Shepley Road, Stocksmoor Proposed Residential Development

Intensification of Traffic on Stone Wood Lane

Proof of Evidence

Planning Application Reference – 2024/62/91242/E

Contents

1 Qualifications and Experience

1.1.1 I am a Senior Lecturer in Probability and Statistics in the Department of Mathematics at The University of Manchester. Relevant to this case, I have expertise on probability and statistics, mathematical modelling, and queuing theory, a branch of mathematics which has numerous applications to traffic management.

1.1.2 I hold a First Class Honours MMath Mathematics degree from the University of Oxford and a DPhil in Statistics, also from Oxford.

1.1.3 I grew up in the neighbouring village of Thurstonland and now live in Stocksmoor with my family. I have used Stone Wood Lane (SWL) throughout my life, as a driver, keen cyclist, and as a walker to access the ancient woodland with my family.

1.1.4 STATEMENT OF TRUTH

I confirm that the facts and opinions expressed in this Proof of Evidence are true to the best of my knowledge and belief.

Signed:

Name:
Dated: 27 January 2026

2 Background and introductory comments

2.1.1 I support the LPA's rejection of this application on highways safety grounds, and believe that they have provided a convincing rebuttal to the Appellant's appeal.

2.1.2 I will focus on the matter of predictive vehicle movements on SWL arising from the proposed development and the corresponding effect on highways safety and function. Given my professional expertise, I believe that I am well placed to comment on this matter.

2.1.3 I will argue that the projected vehicle movements on SWL proposed by the Appellant's third traffic consultant are unreliable and most likely underestimate the additional vehicle movements on Shepley Road and SWL.

2.1.4 The Appellant's third traffic consultant predicts that the development would result in, on average, an additional 7 vehicle movements on SWL during peak hours (which the LPA consider to be an underestimate). They then conclude, without further analysis, that "it is evident by any measure" that this figure "represents a 'non-material' impact."

2.1.5 The LPA have done a higher-level analysis, and reference that on sensitive roads even a 5–10% increase in traffic can be significant.

2.1.6 I will use mathematical modelling to demonstrate why even small increases in traffic on sensitive roads can have a significant effect. My analysis will concern the number of vehicle conflicts, that is when two or more vehicles seek to occupy the same space at the same time on a single-track section when travelling in opposite directions. Vehicle conflicts can sometimes result in delays of just a few seconds if the vehicles meet near passing places, but sometimes need to be resolved through challenging extended reversing manoeuvres with multiple vehicles involved.

2.1.7 There is already a serious issue on SWL concerning when two vehicles meet on a single-track section and are unable to pass each other before other cars join, leading to long queues of cars. The LPA have commented that they have had to perform extended reversing manoeuvres during their site visits. The most problematic section is the extended section through the ancient woodland. Here driver's must perform extended reversing manoeuvres over a severe gradient with limited visibility. This can result in standoffs, frustration and at times anger. Active road users are also put in a difficult position as there is not an adequate place for them to shelter whilst these challenging reversing manoeuvres are performed.

2.1.8 Related to this matter, the Appellant has claimed that the single-track section through the ancient woodland can be divided into a 110m section and another 72m section separated by a passing place. I consider this to be a highly misleading assertion, as this supposed passing place within the ancient woodland is completely inadequate. I will argue that the single-track section through the ancient woodland is in practice around 182m.

2.1.9 My analysis will demonstrate that the number of vehicles conflicts rises at a surprisingly fast rate as a function of overall vehicle movements, with the increase being particularly dramatic for the more severe multi-vehicle conflicts. The implication is that a road that just about functions in peak hours may be tipped out of balance by even an apparently modest intensification of traffic.

3 Predicted vehicle movements arising from the proposed development

3.1.1 Optima have sought to quantify the impact of the proposed development by estimating, on average, an additional 28 vehicle movements on Shepley Road per peak AM and PM hours, including 7 vehicles per peak hour on SWL. These figures can be disputed as being too low (as the LPA have done) and must be considered unreliable on account of the discrepancy with the figures compiled by the other two traffic consultants.

3.1.2 In response to the Appellant's appeal, the LPA have provided a convincing critique of the Appellant's methodology and argued that their figures are most likely to be underestimates. The LPA have argued that more robust figures are, on average, an additional 32 vehicle movements on Shepley Road and an additional 16 vehicle movements on SWL in peak hours.

3.1.3 The figure of 32 vehicle movements on Shepley Road is arrived at through what seems to me to be the most logical approach possible. For the Storthes Hall development, Optima estimated 0.7 vehicle movements per residence, which when applied to this development gives 35 vehicle movements. The figure of 32 vehicle movements per hour is then arrived at through application of a rather generous (in my opinion) 10% discount that is applied due to the travel plan. Given that the connectivity score of the proposed development (33) is almost exactly the same as for the Storthes Hall development, this methodology seems entirely reasonable.

3.1.4 The figure provided by the council thus goes above the threshold of 30 vehicles per hour that the Appellant cites. One should also put this figure into context - this represents an estimated additional 32 vehicle movements from a development located by a blind bend immediately adjacent to a former cart road with significant single-track sections.

