

Technical Note on major Safety Hazards arising from shared surface between 2 blind bends in Lower Road

To:

Planning Services, Havant Borough Council,
Public Service Plaza, Civic Centre Road,
Havant, PO9 2AX



11 December 2020



Land south of Lower Road, Old Bedhampton Conservation Area, Havant

Development of 50 new dwellings together with access, landscaping and open space. HBC Ref APP/20/01031 and *Safety of Life concerns on blind triple bend sole access route*

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1.0 Introduction

This Technical Note is an evaluation of the road safety aspects and Safety of Life concerns on the blind triple bend sole access route that gives access to the proposed development. It also comments on the Developer’s Transport Statement, produced by their consultants, i-Transport LLP and the major mathematical errors contained therein. Within the Transport Statement itself (385 pages), there is i-Transport’s own Technical Note, Ref SJ/RS/ITB/12174-006 TN, dated 20 July 2018. It starts at the 320th page of the overall document and has its own page and paragraph numbering.

Computer modelling has been undertaken by the authors of this Technical Note to produce a traffic simulation using i-Transport’s own data which gives startling different results to i-transport’s “calculations”. It is unfortunate to have to declare that the i-Transport mathematical calculations which involved multiplying percentage probabilities to arrive at a result are, unfortunately, mathematical nonsense. It is noted that the “nonsense” calculation gives a

result supporting the developers application.

The correct calculation, which can only be carried out by computer modelling as it is a complex mathematical problem which cannot be solved analytically, shows that the **i-transport result is in error by a factor of 27,000 fold.**

A crucial safety consideration that i-transport correctly identified is:

“How often would 2 vehicles, going in opposite directions meet on the sole access route in the middle of the blind bends, with no footpath, at the same time as a pedestrian transiting the no-footpath section?

Such a scenario forces a near-emergency stop by one of the vehicles and potentially, a swerve around the pedestrian (often a schoolchild) by the other vehicle. Otherwise, the pedestrian will be hit.

For any given pedestrian transit:

i-transport claim : 1 chance in 56,000 transits (by a “nonsense” mathematical calculation)

Computer modelling Result : 1 chance in 2 transits; this equates to an occurrence every other day, on average.

This is an error by i-Transport of huge proportions.

The computer modelling was prompted by the fact that the first author has lived at the site of the blind bends for over 30 years and even by casual experience the idea of just once in 56,000 pedestrian transits was nonsensical whilst the modelled result of 1 in 2 transits was much closer to perceived experience.

Objectives of this Technical Note:

- The primary objective is to present a justified, engineering assessment that the road layout around the 3 blind bends with a 50 metre shared surface **must** be re-engineered to make it safe for pedestrians plus children and cyclists before it has to carry the substantially increased vehicle traffic the development would generate. Also, that such re-engineering must be designed and approved as a mandatory prior requirement before any approval of the development can be given.

The traffic increase will be considerable; the proposal will add 50 new dwellings to the existing 80 dwellings in the cul-de-sac making 130 dwellings in total. This is an increase of **63%** in the number of dwellings within the vehicular cul-de-sac that is Lower Road. All this extra vehicle traffic will have to pass through these blind bends, which in part have no footways or space to fit footways, along with extra pedestrian and cycling traffic. The shared section is just too narrow for 2 cars and a pedestrian to pass each other. One of the vehicles must brake to a halt.

Evidence:

- In addition to the computer modelling, verifiable data and evidence is presented showing there have been very many near misses on the blind bends over the years plus a recent actual collision.

2. Evidence Base

2.1 Major Statistical Calculation Errors regarding safety by i-Transport:

In their Transport Statement (TS) Technical Note, i-Transport have made major errors:

- During a weekday rush hour, i-Transport claim just once every **56,000** times a pedestrian passes along the blind bend/no pavement section will he/she meet vehicles which are coming in opposite directions on the road at the same time – implying a very safe situation.

In fact when correctly calculated with computer modelling and using i-Transport's own figures for vehicles and pedestrians, the true figure is actually close to **1 in 2**. **This is a 27,000 fold error** in i-Transport's calculation and a vastly more frequent and highly dangerous situation.

Please see Appendix 1 for full details of the correct statistical calculation obtained by computer numerical modelling and using i-Transport's data.

Note that "pedestrians" covers dog walkers, leisure walkers, children going to/from school, parents pushing toddlers in pushchairs, elderly persons (eg from the Care home in the middle of the blind bends) plus mobility scooters etc., all completely at the mercy of traffic coming simultaneously both head-on and coming up behind them on the shared road surface.

Video Evidence : In 2016, several days of video recording were undertaken with the help of a resident whose house looks onto one of the blind bends. This was sent to Havant Council and receipt acknowledged. This is available to HBC on a USB memory stick and even the one selected 2 hour period shows many instances of cars coming from both directions and passing each other as they enter the "shared" road surface at the same time as pedestrians. In other words, the video evidence, along with the author's own and neighbours actual experience supports the correct numerical model of **"1 in 2" not "1 in 56,000"** and demonstrates how much in error the i-Transport statistical calculations are and how dangerous this "shared surface" section actually is. Table 1 lists the 25 safety incidents visible on the video during a 2 hour analysis period.

Further details, including the *correct* statistical calculations obtained by computer modelling, are in Appendix 1 of this note.

NB: No persons can be identified on the deliberately low resolution video so individual privacy is fully protected.

2.2 Serious errors of fact by i-Transport regarding safety

2.2.1 Pedestrian vulnerability of Eastern side of Lower Road blind bends/shared surface

The i-Transport TS, para 6.8.4 (page 38 of 385) states: "Pedestrians are observed to almost universally walk along the western side of Lower Road to continue along the footway to the north, the length of Lower Road without a footway is 50m, roughly a 35 second walk." This was their justification for not carrying out any safety assessment whatsoever for pedestrians walking on the **eastern** side of the blind bends.

