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A COMPARISON OF LOCAL AUTHORITY PROCEDURES IN ROAD SAFETY

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ABSTRACT

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It has been recognised that there are large differences in the working practices of safety teams amongst the highway authorities of Great Britain. This study was undertaken to assist the development of short courses in safety and accident analysis for (amongst others) road safety staff and traffic engineers. The main objective of the study was to discern differences in working practices between three different kinds of highway authority. The study also enabled University and local authority personnel to work together to identify more precisely the teaching objectives in certain proposed courses in safety; and to identify and provide appropriate course material, within the overall aim of making such courses relevant to a wider range of audience.

KEY-WORDS: *road safety; accident analysis; safety audit; continuing professional education.*

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COMPARISON OF LOCAL AUTHORITY PROCEDURES IN ROAD SAFETY

1.INTRODUCTION

1.1 BACKGROUND

It has been recognised that there are large differences in the working practices of safety teams amongst the highway authorities of Great Britain. This study was undertaken to assist the development of short courses in safety and accident analysis for (amongst others) road safety staff and traffic engineers. It constitutes part of a programme of enhancement of the continuing professional education provided at the University of Leeds by the Institute for Transport Studies in association with the Department of Continuing Professional Education, and was funded by the University Funding Council and the (then) Department of Education and Science under their PICKUP scheme. The main objective of the study was to discern differences in working practices between three different kinds of highway authority. The study also enabled University and local authority personnel to work together to identify more precisely the teaching objectives in certain proposed courses in safety; and to identify and provide appropriate course material, within the overall aim of making such courses relevant to a wider range of audience.

1.2ORGANISATION OF THE STUDY

The study was conducted with safety teams in three Local Authorities in Great Britain, these being Humberside County Council, West Yorkshire Highways (HETS) and Highland Regional Council.

In each of these information was obtained in the following areas:

- accident statistics
- organisation of the safety team
- accident data collection and validation
- single site investigation and implementation
- area wide investigation and implementation
- village safety projects
- route studies
- safety audit
- other safety aspects.

1.3CHOICE OF LOCAL AUTHORITY

It was suggested that the three Local Authorities considered in the case studies should have different backgrounds concerning their accident situations. West Yorkshire is a large metropolitan area with 8903 accidents resulting in 11558 casualties in 1990. Humberside is a mixture of urban and rural and in 1990 there were 4361 injury accidents resulting in 5498 casualties. Highland region is a predominantly rural area with 854 accidents in 1989 resulting in 1315 casualties. The difference in the nature of the areas and the number of accidents should give a broader account of the procedures of the safety teams in the respective regions.

An additional reason for choosing Highland Regional Council is that the courses would be designed to cater for employees from all Highway Authorities in the British Isles and the inclusion of the different procedures examined under Scottish law would be a distinct

advantage.

The aim is not to be critical of any one authority on a particular subject, but merely to show how each undertakes it's work, since differences are often due to the authorities circumstances rather than bad practice on the part of the authority.

2.ACCIDENT STATISTICS

In Humberside for the years 1986 to 1990 car occupants accounted for 43% of casualties, whilst pedestrians, cyclists and two wheeled motor vehicles (TWMV's) each had between 15 and 16% of the total number of casualties. In West Yorkshire car occupants accounted for 53% of the total, pedestrians 23%, TWMV's 10% and pedal cyclists 6%. In the Highland Region 80% of casualties were vehicle occupants, 10% were pedestrians, 7% TWMV's and 6% pedal cyclists. The differences between these regions is due to the relative urban nature of the area and the terrain of the region. That is, in rural regions car use is higher compared to walking and cycling and so a corresponding higher level of accidents to these groups would occur. The flat terrain of Humberside also encourages cycling, since 18% of the population travel to work by bicycle compared to the 7% average for England and Wales.

In Humberside between 1981 and 1990, there was a large increase in injuries to car drivers and passengers, a small increase to cyclists and pedestrians and a large fall to two-wheeled motor vehicle riders. The largest increase by age group is to the 26 to 64 group which had a 27.1% increase in casualties between 1981-1990. In West Yorkshire a similar trend was established. In the Highland region there has been a large volatility in the numbers of casualties from year to year compared with the Scottish average. This is presumably due to the small numbers of accidents that occur in the region, whereby a small change in the numbers of accidents leads to a relatively large percentage change.

3.STRUCTURE OF THE SAFETY SECTIONS

The authorities undertake broadly the same tasks, with the exception of HETS who have no input in scheme design. All the team leaders are heavily involved in the safety audit procedure, although they delegate some of this responsibility onto other team members.
In both Humberside and Highland Region the engineers undertake both the accident analysis and the accident investigation roles, whilst in West Yorkshire these roles are separated between two teams. That is, the accident analysis section is responsible for plotting and checking the data, preparing the quarterly statistics and running the enquiries that they receive, whilst the accident investigation section is responsible for the identification and ranking of the sites.

4.ACCIDENT DATA COLLECTION AND VALIDATION

4.1DATA COLLECTION

The source of road accident data lies with the Police. Information is either collected at the scene of an accident, or later, when an involved party reports the incident at a police station.

