RTIG

UK Real Time Information Group

Analysis of Bus RTI Data: Current Practice and Issues

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1 Introduction

1.1 About this document

1.1.1 This document has been produced for the Real Time Information Group (RTIG) by Centaur Consulting Limited (Centaur). It is one of the deliverables to be completed under RTIG Government Task 1.2: Evaluation of Implementations.

1.1.2 With support from the Department for Transport, the Welsh Assembly Government and the Scottish Executive, RTIG conducts case study reviews into areas of importance to Members and Affiliates. This paper addresses the issue of the operational value of the data gathered by real time information (RTI) systems, not for current management of services, but for strategic management.

1.1.3 This document covers:

- the rationale for undertaking data analysis, and the potential benefits and constraints;
- the current practice in data analysis within both local authorities and bus operators;
- the nature of the data which is analysed, particularly where there is a reliance on external data;
- the trends which have become apparent during discussions and the issues which arose.

1.1.4 This review is based on discussions with a number of authorities and bus operators, to capture the range of practices and experiences. Discussions were focussed on a written Brief (recapped as Annex A) and the validated interview notes, which summarise the local practices underlying the main text, are presented as annexes B-G.

1.2 Document status

1.2.1 This document is a **draft for review** by the clients (RTIG and DfT).

2 The purpose of RTI data analysis

2.1 Introduction

2.1.1 RTI is becoming widespread around the UK, primarily as a tool to:

- provide passengers and potential passengers with better information about the current running of the services;
- provide bus controllers and service managers the opportunity to monitor the actual running of services, to enable them to take tactical decisions and guide drivers.

2.1.2 These functions use RTI as it is generated and do not require any long term records to be kept. However, it is also recognised that the data records potentially provide a valuable resource for the *strategic* management of bus services, both by the operator and by the local authority that is responsible for the roads network[1].

2.2 How might data analysis help?

2.2.1 Data analysis is only of value if it contributes materially to providing a better, cheaper or more reliable overall bus service. Some of the key potential analyses here are as follows.

Achieving service targets

2.2.2 Local authorities are committed to ensuring that passengers receive a dependable service and may seek agreements with operators for service targets which operators must meet. The Traffic Commissioner can monitor reliability and set targets for schedule adherence. Failure to meet these targets can result in financial sanctions such as deductions from Fuel Duty Rebate payments and, in extreme circumstances, an operator can be disqualified from running local bus services.

2.2.3 First and foremost, a record of real time vehicle location allows a statistical comparison of how far a bus is from schedule – at a location, by time of day, seasonally, etc. This may be driven by internal reasons (e.g. to reward good performance by staff) or for external reasons (e.g. to report to Traffic Commissioners). Where there is a contractual service target for reliability, the robustness of this analysis will be critical.

Schedule development

2.2.4 If bus running is consistently at odds with the schedule in particular ways, a potential resolution is to adjust the schedule to be more realistic. For this type of analysis the variability of running needs to be known as well as the actual levels of current schedule adherence.

2.2.5 Schedule development needs to take into account many changes, for example network changes or temporary roadworks. The availability of an RTI record could assist in tuning schedules faster than would otherwise be possible.

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[1] This is reflected in the "Hypotheses" of the value of RTI as presented in RTIG's guidance note for evaluations (RTIGT003-1.1, January 2003).

Route development

2.2.6 A reliable schedule does not itself make for an effective service. A commercial bus service needs to carry enough paying passengers to justify itself commercially. If data is available on boarding and alighting, it will be possible for operators to assess not only what their most profitable routes are but what their most profitable route segments are.

2.2.7 Real time data would also allow potential full buses to be spotted early and appropriate controller action taken.

2.2.8 More strategically this could lead to a re-evaluation of services offered, with routes split or combined to provide a more efficient and profitable service (ie higher average seat occupancy).

Incident management

2.2.9 If schedules are fairly well aligned with actual running under normal conditions, the same may not be the case when an incident arises. Incidents might include known events (eg sports fixtures) but might also include unplanned events such as road accidents or even bus breakdown. If real time information is available incidents might be spotted earlier, and better tactical decisions taken by controllers about how to respond.

2.2.10 This might be of use to the local authority as road network manager as well as to the operator in terms of improved service efficiency, allowing re-routing, timely passenger information (especially to affected stops), etc.

Congestion management

2.2.11 Even with an actual incident, service operate differently when the network is congested than when it is free running. The local authority may have sophisticated systems to manage congestion but these do not take particular account of buses (although bus priority may be granted when a bus asks for it at a particular junction).

2.2.12 There is potentially information in bus RTI that might help with this, either actively (ie allowing a traffic control system to prepare for priority along a whole corridor rather than waiting for a trigger) or reactively (for instance by monitoring the improvement in service time or schedule adherence after a priority system has been installed). Such data might allow the local authority to tune the traffic control system to manage congestion better.

Management of contracted services by local authorities

2.2.13 RTI records could be used to verify that services contracted by local authorities from operators have been provided in accordance with the specification. This could replace manual analysis and provide more timely and accurate information.

2.3 Data available for analysis

2.3.1 The potential analyses outlined above call upon a number of different types of data.

Recorded RTI data

2.3.2 The core data provided by an RTI system is the location of an identified vehicle, tracked over time. Records of this already represent a substantial and multi-dimensional database.

2.3.3 Added to this might be logs of other system activity, eg when the driver or controller have initiated voice calls, when the panic alarm is activated, when signal priority has been requested and/or granted, etc.

Data from other operator systems

2.3.4 Some information is not available within the RTI system itself and would need to be imported from other systems operated by the bus operator, either in real time or (provided it can be time-matched) in bulk later on. This might include ETM data for patronage data, engine management data for vehicle diagnostics, etc.

Data from other organisations

2.3.5 Not all data will be available within the operator's own systems, and some will need to be imported from other organisations. This raises potentially significant issues around data ownership, access and confidentiality.

2.3.6 Externally sourced data comes under the following categories:

- Base data, which is likely to be available nationally (eg NaPTAN reference data or basic geographical data);
- Data related to the road network (eg current congestion maps);
- Data related to other bus services (eg other operating companies in the same group);
- Commercial data services.

3 Current practice: what analyses are done?

3.1 Overview

3.1.1 This section reviews the current practice in how bus RTI is analysed, based on the discussions with the local authorities and bus operators interviewed.

3.1.2 As Section 2 discussed, the potential benefit to local authorities and to bus operators is quite distinct. Accordingly, most of the statements in this section are relevant to one or other of these main stakeholder groups.

Achieving service targets – operational

3.1.3 Data analysis is particularly useful to local authorities to test that RTI systems are functioning correctly, thereby ensuring the dependability of the system for passengers. This is one of the primary reasons for analysis among authorities.

3.1.4 Some bus companies use passenger number data in conjunction with systems which permit buses with higher passenger numbers to have priority at traffic light junctions. This ensures that the greatest number of passengers reach their destination on time. This is not yet in wide use.

