Traffic Appendix 1: ***A Study of Traffic Flow Patterns in Sileby*****:**

In Support of Neighbourhood Planning

Executive Summary

The community at large has reported upon regular traffic congestion problems within the Sileby Road Infrastructure (SRI). Today there exist major and generally held concerns about the likely failure of the SRI given plans for further growth.

Within this context, the Transport Theme Group (TTG) of the Sileby Neighbourhood Planning (SNP) initiative has systematically observed and documented actual behavioural patterns of traffic flowing through primary sections of the SRI. When so doing the TTG has considered the three main types of '**traffic flow inhibitor**' that constrain traffic flows within the Sileby village, namely: (1) '**over loaded traffic junctions**'; (2) '**road system flooding**' and (3) '**on-street parked vehicles**'.

With respect to traffic flow obstructions of types (1) and (2) the early work of the TTG began by reviewing 2016 findings of Sileby transport studies (Ref 1) carried out by the Local Highways Authority (LHA) of the Leicestershire County Council (LCC).

The following bullet points summarise those LHA findings:

(I) 2016 LHA modelling studies (Ref 1) confirmed that traffic flows through the Barrow Road to Seagrave Road corridor were near or beyond the capacity of overloaded junctions. Further LHA reviewed granted planning permissions in Sileby and Barrow, over the period 2011 to 2016 and found that those permission were expected to significantly increase traffic flows and levels of on street parking in the two villages; also LHA was concerned that resultant vehicular must reflect into impact upon the whole Soar Valley infrastructure.

(II) LHA therefore stated that additional developmental growth in the two villages (i. e. beyond permissions granted up to 2016) would severely impact on the road network; and particularly so at the 'King Street/High Street junction' and the 'Mountsorrel Lane/Barrow Road/High street junction'; unless suitable mitigation is secured. Consequently the LHA recommended to the Local Planning Authority that all future development proposals in Sileby and Barrow should be assessed by transport models proportionate to their proposed scale of development. In June 2018 however, without evidence to the contrary LHA subsequently revised this recommendation.

(III) Indeed in 2016 the LHA further noted that due to a lack of any extra physical highway capacity at the road junctions listed under (II) mitigation for any future planned growth would be very difficult to realise.

(IV) The LHA had also called for a comprehensive strategic study to be undertaken to inform limits to sustainable growth; covering flooding and transport issues throughout the wider Soar Valley area.

(V) The LHA concluded in its 2016 report that further large developments in Sileby (over 10 houses in scale) should be resisted unless a nil-detriment position over existing traffic conditions can be proven. But this no longer stands as the LHA advice/ position.

Because the Sileby residence at large expressed strong concerns about the performance of the SRI, during the first two quarters of 2018 the SNP TTG made many direct traffic flow observations within the SRI. In general the TTG observations were found to update and directly confirm the importance

of the 2016 LHA observations and recommendations (I) to (V); even though the LHA itself had since withdrawn its public concern about such matters. As described in section 1 of the following report observations were made systematically by the TTG team to further understand actual (rather than simulated) behaviours of traffic flow patterns and to build a knowledge based about the SRI; with a focus of the main hub of the SRI, which included the Barrow Road to Seagrave Road corridor of particular original concern to LHA. Indeed the observations and analyses made by the TTG team were found to extend and enhance the original 2016 LHA LCC concerns about the lack of sustainability of the current SRI.

Arguably of great and critical importance the SNP TTG study has since identified severe impacts of capacity limitation within the SRI that arise from extensive on-street vehicle parking. TTG study shows that a consequence of these on street parking obstructions is to reduce the 'effective capacity' of the SRI by greater than 50%. That reduction in capacity occurs primarily when peak traffic flows occur daily, during weekdays, and results in significant delays through much of the SRI. Furthermore typically each of these peak flows occurs for circa 1.5 hours during both early mornings and early evenings. It follows therefore that if further developmental growth is allowed to cause increased traffic flows the SRI will likely to become deadlocked and fail.

Prior to the TTG study there was a general understanding (amongst the Sileby community) that on-street parking causes significant congestion and that this leads to much frustration in the village. But the scale of impact that this causes on the SRI capacity was not formerly known. Furthermore the LHA 2016 study and report did not itself consider on street parking obstructions; i. e. as part of its simulation modelling work (see section 2.3.4 of the LHA LCC 2016 report).

Thus we emphasise that the SNP TTG has essentially carried out a largely new study of this topic (and particulalry related to traffic flow inhibitors of type (3)). The evidence base formed by the new TTG study shows that on-street parking severely limits sustainable traffic flows through the SRI. This is discussed in some detail through sections 1 and 2 of this report and within the appendices which detail the experiments performed by the TTG team. We believe that our new evidence base should be of prime consideration to local government agencies charged with planning developmental growth.

1.0 Sileby Road Infrastructure Performance Appraisal and Observed Traffic Flow Problems

1.1 TTG Study Design

This sub-section outlines the study rationale used by the TTG during the period January 2018 to July 2018.

The overall study aim was to provide a 'traffic flow evidence base' for six main purposes, namely:

(p1) 'Policy Design' within the context of the Sileby Neighbourhood Plan- by referencing current and possible future performances of the SRI

(p2) Characterisation of the SRI- in terms of National Transport Norms (Refs 2, 3, 4 & 5)

(p3) Identification of the main inhibitors of SRI performance

(p4) Justification and selection between potential NP Community Actions related to the SRI

(p5) Seek to provide a base-line prediction of likely outcomes from planned housing development, linked to alternative forms of road mitigation

(p6) Build upon, update, test and enhance 2016 traffic study findings of the LHA LCC

Prime Assumptions – that were made to underpin the design of the study methods

A1: Based upon common knowledge held amongst Sileby parishioners: it was assumed that the SRI performs well when its traffic flows are light; but that there are significant levels of congestion in the SRI when peak vehicle flows occur

A2: Consequent upon A1, evidently the performance of the SRI is dynamic (i.e. is time varying) with traffic obstructions growing and decaying in relation to: 'changes in patterns of traffic flow' and 'changing patterns of obstructing (movements of on-street parked) vehicles'

A3: Following from A2, it was decided that traffic flows through the SRI should be measured with sampling primarily at peak flow times; which based upon local knowledge would likely be in 'early mornings' and 'late evenings' during non-holiday weekdays

A4: That the impacts of growing and decaying traffic obstructions should be characterised, with a view to considering the need to reduce those impacts

A5: That where possible SNP SRI performance assessments should be made in the light of established UK norms, such that local authorities would accept the assessments made.

Main Elements of the Performance Study

The SRI performance study of the TTG comprised four interconnected elements, as follows:

E1: Achieve up to date capture of real case data about traffic flows through primary road sections of the Sileby village

E2: Analysis key aspects of SRI performance with reference to its dependence on road geometry (expressed in terms of National Norms for road design) that forms the hub of the SRI

E3: Analysis of on-street vehicle parking and its impact on SRI capacity.

E4: Compare results of the TTG study with those previously formulated via the LHA LCC 2016 study

1.2 Traffic flows observations made- building the new information base

Six sets of traffic flow measurement where taken in a systematic way by the SNP TTG and assisting parishioners - as follows:

#1. Two measurements sets, taken during peak morning traffic flows (see Appendix A)

#2. Two measurements sets, taken during peak afternoon traffic flows (see Appendix A)

#3. One measurement set, taken during mid-afternoon (relative light) traffic flows (see Appendix A);

#4. One measurement set taken during a flooding of Slash Lane (see Appendix B).

Those six sets of traffic flow measurement were systematically recorded and subsequently reported and analysed into Appendices A and B. Collectively they provide a 2018 real case data base, which illustrates the scale of the Sileby traffic flow dynamic in terms of bi-directional flow rates along: the five main radial roads that feed into/out of the village; and along four other interconnecting main roads which link those radial roads to each other and to the village centre.

The six measurement sets obtained illuminate significant flow rate differences through individual roads of the SRI. Also that peak (or near peak) flows did indeed occur at the times outlined above.

Tables 1 and 2 show and compare stereotypical specimen results from three of the measurement sets. See Appendix A for the full results & discussion

Run number	Mountsorrel Rd	Radcliff Road	Barrow Road	Cossington Lane	Seagrave Road
Run1 AM In	189	243	187	219	119
Run 1 AM out	396	354	218	194	175
Run 2 Mid PM In	214	222	202	177	104
Run 2 Mid PM Out	188	196	114	141	146
Run 3 Late PM in	321	373	287	311	146
Run 3 late PM out	241	250	174	155	81

Table 1 Flow rates (in vehicles per hour) through Sileby's 5 radial roads

Run number	High Street	Brook Street	King Street	Swan Street
Run1 AM Clockwise	479	360	193	100
Run 1 AM Anti Cl	291	234	200	104
Run 2 Mid PM ClK	277	195	253	132
Run 2 Mid PM AClk	285	211	170	114
Run 3 Late PM Clk	365	255	344	138
Run 3 late PM AClk	375	318	202	121

Table 2 Flow rates (in vehicles per hour) through Sileby's inner-centre roads

Table 3 shows example results from the fourth measurement set taken during a significant flooding incidence. See Appendix B for further details

Comparison- with same time in day & no flooding

	Seagrave Road		Ratcliffe Road		Cossington Road		Mountsorrel Lane		Barrow Road	
		Up 17%			Up 14%	Up 40%		Down 16%	Up 74%	Up 45%
13th March Flood run	In 124	Out 205	In 243	Out 351	In 221	Out 306	In 171	Out 333	In 325	Out 316
24 Jan early AM run	In 119	Out 175	In 243	Out 354	In 194	Out 219	In 189	Out 396	In 187	Out 218

Table 3 Illustrative comparison between traffic flows; with &without flooding on Slash Lane

1.2 Initial SRI Performance analysis

1.2.1 'Junction inhibition of traffic flows' and flow rates at critical Junctions of the SRI

The 2016 LHA LCC simulation study focussed heavily on 'capacity constraints at two critical junctions', namely the junctions of 'King Street/High Street' and the 'Mountsorrel Lane/Barrow Road /High Street'. This junction comprises two closely related junctions; as illustrated in Figure 1.

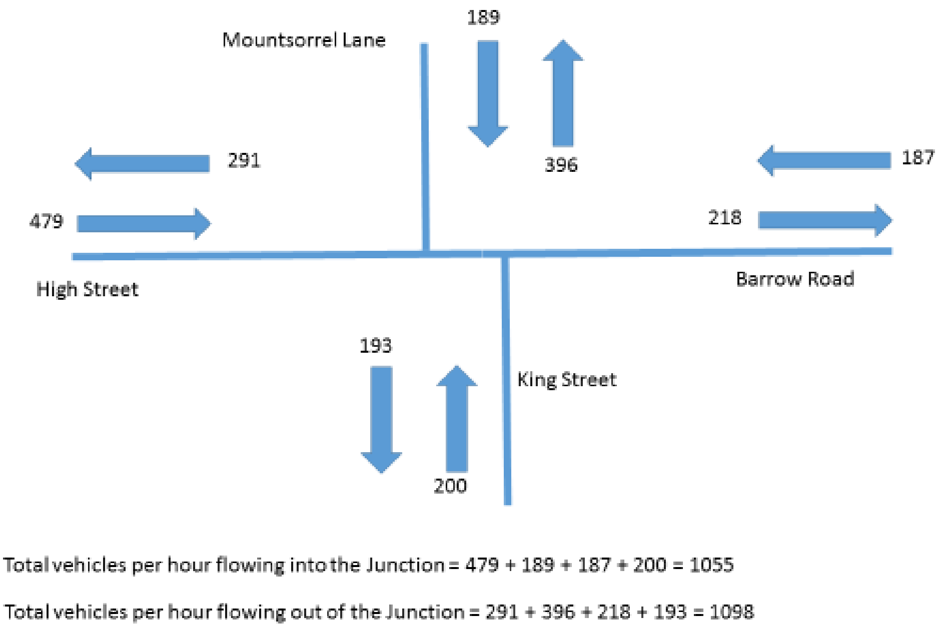

Figure 1 Illustrative case of AM peak flows (on 29/01/2018) at the junction of concern to LHA LCC

The TTG deployed its 2018 traffic flow data to exemplify typical loadings of those junctions during morning and afternoon peak flows. Figures 1 & 2 are constructed to illustrate stereo-typical volumes of traffic flow into and out of that 'Junction'; namely flows that were measured during the periods of the measurement sets 1 and 3. Herein the TTG measurements show that more than one thousand vehicles per hour flow into and out of the combined junction during both AM and PM peak traffic flows. Furthermore as discussed below, this junction is physically comprised of four UAP 4 roads which each have a theoretical maximum capacity of 900 vehicles per hour. This simple analysis confirms the point made by LHA simulation studies; when they state that this combined junction has already exceeded its capacity. Further TTG inspection of the geometry of that junction also proved the LHA point that there is little or no opportunity to mitigate for any increased traffic flows at this combined junction.

Similar analysis can be repeated at other heavily loaded Sileby road junctions (such as at the High Street/Brook Street/Cossington Lane junction) by summing peak flows measured by the TTG and recorded into Tables 1 and 2.

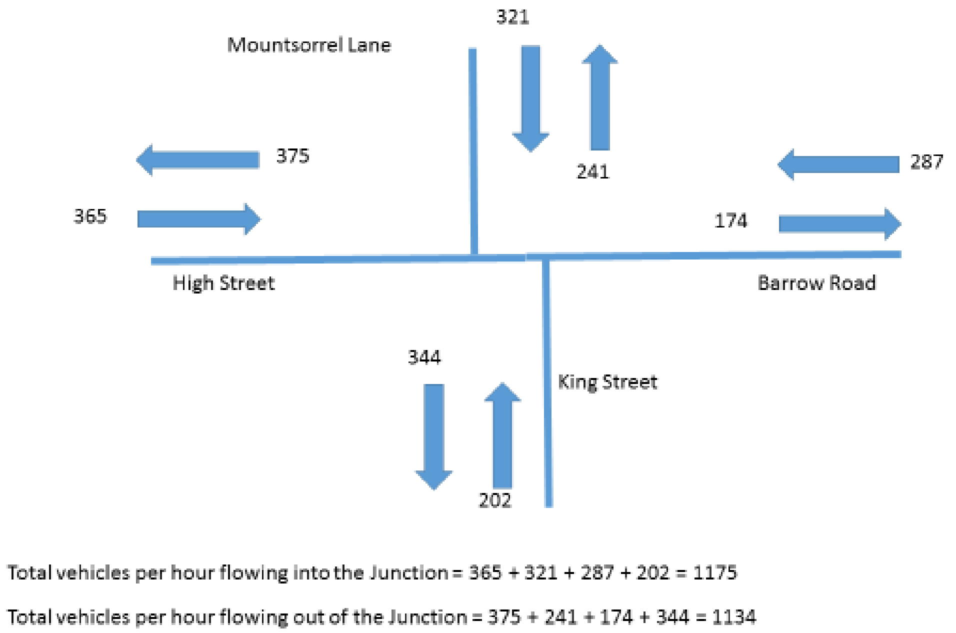

Figure 2 Illustrative case of Late PM peak flows (on 07/02/2018) at the junction of LHA LCC concern

The TTG has also sampled queue sizes at the most troublesome Sileby road junctions (Refs 5 & 8). The observed occurrence of 'peak queue lengths' and their 'related peak wait times', at the most loaded entry roads to the junctions, are recorded into Table 4 (Refs 11 to 13).

King Street	King Street	Mountsorrel Lane	Mountsorrel Lane	Brook Street	Brook Street
No. of vehicles	Max wait time in minutes	No. of vehicles	Max wait time in minutes	No. of vehicles	Max wait time in minutes
29	5.3 mins	11	1.5 mins	15	1.25mins
23	4 mins	11	1.4 mins	8	1.25 mins
10 + Bus	5 mins	12	1.35 mins	8	1.25 mins

Table 4 Measured Data –about Queues in Sileby on 19th February

Queues of up to 30 vehicles were observed; and this, typically involved wait times for drivers of up to 6 minutes at a single road junction. However the TTG did not consider this to be particularly excessive compared to other cases of queueing that fall within the responsibility domain of LHA LCC (see Appendix C); nor was this considered to be particularly large compared to typical programmed maximum wait times (of circa 2 minutes) targeted at traffic lights [R9].

Also, as discussed in section 1.2.3, the TTG has assumed that the occurrence of extensive on-street parking in Sileby obstructs traffic so as to distribute queues throughout the village, rather than build up very large queues only at road junctions.

1.2.2 'Flood related inhibition of traffic flows'

As illustrated by Table 3 the TTG sought to assess some impacts of flooding on the performance of the SRI; see Appendix B. This was done for two reasons, namely (1) because there is significant concern about road flooding incidences within the Parish and (2) because in their 2016 study LHA LCC refer to this issues as a problem which much be faced if additional housing and vehicular growth is sanctioned by CBC. However during the relatively short period of operation of the SNP, and its TTG, few actual cases of flooding occurred; such that only one case of the flooding of Slash lane was investigated by our team. That single flooding case investigation (see table 3) did confirm however that distinctive redistributions of flows occur; which does lead to additional and significant SRI capacity issues. Hence during period of heavy rain the onset of any additional housing and vehicular growth may well block this section of the Soar Valley road system. Consequently the warnings of the LHA have been further emphasised.

1.2.3 On-street vehicle parking inhibition of traffic flows and impacts on 'SRI capacity'

Geometric properties of the nine main roads (that collectively form much of the hub of the SRI) were also measured; thereby those roads were characterised in terms of relevant UK norms for road design (Refs 4, 6, 7 & 8). This showed that much of that SRI hub comprises so called UAP 4 roads of typical width circa 6.7 meters [Ref8]. Accordingly from [Ref8] this means that without any traffic obstructions the assumed 'design capacity' of the SRI hub is circa 900 vehicles/hr.

However in reality those measured sections of the SRI bear very significant on-street parked vehicles. An initial physical review of on street parking showed that this occurs along approaching circa 60% of the length of the main roads forming the SRI. Thus parked vehicles frequently cause significant road obstructions. Much of the on street parking is legally permitted; primarily because the nearby housing style does not generally incorporate off street parking within the curtilage of dwellings. Whilst some of that on-street parking is not permitted (i.e. is illegal): yet parking restrictions have limited enforcement and vehicle owners commonly continue to park illegally and expect not to be fined. As a consequence, over unpredictable periods of time, significant sections of the main roads that form the SRI actually perform as a single lane highway (i.e. they do not perform as a two way highway for which they were originally designed); and this form of restriction/traffic impedance continues to occur at various points along their length. Often vehicles are even parked on both sides of the road; with vehicles possibly positioned partially on the road and on pavements and fairly frequently opposite vehicles parked on the opposite side of the road.

