Tilley Award 2005

Application form

The following form must be competed in full. Failure to do so will result in disqualification from the competition.

Please send competed application forms to Tricia Perkins at patricia.perkins@homeoffice.gsi.gov.uk

All entries must be received by noon on the 29 April 2005. Entries received after that date will not be accepted under any circumstances. Any queries on the application process should be directed to Tricia Perkins on 0207 035 0262.

1. Details of application

Title of the project Automated Road Collision and Casualty Data Analysis and Reporting

Name of force/agency/CDRP: Cumbria Constabulary

Name of one contact person with position/rank (this should be one of the authors): Sgt John Forrester

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Position and rank of endorsing senior representatives(s) ACC

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Cumbria Police Headquarters
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2. Summary of application

In no more that 400 words please use this space to describe your project. Include details of the problem that was addressed a description of the initiative, the main intervention principles and what they were designed to achieve, the main outcomes of project particularly in relation to the problem, evidence was used in designing the programme and how the project is evaluated.

Objective
To rationalize the data analysis of road traffic accident data by developing a computerised analysis system to allow prompt action to be taken to reduce road casualty volume by a series of partner agencies.

Problem

Cumbria police collect Stats 19 casualty data daily and have collected and stored road collision and casualty data since 1994, this data being stored on a central computer system. The computer system used to store the data did not provide a means of data extraction or analysis. The lack of an efficient reporting system prevented the data from being used to analyse problems and determine the most frequent causation factors for road traffic accidents and directing Police and partner agencies in the reduction of collision and casualty volume. Data was exported for analysis to a contractor on an annual basis when an annual report was produced for the previous year but no other use was made of the data.

The data was not being used to provide dynamic information to drive the casualty reduction effort.

A system was required to provide timely reports using computerised analysis and reporting on demand.

Response to problem

A standard Stats 19 data profile was created within the Collision Accident Recording System (CARS) this could be used to extract common data by year, month, day and location from the sourced data. This information was saved in the form of a text document that could be imported into software applications such as excel.

A Excel template was created in co-operation with relevant partners (TMO's, County Council) that would extract all relevant information from the imported text files in the form of tables and graphs instantly. This report can be printed or saved as PDF document for easy distribution to relevant partners.

This template took a number of months to create due to the unusual characteristics of the source data and underwent a number of iterations and trials before final acceptance from partner groups. Analysis templates are now under document control to ensure stability.

Evaluation

Analysis reports from these templates are now used to provide information to the following partners to direct actions toward reducing road traffic casualties:

- Cumbria Constabulary
- Cumbria County Council & Agents
- The Highways Agency & Agents
- Cumbria Casualty Reduction Partnership
- Cumbria Road Safety Partnership

Safety Camera Unit: Reports provide three-year analysis on location and routes to aid in identifying future site s and effectiveness of existing enforcement locations.

Cumbria County Council: Annual Road Safety Statement includes reports extracted using these templates providing information in days rather than years. The cost saving in this alone more than justifies time spent in creating analysis templates, future information can be provided almost instantly.

Area Commanders: each area commander can now access monthly reports to develop casualty reduction strategy and monitor effectiveness against targets. This provides decision makers with a real-time option of assessing there casualty reduction methods.

Traffic Management Officers: Analysis trend reports can be generated quickly in order to identify specific location problems that can be resolved by either enforcement or road engineering.

Local Policing Teams. Templates provide dynamic update of reports to identify problem locations, devise strategy and assess effectiveness.

The largest indicator in the evaluation of this project is the amount of time saved in the data analysis where reports can be produced on demand in minutes rather than in a few weeks or months without the requirement for the

associated man-hours and cost.

The system has already been used to replace a contractor service required by the County Council that was used to analyse and report on data to produce the annual road safety statement. This has saved in the region of £15,000 in the first year alone with the first draft of the report being delivered 6 months ahead of schedule.

3. Description of project

Objective

To rationalise the data analysis of road traffic accident data by developing a computerised analysis system to allow prompt action to be taken to reduce road casualty volume and increase effective deployment of resources.

Specific objectives include:

1. To develop an analysis reporting system from Excel templates that report from stored road traffic accident data.
2. Provide information in the form of common reports to partners to aid casualty reduction by identifying majority causation factors, times, locations, weather conditions, etc
3. Custom reports to be made available to partner agencies at all levels
4. To provide intelligence to lead policing, highways engineering, educational and speed enforcement activity to reduce road casualty volume by way of efficient deployment of resources

The success of the project can be measured by the realisation of:

1. A computerised analysis system for the extraction and reporting of data
2. The acceptance of formatted reports by partner agencies
3. An operational working policy between partners to target casualty reduction resources via a tasking package system

The ultimate success criterion is of course the reduction of road traffic casualties that materialise as a result of operation of this system.

