Paper 119

# USING DECISION SUPPORT SERVICES TO FIGHT CRIME

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## ABSTRACT

In 1996, a major data warehousing project was undertaken by the Information Resource Centre, Queensland Police Service. The objective of this project was to implement an infrastructure for the provision of crime related information and official Queensland Police Service statistics. This was achieved in 1997, however, access to key information was restricted to a number of specialists due to the type of skills required to interrogate the data warehouse. Senior executives received information on crime trends and summary statistics through a bimonthly publication. There was no provision of information to operational police throughout the state.

In late 1997, the Information Resource Centre undertook a strategy to enhance access to the critical information now contained within the data warehouse. A key issue was how to deliver this information to over 8000 Queensland Police Service employees throughout the state of Queensland in an efficient and timely method to support the decision making process.

The rapid development and delivery of information was key to the success of the decision support services strategy. Web technology and SAS IntrNet have been utilised to develop a suite of decision support services that allow statewide access to the data warehouse.

This paper will explore the use of web technology, the development of decision support services within Queensland Police Service and related impacts and issues.


## 1 INTRODUCTION

### *1.1 The Fitzgerald Inquiry*

In 1989 the 'Commission of Inquiry into the Possible Activities and Associated Police Conduct' (Fitzgerald Report) [1] was tabled by Mr Fitzgerald. The Fitzgerald Report focussed on a number of issues within the Queensland Police Force especially as it related to the longitudinal strategies that should be embraced in combatting crime. This Report highlighted the importance of 'Community Policing' as an operational policing philosophy for addressing crime.

Fitzgerald was also direct in his commentary on information management within the Queensland Police Force. He identified the importance of reliable and comprehensive information to a Police Department in serving the community and highlighted that operational police are profoundly dependent on information. Further, operational police would be severely limited unless they had access to timely and complete information essential to crime prevention and detection activities.

Unfortunately, as Fitzgerald identified, the provision of crime statistics was still a manual process. Information was manually extracted from hard copy crime reports rather than being generated from electronic information systems in a real time environment. The implications of this are apparent. Manual systems are slow and cumbersome. Consequently, the ability to provide timely and complete information was significantly impeded.

### *1.2 Crime Reporting Information System for Police - CRISP*

The Queensland Police Service (renamed from the Queensland Police Force) was afforded a significant opportunity and a major challenge by Fitzgerald. It was quite apparent that any policing strategy which would be embraced by the Queensland Police Service would require information. The manual systems, which had been in operation for a number of years, were no longer able to meet the demands of a modern and dynamic policing organisation in the late 20th century. It was imperative that the Queensland Police Service embark, with some urgency, to replace the manual crime recording system with a modern computerised application. The genesis of this endeavour was CRISP - Crime Reporting Information System for Police.

CRISP is an on-line transaction system which allows for the entry of all criminal offences and associated matters. CRISP replaced numerous manual systems and was complemented with changes in roles and responsibilities of staff throughout the Queensland Police Service. CRISP allowed police officers, for the first time, to obtain current information on the status of crimes and investigations. Further, it provided information critical to the decision making process within the Queensland Police Service.

# 2 INFORMATION RESOURCE CENTRE

The Queensland Police Service is a large and complex organisation "dedicated to excellence and committed to working in partnership with the people of Queensland to enhance the safety and security of our community" [2]. Law enforce-ment, especially in the area of crime, is a traditional role of any policing agency and decision making within this volatile environment is extremely complex [3].

The provision of timely and pertinent information can greatly assist police officers in strategic, tactical, and operational decision making [4] - fundamental to responding to the needs of the community they serve.

## *2.1 Role and Responsibilities*

The Information Resource Centre (Centre) is responsible for providing information services which enhance decision making within the Queensland Police Service. The Centre's evolution parallels, in many respects, the information management maturity of the Queensland Police Service.

The Centre is unique, in that it provides a decision support analyst function, information distribution services and transactional management information system specifications predominantly in the area of crime. In part, this is a legacy of the Fitzgerald Report which highlighted that "crime statistics were presented in a manner which tended to disguise the nature and extent of the crime prevention and control problem." [1] The Centre has responsibility for ensuring the integrity of the Queensland Police Service Crime Statistics Collection and the provision of 'official' crime statistics information.

The Centre has also taken a major role in defining operational management information system requirements. With the introduction of CRISP, the QSTAT module (Appendix 1: Figure 1) was deployed. QSTAT allows police officers to access, on-line, the most recent management information available on reported crime. However, this information is of a 'low order.' In statistical terms it provides 'basic descriptive statistics' of crime predominantly limited to frequency tabulations. Though this system was a major leap forward at the time, the information needs of police officers have grown. They are now demanding greater and more complex information services. In many respects this is an extremely positive outcome. However, it creates new challenges.

## *2.2 The Challenge*

The Centre is now facing more demanding clients and more aggressive information demands than it has in previous years. Clients want flexibility in the provision of information without an increase in time frames or a reduction in service. Some clients require basic descriptive statistics (mainly external clients) while others require highly complex analysis in a spatial and non-spatial environment.

In addition to QSTAT, which provides a broad range of management information, police officers have access to other intelligence and mapping based systems. However, the Centre is currently the only area within the Queensland Police Service able to provide highly specialist services across the broad spectrum of Queensland Police Service operations. The most dramatic increase for these services has been internal to the Queensland Police Service with police officers and staff members requiring more information for reviews, policy formulation and operational policing. The Centre is spending more time servicing these requirements.

Without radical changes, the Centre will not be able to satisfactorily service its clients in the future. The Centre expects information requests and the complexity of these requests to increase. Given the Centre's limited resources, it cannot continue to provide the information services demanded by its clients without technological advantage.

## *2.3 The Vision*

Incremental process improvements will not solve this problem. The Centre plans to transform its operations through technological advances. At the heart of this transformation will be a move from a 'limited access' model of information distribution to a distributed model. In addition, the new service will allow for scalable growth of the Centre's pre-existing technology infra-structure. This strategy will also draw extensively on the diverse specialist areas of the Centre.

The Centre's customer model will undergo a quantum change. The new model will enable the Centre to deliver its products and services more rapidly. Information services will be produced and distributed through the Queensland Police Service Intranet. The Centre will convert manual centralised programming routines into a dynamic interactive system accessible via any networked personal computer within the Queensland Police Service.

