Great Lakes ITS Case Study and Lessons Learned for the Airport ITS Integration and Road Infrastructure Management System Projects Final Report

Wayne County, Michigan

Contract: DTFH61-96-C-00098 Task: 9844

Submitted to:
United States Department of Transportation

Submitted by:
Science Applications International Corporation (SAIC)

March 2, 2007

FOREWORD

This national evaluation report presents the case study and lessons learned resulting from the examination of the events, challenges, and factors that affected the deployment of the Great Lakes Intelligent Transportation Systems (GLITS) Program Airport ITS Integration and the Road Infrastructure Management System (RIMS) projects in Wayne County, Michigan.

The GLITS Airport ITS Integration project is a multi-phased effort that will include the deployment of ITS field devices and a Traffic Management Center (TMC) to optimize traffic flow in and out of the airport, as well as to optimize airport traffic flow to terminals and short-term parking facilities. The goals of the RIMS project are to utilize modern communications technologies to improve public safety and modernize transportation services and information from over 400 databases into one seamless database within the Wayne County Department of Public Services (DPS), and improve coordination between the DPS, Michigan Department of Transportation (MDOT), and local units of government within the County.

The purpose of this document is to report a case study analysis of the events associated with the GLITS deployment efforts and to present lessons learned that are based on the GLITS project management team experiences. It is anticipated that the reporting on the events and lessons learned may be useful to other public/private sector individuals, Metropolitan Planning Organizations (MPOs), and jurisdictions who may be considering a similar deployment effort.

This document does not supersede an earlier report on the subject.

Cover illustration: Wayne County Airport Authority

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Questions or comments on this document
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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Case Study and Lessons Learned for the Great Lakes ITS Program, Airport ITS Integration and the Road Infrastructure Management System Projects Final Report, Wayne County, Michigan		**5. Report Date** March 2, 2007 **6. Performing Organization Code**
7. Authors Robert R. Sanchez (SAIC) and Carol Mitchell (SAIC)		**8. Performing Organization Report**
9. Performing Organization Name and Address Science Applications International Corporation (SAIC) 1710 SAIC Drive, M/S T1-12-3 McLean, VA 22102		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH61-96-C-00098; Task 9844
12. Sponsoring Agency Name and Address United States Department of Transportation ITS Joint Program Office, Room 2416 400 7th Street, SW Washington, DC 20590		**13. Type of Report and Period Covered** Final Report 5-27-02 – 3-31-07 **14. Sponsoring Agency Code** HOIT-1

15. Supplementary Notes

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16. Abstract

This report presents the case study and lessons learned for the national evaluation of the Great Lakes Intelligent Transportation Systems (GLITS) Airport ITS Integration and Road Infrastructure Management System (RIMS) projects. The Airport ITS Integration project is a multi-phased effort that includes the deployment of ITS field devices and a traffic management center (TMC) to optimize traffic flow in and out of the airport, as well as to terminals and short-term parking facilities.

The RIMS project will integrate a Geographic Information System (GIS) with nearly 400 independent databases being used by various divisions within the Wayne County Department of Public Services (DPS). Using a Web-based approach, information will be made available to Wayne County DPS and the traveling public to improve public safety and modernize transportation services within DPS.

The evaluation originally planned to assess mobility, safety, security, and customer satisfaction impacts. However, because of deployment delays, the evaluation was modified to a case study of key events and the development of lessons learned based on the GLITS project management experiences from 2002 through early 2007. For the Airport ITS Integration project, two events had a significant impact on the project and consequently led to deployment delays. First, the formation of an independent airport authority in 2002 complicated the allocation of funding for the Airport ITS project. Second, the change in Wayne County leadership resulted in a change in project leadership positions within the Wayne County Roads Division. In addition, the changes in project management, personnel, and a loss of project champions also likely contributed to delays in the deployment.

For the RIMS project, three events had a significant impact on the project and resulted in the deployment delays. First, a change in leadership and transfer of project management to the Wayne County Department of Technology (WCDT) slowed the development and the Request for Proposal process. Second, vendor selection and a formal protest by a non-selected vendor delayed the procurement. Finally, negotiations with the vendors to adjust costs and the Statement of Work (SOW) took longer than expected.

The lessons learned effort developed the following three lessons: 1) Develop a project champion succession plan within participating organizations to avoid orphaning a project; 2) delays in finalizing funding arrangements can lead to delays in executing contracts; and 3) recognize that deployment delays can lead to a ripple effect of challenges that affect project deployment progress.