3.1.5 Data analysis by operators can also help exonerate them from blame for poor performance, by identifying external factors that have affected the service. Conversely, authorities analysing schedule adherence can identify issues that can be raised with the respective operators.

3.1.6 Engine diagnostic data is not widely collected, though some trials are taking place to capture engine performance. This would allow operators to track the health and efficiency of the engine. Repairs would be made more quickly as parts could be ordered in advance of a breakdown and fuel consumption could be tracked to ensure that buses are run as efficiently as possible.

3.1.7 Additionally, TfL do 'lost mileage' analyses using RTI data. This is the result of buses curtailing their journeys as a result of congestion to ensure that a service runs on time in the opposite direction.

3.1.8 A number of respondents emphasised that there is a distinction between operational management and regulatory control. Traffic Commissioners do not have the rights to view data analyses and there are no agreements in place to allow them to receive such information. It was stated that it is in neither operator nor authority's interests that they do so.

Achieving service targets – commercial

3.1.9 No bus operator wants to have too many buses on a route or have them sitting for long periods of time because the schedule has too much slack. Performance measurement of buses (planned vs actual journey times) is therefore one of the main reasons for RTI analysis. This is important for reasons such as performance related pay contracts and operating licences. Bus operators wish to know that their services are generating revenue at the best possible investment. Post-event analysis is used to assess a route's profitability.

Service and schedule development

3.1.10 Bus operators use their schedule adherence analyses to adjust and develop schedules and routes for the future.

3.1.11 Schedule development is routinely carried out, using data from running time analyses and comparing results with operators' schedules, allowing the development of new running times, stand times and "dead routes" (routes that buses take from the completion of one route to the start of a different route).

3.1.12 Route development is also carried out with assistance from these analyses, ensuring that safety and variability is incorporated (e.g. breaks for bus drivers between shifts), and monitoring the impacts of new road schemes that have been put in place (e.g. the effects of a new bus lane on bus times). The planning of routes using current data can be quite difficult, as the current data does not cover the new routes.

3.1.13 Where patronage data is collected, it is extracted from ticket machines by operators to measure the number of tickets sold. However, the granularity of the data is not sufficiently fine to allow for journey times, journey lengths, or passenger density. A trial is currently being carried out which counts passenger numbers in real-time. This is then compared with ticket machine data post-event.

3.1.14 Patronage data does not get recorded by real time systems in authorities. This data is perceived as commercial and therefore of no direct interest to authorities.

Incident and congestion management

3.1.15 The use of RTI for congestion management does not yet appear to be mature, outside of (tactical) traffic signal priority. Nevertheless there are a number of places where this is beginning to happen.

3.1.16 Pre-planned route scheduling is carried out to cater for major events, such as football matches or carnivals. Live data analysis is carried out in some areas of the country for the control of incidents or congestion, including conveying messages to passengers about delayed or cancelled services by sending information to RTI signage at bus stops.

3.1.17 Post-analysis of a new road scheme's impact on safety and variability is also monitored through RTI data analysis.

3.1.18 Management of buses in response to congestion is currently only carried out to effect in London: TfL will analyse running time data, and, if buses are caught up in congestion on their route, they can be requested to shorten their route and return, to ensure a steady flow of buses occurs in both directions of a route. Lost mileage reports are created as a result, which are analysed post-event. Delays and detour/journey lengths are also analysed by several authorities.

3.1.19 If a bus diverts off its route due to an incident, the operator can ensure that it follows a suitable route and does not encounter hazards such as low bridges, narrow roads, weight-limited bridges, etc. Locating buses can be carried out through analysis of RTI data, for instance, in London during a police "Code Red" emergency situation.

Analysis for reporting or publicity

3.1.20 Even where base data is not shared, much analysis is done with an external party in mind. Bus operators will share analyses with local authorities for issues such as operation management and service planning. TfL Buses will also share analyses with other TfL departments, e.g. TfL Street Management to assist street design planning and bus priority system management.

3.1.21 At the moment, local authority websites can only publish static timetable information. However, they would like to display some of the RTI system's results on their websites in the future. This, however, will require different data sharing agreements with operators before it could be implemented, and may require difficult negotiations with operators to convince them of the value of such an agreement.

3.1.22 TfL sometimes receives ad hoc requests for information from universities (information for projects and theses) and external requests made under the Freedom of Information Act.

3.1.23 The output of data analyses is used to promote bus services in literature and press releases, by both operators and local authorities.

3.2 Plans for future analysis

3.2.1 Currently, data analyses for service targets are carried out post-event, although there are plans in some areas for this to be monitored in real time in the future (iBus in the TfL region, for example, will allow real-time analysis and operators will be encouraged by TfL to make the most of the new technology).

3.2.2 TfL have cited the following as examples of new reports that they will be carrying out using their new iBus system:

- bunching analysis;
- corridor analysis;
- performance of bus priority junctions;
- layover time analysis.

3.2.3 Plans are in place by some operators to measure patronage numbers to determine passenger trends.

3.2.4 Analysing engine diagnostics information is being developed by bus operators. This will allow operators to analyse wear and tear on the bus so that they can anticipate service and repairs. They will also be able to determine if the bus is being driven economically and efficiently.

3.2.5 Future analysis of RTI data will be carried out for post-event schedule monitoring and revision. One operator has had difficulties in relying on different data inputs and plans in the future to work with TransXChange-formatted data from each of its systems.

3.2.6 Both local authorities and operators archive their data for future use. They do not always know to what uses this data will be put, but deem it prudent to ensure that it is not lost. Others have collated several years' data, but have not got the resources to analyse it in great detail.

3.3 Summary

3.3.1 Real time data is used primarily for schedule adherence analysis. This allows the local authority or bus operator to compare actual bus times with planned or expected times over a given route or over time. For instance, a bus may regularly fail to meet its schedule at a particular time of day or between a particular set of stops.

3.3.2 Trend analyses using historical, archived real time data are also carried out patchily both by operators and by authorities. Operators use trend analysis to check profitability over time while local authorities are more interested in the historical record for their Annual Reports. There are some plans to do more in the future as RTI systems become more bedded in and sufficient data has accumulated to make it possible.

3.3.3 Location information is widely collected in real time and this information is used by both local authorities and operators for congestion and incident management. Patronage data is not collected in real time; operators undertake commercial analyses based on ticket machine records, and local authorities have little interest in this.

4 Current practice: how analyses are done

4.1 Tools

4.1.1 There is a strong national and international supplier marketplace for RTI systems which incorporate analysis tools. This offers local authorities a wide range of analysis systems to choose from, allowing competitive tendering bids and advances in technology. As a result, the majority of data analyses are carried out using the RTI system.

4.1.2 Both operators and local authorities also use other data analysis tools to compare data from different regions and as a management tool. Many of these are based on spreadsheets, mainly MS Excel™.

4.1.3 Other software, such as performance monitoring and planning software, is used. Example software brands and specialist software houses include: Marquis, Trapeze and Lotus 123 spreadsheets, and MS Access in one PTE, using TransXChange data and SQL commands.