This service will allow clients to generate and submit their own inquiries interactively using a common user interface and access the information immediately. Clients will be able to access and interrogate information crucial to their operations

including Computer Aided Dispatch, Traffic and Crime information. This new model empowers the client and substantially reduces delivery time for products and services. Clients will obtain a broader range of information using a more efficient medium.

This strategy will also allow for the development of a new generation of products and services. For example, the Centre is developing an Exception Reporting System as part of a Decision Support Service targetting Motor Vehicle Theft, as well as providing geographic information services via the Queensland Police Service Intranet.

# 3 DECISION SUPPORT SERVICE - CRIME ANALYSIS

## *3.1 General Crime Analysis Functions*

"On the assumption of regularity of crime and similar occurrences, it is possible to tabulate these occurrences by areas within a city and thus determine the points which have the greatest danger of such crimes and what points have the least danger."

*August Vollmer*
*"The Police Beat"*
*Shortly after the turn*
*of the 20th Century*

The application of crime analysis functions to strategic, tactical and operational decision making within law enforcement agencies has been in existence for some time.

Examples of some commonly applied functions include:

- Crime Pattern Identification - to identify crime incidents which share common attributes or characteristics such as geographic location, time of occurrence, and modus operandi;
- Victimisation Profile Identification - to identify potential victimisation risk;
- Exception Reporting - to monitor crime thresholds; and
- Forecast Crime Trends - to identify trends in crime incidents.

Each of these functions assist the police officer in determining the most appropriate course of action to address any potential event. "Police officers implement, individually or in combination, crime prevention, suppression or apprehension strategies. However, crime analysis is merely a tool that supports law enforcement operations. It is not a panacea for our crime problems, but rather a means to assist law enforcement officers, in the decision making process. Regardless of the sophistication of the crime analysis function, the human element will always be required to produce the end result." [5].

## *3.2 Exception Reporting*

Exception reporting is a case in point. This function allows police officers to monitor victimisation rates within the community and quickly identify increasing or decreasing crime trends. This may result in decisions to re-prioritise resources or vary operational strategies.

A number of methodologies have been developed by the Centre to monitor overall crime trends and highlight anomalies. For example, the Centre has introduced exception reporting in a non-spatial environment, using statistical techniques such as linear regression and moving averages.

Linear regression summarises the data into a single representative equation. From this equation, 80% and 95% confidence limits can be calculated. This can then be used to highlight extreme values. Moving averages allow quick assessment of the data to identify overall increases or decreases in crime trends by smoothing out the random fluctuations in the data [6][7]. Charts 1 and 2 in Appendix 1 illustrate the application of the two statistical techniques when applied to Motor Vehicle Theft crime statistics.

One of the difficulties that must be considered in dealing with police crime statistics is that they only relate to 'reported' crime. Certain crime categories are subject to variations in complainant reporting rates and therefore can be extremely undernumerated creating further complexity in the final analysis [8]. However, Motor Vehicle Theft has an extremely high reporting rate and can be used with a relatively high degree of confidence [9]. In other crime categories it may be necessary to incorporate Crime Victimisation Survey information to complement the police crime statistics in the final analysis [10].

# 4 THE QUEENSLAND POLICE SERVICE DATA WAREHOUSE

## *4.1 Implementation*

The foundation of the Decision Support Service strategy is the Information Resource Centre Data Warehouse - CRIMS (Crime Related Information Management System). In 1996, the Centre embarked on a major data warehousing project. The objective of this project was to implement a data warehouse, utilising CRISP, in support of the provision of crime related information and official Queensland Police Service crime statistics.

This objective was achieved in 1997. However, the process re-enforced that the classical system development life cycle does not apply in the world of decision support [11]. The paradox was simple and direct:

The Decision Support Analyst mind set was:

*"Give me what I say I want (everything), then I can tell you what I really can use".*

Meanwhile, the Systems Analyst mind set was:

*"Tell me what your requirements are, then I will build it for you."*

The Decision Support Analyst operates in 'discovery' mode while the Systems Analyst operates in 'requirements' mode.

Upon implementation, access to the data warehouse was restricted to a small number of specialists within the Centre due to the skills required to interrogate the data warehouse. Senior Executives and other officers continued to receive information on crime trends and other statistics through traditional hard copy publications. There was no access to the data warehouse by any other officer within the Queensland Police Service and no alternative distribution technique for standard or specialist requests.

## *4.2 Decision Support Service Prototype*

In early 1998, the Centre embarked on the development of a prototype which underpinned the Centre's vision to radically transform its operations and concurrently increase access to information vital to the corporate decision making process. The cornerstone of this strategy was the web enablement of the Centre's products and services. This strategy provided the capacity to reach over 8000 Queensland Police Service employees throughout the state of Queensland.

Web technology and the SAS IntrNet product suite have been utilised to develop a Decision Support Service prototype which will allow statewide access to the Centre's products and services. There is little question of the benefits that can be gained from the suitable deployment of decision support information throughout the Queensland Police Service. Decision makers cannot avoid the impact such information will have on their ability to make decisions.

The prototype allows clients to:

- interrogate the Motor Vehicle Theft information by composing ad hoc queries using the web interface;
- perform temporal analysis on Motor Vehicle Theft information in a non-spatial environment; and
- view summary information including 'drill down' tables and charts (Appendix 1: Figures 2 and 3).

## *4.3 Co-ordination and Growth*

Web enablement has afforded the Queensland Police Service greater flexibility in deploying decision support and other information. The Web is fast becoming an important new channel for the provision of information services [11]. Legislation, Operational Procedures Manuals, statistical publications and many other sources of information key to the decision making process are presently available within the Queensland Police Service using this empowering technology.

By applying web technology, the development and deployment of a Decision Support Service can be centralised and co-ordinated. By combining the various specialities within the Centre, a new generation of products and services can be created and readily deployed. This centralised highly business focussed group can ensure that the Decision Support Service remains scalable and grows to meet the ever-expanding requirements of the Queensland Police Service.

This in no way prohibits input from operational police officers as the conventional understanding of the words 'centralised' and 'co-ordinated' may imply. Rather, the Centre has a contingent of five police officers who will assist in the growth of the service and provide the principal interface with operational police officers in the field. With the introduction of office administration products such as email, the traditional tyranny of distance and isolation has become obsolete. Police officers from anywhere in the State can have immediate and direct input into any process. The 'virtual' team is progressively coming to fruition within the Queensland Police Service. "In virtual teams, power comes from information, expertise, and knowledge, the new foundations of wealth" [12].