Problem

Cumbria Constabulary has collected and stored road collision and casualty data in accordance with Stats 19, 20 and 21 since 1994, this data being stored on a central computer system. The data can provide information, if analysed and reported, to aid in the reduction of road traffic collisions and casualties. To efficiently analyse and take action resulting from this data it is imperative that it is done in an efficient and timely manner. The volume of data and the manner in which it has been stored up to August 2004 has prevented the efficient analysis and use of the available data.

In order to reduce road collisions and casualties it is important to maximise the effect of the deployment of resources. To direct resources to have the greatest effect on the reduction of road traffic accidents and their consequences it is necessary to identify the causation factor most prevalent in the greatest number of accidents. An application of the Pareto Principle[1] or the 80/20 rules can be utilised to achieve this.

The computer system used to store the data before August 2004 did not provide a means of data extraction or analysis. The lack of an efficient reporting system prevented the data from being used to analyse problems and determine the most frequent causation factors for road traffic accidents and thus directing Police and partner agencies in the reduction of collision and casualty volume. Data was exported for analysis to a contractor on an annual basis where an annual report was produced for the County Council for inclusion in the Annual Road Safety Statement. This was the only computerised manipulation of the stored collision data, all other analysis had to be carried out manually. This extract, analysis and report was not a useful tool that could be used to direct the police resource to tackle the most prevalent accident causes. A conceptual view of the manual data analysis in existence before August 2004 is shown in figure 1.

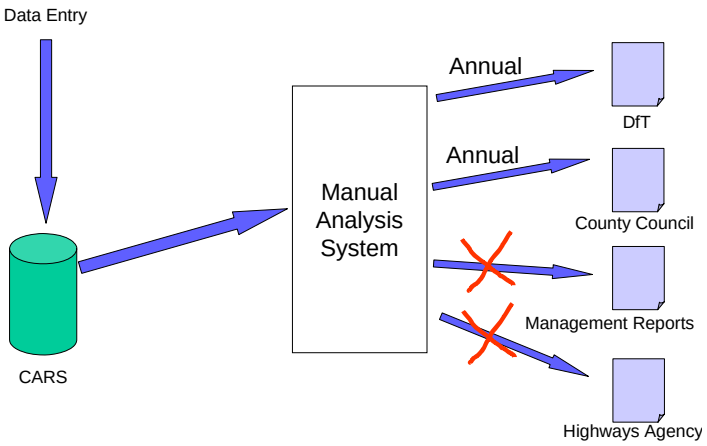

Figure 1 - Conceptual view of manual data analysis

Cumbria Constabulary collected, stored, managed and exported the data but analysis was made difficult because of the volume of data and a lack of a computerised interrogation system.

This lack of an interrogation system meant the data was not being used to provide dynamic information to drive the casualty reduction effort.

A system was required to provide timely reports using computerised analysis and reporting on demand that could direct a quick and efficient response from the Police where appropriate and supply information to partner agencies for non-Police action.

Response to problem

The Safety Camera Team, Traffic Management Officers and MSG department of Cumbria Constabulary met to discuss the requirements of a road traffic data reporting system that would provide customised reports to various departments within Cumbria Constabulary and Cumbria Safety Cameras that would suggest actions for the deployment of resources.

The Safety Camera Data Analyst and Camera Manager were skilled in the use of computer based analysis tools and proposed that they build a computerised analysis reporting template that could be used to import, analyse and report the Stats19 data stored since 1994 and all subsequent data.

The Traffic Management Officers and MSG Police developed the required reports because these personnel provided the required expertise and experience of road traffic matters. During the development of the reports it was determined that they should have the content directed to the readership at all levels within the organisation. For example, the report must be able to contain countywide data at Chief Officer level but also allow for area, LPT and even to street level of detail to enable the most appropriate data be presented to direct a suitable response.

From August 2004, a Collision Accident Recording System (CARS) was implemented to allow the mapping and export of collision data to allow further and efficient analysis. A standard Stats 19 data query was created within CARS that is used to extract a common data set from the source data. The extract data is saved in the form of a text file that is imported into computer based analysis tools created in applications such as Excel and Access.