Although the national evaluation of the GLITS Airport ITS Integration and RIMS projects did not yield quantitative system impacts results, it has resulted in some important lessons that could be shared with stakeholders across the country who may be considering a similar deployment effort.

17. Key Words	18. Distribution Statement
Intelligent Transportation Systems, GLITS, Great Lakes ITS, FY2001 Earmark, Detroit Metropolitan Airport ITS Integration, RIMS, Road Infrastructure Management System, Lessons Learned	No restrictions. This document is available to the public from: The National Technical Information Service, Springfield, VA 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21.No of Pages	22. Price
Unclassified	Unclassified	85	N/A

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List of Acronyms

AM	Morning peak traffic period
ATIS	Advanced Traveler Information System
AVL	Automated Vehicle Location
CCTV	Closed Circuit Television
CMAQ	Congestion Mitigation and Air Quality
DDOT	Detroit Department of Transportation
DMS	Dynamic Message Signs
DPS	Wayne County Department of Public Services
DTW	Detroit Metropolitan Wayne County Airport
FHWA	Federal Highway Administration
FIS	Federal Inspection Station
FY	Fiscal Year
GIS	Geographic Information System
GLITS	Great Lakes ITS Project
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MALI	Michigan Accident Location Index
MDOT	Michigan Department of Transportation
MITSC	Michigan ITS Center
MPO	Metropolitan Planning Organization
MOE	Measure of Effectiveness
NTR	North Terminal Redevelopment
OAG	Office of the Auditor General
PDO	Property Damage Only
PM	Evening Peak traffic period
PS&E	Plans, Specifications, and Estimates
RCOC	Road Commission for Oakland County
RFP	Request for Proposal
RIMS	Road Infrastructure Management System
SAIC	Science Applications International Corporation
SEMCOG	South Eastern Michigan Council of Government

SOW	Statement of Work
SMART	Suburban Mobility Authority for Regional Transportation
TEA-21	Transportation Equity Act for the 21st Century
TMC	Traffic Management Center
U.S.	United States
USDOT	U.S. Department of Transportation
WC	Wayne County
WCAA	Wayne County Airport Authority
WCDT	Wayne County Department of Technology

EXECUTIVE SUMMARY

This document presents the case study and lessons learned resulting from the examination of the events, challenges, and factors that affected the deployment of the Great Lakes Intelligent Transportation Systems (GLITS) Program Airport ITS Integration and the Road Infrastructure Management System (RIMS) projects in Wayne County, Michigan.

Background

In 2001, the United States (U.S.) Congress earmarked funds for selected projects that supported improvements in: transportation efficiency; promoting safety; increasing traffic flow; reducing emissions of air pollutants; improving traveler information; enhancing alternative transportation modes; building on existing ITS; enhancing integration; and promoting tourism.

A small number of Fiscal Year (FY) 2001 earmarked projects were selected for national evaluation as part of the U.S. Department of Transportation (USDOT) ITS Integration Program. The purpose of the national ITS evaluation program is to investigate the impacts of ITS across the country and to provide insights into the potential strengths and weaknesses of the overall national integration program. Each evaluation is intended to provide information on the benefits and lessons learned of the project to potentially assist other agencies across the Nation who may be considering similar deployments.

The GLITS program in the Detroit, Michigan metropolitan area was among the projects selected for national evaluation. The FY 2001 GLITS program consists of six major projects designed to integrate current ITS functionality and to deploy additional ITS functionality. Two of the six projects within GLITS, the Wayne County RIMS and the Detroit Airport ITS Integration, were the focus of the national evaluation under the direction and partial funding by the U.S. Department of Transportation (USDOT) ITS Joint Program Office (JPO).

The GLITS Airport ITS Integration project is a multi-phased effort that will include the deployment of ITS field devices and a traffic management center (TMC) to optimize traffic flow in and out of the airport, as well as to optimize airport landside traffic flow to terminals and short-term parking facilities. The goals of the Airport ITS Integration project are to improve the internal circulation and access needs of airport patrons and integrate the roads and freeways surrounding the airport to ensure efficient airport traffic patterns.