4.1.2 Humberside

In Humberside the Police fill in a Police Notification of a Road Accident (PNA) booklet which gives details of the drivers and vehicles involved, date, time and location of the accident, witnesses names and addresses and a summary of the accident. If it is a non-injury accident, then no further details were taken at the time, but if the accident involves personal injury then another booklet (the HO/RT7) is filled in. It is this that contains all the information held in the STATS 19 database. These booklets are sent to the Police headquarters for input into the computer. The HO/RT7 form is returned to the police officer to complete his/her enquiries and the PNA form is retained by the accident records department. Any personal information is removed such as names and addresses and the data is transferred to Humberside County Council. The complete system is known as the Technical Accident Data System (TADS) which removes the need for the Police to fill in the STATS 19 form. This has reduced the data input time from 14 to 6 weeks.

4.1.2 West Yorkshire

In West Yorkshire the form HO/RT7 is filled in at the scene of the accident, the policeman then goes back to the station and fills in form RT35. This is sent to the Police headquarters in Wakefield where the civilian staff transfer the data onto a 'punching document'. They analyze the location of the accident from information on the RT35 (location description/sketch plan) and assign the OS grid reference to each accident. The information from the punching document is entered into a temporary computer file.

4.1.3 Highland

In the Highland Region the Police fill in their accident notebook on site and they transcribe this to form R43, which is the standard report form. The form contains extra information to the standard STATS 19 document which includes whether there was a left hand driver, foreign driver or learner driver. The form is sent to the police headquarters where it is put onto a database held on an ICL mainframe at the Highland Regional Council offices. Details from damage only accidents are also recorded and the position of vehicle occupants in these accidents are also logged.

4.2VALIDATION

In order to have accurate road accident records it is necessary to have a process which checks them. In all three areas the data is validated by the Police using the STATS 21 computer program. In addition, the accuracy of some items are checked manually by the data input staff at the Police Headquarters. Once the data has been validated by the Police the data is then transferred to the Local Authorities.

4.2.1 Humberside

Humberside validates the data at both the Police headquarters and at the County Council

which is a duplicate of the Police validation but includes extra fields such as Local Authority area. Members of the AIP team check the location of the accident and plot it onto a map and log the co-ordinates onto the database. They also convert the plain language description of the accident into one that can be held within 120 characters. The records are then sent to the Department of Transport.

4.2.2 West Yorkshire

In West Yorkshire the narrative of the accident is sent to HETS which includes a description of the accident, a description of the location and the grid reference. It also contains the road safety area that the accident occurred in.

A plotting run is initiated by searching for all accidents without a road safety committee number and they are produced in ascending grid order. From this the location of the accident is plotted onto a map. Any queries over the location, road number or District number are then corrected.
The plotting run is then returned to the Police for the grid references, road numbers and District errors to be amended. Only the Police staff are allowed to make alterations to the database which ensures that as few people as possible can tamper with the database. The inaccurate returns are then sent back to HETS to see if they have been changed correctly. The Police will only alter the grid reference if it is inaccurate by more than 50 yards.

A further check is available through the handwritten forms which contain the same data as the plotting run. The hand written information on the green form is correct, but the data on the computer can be incorrect due to transposition errors (the grid reference in particular is prone to this). Independent checks on road numbers are also made by running a graph plot, and searching on particular road numbers. A visual check will normally show up any error. These are then searched for by grid and road number, and isolated. They are then sent for amendment in the usual way.

4.2.3 Highland

In the Highland Region members of the AIP team check the grid reference location of the accident and plot it onto the map. For rural areas the maps are to the scale of 1:50,000 and for urban areas this is 1:2500. For rural areas links are specified according to the Scottish Office system and are separated by junctions, speed limit changes or major changes in carriageway type. For urban areas links are specified by the two nodes that they connect, for example, link 990991 would be between node 990 and 991. This node number is prefixed by the town number. This data are included in the STATS 19 records and is sent to the Scottish Office.

4.3DATA OUTPUT

To produce the statistics required it is necessary to have an efficient information retrieval system. Humberside uses a Sun workstation to run a SIR database. In both HETS and Highland a mainframe is used.

Highland Region use AQUERY which was set up in 1983. This contains the fields of date, day, time, location, accident reference number, road and link number, the numbers of vehicles and casualties involved and the accident severity. The relevant fields are printed out. The investigator then goes into TPS which asks for a reference number and gives a portion of the STATS 19 record for each. A problem with AQUERY is when accidents involving fatal and serious injuries are asked for it will first look at fatals and print them out and then look for serious and print them out. If a fatal and serious injury occurred in same accident then the

accident were printed out twice.

Both Humberside and Highland region run enquiries to suit the question posed on an ad hoc basis. HETS have a formal method of data output, whereby a standard form is filled in to obtain information. The data output could be in one of the following:

- Numbers only at a specific site
- Numbers only - by year and severity.
- The full form
- Two page summary
- Narrative, this is a brief report ideal for handling large numbers of accidents. It gives the location and details of the circumstances.
- Abbreviated print out: This report details all the vehicles and casualties involved in an accident along with the time and location.
- Stick diagram and location. The accident details plus vehicle manoeuvres are tabulated and cross-referenced with the location. Comments are made if any pattern or common contributory factor is identified.
- Graph plot is a good technique for visually locating accidents by overlaying them against a base map which can be drawn to any scale. The output can be displayed on VDU screen for more instant results.