An Excel template was created in association with partners including the Traffic Management Officer's and the County Council that would import all relevant information from the text files, store them in the form of tables and produce graphs automatically. This report can be printed or saved as a PDF document for easy distribution to relevant partners or used as a source of report elements for a template generated in Microsoft Word.

The template took a number of months to create because of the unusual characteristics of the source data; it also underwent a number of iterations and trials before final acceptance from partner groups. Analysis templates are now under document control to ensure stability.

The SQL text query that extracts the data from the CARS system has been modified to allow the analyst to filter the data to restrict it to the geographic boundary of interest to the reader of the report.

The Data Analysis System

The recognised problem was that using manual techniques didn't make the best use of automated computer systems.

The CARS system stores all road traffic collision and casualty data since 01 January 1994. The advantage of CARS is that it allows SQL queries to be used to extract filtered data for storage in a format that can be manipulated by a series of data analysis templates. Once the road traffic data is finalised it remains static in form and detail within the CARS system and any subsequent export, this allows storage of the data in a form that can be easily manipulated within common software applications such as Microsoft Excel and Access. The advantage of using these applications is that they are readily available, have a wide user base and present a no extra cost solution. The illustration in figure 2 shows a conceptual view of the system with input and outputs.

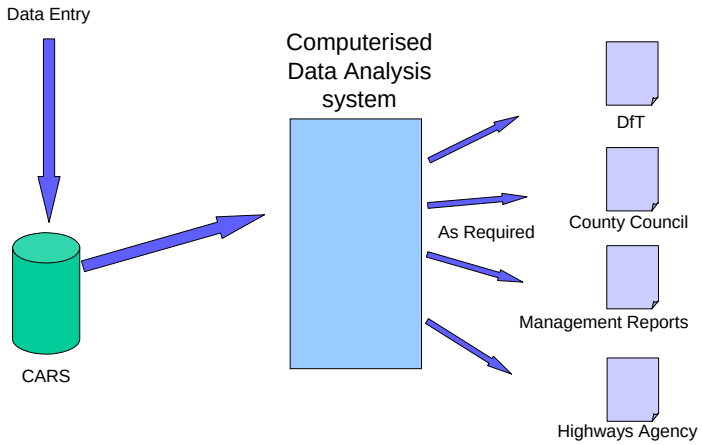

Figure 2 - Computerized analysis and reporting

The system as described is shown in a little more detail in figure 3. It can be seen that the links and the reporting can be set up as required with the same data extracts being used for many reports.

All of the green boxes are contained on the central servers within the Cumbria Constabulary IT network but are under the control of the data analyst in the Safety Camera Unit and the Traffic Management Office at Carleton Hall, Penrith.

Standard Query Language files are used to interrogate the CARS system database and store the exported data in a Microsoft Excel format. One Excel file for each calendar year is used to ensure the application is capable of storing the large export files. The data store also orders the data through the use of formulae and filters to produce specific tables and charts that will be available through links to Data Reports and Custom Reports.

The Traffic Management Officers and the Safety Camera Data Analyst operate the reports and the data extraction. The reports can be produced on request, to schedule for meetings and reports or on an ad-hoc basis.

The average reporting time has been reduced from weeks to minutes saving on both man-hours and cost while, more importantly, increasing the detail, variety and usefulness of the data analysis output. Reports can also be provided that detail accidents on a county wide, Police Command Area, per road, per Police Beat or other defined area allowing customised areas of interest to be addressed by the reader of the report.

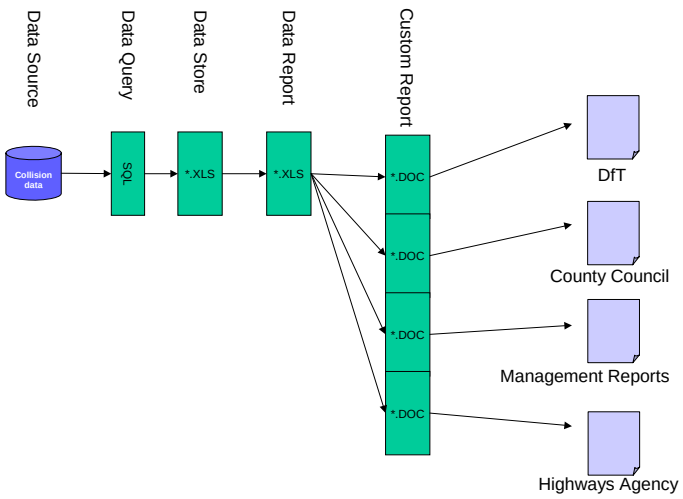

Figure 3 - Data analysis system detail

Sample Reports

To illustrate the capability and versatility of the analysis system, 2 typical data analysis reports will be shown here.