3.1.5 The LPA argues that the third traffic consultant's methodology contains flawed assumptions, citing examples, one of which is the (incorrect) claim by the Appellant that residents would not use SWL to access the M1.

3.1.6 A further significant omission is that the Appellant appears to have not considered vehicle movements based on trips to nurseries. The nearest nurseries are Shepley Pre School and Greyfell Academy (both with opening hours 7.30am to 6.00pm), which are most directly accessed via SWL. Since September 2025, the government has made available free childcare for 30 hours per week for children aged 9 months to 4 years old, growing from 15 hours per week in September 2024. This has resulted in a significant behavioural shift, with many parents now making use of these free hours for children as young as 9 months old.

3.1.7 I will not attempt to make a precise prediction as to the expected number of vehicle movements based on trips to nursery, but I believe that it is reasonable to assert that the development would almost certainly generate at least 2 such vehicle movements in peak hours, which would push the third traffic consultant's figure of 28 to over 30. Moreover, in terms of a robust analysis in terms of all reasonable future scenarios, even if one takes the Appellant's figure of 7 vehicle movements per hour on SWL, it would only take 5 families making return trips to drop kids off at nursery during peak hours (certainly a reasonable future scenario) to elevate this figure to the LPA's proposed figure of 16 vehicle movements per hour.

4 Single-track sections and passing places

4.1 On the length of the single-track section in the ancient woodland

4.1.1 Relevant to my analysis of vehicle conflicts, it is important to establish the length of the single-track section through the ancient woodland.

4.1.2 The Appellant has claimed that the longest section is 110m before a passing place is arrived at. After this supposed passing place there is another extended 72m single-track section that continues further down the hill.

4.1.3 This passing place is completely inadequate and improvements appear infeasible as it is enclosed by stone walls built into the ancient woodland. The passing place is just about large enough to allow a single small to average sized car to shelter whilst another small to average car passes with its wing mirror pulled in. However, the passing place is too small for large cars and vans and can only hold a single vehicle. Given that multi-vehicle conflicts are quite common in peak hours on this section, it is particularly poorly suited as a passing place in peak hours. Using the passing place is also demanding, and when walking the route I noticed tyres marks that indicate that a vehicle had reversed into the wall when attempting a reversing manoeuvre (photo in Appendix C).

4.1.4 In my experience, this passing place is quite rarely used in practice, with most drivers performing a reversing manoeuvre a further 72m down the hill until the road opens up to a dual-track section. It tends to be used only by skilled drivers of small cars who are familiar with the road and are confident performing the delicate manoeuvre. Photographs showing a reversing manoeuvre down the hill past the supposed passing place are given in Appendix C.

4.1.5 I advise the Inspector to assess this passing place during the site visit and ascertain for himself whether he believes that this can be considered an adequate passing place.

4.1.6 If this passing place is deemed inadequate (my strong opinion), then the single-track section through the ancient woodland is in fact around 182m in length. This figure is completely unacceptable. It is well in excess of guideline figures, and the severity of the issue is compounded by the poor visibility, severe gradient, lack of street lighting, lack of gritting in winter, and an absence of suitable places for active road users to shelter when vehicles meet along this section.

4.1.7 Going forwards, I will carry out my analysis based on a 182m single-track section through the ancient woodland. I consider this entirely reasonable, because my analysis of this section of road considers multi-vehicle conflicts, and it is simply not possible for these conflicts to be resolved at this passing place. However, I have also provided figures based on a 110m single-track section in Appendix B.

4.2 Comments on other single-track sections

4.2.1 Also relevant to my analysis is the total length of the single-track sections along SWL. For my analysis, I will take the total length of the single-track section to be 600m. This figure has been cited in some of the 307 objections by residents who paced out the single-track sections in response to the Appellant's first traffic consultant only acknowledging that SWL narrows for 125m (page 5 of the Transport Assessment (01/05/2024)).

4.2.2 It is the experience of several long-term residents that in late autumn 2024 and late autumn 2025 the vegetation along SWL received its most vigorous trim that they had ever observed.

4.2.3 When the vegetation grows back in the summer, sight lines will be significantly reduced and passing on certain parts of SWL will become significantly more challenging than at the date of the Inspector's site visit.

4.2.4 I will not comment in much further detail on passing places, as the LPA have already conducted a detailed analysis. However, I wish to state that it is my opinion that the Appellant's third consultant has understated how problematic SWL is in their discussion of passing places. For example, on reading paragraph 6.2.17 of their report one may be led to believe that the section 'Chainage 708.00 to 890.00' is fairly innocuous with perfectly adequate passing provision. I view their assertion that the passing place is "still sufficient to permit two opposing cars to pass and allow pedestrians/cyclists/horse riders to shelter" to be misleading, as this section can prove challenging when the vegetation has not been trimmed. A photograph demonstrating this is provided in Appendix C.

