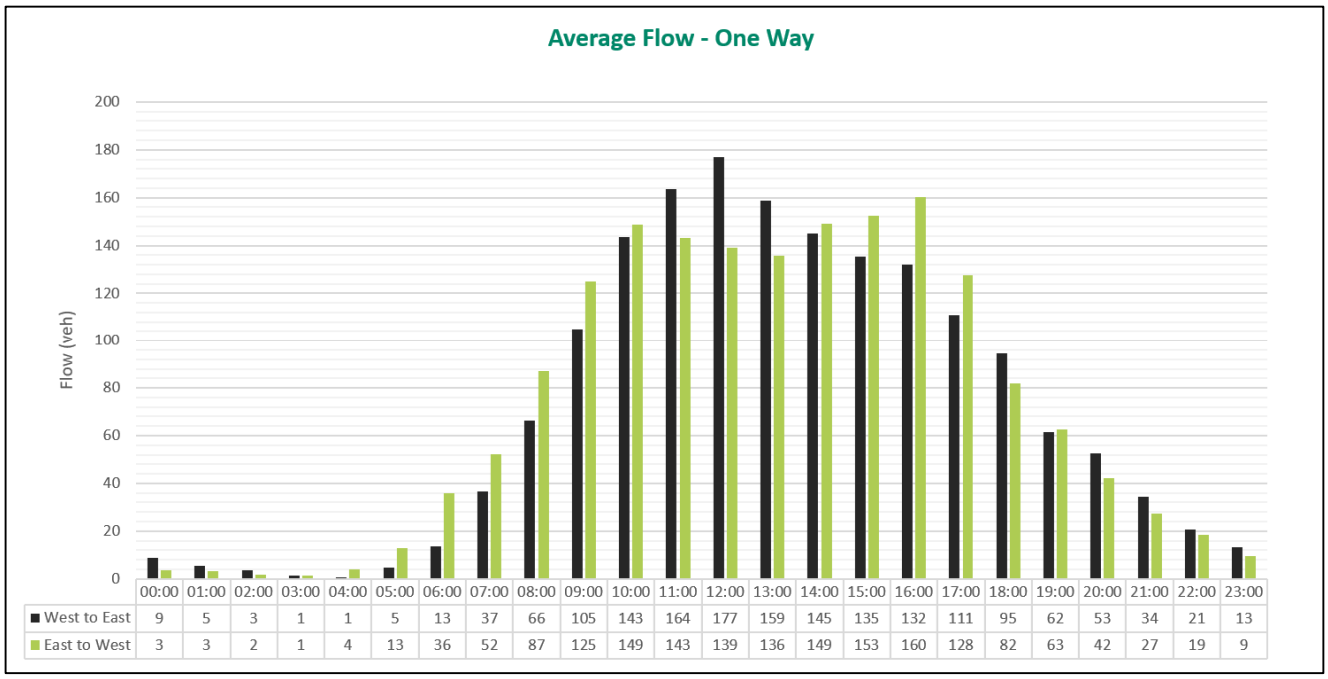


	12/04	13/04	14/04	15/04	16/04	17/04	18/04
Mean Speed - West to East	17.4	18.3	17.9	18.1	17.7	17.7	17.8
85%ile Speed - West to East	20.6	22.0	22.0	22.3	22.2	21.7	21.5
Mean Speed - East to West	22.3	22.2	22.0	21.9	21.9	21.7	22.1
85%ile Speed - East to West	26.2	26.7	26.5	25.8	26.1	25.9	26.4

Figure 41 MILL-01 Daily Mean and 85%ile Speeds (mph)

5.3.2 MILL-02

The following graphs provide the 7-day average flow recorded in each direction (see Figure 42) and in both directions (see Figure 43) at station MILL-02.



	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
West to East	9	5	3	1	1	5	13	37	66	105	143	164	177	159	145	135	132	111	95	62	53	34	21	13
East to West	3	3	2	1	4	13	36	52	87	125	149	143	139	136	149	153	160	128	82	63	42	27	19	9

Figure 42 MILL-02 7-day Average Flow - One Way

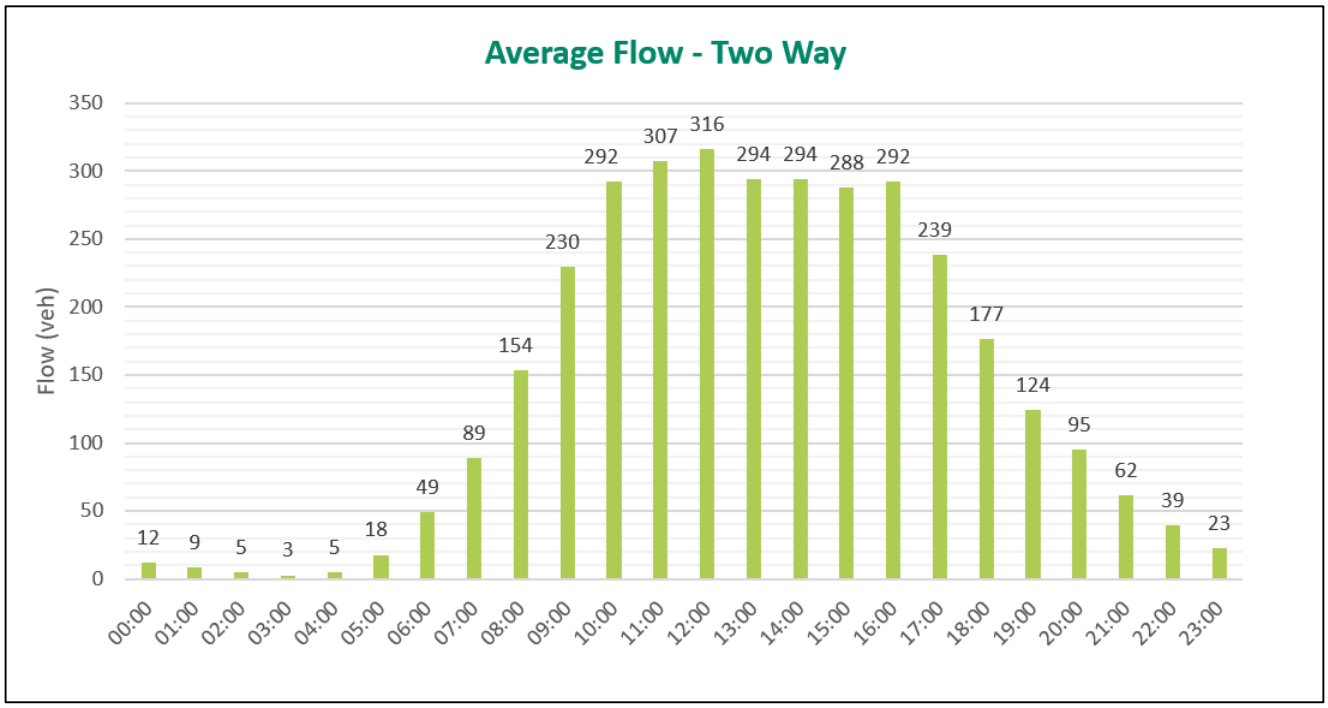
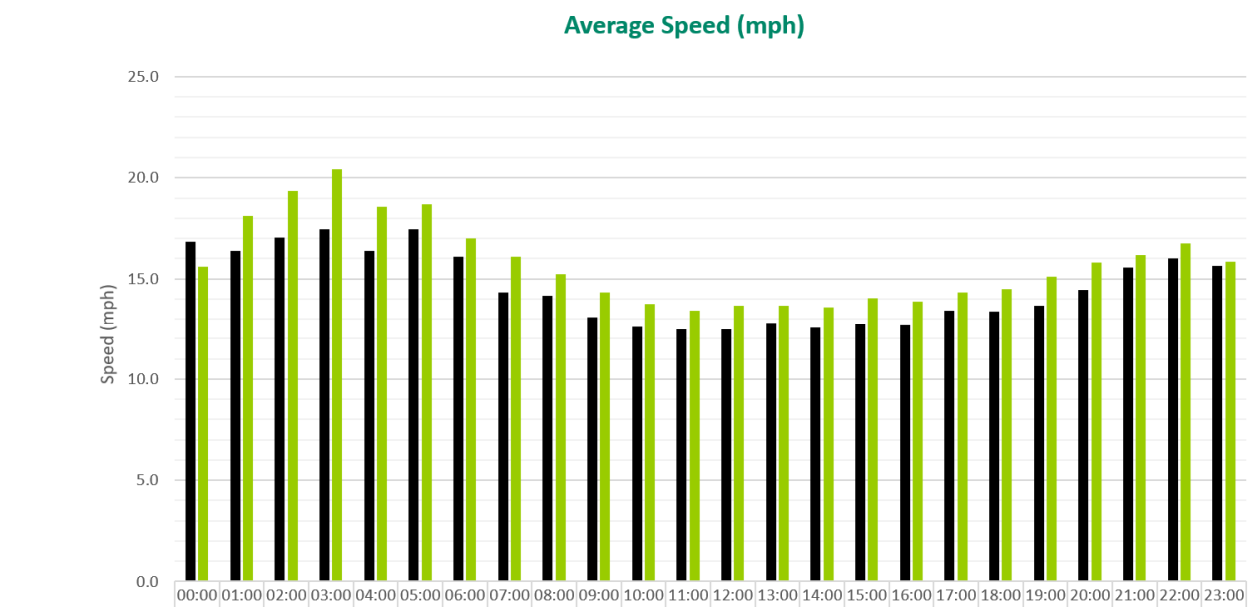


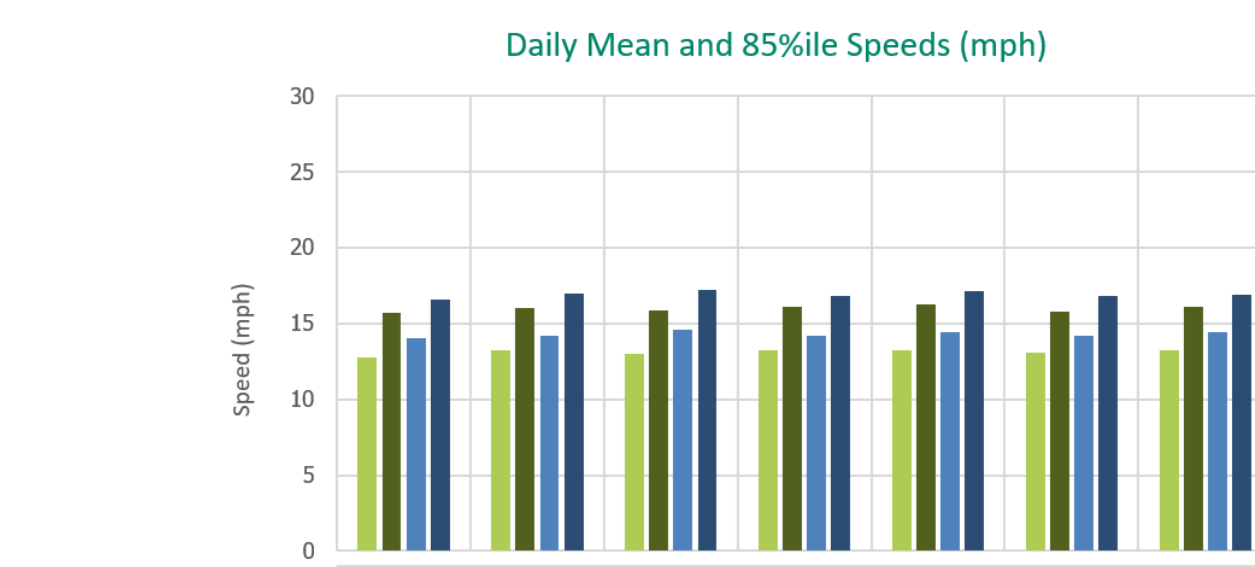
Figure 43 MILL-02 7-day Average Flow - Two Way

The following figures show the average speed in each direction across a single day (see Figure 44), and the mean speed and average 85%ile speed recorded in each direction across the 7-days (see Figure 45) at station MILL-02.



	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Speed - West to East	16.8	16.4	17.1	17.5	16.4	17.4	16.1	14.3	14.2	13.1	12.6	12.5	12.5	12.8	12.5	12.7	12.7	13.4	13.4	13.7	14.4	15.5	16.0	15.6
Speed - East to West	15.6	18.1	19.3	20.4	18.6	18.7	17.0	16.1	15.2	14.3	13.7	13.4	13.7	13.7	13.6	14.0	13.9	14.3	14.5	15.1	15.8	16.2	16.8	15.9

Figure 44 MILL-02 Average Speed (mph)

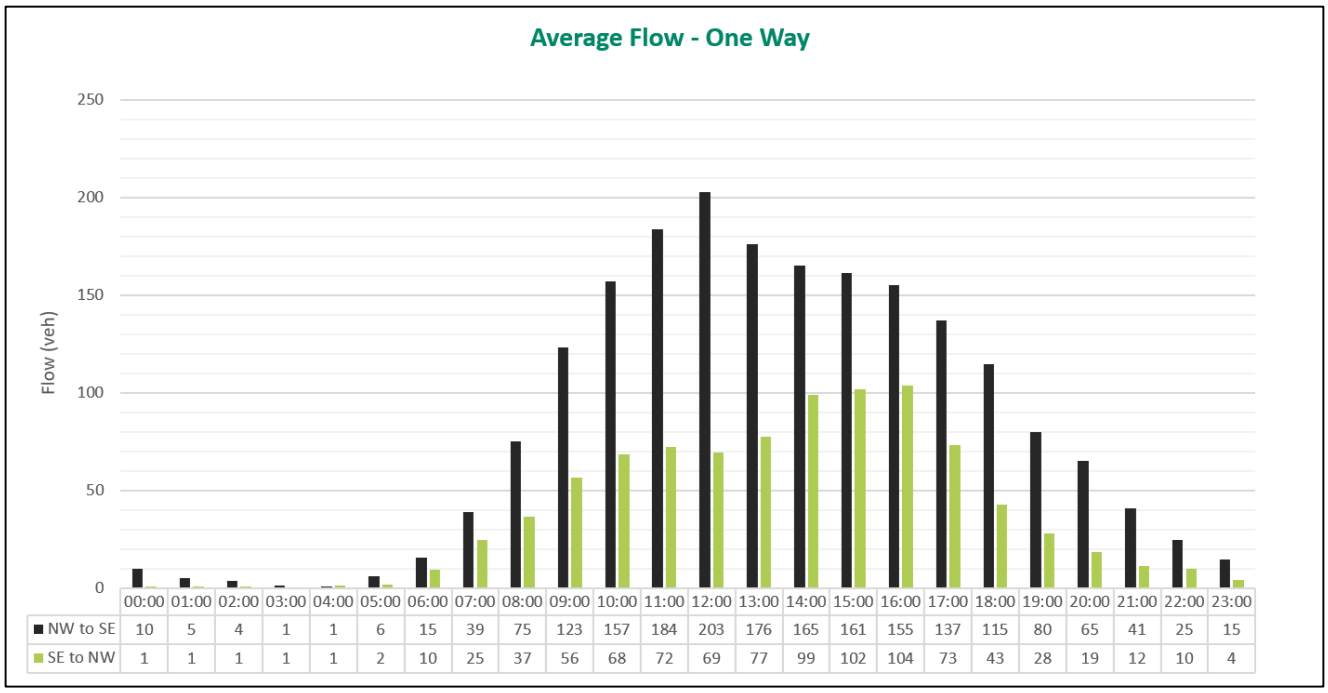


	12/04	13/04	14/04	15/04	16/04	17/04	18/04
Mean Speed - West to East	12.8	13.2	13	13.2	13.2	13.1	13.2
85%ile Speed - West to East	15.7	16	15.9	16.1	16.3	15.8	16.1
Mean Speed - East to West	14	14.2	14.6	14.2	14.4	14.2	14.4
85%ile Speed - East to West	16.6	17	17.2	16.8	17.1	16.8	16.9

Figure 45 MILL-02 Daily Mean and 85%ile Speeds (mph)

5.3.3 MILL-03

The following graphs provide the 7-day average flow recorded in each direction (see Figure 46) and in both directions (see Figure 47) at station MILL-03.