One of the greatest advantages of web architecture is equity of access for all police officers and staff members throughout Queensland. A police officer at Thursday Island has identical access to a police officer on the Gold Coast. Even the most geographically remote police officer has the same access privileges as their police officer counterparts in the more densely populated coastal regions of Queensland.

# 5 WEB MANAGEMENT

The use of the Internet over the past few years has grown at an exponential rate. Access to information technology generally, and the web in particular is pervasive. Our homes, businesses, banks, and schools have all been affected by the introduction of these new technologies. People are currently utilising web technology for home banking, purchase of products, as a medium for educational studies and in many other areas of everyday life. Thus, a client's skill set in relation to the use of web technology is also highly developed, reducing the learning curve in accessing information.

## *5.1 Intranet*

The Intranet can be defined as follows:

"the use of Internet technologies to link together the information resources of an organisation, from text to legacy databases to workflow and document management." [12]

Early uses of the Intranet involved organisations developing 'web sites' or 'Simple Intranets'. The Queensland Police Service is characterised by this model. At the outset, the Queensland Police Service established an internal Web server that published static pages of HTML text for online retrieval. This service was to become known as the 'Bulletin Board'. Though its operations were very simplistic it had a profound impact on the organisation. As an example, hard copy legislation, policy documents and procedures manuals have all been replaced by an online 'Bulletin Board' service.

The Queensland Police Service has also deployed a number of web enabled information systems. These can be characterised as the next phase of the intranet information model evolution - 'Interactive Intranets'. They enable the client to request information from a variety of back end servers - a first stage intranet information distribution model. This model, normally associated with transactional information systems, offers much greater benefits to an organisation when coupled with a data warehousing strategy.

By adapting the 'Interactive Intranet' model, the development and deployment of a decision support service can be centralised, co-ordinated and rapidly deployed. This central repository of information, interrogated using the web, provides a number of advantages. These include:

- access to a common information base regardless of geographic or departmental locations;
- low deployment and maintenance costs; and
- a single interface to access complicated applications and in some instances extremely complex information.

Further, the 'Interactive Model' coupled with the CRIMS data warehouse provides the foundations of the Centre's new Decision Support Service strategy and the first steps in the migration to a 'Distributed Intranet' and a 'Knowledge Architecture'.

## *5.2 Platform Independence*

Another major advantage of the Intranet (and web technology generally) is its platform independence. Web technology eliminates the restriction that software or applications must be developed on and for a specific platform. An application developed using web technology can be seamlessly accessed across a number of different types of workstations concurrently. For example, the Queensland Police Service Finance Division operates Intel based personal computers while operational police use Apple Computers. This, however, poses no problem when web technology is utilised as the development tool.

# 6 TECHNOLOGICAL ARCHITECTURE

## *6.1 Hardware Environment*

The foundation of the Decision Support Service strategy is the CRIMS data warehouse. The CRIMS data warehouse resides on a Hewlett Packard 9000 K Class Enterprise Server. This server, a 'K210 2 way' was chosen after substantial testing had been conducted on a much smaller platform. Two key issues in addressing the hardware requirements of the data warehouse and in turn the Decision Support Service, were scalability and redundancy. The K class servers are highly scalable, allowing the

addition of up to 4 CPUs and the addition of disks up to a total capacity of 35 Terabytes of data.

The data warehouse is populated using a nightly extract process. This process extracts all crime related data from CRISP - a VME transactional system. The CRISP data is then transferred to the data warehousing platform where it is loaded into a number of INGRES tables.

## 6.2 Motor Vehicle Theft Datamart

Following the completion of the extract, transform and load routines, SAS is used to perform tasks which summarise key elements of the data and further extract Motor Vehicle Theft data for use with the Decision Support Service. A single subject oriented SAS dataset -SVMASTER - is then updated using the data extracted in the previous process. SVMASTER is a datamart or subset of the CRIMS data warehouse, which contains data purely related to Motor Vehicle Theft. A number of lookup tables which relate directly to the Motor Vehicle Decision Support Service accompany the datamart in providing a solution that addresses the data requirements of the Decision Support Service.

Substantial benefits can be achieved by using a datamart. Since the datamart is a subset of data, it does not contain the complex relationships nor the sheer volume of information that can be seen in the data warehouse. Administration of the datamart is therefore less complex than that of the data warehouse.

If necessary, the datamart can be easily reconstructed by extracting data from the data warehouse. This is also a much less complicated process than would be required if the data were to be extracted directly from the transactional systems.

The high speed at which a query can be processed is another benefit that can be gained by utilising a single subject oriented datamart. Any interrogation of this data results in a query that only needs to traverse tens of thousands as opposed to millions of records. Further, a query that would require joining of datasets or tables in a data warehouse is simplified in the datamart scenario as there is no requirement to join tables.

## 6.3 Motor Vehicle Prototype

The Motor Vehicle Decision Support Service utilises a combination of web technology, a Common Gateway Interface (CGI), the SAS IntrNet product suite and SAS tools to deliver a powerful client driven statistical analysis and presentation tool.

To access and analyse Motor Vehicle Theft information, the client constructs a query by completing a number of HTML forms in their web browser. These forms pass information in the form of name/value pairs to a SAS session. The SAS software then processes the information and returns the results to the web browser.

The results can include HTML code, GIF and JPEG images, animation, text and any other format accepted by the web browser.

### 6.3.1 The Components

The SAS Application Server environment is used to exchange information between the web browser and a SAS session. This environment consists of a number of components, as follows.

### 6.3.2 HTML Web Pages

A number of HTML web pages form the user interface or input component of the Motor Vehicle Decision Support Service. The client completes a single page at a time and then submits the page. SAS IntrNet software is then used to generate the next page, depending on which options have been selected on the previous page.

A number of hidden fields must be included within each page submitted. These include:

- the identification for the service that is used to process the request. For example: <INPUT TYPE= "hidden" NAME= "_service" VALUE= "default"> In this example, the default service is being utilised;

- the name of the program that the Application Server should use. For example: <INPUT TYPE= "hidden" NAME="_program" VALUE=" pgweb. dispreg.sas"> In this example, pgweb is the defined program library and dispreg.sas is the program that will be used to process this request.