5 Implications of the increased traffic on Stone Wood Lane

5.1 Background and some intuition

5.1.1 I will study the implications of the increased traffic on SWL in terms of its impact on the number of vehicle conflicts. This work, which will involve mathematical modelling of traffic flow on SWL, will demonstrate why small increases in traffic on sensitive roads can be significant. Mathematical modelling of the number of conflicts can become rather involved, so I will limit my focus to understanding the increase in traffic flow in two settings, which have the desirable features of being instructive and allowing for tractable and relatively transparent modelling. These settings are (i) the total number of vehicle conflicts in peak AM and PM hours and (ii) the number of multi-vehicle conflicts on the extended single-track section through the ancient woodland.

5.1.2 Whilst, I have strived to keep the analysis as simple as feasible, it is inevitably a little technical. Therefore, before diving into the analysis, I wish to explain the intuition behind why increases in vehicle movements have a disproportionately great effect on the number of conflicts.

5.1.3 The total number of vehicle conflicts is proportional to the product of the number of northbound and southbound cars (this is quantified in formula (5.1) below), not their sum, and as such grows at a faster rate than may naively be expected.

5.1.4 In the case of multi-vehicle conflicts on the single-track section through the ancient woodland, my analysis will reveal a steep increase in the number of 3, 4 and 5 vehicle conflicts. This steep increase arises because if a northbound vehicle and southbound vehicle have met in a single-track section and cannot pass one another quickly enough, other vehicles will start to join them. As the the number of vehicles on SWL increases, there is a greater chance that an additional vehicle meets the original two vehicles before they are able to pass one another, and this effect compounds with each additional vehicle.

5.1.5 Finally, I wish to stress that the forthcoming mathematical analysis involves a number of approximations and assumptions (as is the case for any mathematical modelling). I have strived to make these assumptions clear and to ensure that my modelling is conservative, meaning that the forthcoming figures are most likely to be underestimates.

5.2 Predicted vehicle counts

5.2.1 In order to conduct my analysis, I will require figures for two-way traffic flow on SWL that have been compiled in the traffic reports. Table 3 of the LPA's Highways Technical Response (24/11/25) provides average and maximum two-way weekday peak hour traffic flows and also a projection for the 2030 base flow that assume a 1.052% increase in traffic. For my analysis, I will also require the number of northbound (NB) and southbound (SB) vehicle movements, which can found in Appendix A of the LPA's Highways Technical Response. I could not find the breakdown of northbound and southbound vehicle figures for the peak AM two-way flow of 90, so estimated the number of northbound and south bound vehicles to be $90 \times 0.58 \approx 52$ and $90 \times 0.42 \approx 38$, respectively, as from Appendix A of the LPA's Highways Technical Response the proportion of northbound and southbound vehicles in the peak AM hour are 0.58 and 0.42, respectively. The figures are reported in Table 1.

5.2.2 The raw vehicle counts given in Appendix A of the LPA's Highways Technical Response reveal that the average two-way flow is significantly higher on Tuesdays, Wednesdays and Thursdays than on Mondays and Fridays. In that sense, the average figures reported (the average over all weekdays) are a little misleading. The maximum traffic flow numbers (given in Row B) should not be viewed as outliers, as in fact the maximum PM figures across the four survey weeks are quite consistent at 84, 85, 87 and 89. It is therefore my opinion that analysis of traffic flow on SWL should mostly focus on the maximum weekday figures given in Row B (and the projections thereafter) as these figures provide a more robust description of reasonable future scenarios than the average figures that are skewed down by the lower Monday and Friday counts. For this reason, I also believe that the 1.05% base flow increase should have been applied to the maximum weekday traffic figures. However, going forwards, I will consider projections based on average weekday flow (with the base flow increase applied) and maximum weekday flow (without the base flow increase applied) to keep figures consistent with those presented in the LPA's SoC.

Table 1: Weekday peak hour two-way flows on Stone Wood Lane.

| | Traffic Flows | | | | | |
| | AM Peak (0800–0900) | | | PM Peak (1700–1800) | | |
Scenario	NB	SB	Two-way	NB	SB	Two-way
Row A: Max. Average Weekday Base	40	29	69	32	42	74
Row B: Max. Weekday	52	38	90	39	50	89
Row C: 2030 Base Traffic Flow (Row A ×1.052)	42	31	73	34	44	78

5.2.3 Table 2 provides projected traffic flows on SWL based on figures of the Appellant's third traffic consultant, which proposes an additional 2 northbound and 5 southbound vehicle movements in the peak AM hour and an additional 5 northbound and 2 southbound vehicle movements in the peak PM hour. The LPA's Highways Technical Response (24/11/25) proposed an additional 16 vehicle movements per peak AM and peak PM hour. I could not find a breakdown of this figure into northbound and southbound vehicle movements, so have used the same ratio as the Appellant's third traffic consultant to arrive at a projection of an additional 5 northbound and 11 southbound vehicle movements in the peak AM hour and an additional 11 northbound and 5 southbound vehicle movements in the peak PM hour. These projections are recorded in Table 3.