The RIMS Project is intended to demonstrate how geographic information systems (GIS) can be used to build a national intermodal transportation system for the 21st century.[1] This project is being carried out in support of the "National Spatial Data Infrastructure" initiative promulgated by the USDOT. The RIMS project will integrate information currently gathered and stored in 400 existing databases by various divisions within the Wayne County Department of Public Services (DPS) into one seamless system. Using a Web-based interactive program, DPS and the

[1]The Transportation Equity Act for the 21st Century (TEA-21) was enacted June 9, 1998, as Public Law 105-178. TEA-21 authorizes the Federal surface transportation programs for highways, highway safety, and transit for the 6-year period 1998-2002.

traveling public can gain access to road conditions, construction project detours, and the real-time locations of DPS maintenance and snow and removal crews. As one of the most important aspects of Wayne County operations, the RIMS is a management system for planning, designing, building, operating, and maintaining the County's roadway infrastructure. The RIMS is needed to improve the integration between these services. The goals of RIMS are to utilize modern communications technologies to improve public safety and modernize transportation services within DPS and improve coordination between the DPS, Michigan Department of Transportation (MDOT), and local units of government within the County.

Evaluation Overview

To investigate the extent to which the project goals are met and to document best practices in deploying and operating such systems, the USDOT contracted with Science Applications International Corporation (SAIC) to conduct an independent evaluation of the GLITS projects.

Originally, the GLITS project evaluation was intended to be a system impact study to measure or confirm the expected safety, mobility, and customer satisfaction impacts. An evaluation approach was developed for each project based on the anticipated project's performance goals. Pre-deployment (baseline) data was collected for the Airport ITS Integration project but not the RIMS project. Baseline data was collected at the Detroit Metropolitan Airport for the Airport ITS Integration project evaluation. Traffic count data were manually collected for non-peak and peak traffic days at three locations on October 22-23, 2003, and November 26, 2003 in support of traveler mobility analyses. Air passenger counts for a 15-month period from October 2002 through December 2003 were collected to describe the number of scheduled passengers, air taxi (commuter) passengers, and charter passengers. Parking lot transactions for a 2-year period from February 2002 through February 2004 from the Smith/Berry and McNamara Terminals also were collected and analyzed. Finally, the Detroit Metropolitan Wayne County Airport Authority, Division of Public Safety, provided crash data from State of Michigan Traffic Crash Reports for all vehicle crashes occurring on the airport roadways and parking areas from February 2002 through January 2004, which also was collected and analyzed. Results of these analyses are presented in appendices A through D of this report.

Due to the numerous unforeseen events resulting in deployment delays for both the Airport ITS Integration and RIMS projects, the evaluation was modified into a case study investigation of key events and the development of lessons learned based on the stakeholders' experiences. The case study and lessons learned activities included the following tasks:

- Interviews conducted with the GLITS management team.
- Data collection of supporting information.
- Development of lessons learned.
- Development of a final Case Study Report.
- Presentation of findings and conclusions to USDOT.

History of Key Events

Key events that affected the deployment of the Airport ITS Integration and RIMS projects were identified using information obtained from interviews with the GLITS management team; Michigan Legislative session archives; news articles; press releases; archives of Evaluation Team briefings and monthly reports to USDOT; and information derived from the Wayne County and Detroit Metropolitan Wayne County Airport (DTW) Websites.

For the Airport ITS Integration project, two events had a significant impact on the deployment: 1) the formation of an independent airport authority, and 2) a change in leadership. A third event, construction of a new north terminal at the DTW, affected the evaluation effort in terms of the usability of the baseline data which had been collected.

The impact of the creation of a separate independent airport authority complicated the allocation of funding for the Airport ITS project. Since the airport was an independent authority and no longer part of Wayne County, the County had no legal rights or authority at the airport. Michigan State law required that the agency receiving the GLITS and Congestion Mitigation and Air Quality (CMAQ) funds, which are highway funds, were programmed with the understanding that they would be used for ITS at the airport, needed to be an eligible Government county, city, or village agency (per the requirements of Act 51 of Public Acts of 1951) to administer the highway funds.

As a result, the Wayne County Airport Authority (WCAA, the independent authority) and Wayne County experienced a funding dilemma, which resulted in the deployment languishing until both agencies came to an agreement that:

- Wayne County will administer the project.
- Wayne County will release the CMAQ funds for the Airport ITS project.