These vehicle obstructions typically result in the usable road width (for passing traffic) becoming significantly less than 6 meters (indeed it is not uncommon for parked vehicles to leave less than 4.5 meters of actual usable road width for main road traffic). Whereas according to the UK road design standard [Ref8] a minimum width of 6 meters should be available for all roads designed to bear two way traffic flows. Hence when (1) much of the SRI bears its typical daily peak loadings of passing traffic and (2) significant on street parking of vehicles also occurs; then the road sections concerned cannot function in a 'fit for the purpose way'. Indeed on most weekdays in Sileby conditions (1) and (2) simultaneously occur for up to circa 3 hours a day- which imposes a very significant community burden in terms of loss time and opportunities

An analysis was made of impacts of these on-street parked vehicle obstructions, to determine the '**effective capacity**' of the UAP 4 roads that form the SRI. This analysis showed that when those roads bear significant on-street parked vehicles the effective (i.e. the obstructed) capacity of these roads is reduced to less than half of the original design capacity of 900 vehicles per hour capacity (i.e. to an effective capacity in the range of 300 to 450 vehicles per hour). Hence even with current traffic loads the presence of extensive on parked vehicles leads to the SRI capacity being commonly exceeded, and at various locations along several of its main roads (see Tables 1 and 2). Hence it is undeniable that major road congestion occurs as a consequence of on street parked vehicles, during early mornings and late evenings on week days.

Importantly also the impacts of those on-street parking obstructions add very significantly to that of the other obstruction types; namely 'poorly designed main road junctions' and 'occasional road flooding'.

As part of their SRI performance study, the SNP TTG have documented an initial set of observations about on-street parking instances: in terms of individual and collective locations of parked vehicles, and their frequency, lengths and patterns of stay such that they lead to a usable road width of less than the required National norm (Ref8 of 6 meters).

Another critically important conclusion drawn from TTG observations has been these on-street parking obstructions are particularly dynamic, in the sense that typically vehicle owners park outside their properties during evening, weekends and for parts of weekdays; and may progressively move, then re-park, their vehicles as they conduct their lives and daily business. Bearing this dynamic in mind, the SNP TTG has considered additional means by which the impacts of that dynamic might best be characterised; and has informally linked this to the above capacity analysis. A measurement methodology has been devise for this purpose but its implementation has been delayed until discussions are held with LHA LCC.

1.2.4 Outcomes of the SRI Performance study

For p1 (see section 2.1): Our traffic flow evidence base shows that in their current condition many of the main roads forming the SRI are under very significant stress; in as much that their traffic loads already approach their 'effective capacity' (of between 300 to 450 vehicles per hour around parked vehicles and of circa 900 vehicles per hour at road junctions) during week day, peak traffic flows. Also our findings confirm the LHA LCC observation that some critical road junctions have reached or exceeded their design capacity. As a consequence of junction overloads and extensive on-street parking of vehicles, significant traffic congestion results in many sections of the SRI. Hence additional housing and business development planned in Sileby or near to Sileby may very soon terminally overload these sections of the SRI and indeed the wider Soar Valley road infrastructure. Consequently it will be very risky for the Local Authorities to allow any such development unless it is accompanied by appropriate road mitigation; such that no further stress to the SRI is imposed.

In the short term therefore the Sileby Parish Council may wish to use the evidence base created during this SRI performance study, to seek to off-set major housing development in the parish and/or ensure that appropriate on-street parking problems (in addition to conventional junction and flooding congestion problems) will be appropriately mitigated. Such a requirement for on-street parking mitigation (to offset potential road capacity overload) in respect of Sileby planning applications has not previously been formally considered by the CBC planning authority.

For p2 & p3: The performance of major sections of the SRI has been measured, analysed and documented in terms of national road design norms. The evidence collected conclusively shows that the Sileby road infrastructure requires improvement and future proofing. The evidence also illustrates the dynamic nature of the congestion problems and that they are caused in three fold ways, viz: via ‘poor junction design’, ‘significant and unpredictable on-street parking’ and ‘occasionally significant flooding’ problems.

For p4: That regarding making improvements to on-street parking it is necessary to seek to identify and alleviate the main causes of resultant instances of one–way traffic flows, bearing in mind: the dynamic situation where cars are unpredictably parked; possibly where no alternative parking can be devised; and in an overall planning environment where it is recognised that the local authorities have little development budget and little resource to allocate towards legal on-street parking enforcement.

Also a major worry associated with facilitating better on street parking is that greater through traffic flows may ensue because of the reduced impacts of congested travel through the village? This point has been made by Duncan Forbes of EAE as part of his assessment for Sileby Parish Council.

For p5: Discussion has already been held with CBC and a meeting with HA LCC is planned to seek to involve them in subsequent policy making and to prepare for possible future Community Actions.

For p6: The source information afforded by the LHA LCC 2016 study [Ref1] offered a very useful starting basis for the work of the TTG. Additionally up to date measurements and new analysis, carried out by the TTG, updates, strengthens and re-enforces the various recommendations made by that local authority. In addition the TTG study points up the fact that the inhibition of traffic flows caused by on-street parking in Sileby is most probably of equal importance to that of road junction and flooding inhibition. Thus when considering future development proposals the TTG recommend that mitigation schemes should bear all three inhibitor influences in mind when establishing that nil detriment to the SRI performance will arise from any additional traffic loads.

*2.0 TTG Follow-up Study- **to document common instances of SRI on-street parking obstruction and to consider practical solutions that may alleviate those impediments***

TTG study of SRI performance has identified a need to better characterise common on-street parking problems and to seek feasible means of alleviating those problems. Hence a second phase of study has been carried out by a TTG sub-group. The progress made on this study is reported in Appendix C

This second phase of on street parking study has captured a significant body of evidence showing instances of on-street parking along many of the roads that comprise the SRI. It has also observed possible ways of re-organising on-street parking at selected locations within the SRI. Appendix C describes the evidence gathered which is expected to have significant value as part of the Sileby Neighbourhood Plan, in support of the design of NP Community Actions, by achieving:

B1: Improved (less congested) traffic flows through the village

B2: Improved SRI aesthetics within the village.

As yet the benefits and likely costs of making suggested alterations to on-street vehicle parking have not been identified, nor has their feasibility been discussed with the responsible local authority (LHA LCC). Also if effective new (near on-road) parking schemes can be devised, and can become practically applicable, they may require enforcement by HA LCC (who as previously mentioned has limited resources for parking enforcement within Charnwood villages). Furthermore should less impeded traffic flows result this may ultimately open up the SRI to significantly greater **through traffic volumes at peak times**; as also earlier discussed.

Generally therefore before deciding to adopt any on-street parking improvements further work is required to determine the likely costs and benefits that may accrue.

3.0 Conclusion

New traffic flow and on-street parking evidence captured by the Sileby Transport Theme Group can be used to reason about ways of enabling performance improvements to the SRI; and potentially this may facilitate sustainability of the hub of the SRI over and beyond the lifetime of the NP (i.e. beyond 2028).

As yet our SRI performance study does not have a complete evidence base to inform policy making, nor SRI capacity improvements schemes. But it does provide an additional data basis to guide the design of housing developer mitigation schemes, given possible future scenarios of population growth in Sileby.

Critically important is that the performance of the SRI has been characterised in standard UK road design terms/norms; ideally so as to illuminate the importance the three factors that impede the SRI capacity (namely (a) on-street parking causing one way traffic flows, (b) poor road system junction designs and (c) potential road flooding. This should better illuminate any needs for road mitigation, by housing developers and CBC planners when they propose and sanction future housing schemes within Sileby, or in nearby locations which will heavily utilise the SRI.

Addendum: Growth Estimates and Impacts

In 2016 the LHA LCC reported on Leicestershire Transport Trends using Cordon Traffic Volume Measures [Ref 2]. It found in that in the Loughborough area the AM and PM traffic peak flows had increased by circa 12% over the period 2011 to 2016 (see Ref 2: sections 2.6.3 and 2.6.4). Based upon a simple projection of these traffic growth figures into the Sileby SRI an increase in traffic volumes over the period 2018 to 2028 can expect a further traffic volume increase in the range 30% to 35%.

Additionally this traffic growth impact may well be greater in the case of the Sileby where significant housing and population growth of circa 30% has already been sanctioned by the CBC and further planning applications are under consideration.

References

Ref1 2016 HA LCC Sileby and Barrow upon Soar Study Report Version 14042016;
https://www.leicestershire.gov.uk/sites/.../pdf/2016/.../sileby_barrow_traffic_study.pdf

Ref2 2016 the LCC reported on Leicestershire Transport Trends and vehicular growth;
https://www.leicestershire.gov.uk/sites/.../Transport-trends-in-Leicestershire-2016.pdf

Ref3 SNP Questionnaire Responses

Ref4 Standards for Highways
www.standardsforhighways.co.uk/ha/standards/dmrb/vol6/section1/td993.pdf

Ref5 Manual for the Streets
https://assets.publishing.service.gov.uk/government/uploads/.../pdfmanforstreets.pdf

Ref6 Design Manual for Roads and Bridges (DMRB) | Standards for Highways Volume 6..
www.standardsforhighways.co.uk/ha/standards/dmrb/

Ref7 Design and Construction of Roads and Accesses to Adoptable
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Ref9 Highway Analysis and Design; R. J. Salter, University of Bradford, 2nd edition

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Ref11 Traffic Flow Theory; Chapter 9; http://www.fhwa.dot.gov.tft

Ref12 Travel Time prediction in Urban Road networks; J Anniston IFAC pubs 1997

Ref13 Time-dependent queueing at road junctions: Observation and prediction; R.M.Kimber & P.N.Daly, Volume 20, Issue 3, June 1986, Pages 187-203

Ref14 Optimizing road capacity and type, Economics of Transportation

Volume 3, Issue 2, June 2014

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Appendix 2: Further Details of the Transport Theme Groups Sileby Traffic Flow Study 2018 – Covering three sets of measurements (#1, #2 & #3) taken and analysed

1. Introduction

This report describes the purpose and outcomes of a traffic flow study carried out to inform the development of transport aspects of the Sileby Neighbourhood Plan (SNP).

On behalf of the SNP the Transport Theme Group (TTG) had reviewed questionnaire responses from parishioners as to how the Sileby Transport Network might be improved. A number of positioning papers about Sileby traffic problems focussed TTG attention on two related key traffic flow concerns namely:

(1) ***Traffic flow congestion***, through much of the village which is observed on a daily basis, and

(2) Likely ***impacts of housing builds*** being planned and sanctioned (both within Sileby and in adjacent Parishes), with a related fear that current traffic congestion problems will be exacerbated.

The TTG developed an evidence based approach to measuring Sileby traffic flows. This approach is described in the document entitled 'Traffic Flow Methodology V23B'. To implement that methodology the TTG involved additional people resources from other Sileby NP Theme Groups. Initially this enabled traffic counts to be taken simultaneously at nine locations around the Sileby road network; where the volume of two traffic way flows could be safely counted and recorded.

Two 'pilot' measurement hours were initially selected; which respectively it was assumed would enable the counting of a 'peak early-morning traffic flow' (on Monday 29th January, between 0800 and 0900 hrs) and an 'average-afternoon traffic flow' (on the same day between 1500 and 1600 hrs). The persons deployed are named in Figures 1 and 2, as is their measurement location. Having proven, via the pilot runs, the effectiveness of the methodology a third measurement run was conducted on Wednesday 7th February between 1700 and 1800 hrs. This third run was timed to correspond to an expected 'late-afternoon peak traffic flow', and deployed a total team of eleven persons whose names and locations are recorded in Figure 3.

For the five radial link roads which enter Sileby counting took place at the housing-edge of the village; this with a view to differentiating village entry and exit. For the Wednesday late-afternoon run the two extra persons were deployed to successfully overcome difficulty found during pilot runs to accurately map flows arriving at a complex road junction.

The following sections describe: results obtained and observations made; how the results were analysed; and some early recommendations are posed by the present author. Also three appendices are attached in support of this draft document. Readers wishing to view a description of the methodology, and how data sheet results were recorded, collected and collated, should request a copy of the methodology description and completed count sheets from rickweston@btinternet.com.

2 Traffic Flow Data Collected During the Three Measurement Runs

2.1 The Data Captured

The three measurement runs sought to:

(a) Test the soundness of the method and

(b) Elicit two way, traffic flow data at locations and times specified by the method.

Figure 1 graphically summarises the magnitude of 'early-morning vehicle flows' during the first pilot run. From which we observe significant vehicle traffic volumes flowing into, out of, and around the village. In this one hour alone 1,362 vehicles left the village and 932 vehicles entered the village.

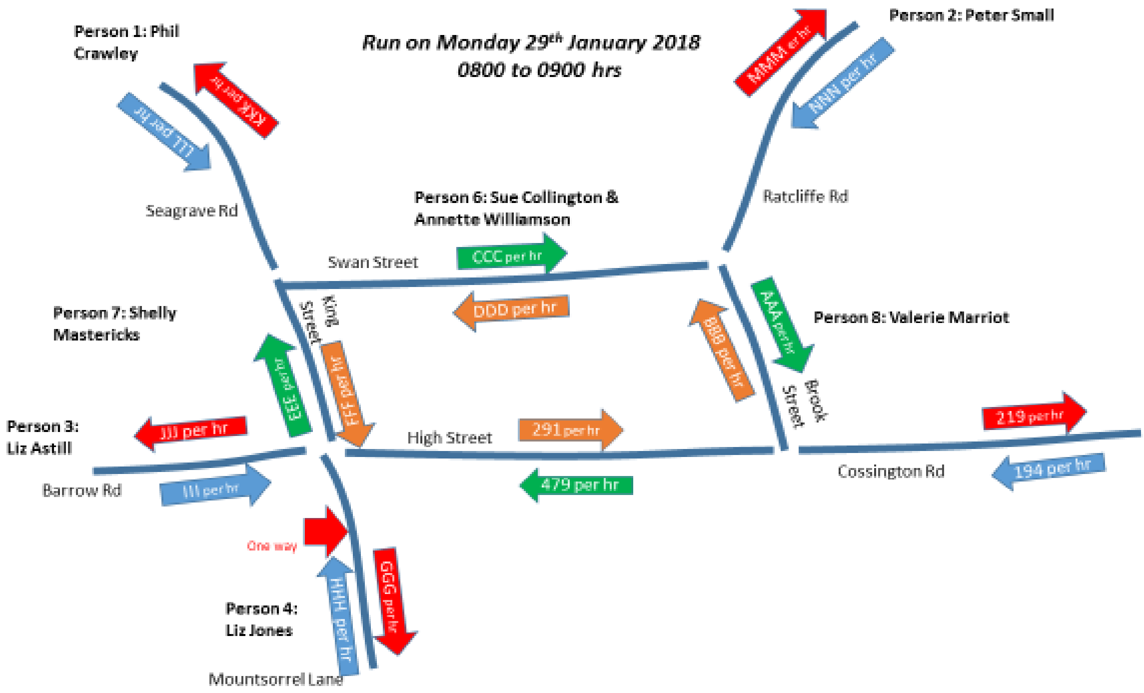

Figure 1 Summary Results from the Pilot Morning Run

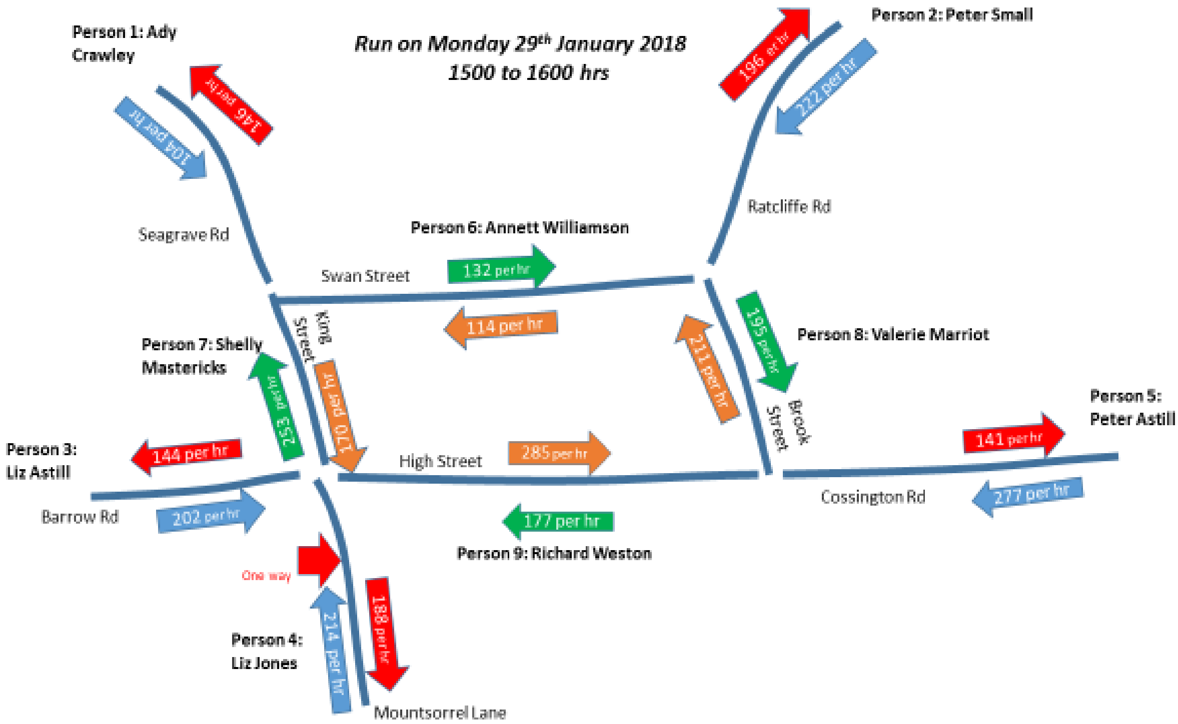

Figure 2 Results Summary from the Afternoon Pilot Run

Figure 2 graphically illustrates results obtained during the mid-afternoon pilot run; we observe that the magnitude of mid-afternoon flows is reduced relative to late-morning flows. But the flows remain significant and it is probable that 'average traffic flow conditions' prevailed. Likely these flows comprise significant school traffic but relatively small flows of work traffic relative to the late-morning flows.

