Deliverable No. 3 – Scoping report. Working report within the project Conflict Study – Application in HA (Highway Agency) Road Safety Management

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Highways Research Group

Conflict Study – Application in HA Road Safety Management

Deliverable No. 3
Scoping Report summarising the work undertaken, relating back to the study objectives

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Executive Summary

This report summaries the work undertaken to date, and provides a platform on which further site selection, training and fieldwork may be undertaken. The outline quantity of sitework is stated, based on a build up of likely time input required. The availability and applicability of the two main datasets, STATS19 and On The Spot (OTS) data, is summarised. Currently, STATS19 has yielded 11 potential study sites out of 997 accidents on the network over a 5 year period. While OTS data has limited coverage of the proposed study sites, it may be utilized at a later stage for operational matters. A proposed methodology of Conflict Study is detailed with further development required through the trialling process. Best value considerations, in terms of choice of methodology and sites, are outlined providing a basis for appropriate placement of conflict studies within the highway safety design process. The potential study sites have been detailed in the Appendices and summarized with reference to the selection criteria, given in the original task specification.

Contents

1. Introduction

This report is part of a wider study, the aims of which are to:

- establish reliable relationships between accident and conflict data, pertinent to different situations on the Highways Agency network
- widen the scope of previous work to consider specific junction types, including rural junctions, and to consider the applicability of conflict techniques to links
- compare actual accident data with prediction using conflict study and SafeNET software, which is now applicable to rural as well as urban roads
- test the use of Conflict Study techniques and determine suitability for use by Road Safety Engineers for assessing safety at specific locations on the network
- develop guidelines on the use and methodology applicable for Conflict Studies

This report is intended to summarise the work undertaken, relating back to the study objectives. In particular this report addresses the following;

- What can reasonably be done in the time available (10 months)
- Availability and applicability of accident data
- Methodology for carrying out Conflict Studies
- Consideration of “best value” in choice of methodology and type of site
- List of potential study sites against criteria in specification

2 Accident Data: Availability and Applicability

2.1 STATS 19

STATS 19 data describes 997 incidents in the South Nottinghamshire area over a 5 year period, from October 2001 to October 2006, with 471 of these accidents occurring at 38 potential cluster sites (Appendix A) where a conflict study could have *potentially* be undertaken using currently recognized techniques. During the site selection workshop this quantity of potential study sites was further filtered through analysis of accident data, aerial photographs, local relevant knowledge and a site visit. This process resulted in 11 sites (Appendix B) being selected as potential sites for conflict studies to be undertaken (Task 5).

This filtering process, and future detailed conflict study methodologies, rely on the following items of information provided by STATS 19.

- Date of Accident
- Cause
- Carriageway
- Day of Week
- Description
- OS Grid References
- Lighting Conditions
- Location
- Month
- Road Type
- Severity of Accident
- Speed
- Time of Day
- Weather

2.2 OTS Data

The use of On The Spot (OTS) data for future statistical analysis in this project has been discounted at this stage, since very few accidents are available from the OTS database at the chosen sites. This low number of recorded events at the chosen sites reflects the fact that OTS covers all roads in the East Midlands with 88% of accidents investigated occurring on urban trunk roads; a further 11% occur at sites that, though on rural trunk roads, are away from the chosen 'cluster' sites. OTS may be utilized at a later date in the study for operational matters (e.g. The use of the video 'fly throughs').

3. Conflict Study Methodology

3.1 Theoretical and practical considerations when performing conflict studies at rural sites

It is proposed that a conflict technique based on the Swedish Traffic Conflicts Technique (TCT) is used at rural sites, with appropriate adaptation made from the urban to rural environment. This approach is informed by both practical and theoretical considerations. An important modification (when compared to the original TCT) will be to consider the potential impact speeds, including the highest speeds and the relative speeds of the involved road users, when estimating the severity. Simultaneous video recordings will be a precondition as speeds, and consequently both distances and Time to Accident (TA) values, will be much higher when compared to urban conditions.

In practice this is neither anything new nor extraordinary, as the present technique is based on the optimal braking distance at all speeds. Also when making conflict studies in urban situations the sites are often video recorded. This provides the observer with a backup and makes it possible to look again at some events in more detail. It also allows for other behavioural studies and use of data which are important complements to conflict studies, such as red light violations, measuring the flow of different streams and types of road users, and measuring speeds. In connection to the training of conflict observers the outdoor activities are always video recorded. On return from site it is then possible to view and assess the conflicts again to give the observers correct feedback on their registrations. At more complex sites such as rural links and junctions, simultaneous video recordings can be of assistance to the conflict observer. The selection of events will still be made by the observer at site while the estimate of conflicting speed and position for evasive action can be verified afterwards from the video recordings.

In summary, the modified Traffic Conflicts Technique will:

- Identify conflict situations using manual observers
- Use video analysis as a tool for checking the reliability of the manual observations and for providing data on vehicle speed and path
- Assess alternative hypotheses that might be preferable at rural conditions, such as:
    1. Distinguishing between the probability of an accident and the probability of an injury once an accident occurs (i.e. distinguish between (a) accident risk and (b) severity of outcome).
    2. For junction purposes, define the conflict severity on the basis of the more severe of the two Time to Accident/ Speed values as proposed by Shbeeb (2000).
    3. For head-on conflicts on links, define the conflict severity on the basis of the relative speed of the participants.

3.2 Specifications regarding the conflict studies

As mentioned before, performing conflict studies at rural sites will be a new, different and more complex task when compared to performing them in urban conditions. A detailed scheme can therefore not be produced before some initial experience is gained. More specific recommendations will be available after analysis of results from the trialling period when the capability of conflict observers is assessed to define:

- Size of area that each conflict observer can cover
- Volume of traffic that each observer can handle
- Impact of considerably higher speeds, compared to urban conditions

The trial period also helped assess the use of video recordings:

- Number of cameras per site and camera location (including height)
- Ability to afterwards find the relevant situations (time coding)
- Ability to measure speeds and distances

All in all the assessment above is not about questioning whether it is possible to perform conflict studies at rural junctions and links; it will be possible to perform conflict studies. The question is how many conflict observers and cameras will be needed to make proper studies.

3.3 Examining Accident Data

The accident history of each potential site should be studied to determine the type of accidents occurring and the manoeuvres involved. Are the accidents randomly distributed with regard to type and location or is it possible to track clusters? These details are essential to get a first rough appreciation of the numbers of observers required at each site, also the location for each observer, as well as the most relevant times (week days, times of the day) to do the observations.

3.4 Inspection of Sites

Site inspections should be carried out carefully, before selecting a site and performing the conflict studies, to determine:

- Layout and possible manoeuvres
- Feasibility to position observers and camera(s), ensuring:
    1) safe position
    2) good overview
    3) no affect on road user behaviour

  If there are no suitable observation points then the site should be excluded
- Traffic volumes
- Traffic speeds

These details are essential in order to be able to decide on the number of observers required at each site. There is however not any “ready-to-use” formula based on, for example, traffic volumes and speeds. This information is gained by the inspection of the sites, the experience and capabilities of the observers and the accident patterns.

3.5 Extension of Observation Time

It will be preferable to cover each site during the periods of the day when accidents occur. For a normal study at an urban junction the conflict studies are carried out for 3 days; 6 hours a day. For rural sites the peak periods might be longer, so an additional 2 hours per day may be relevant.

3.6 Cameras

The number of cameras at each site depends on the specific layout, and there must be correlation between the coverage by the observers and the cameras. The cameras must have a clock in the display to make it possible to find the conflicts that the observers have detected and to measure speeds during post site analysis. To be able to measure speeds and distances from the video recordings the site must be calibrated, which is ideally undertaken by ascertaining the geometry of existing site features such as road markings. If these cannot be clearly observed through the video recording, temporary pegs set back in the verge can be used during the site tasks. A map of the site, to scale, also helps when making these estimates back in the office.

3.7 Conflict recording method

The conflict recording method to be used at rural sites has its basis in the traditional Swedish TCT for urban studies. The original Swedish technique is founded on comprehensive validation of manual (i.e. not video) studies. This can not be done in the prevailing project due to time and budget constraints. The proposed changes of the original technique will therefore be based on “sound theoretical considerations” originating in the experience from earlier validation studies.

During the 5-day training course the observers are be trained to

- Distinguish a serious conflict from other events in traffic
- Estimate the speeds of the involved road users
- Estimate the distances between vehicles

For the first 2 days, the training is carried out in urban conditions according to the traditional Swedish TCT. Then the training will be/was moved to rural sites. The modification of the technique is based on both the observers' and trainers' experiences. There are discussions on the applicability of the traditional TCT to rural conditions, suggestions on modifications, and introduction of new parameters. Then the modifications are tested which perhaps leads/led on to further suggestions on modifications; i.e. in an iterative process. An observer's subjective severity rating of a conflict is, for instance, not a parameter that is part of the traditional technique, but is a parameter considered to be of interest for a rural TCT and a future modified urban technique. Subjective severity rating will therefore be a new parameter most likely to be introduced in the modified technique. Before the end of the training course, there is a decision on a conflict recording method to be used for this project. (Although such a method will be employed during this study there may be further modifications in the longer term).

The most important tasks for the observer performing the rural conflict studies will be to detect and register the serious conflicts and to note parameters which are not possible to estimate from the video recordings. Physical parameters of interest, such as speeds and distances, are of course important, but the simultaneous video recording will assist in making such estimates. This of course implies that the conflict observer registers the time of the event, identifies the vehicles involved (i.e. type and colour), and describes the direction of the vehicles and the process preceding the serious conflict, making it possible to identify the correct conflict on the video afterwards.

3.8 Conflict registration protocols

Each conflict is recorded on one sheet; the data includes speeds, distances, TA-values and a description of the process preceding the conflict. To facilitate different types of analyses (when compared to conflict studies performed at urban junctions) it is important that the speed is estimated for both vehicle users. The conflict observer will probably also be instructed to include some subjective estimates and other additional information based on the modifications that have been developed form the trials. The subjective estimate consists of:

1) probability of an accident
2) probability of an injury if there has been a collision

i.e. the observer is to estimate the likelihood of an injury accident.

One of the validation studies of the Swedish TCT showed that the subjective severity had a good correlation with the accident potential; a dimension that is not fully appreciated in the present objective definition of a serious conflict.

With the general conflict registration protocol described above it will be possible to analyse the conflicts in all sorts of ways; both according to the traditional conflict theory and according to alternative hypotheses that might be preferable at rural conditions, such as:

- Distinguishing between the probability of an accident and the probability of an injury once an accident occurs. The first part of this, probability of an accident, should be well covered by the original technique's estimates of TA-value and Conflicting Speed. The second part, probability of an injury once an accident occurs, must be based on possible impact speed and the vulnerability of the road users in the type of conflict they are involved (type of road user, type of collision – rear end, head on, side sweep)
- Specifically for perpendicular courses (side impact): Irrespective of who's taking evasive action it is the highest speed involved that has a relationship with injury accidents
- Specifically for head-on courses: It is the relative speed of the involved road users that has a relationship with injury accidents

4 'Best Value' Considerations

The Traffic Conflict Technique has demonstrated a high confidence level between the number and type of conflicts and the number of serious accidents. To enable this level of confidence to be maintained the methodology for use on rural links should be as close to the original method, validated for urban roads, as possible.

It is likely that the technique could be used on sites where there is no dominant collision type and therefore solutions would be difficult to determine. Undertaking a Conflict Study on this type of site will facilitate optimum safety scheme design based on a knowledge of the dominant conflict types.

5. Potential Study Sites

5.1 Introduction

As a result of the site selection workshop, the 38 cluster sites have been filtered, in terms of suitability for conflict studies, to 11 potential sites. Appendix B provides details of these sites in terms of the selection criteria with a general overview provide in Section 5.2. There are 3 sites where multiple conflict types have been identified, and these are described in Section 5.3. Finally, liaison with the local Managing Agent Contractor (MAC) is detailed in Section 5.4. The details of traffic flow and accident data have been obtained from TRADS and STATS 19 respectively and are given in Appendix C.