Table 2: Projected weekday peak hour two-way flows on Stone Wood Lane, using the figures of the Appellant's third traffic consultant.

| | Traffic Flows | | | | | |
| | AM Peak (0800–0900) | | | PM Peak (1700–1800) | | |
Scenario	NB	SB	Two-way	NB	SB	Two-way
Projected average weekday flow (1.052% base flow increase applied)	44	36	80	39	46	85
Projected maximum weekday flow (1.052% base flow increase not applied)	54	43	97	44	52	96

5.3 Predicted vehicle conflicts I: initial comments on modelling

5.3.1 I will follow a simple and canonical approach to the mathematical modelling of vehicle conflicts. I will model the flow of northbound and southbound vehicles on SWL using the Poisson

Table 3: Projected weekday peak hour two-way flows on Stone Wood Lane, using the an extrapolation of figures given in the LPA's Highways Technical Response (24/11/25).

| | Traffic Flows | | | | | |
| | AM Peak (0800–0900) | | | PM Peak (1700–1800) | | |
Scenario	NB	SB	Two-way	NB	SB	Two-way
Projected average weekday flow (1.052% base flow increase applied)	47	42	89	45	49	94
Projected maximum weekday flow (1.052% base flow increase not applied)	57	49	106	50	55	105

process, which is a canonical stochastic model used in queueing theory, a branch of mathematics that has been widely applied to traffic management on account of a good fit to real traffic flow data and that it allows for a relatively tractable mathematical analysis of features of traffic systems. It is one of the simplest stochastic models and is typically encountered in second-year courses on probability as part of a BSc Mathematics degree.

5.3.2 Northbound and southbound traffic will be modelled using Poisson processes. To do so, we must prescribe rate parameters λ_N and λ_S, which specify the average number of northbound and southbound vehicles per hour. As an example, if modelling traffic flow using the current average weekday base (plus the 1.05% base flow increase) in the peak AM hour, we would use the figures from Table 1 to get $\lambda_N = 42$ and $\lambda_S = 31$.

5.3.3 In simple terms, using a Poisson process to model northbound traffic can be understood as follows; the same applies to southbound traffic. Over the course of the hour, a Poisson distributed (with parameter λ_N) number of vehicles will enter SWL in the northbound direction, with the times between vehicles entering being exponentially distributed (with parameter λ_N).

5.3.4 A key feature of the Poisson process model is that all northbound (and southbound) vehicles are assumed to enter SWL independently of one another. This feature makes the mathematical analysis of the Poisson process simple and is a good first approximation, as most cars would enter the road independently of one another. However, in practice some cars do not arrive independently; for example, a faster vehicle may be stuck behind a slower vehicle, friends or family may be travelling to an event together etc. It is therefore important to note that using the Poisson process to model vehicle conflicts will naturally underestimate the number of multi-vehicle conflicts.

5.4 Predicted vehicle conflicts II: estimates for the total number of conflicts

5.4.1 In this analysis, we seek to estimate the total number of two-vehicle conflicts on SWL in peak hours, that is the number of times that a northbound and southbound vehicle will meet on the single-track sections during peak hours.

5.4.2 My model for estimating the total number of two-vehicle conflicts on SWL is very simple. Vehicles enter SWL northbound and southbound according to Poisson processes (with certain rate parameters) and each time that a northbound and southbound vehicle meet in a single-track section this is counted as one vehicle conflict. In this simple model, it is assumed (to keep the analysis tractable, and also conservative) that if a northbound and southbound vehicle meet in a single-track section then the vehicles immediately resolve their conflict and pass straight past one another with no reduction in speed. As such this (conservative) analysis

does not detect multi-vehicle conflicts involving three or more vehicles; this is the subject of the next section.

5.4.3 Under the above model, the expected number of vehicle conflicts E in a peak AM or PM hour is given by

$$E = \lambda_N \lambda_S \, t, \tag{5.1}$$

where t denotes the average time (in hours) that it takes vehicles to traverse the circa $600\,\mathrm{m} = 0.373\,\mathrm{miles}$ of single-track sections. This simple formula is derived in Appendix A, as are all other formulas presented in this section. Taking the average speed of vehicles to be 19.7mph, gives that $t = 0.373/19.7 = 0.0189\,\mathrm{hours}$. The figure of $19.7\,\mathrm{mph}$ is given as the mean speed (in both directions) at Site No. 3 along SWL as reported in Appendix B of the the report of the Appellant's third traffic consultant. Speeds at Site No. 3 are the most representative as indicative of average speeds along single-track sections among all other sites considered in the ATC survey. I tested this figure myself by driving SWL several times and observed 19.7mph to be a reasonable average speed along single-track sections when unimpeded by other vehicles; if one were to include situations in which vehicles must slow down to pass other vehicles, the average speed may be lower than 19.7mph, so I consider this to be a reasonable and conservative figure. As an example, using the current average weekday base in the peak AM hour we have $\lambda_N = 42$ and $\lambda_S = 31$, giving an expected number of vehicle conflicts as

$$E = 42 \times 31 \times 0.0189 = 24.6 \approx 25.$$

The expected number N of conflicts per vehicle per peak AM or PM hour is given by

$$N = \frac{2\lambda_N \lambda_S \, t}{\lambda_N + \lambda_S}. \tag{5.2}$$

Table 4: Weekday peak hour expected vehicle conflicts on Stone Wood Lane.