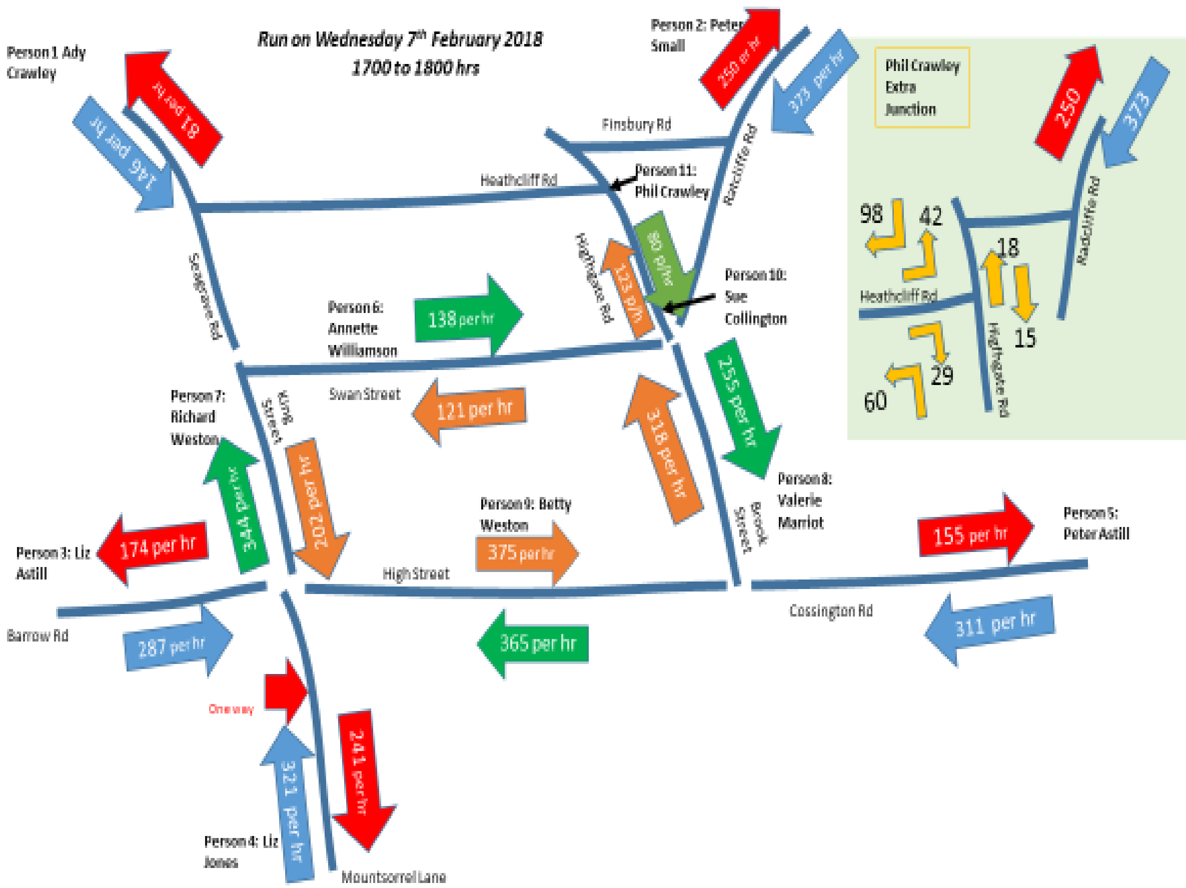

Figure 3 Results Graphical Summary from the Late Afternoon 7th Feb Run

Having successfully completed the two pilot runs a third run was carried out on 7th February. The 1700 to 1800hrs timing was chosen with the purpose of observing peak late-afternoon vehicle flows on a typical weekday. Figure 3 graphically illustrates the results obtained, during which vehicle flows of similar magnitude occurred to those observed for pilot early-morning flows.

2.2 Traffic Data Quality Check

Because the application of the traffic flow data capture methodology required nine, then eleven, persons to simultaneously count and record two way vehicle flows it was deemed to be important to test the quality with which those measurements had been taken; and thereby the extent to which they collectively formed a coherent picture of traffic flows through the village.

Hence as detailed in Addendum 1, simple arithmetical checks were made at each of the four junctions labelled as J1 to J4 in Figures A1.1 to A1.3. The principle behind this type of check is that the 'magnitude of vehicular traffic flowing into a given junction' should equal the 'magnitude of vehicular traffic flowing out of that junction'; as traffic cannot instantly be materialised or destroy. However it was understood that this simple check could only deliver approximate results because each 'traffic count location' was not directly located at the 'junctions'. Therefore as the count team was not equipped with latest measurement technology there must be: 'different timings of counts'; the possible 'starting and stopping of vehicles in road sections between each count point and the junction concerned'; and 'human error when counting'. But despite these evident error sources as explained (in Addendum 1 which describes the testing) good quality data was proven to have been captured; with vehicle counting accuracy being better than 12 %. Initially after data testing it was thought that at one count point the data had been recorded inaccurately; but this data discrepancy was later found to be a consequence of traffic not directly routing between Junction 3 and count point 2; rather traffic was taking alternative routes to the East of the village. Hence during the Wednesday 7th late-afternoon run two further count points, deploying two extra persons, were established to data capture about flows through these alternative routes.

Appendix 1 summarises the data test method adopted, and the results found when arithmetically checking the quality of the traffic flow data counted.

2.3 Traffic Data Capture Summarized

For the reader's convenience, the magnitude of traffic flows measured in terms of 'vehicles per hour' is summarized into Tables 1 and 2.

Run number	Mountsorrel Lane	Ratcliff Road	Barrow Road	Cossington Road	Seagrave Road
Run1 AM In	**189**	**243**	**187**	**219**	**119**
Run 1 AM out	**396**	**354**	**218**	**194**	**175**
Run 2 Mid PM In	**214**	**222**	**202**	**177**	**104**
Run 2 Mid PM Out	**188**	**196**	**114**	**141**	**146**
Run 3 Late PM In	**321**	**373**	**287**	**311**	**146**
Run 3 late PM Out	**241**	**250**	**174**	**155**	**81**

Table 1 Flow rates through Sileby's 5 radial roads

Run number	High Street	Brook Street	King Street	Swan Street
Run1 AM Clockwise	**479**	**360**	**193**	**100**
Run 1 AM Anti Cl	**291**	**234**	**200**	**104**
Run 2 Mid PM ClK	**277**	**195**	**253**	**132**
Run 2 Mid PM AClk	**285**	**211**	**170**	**114**
Run 3 Late PM Clk	**365**	**255**	**344**	**138**
Run 3 late PM AClk	**375**	**318**	**202**	**121**

Table 2 Flow rates through Sileby's inner-centre roads

3 Road Capacity Assessment and Overloaded Roads in the Village

3.1 Do the Traffic Flows Measured Indicate Road Network Capacity Overload?

Evidently therefore during weekday early-mornings, mid-afternoons and late afternoons significant traffic volumes flow through the Sileby road infrastructure. However to determine the extent to which those flows typically approach full road capacity conditions we require an understanding about the 'capacity' of those roads. Hence to determine the actual capacity of Sileby roads the present author has referenced the literature and carried out initial measurements concerning road geometries and road obstructions. Appendix 2 describes the steps so taken and details findings; here only a summary of those steps and the observed outcomes are described.

All primary link roads forming the Sileby road network/infrastructure (i.e. including the roads listed in Tables 1 and 2) are classed by the UK Highways Authority as being UAP 4 (Universal All Purpose, type 4) link roads. The UK link road standard http://content.tfl.gov.uk/technical-note-10-what-is-the-capacity-of-the-road-network-for-private-motorised-traffic.pdf lists qualifying characteristics of this class of road and goes on to specify the 'designed capacity' of UAP4 roads, in terms of their width and their required number and directions of traffic flow.

Initial road width measurements taken by the present author show a typical width variation between 6.0 and 7.0 meters through much of the Sileby roan network; although there are a few notable locational cases where roads widths are outside of this range. It follows that for a very large proportion of the Sileby road network, the design intention is to support simultaneous two way traffic flows; and to do that with a design capacity of up to 900 vehicles per hour, see Addendum 2.

However as explained in 'the UK link road standard' the 'effective capacity' (i.e. the actual capacity which can be practically achieved) of any given road can be very different to its 'design capacity' (see Appendix 2). Indeed for one primary reason the 'effective capacity' of the Sileby road network is significantly less than the capacity for which it was designed; namely because on-street parking is permitted alongside a very significant fraction of this network. Indeed Figure A2.1 in Appendix 2 provides a graphical illustration of the extent of allowed on-street parking in Sileby; which has initially been measured and found to be of circa three miles in length, thereby traversing most of the Sileby roads within circa 800 meters of the village centre.

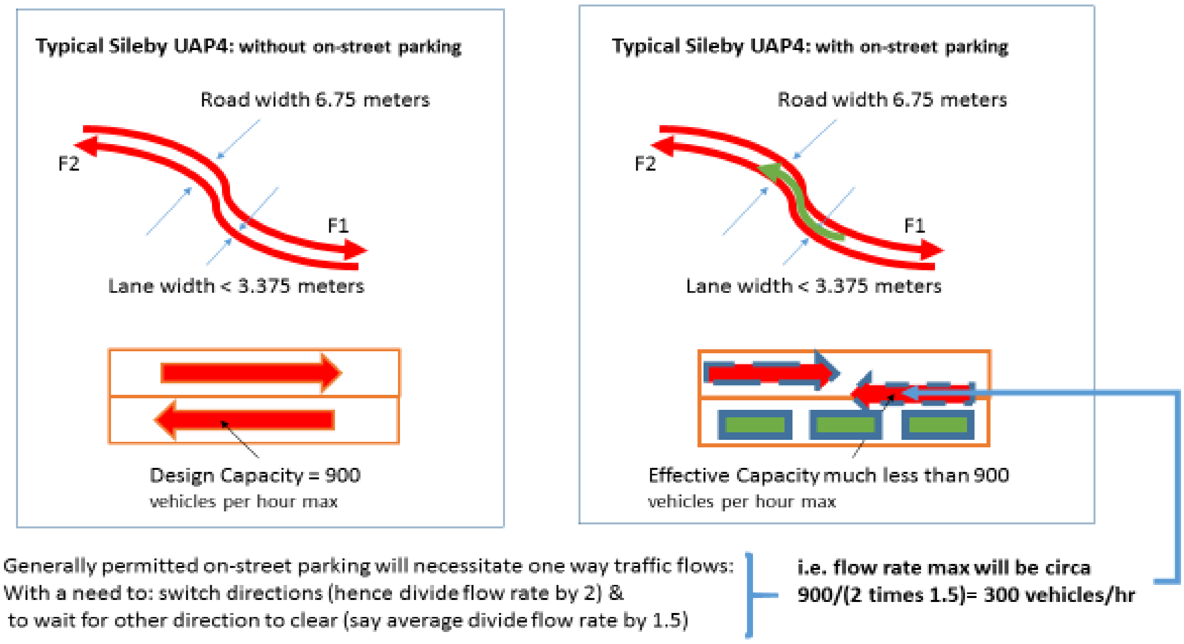

Figure 4 Illustrative Reduction in Road Capacity from On-Street Parking

Figure 4 illustrates conceptually how the 'effective capacity' of much of the Sileby road network will be significantly reduced; typically it is presumed to one third, namely to 300 vehicles per hour (see Figure 4 and Addendum 2). Such a capacity limitation is expected to be stereo-typical for much of the length of the roads listed into Tables 1 and 2; and indeed along some road sections 300 vehicles per hour may be an over estimate; such as where a specific road width is less than 6.75 meters in total, or where cars are parked on bends such that the line of sight is impeded, or on up or down inclines, or when vehicles are parked badly, or on both sides of the road.

3.2 Initial Assessment of Network Capacity Overload?

It follows that when using 300 vehicles per hour as the being the 'effective capacity' of roads that comprise the Sileby road network Tables 1 to 2 can be re-interpreted in the form of Tables 3 and 4 respectively. In this representation, those roads measured as exceeding their capacity are highlighted in blue, and those that were approaching their capacity are highlighted in yellow.

Run number	**Mountsorrel Lane**	**Ratcliff Road**	**Barrow Road**	**Cossington Lane**	**Seagrave Road**
Run1 AM In	**189**	**243**	**187**	**219**	**119**
Run 1 AM out	**396**	**354**	**218**	**194**	**175**
Run 2 Mid PM In	**214**	**222**	**202**	**177**	**104**
Run 2 Mid PM Out	**188**	**196**	**114**	**141**	**146**

Run 3 Late PM In	**321**	**373**	**287**	**311**	**146**
Run 3 late PM Out	**241**	**250**	**174**	**155**	**81**

Table 3 Instances of Over-loaded Flow Rates Recorded for Sileby's 5 radial roads

Key: *highlight in yellow means >80% capacity; highlight in blue means >100% capacity*

Run number	High Street	Brook Street	King Street	Swan Street
Run1 AM Clockwise	**479**	**360**	**193**	**100**
Run 1 AM Anti Cl	**291**	**234**	**200**	**104**
Run 2 Mid PM ClK	**277**	**195**	**253**	**132**
Run 2 Mid PM AClk	**285**	**211**	**170**	**114**
Run 3 Late PM Clk	**365**	**255**	**344**	**138**
Run 3 late PM AClk	**375**	**318**	**202**	**121**

Table 4 Instances of Over-loaded Flow Rates Recorded for Sileby's inner-centre roads

Key: *highlight in yellow means >80% capacity; highlight in blue means >100% capacity*

The present author wishes to append caveats to the above reasoning. First it should be stated that the capacity flows reported in section 2, are for actual traffic data that were accurately recorded; and were seen by those involved in the recording to replicate typical instances of every day traffic flow behaviours in Sileby. Also UK standard design data was used to determine the design capacity for the Sileby roads, hence the estimations in Tables 3 and 4 are soundly based. However the author could not find reference material for a commonly used (by government) means of estimating the impacts of on-street parking on effective road capacity. Consequently the present author conceived then adopted the reasoning outlined in Addendum 2 and illustrated conceptually by Figure 4. None the less, the resultant estimate of the 'effective capacity' of major sections of the Sileby roads as being 300 vehicles per hour is believed to be soundly based in natural engineering design principles.

3.3 Initial Thoughts About Mitigating Capacity Overload in the Sileby Road Network?

Actual occurrences of road capacity overload measured and reported herein support, and for some road locations exceed, over capacity conditions predicted in 2016 for Sileby made by in 'the LCC traffic modelling study'.

On Mountsorrel Lane there is a 'permanent one way restriction' on traffic flows which is imposed via a traffic calming measure not far from the Church on Mountsorrel Lane. Our evidence shows that this link road runs significantly beyond its design capacity of circa 300 vehicles per hour; with an outflow of circa 400 vehicles per hour observed over the early-morning measurement hour and an inflow of circa 320 vehicles per hour in the late-afternoon. Very commonly this results in significant queuing along Mountsorrel Lane; which is known to become very troublesome and even blocks this (and other related) section of the Sileby road network when Slash Lane is closed due to flooding. It is not however a simple matter to alter this road restriction & traffic calming measure, because of the road geometry and the conservation status of surrounding buildings (including the Church which has stood and been used for hundreds of years).

Cognisant of the allowed on-street parking along all five radial link roads, and indeed also most of the central village link roads, we also observed that nearly all of these roads operate in a one way fashion along some fraction of their length; and that this we have assumed will impose an effective capacity limitation of circa 300 vehicles per hour on those roads

As discussed previously circa 3 miles of on-street parked cars are permitted alongside the 5 radial and 4 inner roads (all within circa 800 meters of the village centre-refer again to Appendix 2). However this on-street parking has been permitted long term and apparently is causally related to the style and age of much of the housing along the radial roads; which means that those dwellings do not have integral parking within their curtilage. Withdrawing that permission would not likely be accepted by significant numbers of parishioners. But, as previously discussed, these 'permitted road restrictions' significantly reduce the 'Effective Capacity' of much of the Sileby Road Network; such that during peak flow hours it was directly observed that the network simultaneously reaches its capacity limit at all the locations and times indicated by Tables 3 and 4.

During early-mornings and late-afternoons the traffic measurements reported herein show that over 350 vehicles per hour exit the village along Ratcliffe road. These are not only over capacity cases but potentially they induce much increased chance of traffic accidents and injury; particularly here the on-street parked cars are frequently located on bends and on up and down hill stretches.

Other over-capacity instances of Sileby roads were recorded during the early-morning and late-afternoon on Brook Street and High Street. However on these roads the permitted on-street parking is better regulated and generally traffic flows more smoothly. None the less traffic queuing is frequent at the junction of Brook Street and High Street.

For Swan Street, on-street parking causes major traffic discontinuities and queuing, even though theoretically the road runs under capacity. Similar comments and observations can be made in regard to King Street in the early-morning; but in the late-afternoon King Street exceeds it effective capacity and long and regular queues result. Indeed on King Street vehicles are regularly parked on both sides of the road; such as when drivers access shops and fast foods.

During the late-afternoon, Figure 3 shows that as the traffic enters extremities of the village it exceeds respective road capacities (of 300 vehicles per hour) on three of the five main radial roads; namely on Ratcliff Road (373 vehicles per hour); on Cossington Lane (311 vehicles per hour); and on Mountsorrel Lane (321 vehicles per hour). Barrow Road traffic also approaches its capacity limit (with 287 vehicles per hour). Additionally three of the inner roads circulating the village centre exceed their capacity, with: circa 479, 200 and 360 vehicles per hour (early-morning) and 325, 344 and 318 vehicles per hour (late-afternoon) flowing respectively along High Street, King Street and Brook Street; such that during peak flows queues build up at the junctions of ‘Brook Street-Cossington Road- High Street’ and ‘King Street-High Street-Barrow Road’.

Evidently therefore on week days (early morning and late afternoon) the majority of the Sileby road network will exceed its capacity limit. Additionally, it is widely understood by Sileby residents that this measured situation is essentially a norm; which can become worse when local flooding directs significantly more traffic (including HGVs) through the Sileby village.