5.2 Selection criteria: General overview

The sites selected include the following features:

- Termination of dual carriageways to single carriageway
- Bends on single / dual carriageway
- Termination of climbing lanes
- Overtaking on single carriageways
- Roundabouts

The following criteria have also been considered:

- ***Where:*** The sites are in derestricted (national speed limit) areas and are predominantly in non-built up areas.

- ***Why:*** The sites possess a range of unique characteristics such as roundabouts, T-Junctions, Y-Junctions, slip roads, and crossroads. The sites possess a range of curvature and gradient with varying scope for overtaking. None of the sites have designated hard shoulders.

- ***Local Character and Geometry:*** The traffic volumes through the sites vary from 7,475 - 23,912 vehicles per day, with speeds in the range 36 - 76mph and with 9.7 - 19.7% of vehicles being greater than 5.2m in length. It should be noted that no pedestrian or cyclist traffic counts have been examined. From Appendix B it may be observed that between 16 - 66% of accidents occurred when the road surface was wet with the majority of sites exhibiting less than 36% of accidents on wet surfaces. With the exception of the A1 there were no fatal accidents at the sites; accidents were split between slight and serious, ranging from all slight accidents up to a 67/33 split between slight and serious accidents. It should be noted that the STATS 19 data reveals that fatal accidents account for 2.4% of all reported accidents, with 66% of these occurring on the A46 away from the cluster sites identified; the largest single cause is connected with an overtaking manoeuvre at speed.

- ***When:*** The patterns of daily traffic at each site are broadly similar with low flows occurring between 00:00-05:00, morning peak flows between 07:00-09:00, and evening peak flows between 16:00-18:00. However, within these general patterns there are significant variations in magnitude between morning and evening peak flows, likely reflecting the daily commuter traffic close to the place of work. Analysis of weekly traffic patterns reveals that the sites typically exhibit similar daily patterns Monday to Friday, with the exception of Friday evening where larger flows are observed. Weekend traffic patterns see the morning peaks occurring later, typically around midday.

5.3 Multiple Sites

It should be noted that two of the 11 sites selected potentially comprise 2 - 3 conflict types, these sites being:

Saxondale: The predominant manoeuvres at this roundabout are A46 southbound to A52 westbound during the morning peak, and A52 eastbound to A46 northbound during the evening peak. This provides several potential sites at different times of the day on this intersection.

Borrowash: From an observation point situated on an overbridge above the A52 dual carriageway, three potential conflict sites may be observed.

1. Vehicles turning onto the westbound A52 from a minor road
2. Vehicles turning onto the eastbound A52 from a minor road
3. Vehicles overtaking in the vicinity of a slight gradient and curve.

These sites were used during the training and trialling process.

5.4 MAC Liaisons

Liaison with the MAC (AmScott) has been taking place in specific relation to the following:

Planned events / Road works: The project Task Manager has been notified of all planned events / road works in the area and will receive weekly updates.

Accident history: The MAC has supplied details of the 50 top collision cluster locations in Area 7. This provides detailed trends for the past 2 years as well as a brief commentary.

Site Specific Study: The MAC has agreed to supply reports on detailed studies at the sites of interest, such as the current scheme identification study being undertaken at Saxondale. The MAC have provided a list of schemes which are likely to be undertaken this financial year.

6. Realistic Scope

The project had been scoped at tender stage to undertake 2 trial sites and up to 9 test sites, assuming an average of 8 person days on site, and 5 person days post site analysis. The assumptions made at tender stage assumed the studies to be undertaken at specific points and at one time frame. During the training and trialling period it was found that each observer should not observe more than 150m length of road. Due to the complexity and speed over which conflicts may take place the number of person days currently assumed would not be sufficient to gather the quantities of data required for validation on some sites. Thus, each site described below has been assigned an "equivalent number" of sites based on the complexity and size of site, and the number of visits required.

A short list of 11 potential sites had been identified with final selection undertaken during training and trialling week 11-15th June. After consideration of both the project aims and the available sites within the time frame afforded, the following sites have been recommended for study. Although Saxondale and Borrowash have been used during the training and trialling phase, they have not been selected for the main phase of data collection. This is due to receiving fresh information from the MAC, resulting in other sites, listed below, being deemed to be more suitable. The majority of the fieldwork will be undertaken from September to October, with the 'post-construction' survey at Winthorpe Roundabout being potentially undertaken in November after the safety works have been completed.

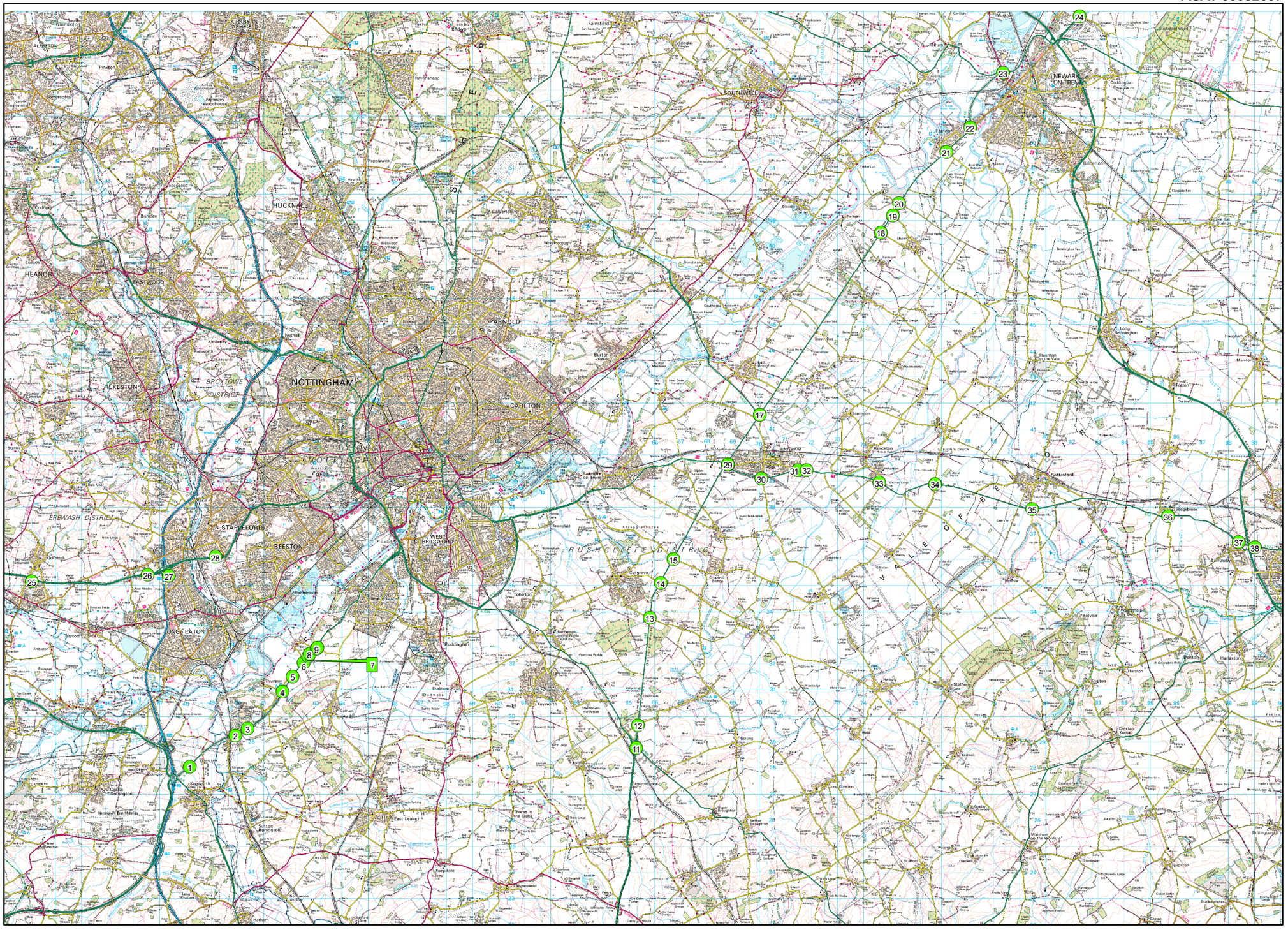
Winthorpe Roundabout (A46)	The Winthorpe Roundabout has been selected primarily due to the fact that safety works (transverse yellow bar markings) are provisionally due for construction in October 2007. Winthorpe Roundabout has been included in preference to Saxondale since these safety works allow 'before and after' studies to be undertaken during the project. This should provide an indication whether the conflict study technique is suitable for early monitoring of the success, or otherwise, of highway improvement schemes. Equivalent number of sites = 6
Barton Lane (A453)	Barton Lane Junction is currently ranked 28 in the MAC's top collision cluster locations. Safety improvement works have been undertaken in 2004 with a stage 4 audit imminent. Studying this site will allow validation of the adapted TCT to rural junctions on single carriageways. Equivalent number of sites = 1
Tithby Road (A52)	Tithby Road Junction is currently ranked 53 in the MAC's top collision cluster locations. Studying this site will allow validation of the adapted TCT to rural junctions where there is also a change in cross section of the route, i.e. dual to single carriageway. Equivalent number of sites = 1
Colsterworth – Little Ponton Gap Closures (A1)	Although these sites were not considered during the initial phases of site selection they are part of a current study being undertaken by Scott Wilson (Matlock) on behalf of AmScott. The Highways Agency has a programme to close the central reserve gaps along on the A1. However, there is currently insufficient accident data to provide conclusive evidence as to which gaps to close. Studies to date have revealed that out of 34 gaps, which are mainly farm accesses, there are 4 cluster sites with 2 of these sites having had fatal collisions since 2000. Undertaking investigation on 2 of these sites would demonstrate the validity of performing the TCT where there are high vehicle speeds, and potentially establish a sound methodology for identifying suitable gap closure schemes. Further, fieldwork at these sites will demonstrate the applicability of the technique to higher speed situations, thus negating the further use of the Borrowash site at this stage. Equivalent number of sites = 4

BRITISH NATIONAL GRID/
OSGB1936

APPENDIX A: MAP OF THE POTENTIAL SITES IN SOUTH NOTTINGHAMSHIRE

ASAT 03082007

Highways Research Group



Number	Site Name	Mid Point Eastings	Mid Point Northings
1	Kegworth	448145	328063
2	Ratcliffe on Soar	449900	329270
3	Ratcliffe on Soar Power Station	450370	329530
4	Thrumpton	451710	330945
5	Thrumpton NE	452100	331530
6	Manor Road	452515	332050
7	New Road	452700	332305
8	Barton in Fabis	452765	332395
9	New Road	453020	332590
10	Barton Lane	453060	332630
11	Widmerpool	465280	328780
12	Kinoulton	465350	329660
13	Owthorpe	465810	333780
14	Colston Gate	466220	335110
15	Stragglethorpe	466710	336020
16	Saxondale	468800	339650
17	Margidunum	470020	341560
18	Elston Towers	474670	348550
19	Elston Lane	475130	349190
20	East Stoke	475370	349660
21	Farndon	477190	351630
22	Farndon NE	478100	352560
23	Cattle Market	479360	354650
24	Winthrope	482290	356820
25	Ockbrook/ Borrow Wash	442096	335168
26	Risley	446532	335429
27	J25 - M1	447347	335381
28	Bardills	449140	336105
29	Saxondale (A52)	468800	339650
30	Tithby Road	470090	339110
31	Grantham Road	471490	339430
32	Jet Services	471820	339440
33	Old Grantham Road	474610	338960
34	Manor Arms	476760	338910
35	Belvoir Road	480470	337945