	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
NW to SE	10	5	4	1	1	6	15	39	75	123	157	184	203	176	165	161	155	137	115	80	65	41	25	15
SE to NW	1	1	1	1	1	2	10	25	37	56	68	72	69	77	99	102	104	73	43	28	19	12	10	4

Figure 46 MILL-03 7-day Average Flow - One Way

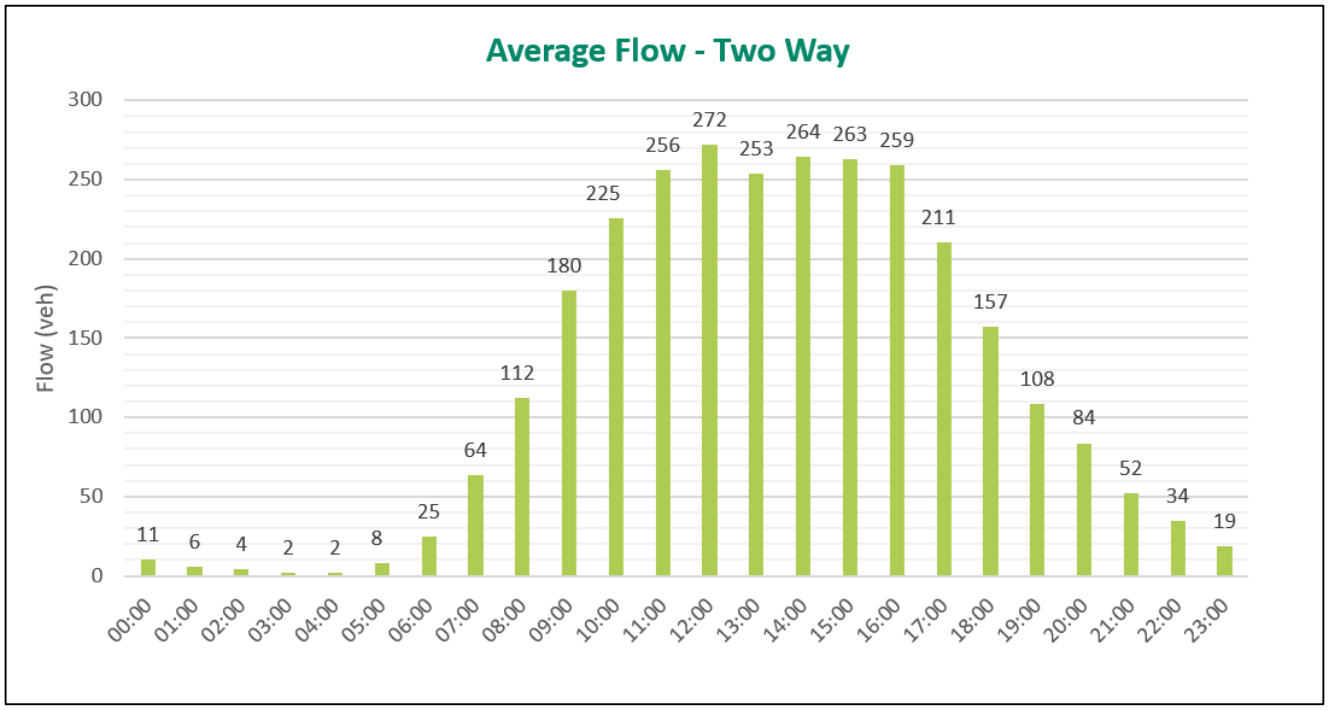
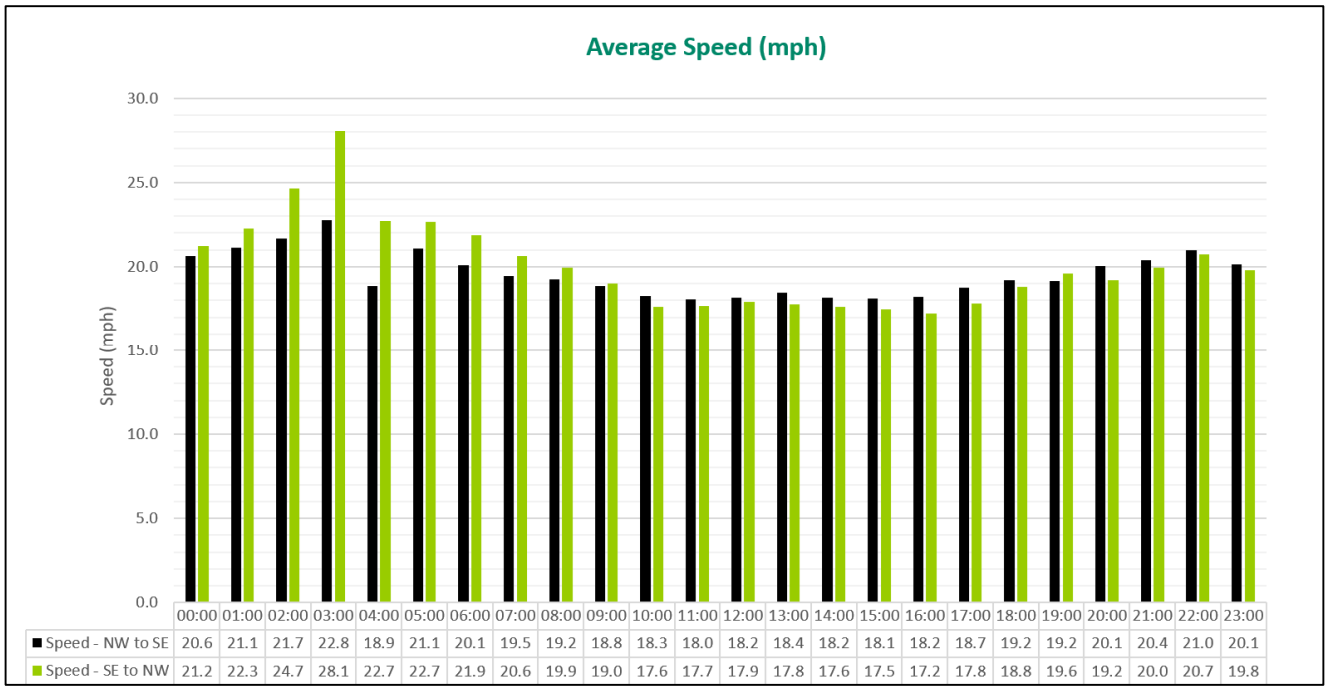


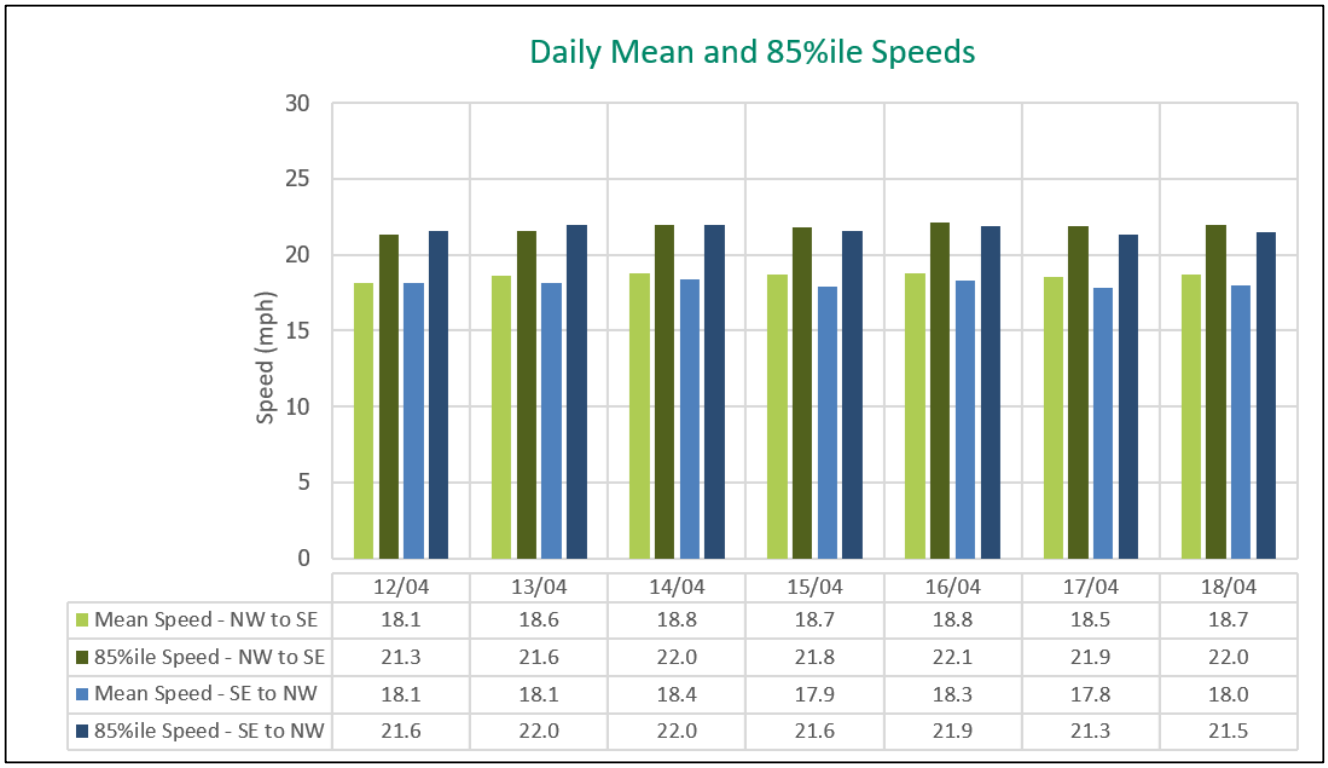
Figure 47 MILL-03 7-day Average Flow - Two Way

The following figures show the average speed in each direction across a single day (see Figure 48), and the mean speed and average 85%ile speed recorded in each direction across the 7-days (see Figure 49) at station MILL-03.



	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Speed - NW to SE	20.6	21.1	21.7	22.8	18.9	21.1	20.1	19.5	19.2	18.8	18.3	18.0	18.2	18.4	18.2	18.1	18.2	18.7	19.2	19.2	20.1	20.4	21.0	20.1
Speed - SE to NW	21.2	22.3	24.7	28.1	22.7	22.7	21.9	20.6	19.9	19.0	17.6	17.7	17.9	17.8	17.6	17.5	17.2	17.8	18.8	19.6	19.2	20.0	20.7	19.8

Figure 48 MILL-03 Average Speed (mph)



	12/04	13/04	14/04	15/04	16/04	17/04	18/04
Mean Speed - NW to SE	18.1	18.6	18.8	18.7	18.8	18.5	18.7
85%ile Speed - NW to SE	21.3	21.6	22.0	21.8	22.1	21.9	22.0
Mean Speed - SE to NW	18.1	18.1	18.4	17.9	18.3	17.8	18.0
85%ile Speed - SE to NW	21.6	22.0	22.0	21.6	21.9	21.3	21.5

Figure 49 MILL-03 Daily Mean and 85%ile Speeds (mph)

5.3.4 Vehicle Classification for all ATC Surveys

The following table provides the total percentage of vehicle classifications recorded in each direction along the different locations during the survey period (see Table 2).

		Vehicle Classification (%)								
Survey ID	Direction	Car	LGV	2 Axled Rigid	3 Axled Rigid	4 Axled Rigid	3 Axled Artic	4 Axled Artic	5+ Axled Artic	Bus
MILL-01	B3247 Hounster Hill (Eastbound)	93.12	5.78	0.71	0.10	0.03	0.15	0.00	0.11	0.00
MILL-01	B3247 Hounster Hill (Westbound)	89.02	8.91	1.57	0.22	0.09	0.14	0.00	0.04	0.01
MILL-02	B3247 West Street (Eastbound)	85.32	12.17	2.02	0.08	0.04	0.28	0.00	0.04	0.05
MILL-02	B3247 West Street (Westbound)	88.29	9.84	1.46	0.05	0.06	0.14	0.00	0.16	0.00
MILL-03	B3247 (South-Eastbound)	86.09	11.75	1.83	0.11	0.01	0.15	0.01	0.01	0.04
MILL-03	B3247 (North-Westbound)	81.80	14.88	2.93	0.21	0.01	0.15	0.00	0.02	0.05

Table 2 Total Traffic Flow and Vehicle Classification

5.3.5 MILL-01 LGVs and HGVs

The following tables provide the total flow of LGVs and HGVs recorded throughout the 7 days in each direction at station MILL-01 (see Table 3 and Table 4).

	B3247 Hounster Hill (Eastbound)						
Day	LGV	2 Axled Rigid	3 Axled Rigid	4 Axled Rigid	3 Axled Artic	4 Axled Artic	5+ Axled Artic
Tuesday (12/04/2022)	57	7	6	1	2	0	7
Wednesday (13/04/2022)	97	22	5	0	1	0	2
Thursday (14/04/2022)	101	19	1	0	7	0	0
Friday (15/04/2022)	119	11	0	1	4	0	0
Saturday (16/04/2022)	97	9	0	1	0	0	1
Sunday (17/04/2022)	81	1	0	0	2	0	1
Monday (18/04/2022)	76	9	0	0	1	0	1
Total for 7 Days	628	78	12	3	17	0	12

Table 3 Total 7-day Flow of LGV and HGV's for B3247 Hounster Hill Eastbound

	B3247 Hounster Hill (Westbound)						
Day	LGV	2 Axled Rigid	3 Axled Rigid	4 Axled Rigid	3 Axled Artic	4 Axled Artic	5+ Axled Artic
Tuesday (12/04/2022)	180	29	8	2	3	0	2
Wednesday (13/04/2022)	178	39	8	3	2	0	0
Thursday (14/04/2022)	171	41	4	2	3	0	1
Friday (15/04/2022)	139	22	0	1	2	0	0
Saturday (16/04/2022)	133	18	1	1	3	0	0
Sunday (17/04/2022)	97	8	2	2	2	0	1
Monday (18/04/2022)	110	19	2	0	1	0	0
Total for 7 Days	1008	176	25	11	16	0	4

Table 4 Total 7-day Flow of LGV and HGV's for B3247 Hounster Hill Westbound

5.3.6 MILL-02 HGVs Analysis

The following tables provide the total flow of LGVs and HGVs recorded throughout the 7 days in each direction at station MILL-02 (see Table 5 and Table 6).