| | Vehicle conflicts | | | |
| | AM Peak (0800–0900) | | PM Peak (1700–1800) | |
Scenario	total conflicts	conflicts per vehicle	total conflicts	conflicts per vehicle
2030 Base Traffic Flow	25	0.67	28	0.72
Max. Weekday	37	0.83	37	0.83
2030 Base Traffic Flow + Appellant's projected increase	30 (+20%)	0.75 (+12%)	34 (+21%)	0.80 (+11%)
Max. Weekday + Appellant's projected increase	44 (+19%)	0.90 (+8%)	43 (+16%)	0.90 (+8%)
2030 Base Traffic Flow + LPA's projected increase	37 (+48%)	0.84 (+25%)	42 (+50%)	0.89 (+24%)
Max. Weekday + LPA's projected increase	53 (+43%)	1.00 (+20%)	52 (+41%)	0.99 (+19%)

5.4.4 Expected total conflicts on SWL in peak AM and PM hours and conflicts per vehicle are reported in Table 4. One observes that increases in traffic flow has a disproportionate increase on the number of conflicts. For example, the maximum weekday peak AM traffic two-way traffic count of 90 increases to 97 under the third traffic consultant's projections (an 8% increase), whilst the number of conflicts increases from 37 to 44, representing a 19% increase. This rises further to 53 conflicts per hour under the LPA's projected additional 16 vehicle movements per peak hour, representing a 43% increase over the current baseline. Under the

LPA's projected additional 16 vehicle movements per peak hour, the estimated maximum weekday peak hour conflicts per vehicles are 1.00 and 0.99 in the peak AM and PM hours, meaning that each vehicle would expect to meet on average one vehicle in a single-track section of SWL per peak hour, a future scenario that appears to me to be rather stressful, especially when it is noted that these figures are likely underestimates.

5.5 Predicted vehicle conflicts III: estimates for the number of multi-vehicle conflicts on the single-track section through the ancient woodland

5.5.1 We now analyse the expected number of multi-vehicle conflicts on the circa 182m single-track section through the ancient woodland. Letting E_k denote the expected number of k-vehicle conflicts ($k \geq 2$) in a peak AM or PM hour, we have the formula

$$E_k = \lambda_N \lambda_S \, t_{\text{section}} \cdot \mathrm{e}^{-(\lambda_N + \lambda_S)\tau} \frac{((\lambda_N + \lambda_S)\tau)^{k-2}}{(k-2)!}, \quad k \geq 2, \tag{5.3}$$

where $\mathrm{e} = 0.271\ldots$ is Euler's constant, $(k-2)! = 1 \times 2 \times 3 \times \cdots \times (k-2)$ is the factorial function, t_{section} is the time taken for a vehicle to traverse the 182m section and τ is the average time taken (in hours) to resolve a conflict between a northbound and southbound vehicle in the single-track section.

5.5.2 Formula (5.3) is derived as follows. We first calculate the expected number of times that a northbound and southbound vehicle will meet in the single-track section (which is given by the factor $\lambda_N \lambda_S t_{\text{section}}$). We then suppose that it takes 30 seconds to resolve this conflict. The other term of the formula then provides the probability of these vehicles being joined by $k-2$ more vehicles within these 30 seconds.

5.5.3 Formula (5.3) can thus be seen to provide a conservative estimate for the expected number of conflicts involving four and five vehicles for the following reasons. In practice, if a third vehicle joins two vehicles trying to pass one another, one would expect that the presence of a third vehicle will increase the time it takes the first two cars to pass one another (for example, if an additional vehicle needs to perform a reversing manoeuvre), thus giving more time for a fourth vehicle to join. This effect would compound as more vehicles join the conflict. To keep the model tractable, I have not included this feature of the delay length increasing as more vehicles join the conflict, and I thus most likely underestimated the number of conflicts involving four or five vehicles.

5.5.4 I will set $t_{\text{section}} = 20/3600 = 0.00556$ hours. I have arrived at this figure by driving the circa 182m section several times. When unimpeded by other vehicles, my average time to drive this section was 20 seconds (average time of 19 seconds going up the hill and 21 seconds going down the hill, slower down hill due to the poor visibility on the bend when going down the hill). I believe that I drive slightly faster than average and the figures are for an unimpeded drive along the section, so I consider the estimate to be a conservative estimate for the time taken by an average car in peak hours to traverse the 182m single-track section.

5.5.5 I will set the average time to resolve a conflict to be 30 seconds, so that $\tau = 0.5/60 = 0.00833$ hours. It is difficult to estimate this figure, and I am going a little on my own experiences. However, I consider it to be a reasonable and likely conservative figure. Whilst conflicts can be resolved in a matter of seconds if both vehicles are near the end of the single-track section, they can take over a minute if the vehicles meet nearer to the middle of the

section. I am also not accounting for additional delays caused if additional vehicles join two others, which increases delays further. Finally, more precise modelling would treat τ as being random (delays can be a matter of seconds or go into the minutes); I do not attempt to do so due to the additional complexity of estimating a suitable distribution for τ. By keeping τ constant (and not random), my modelling will underweight the number of conflicts involving 4 and 5 vehicles, as such multi-vehicle conflicts are more likely to occur if the first two vehicles that meet take a long time to resolve their conflict.