SCALE 1 : 150 000

5 2.5 0 5 10 15 20 Kilometers

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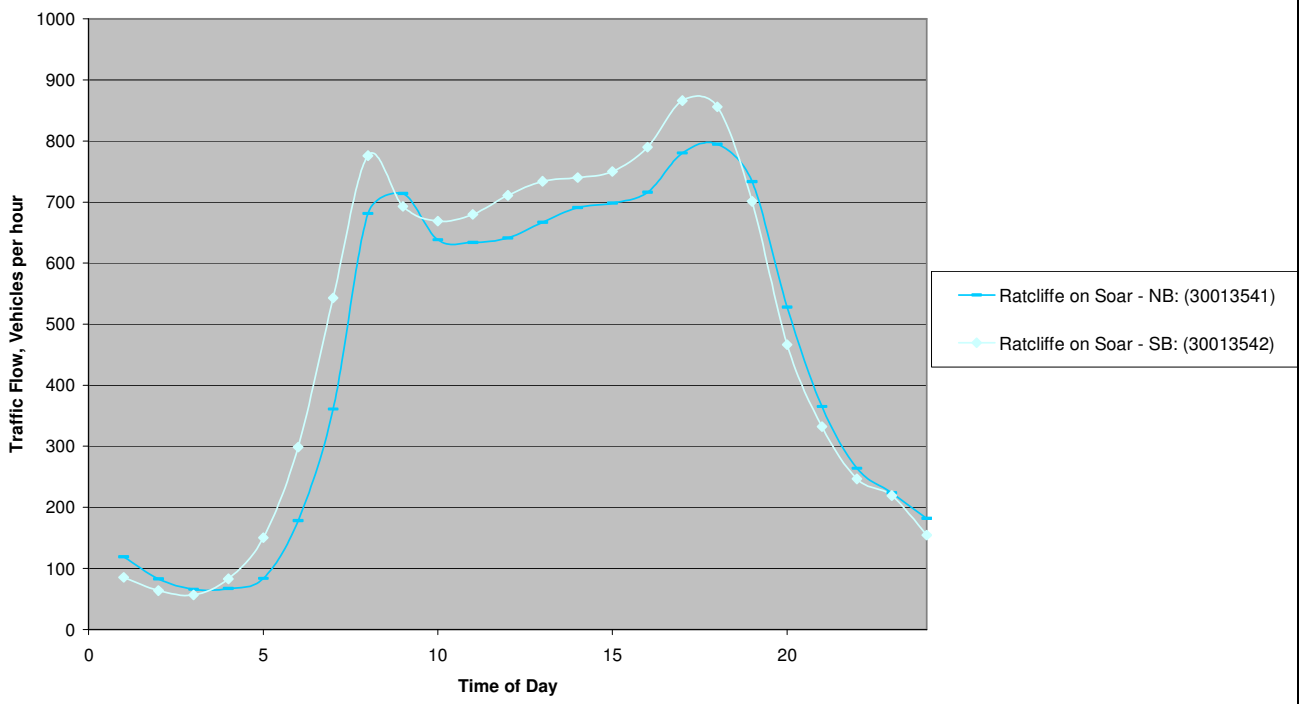
Appendix B: Details of Potential Study Sites

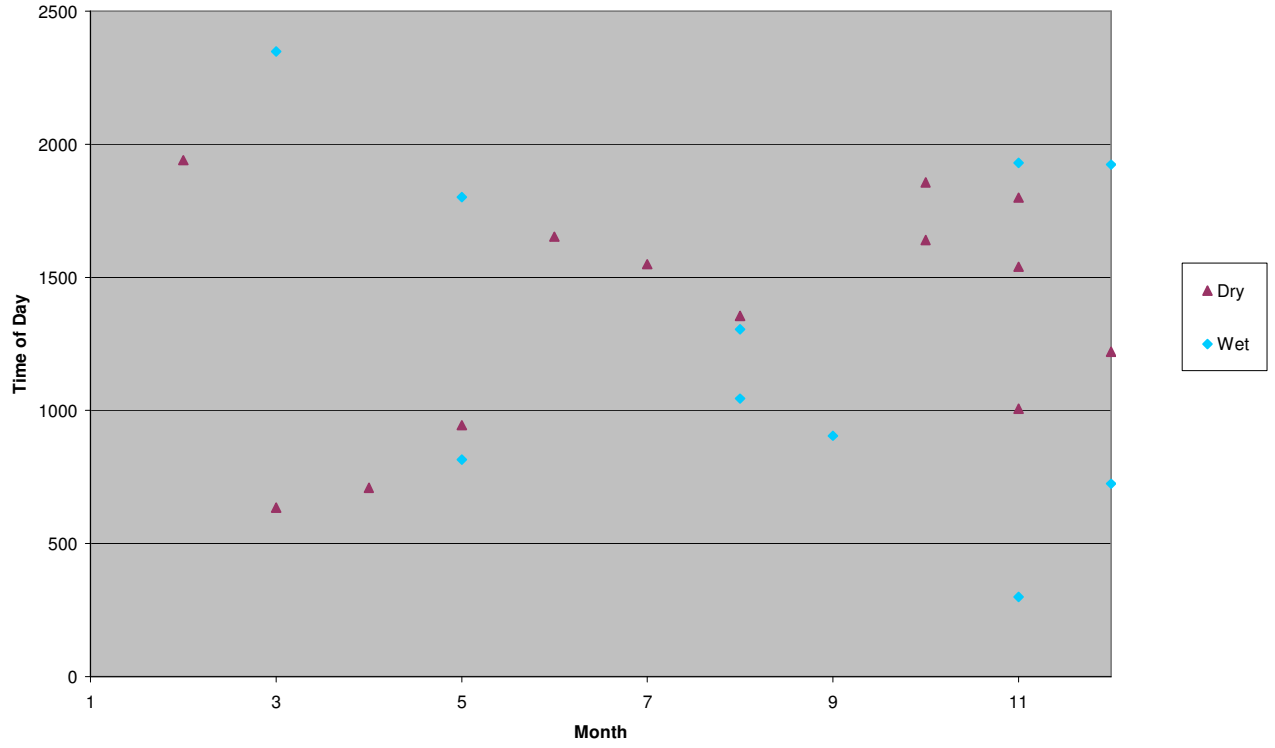
Site Details			Analytical Factors																		
Site Number	Site Name	RD CLASS	MAC's Top 50	Road Class	Carriageways	Location		Bends/ Crests	Over taking length	Hard Shoulders	Gradient	Traffic Volumes - East Bound	Traffic Speeds - East Bound	HGV Flows - East Bound	Traffic Volumes - West Bound	Traffic Speeds - West Bound	HGV Flows - West Bound	Weather Cinditions, % of accidents in the wet	Accident Severity, % Fatal	Accident Severity, % Serious	Accident Severity, % Slight
1	Ratcliffe on Soar	A453	Currently Ranked 27, no history. KSI site, East Midlands Parkway roundabout due 07/08	Single carriage way	1	Rural	Non-built up	Slight Bend	500m	None	Slight	10935	52.4-65.8	19.1	11681	52-64.2	18.8	42	0	21	79
2	Saxondale	A46	Currently Ranked 5, from 6 last year. Scheme completed November 04	Dual carriage way	2	Rural	Non-built up	Sharp	N/A	None	None	12426	36-52.3	18.1	12020	38.8-53.9	18.3	16	0	20	80
3	Sedgebrook	A52	Currently Ranked 53, no history.	Single carriage way	1	Rural	Built up	Moderate Bend	150m	None	Moderate	8256	55.2-70.1	11.9	8325	54.4-68.9	12.7	29	0	0	100
4	Stragglethorpe	A46	Currently Ranked 41, no history. Scheme completed 04; New SPECS	single/ dual carriage way	.1-2	Rural	Non-built up	None	500m	None	None	7624	53.2-59.8	19.7	7475	52.9-60.9	19.2	20	0	0	100
5	Tithby Road	A52	Currently Ranked 53, no history.	Single carriage way	1	Rural	Non-built up	Slight Bend	N/A	None	Slight	8079	55.1-61.3	15.9	8043	54.8-64.9	16.5	66	0	33	67
6	Widmerpool	A46	Currently Ranked 41, from 38 last year. Scheme completed Dec 2005.	single/ dual carriage way	.1-2	Rural	Non-built up	Sharp	N/A	None	Moderate							43	0	21	79
7	Barrowby Hill	A52	Currently Ranked 53, no history.	Dual carriage way	2	Rural	Non-built up	Slight Bend	700m	None	Severe	8256	55.2-70.1	11.9	8325	54.4-68.9	12.7	23	0	8	92
8	Barton Lane	A453	Currently Ranked 18, from 29 last year. Safety scheme completed Oct 04.	Single carriage way	1	Rural	Non-built up	Bend	N/A	None	Moderate	10823	28.2-52.8	17.9	11744	42.3-52.2	15.6	35	0	30	70
9	Borrow Wash	A52	Currently Ranked 53, no history.	Dual carriage way	2	Rural	Built up	Slight Bend	N/A	None	Moderate	23912	67.3-72.1	9.7	19650	70.7-76	10.4	17	0	7	93
10	Cattle Market	A46	Currently Ranked 21, from 25 last year. Economy / safety study in progress.	Dual carriage way	2	Rural	Non-built up	Sharp	N/A	None	None	12852	54.9-63.9	20.4	?	?	?	30	0	4	96
11	Margidunum	A46	Currently Ranked 23, from 29 last year. Study complete; re-surfaced in January 06 with changes to road markings on NBD approach	Dual carriage way	2	Rural	Non-built up	Sharp	N/A	None	None	12729	49.2-64.3	18.0	12268	45.8-60.9	17.5	33	0	13	88