The second event, the election of a new Wayne County Executive, resulted in a change in the senior project management for the airport project. In 2003, a new Wayne County Executive was elected and project leadership positions at Wayne County Roads Division changed. The new management had new priorities, such as managing a budget deficit. As a result, the GLITS Airport ITS project lost much of the early deployment momentum and priority, which also likely contributed to delays in the deployment schedule.

The third event, the beginning of construction of a new north terminal at DTW in 2005, affected the evaluation effort in terms of the baseline data which had been collected. The North Terminal Redevelopment (NTR) project had a significant impact on the usability of baseline traffic count and crash data collected in 2002 and 2003. The usability of baseline traffic count and crash data collected was called into question because of changes to the airport roadways that were made to accommodate NTR construction activity.

For the RIMS project, three events substantially slowed the project's deployment: 1) Changes in Wayne County leadership and transfer of project; 2) vendor selection and a formal protest by non-selected vendor; and 3) vendor negotiations to adjust cost and Statement of Work (SOW). The first event began in the fall of 2002 when a new Wayne County Executive was elected and took office in early 2003. Also occurring in early 2003, the RIMS project was transferred from the DPS to the Department of Technology (WCDT). After the transfer, a review of the RIMS project was conducted to integrate the project elements with other WCDT plans. In addition, the RIMS project received a new project manager at WCDT. The leadership change (in conjunction with other factors such as organizational changes and internal reviews) appears to have contributed to the project falling behind the original schedule. This sequence of events also slowed progress in developing the Request for Proposal (RFP) necessary to procure vendor services.

Vendor selection and the formal protest by a non-selected vendor also delayed the deployment. By the end of 2003, it was anticipated that a contract would be awarded in early 2004; however, two unexpected events resulted in additional delays. First, a longer-than-expected vendor selection period slowed down project progress. Second, a formal protest lodged by a non-selected bidder effectively halted all progress and prevented any negotiations to finalize vendor contracts.

In early 2004, the longer-than-expected vendor selection period was due to the complexity of the RIMS application. The RIMS application needed multiple vendors to integrate the nearly 400 independent Wayne County databases. As a result, the award was delayed as the RIMS team identified the best combination of bidders to accomplish the range of tasks required in the RFP. In the summer of 2004, a team of vendors were chosen to perform different elements of the contract tasks. During this time it was anticipated that a project kick-off meeting would move to September 2004. However, the official kickoff of the design effort was moved to the first week of January 2005 due to the formal protest by one of the non-selected vendors.

The third event, negotiations between Wayne County and the selected vendors to adjust cost elements and the SOW, also compounded the delay. The negotiations and final approval of contracts, which began in January 2005, took substantially longer than expected. The vendor contracts were finalized in 2006, and the RIMS project was finally re-started in December 2006.

Lessons Learned

Since its inception in 2001, the GLITS project management team for the Airport ITS Integration and RIMS projects has encountered a variety of situations that have challenged the projects' development. In an effort to better understand the events, issues, and factors that have influenced the GLITS deployment and share this knowledge so others may learn from the experiences, interviews were conducted with the GLITS project management team. In addition, supporting information was collected to investigate, identify, and examine information that might be useful in describing the events and factors. From the resulting information, a series of lessons learned were developed in a format compatible with other lessons currently residing on the ITS Lessons Learned Knowledge Resource Website.

Three primary lessons were developed based on the GLITS project management experiences from 2002 through early 2007, and are identified as follows.

Lesson 1: Develop a project champion succession plan within participating organizations to avoid orphaning a project and facilitate project progression.

The following leadership- and staffing-related insights are based on the discussions with the GLITS management team:

- **Develop a succession plan that anticipates changes in the political environment if changes may adversely affect the project.** The election of a new Wayne County Executive in 2003 resulted in a change of project management at the Wayne County Roads Division. The new management had new priorities, such as managing a budget deficit. As a result, the GLITS Airport ITS project lost much of the early deployment momentum and priority. Given that changes in the political environment are likely to occur during election years, projects benefiting from politically appointed champions should consider building public support and organizational structures that will foster continued support for the project.

- **Build relationships with organizations that can help identify candidates to fill personnel vacancies before the project is adversely affected.** The contributions of key personnel are as important to a successful project as project champions and senior management. Similarly, the loss of key personnel can be just as detrimental to a project as the loss of a project champion or senior manager. Consequently, project managers need to identify and cultivate relationships with other organizations, which may be helpful in identifying qualified candidates to fill personnel vacancies.

