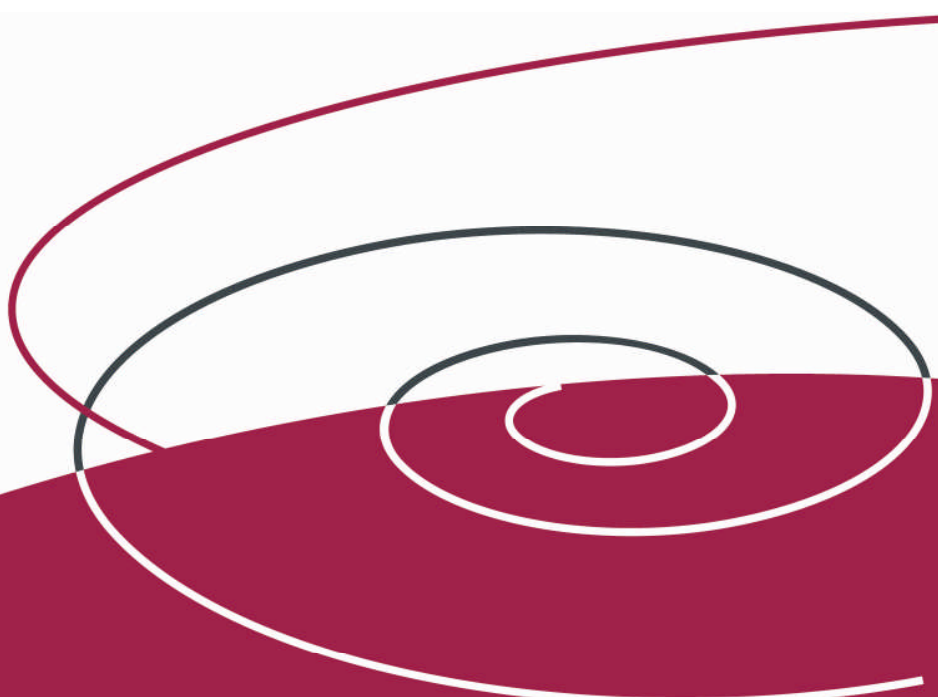




The Future of Decision Making in Transit

A White Paper by **Trapeze Group**

April 2008



Overview

Transit agencies have a wealth of information stored within their back-office databases. However, it can be difficult for managers to use this information to make informed and timely business decisions. In many cases their plight can be attributed to an inability to access meaningful performance information because of a lack of data integration across the transit enterprise. It is clear that more accurate information leads to better decision making but unfortunately oft inaccessible back-office transit data acts as a roadblock.

Transit agencies often spend significant time and money on data integration projects in an effort to connect their data such that they can use it for performance reporting purposes. Converting “data silos” to “data marts” is a common strategy used on transit data integration projects. These integration projects are often performed as one-off solutions that do not leverage the effort of other transit organizations performing similar data integration tasks themselves. The end result is that transits end up building highly customized solutions that cannot be packaged and re-deployed at other agencies.

Most transit agencies in North America have similar decision making and performance measurement needs and consequently, they typically have the same core back-office databases: scheduling, planning, revenue, operations dispatch, payroll, customer service, maintenance, finance, safety and security, AVL and APC. By leveraging the efforts of other transit agencies and implementing standard, package-able and re-deployable transit intelligence solutions, transit agencies can accelerate their data integration projects, reduce the time and money spend on integration and build a solid baseline for custom enterprise data integration.

Hence while data consolidation and systems integration are becoming a necessity in order to meaningfully access the information required to make better decisions, the future of decision making lies in the ability of transit agencies to implement transit intelligence solutions that build on the efforts of their peers.

Introduction

Experienced transit managers will generally base their evaluations on past events and historical trends. Experience and intuition help them make conclusions ranging from where to reduce costs and where to most effectively spend grant money to how to improve ridership and how to reduce the number of accidents. But what if one asks: Is it the correct decision? Can it be validated? Can you measure its success? How does it fit with the rest of the processes? What impact has it had over time? For those answers one requires quantitative historical information. To find such information, one has to go to a consolidated system of record - a single version of the facts contained in back-office transit databases.