Appendix C: Daily Flow Rates and Accident Distributions

Radcliffe on Soar

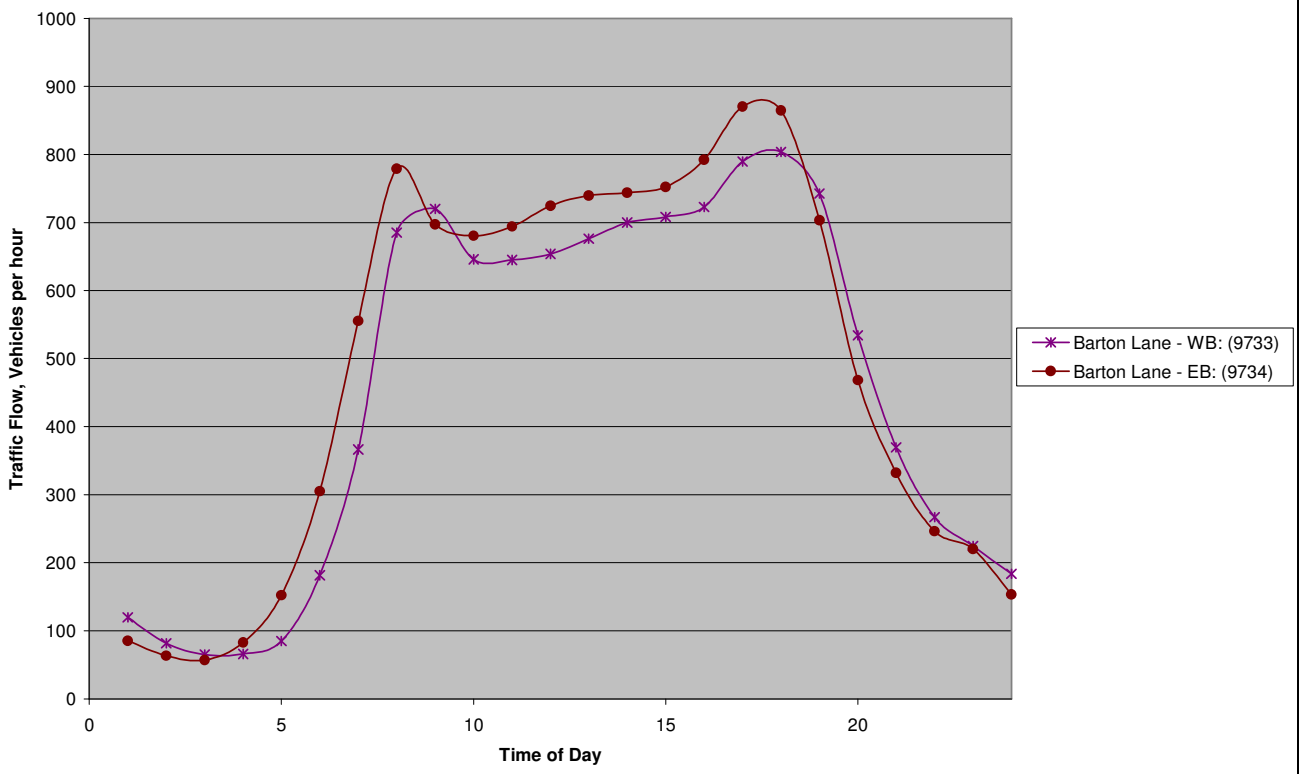


Daily Traffic Flow

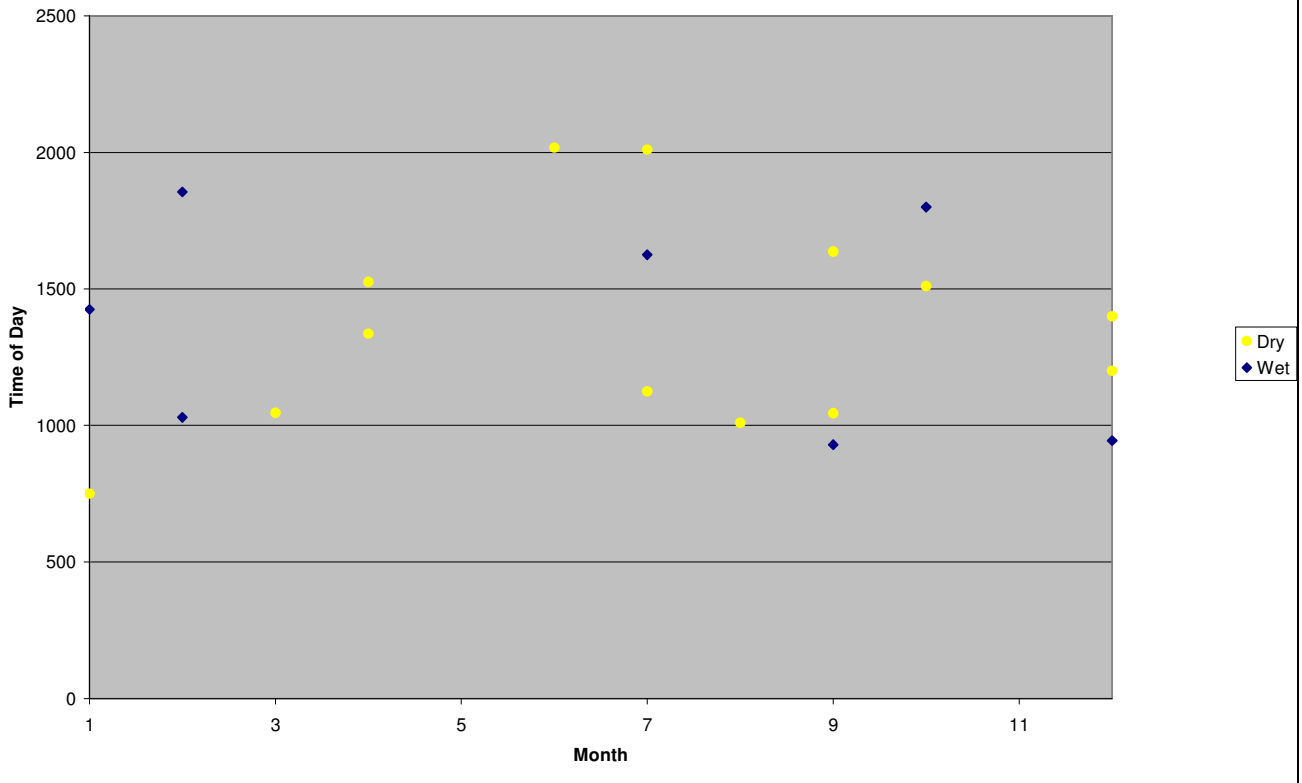


Accident Distribution

Barton Lane



Daily Traffic Flow

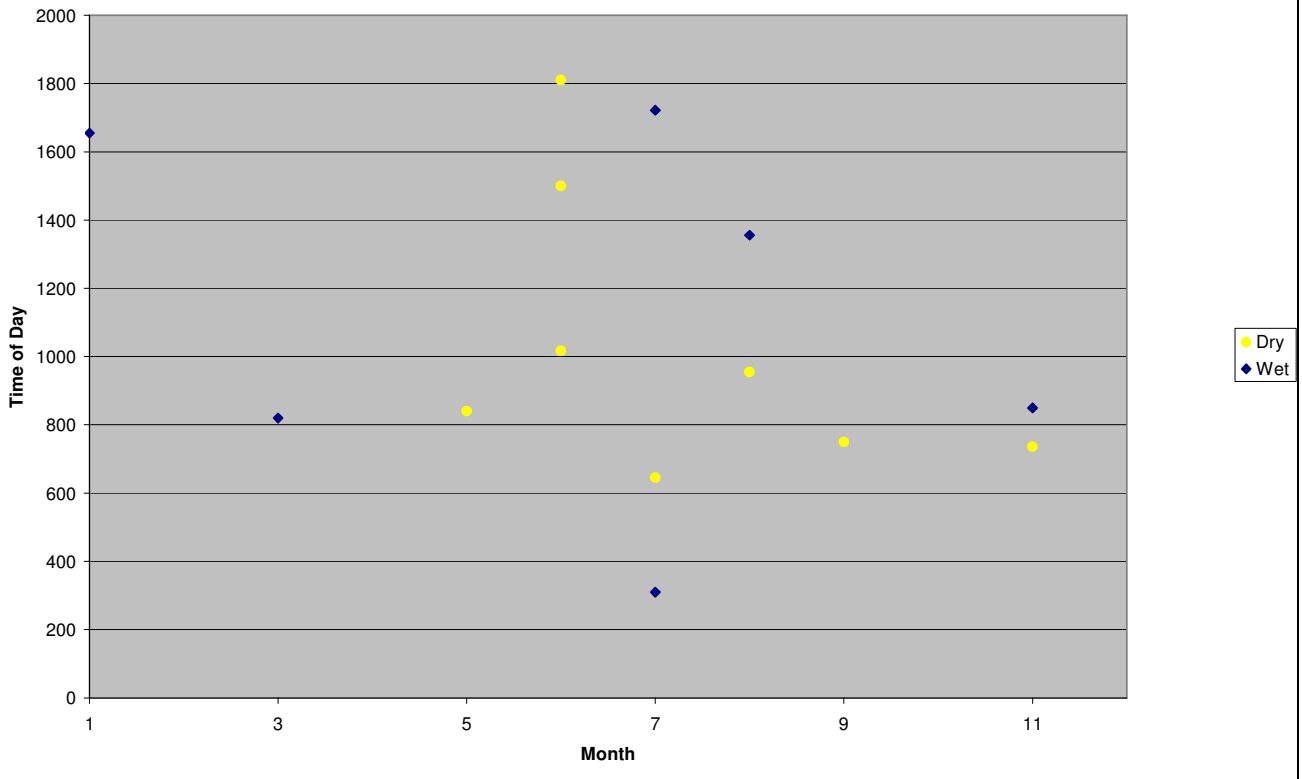


Accident Distribution