In addition to the above hidden fields, one or many name/value pairs or variables may be passed to the SAS Application Broker by the HTML web pages.

### 6.3.3 Application Broker

The CGI program that communicates directly with the web server is called the Application Broker and forms the second component. The Broker interprets

the information received from the HTML web pages and passes it directly to the SAS Application Server.

The service that will be used by the Application Server to process the information is determined by the Broker using a combination of the _SERVICE value pair and the Broker Configuration file.

The Broker Configuration File references the services that are available for the Application Server to use.

### 6.3.4 Application Server

The Application Server is a process that runs continuously, awaiting requests or input from the Application Broker. This server is a socket service and uses the networking protocol TCP/IP to communicate with the Application Broker. When the Application Server receives a request from the Broker, it invokes an Application Dispatcher program.

The Application Dispatcher program name is referenced in the name/value pair _PROGRAM.

The following is an excerpt from the Application Server log file:

```
Beginning to process request number 2 :
23JUN98:07:55:35
SYMBOLS=(RMTHOST=''
        RMTADDR='164.112.173.94'
        RMTUSER=''
        HTCOOK=''
        HTUA='Mozilla/4.01 (Macintosh; I; PPC)'
        HTREFER='http://ircsvr01.irc.qldpol:8001
/cgi-bin/broker?service=default&program=
pgweb.intelreg.sas&geolevel=region'
        PROGRAM='pgweb.inteldd.sas'
        SERVICE='default'
        DEBUG='2'
        GEOLEVEL='region '
        GEOAREA='South Eastern'
        X='511'
        Y='568'
        VERSION='1.0.1'
        URL='/cgi-bin/broker'
        ADMIN='Nina Du Thaler')[133]
```

This information shows:

- the hidden name/value pairs _SERVICE and _PROGRAM being passed to the Application Server;
- the name/value pairs GEOLEVEL and GEOAREA. In this example the client has selected a GEOLEVEL of “region” and a GEOAREA of “South Eastern” from the HTML web pages;
- the time and date that the Application Server received the request and began processing; and
- the IP address of the requesting machine or client. This information is referenced in the name/value pair _RMTADDR.

The Application Server now recognises that the Application Dispatcher program pgweb.inteldd. sas must be called.

### 6.3.5 Application Dispatcher Program

The Application Dispatcher program is responsible for executing the SAS program referenced in the _PROGRAM name/value pair using any other name/value pairs that have been received by the Application Server.

The Application Dispatcher program can take the form of a SAS program, a compiled SAS macro, and many other forms.

The programs used by the Application Server must be stored in a specific location. This location is the only place from which the Application Dispatcher is allowed to execute programs. This location, referred to as the program library, is defined in the srvauto.sas configuration file.

Similarly, data created and used by the Application Dispatcher programs must be referenced using a libname or filename statement in the Application Dispatcher program code. Permanently assigned libname or filename statements can be added to the permdata.sas file.

### 6.3.6 Passing Variables

Each of the variables or name/value pairs sent from the HTML web pages to the Application Dispatcher program are made available as macro variables.

These macro variables are created and the passed value assigned by the Application Dispatcher program. For a SAS program to use these values, a call must be made within the SAS program code. This can be done by either:

- calling the SYMGET function from within a SAS data step with the code: region=symget(‘region’); or
- using a direct reference such as: region=&region;

All of these values are cleared by the Application Server when the Application Dispatcher program completes.

### 6.3.7 The Results

Finally, the Application Dispatcher program produces some form of output which is then converted to HTML (using either one of the SAS HTML Formatting Tools or a data step) and passed back to the web browser.

This is done by redirecting standard output from a SAS program to the fileref _WEBOUT.

### 6.3.8 An Example

The Motor Vehicle Decision Support Service uses a combination of SAS IntrNet macros and the SAS data step to dynamically create HTML pages. The following code is used within the Motor Vehicle Decision Support Service to generate an HTML table of the results:

```
libname web
'/usr/data/sas/programs/web/lookups';
data web.tempdate;
fdate = mdy(symget('frmonth'),
symget('frday'),symget('fryear'));
tdate = mdy(symget('tomonth'),
symget('today'),symget('toyear'));
run;

proc SQL;
create table web.test1 as
Select &dispvari, &geolevel,
       loc_desc, count(cor_key) as total
From web.svmaster as S, web.ludates as D,
web.ludiv2 as V,web.tempdate as T,
web.lulocs as L
Where T.fdate <= S.repdate <= T.tdate
  and T.fdate <= D.day2 <= T.tdate
  and D.day2 = S.repdate
  and S.occurdiv = V.crcode
  and &geolevel = symget('geoarea')
  and L.locnum = symget('location')
  and L.loctype = S.stolocty
  and D.datetype = symget('dispvari')
 group by &dispvari, &geolevel, loc_desc
 order by &dispvari, &geolevel, loc_desc;
 quit;

data _null_;
   file _webout;
    set web.test1 end=last;
    if _n_=1 then do;
     put 'Content-type: text/html';
     put ;
     put '<HTML><HEAD> ';
     put '<TITLE>Motor Vehicles-DSS-Operational
Data Stolen Vehicles </TITLE>';
     put '</HEAD>';
     put '<BODY BGCOLOR="#ffffff"
TEXT="#0830de"';
put'BACKGROUND="/sas/crimsp2/images/headfoot/
backgrou.gif">';
     put '<BLOCKQUOTE>';
     put '<P><TABLE WIDTH="624" HEIGHT="137"
BORDER="0" CELLSPACING="2"';
     put 'CELLPADDING="0">';
     put '<TR>';
     put '<TD WIDTH="11%" HEIGHT="132"> ';
     put '<IMG SRC="/sas/crimsp2/images/
headfoot/ircicon1.gif"  WIDTH="53"';
     put 'HEIGHT="115" ALIGN="BOTTOM"
NATURALSIZEFLAG="3"></TD>';
     put '<TD WIDTH="89%" VALIGN="TOP"
ALIGN="CENTER"><P>';
     put '<IMG SRC="/sas/crimsp2/images
/headfoot /irctitle.gif"  WIDTH="481"
HEIGHT="36"';
     put 'ALIGN="BOTTOM" NATURALSIZEFLAG=
"3"></P>';
     put '<P><BR>';
     put '<IMG SRC="/sas/crimsp2/images
/headfoot/operhdr.gif"';
     put 'WIDTH="413" HEIGHT="49" ALIGN="BOTTOM"
NATURALSIZEFLAG= "3"></TD></TR>';
     put '</TABLE>';
end;
 %ds2htm (data=web.test1,
         runmode=s,
         htmlfref=_WEBOUT,
         bgtype=image,
         bg=/sas/crimsp2/images/headfoot
/backgrou.gif,
         clbgcolr=#51005F,
         clcolor=white,
         talign=center,
         tbbgcolr=white,
         vbgcolr=white,
         ccolor=blue
         caption=TITLE);
```