In fact, the evidence shows (as visible in the photo, Fig 1, below, and also the video referenced in 2.1 above) that pedestrians often walk on the **eastern** side of the blind bends /shared surface of Lower Road. Given the greatly reduced sightline, this is a major safety concern not even considered by the Transport Statement.



Fig 1 Photo of pedestrians walking northwards on the **eastern** side around the blind bend.

Discussion of Fig 1 and safety of life implications : This photo was taken by the first author on 15th June 2019 at 11:00am from the passenger seat of my wife's car travelling northbound on the shared surface road section of Lower Road where there is no footway. Two pedestrians are clearly visible walking along the eastern side of the road towards the blind bend. The significance of this image is that any oncoming southbound vehicles must either perform an emergency stop, or swerve around the pedestrians to avoid hitting them which would probably result in a collision with my wife's car or other northbound vehicles. i-Transport did not carry out any safety assessment for this scenario and instead assumed that it did not happen. This photo is evidence that it does occur in reality. I would stress that this

photo was not in any way "staged" for illustration purposes. It was a random, genuine photo of two complete strangers, taken by the author on a typical Saturday morning shopping trip (my wife driving).

The 2 walkers have backpacks and will have walked along the southern verge (also no footway) of Lower Road, most likely entering from the footpath at the western end of Lower Road (near the Rusty Cutter). By naturally choosing to avoid walking across the multiple driveways on the northern side of Lower Road, they enter the blind bends shared section on the **eastern** side. They are walking towards any vehicles which may come towards them but that does not help them – they cannot avoid any such vehicle (eg a large supermarket delivery van) as there is nowhere for them to go. Instead, current safety relies on a driver heading south who is coming around the bend on the same side as the walkers, performing either an emergency stop, or more usually, a "swerve manoeuvre", relying on there being no on-coming traffic (such as our car). By good fortune, there was no oncoming vehicle coming south around the bend on this occasion. For a vehicle approaching around the sharpest point on the bend on the same side of the road as the 2 pedestrians, the driver's forward visibility is only 16.1 metres (See Appendix 2) and such a limited sightline means there is very little time to stop. The calculation in Appendix 2 (and verified in Excel spreadsheet, Appendix 4) shows that with a vehicle speed above 24.2 mph a collision is certain with a pedestrian in the same position as shown in Fig. 1 unless the driver is able to perform the swerve manoeuvre. However, the driver may be blocked from the swerve manoeuvre due to an oncoming vehicle (eg a vehicle positioned such as ours is in the photo), unless there is the presence of mind to accept a head-on collision with said oncoming vehicle, in preference to hitting the pedestrian. It should be noted that even according to the i-Transport Transport Statement ("TS"), (para 6.8.5, page 38 of 385), two vehicles travelling at 21 mph (85th percentile), would have a closing speed (at the moment of the swerve manoeuvre) around that blind bend of 42 mph.

Particularly during the summer months, this is a popular route for walkers whose numbers are expected to increase – as stated in the TS, para 6.8.6 (page 33). The only reason a tragedy has not happened yet is that drivers can be observed to regularly perform the swerve manoeuvre to swerve around pedestrians on the apex of the blind bend

on the eastern side. That this manoeuvre has averted a serious or fatal accident to date is only due to there having been no oncoming traffic at the time. With the increase in vehicle traffic from the proposed development plus the ever-increasing cycle and pedestrian users from the surrounding new developments which will use Lower Road (as acknowledged by the TS), this will not continue to be the case. Hence re-engineering of this area of the road is essential to protect safety of life.

The Video Evidence referenced in section 2.1 shows many instances of individuals – and groups - travelling around the eastern side of the shared road surface, sometimes (youngsters) even randomly zig-zagging across the road.

2.2.2 Residents Own Reports of Safety Incidents around the blind bends + actual accident report (July 2019).

As further evidence of use of pedestrians + cyclists on the eastern side of the road and rebuttal of the completely erroneous “1 in 56,000” probability of 2 cars and a pedestrian meeting together on the shared surface”, 11 residents wrote letters describing their experience of safety incidents. The signed originals are all available for viewing.

Three examples are below (one of which is my own very recent experience). Another 9 letters are in Appendix 3.

Example 1 :



TRAFFIC INCIDENTS

Saturday 8th of June 2019, late afternoon, on my way home. On the blind bend by The Elms I was driving very slowly and was confronted by 4 young lads on bikes riding towards me. They were completely unaware of anyone else on the road; not one of them had a helmet on. If I had been driving any faster the outcome could have been serious.

Sunday 9th of June 2019 again later in the afternoon on my way home; on the blind bend again outside The Elms this time 2 horses one with the rider and the other being led; so as to avoid them, I had to pull over so that I was facing an oncoming car.

About a week later, I am not sure of the day in the same spot this time: a lad on a horse riding bareback who I could not see until I found myself behind him. I stopped; he waved me on; I drove very slowly past and once again a car was being driven towards me. If either of us had been driving any faster or the horse had been frightened the outcome could have been very different.

ACCIDENT:

Thursday 4th of July 2019 at 6:15 PM: I was driving towards Brookside on the blind bend; 2 lads on bikes, possibly the same lads as before, riding from one side of the road to the other going in the same direction. A man driving a Mercedes came round the bend, knocked one of the boys off his bike; he got out of his car and made sure that rider and bike had not been damaged. One of my neighbours was behind the Mercedes and must have witnessed the incident.

All these incidents occurred because you cannot see what is happening on that bend. There is going to be a serious accident if the volume of traffic increases; it is just because most of the residents are aware of the dangers and drive with caution round that bend. 