Widmerpool

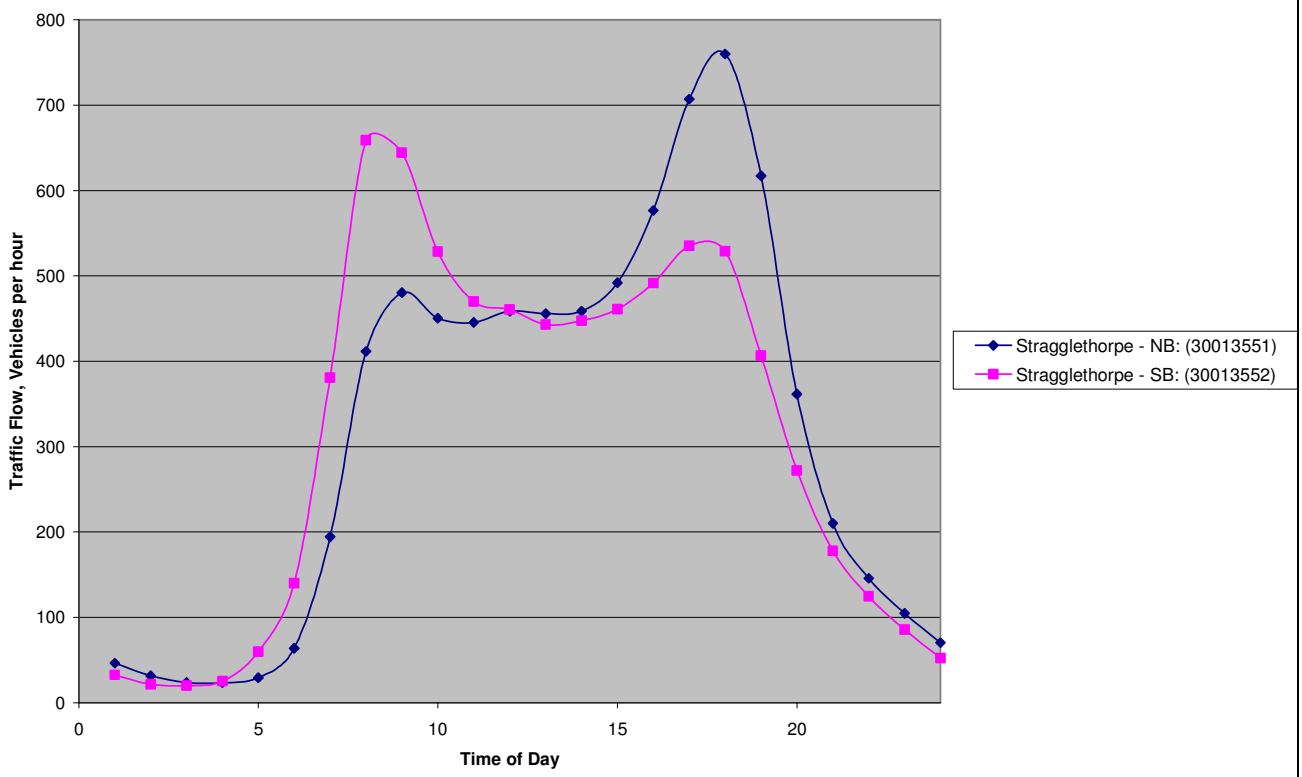
TBA

Daily Traffic Flow

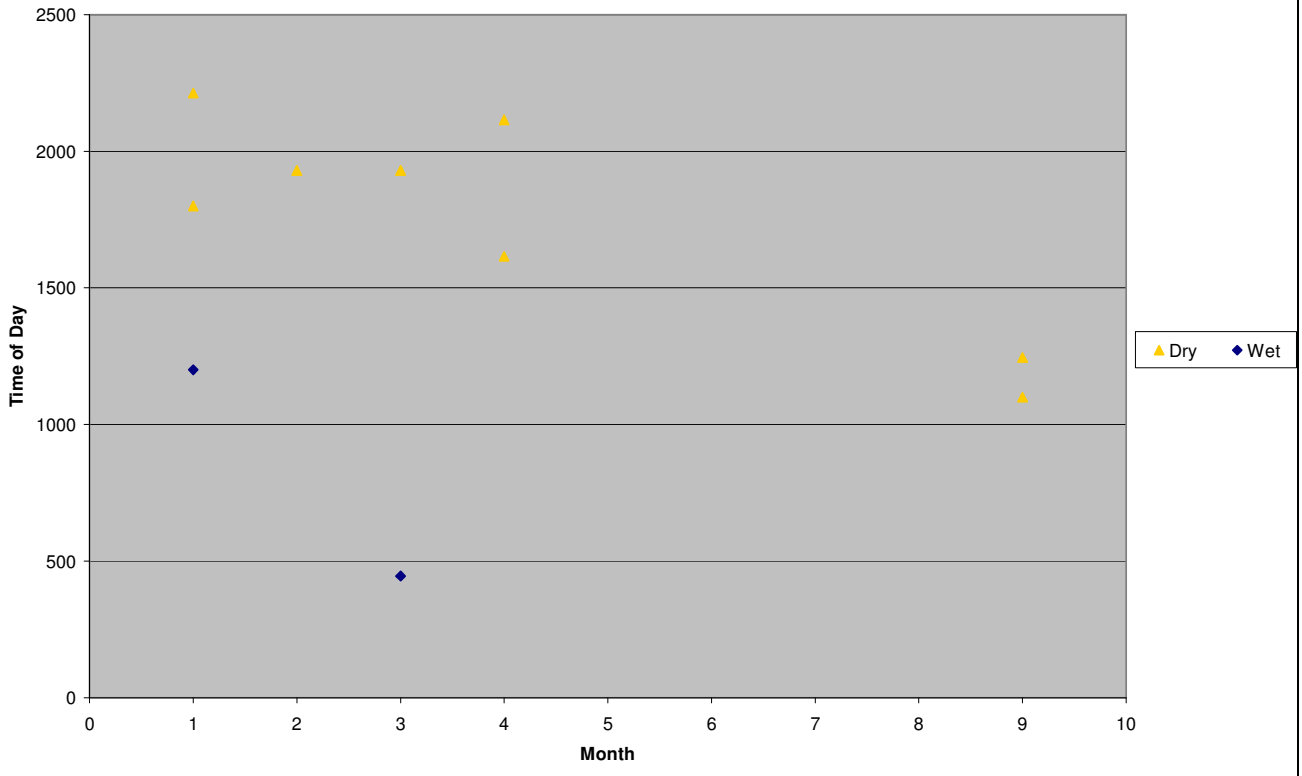


Accident Distribution

Stragglethorpe

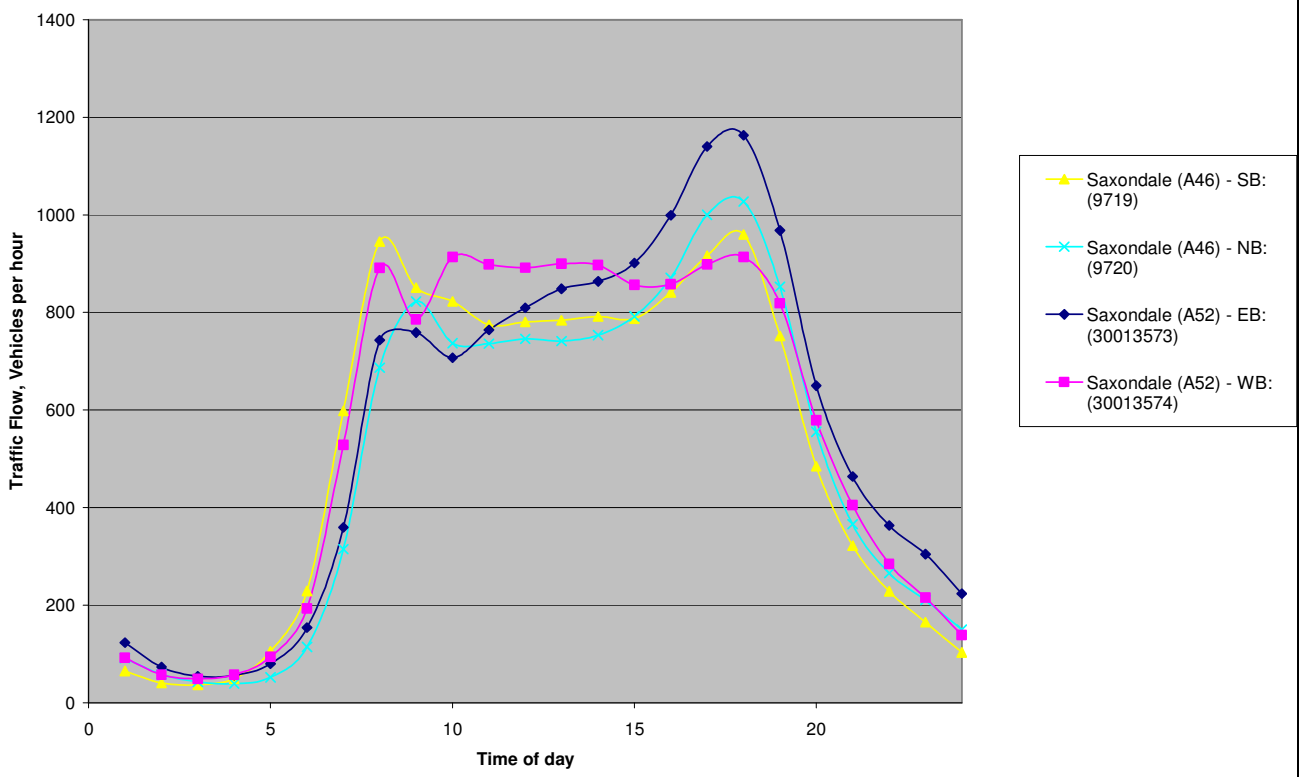


Daily Traffic Flow

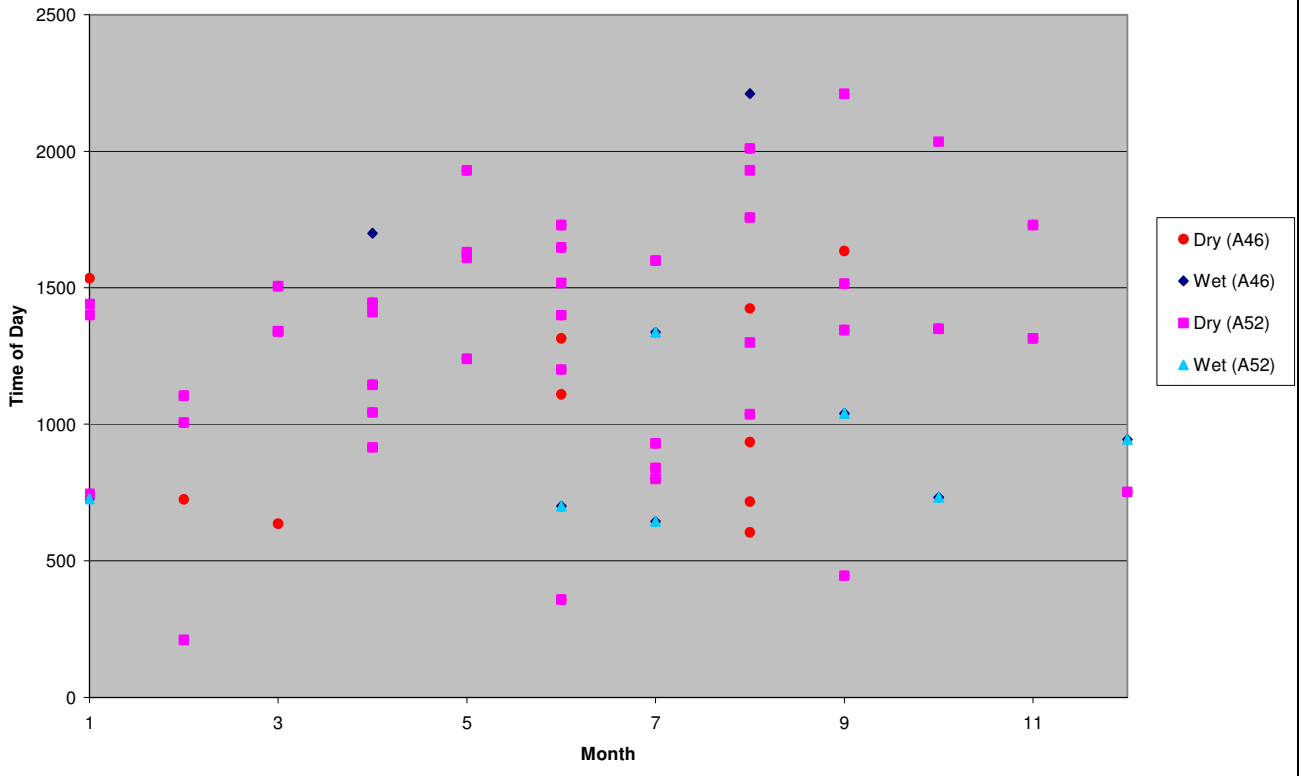


Accident Distribution

Saxon Dale