Table 5: Weekday expected multi-vehicle conflicts on the circa 182m single-track section through the ancient woodland in the AM peak (0800–0900).

	Expected number of multi-vehicle conflicts			
Scenario	2 veh.	3 veh.	4 veh.	5 veh.
2030 Base Traffic Flow	3.94	2.40	0.73	0.15
Max. Weekday	5.19	3.89	1.46	0.36
2030 Base Traffic Flow + Appellant's projected increase	4.52 (+15%)	3.01 (+25%)	1.00 (+37%)	0.22 (+47%)
Max. Weekday + Appellant's projected increase	5.75 (+11%)	4.64 (+19%)	1.87 (+28%)	0.50 (+39%)
2030 Base Traffic Flow + LPA's projected increase	5.22 (+32%)	3.87 (+61%)	1.44 (+97%)	0.35 (+133%)
Max. Weekday + LPA's projected increase	6.42 (+24%)	5.67 (+46%)	2.51 (+72%)	0.74 (+106%)

Table 6: Weekday expected multi-vehicle conflicts on the circa 182m single-track section through the ancient woodland in the PM peak (1700–1800).

	Expected number of multi-vehicle conflicts			
Scenario	2 veh.	3 veh.	4 veh.	5 veh.
2030 Base Traffic Flow	4.34	2.82	0.92	0.20
Max. Weekday	5.15	3.82	1.42	0.34
2030 Base Traffic Flow + Appellant's projected increase	4.90 (+13%)	3.47 (+23%)	1.23 (+34%)	0.29 (+45%)
Max. Weekday + Appellant's projected increase	5.71 (+11%)	4.57 (+20%)	1.83 (+29%)	0.49 (+44%)
2030 Base Traffic Flow + LPA's projected increase	5.60 (+29%)	4.39 (+56%)	1.53 (+66%)	0.40 (+100%)
Max. Weekday + LPA's projected increase	6.36 (23+%)	5.56 (+46%)	2.34 (+65%)	0.89 (+162%)

5.5.6 The expected number of 2, 3, 4 and 5 vehicle conflicts on the single-track section through the ancient woodland are reported in Table 5 (AM peak) and Table 6 (PM peak). One observes that the expected number of 3, 4 and 5 vehicle conflicts rises steeply. For example, recall that the maximum weekday peak AM traffic two-way traffic count of 90 increases to 97 under the Appellant's projections, representing an 8% increase. However, the expected number of 3, 4 and 5 vehicle conflicts increases by 19%, 28% and 39%, respectively, relative to the baseline current number of multi-vehicle conflicts. The rises are greater still under the LPA's projected two-way traffic flow increase, with expected number of 3, 4 and 5 vehicle conflicts increasing by 46%, 72% and 106%, respectively, relative to the baseline. Under the Appellant's lower projections, the expected number of 5 vehicle conflicts during the busiest peak AM and PM hours are given by 0.50 and 0.49, respectively. This means that one would expect to see a 5-vehicle conflict on the extended single-track section every other peak AM or PM hour.

6 Summary

6.1.1 I have disputed the claim by the Appellant that the extended single-track section through the ancient woodland can be viewed as 110m and 72m single-track sections separated by a passing place. I have pointed out that this passing place is completely inadequate. If this point is taken, then it means that the extended single-track section through the ancient woodland is 182m in length. This figure of 182m greatly exceeds industry standards, and the severity of the issue is exacerbated by other constraints such as the poor visibility, steep gradient, lack of street lighting, lack of gritting in winter, and an absence of suitable places for active road users to shelter when vehicles meet along this section.

6.1.2 Based on the projected vehicle movements along SWL proposed by the Appellant's third traffic consultant and the LPA, I have considered the implications of this increase in traffic on the number of vehicle conflicts in SWL in peak hours. This analysis is highly relevant, because multi-vehicle conflicts are already a serious problem on SWL during peak hours. Multi-vehicle conflicts can be highly stressful for drivers who are put on the spot to perform challenging reversing manoeuvres. Standoffs, frustration and at times anger are unfortunately common during peak hours, and active road users can be put in difficult situations as this unfolds.

6.1.3 I have demonstrated by standard and conservative modelling that the projected increases in traffic along SWL will result in a disproportionate increase in the number of vehicle conflicts, particularly for the multi-vehicle conflicts arising on the extended single-track section through the ancient woodland. The percentage increases that I arrive at (which are likely underestimates) are rather substantial even for the lower projected vehicle movements proposed by the Appellant's third traffic consultant.

6.1.4 Some of my figures point to a road under severe stress in peak hours. Under the LPA's projected vehicle movements, my conservative modelling suggests that during the busiest peak hours each vehicle will meet on average one other vehicle in single-track sections when traversing SWL. Even under the Appellant's lower projected figures, my modelling suggests that on the busiest days the number of conflicts involving 5 vehicles will increase to the point that every other peak hour one would expect to see a 5-vehicle conflict along the extended single-track section through the ancient woodland (on average 0.50 five-vehicle conflicts in the AM peak and 0.49 five-vehicle conflicts in the PM peak). Five vehicle conflicts are very troublesome to resolve and can result in even longer queues of cars, leading to immense stress. That these stressful scenarios could become a daily event is of serious concern.