1. **Pareto Analysis of Age Range of Accident Involved Drivers Over 3 Year Period.**

To establish the age range of drivers that are contributing to 80% of the road traffic collisions in the whole of Cumbria a data extract stored in the Data Store spreadsheet is linked to the Data Report that uses the stored data to generate the Pareto Analysis chart shown in figure 4. The age ranges are sorted in descending order of their contribution to the total number of collisions in all age groups. The contribution percentage is accumulated and plotted to show where the 80% contributory age groups fall.

The red line is shown at the 80% mark to designate the age ranges of drivers contributing to 80% of the accidents in Cumbria. These are the age ranges to the left of the position where the red line crosses the accumulated percentage of accidents. The red line can be termed the Pareto line.

It is clear that drivers in the age group 16 to 50 years of age experience 80% of the accidents in Cumbria, with drivers older than 50 only experiencing 20% of the accidents.

Unfortunately, this means that 50% of the age groups shown contribute to 80% of the accidents. This does not allow a useful basis upon which to direct the assets of the accident prevention agencies. Further analysis is required.

Because the data is already extracted, stored and ordered logically further Pareto analysis automatically carried out without a great deal of further effort. An example of further analysis is shown in example 2 where one of the age groups contributing to 80% of the accidents is analysed using the Pareto principle to ascertain the causation factors that contribute to 80% of the accidents within the age group 31 to 35.

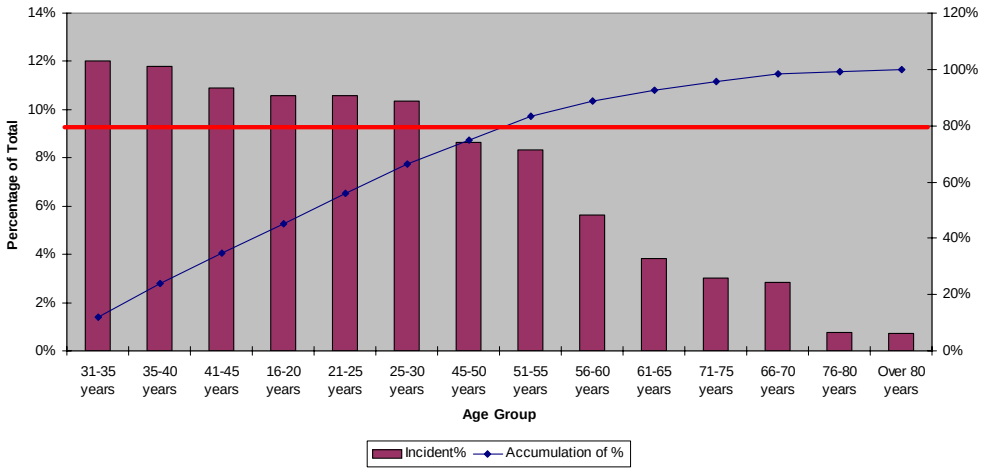

Figure 4 - Age profile Pareto chart

2. **Pareto Analysis of Contributory Factors Involving drivers in the 31 to 35 Year Age Group**

When the Pareto analysis is examined for the contributory factors of this age group it can be seen that 80% of the accidents are caused by 10 contributory factors. The “Other Factors” that contribute to 20% of the accidents number 32 factors. This means that 80% of the accidents in this age grouping is caused by approximately 20% (the actual figure is 10/42 or 23.8%) of the causation factors recorded in the CARS system.

The Pareto chart is shown in figure 5.

Now that this is known resources can be targeted efficiently to reduce accidents.