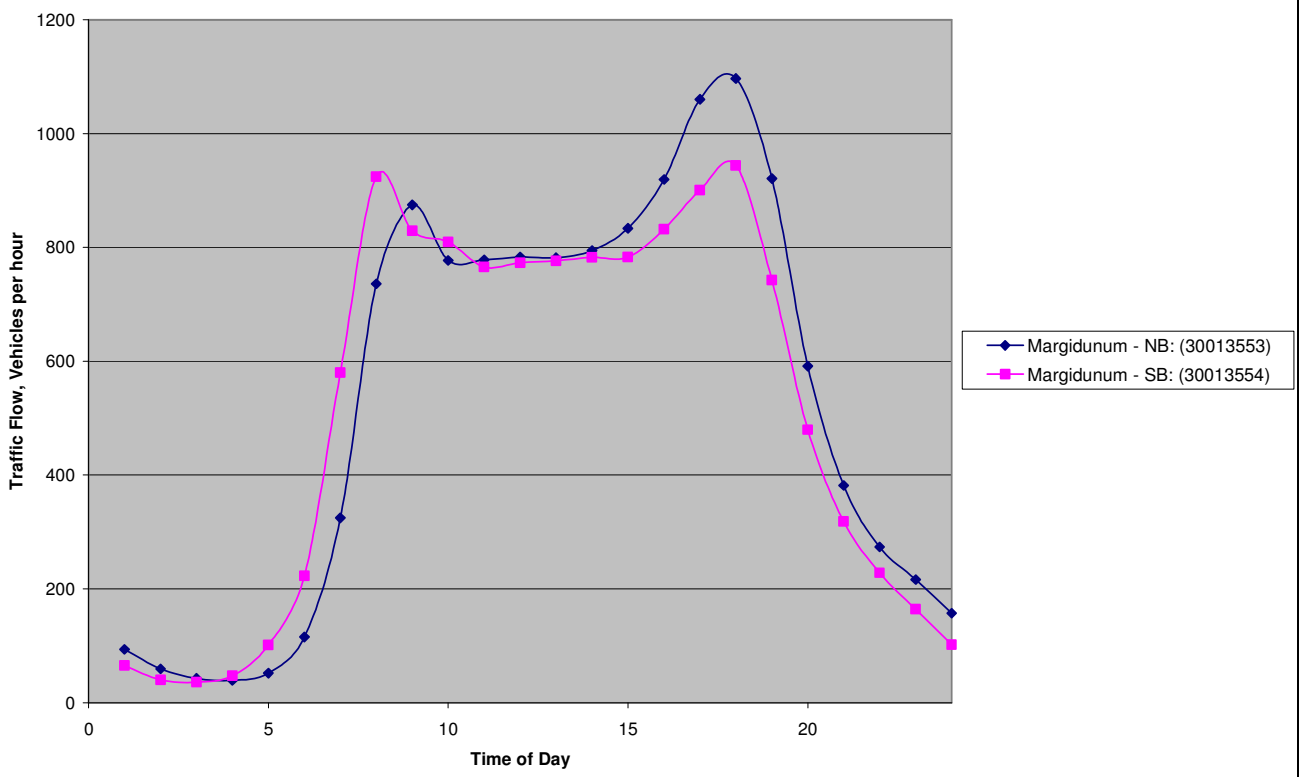


Daily Traffic Flow

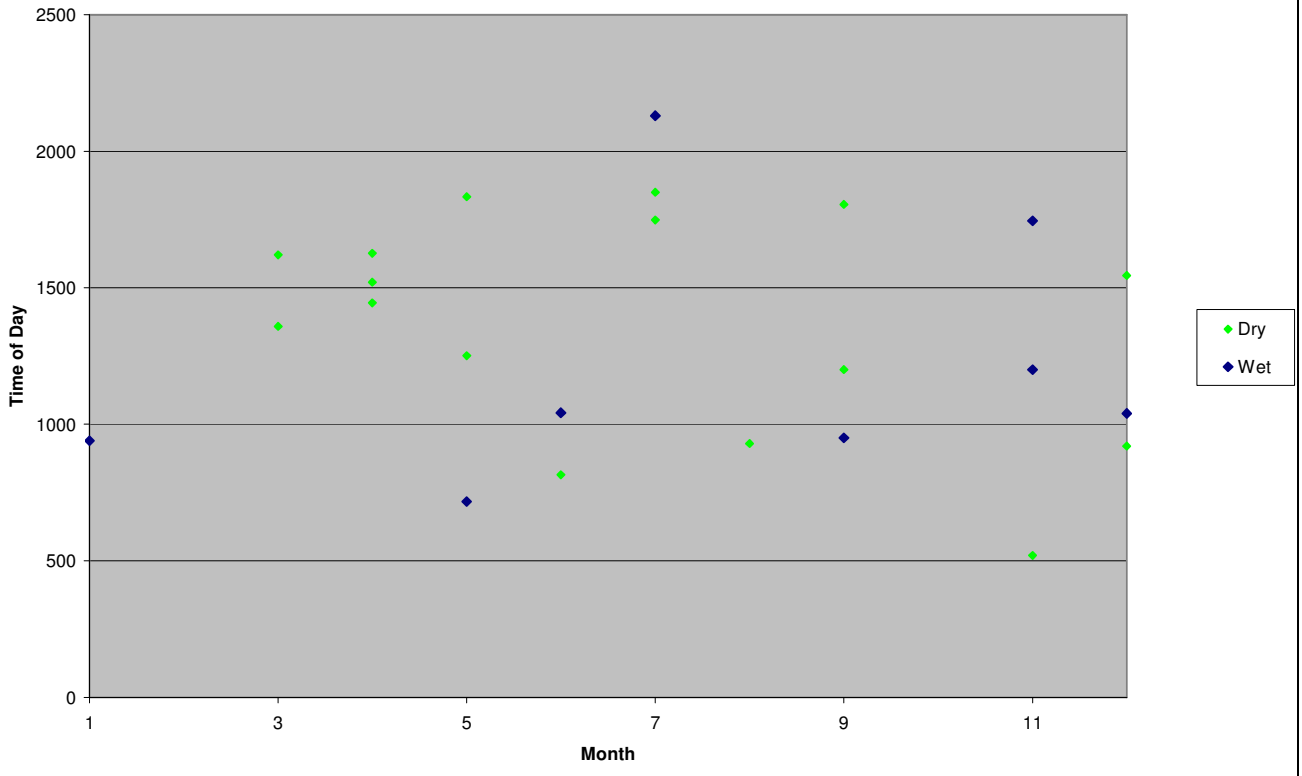


Accident Distribution

Margidunum

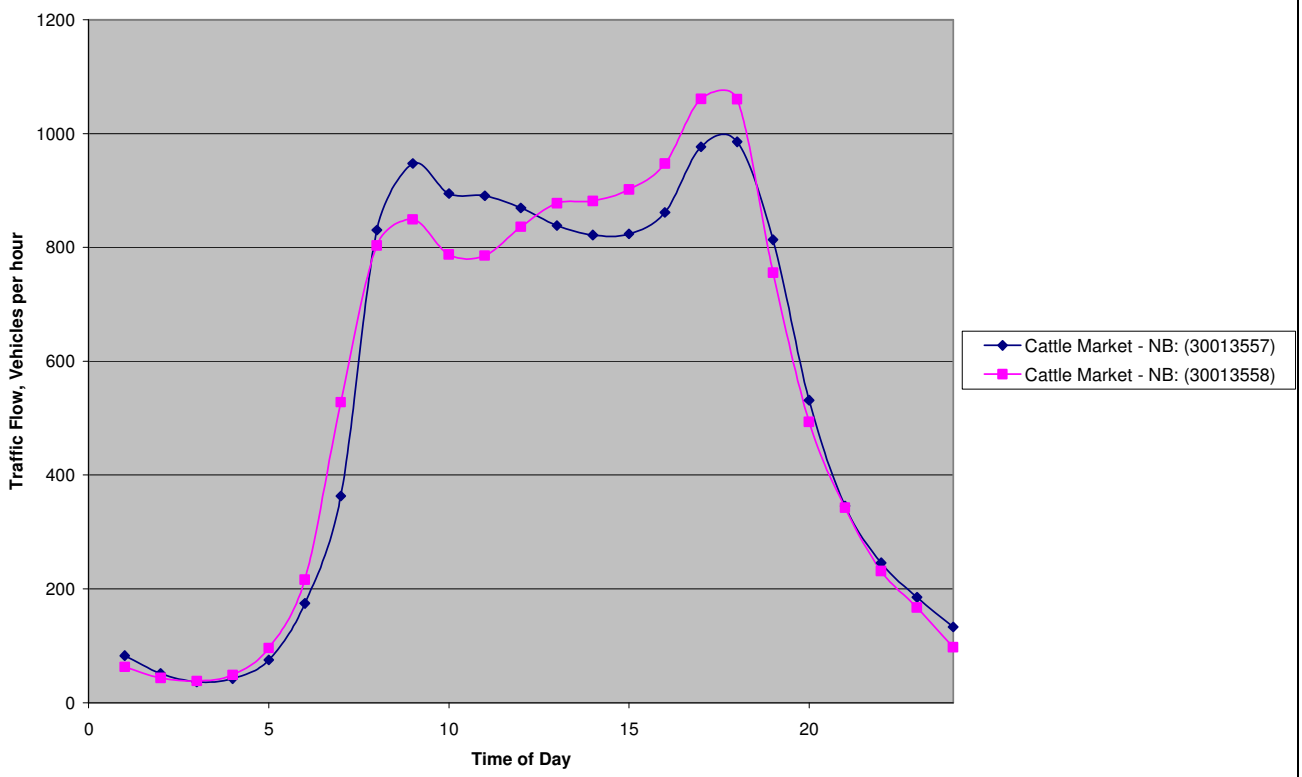


Daily Traffic Flow

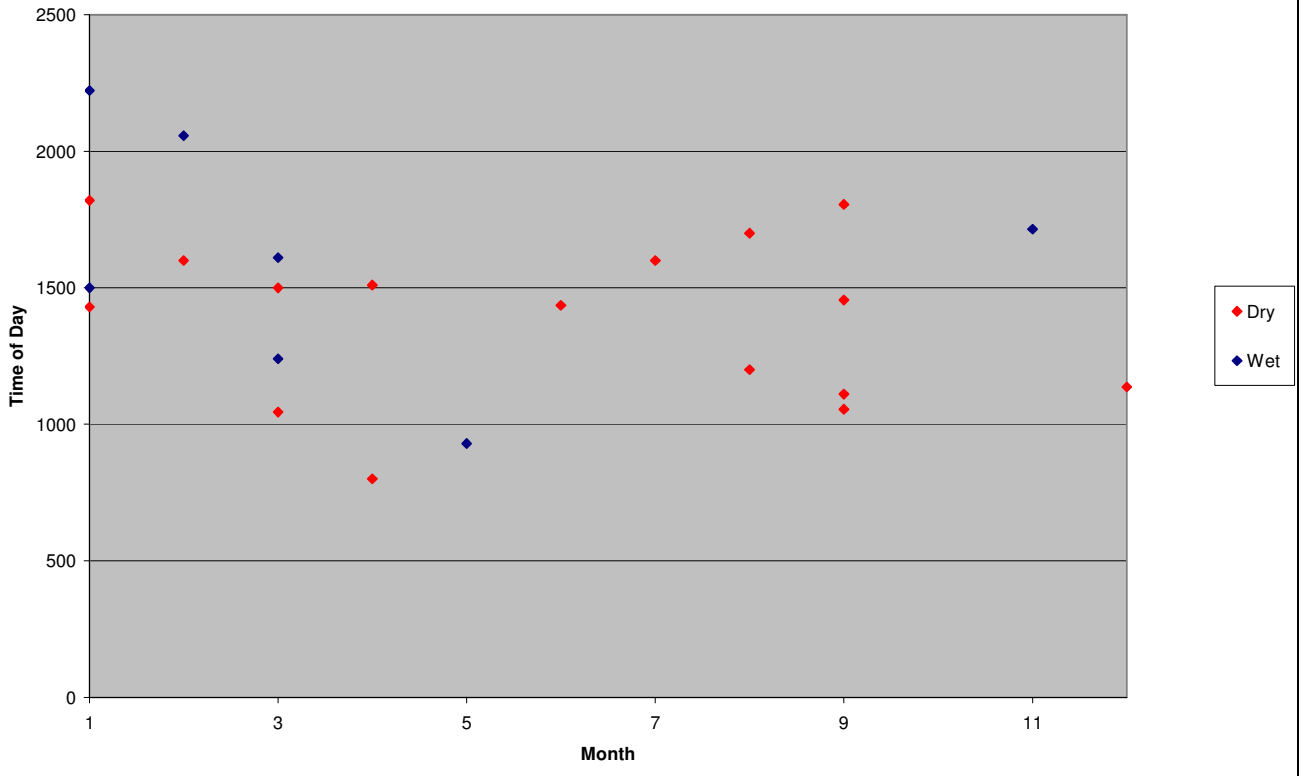


Accident Distribution

Cattle Market