Example 2 :



5th September 2019, 5 pm : I was walking back to my home around the blind bends. I was positioned on the “shared space” on the eastern side of the road, walking as close as possible to the brick boundary wall which marks the edge of the shared space. I was in fact roughly positioned where our car shown in Fig. 1 above is, except keeping as far to the nearside as I could. I heard a car coming up behind me (ie northwards) so I turned and “flattened” myself against the boundary wall to give the driver as much room as possible. The car did the usual “swerve manoeuvre” where he swung his car onto the “wrong” side of the road to go past me. However he was travelling quite fast (estimated 25 mph) for that section. He went past me and steered so as to head back onto the correct side of the road. However, at that moment, another vehicle appeared coming the other way (southwards) around the blind bend. This vehicle came into view at about the same position as the 2 pedestrians shown in Fig 1. A head-on collision between the 2 vehicles seemed imminent. Fortunately, the southbound car came around the blind bend quite slowly (about 15 mph) and was

able to do an emergency stop to avoid a collision, despite the closing speed of the two vehicles being approx 25mph + 15 mph = 40 mph. [REDACTED]

[REDACTED]

Incident 1 2017: Middle of the day travelling out of Lower Road during the summer: as I passed in front of The Elms and round the corner I was faced with a white van on my side of the road travelling at speed. The only way for me to avoid head-on contact was for me to mount the verge as the van passed. The driver was avoiding a group of pedestrians entering Lower Road on the south side of the carriageway.

Incident 2, 2018: Middle of the day entering Lower Road (in February or March 2018). As I got close to the first blind bend I was faced with a large blue pantechnicon straddling the centre of the carriageway. My only option was to break hard and push my near side wing mirror into the hedging of Orchard Cottage. The driver was avoiding a dog walker with a young Dalmatian. The dog was proving troublesome, circling the walker outside the entrance to The Elms and the adjacent bungalow and may have "bounced" onto the carriageway. Once the dog settled, the driver manoeuvred around me. No damage apart from scratches on the wing mirror casing was done.

40 years of use of the blind bends has meant having many experiences of potential dangers and a natural tendency to proceed with caution. These include groups of cyclists and groups of ramblers filling the road; a young cyclist riding with no hands; a mobility scooter on the inside of the blind bend. Cars regularly avoid the large puddle that forms opposite "Long On" (No 12) bungalow which means exiting the bends on the wrong side of the road.

[REDACTED]

5 June 2018

9 more residents incident reports are given in Appendix 3. The signed originals are all available for inspection.

2.3 Non–viability of Lodge Road footpath as an effective alternative pedestrian access

Section 5.0 of the i-Transport Technical Note describes in some detail a footpath denoted as Route 1 from Lodge Road to Havant road and states in para 5.5.2: “The route is clearly a suitable alternative for any pedestrian users from the site should they not wish to use Lower Road.”

This statement is not correct.

As can be seen from the two photographs below, the “footpath” is more akin to a long, dark alleyway. For most of its 130 metre length, it is only 1 metre wide or less with walls, fences and tall, thorny hedgerows which exceed head height. 35 metres in, the alleyway takes a 90 degree turn to the east. There is a straight section of a further 18 metres before the alleyway turns 90 degrees to the north.

On this 18 metre section with head-height fencing/walls/hedgerows, a pedestrian is completely invisible. Should any kind of assault take place, the victim would be hidden from view. From an assailant’s viewpoint, the location is ideal. An attack could be carried out, leaving the victim possibly on the ground, hidden from all sight whilst the assailant calmly makes their escape.

In no way can this “alleyway” be regarded as suitable alternative for pedestrians, particularly vulnerable groups such as children or lone females.



Fig 2 : Entrance to Lodge Road “footpath” or alleyway.



Fig 3 : Early evening on the Route 1 “alleyway”, in the 18m “hidden” section. Some evening blue sky can be seen. The faint illumination in the upper centre is the streetlight.

Disabled users (eg Wheelchairs) : Whilst Section 5.0 maintains the alleyway is suitable for wheelchair users, for much of the distance, they would need to wear thick gloves on each hand to avoid scraping their knuckles on either the sharp, pebble dash wall surface, fence panels or thorn spikes from the hedgerow. There is certainly no room to turn round. Should another user come from the opposite direction (eg a parent with a baby in a pushchair), one or the other would need to travel in reverse for many tens of metres to one of the few places it may be possible to pass.

Table 1 (See para 2.1: Video Evidence)

Analysis of Video 14 of Safety Incidents			Date: 26-Oct-16, Analysis Start Time: 15:30, Analysis Duration: 2 hours; Filename Video 14.wmv
Incident	Elapsed Hrs/mins on video recording	Time of Day (BST)	Additional Traffic Safety Risk Events on blind double bend with no footpaths (additional to vehicle & cycling traffic)
	20:20:00	15:30	Start of Analysis Period
1	20:30:00	15:40	2 children on push scooters with adult heading towards bend (see Item 3 below)
2	20:30:00	15:40	Cyclist + pedestrian walking abreast with another cyclist meeting car in the road.
3	20:31:00	15:41	See Item 1 above; 2 Children on push scooters with adult walking in road around the bend (1 event)
4	20:51:00	16:01	2 Adults walking in the road around the bend
5	20:58:00	16:08	3 cyclists, together all abreast coming around the bend
6	20:59:00	16:09	Pedestrian walking around the bend, in middle of road with cars coming in both directions
7	21:15:00	16:25	Jogger coming from around bend in the road, with back to traffic
8	21:18:00	16:28	Pedestrian walking in the road, around the bend, back to traffic, using mobile phone
9	21:21:00	16:31	Vehicle from Elderly persons home reversing into road
10	21:25:00	16:35	Lady pushing child in pushchair in the road
11	21:26:00	16:36	Pedestrian walking in the road, around the bend, his back to the traffic
12	21:29:00	16:39	2 pedestrians walking dogs in the road
13	21:37:00	16:47	Lady pushing child in pushchair in the road
14	21:39:00	16:49	2 Pedestrians walking abreast, in the road, around the bend, backs to the traffic
15	21:47:00	16:57	2 Pedestrians together, walking abreast, in the road from around the bend; one walking a dog
16	22:05:00	17:15	Mobility Scooter meets cyclist head-on in the road
17	22:09:00	17:19	2 Pedestrians walking 2 abreast in the road, their backs to traffic meeting cars on the road
18	22:11:00	17:21	2 Pedestrians walking widely abreast across the whole road, around the bend
19	22:13:00	17:23	1 Pedestrian in Road
20	22:13:00	17:23	2 Pedestrians in the road, walking abreast
21	22:15:00	17:25	2 Pedestrians in the road, walking abreast
22	22:16:00	17:26	Cyclist in the road pushing his bike around bend
23	22:17:00	17:27	Cyclist, on wrong side of road, with friend walking alongside in the road
24	22:17:00	17:27	3 cyclists; 2 together on wrong side of road
25	22:18:00	17:28	3 cyclists, together all abreast across the full road width going around the bend
	22:20:00	17:30	End of 2-hour Analysis Period