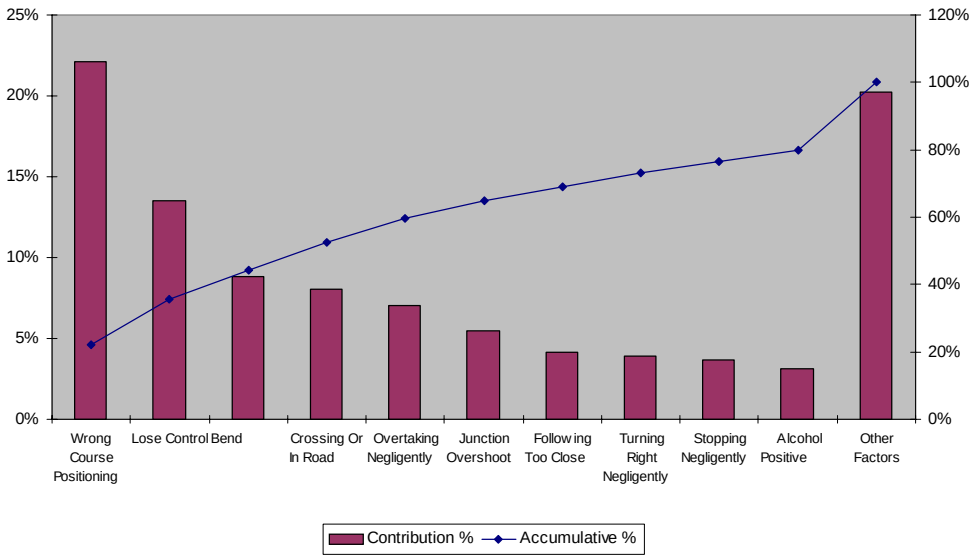

Figure 5 - Pareto Analysis of Contributory Factors

The Automated Analysis Template

The two samples shown above illustrate a very small number of the possible analysis reports that are produced automatically when data is imported from the CARS extract. There are a large number of reporting charts and tables contained in the Data Report Template of which just two are shown here. Some of the reports already contained in the system include:

- Age in years
- Age in years/gender
- Weekday/Weekend
- Day of week
- Age Range/Fixed Penalties for Speeding
- Age Range/Road Classification
- Time of day/Number of accidents
- Class of vehicle
- Collisions/month
- Contributory factors
- Contributory factors/Age grouping
- Casualty type
- All driver/casualty ages
- KSI casualty ages
- District Council casualty totals
- Vehicle type/Road type
- Weather conditions
- Surface conditions
- Lighting conditions
- Vehicle manoeuvres
- Junctions
- Alcohol related
- Key performance indicator targets
- 2-wheeled vehicle casualties

All of this information can be reported after filters have been applied to generate the report that suits the purpose of the intended reader. In this way the most appropriate actions can be taken to address casualty reduction in the most efficient and intelligence led way.

Tasking Process

To ensure a coordinated and sustained effort is applied to road casualty reduction, the Traffic Management Officers (TMO) of Cumbria Constabulary operate a Tasking Procedure that is driven by the output from the analysis system described herein. A Speed Complaints Protocol was developed by the TMO organisation during 2003 that was used to manage the process following public concern regarding speed. The process recorded the complaint, its investigation, actions and results. This procedure has been extended to include the actions following the data analysis output of the Data Analysis System. The procedure calls for action from the Police, the Safety Camera Unit, the Highways Agency, the County Council as well as the communications officers of all partner agencies. Reports are also produced for the Casualty Reduction and Safer Highways (CRASH) meetings where attendee agencies such as the Ambulance Service, the Fire & Rescue Service and parish councillors can use the data to take action as appropriate.

The process that is used to allocate resources is contained in the flow chart in figure 6 on page 11.

Evaluation

Analysis reports from these templates are now used to provide information to the following partners.

Safety camera unit: Reports provide three-year analysis on location and routes to aid in identifying future site s and effectiveness of existing enforcement locations.

Cumbria County Council: Annual Road Safety Statement includes reports extracted using these templates providing information in days rather than years. The cost saving in this alone more than justifies time spent in creating analysis templates, future information can be provided almost instantly.

Area Commanders: each area commander can now access monthly reports to develop casualty reduction strategy and monitor effectiveness against targets. This provides decision makers with a real-time option of assessing there casualty reduction methods.

Traffic Management Officers: Analysis trend reports can be generated quickly in order to identify specific location problems that can be resolved by either enforcement or road engineering.

Local Policing Teams. Templates provide dynamic update of reports to identify problem locations, devise strategy and assess effectiveness.

End

1. **The Pareto Principle**. Almost a century ago in 1906, Italian economist Vilfredo Pareto devised a mathematical formula to explain the uneven distribution of wealth among people in Switzerland. His observation was 20% of the people held 80% of the total wealth. Though the principle was initially applied to economics, it was hugely popular and successful in explaining the rationale behind other problems as well. Accident causation factors are no different. The Pareto Principle is also referred to as the 80/20 rule. Using this rule, when we analyse raw data of any problem using Pareto charts, it gives us valuable information that helps us in management decisions. The 80/20 rule is basically empirical and not absolute. The figures 20 and 80 are not important; it may sometimes be 10 and 90 or 30 and 70. We are not concerned with the exact figures as long as it helps us to identify the key factors.