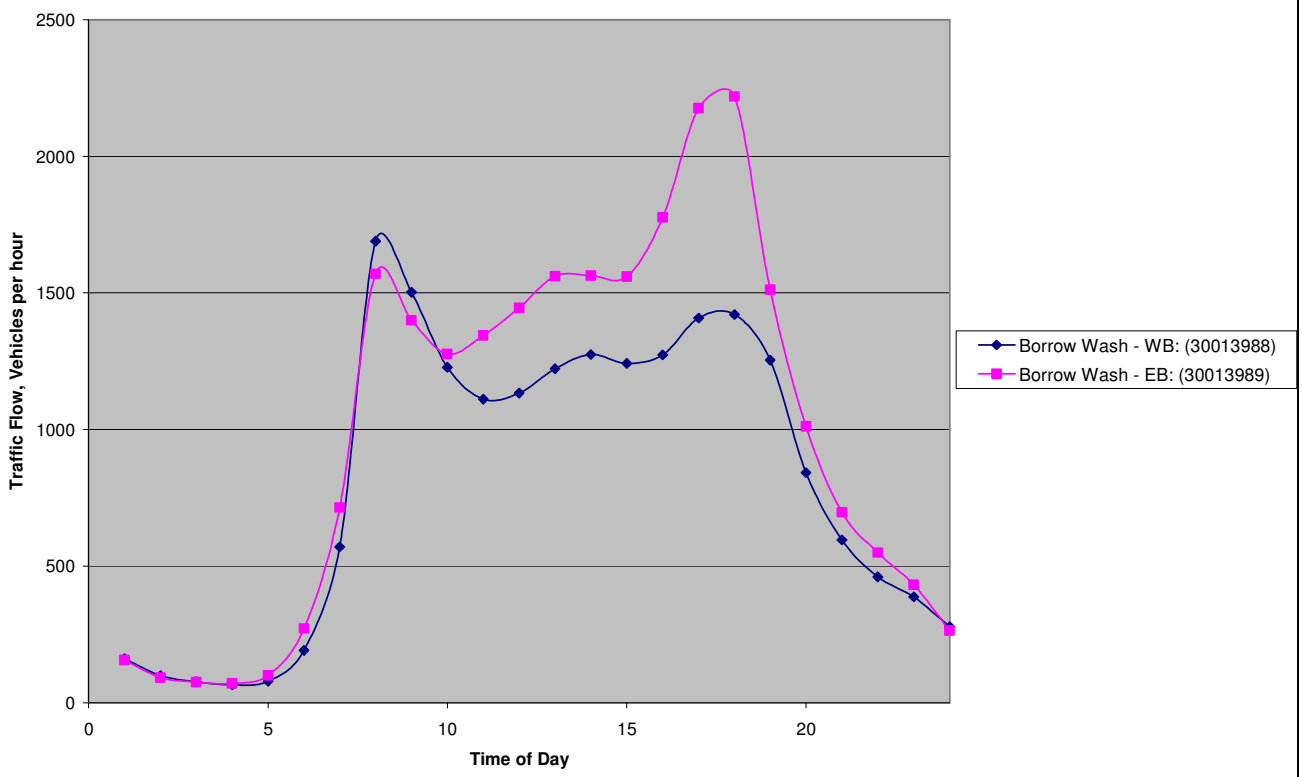


Daily Traffic Flow

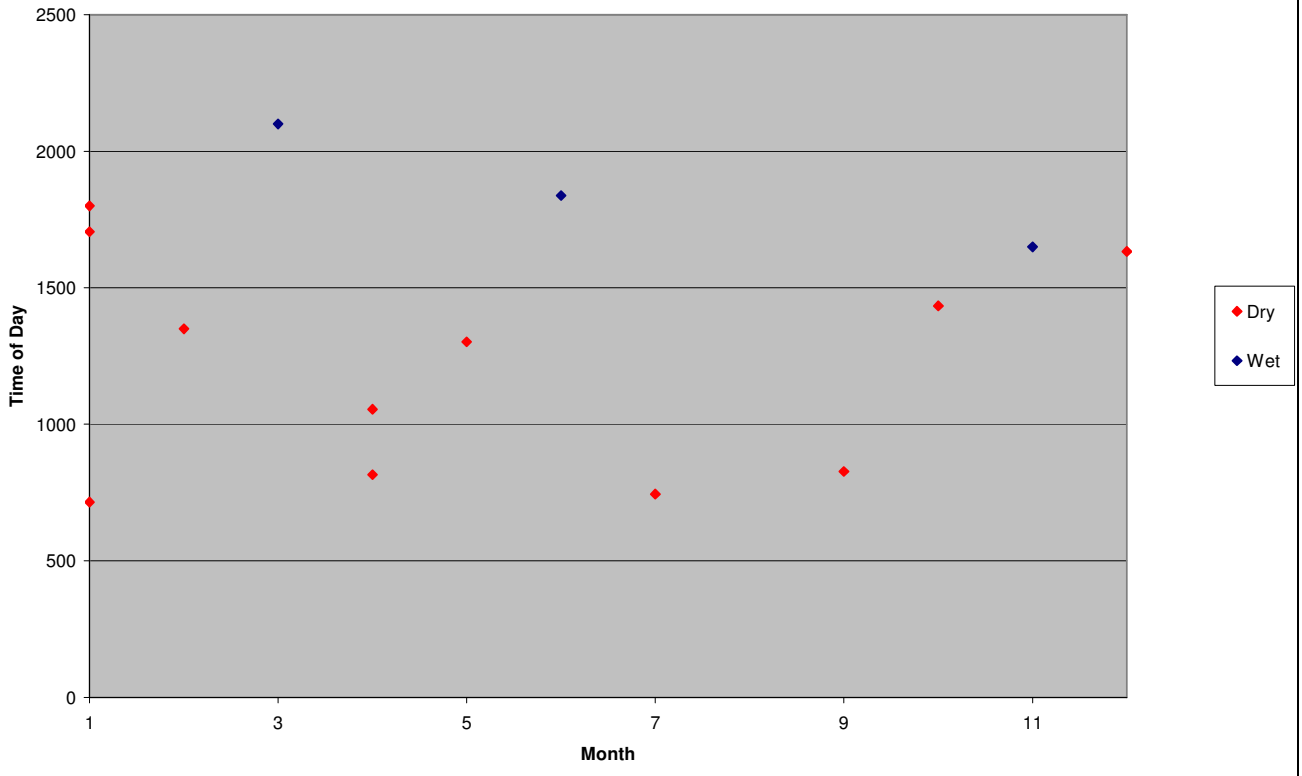


Accident Distribution

Borrow Wash

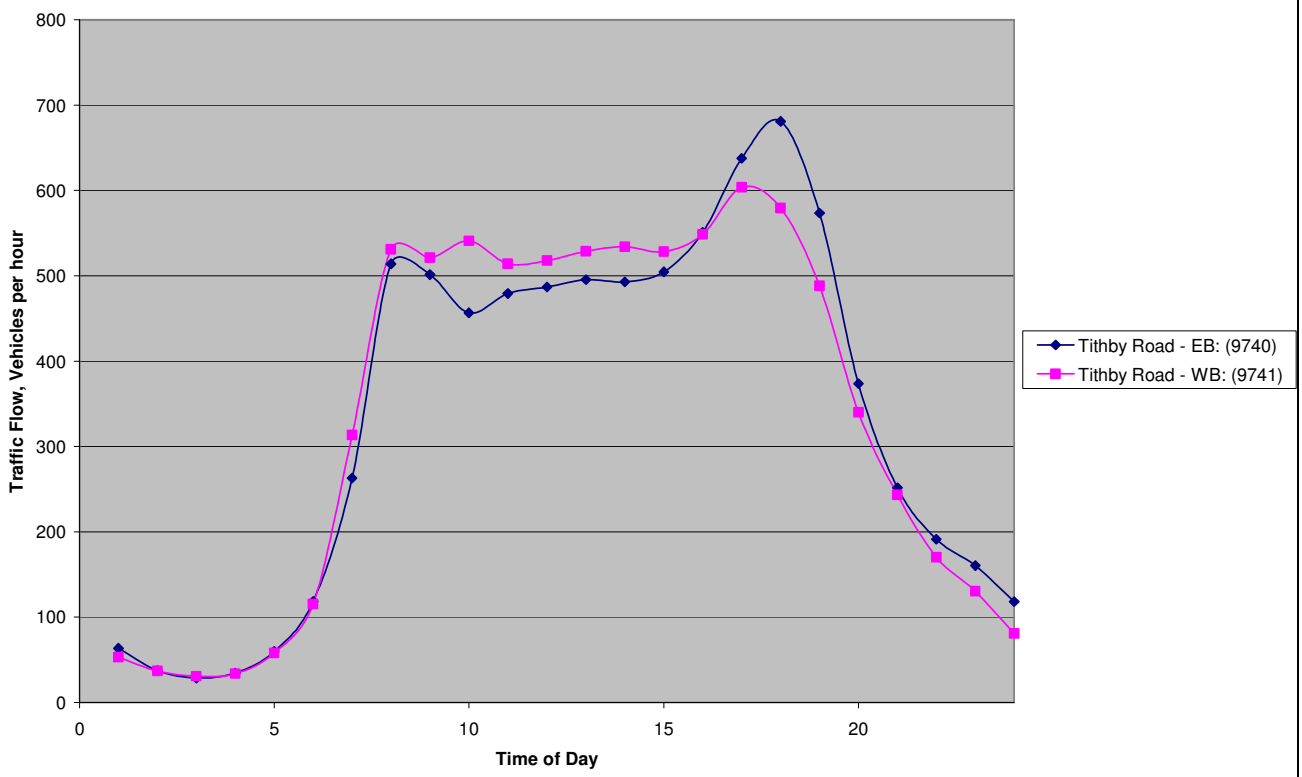


Daily Traffic Flow

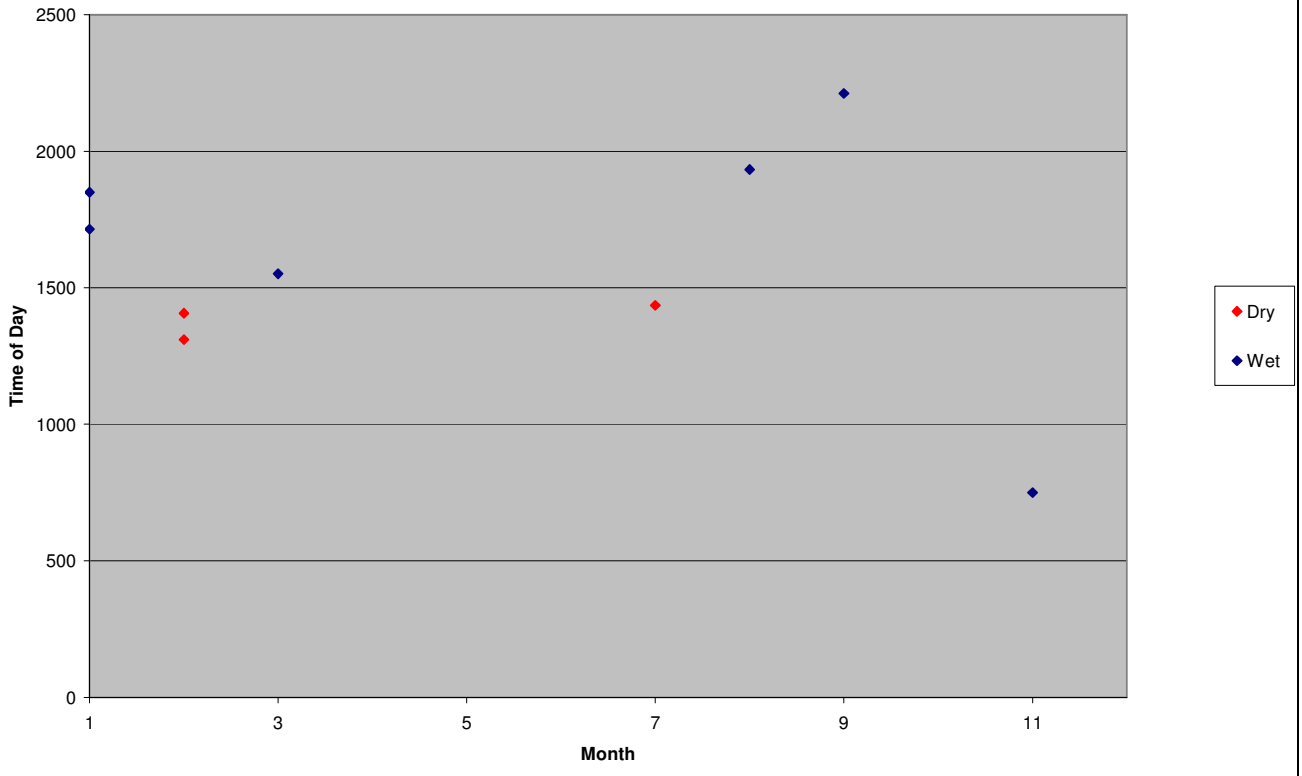


Accident Distribution

Tithby Road

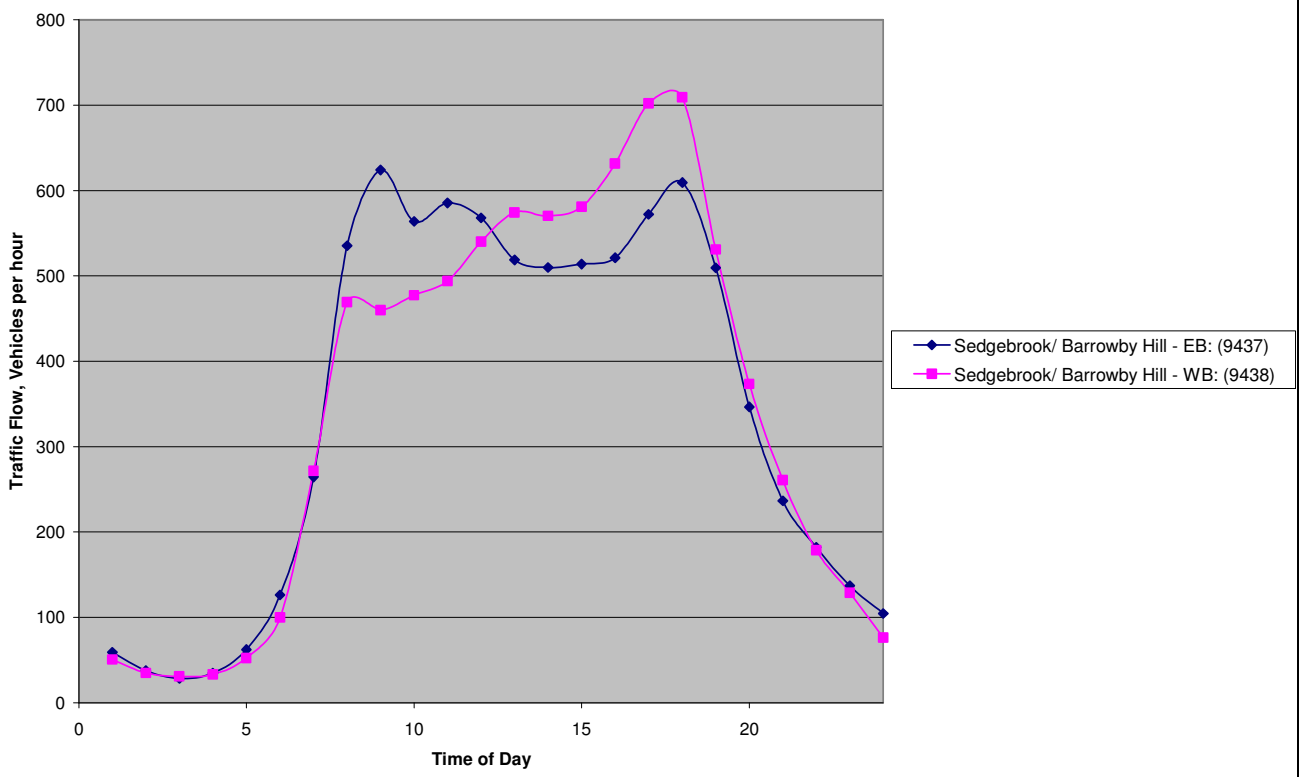