	B3247 West Street (Eastbound)						
Day	LGV	2 Axled Rigid	3 Axled Rigid	4 Axled Rigid	3 Axled Artic	4 Axled Artic	5+ Axled Artic
Tuesday (12/04/2022)	276	47	1	1	3	0	0
Wednesday (13/04/2022)	241	60	4	0	3	0	0
Thursday (14/04/2022)	240	44	4	1	5	0	1
Friday (15/04/2022)	199	29	0	0	8	0	1
Saturday (16/04/2022)	185	23	0	3	6	0	0
Sunday (17/04/2022)	144	9	0	0	2	0	1
Monday (18/04/2022)	169	25	0	0	7	0	1
Total for 7 Days	1454	237	9	5	34	0	4

Table 5 Total 7-day Flow of LGV and HGV's for B3247 West Street Eastbound

	B3247 West Street (Westbound)						
Day	LGV	2 Axled Rigid	3 Axled Rigid	4 Axled Rigid	3 Axled Artic	4 Axled Artic	5+ Axled Artic
Tuesday (12/04/2022)	255	33	1	1	2	0	1
Wednesday (13/04/2022)	233	48	3	3	1	0	2
Thursday (14/04/2022)	208	37	1	0	2	0	2
Friday (15/04/2022)	154	22	1	0	4	0	3
Saturday (16/04/2022)	137	17	0	0	6	0	2
Sunday (17/04/2022)	103	5	0	3	0	0	5
Monday (18/04/2022)	106	16	0	1	2	0	4
Total for 7 Days	1196	178	6	8	17	0	19

Table 6 Total 7-day Flow of LGV and HGV's for B3247 West Street Westbound

5.3.7 MILL-03 HGVs Analysis

The following tables provide the total flow of LGVs and HGVs recorded throughout the 7 days in each direction at station MILL-03 (see Table 7 and Table 8).

	B3247 (South-Eastbound)						
Day	LGV	2 Axled Rigid	3 Axled Rigid	4 Axled Rigid	3 Axled Artic	4 Axled Artic	5+ Axled Artic
Tuesday (12/04/2022)	316	47	0	0	2	0	0
Wednesday (13/04/2022)	274	55	7	0	1	0	0
Thursday (14/04/2022)	284	50	8	0	5	0	0
Friday (15/04/2022)	241	28	0	1	5	0	0
Saturday (16/04/2022)	190	27	0	0	4	0	0
Sunday (17/04/2022)	160	9	0	0	3	1	1
Monday (18/04/2022)	154	29	0	0	1	0	0
Total for 7 Days	1619	245	15	1	21	1	1

Table 7 Total 7-day Flow of LGV and HGV's for B3247 South-Eastbound

	B3247 (North-Westbound)						
Day	LGV	2 Axled Rigid	3 Axled Rigid	4 Axled Rigid	3 Axled Artic	4 Axled Artic	5+ Axled Artic
Tuesday (12/04/2022)	158	37	1	1	2	0	0
Wednesday (13/04/2022)	137	45	6	0	4	0	0
Thursday (14/04/2022)	126	37	6	0	3	0	0
Friday (15/04/2022)	133	20	0	0	1	0	0
Saturday (16/04/2022)	136	18	0	0	0	0	0
Sunday (17/04/2022)	125	11	0	0	0	0	1
Monday (18/04/2022)	137	17	0	0	0	0	0
Total for 7 Days	952	185	13	1	10	0	1

Table 8 Total 7-day Flow of LGV and HGV's for B3247 North-Westbound

5.4 Analysis

5.4.1 Average Flow

By looking at the one-way average flow data at stations MILL-01, MILL-02 and MILL-03 (Figure 38, Figure 42 and Figure 46 respectively); it can be established that the time frame that experienced the most eastbound traffic on the B3247 through Millbrook was from 12:00pm to 12:59pm at all 3 stations. Between this time, station MILL-01 had 169 vehicles, MILL-02 164 vehicles and MILL-03 203 vehicles.

Similarly, to the eastbound traffic, it can be established that the time frame that had the most westbound traffic on the B3247 through Millbrook was from 16:00pm to 16:59pm. Between this time, station MILL-01 had 156 vehicles, MILL-02 160 vehicles and MILL-03 104 vehicles.

By analysing the two-way average flow data at stations MILL-01, MILL-02 and MILL-03 (Figure 39, Figure 43 and Figure 47 respectively); it can be established that the time frame that had the most traffic heading through the stations in both directions was from 12:00pm to 12:59pm. Between this time, station MILL-01 had 301 vehicles, MILL-02 316 vehicles and MILL-03 272 vehicles.

The patterns displayed for the single way average flow between stations MILL-01 and MILL-02 appear to be similar, where there are more vehicles heading eastbound from 12:00pm to 12:59pm, and more vehicles heading westbound from 16:00pm to 16:59pm. There is also a pattern from 14:00pm to 16:59pm at both stations, where more vehicles were found to be heading westbound out of Millbrook. Using Table 2, it establishes that around 87% to 88% of the traffic recorded passing eastbound through stations MILL-01 and MILL-02 are cars, signifying the possibility that commuter traffic is either heading to or through Millbrook to work. As the ATC survey took place during the Easter Holidays, tourism may also be a contributing factor to the traffic leaving Millbrook, which may also be responsible for the eastbound traffic levels at 11:00 to 12:59.

Unlike the single way average flow levels recorded at stations MILL-01 and MILL-02; throughout the whole day, MILL-03 had far less traffic heading westbound. While 16:00pm to 16:59pm still had the highest average flow level heading westbound with 104 vehicles, it was a far lower number of vehicles compared to those heading eastbound throughout the same time frame, where there were a recorded 155 vehicles. Whilst there may not be a precise reason for this, some assumptions could be made.

Due to the difficult road layout, commuters or tourists that head eastbound through Millbrook earlier in the day may have chosen to go a different route on the way back. As stations MILL-01 and MILL-02 show more vehicles heading westbound at most times compared to station MILL-03. There is a possibility that commuters may have chosen to turn off at either Wells Court or Millpool Head to reach West Street, which compared to entering the B3247 - West Street junction using the B3247 from the east, could have allowed for better junction and forward visibility. For the vehicles not accounted for at stations MILL-01 and MILL-02 in the westbound direction, commuters or tourists that may have headed to Kingsand and Rame,

could have used Military Road for their return journey, therefore bypassing Millbrook altogether.

As the ATC survey was conducted during the Easter Holidays, there is a likely possibility of tourists who headed eastbound through the ATC stations during the span of the survey, may not have made their journey back until the following week. As a result, their return journey through the ATC stations would have not been picked up, as it would have been outside the timeframe the ATC survey was conducted.

5.4.2 Average, Daily Mean and 85%tile Speed

By analysing the average speed of vehicles throughout an average day at stations MILL-01, MILL-02 and MILL-03 (Figure 40, Figure 44, and Figure 48 respectively); there appears to be differences in the results between all three stations at all times.

For example, from 12:00pm to 12:59pm, the average speed driven by vehicles in the eastbound direction at station MILL-01 was 17.2mph, MILL-02 was 12.5mph and MILL-03 was 18.2mph. This is also the same for vehicles that were travelling westbound from 12:00pm to 12:59pm, where the average speed driven at MILL-01 was 21.4mph, MILL-02 was 13.7mph and MILL-03 was 17.9mph. While the speed limit through all three stations was 20mph, a possible explanation would be linked to the geometry of the B3247 in Millbrook. At MILL-01 and MILL-03, there is enough space for 2 vehicles to pass each other, whereas at MILL-02, there is only enough space for a single vehicle. As a result, vehicles heading in both directions would need to slow down and stop to give way to other vehicles passing through these sections, which would result in deacceleration or even coming to a complete stop. Furthermore, at MILL-02, there is a virtual footway instead of a grade separated footway. This essentially requires pedestrians to walk in the carriageway, causing drivers taking caution to decelerate. Finally, another possible explanation is the observed lack of forward visibility on the bend at a junction, located eastbound past MILL-02 and before MILL-03, where drivers taking caution of oncoming vehicles or pedestrians would cause a vehicle to decelerate or even come to a complete stop. While there is grade separated footway and space for two vehicles to pass at station MILL-03, the station is located close to the same junction, where vehicles may slow down due to the lack of forward visibility around the bend.

Another pattern that can be seen in the average speed results at all stations, is the difference in average speed between different times of day. An example of this, is at station MILL-01, the average speed in the eastbound direction at 03:00am to 03:59am was 27.2mph, where after this time, the average speed decreased down to 17.2mph between 12:00pm to 12:59pm. After, the average speed increased up to 21.2mph at 23:00pm to 23:59pm. The reason for this, is possibly due to there being a very low level of traffic during the early mornings and late evenings. As a result, there is less impediment to speed, resulting in some drivers exceeding the speed limit. While it would be expected that drivers would tend to be more cautious during low light conditions, they may more likely travel at faster speeds if they feel that they have adequate visibility of what's ahead of them. As station MILL-02 was situated on a section of the B3247 which only a single vehicle could travel down, along with a bend further eastbound of the station with inadequate forward visibility, it may be the reason why all the average

speeds taken at MILL-02 in both directions were all below the 20mph speed limit throughout all the times recorded.

By looking through the recorded results for the daily mean and 85%ile speeds throughout stations MILL-01, MILL-02 and MILL-03 (Figure 41, Figure 45 and Figure 49 respectively); the mean speed throughout station MILL-01 was slightly over the speed limit of 20mph. The highest mean speed taken was on the Tuesday (12/04/2022) at 22.3mph in the westbound direction, whereas the lowest mean speed taken was on the Sunday (17/04/2022) at 21.7mph in the westbound direction. In contrast to this, all mean speeds taken in the eastbound direction through the 7-days at MILL-01 were all below 20mph, where the highest mean speed taken was on the Wednesday (13/04/2022) at 18.3mph. Compared to MILL-01, throughout the same 7-days, MILL-02 and MILL-03 did not have a mean speed in either the eastbound or westbound that exceeded 20mph, which is possibly due to reasons that were earlier mentioned in this section when analysing the average speed.

For the recorded 85%ile speeds that were taken throughout the 7-days, it can be seen in Figure 41 that at station MILL-01, the highest 85%ile speed was 26.7mph, which was recorded on the Wednesday (13/04/2022) in the westbound direction. In comparison, the highest 85%ile speed in the eastbound direction was 22.3mph and was recorded on the Friday (15/04/2022). It can also be seen in Figure 41 that across the 7-days at station MILL-01; both the mean speeds and the 85%ile speeds are all higher in the westbound direction compared to the eastbound direction. The possible explanation for this, is related to the geometry of the road through this section of the B3247. In the westbound direction, the road is straight, which usually can cause drivers to accelerate. The width of the road also appears to be adequate for two vehicles to pass each other, without causing drivers to slow due to caution. West of station MILL-01, there is a chicane located within the eastbound carriageway to slow down traffic. Westbound traffic has priority (indicated by a sign to diagram 881A), and therefore may not cause traffic that's travelling westbound to slow down. However, as traffic on the eastbound needs to give way at the chicane to westbound traffic, vehicles heading eastbound would either slow down or stop to give way to oncoming westbound traffic. In addition, the road further up on the eastbound also narrows, where even though there appears to be space for two cars to pass, there may not be enough space for two larger and wider vehicles to pass each other. As a result, vehicles may decelerate or come to a complete stop to give way to oncoming traffic. In additional to this, the slight curvatures, proximity of the structures to the road and poor forward visibility may also cause eastbound traffic to slow down.

Compared to the 85%ile speed data that was recorded at station MILL-01, station MILL-02 and MILL-03 had a similar recorded 85%ile speed throughout the 7-days in both the westbound and eastbound direction. The most likely reasons for this are the road geometry and forward visibility at both stations, which has been previously discussed earlier in this chapter.

5.4.3 Overall Usage

By looking at the breakdown of vehicle classes at stations MILL-01, MILL-02 and MILL-03 in Table 2; most vehicles were cars, as they made up 80%-93% of the traffic across all three stations. Large goods vehicles (LGVs) made up the second highest number of vehicles, making up 5%-15% of the traffic across all three stations. While HGVs were recorded into six separate

categories, combined they made up the second lowest number of vehicles, where they made up 1%-4% of the traffic across all three stations. Buses were found to make up the lowest, where they made up 0.01%-0.06% of the traffic across all three stations. The LGVs and HGVs usage will be analysed in more detail in the following section.

5.4.4 LGV and HGV Usage

As discussed in the previous chapter, HGVs have been recorded into six categories, where this chapter will investigate the number of LGVs and HGVs per category that were recorded at all three stations throughout the 7-days of the ATC.

LGVs:

At station MILL-01 in the eastbound direction (see Table 3), a total of 628 LGVs passed through the station, where the highest number of LGVs passed through the station on the Friday (15/04/2022) at 119 LGVs. In comparison, in the westbound direction (see Table 4), a total of 1008 LGVs passed through the station, where the highest number of 180 LGVs passed through the station on the Tuesday (12/04/2022).

At station MILL-02 in the eastbound direction (see Table 5), a total of 1454 LGVs passed through the station, where the highest number of LGVs passed through the station on the Tuesday (12/04/2022) at 276 LGVs. In comparison, in the westbound direction (see Table 6), a total of 1196 HGVs passed through the station, where the highest number of 255 LGVs passed through the station on the Tuesday (12/04/2022).

At station MILL-03 in the south-eastbound direction (see Table 7), a total of 1619 LGVs passed through the station, where the highest number of 316 LGVs passed through the station on the Tuesday (12/04/2022). In comparison, in the north-westbound direction (see Table 8), a total of 952 vehicles passed through the station, where the highest number of LGVs passed through the station on Tuesday (12/04/2022) at 158 LGVs.

While it appears that for the most part, the Tuesday (12/04/2022) is the day which saw the most LGVs in both directions, this is not the case for station MILL-01, where instead the Friday (15/04/2022) saw the most traffic in the eastbound direction. Looking into this, where 190 LGVs passed through MILL-02 and 241 LGVs passed through MILL-03 on the same day, only 119 LGVs passed through MILL-01. A possible reason for this, is that LGV drivers have been using an alternative route into Millbrook which bypassed station MILL-01 on the eastbound journey, where the only road available to do this is Radford Lane. There is also a possibility that there are LGVs making a U-turn using the B3247 – Radford Lane junction.

HGVs:

At station MILL-01 in the eastbound direction (see Table 3), the Wednesday (13/04/2022) is the day which saw the most combined HGVs at 30, where when separated by category, there were:

- 22no 2 Axled Rigid HGV

- 5no 3 Axled Rigid HGV
- 0no 4 Axled Rigid HGV
- 1no 3 Axled Articulated HGV
- 0no 4 Axled Articulated HGV
- 2no 5+ Axled Articulated HGV

When looking at the days that saw the most HGVs by category, there were:

- 22no 2 Axled Rigid HGV on Wednesday (13/04/2022)
- 6no 3 Axled Rigid HGV on Tuesday (12/04/2022)
- 1no 4 Axled Rigid HGV on Tuesday (12/04/2022), Friday (15/04/2022) and Saturday (16/04/2022).
- 3no 3 Axled Articulated HGV on Friday (15/04/2022)
- 0no 4 Axled Articulated HGV throughout the 7-days.
- 7no 5+ Axled Articulated HGV on Tuesday (12/04/2022)

At station MILL-01 in the westbound direction (see Table 4), the Wednesday (13/04/2022) is the day which saw the most combined HGVs at 52, where when separated by category, there were:

- 39no 2 Axled Rigid HGV
- 8no 3 Axled Rigid HGV
- 3no 4 Axled Rigid HGV
- 2no 3 Axled Articulated HGV
- 0no 4 Axled Articulated HGV
- 0no 5+ Axled Articulated HGV

When looking at the days that saw the most HGVs by category, there were:

- 41no 2 Axled Rigid HGV on Thursday (14/04/2022)
- 8no 3 Axled Rigid HGV on Tuesday (12/04/2022) and Wednesday (13/04/2022)
- 3no 4 Axled Rigid HGV on Wednesday (13/04/2022)
- 3no 3 Axled Rigid HGV on Tuesday (12/04/2022), Thursday (14/04/2022) and Saturday (16/04/2022).
- 0no 4 Axled Articulated HGV throughout the 7-days.
- 2no 5+ Axled Articulated HGV on Tuesday (12/04/2022)

At station MILL-02 in the eastbound direction (see Table 5), the Wednesday (13/04/2022) is the day which saw the most combined HGVs at 67, where when separated by category, there were:

- 60no 2 Axled Rigid HGV
- 4no 3 Axled Rigid HGV
- 0no 4 Axled Rigid HGV
- 3no 3 Axled Articulated HGV
- 0no 4 Axled Articulated HGV
- 0no 5 Axled Articulated HGV

When looking at the days that saw the most HGVs by category, there were:

- 60no 2 Axled Rigid HGV on Wednesday (13/04/2022)
- 4no 3 Axled Rigid HGV on Wednesday (13/04/2022) and Thursday (14/04/2022)
- 3no 4 Axled Rigid HGV on Saturday (16/04/2022)
- 8no 3 Axled Articulated HGV on Friday (15/04/2022)
- 0no 4 Axled Articulated HGV throughout the 7-days.
- 1no 5+ Articulated HGV on Thursday (14/04/2022), Friday (15/04/2022), Sunday (17/04/2022) and Monday (18/04/2022).