6.1.5 Since the Pre-Application Enquiry, the LPA has made it clear that it views SWL as being unsuitable for any further intensification of traffic. This view is consistent with the experience of residents of Stocksmoor, as expressed in many of the 307 objections. The projected increases in vehicle conflicts given in my conservative modelling should therefore by viewed as very concerning. I therefore strongly believe that this appeal should be refused on the grounds that the proposed development posses an unacceptable risk to highways safety and will lead to an unacceptable deterioration of highway function on a highly sensitive road.

A Derivations

A.1 Basics on Poisson processes

Consider a Poisson process with rate parameter λ. In a time interval of length t, the number of events observed in the Poisson process is Poisson distributed with parameter λt. That is, if we let N_t be the number of events, then N_t is Poisson distributed with parameter λt, so that the probability that $N_t = k$ $(k = 0, 1, 2, \ldots)$ is given by

$$\mathbb{P}(N_t = k) = \mathrm{e}^{-\lambda t}\frac{(\lambda t)^k}{k!}, \quad k = 0, 1, 2, \ldots.$$

The expected number of observations in a time interval of length t is given by the mean of the corresponding Poisson distribution, and is thus given by λt.

A.2 Derivation of formula (5.1)

Recall that we suppose that northbound and southbound vehicles enter SWL according to independent Poisson processes with rate parameters λ_N and λ_S, respectively. We assume that vehicles travel through all single-track sections at a constant velocity and that if a northbound and southbound vehicle meet on a single-track section then they just drive straight past one another with no delay. We wish to calculate E, the expected number of times that a northbound vehicle and a southbound vehicle meet in a single-track section during a peak hour.

Due to our assumptions that all vehicles travel at constant velocity over the single-track sections and that northbound and southbound vehicles maintain this constant velocity even if they meet one another, it suffices to view the 600m of single-track sections across SWL as a single 600m single-track section with northbound and southbound vehicles entering this section according to independent Poisson processes with rate parameters λ_N and λ_S, respectively.

When a northbound vehicle enters the single-track section, it will take time t to traverse it. In this period it will meet a Poisson distributed number of southbound vehicles, with the parameter being $\lambda_S t$. Thus, the expected number of southbound vehicles that a single northbound vehicle meets is given by $\lambda_S t$. Now, the expected number of northbound vehicles in an hour is given by λ_N. Thus, $E = \lambda_N \times \lambda_S t = \lambda_N \lambda_S t$, which is formula (5.1).

A.3 Derivation of formula (5.2)

Each vehicle conflict means that both a northbound and southbound vehicle have experienced a conflict, meaning that the expected number of vehicles that experience a conflict is given by $2E = 2\lambda_N \lambda_S t$. The expected number of conflicts per vehicle is then obtained by dividing through by the expected number of vehicles that enter SWL in a peak hour, which is given by $\lambda_N + \lambda_S$ (due to the additivity property of the sum of independent Poisson processes). Carrying out this division yields formula (5.2).

A.4 Derivation of formula (5.3)

From formula (5.1), we have that the expected number of vehicles that meet in the single-track section is given by $\lambda_N \lambda_S\, t_{\text{section}}$, where t_{section} is the time taken for vehicles to traverse the single-track section (when unimpeded). Recall that in our model, we suppose that when a northbound vehicle and a southbound vehicle meet in the single-track section it takes them a length of time τ to pass one another. The number of northbound vehicles that meet the two original vehicles is Poisson distributed with parameter $\lambda_N \tau$, whilst the number of southbound vehicles that meet the two original vehicles is Poisson distributed with parameter $\lambda_S \tau$, and is independent of the number

of the northbound vehicles. Thus, the number of vehicles that meet the original two vehicles is Poisson distributed with parameter $(\lambda_N + \lambda_S)\tau$. The probability that an additional $k - 2$ vehicles join the original two vehicles is then given by

$$P_k = \mathrm{e}^{-(\lambda_N + \lambda_S)\tau} \frac{(\lambda_N + \lambda_S)\tau)^{k-2}}{(k-2)!}, \quad k = 2, 3, 4, \ldots.$$

Finally, putting this together we get, for $k \geq 2$,

$$E_k = \lambda_N \lambda_S \, t_{\text{section}} P_k$$

$$= \lambda_N \lambda_S \, t_{\text{section}} \cdot \mathrm{e}^{-(\lambda_N + \lambda_S)\tau} \frac{((\lambda_N + \lambda_S)\tau)^{k-2}}{(k-2)!},$$

which is formula (5.3).

B Further projected multi-vehicle conflicts

Tables 7 and 8 provide projections for the expected number of multi-vehicle conflicts on the circa 110m single-track section through the ancient woodland in weekday peak hours up to the supposed passing place. I will set $t_{\text{section}} = 14/3600 = 0.00389$ hours. I have arrived at this figure by driving the circa 110m section several times. When unimpeded by other vehicles, my average time to drive this section was 14 seconds (average time of 13 seconds going up the hill and 15 seconds going down the hill, slower down hill due to the poor visibility on the bend when going down the hill). I will take the same average delay time of 30 seconds as in my original analysis for the circa 182m section, so $\tau = 0.5/60 = 0.00833$ hours. The rate parameters λ_N and λ_S are naturally unchanged.