3.0 Conclusions

This Technical Note has provided quantitative evidence that the Lower Road blind bends with a section of no footway between 2 of them present major and unacceptable risks. These risks can only be mitigated by re-engineering this section of shared surface to accommodate the substantially increased volumes of vehicular, cycling and pedestrian traffic the proposal would generate from the 63% increase in the number of dwellings that are the served by this sole access/egress route for vehicles.

3.1 Huge Errors in i-Transport's risk probability calculations

It has been shown that i-Transport's risk probability calculations are in error to a major extent and drastically underestimate the dangers of cars and pedestrians colliding on the no footway section between the blind bends. In this road section it has been shown (and is acknowledged by i-Transport) that is impossible for 2 cars to pass each other if a pedestrian is also present. i-Transport's calculation of this happening wrongly states this to be a 1 in 56,000 probability.

This figure has been proven to be hugely in error. In fact, the probability correct calculations obtained through mathematical modelling (See Appendix 1) has been shown to be close to **1 in 2** – or **52.9%**, a massively more dangerous situation. This correct **1 in 2** figure is much more in line with the residents' experiences, 3 examples of which are given in section 2.2.2 and a further examples in Appendix 3.

Hence in a real-life situation, over the course of a year with 250 weekday rush-hour periods, one could expect typically **132** occasions when a pedestrian and 2 vehicles going in opposite directions are on the shared surface and one of the vehicles is forced to slow down or halt behind the pedestrian.

This is a **27,000 times more frequent** rate than the 1 in 56,000 figure wrongly given in the i-Transport Technical Note.

Of course, over a 24 hour period, the number of instances of vehicles meeting a pedestrian will be much higher than even the 132 instances calculated, since this is for a single, 1 hour morning rush hour period, using i-Transport's own data. The evening rush hour figure may not be much less and there will be further, if fewer, instances during the other hours of the day.

The 132 figure above is proven but is just for the busiest morning weekday peak hour. Making a judgement for all the other hours in the day, including weekends suggests a probable number occasions of **at least 400** instances per year when a pedestrian will encounter two vehicles, going in opposite directions on the shared surface, between the 2 blind bends. If on any one of those occasions, a vehicle fails to brake to a sufficient extent to either pull in behind the pedestrian(s) or tries to overtake at the moment the on-coming vehicle is coming around the blind bend ahead, an accident is certain. This will either mean the pedestrian is hit or the 2 vehicles have a head-on collision.

When considering the danger to pedestrians such a high rate represents, one must also consider the low light level conditions during the winter period as well as weather conditions such a rain, ice and snow and the profusion of slippery leaves on the surface at times during the year.

3.2 Transport Statement fails to address the high safety hazards to pedestrian on the eastern side of Lower Road.

In addition, i-Transport completely omits to address the safety of pedestrians on the eastern side of Lower Road between the blind bends by suggesting no one walks on that side. The evidence presented, photographic, video plus written near-miss statements from residents in section 2.2.2 and Appendix 3 all point very clearly to frequent use of the eastern side of the road by pedestrians often including children. The safety significance of this is that the sightline is only 16.1 metres, or less – see Appendix 2, compared with the 30 metres sightline on the western side as stated by i-Transport. Hence as shown in Appendix 2, a collision is a near certainty for traffic travelling more than 24 mph - just slightly above the 85th percentile (21 mph – as calculated by i-Transport) since a 16.1 metre sightline does not give time for an emergency stop at any higher speed. Currently, only the good fortune of drivers being able to execute a swerve manoeuvre around pedestrians has averted an accident. Except that an accident did occur in July 16 as described in 2.2.2 when children were knocked off their bikes by a car in this road section. No injuries were incurred and the police were not involved on this occasion. If the proposed development does go ahead with the

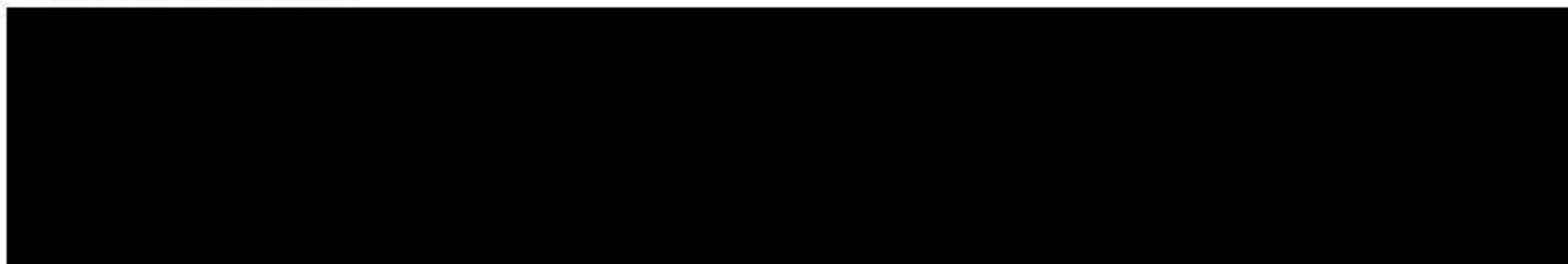
63% increase in the number of dwellings served by this section of road, the probability of the swerve manoeuvre being blocked by the presence of another vehicle is much higher. Hence a collision is a near-certainty unless vehicle speeds are somehow reduced to much less than have been measured by i-Transport.