The example code illustrates the use of the libname statement, the use of the SAS PROC SQL procedure that selects information from the datamart SVMASTER, creates a new SAS dataset called web.test1, uses a SAS datastep to compose a HTML header including graphic images and finally converts the dataset web.test1 to HTML. The converted dataset along with the HTML header are output to _WEBOUT which results in the output being displayed using the client's web browser.

## 6.4 Human Computer Interaction

One of the deficiencies of the Motor Vehicle Decision Support Service prototype is that it requires the client to step through a number of web pages, making choices on each page, and then finally submitting the request. Once the client has submitted the request it is very difficult to change one parameter without reselecting all of the previous parameters. This is a prominent pitfall of a 'Simple Intranet' model especially when an attempt is made to adapt the model to fit the need for more complex information delivery services.

"In general, the more complicated or complex the information, the more objects in the data repository, the more operations and options a system contains - i.e., the more functionality a system provides: the more buttons, menus, icons, text fields, etc. have to be presented to the user interface. An effective interface that has the system functionality and data only "one mouse-click away" tends to have a rather cluttered look. For experienced users this may not be a problem but the most efficient way to invoke functionality. For other users this may not invoke functionality (e.g., eliminating those features which are of no relevance to them means achieving a simpler interface) and thus may eventually improve their efficiency in using the system. In other words: effectively it may be efficient for some user groups while it may not be efficient for others." [14]

With these observations in mind, a 'Control Panel' web interface prototype has been developed which attempts to balance these competing issues (Appendix 1: Figure 4). This interface allows the client to select parameters in any order, change one or more variables, and resubmit the query. However, our long term strategy is to develop a user interface that can be 'tailored' by our clients using the Web environment. This interface will allow clients to match their user interface to their skills and work requirements.

# 7 CONCLUSION

The Centre has drawn upon its previous scalable investments to create an environment for transforming its business. What has been a manual, labour intensive, limited access business will become a fully corporate Decision Support Service. This Service will combine the Centre's data warehouse and specialist skills in statistics, geographic information, expert systems and web management to create substantial new products and services.

The new Decision Support Service will radically enhance the decision making process within the Queensland Police Service. Although web enablement is an extremely important component of this strategy, the process of organisational change will not come from within the Intranet. Rather, it will revolve around the police officers themselves who will change the way in which they make decisions, develop policing strategies and share information. The true power of the 21st century will be shared knowledge - the Intranet will be the cornerstone of this new vision.

# 8 ACKNOWLEDGEMENTS

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# 9 DISCLAIMER

The comments and views expressed in this paper by the authors may not necessarily reflect those of the Queensland Police Service.

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# APPENDIX 1: FIGURES AND CHARTS