An additional problem is faced by Highland Region in that the Northern Constabulary cover the Highland Regional Council and the Western Isles Council areas and so those that do not correspond to the Highland Region have to be deleted.

5.SINGLE SITES

5.1 IDENTIFICATION

5.1.1 Humberside

The investigation and treatment of single sites have been the mainstay of the councils work for the last few years. The following stages are included in the procedure of ranking and selecting sites for treatment.

a)Single sites were initially selected by the Road Safety Code of Good Practice method whereby those sites that had a least 4 accidents in 3 years and at least 3 accidents in any 1 year would be selected. A manual method is used where an investigator counts the number of accidents in the last three years plotted in a map book.

b)These are separated into district and ranked according to these areas.

c)Any sites that have been treated and those that are to be included as part of a capital programme are removed.

d)For the remaining sites accident details are asked for by specifying the grid co-ordinates that surrounds the site, and the details of all accidents inside that box are brought out. If any do not correspond to an accident at that site then they are deleted. This would often be 5 years data so trends can be assessed.

e)Each site is investigated for dominant factors and those sites where no dominant factor exists are removed.

f)For the sites that are remaining the accidents are brought up on a stick diagram and the likely common cause of the accidents at that site are assessed. A sheet is filled in determining the expected number of accidents at a site for that traffic volume

according to COBA 9. A site visit is made to assess if any factors are obviously causing accidents.

g)A remedial measure is suggested along with it's likely effectiveness in reducing accidents and the estimated cost of implementation.

h)The measures are assessed for casualty reduction value and payback. Casualty reduction value is defined as:

1.2 x Accidents x accident reduction numbers x value of casualty.

The payback value is defined as the cost of the scheme divided by the casualty reduction value. For schemes to be acceptable they must have as casualty reduction value of greater than 0.9 and a payback time of less than 2 years. This is a new concept and so is only considered on the schemes investigated in the last year.

i)The schemes that pass this criteria are then ranked by casualty reduction value by area.

5.1.2West Yorkshire

The abolition of the metropolitan councils removed the role for the design and implementation of remedial measures. This role was given to the districts.
The objectives are to:

- Provide a list of locations together with their accident record, which is an essential first step into identifying those with an accident problem.
- Provide a synopsis of the accident situation at the locations
- Recommend improvements based purely on accident grounds.

The procedure for setting up sites for concern is as follows.

a)When the person who plots the accidents sees that a cluster satisfies the one year criteria, they draw a box around the site.

b)A plan is obtained of the site. The full accident statistics and stick diagrams are run. Refinements to the grids are executed here and accidents not satisfying this criteria are deleted on the full print out and stick diagram. The number of accidents inside the rectangle on the plot book and from the computer print out are compared.

c)The information is put into a blue wallet. The junction title and the grid co-ordinates are now put onto the database. This section is not undertaken for Kirklees and so the full printout is not retained and all Kirklees sites are put into one folder.

d)When the county was whole there was one criteria to rank sites. Now the county has been divided into separate districts each one wants their own list. The sites are ranked by accident numbers over the last 5 years. There is also a separate criteria whereby the number of accidents in the last year are checked which is done to see if any measure may have increased accidents sharply. With 80% of these they revert back to a low number of accidents.

Both Leeds and Bradford's criteria is 15 accidents in the last 5 years or 4 in the last year. Calderdale and Wakefield specified 10 accidents in 5 years and 3 in the last year, whilst Kirklees had a criteria of 12 accidents in 5 years and 3 in the last year.

Each of the sites that conformed to this criteria were then looked at in detail. They analyze five years accident data, stick diagrams and predict the expected numbers of accidents. This is based on COBA 9 values or predictive relationships as developed by Southampton University if traffic flows are known, or local norms if they are not.

The dominant factors are considered and the site is visited. Fifty-six of the 99 sites in Leeds were photographed in the current year, the ones that were not were considered not to have altered from the previous photograph. For each site the description of the site, accident record, accident analysis and recommendations are made. They then recommend what action should be taken, this could be:

- recommend an in-depth study if cost-effective
- recommend a measure
- recommend to continue monitoring.

A priority list of sites is given where action is justified on purely accident reduction grounds. The priority is assessed at a meeting between the site identification staff, all the sites on the list are discussed each year and new recommendations are given.

5.1.3 Highland

Five methods are used to identify sites. These are:

- accident analysis
- hazard reports
- divisional officers reports, requesting accident section to look at the site
- Scottish Office (for trunk roads using their own ranking system)
- Councillors representing the public, look to see if problem exists

Local knowledge is important as long as it is backed up by accident figures to justify the schemes.