At station MILL-02 in the westbound direction (see Table 6), the Wednesday (13/04/2022) is the day which saw the most combined HGVs at 57, where when separated by category, there were:

- 48no 2 Axled Rigid HGV
- 3no 3 Axled Rigid HGV
- 3no 4 Axled Rigid HGV
- 1no 3 Axled Rigid HGV
- 0no 4 Axled Rigid HGV
- 2no 5+ Axled Rigid HGV

When looking at the days that saw the most HGVs by category, there were:

- 48no 2 Axled Rigid HGV on Wednesday (13/04/2022)
- 3no 3 Axled Rigid HGV on Wednesday (13/04/2022)
- 3no 4 Axled Rigid HGV on Wednesday (13/04/2022) and Sunday (13/04/2022)
- 6no 3 Axled Articulated HGV on Saturday (16/04/2022)
- 0no 4 Axled Articulated HGV throughout the 7-days
- 5no 5+ Axled Articulated HGV on Sunday (17/04/2022)

At station MILL-03 in the south-east direction (see Table 7), the Wednesday (13/04/2022) and Thursday were both days which saw the most combined HGVs at 63, where when separated by category for Wednesday, there were:

- 55no 2 Axled Rigid HGV
- 7no 3 Axled Rigid HGV
- 0no 4 Axled Rigid HGV
- 1no 3 Axled Articulated HGV
- 0no 4 Axled Articulated HGV
- 0no 5+ Axled Articulated HGV

For the Thursday:

- 50no 2 Axled Rigid HGV
- 8no 3 Axled Rigid HGV
- 0no 4 Axled Rigid HGV
- 5no 3 Axled Articulated HGV
- 0no 4 Axled Articulated HGV
- 0no 5+ Axled Articulated HGV

When looking at the days that saw the most HGVs by category, there were:

- 55no 2 Axled Rigid HGV on Wednesday (13/04/2022)
- 8no 3 Axled Rigid HGV on Thursday (14/04/2022)
- 1no 4 Axled Rigid HGV on Friday (15/04/2022)
- 5no 3 Axled Articulated HGV on Thursday (14/04/2022) and Friday (15/04/2022)
- 1no 4 Axled Articulated HGV on Sunday (17/04/2022)
- 1no 5+ Axled Articulated HGV on Sunday (17/04/2022)

At station MILL-03 in the north-west direction (see Table 8), the Wednesday (13/04/2022) and Thursday were both days which saw the most combined HGVs at 55, where when separated by category for Wednesday, there were:

- 45no 2 Axled Rigid HGV
- 6no 3 Axled Rigid HGV
- 0no 4 Axled Rigid HGV
- 4no 3 Axled Articulated HGV
- 0no 4 Axled Articulated HGV
- 0no 5+ Articulated HGV

When looking at the days that saw the most HGVs by category, there were:

- 45no 2 Axled Rigid HGV on Wednesday (13/04/2022)
- 6no 3 Axled Rigid HGV on Wednesday (13/04/2022) and Thursday (14/04/2022)
- 1no 4 Axled Rigid HGV on Tuesday (12/04/2022)
- 4no 3 Axled Articulated HGV on Wednesday (13/04/2022)
- 0no 4 Axled Articulated HGV throughout the 7-days
- 1no 5+ Axled Articulated HGV on Sunday (17/04/2022)

- Throughout all 3 stations, Wednesday (13/04/2022) saw the most HGV traffic in both directions, where MILL-03 saw the same number of HGV traffic heading in the north-westbound direction on the Thursday, as well as on the Wednesday. It would be likely expected that most HGV traffic would occur on the same day across all three stations, as there are no other suitable routes for HGVs to turn off at between the stations, other than Radford Lane, as they would likely not be suitable for most of the HGVs to use.
- Where there appears to be a smaller difference between the number of HGVs heading eastbound from between MILL-02 and MILL-03 on the same days, there is a large difference between the number of HGVs heading eastbound from between MILL-01 and MILL-02 under the same circumstances. While there is an increase in all types of HGVs at station MILL-02 compared to MILL-01, the largest increase is from 2 axled rigid HGVs. A possible explanation for this is one made previously in this section, where there are HGVs heading eastbound into Millbrook from Radford Lane, which bypasses station MILL-01. Another possible reason is that there are HGVs making U-turns at the junction with Radford Lane, as the driver may see the vehicle may not be able to navigate through the section where station MILL-02 is located.
- While being smaller compared than the previous example, there is also a difference between the number of HGVs heading westbound from station MILL-03 to MILL-02 where again, the largest increase at station MILL-02 is from 2 axled rigid HGVs. The possible reason for this is that HGVs are entering the B3247 from West Street, therefore bypassing station MILL-03.
- The points above assume the data collected through the ATC surveys is accurate. Discrepancies in the data may be causing slight differences in results between the stations. This is analysed further in the 'Vehicle Types' subsection of Chapter 6.4.

6 Camera Survey

6.1 Introduction

A camera survey was carried out on the junction which joins West Street to the B3247. The purpose of this survey is to establish a visual monitor on traffic use and behaviour, where the movement of vehicles and vehicle type across the junction will be analysed.

6.2 Methodology

A camera survey operating for 24 hours a day for 7 days was undertaken at the B3247 – West Street junction (see Figure 50 and Table 9) during the same period which the ATC survey was conducted. Similarly, to the ATC, the study was carried out in the 2022 Easter School Holidays to ensure it covers a particularly busy seasonal period of the calendar year and covers a potential worst-case scenario. It is also important to consider that Friday 15th April and Monday 18th April were bank holidays, and therefore may have experienced higher traffic levels than usual.

Figure 50 Camera Survey Location

Survey ID	Location	Survey Type	Grid Reference
MILL-04	Located on the north-east corner of the West Street – B3247 junction.	CCTV Survey	E: 50.346160 N: - 4.222497

Table 9 Location of Camera Survey

6.3 Results

All figures in this section are screen captures of various points in the camera survey footage which are of interest. The following figures present instances of interaction between the B3247 eastbound and westbound traffic.

Figure 51 Westbound Car Interaction

Figure 52 Westbound HGV Interaction 1

Figure 53 Westbound HGV Interaction 2

Figure 54 Westbound HGV Interaction 3

Figure 55 Eastbound HGV Interaction 1

Figure 56 Eastbound Coach Interaction 1

The following figures present instances of vehicles driving over the virtual footway on the B3247 West Street in both directions.

Figure 57 Eastbound Car Driving Over Virtual Footway

Figure 58 Westbound Refuge Vehicle Driving Over Virtual Footway

Figure 59 Westbound 2 Axled Rigid HGV Driving Over Virtual Footway

The following figures present examples of a vehicle doing the U-Turn and another unloading at the B3247 and West Street junction.

Figure 60 2 Axled Rigid HGV doing a U-Turn at the B3247 – West Street Junction

Figure 61 2 Axled Rigid HGV Unloading at the B3247 - West Street Junction

The following figures present examples of vehicle types travelling across the B3247 – West Street junction during the duration of the camera survey.

Figure 62 Car Towing a 2 Axled Trailer

Figure 63 LGV Towing a 1 Axled Trailer

Figure 64 Camper Van

Figure 65 Telehandler

Figure 66 Tractor Towing 2 Axled Flatbed Trailer

6.4 Analysis

Vehicle Behaviour

By reviewing the figures relating to the interactions between vehicles at the junction, it appears to further support the issue regarding poor visibility on both the eastbound and westbound B3247 approaches, where vehicles are seen to come face on with vehicles travelling in the opposite direction. An example is presented in Figure 51, where a vehicle heading westbound comes face on with a vehicle travelling eastbound at the opening of the bend. The most common reaction observed in the camera survey during this scenario was the same as those found during the on-site observations, where the westbound vehicles were stopping and reversing back around the bend to allow the eastbound vehicles to pass. While this appears to be the only suitable outcome, it may lead to another scenario where the westbound vehicle is at risk of colliding with another vehicle that's approaching from behind, where the driver may not have observed the manoeuvre, either possibly due to poor forward visibility around the bend or from a late reaction.

Similarly, the same issue can be observed with longer vehicles (i.e. HGVs), however the figures appear to show an even greater issue. By looking at Figure 52, Figure 53, Figure 54, Figure 55 and Figure 56; it can be seen that longer vehicles require a larger turning radius to manoeuvre around the bend in both directions. In the case of the westbound examples in Figure 52, Figure 53 and Figure 54; it can be seen that all these vehicles travel to the centre or offside of the carriageway to perform the turn. While this appears to be necessary for these vehicle types, it can create a dangerous and obstructive scenario, where eastbound vehicles approaching the bend not only come head on but may also have little to no room to evade a possible collision. Where the driver of the long vehicles may acknowledge the eastbound vehicle, there is possibly little room for the long vehicle to reverse or for the eastbound vehicle to pass. This either appears to result in the eastbound vehicles manoeuvring around the long vehicle on the offside (as shown in Figure 52) or using the West Street arm of the junction (as shown in Figure 53), as well as potentially mounting the footway.

Where long vehicles approach the junction eastbound, both Figure 55 and Figure 56 show examples of westbound vehicles having to reverse back up the B3247 to provide space for the long vehicles to turn. Figure 55 shows an example of a westbound car reversing and mounting the footway to allow the HGV to pass. Figure 56 shows the westbound cars reversing and the coach mounting the footway to complete the turn.

Overall, all these cases suggest that there is poor visibility at the junction, as well as inadequate space for larger vehicles to safely manoeuvre. For cases where vehicles must mount the footway, not only could it possibly put pedestrians at risk, but it may also obstruct their path of travel, which is already very limited in the area.

Expanding on the safety of pedestrians, Figure 57, Figure 58 and Figure 59 show examples of vehicles overrunning the virtual footway. While it could be argued that the overrun shown by the car in Figure 57 could have been mitigated by the driver; Figure 58 and Figure 59 show overrun on both sides of the vehicles, indicating an unavoidable scenario for certain vehicle

types. It could be suggested that any overrun of any extent could put pedestrians at risk. Not only is it observed that the virtual footways on both sides of the road are narrow in this section; the properties front accesses on both sides of the road lead straight onto the virtual footway, where residents or visitors leaving the properties may immediately find themselves in the path of an oncoming vehicle. Both parties would have very little time to react to this situation.

Figure 60 shows an example of a vehicle doing a U-turn at the junction, using the West Street arm to turn into. While a driver of the vehicle may have sight of a vehicle waiting at the West Street arm, it is observed that there is inadequate visibility to see vehicles approaching the junction further up West Street. This may risk a collision with the vehicle pulling in to make the U-turn, as the vehicle may likely overrun the give-way line to have enough space to make the manoeuvre.

Figure 61 shows an example of a vehicle unloading on the corner of the junction. While it is known that the 'Bar Tusker' business is located on the junction, the stationary vehicle may result in further reduction in visibility. In the case of Figure 61, the westbound visibility of vehicles entering the junction via the West Street arm is affected, as well as reducing space for larger vehicles to manoeuvre around the bend and obstructing pedestrians' path of travel.

Vehicle Types

While the previous figures present examples of some vehicle types that have been observed to use the B3247;
Figure 62, Figure 63, Figure 64, Figure 65 and Figure 66 present additional examples. Figure 62 presents a car towing a 1 axled trailer, where in the ATC data, it is suggested that this vehicle may have been categorised as an 'LGV' and not a 'Car'. Figure 63 presents a similar situation, where in the ATC data, it is suggested from the survey that this vehicle was categorised as a '3 Axled Articulated' vehicle and not an 'LGV'. As there were various other examples of this captured, it is important to consider that the camera survey appears to highlight inconsistencies within the ATC data, where there are vehicles that may have been categorised incorrectly, and therefore may have resulted in an added increase or reduction in vehicle types throughout the different times and days.

Figure 64 indicates an observed example of possible usage by tourists or residents, who are either traveling to or through Millbrook to reach other destinations.

Figure 65 indicates an observed example of usage by either the agriculture or construction industry in the area, where Figure 66 indicates usage by the agricultural industry who are possibly local farmers who operate in the area and use the B3247 through Millbrook.

7 Option Study

7.1 Introduction

Despite the number of HGVs running through West Street being relatively low, they nevertheless cause issues to surrounding private properties and generate an unsafe situation for pedestrians. In Chapter 7.2, options are proposed with varying levels of effectiveness to eliminate or mitigate key issues previously expanded upon in the report. Chapter 7.3 then summarises these options and provides high-level indicative costings for each viable option.

7.2 Options Assessment

7.2.1 Construction of New Road Suitable for HGVs

The physical constraint of properties on West Street has previously shown to be an underlying cause of issues. The existing narrow roads and the need of space for NMUs make the B3247 in Millbrook unsuitable for HGV circulation. This option proposes the construction of a new road or bypass which is fit for purpose for HGV usage, serving as an alternative route.

It will eliminate the hazards currently caused by HGVs in the area, and therefore likely solve the issues of property and pedestrian strikes. It will likely be a long-term plan to divert a large amount of through traffic, therefore it could drastically reduce both the HGVs and general traffic that passes through Millbrook. This in turn could increase NMU safety in Millbrook and may allow for future implementation of urban spaces, such as a shared road space, which could improve NMU safety and further reduce motorised traffic. Construction of a new road would also need to abide by current highway design standards and regulations, and therefore should provide a safer and fit for purpose route for all vehicles.

This solution will be very costly, as it proposes the design and construction of large-scale highway works which will require CPOs / land purchases and a long bridge structure. In addition, by creating an easier route for HGVs to access, it may encourage additional HGV movements in the area. Compared to all the other options, this option has the largest negative impact on the environment. Firstly, due to the characteristics of the surrounding terrain, large amounts of earthworks would be required, which would not only have a large effect on the local environment and ecology, also it would also output a large level of carbon emissions. The new road would most likely have to be built on land previously used for agricultural purposes, as well pass-through various hedgerows, where the result would have a negative impact on the local natural habitats. Due to the scale of the project, large quantities of heavy construction vehicles would be required which may not only have a negative impact on the surrounding environment, but also cause disruption and congestion on the surrounding roads. Any negative impacts on biodiversity will need to be offset elsewhere with biodiversity net gain. This option would take a long time to implement, so this is viewed as a long-term solution.

7.2.2 Diversion of HGVs to Alternative Routes

As discussed, the existing road layout is not suitable for HGV circulation and turning. A diversion of HGVs to alternative routes could be an ideal option as no construction works would be needed. However, as proven in the section "HGV's Restrictions in the Area", there is not a feasible diversion route for the HGVs, as adjacent roads are also not suitable.

As the solution requires the diversion of HGVs away from Millbrook, it is possible that this improves NMU safety along West Street. It could be a low-cost solution to implement, as it only requires the implementation of signage and development of a legal traffic regulation order.

However, it has been highlighted in this report that there appear to be no viable alternative routes that could be used for re-routing the HGVs. This measure is therefore deemed not to be feasible.