4.1.4 There is a keenness to develop a tool that allows them to extract historical data in a standard format. This would allow them to plan, as well as to understand the current Company-wide situation.

4.2 Frequency of analysis

4.2.1 The frequency with which data analyses are carried out depends on what it is for and by whom it is done. Some reports are done by a local authority or bus operator for their own information. Other reports are done in support of the contracts in place between them. Reporting methods and frequency vary depending on the relationships between authorities and their bus operators: where there is a performance partnership in place, reporting is carried out on a more frequent basis.

4.2.2 Some performance indicator analyses are carried out by authorities on a daily and a weekly basis. These reports are carried out as a result of complaints, route development, production of planned reports, etc.

4.2.3 Operators' management reports are performed on a weekly or monthly basis, the results of which are studied and issues acted upon.

4.2.4 When authorities produce data analysis for regular contract meetings between themselves and the operator, the frequency will depend on the contract particulars. Reporting periods vary between contracts, from monthly to quarterly meetings.

4.2.5 Authorities also use data analysis for annual reports or ad hoc requests from bus operators who wish to review their schedules and compare their authority's data with their own systems.

4.3 Where data is required from external organisations

4.3.1 Authorities receive running board, timetable and configuration information from bus operators. They can also receive traffic light priority configuration files which some RTI systems can use to create route prediction reports.

4.3.2 Local authorities point out that some data is not useful to them, precisely because of its commercial nature. Local Authorities do not perceive patronage information (even were it available in real time) as useful for their analyses because they are not interested in the commercial aspects of bus operation.

4.3.3 LAs provide operators with NaPTAN data (used for bus stop data, SMS codes and information for websites) and mapping data (from Ordnance Survey or Bartholomew) for entering into their RTI systems to locate buses and bus stops.

4.3.4 Operators share summarised versions of their reports to PTEs as part of quality bus partnership agreements. Occasionally, data will be shared with LAs to highlight a poor service, allowing the LA and operator to work together to improve performance.

4.3.5 Where routes cross boundaries between authorities, RTI data is shared between adjacent authorities for LTP purposes. This requires consent from the operator, according to the data sharing agreement.

4.3.6 TfL Buses release data to various internal and external parties, such as students doing research projects; other TfL departments, such as TfL Street Management; bus operators and ad hoc external requests under the Freedom of Information Act.

5 Issues with data analysis

5.1 Data ownership issues

5.1.1 An organisation can only analyse data it can get access to, and in some cases this means from other organisations.

5.1.2 Bus operators own the RTI data collected from the systems, and limit what data they release to Local Authorities. Routine exchange is normally governed by a Data Sharing Agreement. Additionally, RTI data may be shared with a local authority to get funding or subsidy for a route.

5.1.3 The release of some types of data (e.g. running board information) can be commercially damaging to an operator. Although operators are content to share data where it can be used to resolve issues of mutual interest, they are reluctant to share data which may jeopardise their commercial interests.

5.1.4 TfL Buses, uniquely in this study, is an authority body that owns the RTI data and uses analyses to manage both their RTI systems and performance related payments to their bus operators. For this reason, and because of their size, TfL's use of data analysis is the richest in the country.

5.2 Data issues

Consistency and accuracy

5.2.1 To undertake a meaningful analysis, it is necessary to ensure that the relevant data is accurate and consistent. This is not always possible, particularly in the context of large scale or trend analysis:

- because operators tend to use a wide range of RTI systems, they will have data from a number of different systems. Not all systems allow data exporting, which makes it difficult to collate the data to gain a Company-wide perspective from the collation of archive data.
- historical data may not always be reliable, since road and route layouts may have changed over a period of time. This means that direct data comparisons cannot reliably be carried out.

5.2.2 Where data is received from other sources or systems (NaPTAN data, in particular), it can be partial or incorrect. This requires time and resources to amend regularly.

Availability

5.2.3 Some functions are not carried out using technology for operational reasons. For example, driver advice and control is, in the main, carried out using voice radio, although messages via ETM screens is beginning to be introduced in areas. Automated ETM displays that allow effective driver advice could be expensive to develop and might not be operationally acceptable.

5.2.4 The means that, even though there might be valuable information which could be obtained by analysis, the data is not available to do the analysis on (and might never be).

5.2.5 Where this is this case, it may sometimes be possible to work out a partial way of getting information from the data that is available. For example, the frequency of airtime use is monitored by some parties.

Commercial unviability

5.2.6 Bus operators, as commercial bodies, are unlikely to implement an RTI scheme in an area where RTI is not supported by the local authority. Investment may not be forthcoming where low numbers of bus services in the area, meaning the cost/benefit ratio is not viable. Therefore, the analysis tools will also not be in use in these areas, either by authorities or operators.

5.3 System issues

5.3.1 Many of the respondents have recently installed RTI systems that they use for analysing their data. Sometimes there are difficulties in extracting data from some systems or reports cannot be handled directly by RTI systems. In such cases, RTI data is exported to spreadsheets to create their own reports.

5.3.2 Data integration was a major problem for operators. Operators receive data from a variety of RTI systems across their fleet. However, there is no "standard export" file that allows them to compare and contrast data from various areas or nationwide results. Data export tools are being developed to allow data from different sources to be collated together for use with their management planning tools.

5.3.3 Additionally, data that cannot be electronically transferred to RTI systems also demands time and resources to enter manually. Re-keying data also increases the likelihood that errors will be made.

5.3.4 TfL are upgrading their RTI system, as their current Countdown had reached its limits in terms of space for holding data and limited reporting capabilities. Their new system, iBus, will allow more routes to be stored and reporting facilities will double from their current number.

6 Conclusions

6.1 Purpose of undertaking data analysis

6.1.1 There are wide ranging reasons for carrying out analyses:

- service targets – ensuring that operators are meeting targets set by authorities and the Traffic Commissioner;
- commercial – ensuring that buses and routes are efficient and economic;
- traffic management – ensuring that buses are managed within the wider context of traffic as a whole;
- future development – developing routes and schedules which are both reliable and practical based on analyses of routes and schedules which are already in operation.

6.1.2 Most of these have been looked at by local authorities, bus operators, or both; however not all are practical.

6.2 Current practice

6.2.1 Operators and authorities currently carry out limited analyses. Schedule adherence analyses are carried out by both operators and local authorities. Trend analyses are carried out patchily by both operators and authorities though the age of many systems and the lack of standardisation in the data format can make these difficult. Although ticket machines can measure passenger numbers, patronage is not measured in real time. What data is available on passenger numbers is not sufficiently reliable or detailed to be useful for analysis. Local Authorities perceive this information as commercial and therefore not within their remit.

6.2.2 Analyses are done regularly both for internal and external purposes. The frequency depends both on the nature of the report and the contract in place between the operator and the local authority.

6.2.3 Most RTI systems provide LAs and operators with in-built tools to analyse the data. There are a wide variety of systems on the market place, but little standardisation in the format of the data produced. This creates problems for operators with importing the data into other packages and cross-comparing data from other systems.