Accident analysis. The plot books are checked regularly to see if any new clusters of accidents exist. A further method is the assessment of Personal Injury Accidents per million vehicle kilometres which can be used as a first stage in looking at certain sites. Last year for regional schemes, rates per kilometre were investigated. This is used to relate the safety of a stretch of road with another. The formula is:-

PIA per MV Km = 1,000,000 x A/(Y x T x L)

where A is the number of accidents in the time period, Y is the time period, T is the Annual Average Daily Traffic (AADT) and L is the length of the section.

This gives a way to locate dangerous areas of road for which a more detailed investigation can be undertaken. Accident rates at each site for each of the last three years are combined. The accidents were then plotted out and analyzed for dominant factors. Those sites with no dominant factors were eliminated and the ones to be treated were selected from those remaining.

Hazard report. These reports are submitted from the Northern Constabulary, and it is where they have noticed an increasing incidence of accidents or a safety problem is evident at that particular location. This report would go to the Police headquarters to be checked and the ones that they consider dangerous would be sent to the accident section.

The section plots the last three years and test for common factors by searching through the accident reports at the Police Headquarters and drawing stick diagrams. If common factors exist, then a site visit would take place. At this visit they would survey the junction layout,

road markings and signs. They may also undertake speed surveys, traffic counts, conflict studies and skid testing. A scheme could be prepared and passed to the divisional engineer. One factor of interest is whether the driver was a local or not. If there were no accidents then the report would be passed to the divisional engineer. He may be able to implement a scheme based on factors other than accidents. They would plot and consider the details of damage only accidents as well which is a useful addition in determining the common factors of accidents at certain sites.

5.1.4 Comparison

Humberside County Council have developed the most comprehensive system of accident analysis using casualty reduction value (relating to the third reduction) and payback (relating to economic efficiency). West Yorkshire use a simple ranking system based on numbers and from these a more detailed study and recommendations are developed. Because they do not have Highway Authority status then it is not necessary to go into any more detail. Highland Region use a more informal basis which appropriate due to the lack of numbers of accidents. They base their identification on potential for accidents to happen and dangerous sites as well as numbers of accidents. The use of damage only accidents provides useful additional data.

5.2IMPLEMENTATION

HETS is not a highway authority and so has no responsibility for the design and implementation of accident remedial schemes.

5.2.1 Humberside

Humberside deals with three bodies in the implementation of sites, these are the Department of Transport, the agency areas (which are second-tier authorities who have sufficient expertise to carry out some of Humbersde County Councils functions) and the area offices which cover the rural regions and are part of Humberside County Council.

For Trunk roads accident sites are either identified by the accident section or by the Department of Transport. Form TR400 is filled in and sent to the DTp to notify them of the scheme design, cost and expected benefits. If this is accepted, then the DTp specify that preliminary work can be undertaken. Form TR401A is sent to the DTP which gives a detailed plan and specifications and estimates of cost. If it is accepted then work can be undertaken.

For agency areas once the site has been identified. A measure is designed on paper and a report on the site is prepared. The scheme is consulted with the agency area, for example, Hull City Council, whereby the drawings are put to them. This would be put to their committee and the scheme would then come back to HCC with any comments for modification and an estimate of the cost. The engineer will then analyze how these modifications will affect their scheme. If it affects their scheme greatly then they would drop the scheme. If the modified scheme is acceptable then detailed drawings and estimates are prepared by the agency. They send these to Humberside County Council and ask to approve/not approve the costs and drawings. If it is approved then Humberside County Council ask the agencies to prepare the scheme and put it to tender.

For the area office a measure is designed on paper and a report on the site is prepared. A letter along with a drawing is sent to the area office and the Police. Other parties such as bus companies may be shown the scheme if it affects them. These groups are asked to comment on the proposals. If they have reservations about the measure then discussions can take place, but the final word rests with safety team. If they have no reservations then a work ticket is

sent out for the signs and an acceptance for the work is sent to the area office.

If the scheme is more contentious then the local engineer may inform the local people about the changes to gauge their reaction.

5.2.2 Highland

On regional roads for schemes less than £1000 a plan and a covering letter are sent to the local divisional engineer, with a request for an estimate of costs and comments on the scheme. No details of accidents are sent. This is returned with any prudent suggestions to alter the scheme. They discuss the engineers comments with him. They give the engineer a cost code and he does the work. Suggestions are often taken up since the engineer has the local knowledge.

For schemes over £1000 a report is written on the site which will contain a description of the site, accident analysis and other information gathered. It will then give recommendations of the work to be undertaken. This is sent to the area engineer and the process highlighted above continues. Only schemes that involve speed restrictions or traffic management would go to committee.

For trunk schemes a report goes to the Scottish Office which details the scheme, the amount of accidents saved, the cost of the scheme and the first year rate of return. The Scottish Office return this stating, yes/no/alterations. If they say no to the scheme they have to give reasons why this was so.

The budget for remedial measures is £50,000 for regional road schemes and so if the section highlight a need for junction redesign costing say £40,000 this would go into capital works and hence the accidents only pinpoint the problem. There is also a budget from the Scottish Office to spend on trunk roads.