## Figure 1
## QSTAT Enquiry Screen Output

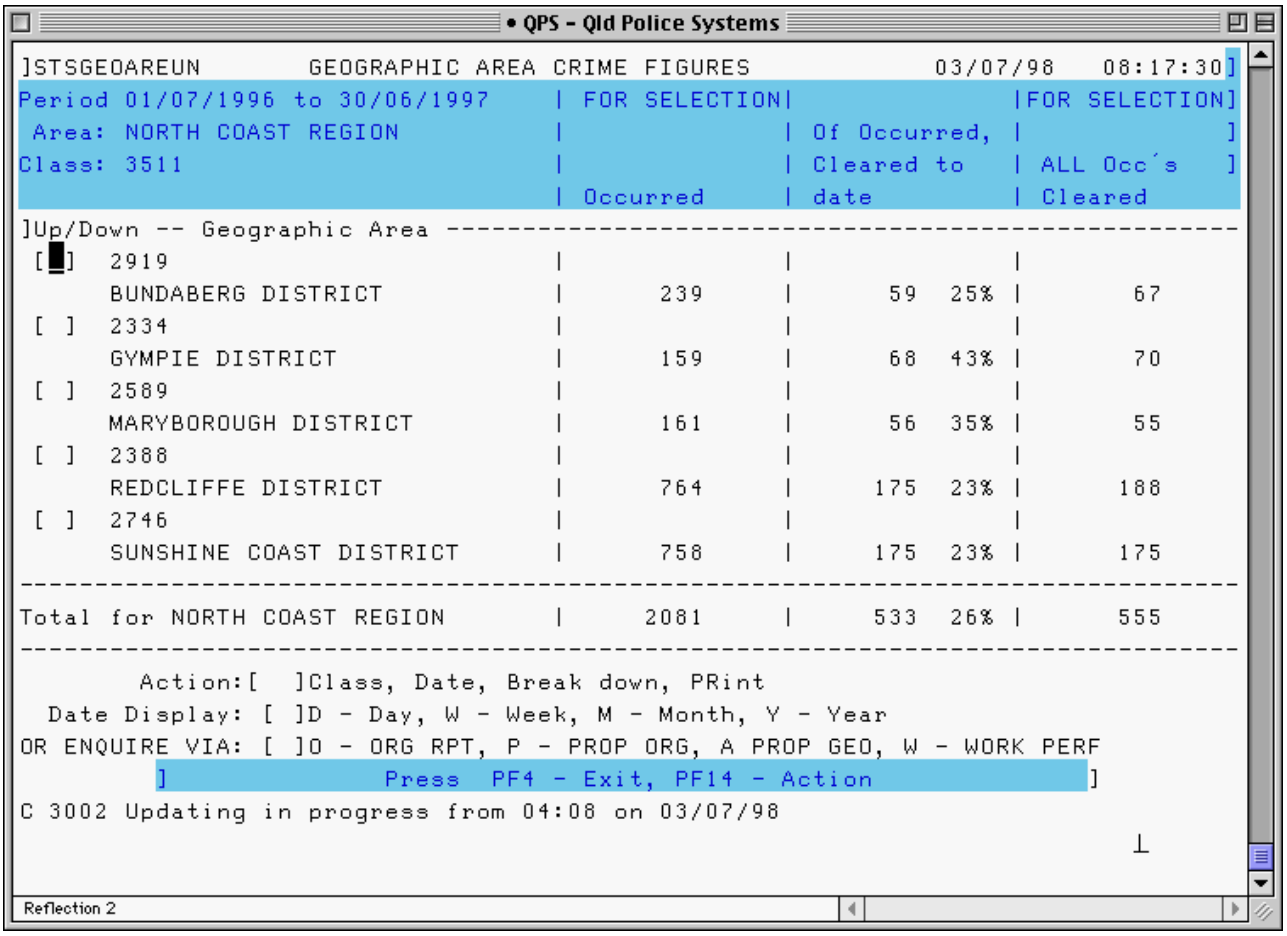
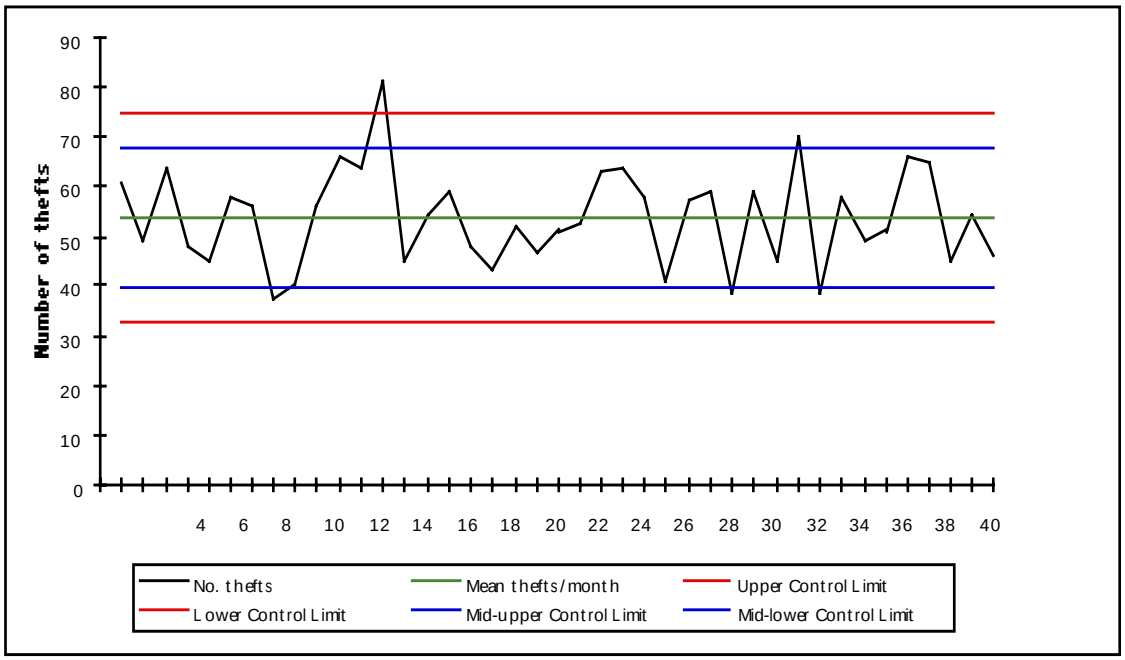
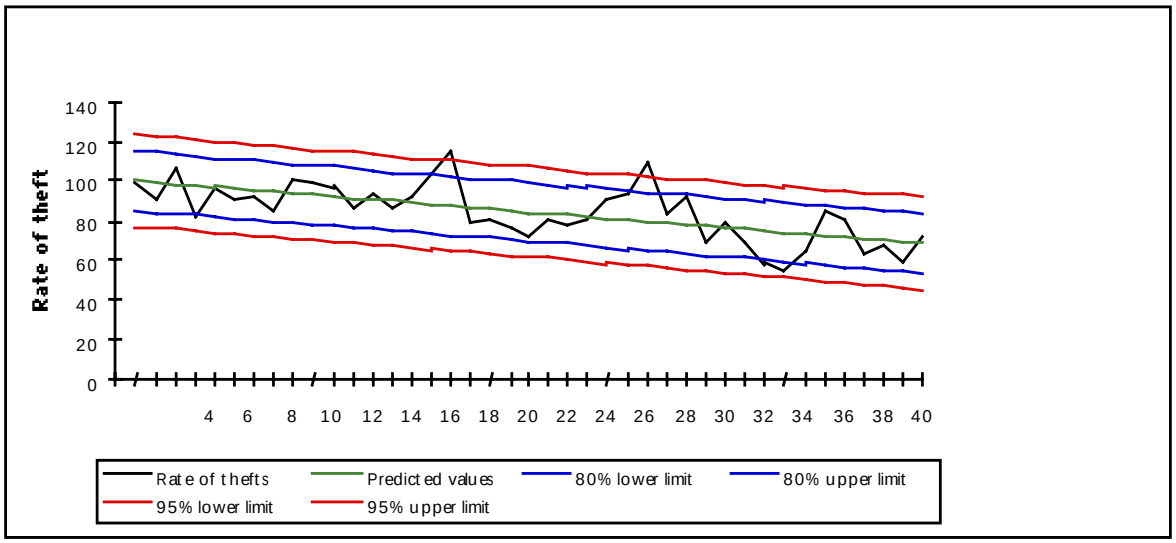


**Chart 1**
**Control Chart Methods Using Motor Vehicle Thefts In Central Region**
Number of Motor Vehicle Thefts (y) by Month (x**)**




Example of the use of Exception Reporting - Control Chart Methodology using Motor Vehicle Theft crime statistics from Central Region. The Time Series itself is stable with no underlying decreasing or increasing trend so Control Charts work well here. Month 13 on the x axis is highlighted as an 'exception' point, we are interested in the last point (representing figures for May, 1998) which is in normal range.