7.2.3 Long Vehicle Restrictions

A Traffic Regulation Order (TRO) restricting the longest vehicles from using West Street, if adhered to and/or enforced, would reduce the use of West Street by long HGVs. It is suggested that a length restriction for 16.5m long HGVs is consulted, and to not restrict local agriculture usage, a supplementary plate "Except for access" should also be used alongside the length restriction (with an example of signage shown in
Figure 67, in accordance with TSRGD Schedule 12, Part 20, Item 33 and Schedule 3, Part 3, Item 15). This is due to the long HGVs being the main cause of property damage due to their large turning radiuses as evidenced from the vehicle tracking and damage reports.

Figure 67 Example of Sign used for 16.5m Length Restriction

This solution may address the property damage caused by HGV of these types turning at the B3247 – West Street junction, as well as improve the safety of NMUs. The solution itself may also be low cost, as it would only require the implementation of the relevant signage and the development of a legal order (TRO).

As it's an option that only applies to HGVs and makes no physical improvements to the existing road conditions, issues relating to visibility and road width would remain. Also, because the

option would restrict larger HGVs from going through Millbrook, HGV traffic could be diverted to other routes such as Military Road. This is an undesirable outcome for Military Road as well as other surrounding roads, as they are also unsuitable for HGVs. For this reason, it may be appropriate to also apply the restriction to Military Road, as well as to Radford Lane. Overall, this may result in no usable route for long HGVs to reach destinations in Millbrook and south of Millbrook, and therefore may have a negative financial impact on local businesses. Businesses affected by the restriction would either have to use a longer route around Millbrook, or downsize the HGVs used to comply with the restriction. Therefore, such a proposal would require extensive local engagement and consultation to fully understand the impacts to local residents, businesses and industry before an informed decision could be made.

7.2.4 Physical Restrictions

Infrastructure changes such as build outs or chicanes could be used to narrow the existing layout, reduce the speed of vehicles and limit HGV access. Speed tables or speed cushions could also be used to reduce the speed of vehicles.

Limiting HGV access could lower HGV usage, which in turn may reduce traffic in Millbrook. It may also result in reducing the occurrence of property damage and strikes to pedestrians. As the use of buildouts or chicanes generally cause vehicles to slow down, it may also reduce the overall speed of vehicles through the section, which may improve response time and increase the caution of drivers.

This solution itself could be of medium cost and may not stop HGVs from using the route, which therefore would not eliminate issues and may also cause issues for local agricultural operations. In addition, as the area is already narrow in parts, with not much room to manoeuvre, implementing build outs or chicanes may exacerbate the issues and cause additional problems with oncoming traffic. As a result, the potential obstacles created by this solution may require increased awareness from drivers in the area. Therefore, the use of advanced signage could be implemented. Also, if this solution resulted in forcing HGVs to use other unsuitable routes, it could expand the issues to other locations. Frequent overrunning of the kerbed chicanes or buildouts could lead to future maintenance issues and ongoing cost of remedial work.

While the implementation of speed tables or cushions may reduce the speed of vehicles, the data from the traffic survey indicates that most vehicles already travel below the speed limit. Therefore, it would be expected that the use of speed tables or cushions would have little to no effect on the current speed of vehicles. The use of speed tables or cushions may also cause ponding or divert surface water towards properties. Although additional surface water drainage systems could be implemented to prevent flooding issues, the associated costs would increase. Noise would also be generated by vehicles that travel over the speed tables or cushions, which may negatively affect the occupants of the surrounding properties.

7.2.5 Use of Smaller HGVs by Businesses

This solution proposes a discussion to take place with both stakeholders and local businesses, that discuss and agree on the reduction of HGV sizes currently used by businesses in the area.

The solution could be implemented as a medium or long-term solution for HGVs and is a medium cost solution. Also, if there were to be a reduction in the use of larger HGVs from arrangements made with businesses, this option may reduce the occurrence of strike incidents involving HGVs and reduce the environmental impact of HGVs in the area.

On the other hand, because it's an option that only applies to HGVs and makes no physical improvements to the existing road conditions, issues relating to visibility and road width would remain. This solution would also require the facilitation of discussions and negotiations with local businesses and stakeholders, where some may not agree to take part. As there is no legally binding arrangement, the effectiveness of this option would also depend on the good faith of businesses and stakeholders to follow any arrangement made. The cost would be incurred by local businesses who may not be willing or able to afford to downsize their vehicle fleet, meaning such a proposal is likely to be ineffective in the short to medium term.

7.2.6 Delivery and Servicing Plan (DSP)

Develop a DSP to provide a basis for managing the nature of freight movements to a particular site (or area) to reduce or re-time the number of vehicle trips generated.

This solution could be implemented as a medium to long-term solution for managing HGV movements and is a medium cost solution to implement. As the purpose of the DSP is to reduce the number of larger HGVs using smaller vehicles. This may reduce the overall HGV traffic from travelling through Millbrook, which could reduce the occurrences of incidents involving HGVs and lessen the environmental impact.

On the other hand, similarly to the previous solution, because it's an option that only applies to HGVs and makes no physical improvements to the existing road conditions, issues relating to visibility and road width would remain. In addition, there is no enforcement of this option, therefore its effectiveness depends on the good faith of businesses and stakeholders to follow any DSP plans. On the other hand, unlike the previous solution, the nature of a DSP may create a level of uncertainty on the effectiveness, as it could be the case that there is no alternative on larger HGVs from being used for certain trips.

7.2.7 Intelligent Traffic Systems (ITS)

Intelligent Traffic Systems (ITS) with warning signals at either side of West Street and the junction with the B3247, which are triggered when a vehicle over a certain weight or number of axles travels over a sensor.

The benefit of this solution is warning general traffic and even pedestrians of heavy or long vehicles approaching the narrow street, therefore mitigating the vehicle conflict with them. It would also provide HGVs with an uninterrupted path through West Street, potentially reducing

the occurrence of incidents. However, if these systems are only configured to heavy vehicles or number of axles, it would not solve general traffic conflicts on West Street.

This option should be relatively low cost to implement. Due to the option not limiting any HGV usage or make any physical changes to the bend at the B3247 – West Street junction, it is likely that damage to properties will continue. No physical changes are to be made to the virtual footways, therefore NMU safety is likely to still be an issue. There is also a possibility that motorists won't comply with the signals due to not being formal or enforceable. Due to the site constraint of the road being narrow for a large distance up Hounster Hill and having to position the warning lights far from the junction, it is likely that there will be occasions that queuing traffic will obstruct westbound vehicles. Therefore, this option has been deemed not to be a viable solution.

7.2.8 Wig-Wag Warning Lights with a Detector

ITS measures could however be used to fully mitigate all vehicle conflicts on West Street through implementing Wig-Wag flashing warning lights positioned on the northbound approach to the B3247 - West Street junction. These would be similar to warning light systems used for level crossings. A detector could be placed on Hounster Hill, prior to the narrow section, and any motorised vehicles passing over it would trigger warning lights or a Variable Message Sign (VMS) on the B3247 alerting drivers to stop at a give-way marking. Signage and lining to support the measure would also need to be implemented, possibly the relocating the existing yellow box to the centre of the junction ahead of the give way lines. See Figure 68 for examples of Wig-Wag lights and Figure 69 for a potential location on the nearside pavement (setback 450mm) adjacent to give way markings.

Figure 68 Examples of Wig-Wag Warning Lights

Figure 69 Example Location for Wig-Wag Lights and Give Way Markings

This solution should be relatively low cost to implement. Due to the option not limiting any HGV usage or make any physical changes to the bend at the B3247 – West Street junction, it is likely that damage to properties will continue. No physical changes are to be made to the virtual footway sections, therefore NMU safety is likely to still be an issue. There is also a possibility that motorists won't comply with the signals due to not being formal or enforceable.

The use of signals may result in queues. Due to the B3247 being narrow further south, there is a possibility of vehicles obstructing oncoming traffic if detectors pick up constant flows, therefore creating congestion and conflict. Road markings could be used in this short narrow section on the B3247 to keep it clear and it is anticipated that if properly implemented, this measure is viable and will significantly improve the current situation. Due to the site constraint of the road being narrow for a large distance up Hounster Hill, as discussed in the previous option, positioning warning lights on Hounster Hill is not a viable solution due to the distance from the junction the lights would need to be positioned and the likelihood of queuing vehicles obstructing westbound vehicle movements.

Authorisation will be required for the potential use of wig wag signals.

7.2.9 Standard Signalized Junction

This option proposes demand dependant 3-way traffic signals at either side of West Street and the junction with the B3247 and on the one-way section of West Street.

The prevention of traffic from approaching head on with other vehicles in the narrow sections could potentially eliminate conflict by alternating priority for traffic in either direction. By

potentially eliminating conflict, it could also provide HGVs with a clear path along the B3247 through Millbrook.

Implementation if traffic signals is a medium cost option. The use of signals would require adequate stacking capacity to allow for vehicles to queue at the lights. This could be difficult, as the B3247 throughout Millbrook is narrow and may not allow the clearance for two-way traffic to safely pass one another. Therefore, this solution would require an increase in carriageway width in certain locations, which in turn may require a reduction in width of the footway to accommodate. Left as it is, it may result in vehicles obstructing oncoming traffic at the waiting areas, therefore creating congestion and additional traffic conflicts. The signal head location on B3247 Hounster Hill is likely to be a considerable distance from the junction due to the narrow section of B3247 Hounster Hill where it transitions to West Street being too narrow for two-way traffic flow. This would lead to long inter-green times and potentially large queues waiting at the signals, which in turn could lead to compliance issues. Overall, the stacking space issues due to the narrow sections are likely to lead to queues and obstructions to oncoming traffic and therefore make this an unviable option. Such an option would require local traffic modelling to understand potential delays or congestion which may result from signalisation.

7.2.10 Improvement of Existing Highways Features

Cutting back the footway on the right-hand side at the approach from the south could generate more carriageway space. This measure could be combined with guiding road markings and/or coloured surfacing for the HGVs. It would be beneficial to add signals to stop the conflict at West Street narrow section, as well as SLOW road markings to make sure the approach to the junction is as safe as possible.

The physical changes to the bend at the B3247 – West Street may allow for a wider turning radius for HGVs, which may reduce or eliminate issues with property damage on the B3247 – West Street junction. Implementing traffic signals would combine the additional clearance provided for larger vehicles, with the prevention of traffic from approaching head on with other vehicles in the narrow section. This could potentially eliminate conflict and provide a free flow of traffic in each direction while the system is active.

This solution could be a medium cost and while more carriageway space may be created, it still may not be enough to achieve a turning radius that provides adequate clearance away from properties and other features at the junction. Design work for this is required. As this solution proposes the removal of a footway at the B3247 – West Street, it removes a facility that is already absent from most of the area, therefore potentially making it both harder and more dangerous for NMUs to navigate around and down B3247 West Street. As previously discussed in options that propose the use of signals, the use of signals may result in queues, as most of the B3247 is narrow and may result in vehicles obstructing oncoming traffic at the waiting areas, therefore potentially creating both congestion and additional traffic conflicts. The removal of an existing pedestrian footway at a location where pedestrian safety is already of concern is not recommended.

7.2.11 Improvement of Non-Physical Highway Features

As previously mentioned, there is a lack of warning signage in the area, so an upgrade and addition of new signage could help to improve safety in the area. The use of TSRGD compliant signs to enforce the prohibition on the lanes, that have been proven to not be suitable for HGVs may help in improving safety. Even if this is not a direct measure for the narrow section along the B3247 West Street, it may possibly help in reducing future incidents on the surrounding roads. This would require a TRO to be implemented. New hazard signs relating to narrow road, pedestrians in footway and visibility could also be implemented to provide awareness to drivers who are not familiar with the area.

The relocating of the yellow box should also be considered, as it has been observed to not be respected in the current location. The yellow box could be relocated to the centre of the B3247 – West Street junction, where it could be used to prevent traffic from obstructing the path of oncoming traffic on the bend. Auxiliary signage could also be placed to ensure all drivers are aware of the constrained area, such as warning signs and information signs.

The use of a concave road traffic mirror on the B3247 east approach of the B3247 - West Street junction may assist in improving the visibility of oncoming eastbound traffic and pedestrians around the bend, which should allow vehicles who are approaching the bend from the east to stop and give way to oncoming traffic. Therefore, it reduces the likelihood of a conflict. A suggested location to install a road traffic mirror is on an existing lighting column located directly in front of the oncoming westbound traffic on the B3247 who are approaching the bend (where location is shown indicatively in Figure 70)

Figure 70 Suggested Location of Road Traffic Mirror on westbound B3247 approach to West Street Junction on Existing Lighting Column

Although it is acknowledged that there are a number of mirrors located on private land, this option is not supported by Cornwall Council, who do not approve the use of such mirror on the public highway for the reasons below:

- Reflecting light and interfering with a driver's vision
- Reducing the ability to judge an oncoming vehicle's speed
- Creating an unreasonable dependence on the mirror
- If dirty, distorting or restricting the view
- Being an easy target for vandals.

There has been evidence in the camera survey of eastbound vehicles cutting the bend at the B3247 – West Street junction, into the path of oncoming eastbound traffic. A centre line on the bend may provide better guidance for drivers to navigate, which may help in preventing a potential incident.

The use of reflective features along the B3247 West Street could help in highlighting features and obstacles to drivers in low light conditions. For example, the use of reflective strips on both the corners and carriageway-facing side of the structures located along the B3247 West Street could improve the visibility of the obstacles to drivers and allow for improved guidance through this section.

If improvements were to be made to the current signage, including the potential addition of more hazard signs, drivers could possibly be made more aware of the hazards along the B3247 through Millbrook, and therefore behave more cautiously. Also, the addition of a concave road traffic mirror at the B3247 – West Street junction, may improve the driver's visibility around the bend of oncoming traffic. The camera survey identified instances of eastbound vehicles cutting the bend at the B3247 – West Street junction and approaching head on with oncoming westbound traffic. Therefore, adding a new carriageway centre marking to the bend at the junction may also make drivers, especially those who may be new to the area, aware of the presence of a two-way road. Although the solutions proposed by this option may only make small improvements to the current situation, it is one of the lowest cost options and potentially easier to implement, therefore it could complement other options.

On the other hand, as this option provides no actions that affect HGV circulation, especially the property damage caused by turning problems at the B3247 – West Street junction; the current issues will likely remain. Furthermore, the use of reflective strips on structures could be visually obtrusive to residents. The maintenance of road traffic mirrors can be an issue, as it is possible for the mirror to be affected by spray or dirt from the carriageway, condensation, accidental damage or vandalism.

7.2.12 Removing Property and Improving the B3247 – West Street Junction

By removing property, it would create extra land that could be used to make geometric improvements to the B3247 – West Street junction.

Obtaining land from property could allow for more longer lasting changes to be made to the junction, which could be used to alleviate the existing safety issues. It could also be implemented as a long-term option and would allow for more physical improvements to be made to the existing layout, that could improve the turning radius of HGVs, therefore possibly reducing, or eliminating the issue of property damage at this location. This solution may also allow for a form of greenspace/landscaping to be implemented into the design, which could bring benefits to the surrounding environment.

This option could be costly, as it would require a CPO for property, where removal could be unpopular with local residents due to loss of local housing stock, aesthetic impacts and loss of heritage. As this option does not restrict HGVs from passing through the section with the virtual footways, issues relating to NMU safety would likely remain. As this solution would

require an existing building to be demolished in a very built-up area, construction traffic may cause disruption. Works on the site may also cause disruption to one of the only main roads that provides passage to the south of the Rame Peninsula, therefore potentially resulting in disruption to local business operations. Overall, while this option may open up the junction to improvements without compromising the space for NMUs; the methods of removing property make this option rather undesirable, and therefore may not be suitable at this time.