Only injury accidents are used to assess the economic feasibility of schemes and the average cost for a rural road accident was £53,132 for 1989. They use the first year rate of return to assess the effectiveness of accidents.

5.3 MONITORING

5.3.1 Humberside

The sites that have been implemented are entered into a book. The date of implementation, cost, and the type of measure implemented along with a plan of the site are included. The number of accidents in the 36 months before implementation are written down along with the accident reference number and whether one of the treated factors was involved in the accident. The same is done for the 36 months afterwards and hence by comparing the two, the success of the measure can be judged. If a site is implemented over a period of greater than one month, then the before period would be the 36 months before the start of the project and the after period would be the 36 months after the completion of the project.

The accident record of 27 engineering schemes implemented during 1987 have been monitored. There was an overall reduction of 36% from a total record of 334 accidents.

5.3.2 West Yorkshire

It was essential to have the co-operation of district engineers for them to give the location of

the measure, the type of treatment and when it was implemented. They hope to develop a full scale mass action monitoring plan which can be based on district or measure. The specified site can be monitored at 3, 6 or 12 month intervals.

The following problems occur in monitoring sites:
- There are a large number of sites to process.
- It is not clear where the limits of the scheme are, so it is impossible to delineate the area of influence of the scheme.
- There is insufficient information on the scheme itself and the problem that thescheme was trying to address. Therefore target groups cannot be identified.
- No information of the transition period of the works are given.
- A degree of duplication of the same site appearing on more than one list with slightly different co-ordinates leading to different accident totals.

5.3.3 Highland

The Area Engineer notifies the accident section of the start and completion date of the project. One year after the completion of the scheme the first year rate of return is assessed, and three years after the scheme's completion the before and after effect is calculated. For trunk roads the number of accidents are monitored every year.

When there has only been a slight effect or a deterioration of effect then they look at the specific factor targeted for accident reduction. They check that the scheme has not increased accidents or caused another problem. The actual average first year rate of return for trunk road schemes in the last six years was 3566% and for regional road schemes there is a figure of similar magnitude. An important factor in this high figure is because most schemes involve low cost treatment (often less than £2000) and so the saving of one accident would achieve this figure.

6.AREA WIDE STUDIES

Humberside is the only Authority that undertakes an area wide accident reduction programme. A zone is considered to be any area enclosed by a natural boundary, for example, an area bounded by a main road or a river etc. This area would mean that changing the traffic at one side of the zone is likely to have an effect on the other side.

The priority rating for accident zones is made up of three factors:

i)% child accidents
ii)internal accident rate
iii)local concern.

These were calculated as follows:

i)For each zone the number of child accident as a proportion of total accidents was calculated using Chi^2
(With Yates' correction) as follows:

$$\%child = \frac{100}{tot+4}\left(1.5 + child - 2\sqrt{\frac{child}{tot}(tot - child + 1) + 0.25\left(2 - \frac{1}{tot}\right)}\right)$$

Yates' correction with Chi^2 was used to correct for the biases involved with small samples, since there is likely to be a small number of accidents at most sites.

ii)The internal accident rate was calculated by dividing the number of internal accidents within the zone by the total length of road within the zone in kilometres.

iii)Local concern (applicable to Hull City Council only at the moment) was calculated by a points system. Hull City Council examined their records to determine:
- outstanding council minutes
- traffic complaints from public
- urban programme public meetings
- environment improvement possibilities.

The figures are factored up to 100% and then the figures were added together as follows:

$$\frac{\%\text{ child accs} + \text{Internal acc rate} + \text{Local concern}}{3}$$

The zones are then ranked. The areas are investigated in detail and those that are extremely expensive are dropped.

In both West Yorkshire and Highland Region traffic calming is going ahead, but it is not based on accident studies.

7.VILLAGE SAFETY PROJECTS

7.1INTRODUCTION

During recent years a number of effective techniques have been developed to reduce accidents in areas using traffic calming measures which include carriageway narrowing and pedestrian refuges. Consideration has been given to extending such benefits to villages on main roads. There is a growing concern in many village communities about conflict due to traffic, requests for lower speed limits or the provision of by-passes. But accident numbers are generally low and so conventional cost/benefit techniques reveal that major expenditure cannot be justified and so a new reasonable cost approach must be highlighted.

If a group of villages were taken together then the total number of accidents would be sufficient to monitor the before and after safety record with some degree of confidence. In both Humberside and Highland Region the village safety concept is being undertaken. This is a project run through the County Surveyors Society and is being monitored by the TRRL

7.2HUMBERSIDE

The following criteria need to be satisfied.

- The main street is also used as a through route.
- There is local concern about road safety.
- There is sufficient road space to permit low cost traffic calming measures at locations likely to require them (eg; shops, schools, junctions,bends).

Priority for selection was based on road space available and the injury accident rate (per million vehicles per population).