6.2.4 Operators and LA's use other specialist software to supplement the analysis tools available within the RTI systems. Again, where data needs to be re-keyed because it is not importable, this wastes time and money and increases the likelihood that errors will occur.

6.2.5 RTI data is not widely shared. Most RTI data is owned by the operators and much of it is deemed commercially sensitive. Although it is shared with Local Authorities where data sharing agreements are in place, the data to which Local Authorities have access is limited. Some data is shared between neighbouring authorities where buses cross boundaries. Otherwise, data is not shared with other organisations.

6.3 Issues

6.3.1 Data analysis is a complex process and a number of practical aspects can make it impossible or meaningless. The key issues are those of:

- data sharing: where sensitivities make it difficult for an organisation to have access to all the data it would need to undertake effective analysis;
- data quality: where data is missing, inconsistent in content or structure, or of doubtful accuracy, whether because of changes over time or because of lack of standardisation;
- cost-effectiveness: the value of RTI or of the data analysis that might be performed upon it may not outweigh the costs of the systems and resources that would be needed.

6.4 The future

6.4.1 More analyses are planned for the future, as more and better data becomes available and as people get more experience working with RTI systems. These include more trend analysis, bunching analysis, corridor analysis, performance of bus priority junctions, layover time analysis.

A Brief to those consulted

The following recapitulates the questions that were put, in writing, to those participating in this review study. This was not a survey questionnaire: respondents were free to expand upon the items listed here, and indeed were encouraged to do so during the telephone interview which followed. All respondents had the opportunity to review the write-up produced by the interviewer for completeness and accuracy.

Q1. Below is a list of types of analysis which you might perform on your data. What types of analyses are currently performed on your RTI data? Are there any others which are relevant? For example,

- Schedule adherence
  Comparison of RTI data with timetable data.

- Patronage
  Using RTI and ticket machine data, or In/Out data, to respond to variations in patronage, e.g. during rush hours or peak travel times such as Christmas.

Q2. What are the reasons for doing the analyses chosen? For example,

- Achieving service targets
  Target checks for achieving planned vs actual targets, either internally or for client(s), e.g. LA, Traffic Commission, Quality Bus Partnership Agreements, etc.

- Schedule development
  Using RTI data to adjust schedules to be realistic, or to reflect traffic changing conditions.

- Route development
  Using RTI data to adjust routes to reflect patronage figures or traffic conditions, e.g. roadworks.

- Incident management
  Using RTI data to plan for extraordinary events such as emergencies, holiday traffic, events (concerts, sports, etc.).

- Congestion management
  Using RTI data to manage congestion.

Q3. What kind of data is collated from other systems and analysed along with your RTI data? For example:

- Passenger numbers
- Engine diagnostics
- Driver advice/control
- Other _____

Please specify

Q4. How often do you perform your data analyses? Why? Are there any constraints on frequency of analysis (e.g. cost, staff time, availability, etc.)?

Q5. Do you collect RTI data with a view to using it in the future for analysis? Which types? For how long do you keep it?

Q6. Do you plan to perform analyses on your RTI data in the future? What types of analysis? Approximately when do you plan to start?

Data Sharing with other organisations

Q7. Do you require data from other organisations? What kinds of data? For what sorts of analysis?
e.g. other bus operators, LAs,etc.

Q8. Do you share your RTI data with other organisations for analysis? Who is it for? What do others do with the data?
e.g. with LAs/traffic managers to develop traffic management strategies, other councils, transport hubs, etc.

Q9. What are the key issues can arise from data sharing?
e.g. security, data protection, commercially sensitive information, etc.

Q10. With whom, if anybody, are the analyses shared? What are the purposes of these analyses?
e.g. Is it made public, is it kept in-house as it is commercially confidential, is it used for operation management, shared with DfT for surveys/grant funding requests, etc.?

Analysis Tools

Q11. What computer application(s) are used by your organisation? For example:

- Spreadsheet
  e.g. MS Excel, Quattro Pro
- Off-the-shelf package
- Bespoke software package
- Integral part of RTI system
- Other _____

Please specify

Q12. What are the main reasons for your choice of current system? Is your current system sufficient for your needs? If not, what improvements would you like to see?

B Transport for London

B.1 [TO BE ADDED WHEN VALIDATED BY THE RESPONDENT]

C First Group Buses

C.1 Introduction

C.1.1 Centaur wishes to thank Paul Clear of First Group Buses (First) for completing the review paper for this case study and participating in a telephone interview on Wednesday 22nd February 2006.

C.2 Data Analysis

C.2.1 Both real-time and post-event schedule adherence are used within First and data is collected using installed systems from AIM, ACIS, Infocell, Init, Siemens and Telenor.

C.2.2 Historically, systems were designed and specified by local authorities in isolation of the bus operators, but where First has been involved in the design exercise as a full partner the resulting systems have been far better matched to their needs and enabled them to make proper use of the available data.

C.2.3 Systems are in use in Aberdeen, Bristol, Essex, Glasgow, Hampshire, Leicester, Liverpool, Manchester, Norfolk, South Wales, South and West Yorkshire, Suffolk, York and will be for the Greater Manchester area in the near future. All the systems have the capability for real time monitoring, but this is not currently used in them all.

C.2.4 The diversity of systems does, however, cause issues for example when buses are relocated within the overall fleet as this involves the swapping out of units and replacing with another system's unit. The interchangability of input/output data between systems is an area that suppliers need to improve to help operators avoid such unwanted additional cost.

C.2.5 Owing to the costs associated with the installation and implementation of RTI systems across its whole fleet, First do not analyse data for all its buses. However, First do use the AIM Tracker system in locations across the UK, switching equipped buses between various routes and depots to give a sample for where other RTI systems are not in place.

C.2.6 Schedule adherence data analysis is carried out to check that service targets are achieved, as well as assisting schedule and route development. In order to pinpoint problem junctions or traffic light phasing issues, First analyse schedule adherence data from a series of buses travelling the same route and deduce from the running times whether there is a problem with route timings or whether the issue is with junctions or traffic light phasing. If the latter issue is shown, First will then approach Local Authorities (LAs) with this information to try to develop Punctuality Improvement Partnerships (PIPs) in order to adjust traffic signal timings, improve bus priorities, or have problem junctions redesigned.

C.2.7 Patronage numbers are not counted in real-time, although ticket machine data is collated and analysed post-event, for route and schedule management.

C.2.8 Where First are made aware of special situations, such as planned events, they can lay on additional buses and where real time monitoring is in use they are able to adjust services to ensure better adherence to published timetables.

Service targets

C.2.9 The Traffic Commissioners can monitor reliability and have set targets for schedule adherence (a minimum of 95% buses at start/end journey timing points and at least 70% for intermediate timing points should be within the defined time period). If operators fail to meet these targets, they can have deductions made from their Fuel Duty Rebate payments, the number of vehicles they are permitted to operate can be reduced or operators can be disqualified from running local bus services.