Table 7: Weekday expected multi-vehicle conflicts on the circa 110m single-track section through the ancient woodland in the AM peak up to the supposed passing place (0800–0900).

Scenario	Expected number of multi-vehicle conflicts			
	2 veh.	3 veh.	4 veh.	5 veh.
2030 Base Traffic Flow	2.76	1.68	0.51	0.11
Max. Weekday	3.63	2.72	1.02	0.25
2030 Base Traffic Flow + Appellant's projected increase	3.16 (+15%)	2.11 (+25%)	0.70 (+37%)	0.15 (+47%)
Max. Weekday + Appellant's projected increase	4.03 (+11%)	3.24 (+19%)	1.31 (+28%)	0.35 (+39%)
2030 Base Traffic Flow + LPA's projected increase	3.65 (+32%)	2.71 (+61%)	1.01 (+97%)	0.25 (+133%)
Max. Weekday + LPA's projected increase	4.49 (+24%)	3.97 (+46%)	1.76 (+72%)	0.52 (+106%)

Table 8: Weekday expected multi-vehicle conflicts on the circa 110m single-track section through the ancient woodland in the PM peak up to the supposed passing place (1700–1800).

Scenario	Expected number of multi-vehicle conflicts			
	2 veh.	3 veh.	4 veh.	5 veh.
2030 Base Traffic Flow	3.04	1.97	0.64	0.14
Max. Weekday	3.61	2.67	0.99	0.24
2030 Base Traffic Flow + Appellant's projected increase	3.43 (+13%)	2.43 (+23%)	0.86 (+34%)	0.20 (+45%)
Max. Weekday + Appellant's projected increase	4.00 (+11%)	3.20 (+20%)	1.28 (+29%)	0.34 (+44%)
2030 Base Traffic Flow + LPA's projected increase	3.92 (+29%)	3.07 (+56%)	1.07 (+66%)	0.28 (+100%)
Max. Weekday + LPA's projected increase	4.45 (23+%)	3.89 (+46%)	1.64 (+65%)	0.62 (+162%)

C Scenes from Stone Wood Lane

Names of provider and date:

- Figure 1, top panel: Stocksmoor resident, 25 April 2023

- Figure 1, bottom panels: Stocksmoor resident, 23 January 2026

- Figure 2   , Stocksmoor resident, 23 January 2026

- Figure 3   , Stocksmoor resident, 8 July 2021

- Figure 4:   Stocksmoor resident, 6 January 2025

- Figure 5   Stocksmoor resident, 22 June 2019

- Figure 6, left panel: , Stocksmoor resident, 1 June 2024

- Figure 6, right panel: Stocksmoor resident, 26 July 2024

Figure 1: The site of the supposed passing place in the extended single-track section through the ancient woodland. Tyre marks indicate that a vehicle reversed into the wall when attempting a reversing manoeuvre at the supposed passing place (see the bottom right panel).
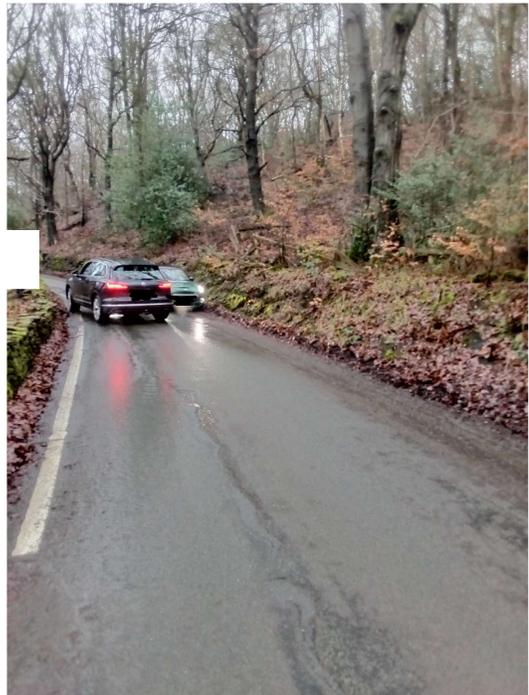
Figure 2: Vehicles reversing down the hill past the supposed passing place to a more adequate passing place at which the single-track section opens up to a dual-track section. Observe the pedestrian taking refuge on the banking.

Figure 3: There is not much chance of this vehicle using the supposed passing place in the extended single-track section through the ancient woodland.

Figure 4: Stone Wood Lane is not gritted. Vehicles are often left stranded during periods of snow. Here is an example of a vehicle stuck in the snow.

Figure 5: Even the section 'Chainage 708.00 to 890.00' (one of the least challenging stretches of Stone Wood Lane) can be problematic when the vegetation has not been trimmed.

Figure 6: Large vehicles, including tractors, use Stone Wood Lane. Also observe the vegetation spilling into the road.