The authors will be pleased to supply the video evidence (as already supplied to Havant Borough Council) on a USB memory stick.

Possible re-engineering measures:

- Safety humps (aka speed bumps) at the entry points to the blind bends may be part of a potential solution
- Traffic lights to turn the road into a single carriageway between the blind bends, allowing a separate footway/pavement for pedestrians to be created is another possible solution.
- Some other solution which the Council would consider acceptably safe.

Technical Note Authors :



APPENDIX 1: Calculation of correct statistical probability (Result: 1 in 2, not 1 in 56,000)

Calculation of Probability of a pedestrian and 2 vehicles (travelling in opposite directions) occupying the “shared surface” at the same time between the blind bends in Lower Road which are within the existing Conservation Area.

Notes :

- (i) The shared surface is not wide enough to permit a pedestrian and 2 vehicles to pass simultaneously. One vehicle must slow or stop behind the pedestrian until the oncoming vehicle has passed.
- (ii) The data used below is taken from the Transport Statement produced by i-Transport for the developer, Bargate Homes in their Technical Note “Land at Lower Road, Bedhampton”, Project No ITB12174.
- (iii) Relevant data from the i-Transport Technical Note is contained in paragraph 4.3 “Probability Assessment”
- (iv) i-Transport Technical Note Para 4.3.2 states that: “inthe morning peak hour, *when the development is complete*,..... 60 vehicles are anticipated to travel north and 25 vehicles travel south (85 two way movements)”
- (v) i-Transport Technical Note Para 4.3.3 : Shared surface is circa 50 m in length. Checked and agreed.
- (vi) i-Transport Technical Note Para 4.3.6 : Number of Pedestrians in the busiest hour = 18

The following sections calculate the true probability of a pedestrian and 2 vehicles (going in opposite directions) being on the shared section at the same time.

This calculation will then be compared with i-Transport’s own calculation.

i-Transport claimed the probability to be **1 in 56000**.

1. A Computer Modelling Approach for Finding an Accurate Probability of 2 vehicles and a pedestrian meeting on the shared surface:

Complex compound probability situations such as the situation here cannot be readily solved analytically as i-Transport attempted do in paragraphs 4.3.6 and 4.3.7 on page11 of their Technical Note. The calculation they used and somehow arrived at a figure of 1 in 56,000 is wildly in error.

A proper consideration of the distribution of cars within the hour is needed in order to account for the gaps between cars and pedestrians and how this influences the probability of overlapping road users.

In situations such as this, the best approach to obtain a good representation of reality is to construct a numerical model in computer software.

This has been done using the scientific software language MATLAB, a language widely used in science and industry for constructing numerical models. It contains probability algorithms within the code which have been validated worldwide.

The MATLAB numerical simulation computer program was written by Dr N. Hindley*, a scientist at the University of Bath.

2. Description of the MATLAB Numerical Simulation :

The simulation works in the following way:

The transits of each northbound car, southbound car and pedestrian across the road section of Lower Road are randomly distributed across an hour, as shown in Fig. A1. The time resolution is 0.1 Seconds. Transits of the same type (i.e. several pedestrians etc) are allowed to overlap in time, as they would be in reality.

We then check to see if there were any time periods where all three of the road users are on the road section at the same time. Since there is not enough room for all three, this represents a hazard.



The results of running the simulation are a computer generated picture as shown in Figure A1 below. The horizontal axis is the period from 07.30 am to 08.30 am, the weekday rush hour period as listed by i-Transport.

The data fed into the simulation comes from the i-Transport data in para 4.3 of their Technical Note as follows:

- 60 Northbound vehicles each taking 5.6 seconds to transit the shared road section between the two blind bends.
- 25 Southbound vehicles each taking 5.6 seconds to transit the shared road section between the two blind bends.
- 18 pedestrians travelling through the shared section, each taking 36 seconds.

The simulation assumes that the above traffic and pedestrian situation occurs every weekday rush hour but allows the vehicles and pedestrians to arrive randomly during the period using the probability algorithms built into the MATLAB software. To ensure normal statistical fluctuations are smoothed out, the simulation was run 100,000 times.

The programme then searches for those instances (among the 100,000 runs) when 2 vehicles (going in opposite directions) and a pedestrian are on the shared section at the same moment in time. The simulation flags these events as “hazard” and counts how many occur in 100,000 runs. The result is there were 52894 occasions where at least one hazard was detected during an hour.

This yields a probability of 52.89%, or around 1 in 2 that a pedestrian and 2 cars meeting

So in a real-life situation, over the course of a year with 220 weekday rush-hour periods, one could expect typically **132** occasions when a pedestrian and 2 vehicles are on the shared surface and one of the vehicles is forced to slow down or halt behind the pedestrian.

This is **27,000 times** more frequent rate than the 1 in 56,000 figure wrongly given in the i-Transport Technical Note.

Of course, over a 24 hour period, the number of instances of vehicles meeting a pedestrian will be much higher than the **132** instances calculated for a single, 1 hour morning rush hour period, using i-Transport’s data. The evening rush hour figure may be not much less and there will be further, if fewer instances during the other hours of the day.

When considering the danger to pedestrians such a high rate represents, one must also consider the low light level conditions during the winter period as well as weather conditions such a rain, ice and snow and the profusion of slippery leaves on the surface at times during the year.