For the sites selected the stages are as follows:

a)carry out before traffic and photographic surveys
b)carry out land survey
c)local consultation over problems
d)formulation over measures
e)local consultation over measures
f)implement measures
g)carry out after traffic, photographic and attitude surveys

The monitoring will consist of 85th percentile speeds at 5 points, 2 distant, 2 ends, 1 centre. vehicle flows by classified count, pedestrian flows and destinations at the times of 0800-0900, 1200-1300, 1500-1600 on a typical weekday. Attitude surveys would be undertaken as well. The design costs were based on a 10 man week design period comprising of:

- site survey (2 weeks)
- preliminary design and consultation (4 weeks)
- preparation of contract documents (4 weeks)

A meeting held at County Hall on 12th October 1989 between the TRRL, The Road Marking Industry Group and H.C.C. suggested

- chicanes to provide sheltered parking and central turning space.
- central island refuges and hatched centre lines.
- shrub planting to create a village road.
- mini-roundabouts
- edge lines.

Speed humps would not be appropriate on through routes and rumble strips would give an unacceptable noise level to adjoining properties. Where appropriate, speed limits would be reassessed after the completion of the scheme in the form of 7 day summaries of meter counts/speeds at the centre, edges and away from the village development. If the speeds reduce significantly then the calming measures would also seem to be working. In addition to the traffic calming measure attention was paid to the general road environment and street furniture. Five villages were selected where there was a concern over traffic speeds, volumes and severance. These were South Cave, North Froddingham, Appleby, Middleton and Newport and over the five year period 1983-7 there was a total of 34 injury accidents. Using an average injury cost of £20,850 and an assumed measure effectiveness factor of 0.4 then the likely savings are 56,712 a year. The total project cost was estimated at £105,000 and so the first year economic rate of return would be 54%.

The scheme at South Cave and Middleton have already been completed.

7.3HIGHLAND

The objectives of the village safety project in Highland Region are to:

- reduce the drivers speed to 30mph or less.
- drivers perception of a reduction in carriageway width.
- illustrate entrance to the village and urban speed limits.

They suggested using road markings to give the impression of speed humps and surface treatment to change the colour of the carriageway at the entrance to the village. Speed limit signs in white are painted on the road at the crests of the hills at regular intervals through the village. At the entrance to the village there was an increased amount of advanced signing and trees will planted at converging distance from the road to give the impression of road narrowing.

This was a typical through village and there was local concern at vehicles speeding through the village. Before they implement the scheme they will undertake a speed survey.

8.ROUTE INVESTIGATION

Both Highland Region and West Yorkshire have developed route investigation programmes.

8.1WEST YORKSHIRE

In West Yorkshire the concept was to look for continuous lengths of road ie; all urban or all rural sections with accidents. All the roads were driven and the location of the speed limit changes from urban to rural ie; from 30-40 to 40+ or the location where the road moves into a different land use pattern eg; from residential to industrial are plotted. The expected level of accidents per million vehicle kilometres were taken from Road Accidents Great Britain and was 100 for urban roads compared to 33 for rural roads.

Any urban or rural site with greater than 10 accidents over a 5 year period were included which give a manageable list for each district. The traffic flows and lengths were taken so the accidents per million vehicle kilometres could be assessed. This gave a standard taking into account the length of road and traffic flows. The urban accidents were higher and so they calculated the observed divided by the expected figure, hence sites were considered with it's peers. They were ranked by the observed rate divided by the expected rate. The cut off for publishing was where the observed rate was 25% greater than the expected rate. This was the same for all districts which gave manageable lists in all cases.

New lengths were identified on an annual basis by examination of the manual plot books for urban areas and 1:25,000 graph plots in rural areas. Identified lengths are gridded up and a folder, complete with plan, made up in the same manner as for single sites. At the year end a narrative print out is run for each length. After strays have been deleted a two page summary for each is produced. The accident rate is calculated for each using the most recent traffic flow information available. For those lengths meeting the 25% above expected criteria a stick analysis is run and the accidents are plotted which leads to the recommendation of a treatment. The sites are only visited when an in-depth study is asked for.

8.2HIGHLAND

There has been route action on the A82 and A9 which are the two major trunk roads in the Highland Region.

The 85th percentile speed is determined by speed counts. Two vehicles drive the route separated by the minimum stopping sight distance for the 85th percentile speed (although the drive the route at a considerably lower speed so as to be separated buy the correct distance). On the A82 they used a video camera because it gives a quick identification of the areas where the road is substandard. From the accident analysis, investigation of sight stopping distance and the video survey they highlight the improvement measure and it's location. They then discuss their proposals with the Police and the Scottish Office. When these have been accepted they produce drawings and mark the position of the lines on the road. At a later date the contractor then places the lines at the relevant sections.

Sections where people may think overtaking is possible but it is not were double white lined, but sections where it was obvious that cars could not overtake remained as hazard markings. Cats eyes were also maintained and replaced. All sites where double white lining was applied had overtaking accidents at that location.

9.SAFETY AUDIT

9.1BACKGROUND

The objective of a safety audit procedure is to provide safety advice to the project manager of a scheme in a structured manner. The advice should be based upon the broadest possible safety experience. It should be consistent and provided from the earliest possible stage of project development.