7.2.13 Diversion of General Traffic Around Millbrook using Military Road

The use of these locations on the directional signs located at the B3247 – Military Road junction could help in diverting traffic away from Millbrook by using Military Road (See Figure 71), which may result in a reduction to the general traffic heading through Millbrook. It is also a potential low-cost measure to implement, as it would only require the design and implementation of signage.

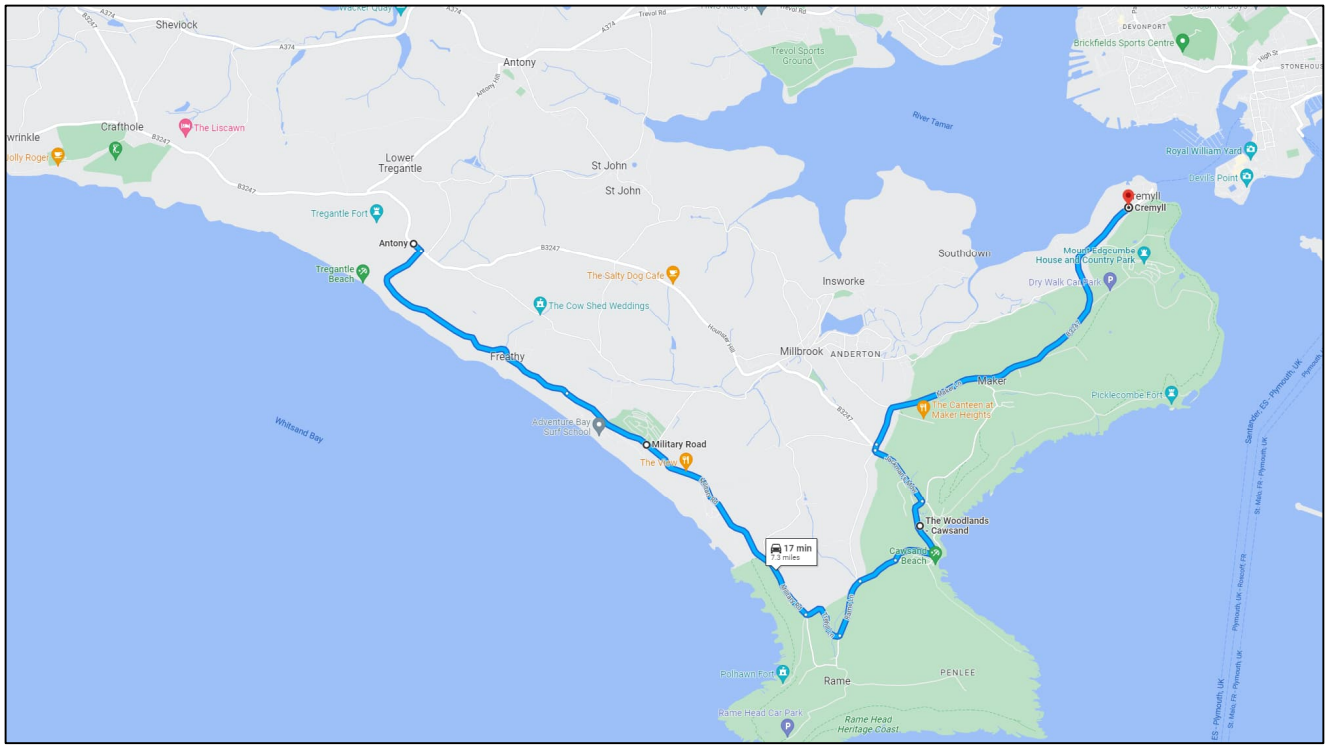


Figure 71 Diversion of Traffic along Military Road (Google Maps 2022)

However, as Military Road is unsuitable for large HGVs, the B3247 through Millbrook would still be the main route for these vehicles and would therefore have little to no impact on the issues that currently exist. This could also lead to displacement of safety issues to surrounding roads. There are also reports of subsidence along Military Road. It is likely that an increase in load from HGV traffic will increase the rate of subsidence, potentially leading to damage to both the carriageway and surrounding structures.

7.2.14 One Way System Using West Street Car Park (Wells Court), West Street, Fore Street and St Andrews Street

This option proposes the use of West Street Car Park (Wells Court), West Street, Fore Street and St Andrews Street (see Figure 72) as a one-way route for B3247 northbound traffic. The B3247 southbound traffic would use Hounster Hill and West Street. The northbound route aims to divert HGVs and general traffic to use a separate route that significantly reduces the conflict with the B3247 southbound traffic.

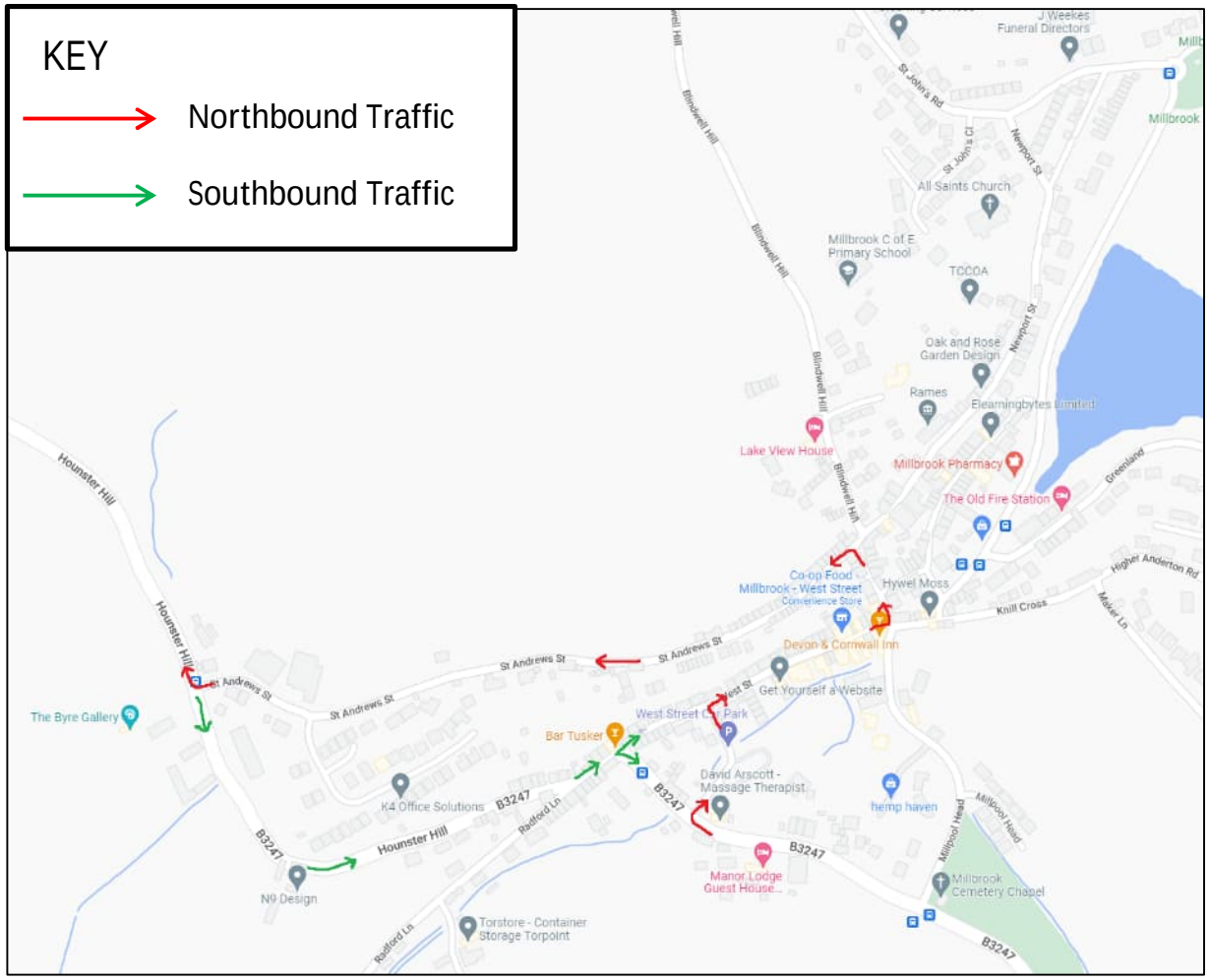


Figure 72 Proposed Direction of One-Way System (Google Maps 2022)

There are multiple constraints that have been identified throughout the proposed route:

- The bridge located at the north of West Street Car Park along Wells Court (see Figure 73) has been identified to be unsuitable for HGVs and would therefore require an upgrade to make it suitable, which would significantly increase the cost of this option.
- West Street contains various commercial businesses (including shops and pubs) and residential properties. Therefore, diverting more traffic down this street may increase the conflicts with NMUs and create traffic congestion.
- The turning from West Street into Fore Street (see Figure 74) is observed to be very sharp and narrow, which may cause HGVs to strike the surrounding structures while making the

turn. There is also poor visibility and no footway on the bend into Fore Street, which may result in conflicts with NMUs who are leaving or approaching the bend.

- There is a Pre School located along Fore Street (Millbrook Pre School), where increasing the traffic may result in an increase in conflict with NMUs and create traffic congestion.
- The turning from Fore Street into St Andrews Street (see Figure 75) is very sharp and narrow. There is also no footway present at the beginning of St Andrew Street. Therefore, similarly to the West Street to Fore Street bend, there is a chance for HGVs to strike the surrounding structures while making the turn. Also similarly, there is poor visibility around the bend into St Andrews Street, where along with no footway, may result in conflicts with NMUs who are leaving or approaching the bend.
- St Andrews Street (see Figure 76) is narrow with no footway in multiple sections along the road, which may result in a conflict with NMUs along the road and those entering/leaving properties.

Figure 73 Bridge at Wells Court (Google Maps 2022)

Figure 74 West Street – Fore Street Junction (Google Maps 2022)

Figure 75 Fore Street – St Andrew Street Junction (Google Maps 2022)

Figure 76 St Andrew Street (Google Maps 2022)

The use of Millpool Head to reach Fore Street (see Figure 77) has also been investigated and while it does bypass the use of the bridge on Wells Court, the vehicle movement that's required to reach Fore Street contains issues with visibility and vehicle clearance. This is likely to result in conflicts with NMUs and vehicle strikes to the surrounding structures.

Figure 77 Millpool Head to Fore Street (Google Maps 2022)

In addition, the two other roads which connect to St Andrews Street, Newport Street and Blindwell Hill have been investigated into their suitability for HGVs. Both of these roads are unsuitable due to space constraints and them being too narrow for HGV traffic with residential properties either side of the carriageway. Blindwell Hill also has a steep gradient, a tight turning onto Newport Street and stone walls either side of the road.

7.2.15 Shared Road Space at B3247 - West Street Junction

A level surface (a type of shared road space) could be implemented using imprinted bitumen (see Figure 78) and granite flagstones to mark out the extents of the area. The texture and visual effect may help to reduce the speed of vehicles and make motorists more aware of NMUs in the area. The at-grade aspect of the level surface could also help in prioritising NMU movements.

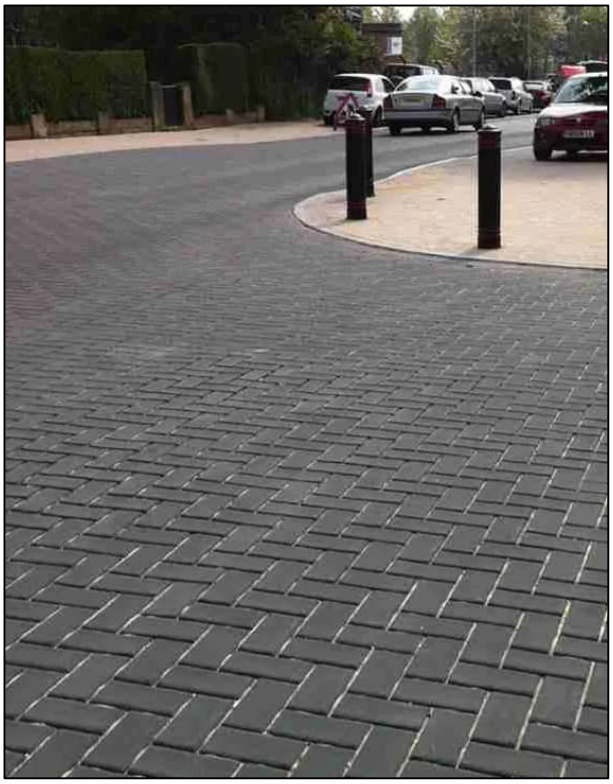


Figure 78 Example of an Imprinted Bitumen Surface (HMS Limited)

While it would be expected that the shared road space may reduce the speed of vehicles, such an area tends to only be effective for large carriageway areas that have high visibility for motorists. The width constraints in Millbrook are therefore not favourable to shared spaces. The shared spaces may provide NMUs with a false sense of security, as it is likely that NMUs would be occupying the same path as vehicles. Combined with the visibility constraints and the B3247 being a main road, a shared road space in this location may increase the likelihood of NMUs being struck by vehicles. It may also create uncertainty for motorists and therefore increase congestion. Due to the B3247 being a main road, the volume of traffic may also cause the surface to suffer wear and tear, which could reduce the lifespan of the materials and incur high costs to maintain.

7.3 Summary of Options

Table 10 presents a detailed summary of each viable option ranking them in order of effectiveness and includes indicative high-level costings (see Appendix B for a breakdown of these costs). The high-level costings provided are estimated capital costs and exclude any external fees for design, consultancy work, land purchase or CPO costs required to develop them further. It should be noted that these high-level costings are indicative estimates based on typical costs of similar schemes/measures to provide the reader with an understanding of the scale of cost for each solution. The costs should not be assumed to be accurate, and AECOM accepts no responsibility for these figures. Further work is required, including producing detailed bill of quantities for each option to increase the accuracy of the figures – work that is not included within the scope of this Feasibility Study.