Daily Traffic Flow

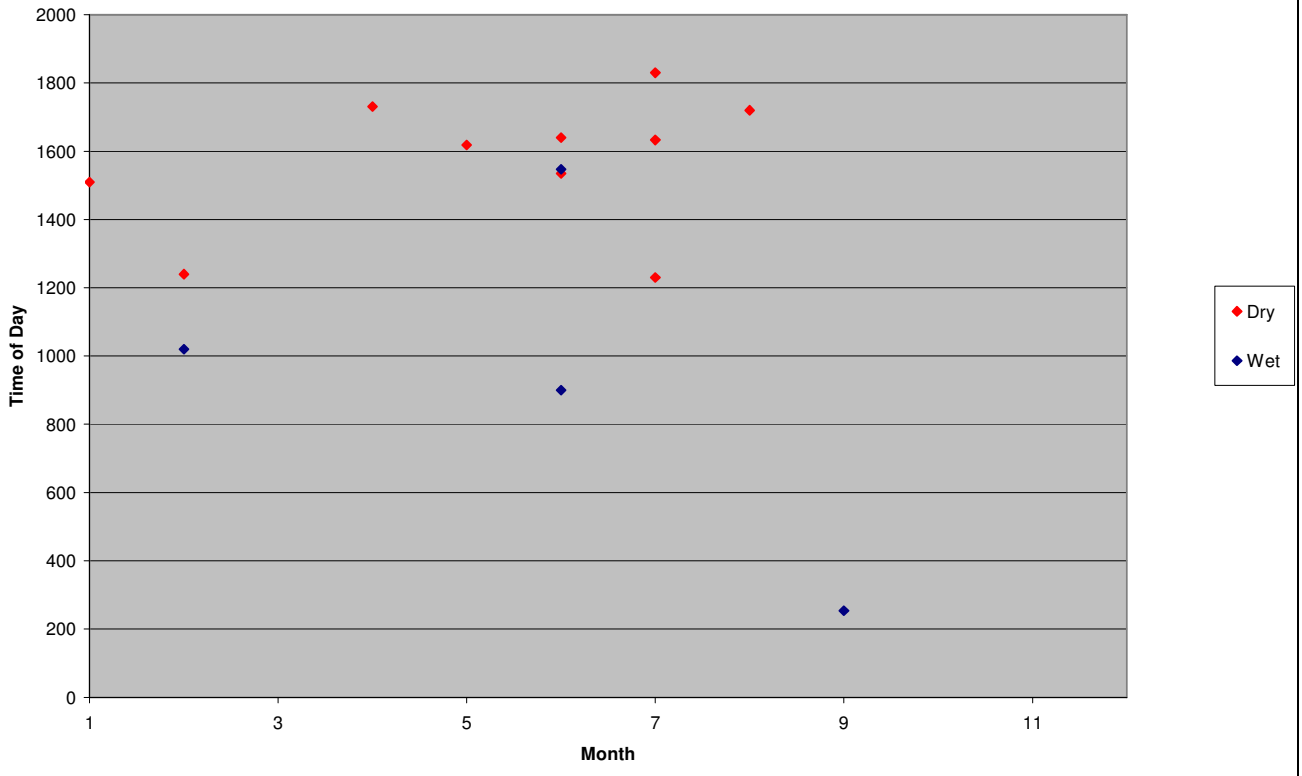


Accident Distribution

Sedgebrook

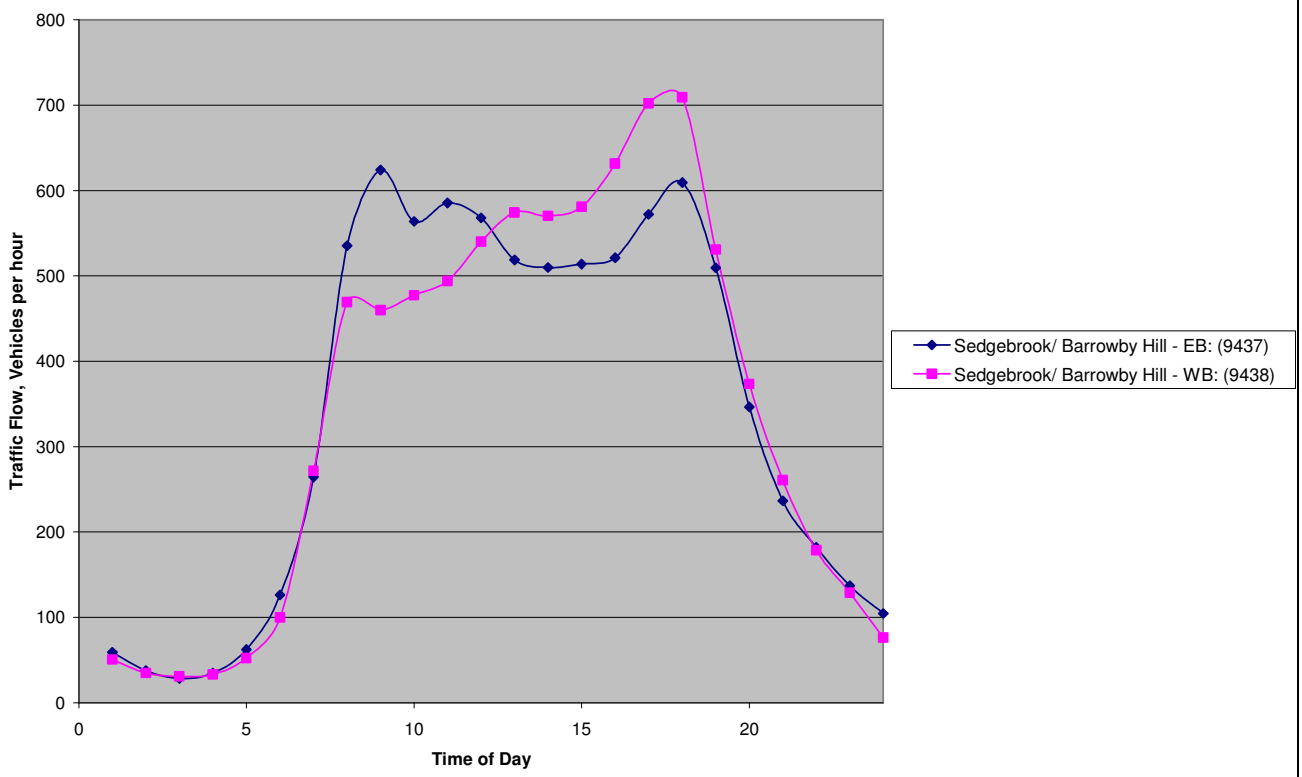


Daily Traffic Flow

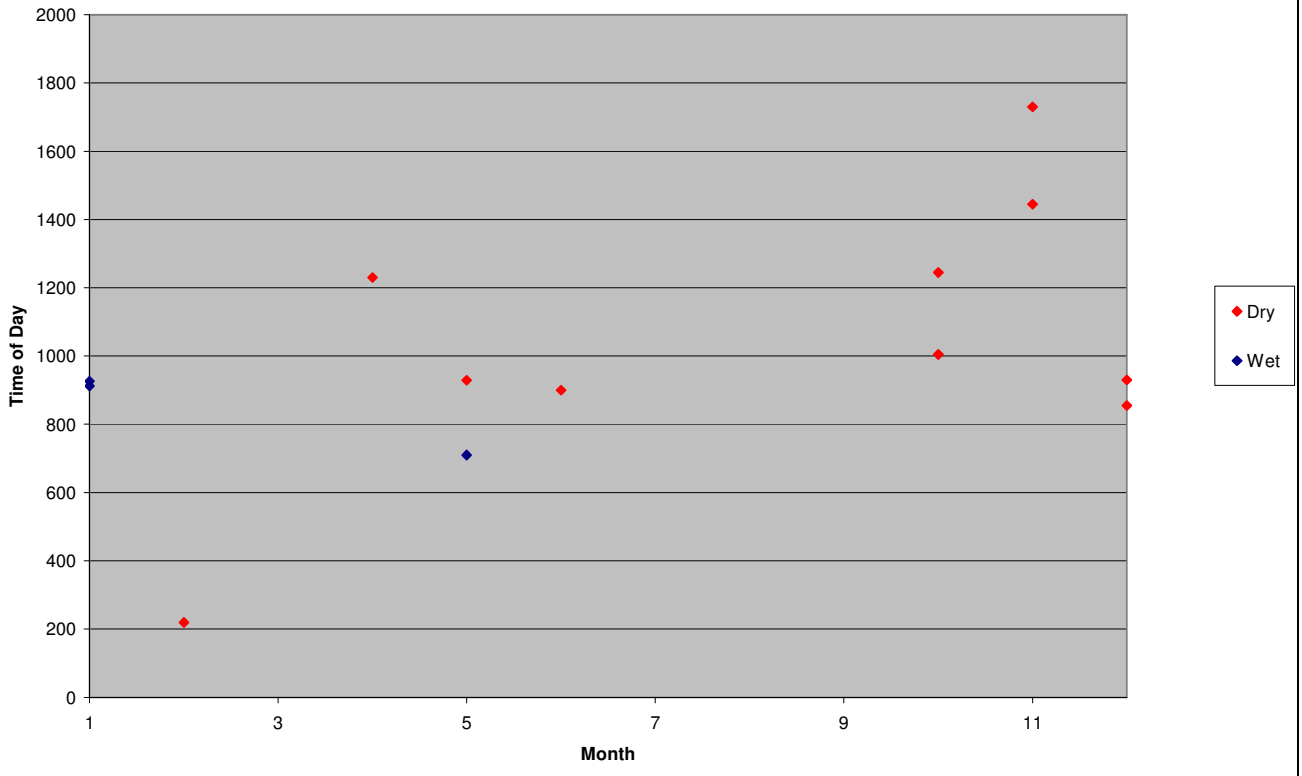


Accident Distribution

Barrowby Hill



Daily Traffic Flow



Accident Distribution