C.2.10 The data gathered helps First to demonstrate that they are taking reasonable steps to ensure their services do run reliably and that they are taking positive steps to counteract any issues, if they occur.

Traffic conditions

C.2.11 In addition to achieving service targets, the data is also used to react to long-term traffic conditions. As described above, information collated that highlights delays at particular junctions or intersections form part of the PIPs and can assist as evidence that there are requirements for changes to junction layouts or traffic light timings, to aid bus (and traffic) flows on a bus route.

Route development

C.2.12 For route development, the RTI data is analysed in association with Start Time Adherence (STA) data collected through the ticket machines. Schedules are then adjusted and reviewed after the changes in a cycle aimed to ensure continuing reliability of the services.

Incident and congestion management

C.2.13 Most of the systems in use allow for live data analysis for incident or congestion management and in the more advanced systems, such as Glasgow, they allow buses to trigger green traffic signals or extend green light phases. Elsewhere, service control inspectors and radio systems are used to monitor and adjust services.

Location information

C.2.14 Real time service monitoring can offer a simple visual picture of all the buses on particular services from one central control location. It can also identify when potential incidents may be about to occur, such as if a bus has diverted off route and near to a low bridge, narrow road, weight-limited bridge, etc. The bus driver can be warned accordingly.

Engine diagnostics and driver advice/control

C.2.15 First is looking to see how these systems can be developed to for example link to engine performance and diagnostic data which will be able to warn if a problem is developing (possible then linking to other systems to ensure that any required parts are available or ordered and having an engineer fit them the same evening before the fault worsens). The data could also be used to ensure the bus is being driven efficiently and economically, helping to improve fuel utilisation.

C.2.16 Whilst a number of First's systems have in-cab displays to show the driver whether he/she is +/- to the schedule, it is also planned to implement a two-way interface between ETMs and the RTI systems enabling data to be passed to the driver via their ETM display and to automatically update fare stages on the ETMs.

Reporting timescale

C.2.17 Data analyses are performed each reporting period (4/5 weeks) as part of standard management reporting. The reports are reviewed by senior management at group and operating company level as well at the UK Bus Board. Additionally, reporting can be carried out on an ad hoc basis where specific requirements arise.

C.2.18 The data is kept on local servers for a year, then is archived.

C.3 Data sharing with other organisations

C.3.1 The systems use NaPTAN data, provided by LAs, as basic input data, as well as mapping system data. Other data is sourced and inputted internally.

C.3.2 Analyses are mainly used in-house for operation management and service planning. Data is also shared with some LAs and local Highways Authorities, usually subject to formal data sharing agreements, ensuring data is not passed to external bodies. For example, when working on quality corridors, data is used to prepare for their justification as well as monitoring after their introduction. In addition, RTI data is shared with LAs for the purposes of obtaining funding for corridor improvements such as through the PIPs detailed above.

C.3.3 There are internal AIM Tracker and ACIS user groups within First who regularly meet and analyse the data outputs from these RTI systems, then liaising with management and suppliers to highlight issues with the system or its data, recommend system upgrades and suggest improvements.

C.3.4 Commercially sensitive information is shared with LAs. It is used for designated purposes only and is held in confidence and enables both parties to work together to resolve any issues.

C.4 Analysis tools

C.4.1 To analyse their data, First use the reporting tools incorporated within their RTI systems and spreadsheets for comparing ticket machine data and RTI information. There are several RTI systems in use as the systems are mainly funded through LAs, with tender processes to select the preferred supplier.

C.4.2 The main issues that First has identified with its data analysis tools are the integration of data into different analysis systems and the need to get accurate input data. First has attempted to resolve these issues by investing in the development of a data transfer program in order to allay fears of greater time costs, duplication of effort involved in re-keying data, and increases in the likelihood of data errors.

D Stagecoach

D.1 Introduction

D.1.1 Centaur wishes to thank Roy Jeffries of Stagecoach for participating in a telephone interview on Wednesday 1st March 2006.

D.2 Data Analysis

D.2.1 Stagecoach does not currently analyse its RTI data in as much detail as other operators may do, and are currently exploring the various ways in which analyses can be useful. RTI is not used in any areas where LAs have not invested in RTI: due to the costs of its implementation when compared to more traditional methods of improving a service or network. There is not a strong enough business case for "doing it alone".

D.2.2 Schedule adherence data is collated and analysed, although real-time analysis is in its infancy. Historical data is currently examined internally and used in the main to check for obvious mistakes in timetables, etc. Where real-time schedule adherence is in place (in 2 or 3 areas), drivers can be told when to change their driving style, for instance if they are behind or ahead of schedule. This is done by voice radio, where it is available.

D.2.3 Schedule adherence can be managed with the assistance of RTI data. For routes that have a high frequency, there are occasions when the buses will "bunch up". The resulting gaps can be better controlled to ensure an even spread of buses across the route, reducing waiting times for passengers. We are in the process of investigating "best practice" for this process.

D.2.4 Patronage data is collected; although this comes from ticket machine data, not real-time systems. The machines download information on ticket sales and passes that they have sold/ viewed into an operational costing software package which, with general costs and ticketing information, allows routes to be analysed for profitability. Patronage is also used as an indicator as to a route's importance within the network.

D.2.5 The analyses of passengers carried are carried out in order to ensure service targets are achieved and to help develop schedules, timetables and routes generally.

Service targets

D.2.6 Analyses are carried out to ensure that service targets are met. This is mainly for internal purposes, although they can also be used to assist explaining how LA targets are not being met due to, for example, congestion issues.

Schedule development

D.2.7 Data is analysed for schedule development. This is managed by the individual Stagecoach commercial teams in each operating company.

Route development

D.2.8 Data is analysed for route development. This is managed by the individual Stagecoach commercial teams in each operating company.

Incident and congestion management

D.2.9 Offices use data to assist in controlling incident situations. They have direct intervention with drivers via voice radios (where fitted).

D.2.10 If drivers find that they are held up by congestion and are running behind schedule, they will radio (where fitted) in to their controller to make them aware of their situation.

D.2.11 From a commercial point of view, Stagecoach would suffer if data analyses were not carried out; they are a necessary requirement, and if RTI data were not collated electronically, the company would continue to collect data by placing observers in the streets and other traditional methods to collect it. Although managers do not use all of the reports available from the analyses, they will want to use them all, once proved to be accurate and reliable.

D.2.12 Although passenger number data within the RTI system is not collected for analysing, it is used in conjunction with systems on board buses which allow bus priority at certain traffic light junctions. This allows priority to be given to a bus with more passengers to ensure that fewer passengers get delayed overall. For example, two buses are approaching a junction from different directions. One bus is 2 minutes behind schedule and its ticket machine has recorded >30 passengers having boarded. A second bus is approaching the same junction, and is 5 minutes late but has recorded only 5 passengers having boarded. The system can be set to allow the bus with more passengers having boarded to go through the traffic lights first, even though it is not as delayed as the bus with fewer passengers. The problem is that without expensive counting mechanisms, these systems assume that all passengers recorded as boarding the bus are still on board. In reality many of them may have already alighted.