Some of the scenarios in which the Pareto Principle can be used are listed below. Please note that it is not limited to the following cases.

- 80% of customer complaints are caused by 20% of our products or services
- 20% of a meeting's duration results in 80% of its value
- 20% of your products or services generates 80% of your profitability

Applying the same principle to road traffic accidents we can assume that a vital few factors cause most of the accidents. If we can correct the 20% of the causation factors that account for 80% of the accidents by directing the available resources of partner agencies to addressing the most prevalent causation than these actions will have greater probability of success.

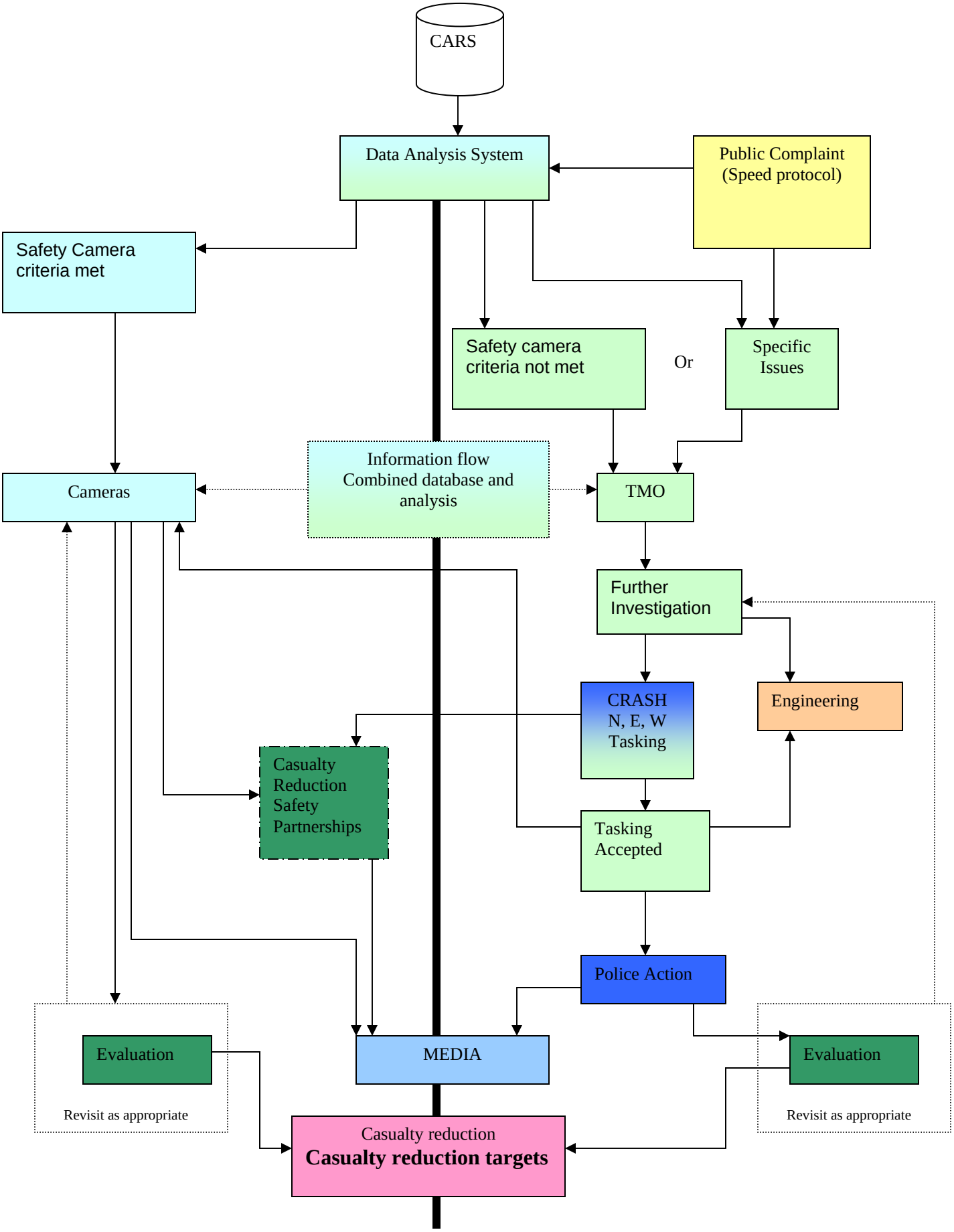

Figure 6 - Process Flow Chart