**Chart 2**
**Regression Method Using Motor Vehicle Theft in Southern Eastern Region**
Rate of Motor Vehicle Thefts per 100,000 Population (y) by Month (x**)**




Example of the use of Exception Reporting - Linear Regression Methodology using Motor Vehicle Theft crime statistics from South Eastern Region. There is an underlying decreasing trend evident which the regression method takes into account when confidence limits are plotted. Months 15 and 27 are highlighted as 'exception' points, we are interested in the last point (representing figures for May, 1998) which is in normal range.

**Figure 2**
**Example of Screen Display for Summary Data Option Selection**

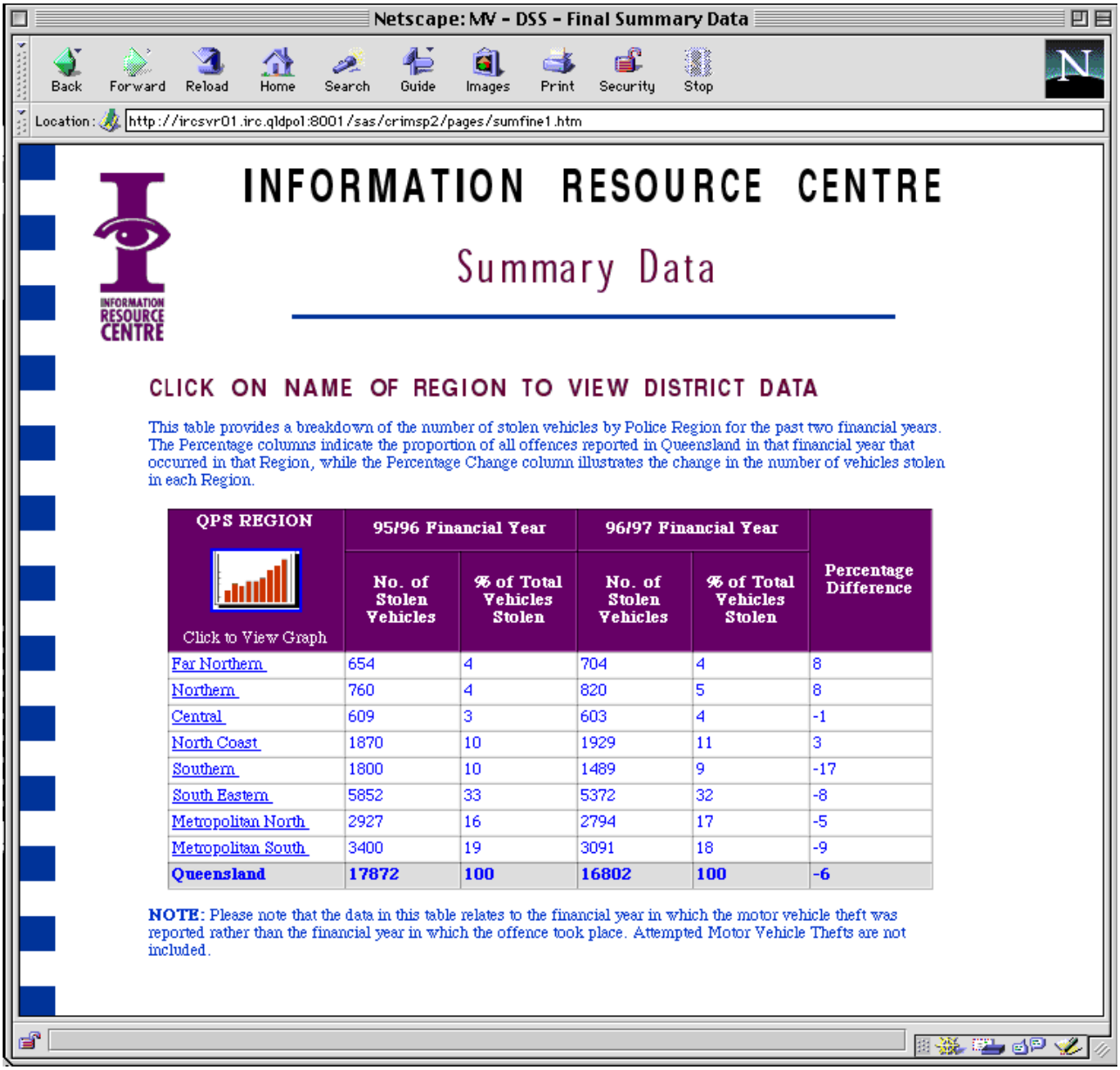
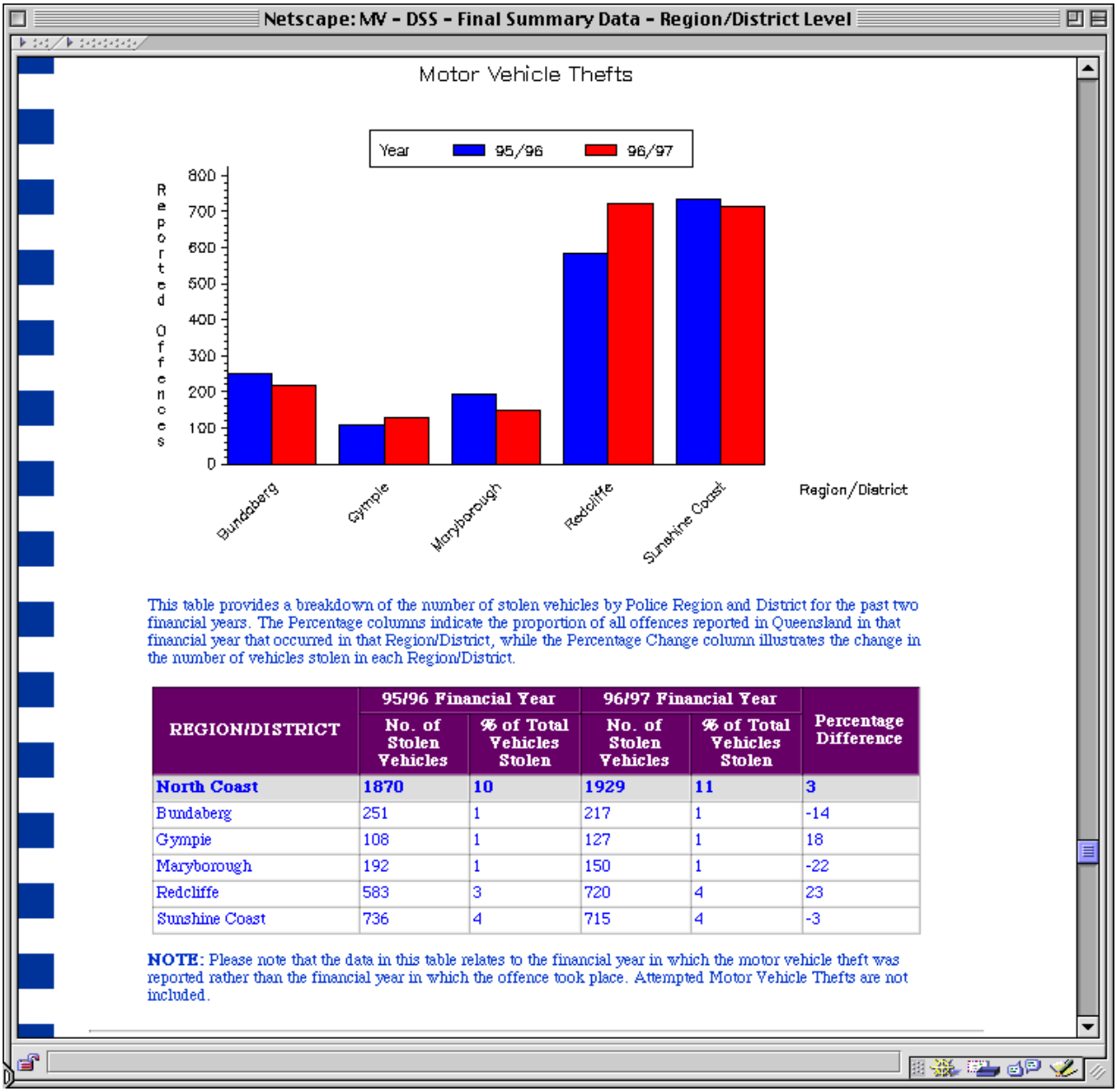