Location information

D.2.13 Location information is collated and then analysed internally by Stagecoach's commercial departments post-event. The results of location information analysis can highlight issues with buses travelling off-route, which can then be dealt with by local managers.

Engine diagnostics and driver advice/control

D.2.14 Engine diagnostics data collation and analyses are being trialled by Stagecoach, but this is not in use via RTI at the moment. If trialled successfully, engine diagnostic data will be used in the future. Benefits of this include analysing wear and tear, warning management if a problem is developing (having spares ordered and having an engineer fit them the same evening as a fault arises) and determining if a bus is being driven efficiently and most economically.

D.2.15 Driver advice is carried out by voice radio, where fitted. This data is not collated and analysed by Stagecoach. There is one ETM system in place on a Stagecoach bus that informs its driver via their ticket machine display that they are running early and to slow down. There are no plans to run this across the fleets, due to the cost of its implementation.

Reporting timescale

D.2.16 Reports are printed out on a weekly basis by depot operations managers. These are studied and problems reported to their respective director, with whom they have regular contact. Data can be analysed in detail on a daily basis, by route or by bus. The current weekly reports in place are adequate for Stagecoach's needs.

D.2.17 Data trend analyses of route schedule adherence are also carried out on a year-on-year basis, where possible (not all RTI systems in place allow for data exporting, which makes it difficult to archive RTI data and collate it at a central point to gain a Company-wide perspective).

D.2.18 Due to difficulties in relying on different data outputs from RTI systems, in the future Stagecoach wish to perform analyses with systems exporting TransXChange-formatted data or similar standard format only. Stagecoach have invested in timetable planning software that allows RTI data to be imported and "what-if" scenarios to be carried out, as well as producing suggested optimal route timetables with their respective running information.

D.3 Data sharing with other organisations

D.3.1 All data held from RTI systems belong to Stagecoach. Information is only shared in order that routes are run more smoothly or for other agreed purposes, e.g. to highlight issues that arise such as on-street parking causing bottlenecks. Information is shared with other organisations only after a decision has been made that it is in the Company's interest to do so, i.e. that value will be added and that it is not a danger to commercial interests.

D.3.2 NaPTAN data is extracted from the national website. This populates a large number of fields in Stagecoach's scheduling software and Trapeze software, for example SMS codes, bus stop data, etc. There are major issues with the accuracy, and reliability, of updates for many NaPTAN datasets, and Stagecoach staff are trying to work with individual Local Authorities to improve this situation. All other data is sourced and inputted internally.

D.3.3 Schedule adherence analyses are shared with LAs on a confidential basis. In addition, data sharing is subject to conditions laid out in a proforma formal data sharing agreement document, which Stagecoach insists on as part of all their RTI agreements with LAs; they will not sign up to joining an RTI scheme if this agreement is not in place.

D.3.4 Summarised versions of analyses are shared with PTEs as part of Quality Bus Partnerships, otherwise operational management, service planning, etc. analysis results are kept within Stagecoach. They are not shared with other parties, such as traffic commissioners: they have no rights to view it. However, where appropriate, data will be voluntarily shared in order to resolve running problems, for example, reviewing traffic light timings during peak hours at particular junctions that cause bottlenecks.

D.4 Analysis tools

D.4.1 To analyse their data, Stagecoach uses various spreadsheets (MS Excel, Lotus 123, dependent on the manager's preference) and the tools incorporated within their RTI systems. In addition, a bespoke software package from Trapeze has been purchased, that integrates and analyses RTI data for timetable preparation and work scheduling. A wide variety of RTI systems are used, as they are funded by the respective LA, with Acis being the most popular supplier, as well as systems from Infocell, Siemens, Telenor, JMW, Aim, SLE and Init in use.

D.4.2 All of the RTI systems used by Stagecoach export data in a format which has been fixed by each system's supplier. As a result, Stagecoach has difficulties in extracting and importing data into their management planning tool that allows work to be scheduled. They are keen for a standard to be developed in the future that would allow RTI systems to export historical data in a standard format. This would allow straightforward data importing into planning software, as well as allowing Stagecoach to use the system to understand its current Company-wide situation.

D.4.3 The current RTI systems that Stagecoach has in place are sufficient for its commercial requirements. They keep a close ongoing relationship with Trapeze, as environments and requirements continuously change.

E Leicester City Council

E.1 Introduction

E.1.1 Centaur wishes to thank David Wright of Leicester City Council (LCC) for participating in a telephone interview on Monday 27th February 2006.

E.2 Data Analysis

E.2.1 Schedule adherence data and patronage data are used for post-event analysis by Leicester City Council. The information gleaned from these analyses is fed back to the Local Transport Plan and Annual Progress Reports. In addition, bus operators occasionally request performance status information.

E.2.2 Patronage figures are extracted from LCC's RTI system, although they are used to a lesser extent than schedule adherence data. A trial is currently being carried out with two buses travelling in Derby that count passenger numbers, and these figures are being compared (post-event) with ticket machine data. The bus operator will use the information received to find out passenger trends. Generally, patronage data is more beneficial to bus operators.

Service targets

E.2.3 Analyses are carried out to check that service targets are achieved and to assist in schedule development. Headline figures are published in the Annual Report and as part of the Local Transport Plan. Schedule development information is passed on to LCC's five bus operators, although LCC finds that they do not make the most of this information.

Traffic conditions

E.2.4 Traffic condition analysis is not managed by LCC. These are managed directly by the bus operators.

Route development

E.2.5 Route development is not managed by LCC. These are managed directly by the bus operators.

Incident and congestion management

E.2.6 Incident and congestion management are not managed by LCC. These are managed directly by the bus operators.

Location information

E.2.7 Location information data is directly collated and analysed by bus operators.

Engine diagnostics and driver advice/control

E.2.8 None of the data collected from LCC's RTI system is used for analysis on other systems. Engine diagnostics data and driver advice/control data is directly collated and analysed by bus operators.

Reporting timescale

E.2.9 Data analyses are carried out for the Annual Reports that LCC publishes, as well as ad-hoc requests from bus operators who use this information for reviewing schedules and comparing data with their own systems. LCC would like bus operators to request and use data analyses more frequently than is currently carried out.

E.2.10 All data is collected and stored for potential future analysis, although LCC currently does not carry out additional uses for the data other than compiling the Annual Review report, and there are no current plans to perform additional analyses on RTI data in the future. As LCC is not a PTE, they do not manage or audit bus operator performance.

E.2.11 LCC will continue to use data for headline figures (for promotional purposes) and for administering the RTI system. Bus operators are encouraged by LCC to analyse their RTI results for location development and new routes.

E.3 Data sharing with other organisations

E.3.1 Contracts in place with Leicester's bus operators state that data from RTI systems is contractually owned by the bus operators, and therefore will not be divulged by LCC to third parties without the consent of the appropriate operator. Bus operators will share analyses with LCC for issues such as operation management and service planning, and any arising problems are resolved between the operator and LCC in confidence.