In Humberside a report to the Departmental Management Team in January 1991 resulted in the adoption a safety audit for schemes over £200,000 in the counties capital programme together with schemes carried out as agents for the Department of Transport in their regional schemes and road construction programme. HETS undertake safety audits when commissioned by the clients, being the Department of Transport or the Highway Authorities within West Yorkshire. In Highland Region the Scottish Office initially specified that all trunk road schemes over £1m and other individually identified schemes where a safety audit is advantageous (for example where there is significant change to the road geometry). This has now been updated to include all trunk schemes which involve change to the existing road layout.

9.2SAFETY AUDIT TEAM

9.2.1 Humberside.

The audit team should be involved from the earliest possible stage and should as far as possible remain unchanged. In Humberside it comprises:

Team leader (AIP) : to provide data led safety experience
Humberside Police :to provide `at the scene' safety experience.
Local engineer :to provide local highway network experience.
(Area surveyor or District engineer)
Independent design engineer:to provide `up to date design' knowledge.

The audit relies on experience of engineering design and safety problems.

9.2.2 West Yorkshire

For West Yorkshire two members of HETS undertake the safety audit report. In some studies the Police, Urban Traffic Control (UTC), civil engineers and lighting engineers are included, but they do not have to include them in all studies.

9.2.3 West Yorkshire

In Highland Region the following people are involved in safety audits:-
- Representative from AIP unit Scottish Office
- Representative from area Scottish Office
- Divisional engineer
- Police
- Highland Regional Council AIP member
- Contractor
- Resident engineers

•Route engineers (Tayside area engineer covers A9 from Perth to Inverness)
•Other relevant representatives

9.3SAFETY AUDIT PROCEDURE

9.3.1Humberside

The procedure in Humberside is as follows:

STAGE	COMMENTS
Preliminary design (by client)transportation group (relevant safety advice sought on an ad- IHT (one)hoc basis)	Internal safety and environmental reviews carried out within
Scheme design briefPart A (para 22 and 29) is completed with reference to the IHT (one)safety audit team and the transportation group report as appropriate. (Note: consultancy can also be requested to carry out this preliminary task - part B section 1).	
Pre-order stage meetingGroup engineer (traffic and road safety) attends meeting IHT (two)offered by consultancy. DTp (one)Safety audit is a required discussion topic and Audit team will brief group engineer prior to meeting.	
Detail design checkScheme checker reviews drawings for compliance with (prior IHT (three) to prepare documents) standards. Audit contract team DTp (two)carries out audit on drawings, indicating: alignment, signs/lines, street lighting and landscaping	
Safety audit siteState of readiness required: assessment meetingi. new road is driveable by a private car at intended IHT (four)design speed DTp (three)ii.signs/lines are 95% complete.	

The AIP team first became involved at the pre-order stage meeting and the procedures follow the DTp guidelines. The safety audit report should be an exception report drafted independently of the project manager, discussed with him and the final draft should be signed by the audit team.

It should:
i)reference comments to signs/lines drawings
ii)suggest possible solutions
iii)assign a priority for action to each comment. Three priority levels are recommended.
priority one:the matter requires urgent attention
priority two:the matter requires serious consideration
priority three:the audit team wish to draw the matter to the attention of the project manager.

The responsibility for requesting each stage of the audit process rests with the scheme project manager. To ensure the safety audit does not delay overall scheme progress, adequate notice should be given to the audit team. A period of six weeks between request for audit and receipt of report would allow the audit team to programme the necessary meetings and draft the report.

9.3.2 West Yorkshire

HETS also follow the DTp guidelines.

9.3.3 Highland

In Highland Region the procedure follows that recommended by the Scottish Office. Prior to stages 1 and 2 the Scottish Office AIP unit will obtain sufficient details of the scheme to enable the audit to be carried out. A copy was passed to the regional AIP unit who will be asked to comment in a specified time period (approximately 2 weeks for stage 1 and 3 weeks for stage 2). The Scottish Office AIP unit will then issue certification and/or make recommendations on how the scheme should be modified. Schemes will not be able to progress beyond the appropriate stage without certification.

The safety audit at stage 3 was carried out via a site inspection. The inspection should take place after all the road markings are laid and the signs are in place prior to the scheme being open to traffic. A nighttime audit is also undertaken as problems not apparent in the day may become so at night. A record of the points discussed at the meeting between the Regional and Department's AIP teams, Area teams, the Police, project manager and resident engineers staff will serve as a record of the audit.

Twelve months after opening a site inspection (with accident data) should be carried out by the Highland Region AIP unit and the Police with any relevant feedback from the divisional engineer for the area concerned and a report is submitted to the Department. This is the stage 4 safety audit.

9.4SUMMARY

In all authorities the guidelines are followed. Humberside and Highland region involve more people in the process than HETS. Highland Region is the only authority to formally have a night-time audit, which was specified by the Scottish Office. They are also the only authority that requires an audit to be undertaken once the road has been opened.

10.OTHER SAFETY ASPECTS

10.1CO-OPERATION WITH OTHER GROUPS

All the authorities work closely with the Police accident records sections as one would expect because of the nature of the data. Both Humberside and Highland work with the Traffic management section of the Police presumably because these authorities have a design input for accident remedial measures. They all have contact with Road safety Officers although in West Yorkshire this consists of giving them data.