**Figure 3**
**Example of Screen Display for Summary Data Option Selection**
**'Drill Down' - North Coast Region Selection**

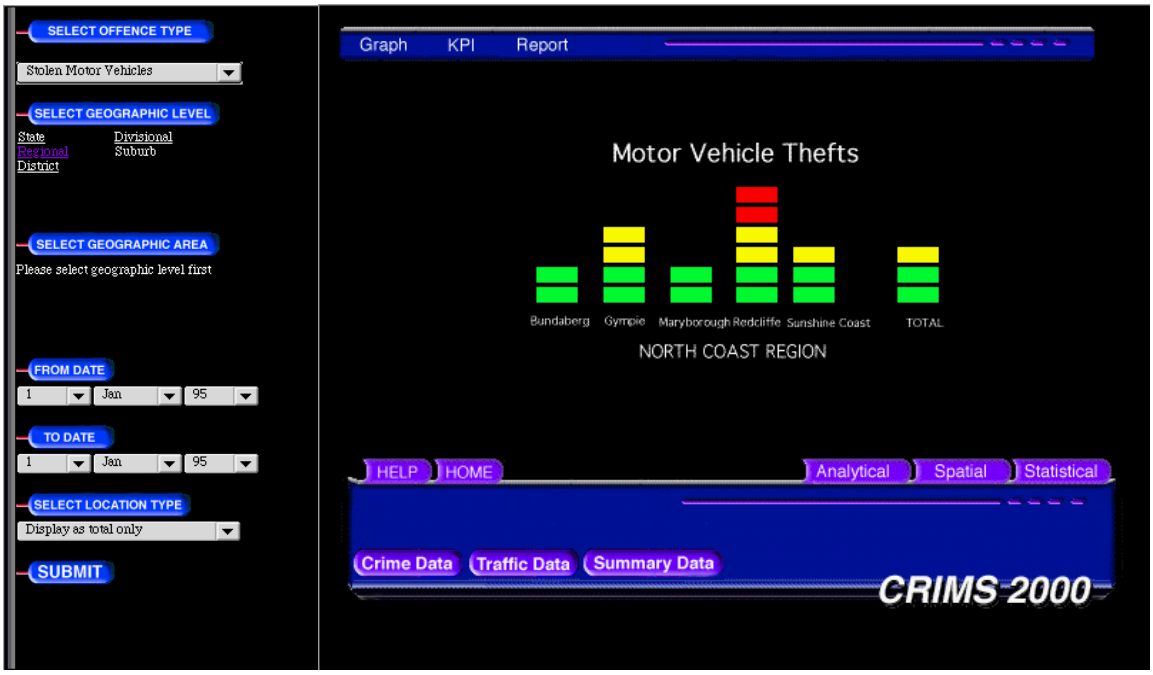



This table provides a breakdown of the number of stolen vehicles by Police Region and District for the past two financial years. The Percentage columns indicate the proportion of all offences reported in Queensland in that financial year that occurred in that Region/District, while the Percentage Change column illustrates the change in the number of vehicles stolen in each Region/District.

| REGION/DISTRICT | 95/96 Financial Year | | 96/97 Financial Year | | Percentage Difference |
|---|---|---|---|---|---|
| | No. of Stolen Vehicles | % of Total Vehicles Stolen | No. of Stolen Vehicles | % of Total Vehicles Stolen | |
| **North Coast** | **1870** | **10** | **1929** | **11** | **3** |
| Bundaberg | 251 | 1 | 217 | 1 | -14 |
| Gympie | 108 | 1 | 127 | 1 | 18 |
| Maryborough | 192 | 1 | 150 | 1 | -22 |
| Redcliffe | 583 | 3 | 720 | 4 | 23 |
| Sunshine Coast | 736 | 4 | 715 | 4 | -3 |

**NOTE:** Please note that the data in this table relates to the financial year in which the motor vehicle theft was reported rather than the financial year in which the offence took place. Attempted Motor Vehicle Thefts are not included.

**Figure 4**
**'Control Panel' Prototype**




The 'Control Panel' will allow for a single point of access to a broad range of information services. In this illustration, the Exception Reporting output has been adapted to create a simple Key Performance Indicator (KPI) panel. Police officers will be able to quickly identify if there is a statistically significant event occurring. If they choose, they can view the actual Exception Reporting - Control Chart by selecting 'Analytical' which would display a range of options including the Exception Reporting - Control Chart.