Our team believe that its ‘Traffic Flow Measurement Exercise’ has captured, and enabled reporting, of representative data from ‘early-morning’, ‘late-afternoon’ and ‘mid-afternoon’ traffic flows within the Sileby road network; such that the data collected provides a useful evidence base for reasoning about future policies, the importance of which will be influenced by the network’s capacity and time-based behaviours.

4 Anticipated Impacts of Traffic Growth

4.1 Secondary Observation Made: *About the Impact of Traffic from Outside the Parish*

The reader is also pointed towards Addendum 3; which uses results depicted in Figures 1 to 4, and Tables 1 to 4, to show that a significant fraction of the road over-capacity problems in Sileby is consequent upon, and exacerbated by, traffic originating from outside of the village. Policing the growth of this externally derived traffic will largely remain outside of the control of any Sileby Neighbourhood Plan; however the approximate, relative size of this traffic (compared to internally derived traffic), should be made known to the Sileby Parish Council. Importantly also as observed within this analysis the Sileby Parish simply cannot be accurately characterised as being a dormitory village; as has been the assertion by certain Building Developers when seeking to reduce their road mitigation costs.

By being cognisant of this ratio the Sileby Parish Council could become better positioned to object to any new housing development applications planned for outside (but near to) the Parish, unless the said development includes suitable traffic mitigation schemes that ensure that the Sileby road network/infrastructure does not further deteriorate.

4.2 Basis of this Secondary Observation about Internal and External Traffic Growth

The analysis of this section is supported in greater detail and is reported in Appendix 3. Whereas this sub-section reports on the main thread of argument and main conclusions drawn.

Figure 5 shows characteristic uses of the Sileby road network and separates those uses with respect to the origin of drivers of vehicles in terms of the location of their home; be that in Sileby or at some location which is external to the Sileby Parish.

In Figure 5 traffic flows A and B relate to vehicle owners who live outside the village, but access the village for some purpose(s); be that to access work, schools, shops, services, recreation and friends. Also traffic flows E relate to vehicle owners who access the village network simply to travel through the village to access another remote location. Traffic flows A, B and E collectively are assumed to comprise all of the 'externally derived traffic' which deploys the Sileby road network for some purpose(s). The reader should note that it is assumed that externally derived flows A and B will return to their out of the village origin; but that they do that at some time later than their village entry. Whereas the externally derived traffic flow E is assume to directly leave the village as it completes its route through the village. Finally traffic flows C and D in Figure 5 are used to denote flows of 'internally (or locally) derived' traffic, for which vehicle owners live in the village.

Appendix 3 reports on an analysis which differentiates traffic flow constituents in the early-morning from those in the late-afternoon; and thereby connects the analysis to the Traffic Flow data collected by the TTG measurement team and reported herein. The outcome of so doing is summarise by Figure 6; which approximates to the magnitude of the externally derived traffic and does so separately for the early-AM and the late-PM. These approximations for the externally derived traffic respectively are numerated as being 932 vehicles per hour and 1438 vehicles per hour respectively.

Importantly although necessary assumption were made to derive these estimates (of externally derived traffic flow rates) the author considers these to be representative; hence he deduces that ***externally derived traffic is of similar magnitude to the internally derived traffic***.

Consequently we can assume that if the Sileby road network has already reached its capacity limit then any significant additional traffic growth, either within Sileby or in nearby parishes, could push the Sileby road network into deadlock conditions. Thus for example if, during the next 5 years, in combination any new set of nearby or within the parish housing developments were to yield an extra 2K houses then an extra circa 3K cars would expect to deploy the Sileby road network; with possibly circa 500 of these extra cars utilising the Sileby network at peak flow times. Based upon the evidence of multiple road capacity excesses reported herein, which relate to the 'as is'/current road network, there is little doubt that the Sileby network would begin to NOT FUNCTION ADEQUATELY at various times on weekdays. Consequently any such housing growths should be accompanied via mitigation schemes that protect the integrity of the Sileby roads and overall Sileby road system.

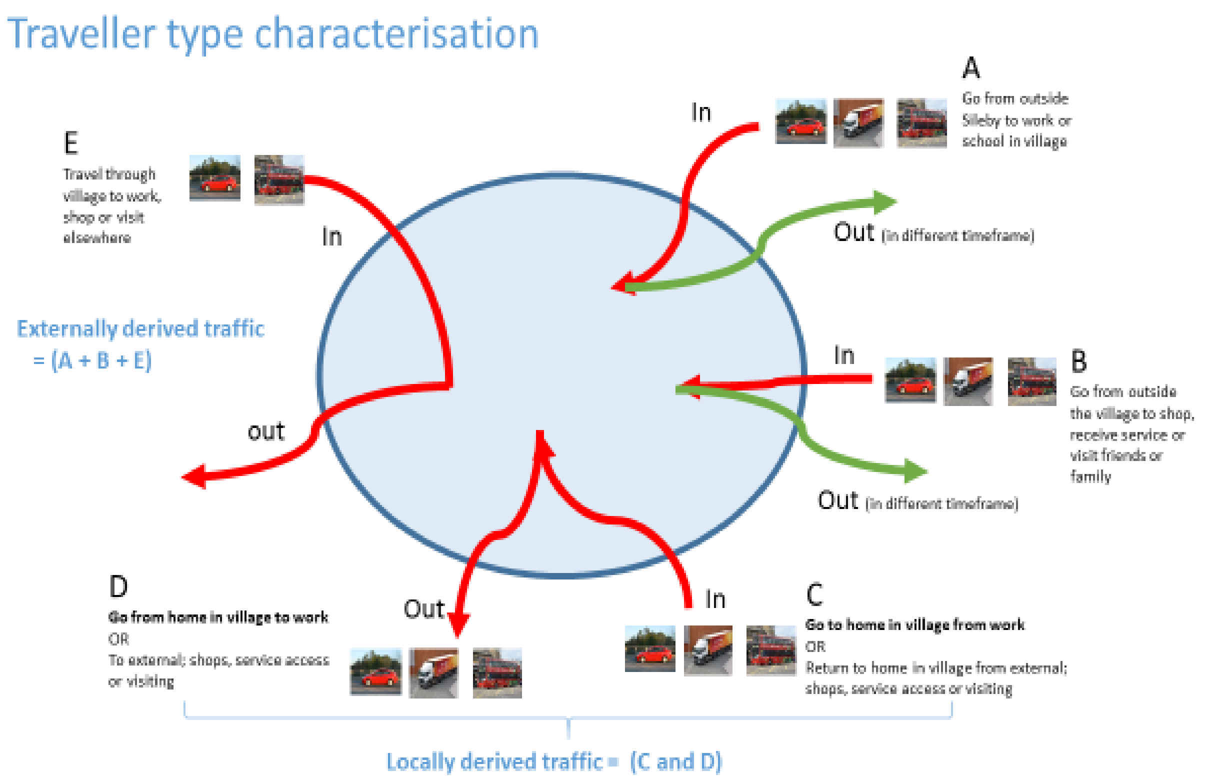

Figure 5 Characteristic Uses of the Sileby Road Network

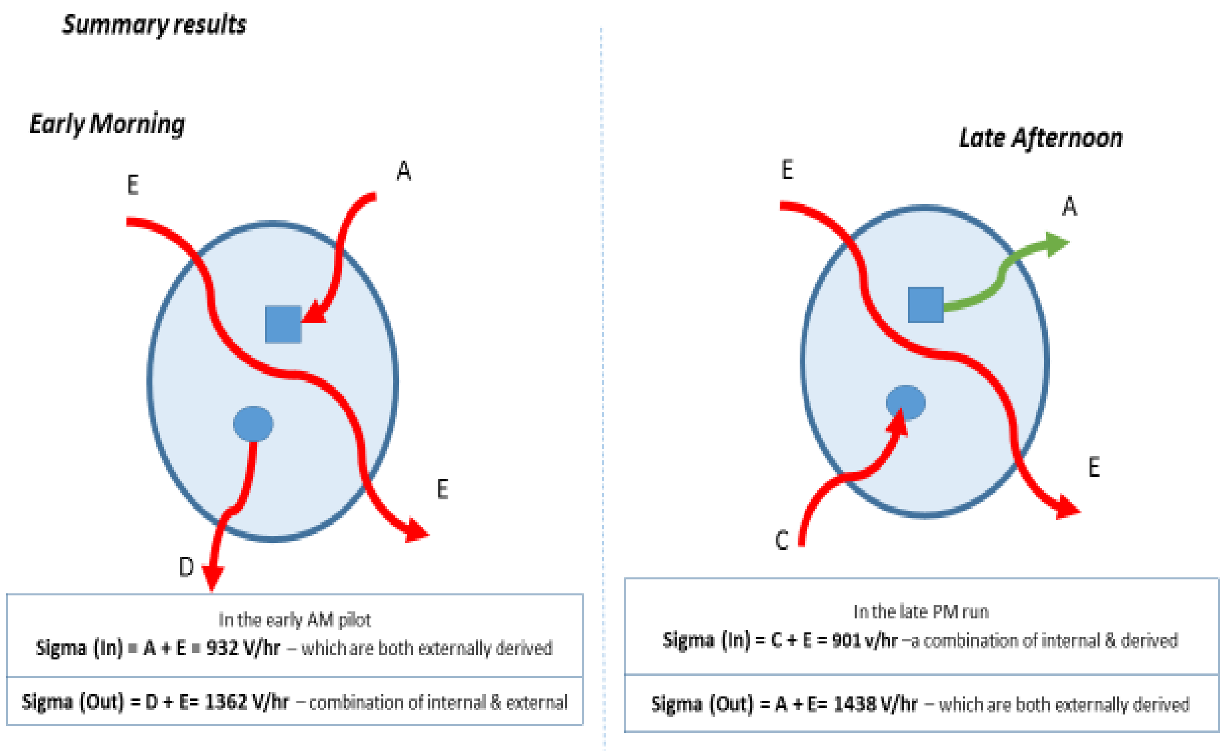

Figure 6 Outcomes of the analysis in respect of the AM and PM peak flows

5 General Recommendations:

In the light of Neighbourhood Planning and Information Feedback to the SPC

This section outlines initial recommendations made by the present author, having studied the Sileby traffic evidence gathered on the 29th Jan and 7th February 2018.

5.1 Regarding Traffic Policies

Direct observation has shown that the Sileby village road network operates close to (and at times significantly beyond) its effective capacity. This capacity limitation is influenced greatly by the off-street parking permissions allowed for much of the Sileby road network. This on-street parking is believed to be relatively massive compared to most other Leicestershire villages (but that assertion should be checked with LCC before this draft report is published beyond the NP working group); and often this makes main Sileby link roads, originally designed for two way traffic flows, actually operate in single lane manner over significant sections of their length.

General solutions to this on-street parking problem are not obvious; because of the general housing styles and locations alongside most roads linking Sileby to the outside world. However the particular locations where these problem have greatest impact should be considered in detail by the TTG, and in an evidence based way, such that possible partial solutions can be proposed and discussed with the NP sub teams, SPC and LCC.

The lack of quality car parking in the village centre is also a closely related issue for the TTG, as it exacerbates both legal and illegal off-street parking and thereby creates significant road obstructions. Once again though as yet no effective solution has been identified or proposed for this problem. But basic evidence of future car park usage and car parking requirements should be gathered by the TTG; such that the outline design of more public (off-street) car parking in the village centre can be provided as a priority.

5.2 Policies in Regard to Housing Development and Growth Impacts

Of critical importance will be growth impacts arising during the NP lifetime (up to 2028). That growth will likely be in housing, businesses and numbers of car ownerships. Without a significant change to the current Sileby road network (such as for example via the development and use of a suitably constructed bypass) it is evident that any substantial new housing and business development in Sileby should be opposed unless it also promises effective traffic mitigation which will ensure that road capacity overload issues in Sileby are not exacerbated.

Because a big proportion (approximately half) of the traffic in Sileby is typically sourced from outside the Parish it is incorrect to characterise the Parish as a dormitory village. This it is recommended that the SPC should also monitor housing development proposals within neighbouring villages; to ensure that they do not make the observed Sileby traffic situation far worse.

For sure, as any new housing development within Sileby occurs this should be with integral parking provision (which is in excess of LCC norms).

5.3 Other TTG Recommended Actions

The TTG may seek to use the evidence base described in this report to further influence CBC and LCC about the near capacity status of the Sileby Road Network. Should vehicle flow magnitudes observed by TTG be shown to correspond and/or exceed the simulated flows generated by LCC (during their 2016 study of the Sileby and Barrow road network) then planning and developmental authorities might respond more positively to proposed network improvements and/or the need for effective developmental mitigation schemes. Ideally therefore the TTG should consult with CBC and LCC on this matter and deliver to them the findings of this report.

6 General Conclusion

This paper explains how 11 Sileby parishioners have systematically measured and analysed data about traffic flows within the road infrastructure of their village. That data collection was made in January and February 2018 about peak traffic flows (early morning and late afternoon) and average mid-afternoon traffic flows.

On-street parking is permitted through much of the Sileby road network, namely along circa 3 miles of its five prime radial roads and four main inner roads. Further our team observed that at many specific locations throughout much of the Sileby road network one way traffic flows are regularly enforced by those parked vehicles. The analysis goes on to show that the Sileby road network comprises UK standard UAP4 roads (with carriageway widths ranging between 6 and 7 metres) and because commonly one way flows are enforced by parked vehicles, those roads have a maximum 'effective capacity of 300 vehicles per hour'. Whereas the measured peak traffic flows on five of the nine Sileby prime road were found to exceed this maximum capacity; and a further two of the remaining four prime roads exceed 80% of that maximum capacity.

It is not claimed that all roads comprising the current Sileby road network consistently run in over capacity conditions; but it is claimed that a significant fraction of the network can typically do so on a daily basis during work day peak early-morning and late-afternoon traffic flows. Indeed this conclusion accords and updates, with actual data, the Highways Authority's 2016 Traffic Study of Sileby and Barrow.

This paper then goes on to show, from a traffic flow perspective, that Sileby is not a dormitory village; simply because during peak flows a significant percentage of traffic flowing into and out of the village (thereby loading its road network) originates from vehicles who's owners actually reside outside of the village. The paper concludes by warning relevant authorities that if any significant vehicular growth ensues from either (a) within the Parish or (b) from nearby Parishes a likely impact may be to deadlock the Sileby road network; simply because this road network already runs at or beyond its 'effective' capacity.

The paper clearly identifies where analytical assumptions have been made. Further the evidence it presents has been generated and analysed based upon sound engineering and mathematical principles. None the less the paper has been passed to local authorities (namely Charnwood Borough Council and the Leicestershire County Council) seeking their opinion as to the quality of its findings and its underlying science. By so doing it is hoped that upcoming planning application processes will take heed of this new evidence base.

Prof Richard Weston, Associate to Yourlocale, MD Manufacturing Modelling Ltd *19th March 2018*

First Addendum to Appendix 2

Checking the Data validity

Typically it is necessary to show that data collected by a distributed team of people is sound and is in conformance with preferred data checking policies. Thus this appendix considers the interconnectivity of the data; and thereby provides a simple check on the data quality.

For the pilot morning and mid-afternoon runs it does this at all four of the main junction points; with a view to testing how accurately counting processes were conducted.

Figure A1.1 Morning Data Check

At each junction '***the combined vehicle flows into a junction' should approximately equal the 'combined vehicle flows out of the same junction';*** simply because vehicles could not disappear into thin air. Such arithmetic testing was carried out and the results posted onto Figures A1.1 and A1.2 respectively for the morning and afternoon runs.

Generally this showed that the vehicle counting was of a high standard.

In the morning run checks made at Junctions 1 and 4 showed the results to be within 4% and 7% respectively. This is particulalry good in view of possible error sources arising mainly from the ***different timing of counts, the possible starting and stopping of vehicles in road sections between each count point and the junctions concerned, human error when counting and the fact that each of the junctions were not of a simple geometry.***

The morning count check at Junction 2 was within 12% which is fine as this was not really a junction, in as much that there were various stopping and starting points available when entering the village. The check at Junction 4 was however within 30% only but later the team realised that a further link road (namely Highgate Road) fed a body traffic onto that junction. Hence the scale of the Highgate feed was investigated during the Wednesday late afternoon run to check & ensure the data quality.

Correspondingly the afternoon data run checks made at Junctions 1, 2 and 4 showed excellent results being within 1%, 4% and 5% respectively. Whereas Junction 3 results were now found to be within 12% and (as indicated) the impact of the Highgate Road link was assessed during the Wednesday late-afternoon run).

Similar data checks were carried out for the Wednesday late-afternoon run, see Figure A3, which shows that all data flows were measured with an accuracy of better than 12 %.