E.3.2 Data, such as running boards and timetable information, is obtained from bus operators and used as a basis for creating the RTI databases. LCC ensure that running board information is kept confidential and does not get passed on to other departments or organisations. Other forms of data from bus operators, such as ticket machine data, are not divulged to LCC.

E.3.3 Adjacent authorities, e.g. Derby and Nottingham, also request RTI data from LCC for LTP purposes. This is released by LCC on approval by bus operators, on condition that data is given in a format such that the authorities cannot trace specific routes or operators. If a single route or individual operator is traceable, then LCC will contact the bus operator for approval prior to releasing the information.

E.3.4 There are no additional issues arising from RTI data sharing, as (explained above) the data is not LCC's property to share.

E.3.5 NaPTAN data is not managed by LCC, but by Leicestershire County Council. This is used for SMS and website queries. NaPTAN data from Nottingham and Derby districts is also used, where bus routes cross regional boundaries.

E.4 Analysis tools

E.4.1 LCC use an Init RTI system which manages all their data analysis needs, from report creation to graph and table extraction for report-writing.

E.4.2 The current Init RTI system replaces their previous system, which was installed in 1999/2000 and came from the LA tender process. In addition to its age, it could also not manage regional areas, e.g. using identically numbered bus routes in different locations. A third issue was that the system had problems with quantities of information, and so its replacement was planned. The new RTI system was installed within the last 4 months, and it allows these additional features that the previous system did not permit.

E.4.3 In the future, there will be a process put in place that will allow bus operators' data downloads to be automatically imported, avoiding the need for re-keying of data.

E.4.4 NaPTAN data has also caused some problems. LCC find that requests to third parties for information and changes are carried out slowly and inefficiently. This is exacerbated when requests for information are made to Leicestershire's adjacent regions as these authorities are often not aware of the needs and priorities of a real-time system.

F Kent County Council

F.1 Introduction

F.1.1 Centaur wishes to thank David Batchelor of Kent Highway Services Alliance for participating in a telephone interview on Monday 6th March 2006.

F.2 Data Analysis

F.2.1 Real-time data from the RTI system is owned by Kent County Council (Kent CC).

F.2.2 Schedule adherence data is used by Kent CC for post-event analysis on a limited number of routes in order to see the operators' current running situations. Issues identified are raised with the respective operators, to ensure that they are aware of possible problems.

F.2.3 Patronage data is not analysed by Kent CC; this information is of more use to operators, as it is of a commercial nature. It is not counted for Government statistics.

Service targets

F.2.4 In the main, analyses are carried out to check that Kent CC's RTI system is working correctly. Analyses could also be carried out to check that service targets are achieved, so that Kent CC can assist with punctuality improvement plans.

F.2.5 Kent CC does not have any RTI key performance indicators in quality bus partnership agreements in place with its region's bus operators.

Schedule development

F.2.6 Schedule development analysis is not managed by Kent CC. This is managed directly by bus operators.

Route development

F.2.7 Route development is managed by bus operators. RTI data analysis could be used by another department in Kent CC that manages tenders for subsidising certain routes.

Incident and congestion management

F.2.8 When incidents arise, Kent CC can display messages onto RTI signage at bus stops to convey messages to passengers about delayed or cancelled services. There are no alerts built into the RTI system that can highlight problems in real time. Accidents would be managed by operators using voice radio; this data does not get saved or analysed.

F.2.9 Kent CC would like to assist with congestion management with RTI data, but are unable to at present. This is because they do not have a controller in place all the time analysing RTI data at Kent CC. In addition, operators do not see it as a worthwhile tool on which to spend their resources.

Location information

F.2.10 Location information data is collected by Kent CC and analysed in spreadsheets for individual journeys.

Engine diagnostics and driver advice/control

F.2.11 Engine diagnostics data is not available from the system and driver advice/control data is not collated and analysed by Kent CC, nor by its bus operators.

Reporting timescale

F.2.12 Data analyses are carried out sporadically, due to lack of staff time to carry analyses out and difficulty in getting data in easy to analyse formats.

F.2.13 Analyses that do get carried out focus on ensuring that systems are performing correctly. Random tests are carried out, demonstrating what x per cent of their system works correctly.

F.2.14 Three-monthly meetings with operators are adequate for Kent CC's current requirements.

F.2.15 Individual operators may have one-off meetings with Kent CC. These are usually held at operators' depots; however, depot managers are not as concerned with RTI system report information.

F.2.16 Historical data is not currently analysed, although RTI data is collected and archived with a view to analysing it in the future. Although there is currently four years' worth of data, some of it has become invalid, due to road changes, etc.

F.2.17 The reporting aim is to look at times taken for buses on their routes, analyse congestion hotspots and discover their causes. An example where this has been successful is an analysis carried out after a complaint by an operator about delays on part of a route. A congestion problem on the route was pinpointed, caused by hospital patients parking cars along a road at one particular time of the day, which caused bottleneck traffic jams for several minutes.

F.2.18 More detailed congestion and running time data analyses are planned to be performed on RTI data in the future. A new Kent CC UTMC database system is currently being tendered for, which will allow RTI data to be entered and analysed.

F.2.19 Analyses for planning new routes is difficult to carry out, as there is no current data for new/ different routes with which to compare current routes' data.

F.3 Data sharing with other organisations

F.3.1 Timetable data is provided by operators, which Kent CC input into their RTI system. Base NaPTAN data is also inputted into the system, with adjustments carried out accordingly. Mapping information is obtained from Ordnance Survey. Other parts of the Authority also contribute data for the RTI system, for example, locations of signal junctions.

F.3.2 Data from the RTI system is not shared with any other bodies. In the future, it may be shared with Traffic Managers or Area Officers, as well as being discussed with operators.

F.3.3 There is only one formal data sharing agreement currently in place, although Kent CC will have to develop an agreement with all participating Operators to allay commercial concerns, for they are planning to distribute real-time information of bus operations on their website.

F.3.4 An issue that arises from Kent CC sharing its RTI data is the interpretation of the data: sometimes the RTI system has to estimate times for its signage, and this can be incorrectly calculated. Decisions on what to display also need to be carefully managed: for example, a route's sign message recently displayed a message that bus routes were cancelled due to snow, but was only meant to refer to RTI-based buses on the route. A non-RTI bus route that also ran on part of the same route had not cancelled its services, yet was affected by this message, as it found no passengers along its route.

F.3.5 Analyses are used for the management of the RTI system's operation only and not shared with other parties. DfT surveys do not ask for analyses of data, only numbers of RTI equipment in place.

F.4 Analysis tools

F.4.1 Kent CC currently uses an Acis RTI system, which won a competitive tender in 1997. In addition, MS Excel spreadsheets are used for some data analysis, e.g. location information.

F.4.2 The Acis system has been developed and tailored to Kent CC's requirements since its purchase, but at the start it was not designed to ask the questions that need to be asked in today's environment. Additionally, some report running can slow up the system, so such reports cannot be carried out on a regular basis.