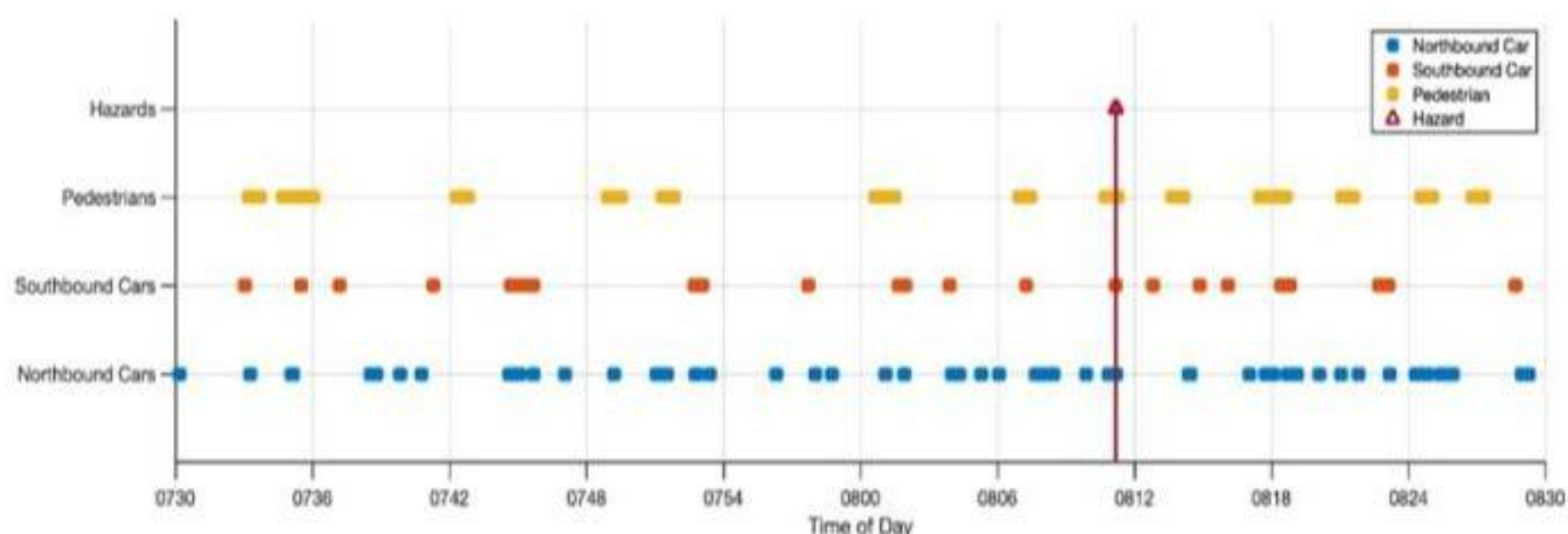


Figure A1: Snapshot of one simulated run from the MATLAB numerical simulation for the road section along Lower Road for the weekday rush hour conditions as listed in the i-Transport Technical Note. Coloured regions represent the randomly-allocated transit along the road section of 60 northbound cars (blue), 25 southbound cars (orange) and 18 pedestrians (yellow). A “hazard” is detected whenever all three users are using the road section at once. One such hazard occurred at around 0810 in the simulation, as marked by the red triangle.

3. Error Analysis

Since we are dealing with calculating probabilities, it is prudent to make an assessment of what level of confidence we can have in the results predicted by the numerical modelling software programme.

To estimate the expected error, a standard error analysis was performed. This involved the above simulation being run instead only 100 times (leading to a more uncertain result), then the whole exercise repeated another 1000 times. This gives us 1000 estimates for the probability, each of which have some unknown error.

However, it was found that a histogram of these values produced a smooth Gaussian distribution, centred around a mean value of 52%, with a standard deviation of around 5%. Given that 99.9% of the distribution is known to lie above 3 standard deviations below the mean for any Gaussian distribution, it is possible to state that we are 99.9% certain of at least one hazard occurring in a single, weekday rush hour is at least 37% or roughly 1 in 3.

To summarise, there is 52.89% probability of hazards occurring when a large number of weekday rush hour events are modelled, ie 132 hazard events in a year. Even when we consider a single weekday rush hour period, we are 99.9% confident that at least one hazard event will occur.

4. Summary

A computer model was created to determine the probability of two cars passing the shared section along Lower Road while a pedestrian was using that road section under weekday rush hour conditions, as listed in the i-Transport Technical Note.

The numerical simulation showed that the probability of such an event was around 52.89% (or 1 in 2), with 99.9% confidence that it was at least 38% (or 1 in 3).

By comparison, the figure i-Transport claim is 1 in 56,000. This figure has been proven to be hugely in error as the correct figure is 1 in 2. **THIS IS A 27,000 FOLD ERROR.**

Hence in a real-life situation, over the course of a year with 250 weekday 1 hour, morning rush-hour periods, one could expect typically **132** occasions when a pedestrian and 2 vehicles are on the shared surface and one of the vehicles is forced to slow down or halt behind the pedestrian.

This is **27,000 times more frequent** rate than the 1 in 56,000 figure wrongly given in the i-Transport Technical Note.

Of course, over a 24 hour period, the number of instances of vehicles meeting a pedestrian will be much higher than the 132 instances calculated for a single, 1 hour morning rush hour period, using i-Transport's data. The evening rush hour figure may be not much less and there will be further, if fewer instances during the other hours of the day.

The 132 figure above is proven but is just for the busiest morning weekday peak hour. Making a judgement for all the other hours in the day, including weekends suggests a probable number of occasions of **at least 400** instances per year when a pedestrian will encounter two vehicles, going in opposite directions on the shared surface, between the 2 blind bends. If on any one of those occasions, a vehicle fails to brake to a sufficient extent to either pull in behind the pedestrian(s) or tries to overtake at the moment the on-coming vehicle is coming around the blind bend ahead, an accident is certain. This will either mean the pedestrian is hit or the 2 vehicles have a head-on collision.

When considering the danger to pedestrians such a high rate represents, one must also consider the low light level conditions during the winter period as well as weather conditions such a rain, ice and snow and the profusion of slippery leaves on the surface at times during the year.