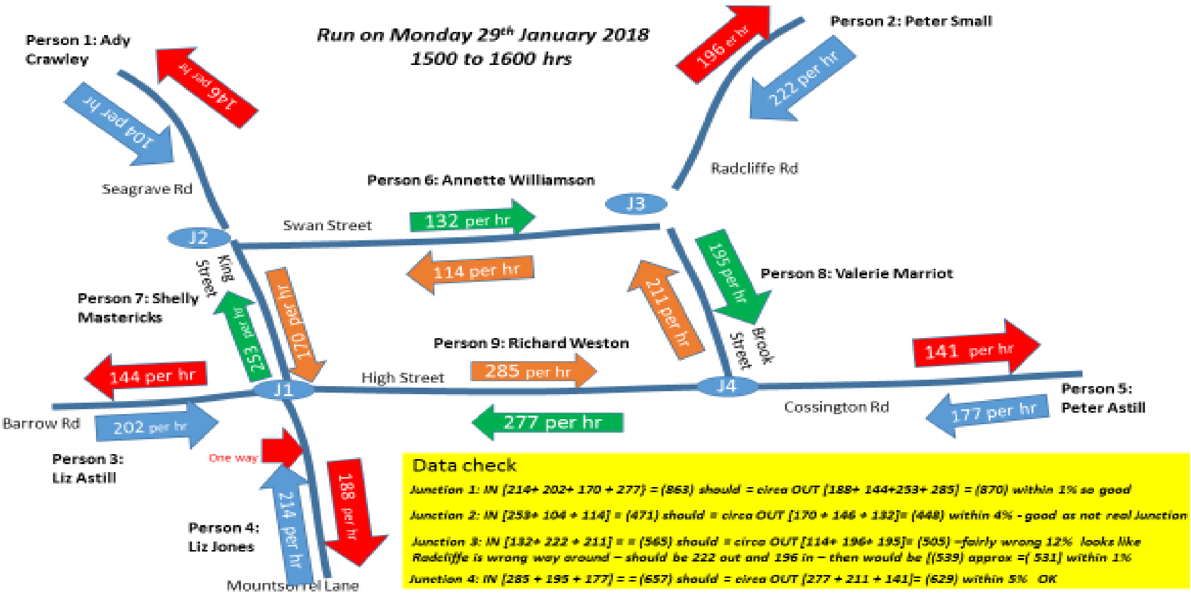

Figure A1.2 Mid-Afternoon Data Check

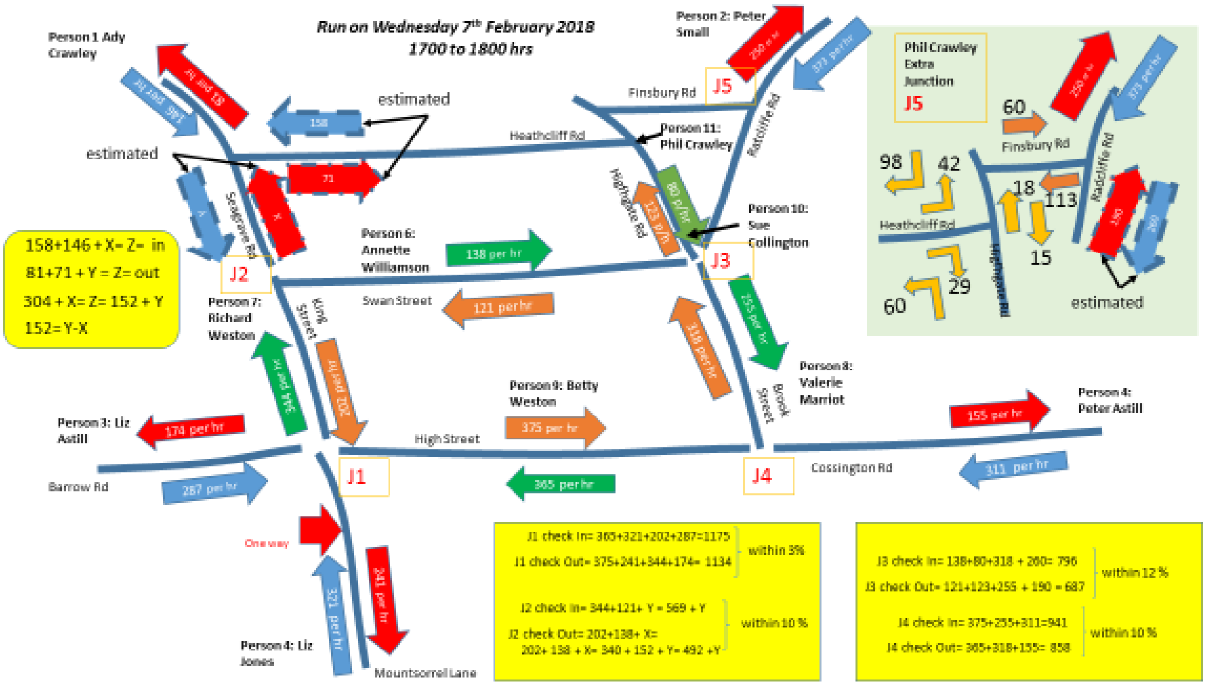

Figure A1.3 Late-Afternoon, 7th February Data Check

Second Addendum to Appendix 2

Definition of some Key Terms

This appendix defines and references key road capacity definitions which are used through the body of the report.

(1) Notes from the UK link road standard http://content.tfl.gov.uk/technical-note-10-what-is-the-capacity-of-the-road-network-for-private-motorised-traffic.pdf.

▪ Road capacity, is the maximum design capacity of a given roadway at link and junction levels for motorised traffic, and is well understood for different lanes and carriageway widths.

▪ "Effective" capacity is the capacity available after many random influences such as the driver behaviour of individuals, changing road conditions and weather have interacted to remove an element of available capacity. The "effective" capacity at the link, junction and network level available for utilisation by traffic is not currently monitored or fully understood.

▪ Road Capacity is the maximum potential capacity of a given roadway. It is usually expressed in terms of vehicles per hour or day. The UK Highways Agency in advice note TA 79/99 has analysed the traffic flows on urban trunk roads to assess the capacities that can be achieved for different road types and widths. In TA 79/99 capacity is defined as the maximum sustainable flow of traffic passing in one hour, under favourable road and traffic conditions.

(2) According to UK National Standards on link-road design all of the Sileby roads studied (and depicted in Figure A2.1) can be classified as being UAP4 (Urban All Purpose class 4) roads

(3) USP4 roads have a standard design capacity which is tabulated in the 'Extract from ROADS TASK FORCE Thematic Analysis' http://content.tfl.gov.uk/technical-note-10 in relation to the road width. An extract from that tabulation is shown in Table A2.1. Herein it is stated that two lane USP4 roads of carriage width 6.1 meters and 6.75 meters will have design capacities respectively of 750 and 900 vehicles per hour.

	Two lanes	Two lanes	Two lanes	Two lanes	Two lanes
	Carriageway width	Carriageway width	Carriageway width	Carriageway width	Carriageway width
Road types	6.1 meters	6.75 meters	7.3 meters	9 meters	10 meters
UAP3	900 vehicles per hour	1110 vehicles per hour	1300 vehicles per hour	1530 vehicles per hour	1620 vehicles per hour
UAP4	750 vehicles per hour	900 vehicles per hour	1140 vehicles per hour	1320 vehicles per hour	1410 vehicles per hour

Table A2.1 Capacities of two way single carriage way urban roads – one-way hourly flows in each direction

(4) The total, two lane width of the Sileby roads was measured and most commonly found to have a carriageway width between 6.0 and 6.9 meters; thus typically it is assumed that the Sileby link roads should carry two lanes; i.e. for two way traffic within two lanes of width circa 3.00 to 3.45 meters. Which means that according to UAP4 standards their 'design capacity' is circa 900 vehicles per hour.

(5) Additionally extensive on-street parking is permitted in Sileby, at locations indicated in red in Figure A2.1. As a consequence the designated roads actually function very differently from their intended design.

(6) Indeed consequent upon uncertain one way, switching of bi-directional flows at many points along each road the '***Effective Capacity***' of those roads is reduced markedly. In this Appendix and paper it is assumed that the reduction will be to approximately one third of their '***Design Capacity'; because each of the two way traffic flows need to take a turn to pass obstructing parked cars, and that before switching of the traffic flow occurs a significant delay will occur whilst the current traffic flow subsides***. Indeed therefore the TTG assumes that the 'Effective Capacity' of the UAP4 roads, which essentially comprise most of the Sileby road network/infrastructure near to the village centre will be circa 300 vehicles per hour.

(7) The present author notes here that the assumption that the UAP4 roads comprising the Sileby road network have an 'effective capacity' of 300 vehicles per hour is an important determinant of the later declarations that some of the roads are capacity limited when current peak traffic flows occur. But it is highly likely that this assumption is correct.

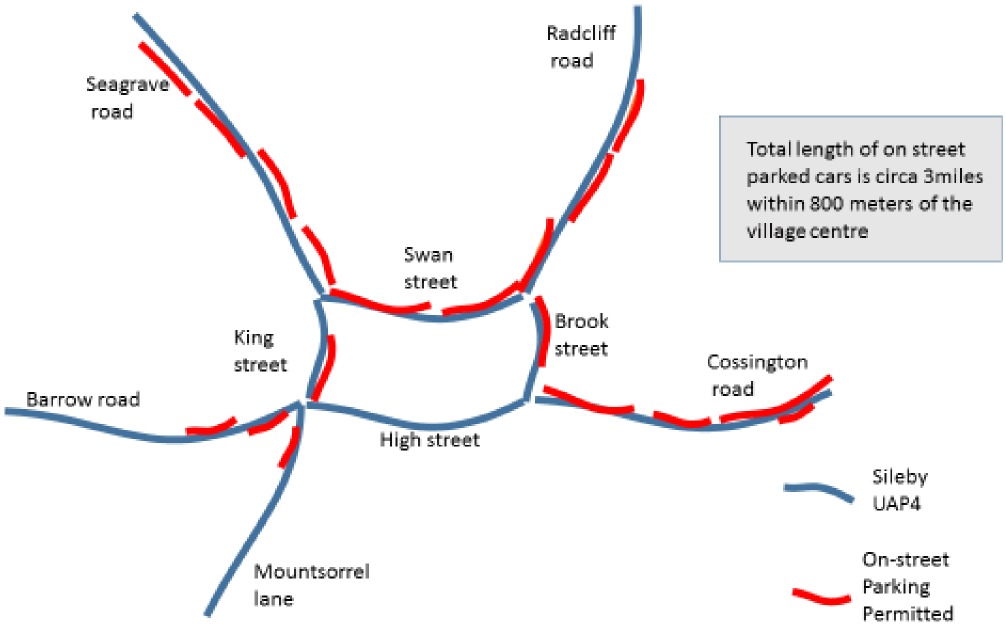

Figure A2.1 Parking Status on Sileby Main feeder/link roads on Sunday 07/01/2018 @ 1530hrs

Note: The figure in this appendix (designated Figure A2.1) needs to be updated to more accurately show the extent of the on-street parking in Sileby. The Sileby TTG have agreed to update this figure and it is hoped that this will be done very soon.

Third Addendum to Appendix 2

Ratio of Traffic Derived from External (to the Parish) & Internal (to the Parish) Derive Flows

Bearing in mind pending housing and business developments planned within a number of the villages neighbouring Sileby, the various Sileby traffic data flows described earlier in this paper were also used for a secondary purpose; namely to gain a ***rough and ready estimate*** of the ratio between 'Externally Derived' and 'Internally Derive' traffic flows. It did not prove possible to instrument our traffic measurement team with latest technology- hence this ratio needed to be estimated and partially so by mathematical means.

There are many possible ways in which this ratio could have been estimated; including that used in an earlier versions of this report. But to assist the readers understanding of the final approach taken reference is made to Figure A3.1.

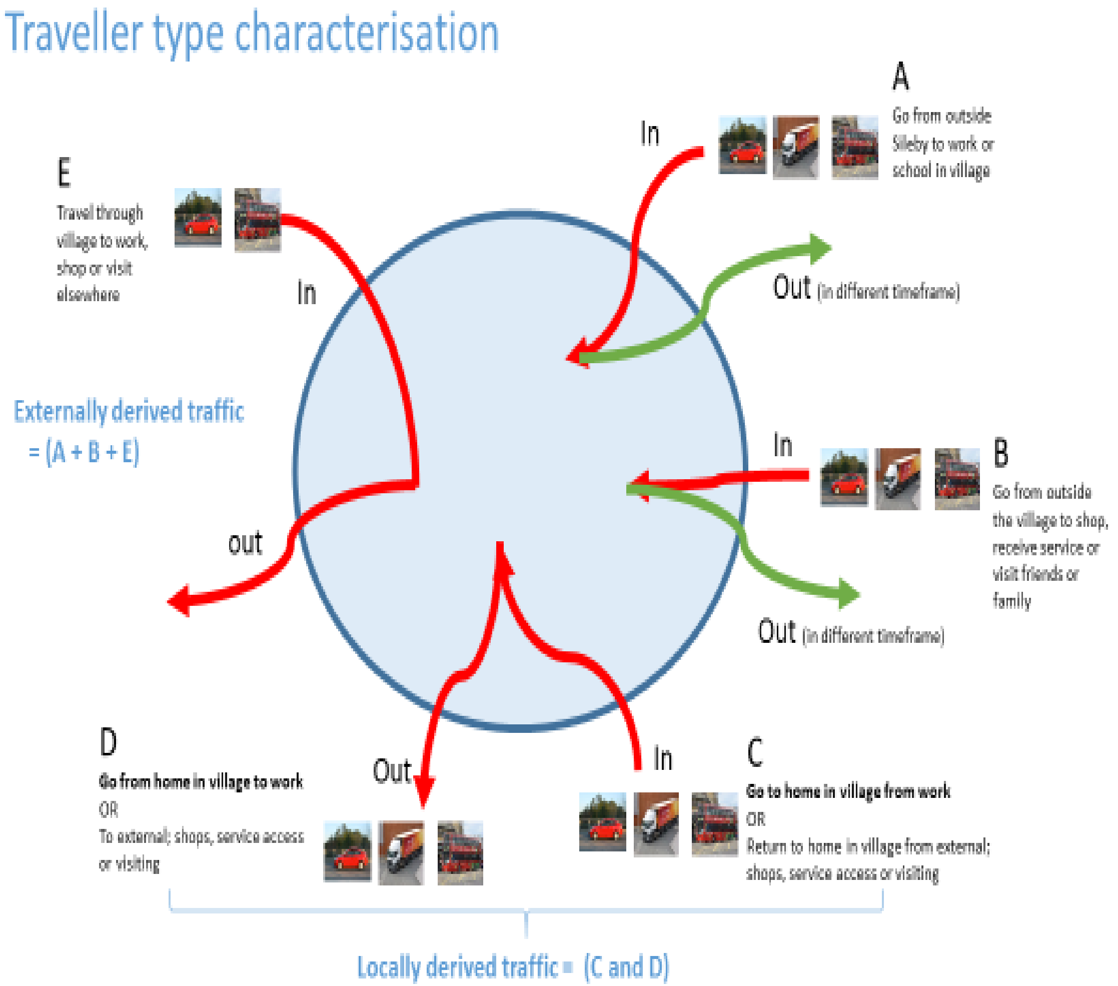

Figure A3.1 Different reasons for vehicles travelling to and from the village

The definition of terms used in Figure A3.1 were subsequently used in Figure A3.2 to express the relativities of primary vehicle flow types that furnished the three run periods described in the report body.

In following Figures A3.3 and A3.4 this allowed estimates for distinctive travel characters to be made respectively for the weekday early-mornings and late-afternoons.

For example in the early-mornings we see from Figure A3.3 that the sum of traffic inflows to the village were estimated as being largely comprised of flows A plus E (i.e. external work and school traffic accessing a Sileby destination plus externally sourced traffic flowing straight through the village); flow types which are both derived externally (i.e. from outside of the village). Whereas in the early-mornings the sum of traffic outflows from the village were estimated as being largely comprised of flows D plus E (i.e. a combination of internally derived traffic [with Sileby residents accessing destinations outside of the village] plus externally derived flows of vehicle passing through the village).

		In – Out =
In 0800-090	C very small + A large + B smallish+ E	(C very small + A large + B smallish + E)- (D large +A small + B very small + E)
Out 0800-0900	D large + A small + B very small + E	Approx= A- D = External (work + school) traffic - Internal work traffic

		In – Out =
In 1700-1900	C large + A very small+ B very small+ E	(C large + A v small + B v small + E)- (D v small +A F large + B F small + E)
Out 1700-1900	D very small+ A fairly large + B fairly small + E	Approx= C- A = Internal work traffic – External work traffic

		In – Out =
In 1500-1600	C medium + A very small+ B fairly small+ E	(C medium + A v small + B f small + E)- (D small +A medium+ B medium+ E)
Out 1500-1600	D small+ A medium+ B medium + E	Approx= C medium – (A medium + B medium) = pretty poor approx

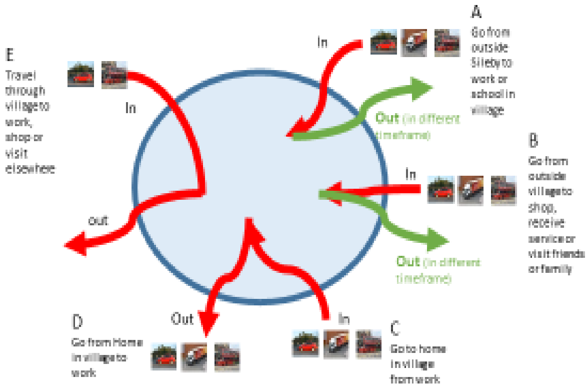

Figure A3.2 Maths estimates made to characterise vehicle travel during the AM run

Also from Figure A3.3 and Figure A3.5, we can see that the sum of A plus E (both external) flows can be enumerated against the arithmetic sum of all inflows to the village; namely to a total flow of 932 vehicles per hour (which was calculated by aggregating traffic flow results shown in Figure 1 and Table 1).

Similarly in late-afternoons we see from Figure A3.4 that the sum of traffic inflows to the village are estimated as comprising largely flows C plus E (i.e. internally sourced traffic returning home to the village from work, etc. plus externally sourced traffic flowing straight through the village). Whereas also in the late-afternoons the sum of traffic outflows from the village were estimated as being largely comprised of flows A plus E (i.e. both being flows originally externally derived and comprising external persons/vehicles returning to their homes outside of the village plus externally derived flows of vehicles passing directly through the village).

Also from Figures A3.4 and Figure A3.5, we can see that the late-afternoon sum of A plus E (external) flows can be enumerated against the arithmetic sum of all outflows from the village; namely a total flow of 1438 vehicles per hour (which again was calculated from the traffic flow results shown in Figure 1 and Table 1).

From which it is shown that although the quantity of externally derived traffic which accesses Sileby is variable throughout the day, at times when there are peak traffic flows through the village a very significant fraction of that traffic is derived from outside of the Sileby parish. There are alternative ways in which the fraction of externally derived traffic could be expressed however. One such reasonable way is to compare the ratios of internal and externally derived traffic flows but this evaluation would really be location dependent.

Hence for the sake of argument and representation a holistic approach has been taken by simply enumerating the ratio of externally derived traffic to that of the total (internal plus externally derived) traffic.

When taking this approach we observe that:

During the early-morning the ratio of 'External to Total Traffic' was 932: (1362+932)

= 1:: 2.46 = APPROX 40 %

Whilst during the late-afternoon the ratio of 'External to Total Traffic' was 1438/ (1438 + 901) =

= 1:: 1.63 = APPROX 61 %

Therefore this Appendix and its derived estimates of 'Externally Derived Traffic' show that the impacts on the Sileby road network of traffic originating from neighbouring villages must not be forgotten; particularly when assessing the suitability of the capacity of this Sileby road infrastructure and its likely resilience to within the village, and nearby to the village, housing and business growth .