Decision Making Today

Managers at transit agencies across North America are typically making many of the same decisions; decisions: how to most effectively use their budget; where to cut costs; how to improve employee satisfaction, etc. Making these decisions effectively requires timely access to accurate information – information that in some cases either doesn't exist or is not readily accessible.

Typical approaches to accessing this information include custom database queries, exports into spread sheets, manual data entry and manipulation or custom reporting packages. In many cases, manual data entry and manual data validation tasks are repeated perpetually in order to produce a meaningful set of reports upon which management will make decisions. The end result is that intuition combined with incomplete data is used to make decisions, decisions that are not always consistent with reality.

Unhappy with this approach many transit agencies have begun to recognize that data integration can result in greater and easier access to information, enhanced performance reporting and therefore better and more accurate decision making.

The Future of Decision Making

The future of decision making in transit involves improving both the transparency and predictability of transit operations. Managers cannot make educated evaluations if they are not aware of what is going on within the business and do not have the necessary information on which to make predictions. Transit managers need to be able to access meaningful and accurate information on-demand, without requiring an intimate knowledge of databases and/or their structure.

Advancements in technology have now made it possible to realize this goal.

Transit intelligence solutions are at the forefront of the future of decision making in transit. They integrate transit data into a single, trusted version of recorded historical information – typically called a data mart - and provide actionable business intelligence on-demand. Actionable intelligence could come in the form of anything from ad-hoc reports to highly formatted management reports and balanced scorecards. In addition, these solutions are “exception-based”, meaning that they not only contain the key performance metrics but they also identify when exceptions in performance have occurred. Transit intelligence technology empowers agencies to not only look at current performance but to analyze it relative to past performance by looking at historical trends. Highly customizable graphical charts and graphs may be used to visualize and better understand key performance metrics. (See Figure 1)

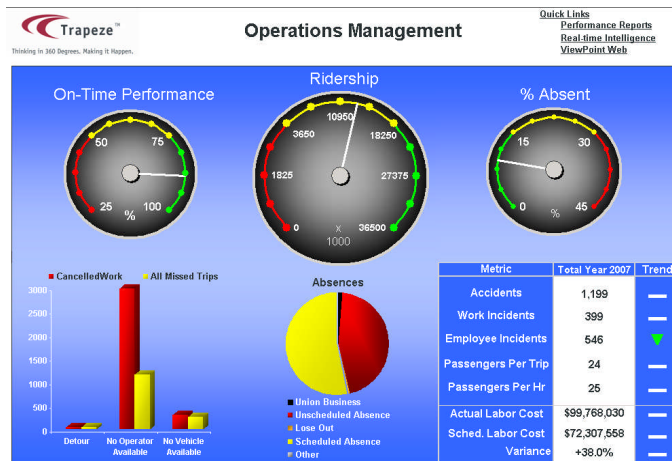


Figure 1. Metrics dashboard

Transit intelligence solutions are most effective when they contain what is termed as actionable information - information that is of sufficient depth and accuracy that it permits managers to make policy decisions. Much of the data contained in transit OLTP (on-line transaction processing) databases is not actionable nor is it required by decision makers. Hence the total integration of data from all the back-office databases and from all the back-office transit systems is superfluous and will both degrade the performance of the transit intelligence solution and prolong the integration project itself.

Effective transit intelligence solutions will drive the future by making it possible for transit agencies to benefit from the collective knowledge and effort of their peers. Vendors that can package a standard data mart and offer a standard package of performance metrics and reports will be able to accelerate transit integration

projects and keep costs down. By adhering to NTD reporting standards and TCIP (Transit Communications Interface Profiles) vendors will be able to build standard 3rd party interfaces that greatly minimize custom development costs. For example, if a transit agency desired to have access to such metrics as fare box revenue per route alongside complaints per route and payroll costs per route, the revenue, customer service and payroll data from a variety of OLTP systems could be transformed into a TCIP standard format and thus integrated into a vendor's pre-defined data mart structure.

Off-the-shelf transit intelligence solutions with standard data mart packages will shorten projects, decrease custom development costs and allow transit agencies to spend less time analyzing requirements and more time testing and cleansing their data.