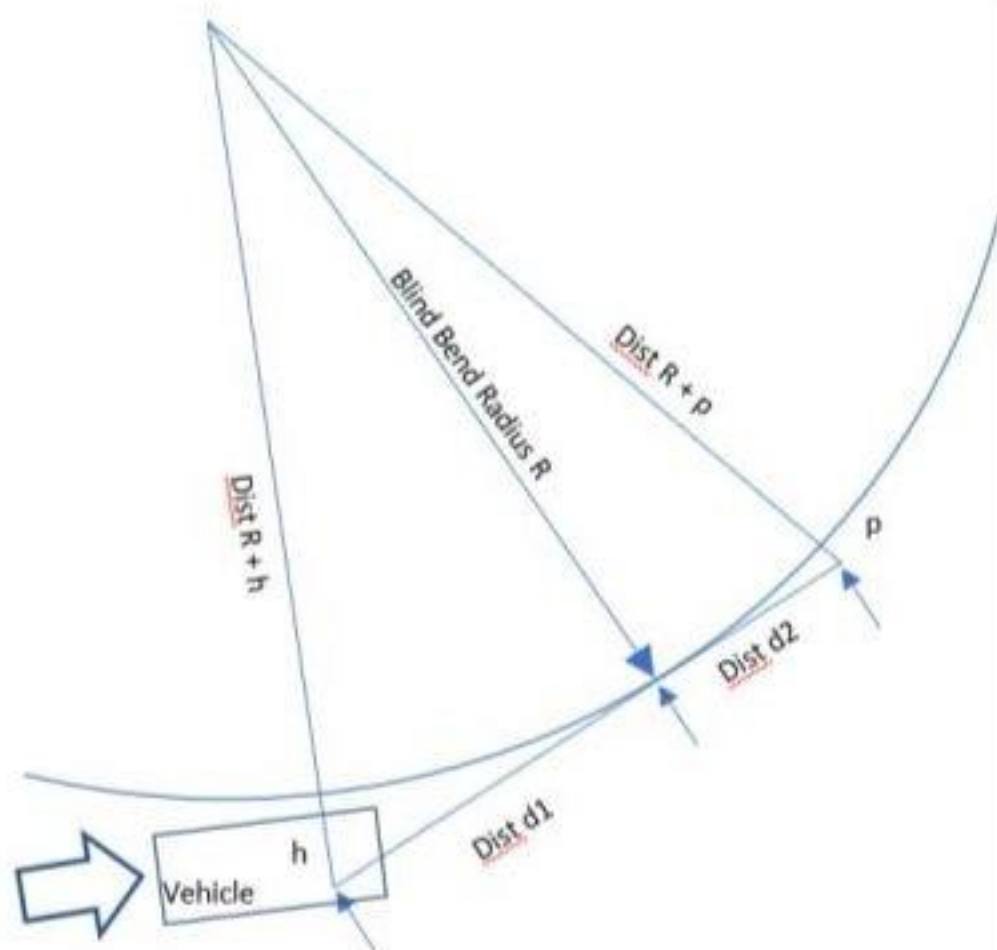
██████████ has advised that he is happy to provide any further clarifications and to supply the MATLAB code to verify the analysis.

His contact details are:

Appendix 2 : Calculation of sightline and high accident risk on eastern side of Lower Road

In the diagram below :

- The curve represents the radius R of the Lower Road corner of the eastern blind bend approx. opposite The Elms entrance. It also approximates to the position of the female pedestrian shown in Fig 1 in Section 2.2. This has been measured to be 41.63 m



Symbols and Sightline calculation

R = blind corner radius measured as 41.63m

p = shoulder width of typical pedestrian (0.47m)

h = typical distance boundary hedge to driver eyes (1.15m)

d1 + d2 = sightline distance from driver to pedestrian

Calculation using basic Pythagoras for 2 right angle triangles :

$$R^2 + d1^2 = (R+h)^2$$

$$R^2 + d2^2 = (R+p)^2$$

Solving for the above:

$$d1 = 9.8 \text{ m}; d2 = 6.3 \text{ m}$$

$$\text{Hence Sightline} = d1 + d2 = \mathbf{16.1 \text{ m} = 52.82 \text{ feet}}$$

Driver Reaction Time (t_r) = 0.67 secs (value used by UK Gov Highway Code and RAC)

Formula for calculating the maximum speed (V_m) that a vehicle can travel and brake to a standstill in a given distance (S_L) is given by :

$$V_m^2 + 2 \cdot f \cdot t_r \cdot V_m - 2fS_L = 0 *$$

Where :

V_m = speed in feet/sec (max speed that a vehicle travel and brake to a halt in a sightline distance S_L (feet))

$f = 21.46 \text{ feet/sec}^2$ (This is the emergency braking deceleration rate as used in the UK High Code)

$t_r = 0.67 \text{ seconds}$ (The standard driver reaction time used in UK Highway Code)

$S_L = 52.82 \text{ feet}$ (Sightline distance around the blind bend as calculated in the above box.)

(Apologies for use of imperial units but these are "traditional" units in UK – eg miles per hour)

The above equation is a standard quadratic and is solved by the usual formula:
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Hence **$V_m = 24.1 \text{ mph}^*$** (35.36 ft/sec) This is the maximum speed a vehicle can be travelling and still come to halt under an emergency stop in *dry conditions* with the sightline of this blind bend and shared surface of **52.8 feet**.

Any faster, and the pedestrian will be hit unless the driver can swerve around. However, as shown in Appendix 1, there will be hundreds of occasions per year when a car will also be coming the other way, blocking a swerve.

*The formula and result is validated in the spreadsheet "Max Speed v Sightlines" attached to this note.