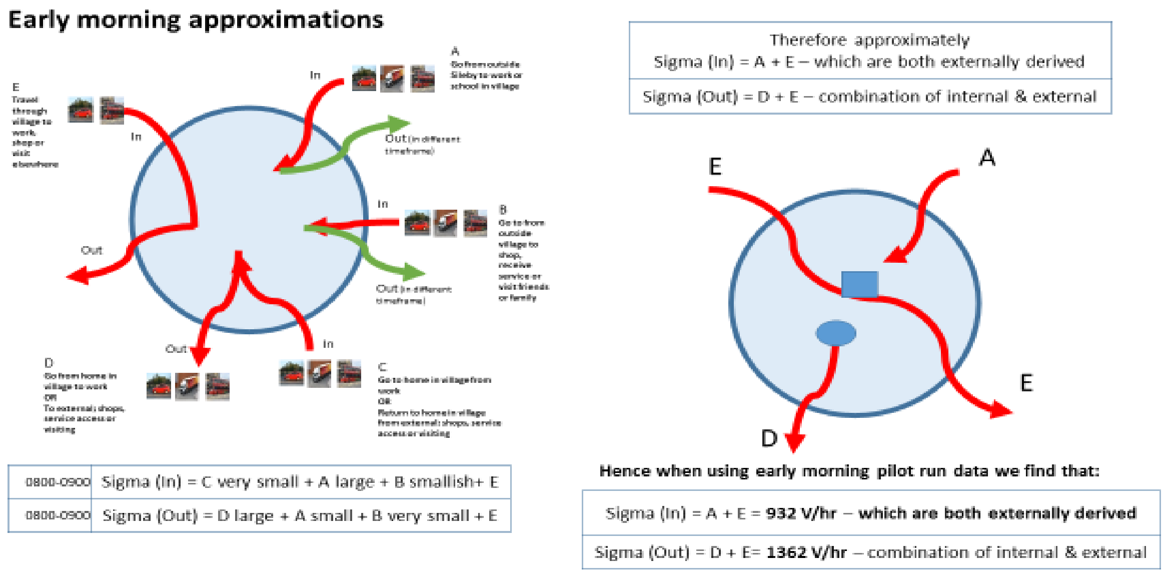

Figure A3.3 Applying the Maths estimates for vehicle travel in the AM run

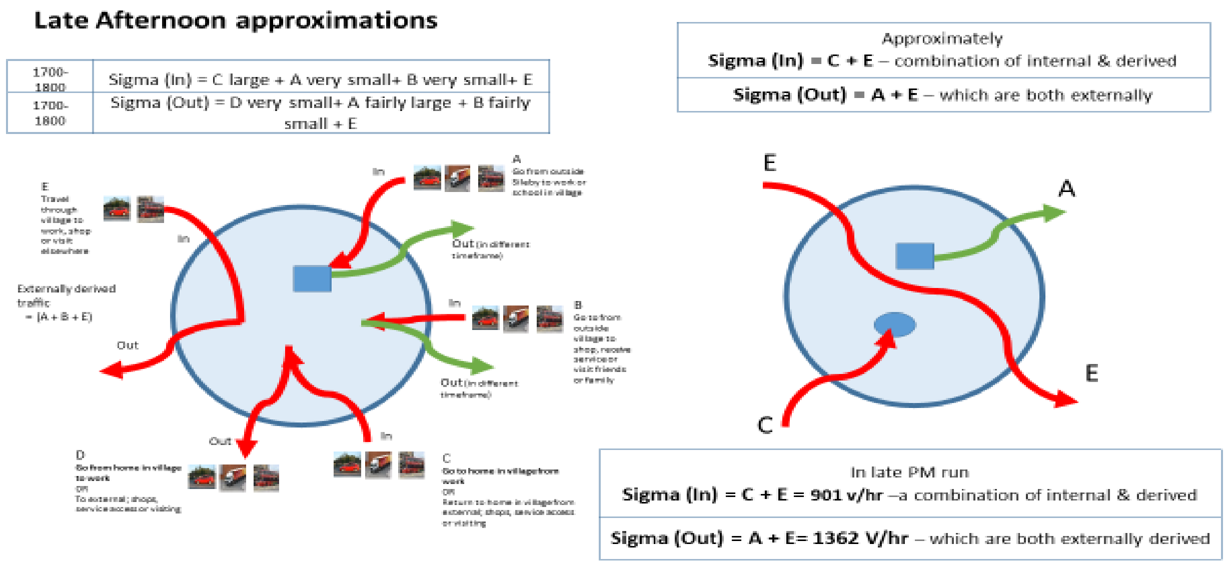

Figure A3.4 Applying the Maths estimates for vehicles travel in the late-PM run

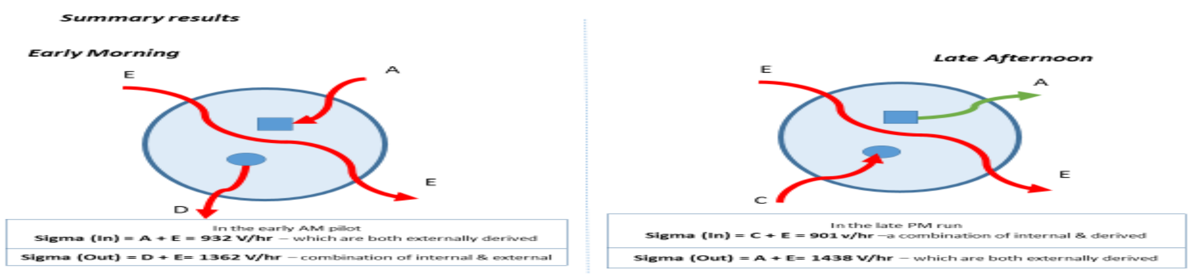

Figure A3.5 Comparing Maths estimates for vehicle travel in the AM and late-PM runs

Appendix 3: A Fourth Set of Sileby Traffic Flow Measurements, for a case of Slash Lane Flooding (#4)

– Measurements taken on 13th March 2018

1. Purpose of this report

This report briefly describes the approach taken when measuring vehicle flow rates during an early morning run on Tuesday 13th March 2018; at a time when Slash Lane was close due to flooding but Mountsorrel Lane remained open despite the presence of some surface water.

The evidence gathered is then reviewed and compared with earlier, but similar, evidence gathered when flooding had not occurred. By so doing the report identifies flow rate and routing changes systematically observed consequent upon what is considered to be a common flooding instance impacting on the Sileby road network.

2. New 'Flood Run' Evidence gathered

The primary purpose of conducting this measurement run was to gather evidence about the ***changes in radial road traffic flows*** through the Sileby road network consequent upon a common but significant flooding instance. There had been heavy rain over the preceding weekend and Monday, this led to this so called 'flood run' which was planned and carried out; such that the peak AM traffic flows observed during flooding could be compared against a regular peak AM traffic flow previously measured on Monday 29th January.

Five persons were each situated aside one of the five main Sileby radial roads to enable them to count vehicles flowing 'into' and 'out of' the Sileby village during the period 0800 to 0900; those measurement positions are illustrated in Figure 1. Figure 1 also pictorially represents the measured flow rates; namely measurements that captured data in the manner shown within Appendix 1, see Figures A1 to A5. During the flood run period the Pillings Lock station had recorded the River Soar level at 1.28 meters.

For comparison purposes, Figure 2 summarises the vehicle flow results of the earlier comparison run; where both the flood run and the comparison run were conducted in a similar manner, albeit that for the earlier run additional flows along internal Sileby roads had also been recorded.

To compare the measured outcomes the reader is referred to Table 1.

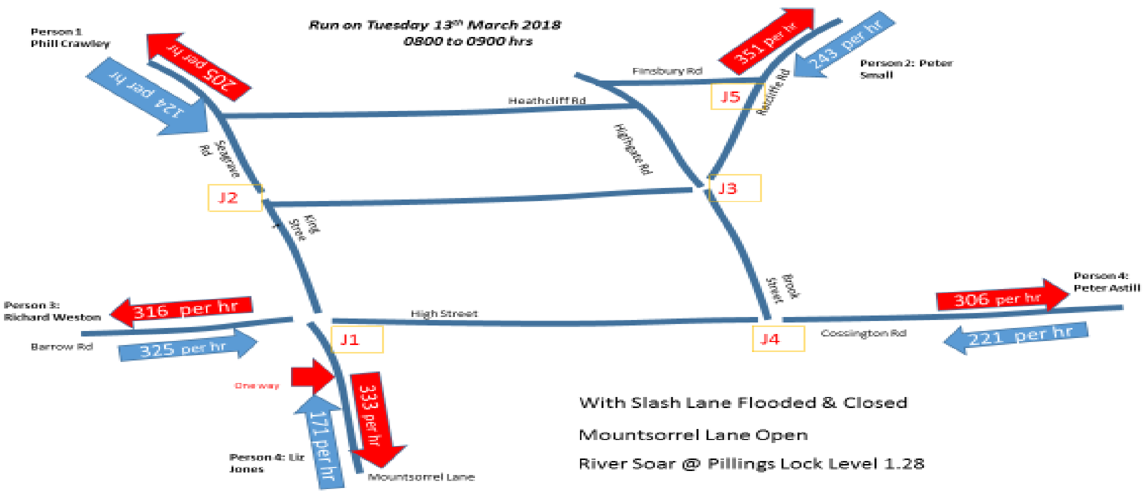

Figure 1: Measurement positions and flow rates recorded

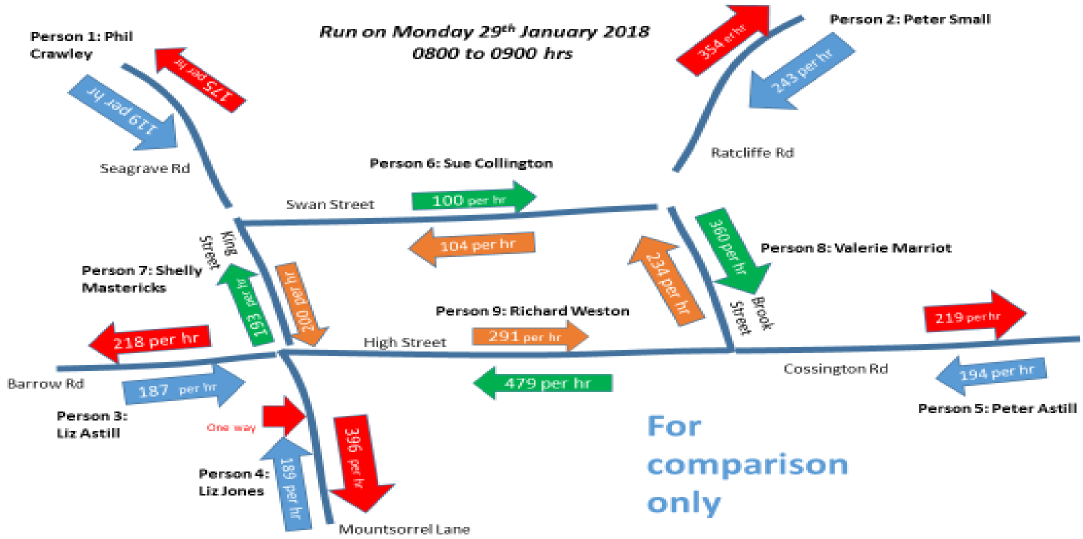

Figure 2: Comparison Results of the 29th January 2018 run

Comparison- with same time in day & no flooding

	Seagrave Road		Ratcliffe Road		Cossington Road		Mountsorrel Lane		Barrow Road	
		Up 17%			Up 14%	Up 40%		Down 16%	Up 74%	Up 45%
13th March Flood run	In 124	Out 205	In 243	Out 351	In 221	Out 306	In 171	Out 333	In 325	Out 316
24 Jan early AM run	In 119	Out 175	In 243	Out 354	In 194	Out 219	In 189	Out 396	In 187	Out 218

Table 1: Comparison between Vehicle flow rates

Table 1 shows that relative to the 24th Jan early morning run by far the biggest change in flood flow rates occurred: on Barrow Road (with a 74% increase in flow towards the village and a 45% increased flow out of the village); and Cossington Road (with a 40% increase in flow out of the village).

Both of these increased flow rates are as might be expected; because with Slash Lane closed many vehicles destined to the West or South of Sileby would now need to arrive into the village on Barrow Road and be re-routed; typically along Cossington Lane (travelling out of the village) if destined South or via Mountsorrel Lane if destined West.

To complicate matters a little, on the evening prior to our measurement run a flood sign was placed on the entry to Mountsorrel Lane; but as this lane had fairly minor surface flooding that sign was moved away just before the 0800 start of the run. This may still have deterred some traffic from turning onto Mountsorrel Lane so as to add their number onto the Cossington Road out of village flow; but we are confident that much of the traffic routing was as per the norm when Slash lane floods and therefore was appropriately recorded.

Similarly an unknown fraction of the traffic flowing from the West (whilst being routed towards or through Barrow) will have entered the village along Mountsorrel Lane, rather than be routed around the village via Slash lane. This unknown fraction of traffic will then likely have added to the normal traffic flow out of the village along Barrow road; and this will likely have explained why there was a significant increased out flow from the village along Barrow road.

Interestingly flows into and out of the Sileby village along Cossington Road were also increased; respectively by circa 14% and 40%. Whereas flows out of the village along Mountsorrel Lane were reduced by circa 16%, although this flow rate was still in excess of 300 vehicles per hour.

Furthermore the total traffic inflows to the village during the flood run totalled circa 1084 vehicles, which compared to a total inflow of 932 vehicles during the comparison run; i.e. a ***16% increase***. Whilst the total traffic outflows from the village during the flood run totalled circa 1511, which compared to a total outflow of 1362 vehicles during the comparison run; i.e. an ***11% increase***. These increases in flow are a little surprising, as one may have thought that vehicle owners might try to avoid Sileby at likely times of flooding. But clearly the two runs were at different times of the year and possibly there was no real/attractive alternative route to take.

A further observation is drawn within Table 2, which for both flood and comparison runs highlights those vehicle flows which are considered to exceed the capacity of the road on which they were travelling. Here the reader is referred to the earlier paper of the Transport Theme group which explained why much of the Sileby road network has a capacity of circa 300 vehicles per hour.

Comparison- with same time in day & no flooding

	Seagrave Road		Ratcliffe Road		Cossington Road		Mountsorrel Lane		Barrow Road	
13th March Flood run	In 124	Out 205	In 243	Out 351	In 221	Out 306	In 171	Out 333	In 325	Out 316
24 Jan early AM run	In 119	Out 175	In 243	Out 354	In 194	Out 219	In 189	Out 396	In 187	Out 218

Over capacity flows

Table 2: Vehicular flow rates that exceed their road capacity

From Table 2 we might take at face value that the chance of the Sileby road network capacity being exceeded will increase during instances of Slash Lane closure.

Professor Richard Weston, MD Manufacturing Modelling, Associate of *Yourlocale*

24th March 2018

Addendum to Appendix 3: Measurement Approach Taken

Figures A1 to A5 indicate the means by which Sileby vehicular flow evidence was captured during the 13th March flood run.