Achieving the Future of Decision Making

At Trapeze, building a transit intelligence solution that could achieve the future of decision making began with exhaustive research into the needs of transit managers. We began by focusing on the needs of transit managers in the following departments: demand response operations, fixed route scheduling and planning, operations dispatch and customer service. By contacting clients, conducting surveys and collecting samples of performance reports we assembled a list of what we felt were the standard set of key performance metrics that most transit managers desired.

Throughout our operational review of transit agencies across North America, a list of the performance metrics and the subsequent data structures and tools required of the transit intelligence solution evolved. We learned that whilst the needs at each transit are subjective, there were underlying similarities in the performance reporting requirements of each department. Accordingly, our data integration tools had to be highly flexible so that they could handle custom metric calculations without requiring custom development. The technical solution had to be robust enough to take into account the mainstream performance metrics with sufficient flexibility that it could be readily adapted to accommodate local nuances.

For example, we found that the way in which paratransit operations define the percentage of trips that are on-time can vary between the different operators. Some define a late event as an event that has an actual *arrival time* outside of the scheduled early/scheduled late time window while others use the actual *depart time* compared to the scheduled early/scheduled late time window. Some do not look at the scheduled early/scheduled late time window at all, electing to define a time window based on the estimated arrival time and the actual arrival time.

These are just a few of the variations seen in the way performance metrics are defined from one transit agency to another. Awareness of the potential variants permits a more comprehensive approach to the system design and our ability to meet each client's needs without requiring a localized custom development. In this way a library of standard performance metrics can be built along with multiple variations in the way these metrics are calculated.

Even with flexibility in the way metrics are calculated, decision makers are always going to want new metrics or variations on existing metrics. With this in mind, a standard data mart structure (with data cleansing and validation tools) was designed to contain information obtained from the OLTP databases in their most granular form. The granular nature of the data mart provides a greater degree of flexibility for making client specific customizations without requiring development resources. In fact, the transit intelligence tools enable administrators to perform their own customizations by creating new metrics, either from information in the data mart or from existing metrics.

Performance metrics themselves play a vital role in the future of decision making but the way in which performance metrics are consumed is also important. Transit intelligence tools can provide decision makers a means of creating their own highly formatted management reports, dashboards and scorecards. For example, a manager may elect to create a balanced score card to track key performance metrics from scheduling and planning, customer service, finance and payroll, all in the same report. Tools that make it easier to visualize and understand performance data better equip managers to make policies based on real information.

Decision Making Technology

For a transit intelligence solution to truly assist managers, it must be adopted and reliable. Transit intelligence tools need to extract meaningful data from OLTP databases, transform data into a flexible format that is easily understood by transit managers and cleanse and validate the data such that results are consistent. Best practices indicate that approximately 80% of the time spent implementing a transit (or business) intelligence solution should be spent on data content and quality, leaving 20% for end-use functionality.

With this in mind, Trapeze built a solution that focuses on the data. Starting with the Trapeze suite of transit products, significant time was spent designing and testing a multidimensional data model (data mart) that could house not only a standard set of performance metrics from the Trapeze OLTP databases but also performance metrics from other non-Trapeze data sources. Primary considerations in the data mart design were scalability, flexibility, query performance and database size.

The data mart structure was developed iteratively in order to provide optimal query performance whilst optimizing the database size. ROLAP (Relational On-line Analytical Processing) tools were integrated into the solution because they are flexible and scalable enough to support the diverse requirements of the decision makers in the transit industry. ETL (Extract, Transform and Load) tools were created to rapidly and automatically move data out of the source OLTP databases whilst also transforming the data into the data mart structure. Together, ROLAP tools and ETL tools became the basis for a transit intelligence solution that supports customizable reports and dashboards and can automatically refresh the data mart without degrading the performance of the OLTP systems. The package-able nature of the ETL scripts along with the scalability and flexibility of the data mart make this a re-deployable solution that can accelerate data integration projects and reduce the time and money spent on custom transit enterprise data integration.

Conclusion

As transit agencies increasingly adopt technology solutions into their business, there will be many opportunities to make more informed and quantifiable operational analyses.

As more and more aspects of a transit operational data becomes available, there will be a larger volume of data available for analysis. The ability to instantly view this data, to assimilate it and drill down into it in order to make business, strategic and political decisions is compelling. Such is the power and potential of transit intelligence solutions and the future of decision making.