Rank	Option	Positives	Detriments	High-Level Costing
1	Construction of New Road Suitable for HGVs	• Will likely eliminate property and pedestrian strikes, therefore improving NMU safety. • Long term solution. • Reduce HGV and general traffic through Millbrook thereby reducing congestion. • May allow for future implementation of an urban space to further increase NMU safety and reduce motorised traffic in Millbrook. • Would abide by current regulation on highway design, therefore provide a safer and more fit for purpose route. • Reduce noise and air pollution in Millbrook.	• Expensive. • Large amounts of CPO / land purchases required. • Would create easier access for HGVs and therefore may increase HGV movements in the area. • Has the largest likely impact on the environment and ecology. • Works may cause large and prolonged disruption on surrounding roads. • Would take a long time to implement. • Need a robust business case.	Approx. £36mill to £46mill
2	Wig-Wag Warning Lights with a Detector	• Short-term or long-term solution. • Should solve congestion issues on West Street if adhered to. • Relatively low cost. • Should allow free flow of traffic dependent on demand. • Supplemented by non-physical measures such as lining and signing. • Visible measure which should alert motorists.	• Informal lights; not enforceable and may not be adhered to by motorists. • Queuing vehicles may obstruct eastbound vehicles in the narrow section of the B3247. • Does not solve issues of property strikes or significantly improve pedestrian safety. • Ongoing maintenance and operational costs	Approx. £15k

3	Long Vehicle Restrictions	• Solution requires TRO, to be legally enforced. • Should remove larger HGVs from going through Millbrook, therefore eliminating issues relating to property damage. • May improve safety of NMUs. • Should update drivers' SatNavs informing HGV drivers that they cannot travel down the Rame Peninsular. This may force businesses into using smaller vehicles. • Low cost.	• No physical improvements made to existing road conditions, therefore existing issues relating to visibility and road width would remain. • Could cause an increase in smaller HGVs in order to carry the same load. • Could cause HGVs to use Military Road, which is also unsuitable. • Displacement of safety issues to surrounding roads • Long vehicle restrictions placed at Military Road may result in no usable route for HGVs to reach destinations in Millbrook and south of Millbrook. • Could financially impact businesses by forcing them to downsize HGVs or by taking a longer route.	Approx. £19k
4	Delivery and Servicing Plan (DSP)	• Could be implemented as either a medium or long-term solution. • May consolidate HGV trips and therefore may reduce overall HGV traffic from travelling through Millbrook. • Medium cost, but targets root cause reducing HGVs in the area. • Reduction in HGV trips could reduce the incident frequency. • Reduction in HGV trips could lessen the environmental impact.	• No physical improvements made to existing road conditions, therefore existing issues relating to visibility and road width would remain. • No legal enforcement, so the effectiveness relies on the good faith of businesses. • The nature of a DSP may create levels of uncertainty on the effectiveness, where there may be no alternative to larger HGVs from being used for certain trips.	Approx. £42k
5	Use of Smaller HGVs by Businesses	• Could be implemented as a medium or long-term solution. • Low cost. • Reductions in large HGV usage could reduce the frequency of incidents. • Reductions in large HGVs lessens the environmental impact.	• No physical improvements made to existing road conditions, therefore existing issues relating to visibility and road width would remain. • Requires facilitation of discussions and businesses agreeing to take part. • No legal enforcement, so the effectiveness relies on the good faith of businesses who will incur majority of the cost. • No formal document in place.	Approx. £37k
6	Improvements of Non-Physical Highway Features	• Increases drivers' awareness of the surroundings and potential hazards. • Assists drivers at the junction. • Low cost, easy to implement, and could be combined with other solutions.	• Provides no actions that addresses the property damage caused by larger HGVs. • Use of reflective strips on structures could be visually obtrusive to residents and may be objected to.	Approx. £3k

7	Removing Property and Improving the B3247 – West Street Junction	• Medium to Long-term solution. • Junction improvements could improve turning radius of HGVs and therefore reduce or eliminate the issue of property damage. • Greenspace/landscaping could be implemented into the design.	• Costly. • Would require CPO for obtaining property, where removal could be undesirable to locals. • Does not restrict HGVs from passing through the section with virtual footways, therefore issues relating to NMU safety would likely remain. • Demolition of property and junction works in built up area may negatively affect locals and the surrounding structures with noise, vibration and air pollution. • Cause prolonged disruption affecting road users and local business operations.	Approx. £1.8mill

Table 10 Summary of Options, Rankings of Effectiveness and High-Level Costings

It is important to note that most of the suggested options can be supplemented with one another to increase the overall effectiveness of the solution. For example, while a DSP may be used to reduce larger HGVs using the B3247 through Millbrook, it may not necessarily eliminate the issue with larger HGVs causing damage to property. Therefore, this solution combined with long vehicle restrictions would prove more effective to eliminate these vehicle types from the area.

8 Recommendations

The main recommendation that could best mitigate the issues highlighted in this report in the long-term is the construction of a new road which bypasses Millbrook.

It is expected that this solution could potentially eliminate most through traffic in Millbrook, including both HGV and other general traffic (i.e., Cars and LGVs). This will resolve the issue of HGV strikes to buildings and pedestrians. It could also open the door up to future urban development within Millbrook, where a shared road space could be implemented along West Street and which may be used to bring improvements to safety for NMUs.

On the other hand, as this solution could provide better access for all vehicles, it may also encourage an increase in usage and attract vehicle use, resulting in more pollution. It is also expected that this option could be very costly, as not only could it require several CPOs for land purchase, the varying levels in the area would also mean extensive earthworks may be required. A bridge may also need to be required, as the road may require a passage across the valley which Millbrook is situated in. This option may have a large negative impact on the surrounding environment and ecology, as most of the land take would be existing agricultural land. Various hedgerows may need to be removed for the new road; however, it may be possible to mitigate this impact through biodiversity net gain in the surrounding area, which may involve habitat creation and planting new hedgerows and trees along the proposed road.

The second recommended solution that could best mitigate the issues highlighted in this report in the medium-term, is the creation and implementation of a Delivery Servicing Plan (DSP), accompanied by facilitated discussions with businesses who operate in the area, with the aim to reduce the size and number of HGVs that are used. It is recommended that this solution is combined with the implementation of an HGV length restriction in the area, as well as non-physical improvements to the B3247 through Millbrook.

While there appears to be no evidence from the camera survey that HGVs of length 16.5m pass through the B3247 – West Street junction, other evidence from police reports (example shown in Figure 14), provide instances that such vehicles have passed through Millbrook. Where facilitated discussions may take place, the DSP could be used to form part of the agreement. The result of the DSP may reduce the number of larger HGVs using smaller vehicles, which may result in an overall reduction of larger HGVs in the area, therefore benefitting the environment.

While it would be hoped that businesses would be forthcoming with any concerns, the effectiveness of the plan would mostly be determined by the good faith of the businesses in following any arrangements made. Therefore, frequent discussions, consultation and engagement would be required, as to allow for businesses to express any concerns over any arrangement previously made, allowing for updates to the arrangement that best suit all parties. Over time, this could possibly encourage businesses to continue following the arrangement.

A vehicle length restriction of 16.5m would be a legally enforceable measure to prevent long HGVs from entering Millbrook, therefore possibly eliminating this type of traffic, along with the issues associated with it. However, if the restriction was to only be implemented in Millbrook, it may force these vehicle types to re-route to Military Road which is also unfit for purpose due to narrow lanes with vehicles often parked along the roadside, therefore making this route difficult to navigate. While it may be possible to implement the same vehicle length restriction at this location, it would leave no other usable route for long HGVs, which may cause disruption to local businesses. Alternatively, a DSP could be used to specifically identify special circumstances when Military Road can be used for long vehicles (for example out of holiday season or for special deliveries).

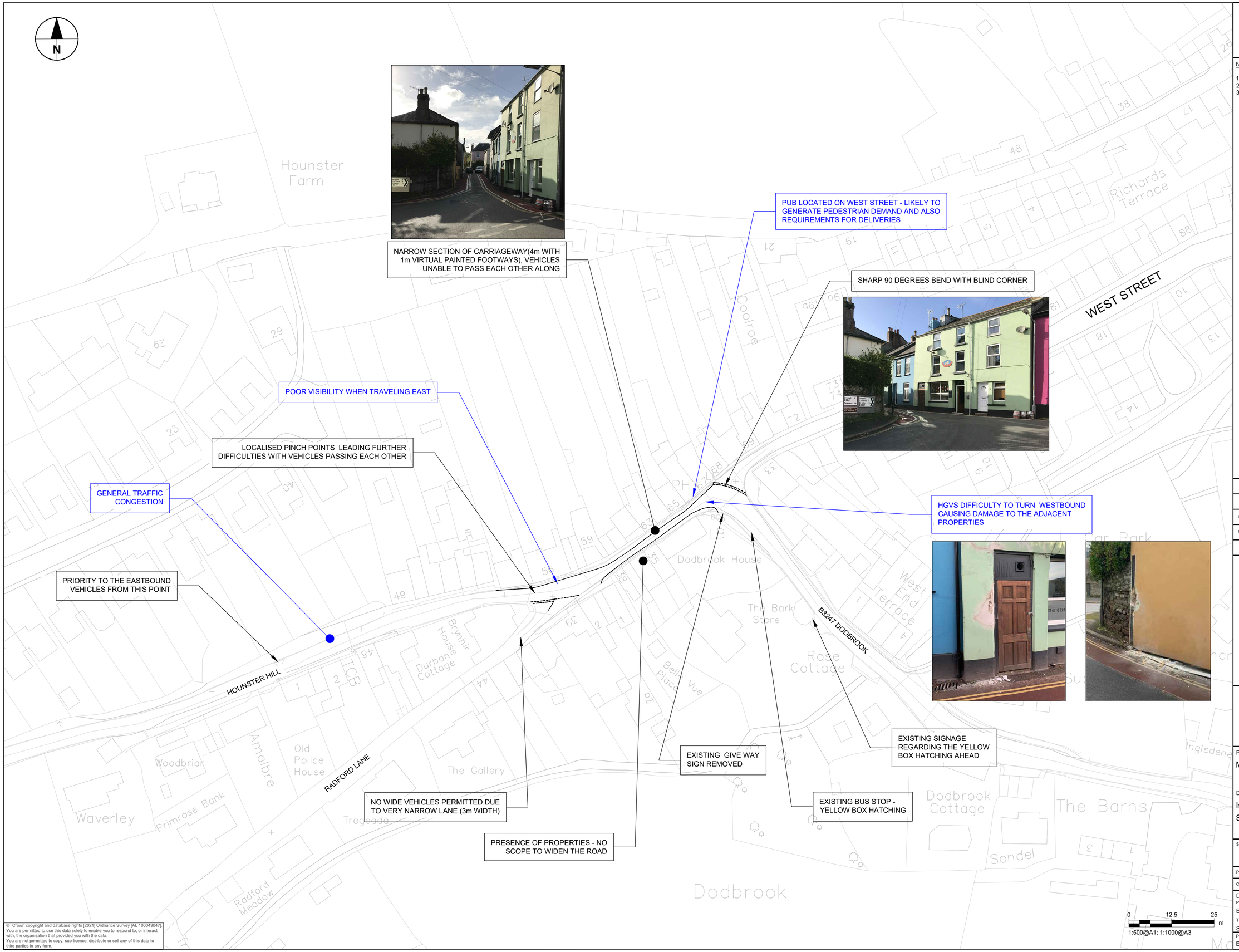
It was also identified in the report that not only were there issues with HGVs, but also with general traffic as well, where the implementation of non-physical improvements would improve the situation. These include the following:

1. Implement wig-wag warning lights on the nearside westbound approach to the B3247 – West Street junction with a detector on Hounster Hill.
2. Introduce a give-way line on the westbound approach to the B3247 – West Street junction which provides a location to stop at the wig-wam warning lights.
3. Introduce a centreline on the bend which could provide vehicles with a visible path to guide them around the bend. In addition, it is recommended the yellow box is removed due to not fulfilling its purpose. It could potentially be relocated if there is inadequate space for 2-way traffic on the approach to the wig-wam lights, as there is a possibility for queuing traffic at the lights.
4. Relocate the give-way line on West Street's eastbound arm (one-way road) away from the mouth of the junction. This is due to existing large vehicles currently overrunning it.
5. Introduce reflective strips on the sides of the properties to improve visibility at night.
6. Improve signage in the area with the aim of ensuring approaching vehicles are aware of (i) the site constraints, (ii) the wig-wag lights (if implemented), (iii) the need to give way to oncoming vehicles and (iv) the need to slow down.

Whilst it is not directly related to HGV traffic and issues on West Street, a sustainable transport strategy for the Rame Peninsula could be considered in the future. This could include improving and adding NMU routes which would provide alternative ways to navigate the Peninsula and assist in a modal shift away from motorised vehicles. Restrictions could also be implemented on the network. This may lower the levels of vehicle traffic on the Peninsula, including through Millbrook and lead to an increase in NMU safety and a general decrease in vehicle conflicts.

Appendices

Appendix A – Existing Site Constraints and Issues Plan



NOTES:

1. All dimensions are in metres unless otherwise stated.
2. Do not scale from this drawing.
3. Photos sources: site visit carried out the 29/10/2021 and incident reported the 15/01/2021.

REV	DATE	NATURE OF REVISION
P01	20/05/2022	First Issue

REVISIONS

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CORNWALL COUNCIL

CORMAC SOLUTIONS
AECOM

PROJECT TITLE:
MILLBROOK FEASIBILITY STUDY

DRAWING TITLE:
Issues identification
Sheet 01 of 01

DRAFT

SCALE: 1:500 @ A1

PROJECT MANAGER: JF		DRAWN BY: AZ	
CHECKED: KL	17/11/2021	APPROVED: AA	18/11/2021

DRAWING NO:

PROJECT	ORIGINATOR	VOLUME	LOCATION
EDG0384	ACM	GEN	SX4251

TYPE	ROLE	NUMBER
SK	D	0001

PROJECT REF.:	DRAWING STATUS:	SUITABILITY:	REVISION:
EDG0384	Concept	S1	P01

Filename: C:\USERS\ARANTXA.ZUDAIREVILLA\DESKTOP\EDG0384-ACM-GEN-SK-D-001 TO 002_1_25149_E699BA78.SV$.DWG

Plot Date: 24 November 2021

Appendix B – High-Level Costings of Viable Options

High-Level Costings of Viable Options

Item Ref	Element of Works	Quantity	Unit	Rate	Total*	Summary	Comments
1. Construction of New Road Suitable for HGVs							
1.01	Wide Single Carriageway All-Purpose Road (Carriageway is 10m Wide)	3000	m	£ 2,550.00	£ 7,650,000.00		The following prices are the approximate costs per metre run of roadway, and are based on information from a number of sources including engineer's estimates, tenders, final account values etc. on a large number of highways contracts. Motorway and All Purpose Road prices include for earthworks, structures, drainage, pavements, line markings, reflective studs, footways signs, lighting, motorway communications, fencing and barrier works as well as allowance for accommodation works, statutory undertakings and landscaping as appropriate to the type and location of the carriageway. Motorway and All Purpose Road prices do NOT include for the cost of associated features such as side roads, interchanges, underbridges, overbridges, culverts, subways, gantries and retaining walls. The following costs are based on a 800 mm construction comprising 40 mm wearing course, 60 mm base course, 200 mm road base, 150 mm subbase and 350 mm capping layer; no footpaths or cycle paths included.
1.02	Reinforced Concrete Bridge With Prefabricated Steel Beams (20m Span)	1000	m	£6,100.00	£ 6,100,000.00		Including excavation; reinforcement; formwork; concrete; bearings expansion joints; deck waterproofing; deck finishings; P1 parapet.
1.03	General site clearance - Open field site	6.0	ha	£2,137.48	£ 12,824.88		
1.04	Land Cost (CPO)	6.0	ha	£200,000.00	£ 1,200,000.00		
	SUBTOTAL				**£ 14,962,824.88**		
	PRELIMS (ASSUMED 40%)				**£ 5,985,129.95**		
	TEMPORARY TRAFFIC MANAGEMENT (ASSUMED 40%)				**£ 2,394,051.98**		
	CONTINGENCY (ASSUMED 40%)				**£ 5,985,129.95**		
	OPTIMISM BIAS (ASSUMED 44%)				**£ 6,583,642.95**		
	TOTAL COST				**£ 35,910,779.71**		**Approx. £36mill**
2. Wig-Wag Warning Lights with a Detector							
2.01	Wig-Wam Warning Lights, posts, controller unit box and cable connection pillar	1	nr	£ 3,000.00	£ 3,000.00		
2.02	Excavate trench for traffic signal cable, depth ne 1.50 m; supports, backfilling - 450mm wide	130	m	£ 18.01	£ 2,341.30		
2.03	Intermittent line in reflectorized white - 200 mm wide with 0.60 m line and 0.30 m gap	14	m	£ 1.80	£ 25.20		Use for giveway lines
2.04	Traffic and road signs - 500 × 500 mm	2.00	nr	£ 78.10	£ 156.20		Sign for Wig-Wag Signal
	SUBTOTAL				**£ 5,522.70**		
	PRELIMS (ASSUMED 40%)				**£ 2,209.08**		
	TEMPORARY TRAFFIC MANAGEMENT (ASSUMED 40%)				**£ 2,209.08**		
	CONTINGENCY (ASSUMED 40%)				**£ 2,209.08**		
	OPTIMISM BIAS (ASSUMED 44%)				**£ 2,429.99**		
	TOTAL COST				**£ 14,579.93**		**Approx. £15k**
3. Long Vehicle Restrictions							
3.01	Permanent traffic sign as non-lit unit on 600mm dia.	8	nr	£ 151.96	£ 1,215.68		Prices will vary depending upon the diagram configurations. The provided price is the average cost of this sign type.
3.02	Standard two post signs; 1200 × 400 mm, extra for fixing singly to one face only	4	nr	£ 259.50	£ 1,038.00		Unit costs do not include concrete foundations
3.03	TRO Application and Public Consultation	1.00	nr	£ 8,000.00	£ 8,000.00		
	SUBTOTAL				**£ 10,253.68**		
	CONTINGENCY (ASSUMED 40%)				**£ 4,101.47**		
	OPTIMISM BIAS (ASSUMED 44%)				**£ 4,511.62**		
	TOTAL COST				**£ 18,866.77**		**Approx. £19k**
4. Delivery and Servicing Plan (DSP)							
4.01	Business engagement (assuming 20hrs engagement per business and 20 businesses engaged)	400.00	hr	£ 50.00	£ 20,000.00		
4.02	Creation of plans (assuming 50% success rate and 10x plans produced at 20hrs per plan)	200.00	hr	£ 50.00	£ 10,000.00		
	SUBTOTAL				**£ 30,000.00**		
	CONTINGENCY (ASSUMED 40%)				**£ 12,000.00**		
	TOTAL COST				**£ 42,000.00**		**Approx. £42k**

*The costs provided are the estimated capital costs of the project, and exclude consultancy fees for design work.