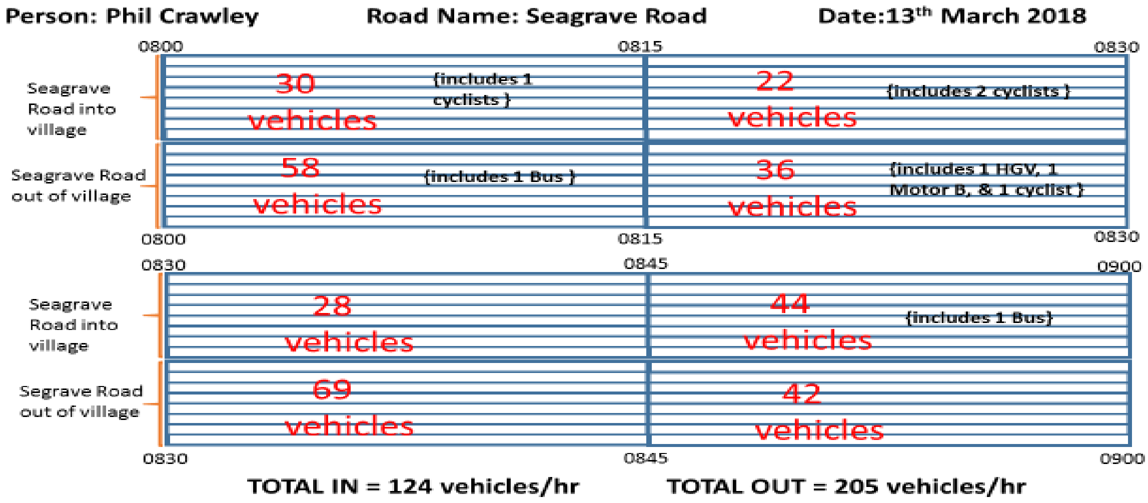

Figure A1: Vehicular flows captured on Seagrave Road

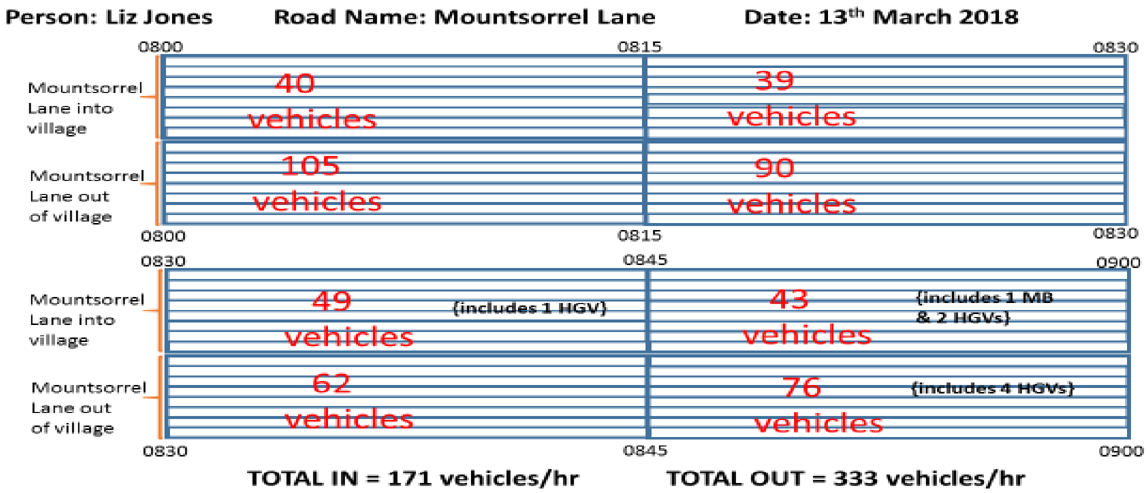

Figure A2: Vehicular flows captured on Mountsorrel Lane

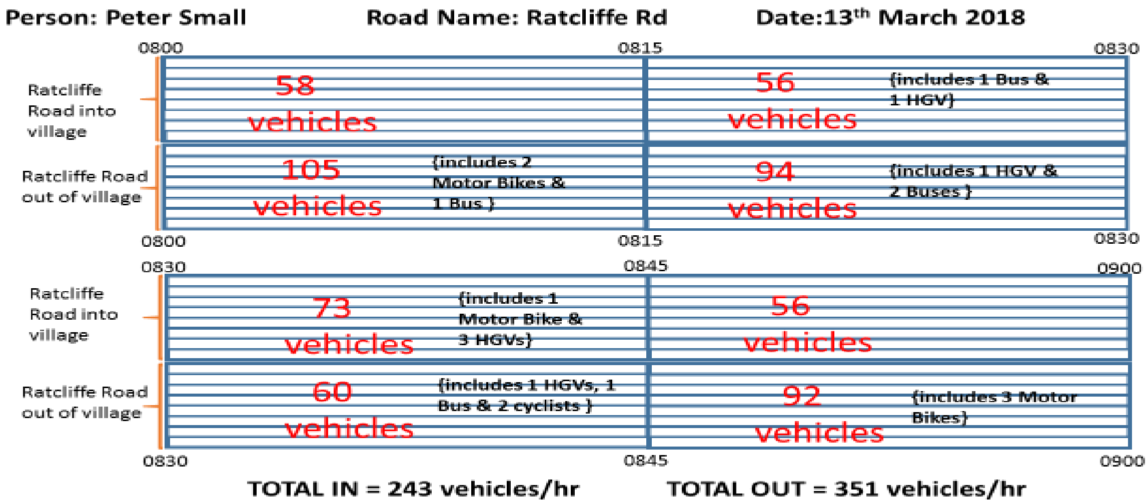

Figure A3: Vehicular flows captured on Ratcliffe Road

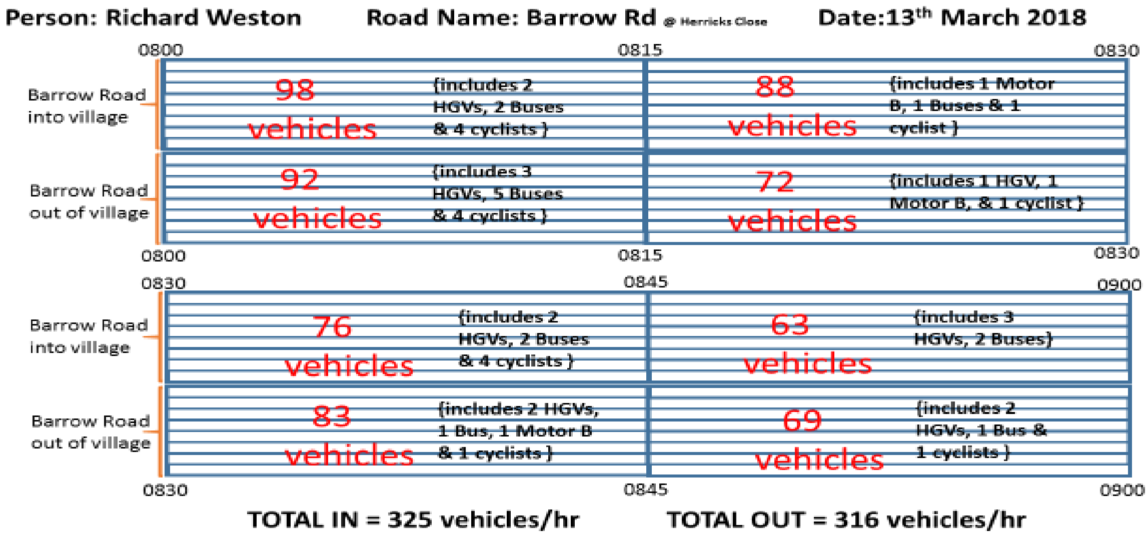

Figure A4: Vehicular flows captured on Barrow Road

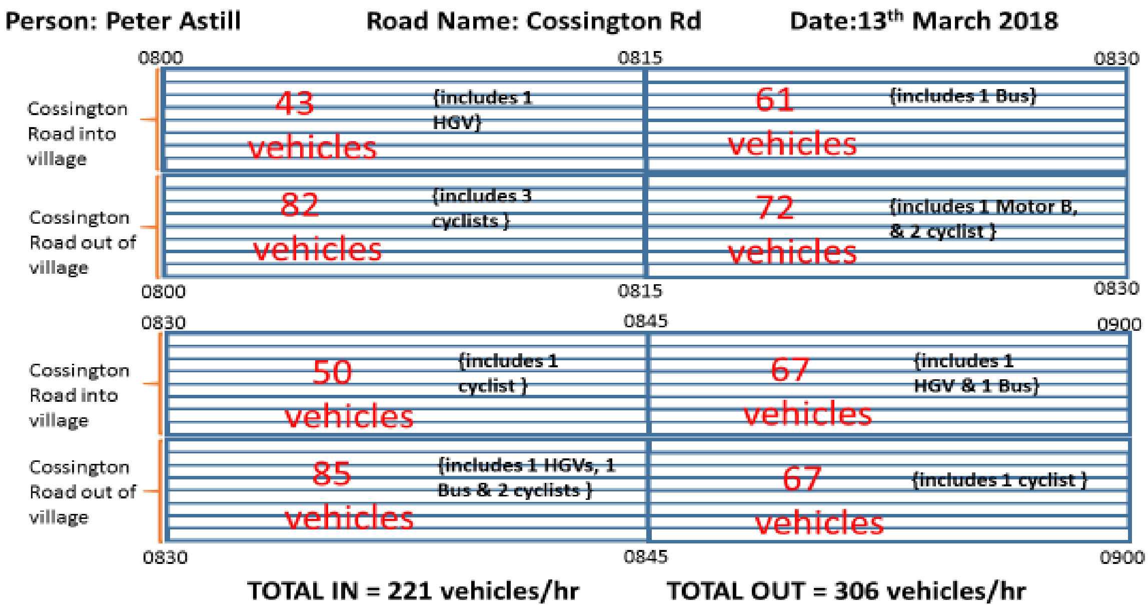

Figure A1: Vehicular flows captured on Cossington Road

Appendix 4: Queuing at three Sileby Junctions on Monday 19th February

1. Purpose of this Document

The appendix records queue measurements taken by three teams of two persons located at three Sileby junctions on Monday 19th February 2018. Figure 1 depicts those junctions. The King Street and Brook Street measurements were taken between 0800hrs and 0900hrs; while the Mountsorrel Lane measurements were taken between 1730hrs and 1800hrs.

This document conducts a first level, simple analysis of those measurements. Then it seeks to compare the results derived with known wait times at other road junctions around the UK; this with a view to considering if Highways Authorities will consider the waits involved to be of particular concern.

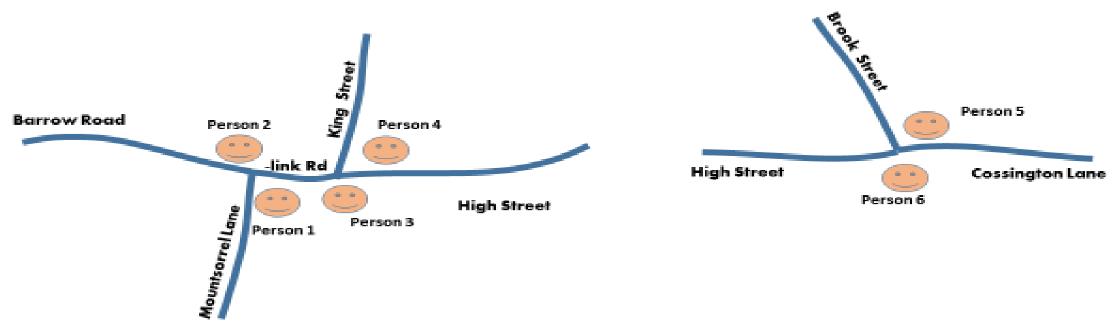

Figure 1 Sileby Junctions at which queue measurements were taken

2 First Level Analysis

There follows a summary and a first level analysis of the queueing results measured. The occurrence of three 'peak queue lengths' and their 'related peak wait times' (i.e. at each of the three junctions) are recorded into Table 1 to simplify understanding of this analysis.

King Street	King Street	Mountsorrel Lane	Mountsorrel Lane	Brook Street	Brook Street
No. of vehicles	Max wait time in minutes	No. of vehicles	Max wait time in minutes	No. of vehicles	Max wait time in minutes
29	5.3 mins	11	1.5 mins	15	1.25mins
23	4 mins	11	1.4 mins	8	1.25 mins
10 + Bus	5 mins	12	1.35 mins	8	1.25 mins

Table 1 Measured Data –about Queues in Sileby on 19th February

The 2016 LCC Sileby and Barrow road study predicted that the Sileby Road network runs near to and (and can exceed) its capacity. But from Table 1 it appears at first sight that there is relatively little queueing at what can be expected to be the busiest road junctions in the Parish (see section 2).

My own reading of this is that the extensive on-street parking, through much of the centre of the village, distributes queues along various sections of the five radial roads and their interconnecting inner link roads. This makes the three junctions of figure 1 operate at relative small queue lengths?

But of course there could be other reasons for this? Any ideas please?

Whereas at times of Slash lane flooding these queue lengths (maybe particulalry on Mountsorrel Lane and King Street may well grow significantly).

3 Comparator Cases

With a view to considering whether the measured wait times indicate unusual road infrastructure behaviours the present author has reviewed literature to seek possible comparison cases.

3.1 Comparator Case 1: *Typical wait times at Traffic Lights*

In this comparator case common wait times at traffic lights are considered; partly because one way of improving queueing behaviours at the three measured junctions would be to introduce traffic light systems.

The mathematics behind maintaining smooth flows at road Junctions is very complex (1, 2, 3, & 4); and the Highways Authorities use various sensory systems and synchronisation techniques to achieve this at junctions where traffic lights are installed. Yet according to Paige Fieldsted (5) the typical light cycle is 120 seconds. On the face of this fact it would appear that neither the Brook Street nor Mountsorrel lane queues measured were of any great significance; because both showed a maximum wait time of less than 2 minutes

However the maximum King Street queue times measured approach three time the average wait at traffic lights. Yet apparently only three occurrences of maximum waits (for less than 10 minutes) were observed during the measurement hour.

3.2 Comparator Case 2: Consider also (for the purpose of comparison) the case of queuing in the Burbage village near Nuneaton; where comparative queues were measured by a NP transport team (that the present author was advising) in 2015 & 2016. Here corresponding queue lengths (herein measured in terms of 'meters of vehicles' and 'length of time over which that queue was formed') were found to be as shown in Table 2.

During Burbage NP development, costs were attributed to vehicle queues tabulated in Table 2 using the following approach:

-*Cost of Human Capital Calculation*: of regular vehicle queuing on Burbage Link Roads and in the Burbage Village

The Burbage Sub group observation was focussed on queues that regularly form at four main road junctions; where over the period November 2015 to February 2016 the average queue lengths were found to be:

- 1.5 km for circa 3 hours each week day at the Junction of the B4109 andM69/A5
- 2.3km for circa 5 hours each week day at the B4109/B590 Junction
- 0.7km for circa 6 hours on each week day at the B4669 and B590 Junction
- 0.3km for circa 6 hours on each week day as the B578 passes through older sections of the village and meets the B4669

Location	Problem Issue	Evidence	Possible Traffic Management Improvement
On the B4109 northbound to Hinckley at the B590 junction	Congestion: Excessive traffic flows and road obstructions cause vehicle queue lengths of circa 2.3km for 5 hours on each week day Tail backs from these lights can make a right turn from Brooke side very difficult at times, no right turn filter light in to Brooke side need notes in fixes	Sub Group's Congestion studies Photographic Evidence Queuing & Road Capacity analysis Ongoing deliberations of local government highways authorities	Modify flows at hub junction traffic lights Improvement/extension to the RH Filter into Brookside Modify traffic Island flows Pursue with other bodies a link from Clickers Way to the M69
At the Junction of the B4109 & M69/A5	Congestion: Excessive traffic flows and road obstructions cause vehicle queue lengths of circa 1.5 km for 3 hours on each week day	Sub Group's Congestion studies Photographic Evidence Queuing & Road Capacity analysis Ongoing deliberations of local government highways authorities	Link the operation of the Hinckley hub traffic lights to the redesigned traffic light flows at Brookside & (e.g. via SCOOT) Pursue with other bodies a link from Clickers Way to the M69
Northbound flows at the B4669/B590 Junction. Also at the B4669 Junction with Brookside	Congestion: Excessive traffic flows and road obstructions cause vehicle queue lengths of circa 0.7 km for 6 hours on each week day	Sub Group's Congestion studies Photographic Evidence Queuing & Road Capacity analysis	Modify the operation of the Brookside traffic lights -to improve the filtering of flows turning onto the B4669
As the B578 passes through the village; mainly along the length of the B578 between Foresters Road the M69	Congestion: Excessive traffic flows and road obstructions cause vehicle queues lengths of circa 0.3km for 6 hours on each week day	Sub Group's Congestion studies Photographic Evidence Queuing & Road Capacity analysis	Introduce 20 mph speed limit on the B578 through the village Install new Traffic Lights at the B578/B4669 Junction (with RH filter) --synchronise with the Brookside traffic light system Permit verge parking (such as Grasscrete)

Figure 2 For Comparison: Measured Queues measured for the NP in the Burbage Parish in 2015-2016

Therefore at these four junctions alone, and on every week day, a total traffic queue of 4.8km occurs for an average of circa 4.6 hours on every work day. If we assume that approximately each vehicle in those queues occupies an average road length of 6 meters then circa 800 vehicles will be delayed in the said queues. Furthermore if on average of 1.2 people occupy each vehicle and there are 250 working days per year it follows that: an equivalent 800 people will be delayed for 250x4.6 hours per year. Namely circa ***0.92 M hours annually.***

If we assume the cost per hour of each person queuing is £25, then the cost of people lost time at the said four Burbage junctions is of the order of ***£23 M per annum***

Clearly the severity of the Burbage Queueing cases is markedly of greater significant than those measured at the three Sileby junctions. That difference in significance can be calculated by comparing the '**average area**' under the '**Queue length against queue wait**' curve- and is probably in the region of 30 to 50 to 1- with Burbage being the larger.

Even so the LCC did not concede (on the basis of queue lengths formed) that the Burbage roads in question needed to be improved; rather LCC focussed their concentration on a 'sometime (possibly never)' provision of a by-pass around Burbage.

Approximate Costing of Queueing in Sileby

In a similar fashion we could attribute human capital costs to the queues in Sileby but these will be significantly lower (say of the order of 0.07 to 0.05) of the Burbage cost; say circa £1.5M per annum of people costs in Sileby queues. Clearly this is still a significant sum of money but is probably less than the cost of typical lost times at three traffic lights; hence I suspect that Highways Authorities will be less than impressed with our waiting at junction problems- in comparison to many others in Leicestershire.

Frankly though I do not know if the Burbage queue lengths were extraordinarily long, but they may have been. Hence I will continue to research the literature for cues to this; with emphasis on finding a KPI (Key Performance Indicators of worrying UK queue size). As yet I have only found one possible document which records examples of actual queue lengths; but this document is relatively costly- hence because I am not sure if it will be useful I have not pursued this avenue further.

4 Interim Conclusion

My interim conclusion is that presenting the Sileby queuing data captured on 19th February in the same Transport evidence base as the traffic flow data, we collected earlier, could be harmful to our much better case of proving that the Sileby Road network exceeds its capacity (of circa 300 vehicles per hour) on a number of the roads that form the village infrastructure; also apparently this earlier case is consistent with the 2016 LCC Sileby and Barrow Road Survey hence they will likely listen.

However perhaps keen group members might wish to pursue other data sources on queue lengths which might indicate that the Sileby network is exceeding its capacity.

Report Prepared by: Prof Richard Weston, 22nd February 2017

5 References

1 Traffic Flow Theory http://www.fhwa.dot.gov.tft.chap9

2 Travel Time prediction in Urban Road networks

Dr Jessica Anniston IFAC pubs 1997

3 Highway Analysis and Design

R. J Salter, Reader in Civil Engineering, University of Bradford, 2nd edition

4 Time-dependent queueing at road junctions: Observation and prediction

R.M.Kimber & P.N.Daly, Volume 20, Issue 3, June 1986, Pages 187-203

5 Traffic: Red, Yellow, and Green: the Science behind traffic Lights

Paige Fieldsted, Daily Herald May 2013

Appendix: QUEUE DATA COLLECTED

Vehicles exiting King St on Monday 19th February 2018 (Liz Astill and Phil Crawley)

Time of Measured Queues	8.01	8.08	8.14	8.24	8.28	8.39	8.44	8.52	8.55
No. of vehicles	6	29	23 1 HGV	6	6	5	4	5	10 1 bus
Time for tail Vehicle to clear In Seconds	130	345	246	35	85	36	75	45	290

Vehicles exiting Brook St on Monday 19th February 2018 (Sue Collington and Peter Small)

Time of Measured Queues	8.00	8.02	8.03	8.05	8.10	8.12	8.13	8.16	8.19	8.29	8.30	8.34	8.41	8.42	8.50	8.51	8.58	8.59
No. of vehicles	15	7+1B	6 +1 H	8	5 +1B	8	8	7 +1H	6	4	7	6 +1H	9 +1H	5	5 +1H	6 +1H	8	8
Time for tail Vehicle to clear In Seconds	74	32	47	49	40	79	76	37	55	18	65	34	37	26	16	61	24	44

Vehicles exiting Mountsorrel Lane on Monday 19th February 2018 (Annette Williamson and Peter Small)

Time of Measured Queues	5.33	5.35	5.37	5.39	5.40	5.41	5.43	5.46	5.48	5.50	5.51	5.52	5.54	5.55	5.56	5.57	5.59
No. of vehicles	3	3	6	7	11	5	9	11	11	10	13	12	8 +1c	14	6	3	5 +1H
Time for tail Vehicle to clear In Seconds	15	31	65	45	85	50	60	80	90	76	58	81	72	64	18	18	47

Notes. Whether vehicles turn left or right, there is only space for a single queue
Generally we only counted queues when there were more than 5 vehicles
There is a bus stop on Brook St. close to the junction but queues behind the busses have not been counted
It was light most of the time and heavy drizzle all the time

Appendix 5: Sileby - Roadside Parking on the Five Radial Roads

Roadside Parking was the most common Transport related complaint in the Villagers' response to the Questionnaire some months ago. In part the need for it, but principally, its effect on passing traffic. Members of the Neighbourhood Planning team in the Transport Theme Group (TTG) examined relevant factors.