Appendix 3 : Additional List of Residents own traffic safety incidents on the blind bends of Lower Road

[REDACTED]

In early May 2018, I was driving back to my house in Lodge Road when on the dangerous blind bend in Lower Road I was confronted with 3 cyclists across the road; none of them had their hands on the handlebars and one was doing a wheelie. I slammed my breaks on. Fortunately, I had no one else in the car and was driving slowly. The cyclists drove past me unaware they had nearly caused an accident, probably thinking as many cyclists do that Lower Road is part of Broadmarsh cycle track. [REDACTED], I arrived home very shaken and this is not the first time this kind of event has occurred.

[REDACTED]

17 June 2018

[REDACTED]

Summer 2015

I had so many near misses on Lower road bend that I dislike having to drive through it! It happens routinely.

Consequently I drive very slowly through this bend and keep well over to the left, because I often encounter cars coming the other way who drive partly on the wrong side of the road cutting the corner and also many cars who drive too fast or both. Even driving slowly, I still have experienced near misses.

Delivery lorries, builder lorries, large trade vans and couriers are more frequent these days and are forced to drive partly on the wrong side round the bend. I was forced into the hedge by a Sainsbury delivery truck. I phoned the company who identified the driver. He admitted that it was his fault but said the shape of the road and the drives plus the trees and hedges made it extremely difficult to stay in the left-hand lane.

Amazingly, people sometimes park on the bends or the lead up to them or sometimes on the grass verge oblivious to the hazard they cause.

On several occasions I have had to brake hard because of children playing in the road on the blind side of the bend and on occasion pedestrians and cyclists on the wrong side oblivious to the danger.

I find it astonishing that anyone could consider increasing the volume of traffic and making an already dangerous bend worse!

[REDACTED]

[REDACTED]

2017

My husband was hit by a wing mirror of a car crossing Lower road to get to Bidbury Park.

I've also had near misses when cars have come towards me in the middle of the road and I've had to step back!

Also cars have had to stop for us where there is no footpath because of overtaking from other cars.

I am the daughter of above and regularly visit my parents from Salisbury. I have had a number of minor incidents / near misses over the last few years. On one occasion my wing mirror was hit as the other car came into the middle of the road. It is also very dangerous to cross the road from Bidbury Park and a crossing would be required if more traffic. Signature follows.

[REDACTED]

9th June 2018

[REDACTED]

10 July 2018

Subject: Near Miss – Lower Road between blind bends

Hi Guys

I don't know if you are still counting near misses but if so please log on for today!

4:30 PM, came around bend (in car) just by The Lodge to meet 3 lads coming along on the road using push scooters. Aged 6 - 11 approx. The last two were on the wrong side of the road. We always crawl around the corner so we were able to stop in time but had we been going at the speed of some vehicles will see coming round there, it could have been very nasty indeed.

Thanks

[REDACTED]

[REDACTED]

11th of June 2018

We were coming out of our drive at approximately 2 PM when a white van (unmarked) came round the corner of Lower road on the wrong side of the road. This was immediately followed by red car and they appeared to be having a race.

This is not an unusual occurrence as there are too many incidents like this and it is only a matter of time before someone drives into our car. We are always very cautious coming out of our drive but the traffic has definitely increased over the last 5 years.

[REDACTED]

14th of June 2018

[REDACTED]

2017

I was driving in a southerly direction on route home entering the first of the double blind bends when I was confronted by a young male cyclist approximately 10 years old riding in the middle of the road coming towards me, as there is no cycle or pedestrian alternative nor is there space to install one.

Due to my quick reflexes I narrowly avoided a potentially serious injury to the child who, by the way was not accompanied by an adult.

This incident occurred last year during daylight hours.

[REDACTED]

Date of Report : 14 June 2018

[REDACTED]

Summer 2017

I was driving home on a weekday afternoon coming down Brookside road turning into Lower road. On rounding the blind bend outside the Elms, I immediately came up behind 2 pedestrians and strolling South along Lower road in the road. They had their backs to oncoming traffic so could not see me approach them suddenly. Had I not been driving carefully at less than 20 miles per hour I would have collided with them both. Fortunately, I stopped just in time and waited until they had crossed the road to the pavement. It was also fortunate that there was not another vehicle approaching from the other direction at the same time or the pedestrians could have leapt into the path of the other vehicle.

This was not the first time I have encountered pedestrians in the road, out of sight of oncoming traffic as they round the blind bend.

May 2018

On driving from my house along Lower road I approached the left hand blind bend round to Number 12 when another vehicle approached the corner at the same time. Although the other vehicle was a small family car, the driver took a line across the blind bend cutting off the corner even though they could see me approaching.

Had I not braked sharply to a halt, I would have hit either the oncoming car or the steep concrete kerbstones on the left hand side of the road along the inner corner (of the blind bend).

[REDACTED]

10th of June 2018

[REDACTED]

On Sunday 13th of May 2018, my daughter and I were weeding the front rockery. As there is no pavement in front of the property we were having to stand in the road.

4 boys in their early teens came riding around the corner 4 abreast on push-bikes and doing "wheelies" completely oblivious to any danger.

A lady who I believe lives in Lodge Road drove round the corner and had to do an emergency stop in order to avoid hitting them.

She later walked by us, as we were still gardening and stopped to talk to us about the incident as she was obviously shaken up.

[REDACTED]

17 June 2018

[REDACTED]

May 2018:

As Lodge road resident of Old Bedhampton for 30 plus years I am fully aware of the dangerous blind bends in Lower Road and always drive with extreme care. I have had to take immediate action to avoid accidents many times.

25th of May 2018: Driving around the blind bends I was met by 3 boys on bikes, no hands, riding across the road towards us towards me. If I had not been driving slowly and if another vehicle had been behind me when I braked sharply there would have been a serious accident.

29th of May 2018: I was driving down Brookside then turned right into Lower Road approaching the bends slowly. I had to make an emergency stop outside the white bungalow as a blue Mini was coming towards me on my side. The driver was avoiding a dog walker in part of his own line. There is no pavement for pedestrians on this section of Lower Road.

[REDACTED]

7th of June 2018

Appendix 4 : This Appendix is in the form of an Excel Spreadsheet, hence it is a separate document