In Humberside there is a formal meeting between these bodies in the form of a casualty reduction working group. This includes the Police Traffic Management Section, Road Safety Officers, AIP members and officials from Hull Royal Infirmary.
This meets monthly to discuss how to develop campaigns. For example, at a location that is about to have an engineering solution implemented the road safety section can go to the schools explaining the measure and leaflet the area, whilst the Police can enforce the area for speeding, illegal parking etc.. It is hoped that greater co-operation will improve the safety in the County.

They all provide information and discuss their proposals with traffic engineers. All have contact with the Department of Transport. HETS does this through the safety audit procedure, whilst Humberside and Highland have a more direct role as agents of the DTp. Both Humberside and Highland deal with councillors since they are the highway authority, although HETS has more contact since it has merged with Leeds City Council. Only HETS obtains information from prosecuting solicitors which can be used as additional information to assess the causes of accidents.

10.2INFORMATION TECHNOLOGY

Both Highland Region and Humberside use Autocad to assist them in the design of schemes. In Highland Region they use a package called HGV which allows the investigator to trace out the swept paths of vehicles around the junction designed in Autocad. This would be used to assess if refuges are located in the right place.

Humberside have developed a zit diagram program. This investigates the sites with accidents and certain factors associated with them. The query could specify accidents in the wet in a certain area. The algorithm does not consider the exact grid reference as to whether different accidents have occurred in the same place, since slight differences in the locational coding exist, but takes into account the density of accidents at the site as to whether a cluster exists. For each cluster a pie diagram is drawn specifying the proportion of the accidents in that cluster of the factor specified. This therefore gives an idea of the sites with the highest levels of accidents and those sites which have a high proportion of the factor examined.

Humberside are also assisting with a study into the use of a Geographic Information System which is being undertaken by a PhD student from the ITS. Information which is regularly collected and stored on computer was used, this includes, hospital, traffic flow, highway inventory and census data as well as the STATS 19 information. It is hoped to give a better picture of the safety problems in an area. HETS have looked at GIS but have found problems in obtaining the maps. They would hope to use this for the monitoring of sites and blackspot analysis.

The accident analysis package "Key Accident" was developed by staff in the accident section of Humberside County Council. This has the capability of plotting accidents and gives the user the ability to manipulate stick diagrams on screen. Highland Region have obtained a demonstration copy of this package and are currently assessing it's worth.

HETS have developed a polygon search program. A polygon is constructed by defining each point in the polygon in order. A main overriding rectangle is also defined. All points inside the rectangle are brought up and they are checked to see if they are in the polygon. This would be useful in assessing the number of accidents in certain areas.

Highland Region use AIP entry which is a standard database form for Scottish Office schemes.

10.3SPECIFIC STUDIES

All the authorities have undertaken specific studies relevant to certain topics. Humberside have undertaken research into accident rates on roads with different land use characteristics.

HETS investigated accidents to two wheeled motor vehicle users in Garforth. They also looked at "pedestrian accidents at crossing facilities 1983-1987".

The districts may ask HETS to undertake an in-depth study. Normally STATS 19 data is sufficient for this, but there are occasions where further information is required from Police files, site measurements and prosecuting solicitors files. These give a much better understanding of the underlying causes of accidents. When all the necessary accident files have been obtained, A4 cards are made up containing all STATS 19 information on one side, with room for other details abstracted from the other files. All information is recorded and any corrections made to the STATS 19 data. Current traffic flow and speed information is gathered as required, along with SCRIM readings as appropriate. The site was visited and photographed. Any remedial action recommended must address the accident pattern and an estimate of the reduction expected would be given. A detailed report is then provided to the initiator of the study.

Highland Region were concerned at the levels of accidents occurring to foreign drivers and so they investigated this in conjunction with an O-D survey of foreign drivers at four sites which were:

- Kyle single carriageway
- Mallaig single carriageway
- Melvich
- Garve

The results were:

	July % foreign drivers	% foreign accidents	
Kyle	19	33	27
Mallaig	17	70	24
Melvich	15	27	33
Garve	12	75	20

These sites were on the most used tourist routes. They found that the foreign drivers had problems keeping to the left side of the road, and so at the exits to garages and tourist sites keep left signs in different languages are posted. Also when the carriageway changes from a single track to two way, arrows are marked on the road.

When a fatal accident has occurred the accident investigation team attend the site soon afterwards to gather information about the site and the accident from the Police. If the directors are quizzed as to whether the road was to blame they have all the information there. This form contains a description of the accident, who was involved and other basic accident details, on the rear there is a plan of the accident site. A fatal summary is also filled in. This is a brief description of the fatal accidents to be given to the heads of department which include date, road number, brief description of the accident and the cause of death.

11.CONCLUSION

This study has uncovered the variation in the working practices of various safety teams. These differences reflect the political and organisational differences between the areas as well as the numbers of accidents. This information could now be used to improve the content of courses in the road safety field.

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