High-Level Costings of Viable Options

Item Ref	Element of Works	Quantity	Unit	Rate	Total*	Summary	Comments
5. Use of Smaller HGVs by Businesses							
5.01	Business engagement (assuming 20hrs engagement per business and 20 businesses engaged)	400.00	hr	£ 50.00	£ 20,000.00		
	SUBTOTAL				**£ 20,000.00**		
	CONTINGENCY (ASSUMED 40%)				**£ 8,000.00**		
	OPTIMISM BIAS (ASSUMED 44%)				**£ 8,800.00**		
	TOTAL COST				**£ 36,800.00**		**Approx. £37k**
6. Improvements of Non-Physical Highway Features							
6.01	Permanent traffic sign as non-lit unit on 600mm triangular.	6	nr	£ 126.61	£ 759.66		
6.02	Intermittent line in reflectorized white 100 mm wide with 2.0 m line and 7.0 m gap	100	m	£ 1.04	£ 104.00		For new centre lines
6.03	Removal of existing reflectorized thermoplastic road markings	52	m	£ 3.13	£ 162.76		For removal of existing yellow box markings
	SUBTOTAL				**£ 1,026.42**		
	PRELIMS (ASSUMED 40%)				**£ 410.57**		
	TEMPORARY TRAFFIC MANAGEMENT (ASSUMED 40%)				**£ 410.57**		
	CONTINGENCY (ASSUMED 40%)				**£ 410.57**		
	OPTIMISM BIAS (ASSUMED 44%)				**£ 451.62**		
	TOTAL COST				**£ 2,709.75**		**Approx. £3k**
7. Removing Property and Improving the B3247 - West Street Junction							
7.01	Demolition of building or structure building; brick construction with concrete floor and roof	2550.0	m³	£ 14.78	£ 37,689.00		
7.02	Demolition of building or structure brick or masonry boundary wall	105.9	m³	£ 86.93	£ 9,205.89		
7.03	General Site Clearance Heavy Density Wooded	0.05	ha	£ 6,920.94	£ 346.05		
7.04	Excavate existing gully pot	0.4	m3	£ 82.55	£ 33.02		
7.05	Remove gully grating and frame	1	nr	£ 6.50	£ 6.50		
7.06	Excavate existing carriageway surface (including for proposed road gullies)	187.5	m3	£ 80.13	£ 15,024.38		
7.07	Excavate existing footway	33.0	m3	£ 80.13	£ 2,644.29		
7.08	Removal of existing reflectorized thermoplastic road markings	201	m	£ 3.13	£ 629.13		For removal of existing yellow box markings, West Street give way line and part of the south virtual footway
7.09	Remove traffic sign including post	1	nr	£ 81.37	£ 81.37		Removal of B3247 West Street priority sign
7.10	Take up or down and remove to tip off site precast concrete kerbs and channels	95.00	m	£ 5.57	£ 529.15		
7.11	Urban link roads - Two lane link road (carriageway is 7.3 m wide)	80	m	£ 1,825.00	£ 146,000.00		The following costs are based on a 800 mm construction comprising 40 mm wearing course, 60 mm base course, 200 mm road base, 150 mm subbase and 350 mm capping layer; no footpaths or cycle paths included.
7.12	Tarmacadam paving two layers; limestone or igneous chipping finish paving on subbase; including excavation and type 1 subbase	100	m²	£ 120.00	£ 12,000.00		
7.13	Land Purchase (CPO)			£ 450,000.00	£ 450,000.00		Assumption considering data from Rightmove.co.uk, size of property and land.
	SUBTOTAL				**£ 674,188.78**		
	PRELIMS (ASSUMED 40%)				**£ 269,675.51**		
	TEMPORARY TRAFFIC MANAGEMENT (ASSUMED 40%)				**£ 269,675.51**		
	CONTINGENCY (ASSUMED 40%)				**£ 269,675.51**		
	OPTIMISM BIAS (ASSUMED 44%)				**£ 296,643.06**		
	TOTAL COST				**£ 1,779,858.37**		**Approx. £1.8mill**

*The costs provided are the estimated capital costs of the project, and exclude consultancy fees for design work.

Appendix C – Collision Reports

Serious Collision Details: 1684543 - 19 June 2016 - 13:17
Visibility: Light Weather: Raining without high winds Road Cond: Wet/Damp
1st Road: B 3247 2nd Road: Not applicable Speed Limit: 30
Junction Detail: Not within 20M Control: Not applicable
Officer Attended? Yes
MILLBROOK B3247
VEH1 AND VEH2 TRAVELLING TOWARDS ONE ANOTHER. VEH1 SWERVES, LOSES CONTROL AND HITS HEDGE ON N/S. VEH1 FLIPS OVER ONTO ITS ROOF, COLLIDING WITH VEH2 IN THE PROCESS.
Contributory Factors:
306 Exceeding speed limit, Vehicle 1
409 Swerved, Vehicle 1

Vehicle and Casualty Details:

- Vehicle 1: Car Driver: Male, 24,
- Movement: Going ahead other From NW to SE
- Location: Lane On main carriageway, Junction Not at, or within 20M of Jct
- Carriageway: Hit object in None, Left Nearside and rebounded, Hit object off Oth perm objects
- 1st Impact: Front, Skidding: Overturned
- Breath Test: Not provided (medical reasons), Hit and Run: Not hit and run, Journey type: Other

- Casualty 1: 2 Driver / Rider Male 24

- Vehicle 2: Car Driver: Male, 53, PL21
- Movement: Going ahead other From SE to NW
- Location: Lane On main carriageway, Junction Not at, or within 20M of Jct
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Front, Skidding: No skidding / overturning
- Breath Test: Negative, Hit and Run: Not hit and run, Journey type: Other

- Casualty 2: 2 Driver / Rider Male 53

- Casualty 3: 3 Vehicle Passenger Female Unk
- Passenger: Car Front seat PSV Not PSV Passenger

Data correct at time of publication 15/12/2021

Serious Collision Details: 17206606 - 24 July 2017 - 14:52
Visibility: Light Weather: Fine without high winds Road Cond: Dry
1st Road: B 3247 2nd Road: Not applicable Speed Limit: 20
Junction Detail: Not within 20M Control: Not applicable
Officer Attended? Yes
MILLBROOK - HOUNSTER HILL B3247
VEH1 WAS TRAVELLING AT SPEED OVERTAKING SLOWER MOVING VEHICLES AND FAILED TO NOTICE STATIONARY VEHICLES AHEAD OF IT. DRIVER OF VEH1 SLAMMED ON THE BRAKES WHICH CAUSED VEH1 TO SKID, RESULTING IN IT LOSING CONTROL AND COLLIDING WITH VEH2. VEH3 THEN RAN INT O THE REAR OF VEH2.
Contributory Factors:
306 Exceeding speed limit, Vehicle 1
602 Careless/Reckless/In a hurry, Vehicle 1
406 Failed to judge other persons path or speed, Vehicle 1
502 Impaired by drugs (illicit or medicinal), Vehicle 1

Vehicle and Casualty Details:

- Vehicle 1: Car Driver: Male, 18,
- Movement: Overtaking moving vehicle O/S From NW to SE
- Location: Lane On main carriageway, Junction Not at, or within 20M of Jct
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Front, Skidding: Skidded
- Breath Test: Not provided (medical reasons), Hit and Run: Not hit and run, Journey type: Unknown

- Casualty 1: 2 Driver / Rider Male 18

- Vehicle 2: Car Driver: Female, 66,
- Movement: Stopping From SE to NW
- Location: Lane On main carriageway, Junction Not at, or within 20M of Jct
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Front, Skidding: No skidding / overturning
- Breath Test: Negative, Hit and Run: Not hit and run, Journey type: Unknown

- Casualty 2: 2 Driver / Rider Female 66

- Vehicle 3: Car Driver: Male, 77,
- Movement: Stopping From SE to NW
- Location: Lane On main carriageway, Junction Not at, or within 20M of Jct
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Front, Skidding: No skidding / overturning
- Breath Test: Driver not contacted, Hit and Run: Not hit and run, Journey type: Unknown

Data correct at time of publication 15/12/2021

Serious Collision Details: 19876609 - 25 August 2019 - 09:15
Visibility: Light Weather: Fine without high winds Road Cond: Dry
1st Road: B 3247 2nd Road: Not applicable Speed Limit: 60
Junction Detail: Not within 20M Control: Not applicable
Officer Attended? Yes
HOUNSTER HILL (B3247)
VEH1 SCRAMBLER MOTORBIKE COLLIDED WITH THE NEARSIDE HEDGE AND OVERTURNED ONTO ITS OFFSIDE.
Contributory Factors:
405 Failed to look properly, Vehicle 1
410 Loss of control, Vehicle 1
505 Illness or disability, mental or physical, Vehicle 1

Vehicle and Casualty Details:

- Vehicle 1: Motor Cycle over 125 - 500cc Driver: Male, 78, PL10
- Movement: Going ahead right bend From NE to NW
- Location: Lane On main carriageway, Junction Not at, or within 20M of Jct
- Carriageway: Hit object in None, Left Nearside and rebounded, Hit object off Wall or fence
- 1st Impact: Nearside, Skidding: No skidding / overturning
- Breath Test: Not provided (medical reasons), Hit and Run: Not hit and run, Journey type: Unknown

- Casualty 1: 2 Driver / Rider Male 78

Data correct at time of publication 15/12/2021

Slight Collision Details: 19813409 - 29 January 2019 - 17:45
Visibility: Dark Weather: Fine without high winds Road Cond: Dry
1st Road: B 3247 2nd Road: Not applicable Speed Limit: 30
Junction Detail: Not within 20M Control: Not applicable
Officer Attended? No - accident was reported over the counter
MILLBROOK - WEST STREET (B3247) - 23 METRES FROM JUNCTION WITH B3247
PED1 WAS OUTSIDE HIS HOUSE SEEING TO HIS PEDAL CYCLE AND WAS HIT IN THE LOWER BACK BY VEH1 WHICH CAME ACROSS THE WHITE LINE. DRIVER OF VEH1 STOPPED BUT REFUSED DETAILS, BLAMING PED1.
Contributory Factors:
602 Careless/Reckless/In a hurry, Vehicle 1
405 Failed to look properly, Vehicle 1

Vehicle and Casualty Details:

- Vehicle 1: Car Driver: Male, 62, PL10
- Movement: Going ahead other From SW to NE
- Location: Lane On main carriageway, Junction Not at, or within 20M of Jct
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Front, Skidding: No skidding / overturning
- Breath Test: Driver not contacted, Hit and Run: Not hit and run, Journey type: Other

- Casualty 1: 3 Pedestrian Male 36
- Location On footpath / verge Movement Unknown or other Direction Standing still

Data correct at time of publication 15/12/2021

Slight Collision Details: 19876452 - 29 August 2019 - 17:54
Visibility: Light Weather: Fine without high winds Road Cond: Dry
1st Road: B 3247 2nd Road: C 127 Speed Limit: 30
Junction Detail: T and Stag Jct Control: Give way or Uncontrolled
Officer Attended? No - accident was reported over the counter
MILLBROOK - WEST STREET (B3247) NEAR JUNCTION WITH B3247
PED1 WAS WALKING HOME AND VEH1 APPROACHED FROM THE OPPOSITE DIRECTION AND HIT PED1 WITH SOME FORCE TO THE LEFT SIDE. DRIVER OF VEH1 DID NOT STOP.
Contributory Factors:
602 Careless/Reckless/In a hurry, Vehicle 1

Vehicle and Casualty Details:

- Vehicle 1: Car Driver: Female, 79, PL10
- Movement: Going ahead left bend From SE to SW
- Location: Lane On main carriageway, Junction Cleared junction or waiting/parked at junction exit
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Nearside, Skidding: No skidding / overturning
- Breath Test: Driver not contacted, Hit and Run: Not hit and run, Journey type: Other

- Casualty 1: 3 Pedestrian Male 63
- Location On footpath / verge Movement In carr facing traffic Direction NE bound

Data correct at time of publication 15/12/2021

Slight Collision Details: 20977427 - 2 September 2020 - 09:54
Visibility: Light Weather: Fine without high winds Road Cond: Dry
1st Road: B 3247 2nd Road: Unclassified Speed Limit: 20
Junction Detail: Pri Drive Control: Give way or Uncontrolled
Officer Attended? Yes
MILLBROOK
V001 HAS BEEN COMING DOWN THE HILL AND V003 HAS POKED OUT FROM DRIVEWAY AND V001 HAS REACTED AND HIT WALL ON NEARSIDE AND GONE DOWN ROAD. V001 HAS THEN HIT A FURTHER WALL ON THE OFFSIDE AND THEN COLLIDED WITH V002.
Contributory Factors:
310 Cyclist entering road from pavement, Vehicle 3
603 Nervous/Uncertain/Panic, Vehicle 1

Vehicle and Casualty Details:

- Vehicle 1: Car Driver: Male, 66, SE9
- Movement: Going ahead left bend From SE to W
- Location: Lane On main carriageway, Junction Jct Approach
- Carriageway: Hit object in None, Left Nearside and rebounded, Hit object off Wall or fence
- 1st Impact: Front, Skidding: No skidding / overturning
- Breath Test: Negative, Hit and Run: Not hit and run, Journey type: Other

- Casualty 1: 3 Driver / Rider Male 66

- Vehicle 2: Car Driver: Female, 87, PL10
- Movement: Going ahead other From W to E
- Location: Lane On main carriageway, Junction Jct Approach
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Front, Skidding: No skidding / overturning
- Breath Test: Negative, Hit and Run: Not hit and run, Journey type: Unknown

- Casualty 2: 3 Driver / Rider Female 87

- Vehicle 3: Pedal Cycle Driver: Female, 73, PL10
- Movement: Starting From N to S
- Location: Lane Cycle lane (on main carriageway), Junction Entering main road
- Carriageway: Hit object in None, Left Did not leave carr, Hit object off None
- 1st Impact: Did not impact, Skidding: No skidding / overturning
- Breath Test: Not applicable, Hit and Run: Not hit and run, Journey type: Unknown

Data correct at time of publication 15/12/2021