F.4.3 In the future, Kent CC is planning to use a UTMC system that allows RTI data to be entered and analysed. This system is currently open to tender. Up until now, integration hasn't been a high priority task, but with the recent Transport Act and traffic management becoming prevalent the opportunity is being taken to raise the profile of the system with a view to justifying continuing to receive a budget to maintain the RTI system.

F.4.4 There are data duplication problems that arise with the current system: due to costs, operators use different scheduling systems, whose outputs do not electronically import into Kent CC's RTI system. In some cases it is printed by the operator, and the data requires re-typing into Kent CC's system. This has caused major problems even this year, as the Traffic Commissioner has created the requirement for electronic local bus service registration information, which has been found not to be compatible with the RTI information requirements.

G Metro (West Yorkshire PTE)

G.1 Introduction

G.1.1 Centaur wishes to thank Martin Siczkowski of Metro (West Yorkshire PTE) for participating in a telephone interview on Monday 6th March 2006.

G.2 Data Analysis

G.2.1 The Metro system is part of a partnership formed between West and South Yorkshire PTE which covers 9 local authority areas between them. It also includes data for Hull, North Yorkshire and York, and holds timetable data for approximately 130 operators. Only 11 bus operators have RTI systems installed; however, these operators cover the majority of the region's routes, for example in West Yorkshire representing approximately 85 per cent of the county's routes. The remainder of this note refers to Metro's use of the information.

G.2.2 Real-time schedule adherence analysis is largely carried out by bus operators; Metro does not manage the operational control of the bus fleets.

G.2.3 Bus operators have the ownership of the RTI data, and a list of "allowable uses" for RTI data has been signed up to, e.g. allowing the prediction of when buses are arriving at stops to be provided to the public. The use of such data is commercially sensitive and may evolve over time.

G.2.4 Post-event schedule analysis is carried out and managed by Metro in two ways:

- use of a reporting package to manage the system performance and availability of RTI on different routes;
- use of the reporting package, using operators' RTI data, for performance analyses that Metro has permission to carry out.

G.2.5 In addition, operators have access to 3 packages to help them manage their business:

- a real time fleet management package to view early and late running, etc, in real time;
- use of a reporting package for performance analyses of their own data;
- replay of a bus route (or groups of buses) to analyse a journey in detail, e.g. after complaints have been made.

G.2.6 Patronage figures are passed to Metro from operators, although these figures are not collated from RTI systems. Due to flat or capped fare structures, free travel for pensioners, travelcards, etc, passenger densities on sections of routes cannot be measured, as the systems cannot tell accurately where passengers alight from the bus.

Service targets

G.2.7 Metro do not currently analyse data for service target achievement: this is a politically sensitive topic. Subject to operator agreements, however, this may be put in place in the future.

Schedule development

G.2.8 Metro do not currently analyse data for schedule development: this is carried out by bus operators. This may be used for tendered services in the future.

Traffic conditions

G.2.9 Metro do not manage traffic conditions in real time. This function is regarded as a task for Districts to manage, rather than PTEs. Metro is increasingly working with the local authorities Urban Traffic Control departments to maximise the benefit of the RTI system for bus priority and traffic management.

Route development

G.2.10 RTI data is not currently used by Metro for route development. Patronage data is used from other sources for this task, particularly for tendered or proposed tendered services.

Incident and congestion management

G.2.11 Data is currently collected for analysing delays. The RTI system can "learn" detours for small incidents, such as emergency roadworks or accidents, and adjust its predictions accordingly.

G.2.12 Congestion management is a task carried out by Districts, rather than PTEs. Metro is working with the districts to provide real time road network performance based on bus data. The RTI system will also in future analyse historical data for congestion link times on individual roads.

Location information

G.2.13 Various location information data is used for reporting packages and replaying situations.

Engine diagnostics and driver advice/control

G.2.14 Engine diagnostic information is not used or recorded by Metro.

G.2.15 The usage of driver advice/control airtime is recorded by the Metro system, although the actual information conveyed is not recorded.

Reporting timescale

G.2.16 Performance indicator analyses are carried out on a daily and a weekly basis, depending on the report being created. Schedule adherence analyses are carried out on an ad hoc basis. These reports are carried out as a result of complaints, route development, producing planned weekly reports, etc.

G.2.17 Metro obtains a lot of valued data now, which is used mainly for testing the technical parts of the RTI system.

G.2.18 Congestion link information times for roads will be used by other PTE departments, Districts and Urban Traffic Control systems. As bus operators own the data from the RTI system, there is not an agreement in place that allows RTI data analyses to be passed to other parties.

G.2.19 Metro is also collecting RTI data with a view to using it in the future. Analyses will be also carried out on a year-on-year basis, allowing focuses to be carried out on specific corridors, congestion monitoring, effect of junction improvements, etc. Data will be kept for several years, with later years archived.

G.2.20 The current bus RTI scheme has only been in live for a few months: it has not been performing long enough to plan for future analyses.

G.3 Data sharing with other organisations

G.3.1 Metro's RTI scheme uses data from other organisations. Timetable schedules, configuration and running board information are received from some operators, the remainder coming from the PTEs/local authorities. Each PTE/local authority provides NaPTAN data and will provide traffic light priority configuration files. Mapping data is acquired from Ordnance Survey. This data is entered into the RTI system to create reports such as route predictions.

G.3.2 Data protection issues are handled by having individual operators separate password-protected areas in the RTI system, allowing them to view only the data relevant to their contract. This is viewed as a good data agreement by the operators.

G.3.3 Other districts/local authorities and the Highways department can also receive appropriate information, for instance, to assist in the purposes of urban traffic control and other traffic-related issues.

G.3.4 Traffic commissioners do not receive any RTI data analyses: there is no agreement in place to allow them to receive such information.

G.3.5 Much of the data analysis undertaken by Metro is currently used to check the performance of the RTI system, rather than the analysing the running of buses. Reports on schedule adherence information are used by the operator to assist in the creation of future timetables and bus performance. In the future, Metro may use timekeeping information for performance meetings with bus operators, subject to operator agreement, however this is currently deemed a politically sensitive area.

G.4 Analysis tools

G.4.1 Metro uses an ACIS RTI system for managing their RTI data analysis, which incorporates a commercial reporting package. This system has been in place for approximately six months, since the introduction of their RTI scheme.

G.4.2 MS Access database is also used for testing some aspects of the RTI system's technical performance. No operator performance analyses are carried out in MS Access. MS Excel is used, although very rarely (operators may make more use of spreadsheet packages).

G.4.3 The main reasons for Metro choosing their ACIS RTI system is that it was the best system, in both terms of price and functionality for their requirements, at the time of tender. The system still meets the needs of Metro, and is undergoing subtle fine-tuning (for instance, there are occasional time delays on report-building).

G.4.4 In the future, expansion and improvements are planned for reports to assist in topics such as improvements for traffic signals and highways, headway management, etc.