The two roads with the longest, unrestricted and most troublesome on-road parking sections are **Cossington Road** (on street parking occurs here over c800yds) **and Seagrave Road** (on street parking occurs here over c280yds). On both roads there are occasional gaps where one or two cars can pass, e.g. by a side road, or where several driveways coincide, or whence cars have already left (and on Cossington Rd where two short sections of Double yellow lines exist)

Seagrave road has other problems....at the end closest to Swan St./King St. junction there are c12 houses with double yellow restriction on both sides of the road outside the houses...those house/car owners have had cars "Keyed" when parking outside another house.
There are reports that drivers have come to blows when refusing to give way.

POSSIBLE SOLUTIONS

1. Off Highway parking offers little potential except perhaps for Seagrave Rd on the Memorial Car Park, should that become open all the time.
2. The pavement by Ladkins is plenty wide enough to allow inset parking for houses opposite which have no roadside possibility. Perhaps there might be a future use of the two factories' parking space.
3. South East Seagrave Rd needs Double Yellow Lines repainting and extending towards the Memorial Park entrance.... and the Bus Stop cleared from car parking.
4. On Cossington Rd, some of the often quite generous pavements might be narrowed to allow inset parking...e.g. opposite Ark Motors
5. South end of Cossington Rd, terraced houses need c30yds of inset parking on their (West) side
6. On both Cossington and Seagrave roads there is plenty of room on the sides opposite from on-road parking to allow inset parking and perhaps allow two or three 50yds long double yellowed passing places
7. On both roads it is suggested that having bus stops in the middle of Double Yellow marked areas to avoid delays by busses stopped to pick up and set down

Ratcliffe road, although this is as long as Cossington Rd is less of a problem by comparison with Cossington Rd. There is on-road parking which causes problems at intervals and on alternating sides of the road... more on the North side nearer the village and then on the South side towards the fringe of the village. There is quite a lot of inset parking on the South side nearer the village.

POSSIBLE SOLUTIONS

1. There is space for some more inset parking on the South side
2. Perhaps a solution for cars at the fringe end on the South side could be found with the future development at Peashill Close.
3. Persuade more house owners to use their front area for off-road parking

Barrow Road is probably the least difficult of the radial roads. It is shorter and wider than the other roads and for all the distance cars can pass each other, even (with care) at the fringe end by Wrights Acre. HGVs and

Busses need to wait or be allowed through first. Cars are often parked part on pavements which are usually wide enough for inset parking anyway.

POSSIBLE SOLUTIONS

1. There is space for more inset parking on South-West side, opposite Wrights Acre
2. The service road opposite Costcutters could be extended and marked for parking

Mountsorrel Lane, has probably the most intractable problems, though it is not the parked cars which cause delays (they are certainly a nuisance and no cars can pass each other except in the short gaps).... it is mainly the junction with Barrow road which causes delays and to some extent the Village road Gateway below the Church

POSSIBLE SOLUTIONS

1. Widen the road by digging into the grass verges on the East side

Flooding on Slash Lane causes additional congestion in the village. This occurs several times each year and in a recent morning peak hour count, the traffic on Seagrave, Cossington, Barrow roads and Mountsorrel Lane increased by between 14% and 74%. When Mountsorrel Lane is closed too, traffic can back up from Barrow through the village and back onto Cossington Road. There is the added problem that Slash Lane is the only route into the village for HGVs from the A6 at Mountsorrel Junction

POSSIBLE SOLUTIONS: Have Slash lane raised on arch-ways so that the water can flow under

Peter Small

July 2018

Appendix 6: Report on Actual Junction Flows - Observed in Sileby first Quarter 2018

Overview

This brief report considers the scale of junction flows observed during traffic Flow study work of the Transport Theme Group (TTG) of the Sileby Neighbourhood Planning Initiative. The target of observations made were directed by the HLA LCC and their 2016 simulation based study of the Barrow and Sileby road infrastructure.

The HLA LCC simulations had predicted that essentially two Sileby junctions were of particular concern, namely (a) composite junction involving junctions of Mountsorrel Lane, Barrow Road, High Street and King Street and (b) the junction of Cossington Lane, High Street and Brook Street.

Bearing in mind housing and vehicular growth between 2016 and 2018 the TTG decided to physically observe flows into and out of these junctions to determine if the LHA LCC simulation findings were within an expected/(LHA LCC Predicted) range relative to the capacity of those road junctions.

Clearly the TTG aim was to measure actual rather than theoretical vehicle flows but this also meant that only samples of actual traffic flows could be systematically taken given the constrained TTG resource available. However a major base of every day experience pointed to junction congestion being greatest in the weekday early mornings and late evenings and these times corresponded to public domain data about general traffic flows through the Leicestershire road systems. Hence a specific samples of traffic flow measurements were taken at those times by teams of TTG members on Monday 29th Jan and Wednesday 7th Feb 2018.

As explained further in following sections the actual traffic flows measured by the TTG were found to correspond well with earlier LHA LCC simulated predictions; in as much that they showed that at both junctions of concern traffic flows actually exceed the fit for purpose junction designs. In the view of this author therefore It is important that this TTG congestion study is brought to the attention of local authority developmental planners responsible for permitting housing and business development programs in the region of the Sileby Parish.

Approach and Results

Tables 1 and 2 summarise the essence of those measurements taken. Whereas a full account of the team based measurement methods used and results observed are reported in the TTG document entitled ‘***A Study of Patterns of Traffic Flows in Sileby: In Support of Neighbourhood Planning’.*** The reader may also wish to reference the methodology documents via the Sileby Parish Council secretary.

Run number	Mountsorrel Lane	Ratcliff Road	Barrow Road	Cossington Road	Seagrave Road
Run1 AM In	189	243	187	219	119
Run 1 AM out	396	354	218	194	175
Run 2 Mid PM In	214	222	202	177	104
Run 2 Mid PM Out	188	196	114	141	146
Run 3 Late PM In	321	373	287	311	146
Run 3 late PM Out	241	250	174	155	81

Table 1 Flow rates through Sileby's 5 radial roads during three runs first quarter 2018

Run number	High Street	Brook Street	King Street	Swan Street
Run1 AM Clockwise	479	360	193	100
Run 1 AM Anti Cl	291	234	200	104
Run 2 Mid PM Clk	277	195	253	132
Run 2 Mid PM AClk	285	211	170	114
Run 3 Late PM Clk	365	255	344	138
Run 3 late PM AClk	375	318	202	121

Table 2 Flow rates through Sileby's inner-centre roads during three runs first quarter 2018

Summary View of congestion observed at two Sileby Junctions of initial concern to LHA LCC

(A) Congestion at the composite junction- involving junctions of Mountsorrel Lane, Barrow Road, High Street and King Street

According to National Road standards this junction is physically comprised of four UAP 4 roads which each have a theoretical maximum capacity of 900 vehicles per hour. Furthermore a permanent road restriction exists on Mountsorrel Lane which permanently restricts traffic flows to one way flows. Additionally on-street parked vehicles further congest the flows (and impacts of this additional type of 'flow congestors' were not included into the LHA LCC simulation study).

However, Figures 1 and 2 show how that actual measured, combined in and out flows from this junction exceeded 1,000 vehicles throughout the two measurement hours. It follows that this junction does not meet the UK design standard and that future vehicular growth may well deadlock this important part of the Soar Valley road infrastructure

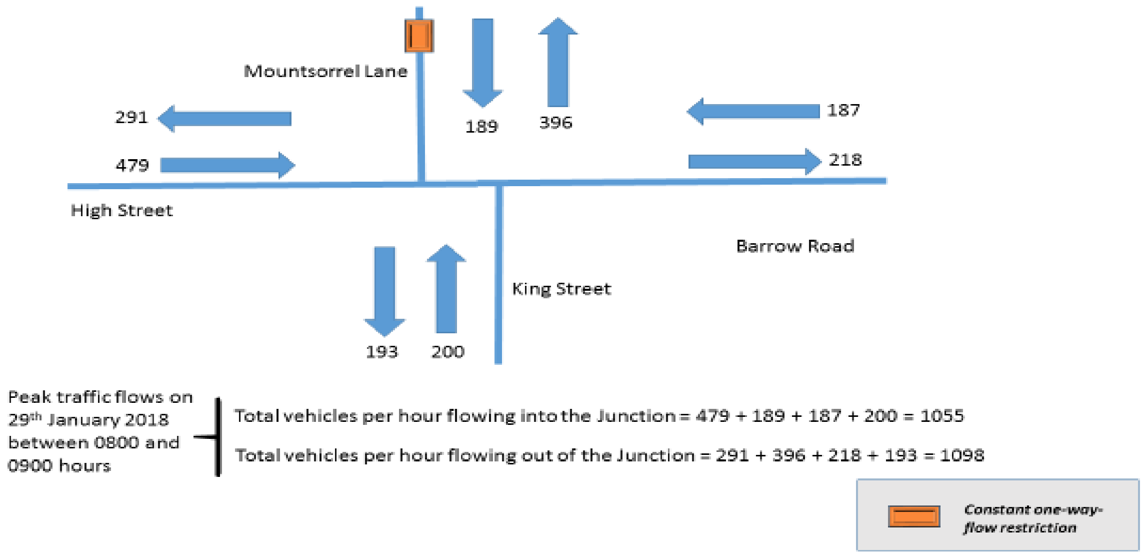

Figure 1 Traffic Flows observed at the composite Sileby road junction early morning 29th Jan 2018

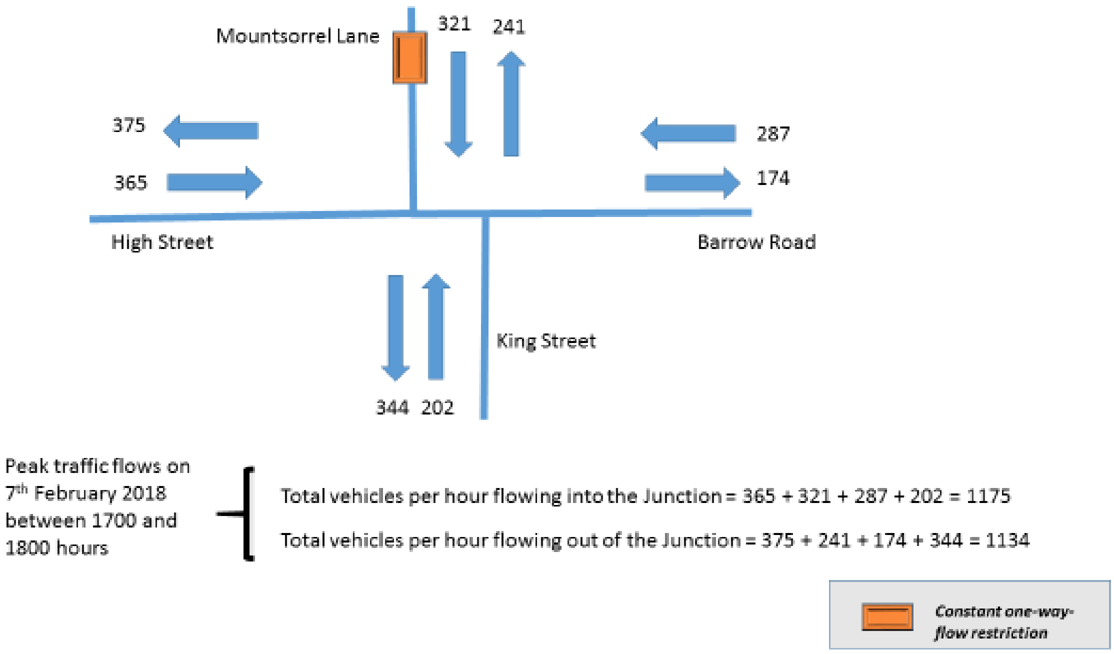

Figure 2 Traffic Flows observed at the composite Sileby road junction late afternoon 29th Jan 2018

(B) Congestion at the junction of Cossington Lane, High Street and Brook Street

According to National Road standards this junction is physically comprised of three UAP 4 roads which each have a theoretical maximum capacity of 900 vehicles per hour. Furthermore a permanent road restriction (i.e. a railway Bridge) exists on Brook Street which frequently restricts traffic flows to one way flows. Additionally on-street parked vehicles further congest the flows.

Figures 3 and 4 show how that actual measured, combined in and out flows from this junction approach the road capacities of 900 vehicles throughout the two measurement hours. It follows that this junction can already function so that it does not meet the UK design standard; hence further vehicular growth will risk the sustainability of the Sileby road system.

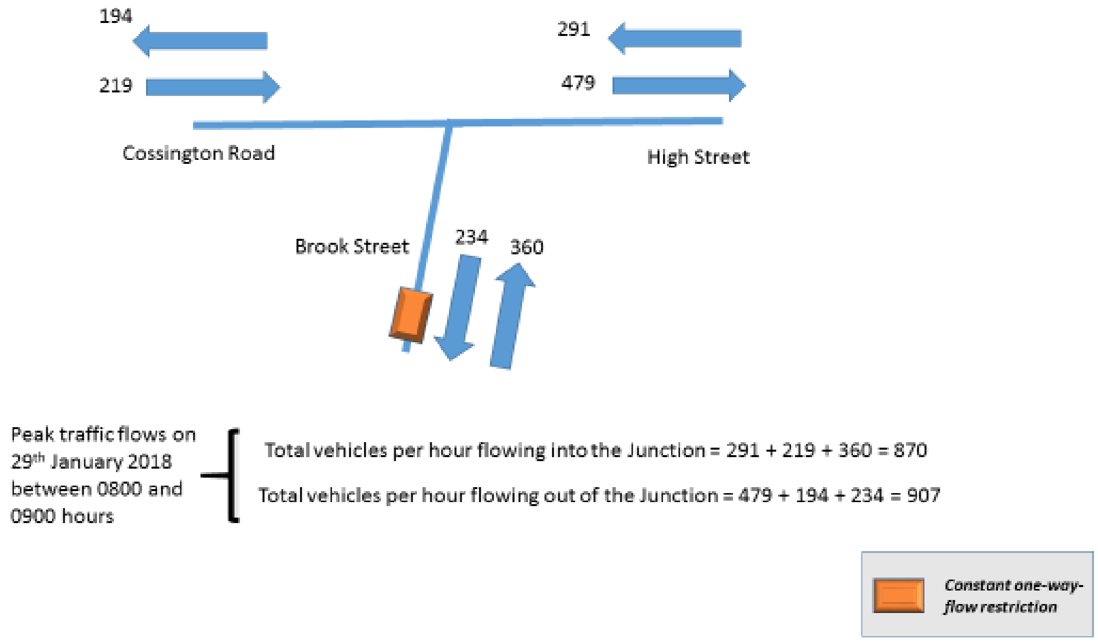

Figure 1 Traffic Flows observed at road junction B early morning 29th Jan 2018

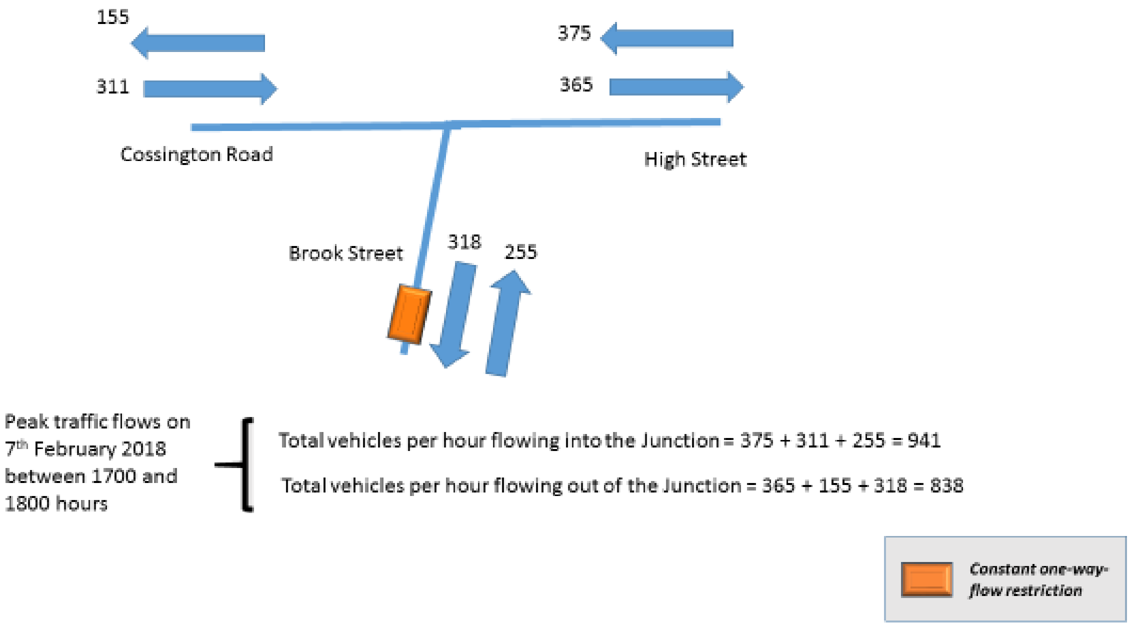

Figure 4 Traffic Flows observed at road junction (b) late afternoon 29th Jan 2018

Richard Weston 14th August 2018

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