- **Prepare for staffing changes and reorganizations that can disrupt project progress.** Whereas changes in the political leadership are likely to occur during election years, staffing changes and organizational changes may occur with little notice and can disrupt project progress. For example, prior to the spring of 2002, the DTW was managed by Wayne County. However, in April 2002, the Wayne County Airport Authority became a separate agency responsible for the management and operation of Detroit Metropolitan Wayne County Airport. The Wayne County Airport Authority also had the power to plan, promote, extend, maintain, acquire, purchase, construct, improve, repair, enlarge, and operate the airport. As a result, the Wayne County Airport Authority wanted to control the funding for the GLITS Airport ITS Integration project. However, the creation of the Wayne County Airport Authority was not foreseen at the time the 2001 Earmark funding was granted. Consequently, the Wayne County Airport Authority's formation resulted in funding issues because it was not allowed under Federal regulations to control and distribute the highway funds.

Lesson 2: Delays in finalizing funding arrangements can lead to delays in executing contracts.

The following funding-related suggestions are based on the GLITS project management team experiences:

- **Explore alternative funding arrangements when changes within stakeholder organizations complicate funding arrangements.** Inter-agency funding arrangements can lead to delays in awarding/executing project contracts. When the Wayne County Airport Authority became an independent entity and was no longer part of Wayne County, the County had no legal rights or authority at DTW. Since GLITS and CMAQ funds, which were programmed with the understanding that they would be used for ITS at DTW, are actually highway funds, under Michigan State law, the agency receiving the funds needed to be an eligible Government county, city, or village agency (per the requirements of Act 51 of Public Acts of 1951) to administer the highway funds. Consequently, the Wayne County Airport Authority and Wayne County experienced a funding dilemma which resulted in the deployment languishing until both agencies came to an agreement on two elements that:

  - Wayne County will administer the project.
  - Wayne County will release the CMAQ funds for the Airport ITS Project.

- **Utilize clearly defined proposal evaluation criteria to determine procurement awards and reduce the likelihood of contractor protests.** The WCDT intended to award two contracts for RIMS hardware. After soliciting for bids and reviewing the proposals, the agency decided on two vendors. However, a non-selected bidder contested the decision and WCDT was forced to delay the procurement while the Wayne County Purchasing Department, Human Relations Division, and Corporation Counsel Department reviewed the evaluation and selection process. The protest review took about 1 year to resolve. In addition to having a clearly defined set of proposal evaluation criteria, agencies should strive to ensure bidders understand the procurement process, especially the evaluation factors, their relative importance, and the scoring and selection process.

- **Funding requirements from ITS Earmarks can place unexpected burdens on the recipient agencies.** The requirement to provide matching funds to receive the Earmark funding can sometimes cause funds to be diverted from other planned projects. Further, ITS Earmarks can be directed toward County or local agencies that have little or no expertise in building ITS projects or managing unanticipated ITS funds. Finally, Earmark funds for ITS projects may not be as high a priority for County or local agencies which are struggling to fund much needed other improvements (e.g., maintenance and repairs).

Lesson 3: Recognize that deployment delays can lead to a ripple effect of challenges that affect project deployment progress.

The following time-related suggestions are based on the GLITS Airport ITS Integration project experience:

- **Keep in mind that the longer a project takes to be deployed, the greater the likelihood the project will lose key personnel.** In addition to leadership changes due to changes in the political environment, long delays can result in the loss of key personnel due to numerous other factors such as desire to change jobs, retirements, promotions, health considerations, etc.

- **Be cognizant that the longer a project takes to be deployed, the more likely stakeholder agencies could reorganize.** Although probably less likely to occur than the loss of key personnel, the GLITS experience has shown that the reorganization of agencies can have a detrimental effect on the project deployment.

- **Realize that stumbling blocks that produce long delays can put a project in competition with other high-priority emerging projects.** The long delay for the Airport ITS Integration project pushed the ITS-related deployment activities into the civil construction activities scheduled for building the new $418 million NTR project. As a result, the Airport ITS Integration project will be required to share the Wayne County Airport Authority staff and coordinate time resources to avoid conflicts with the construction activities—a responsibility that was not foreseen several years ago.

Conclusions

Although the national evaluation of the GLITS Airport ITS Integration and RIMS projects did not yield quantitative system impacts results, it has resulted in some important lessons that could be shared with stakeholders across the country who may be considering a similar deployment effort.

1 INTRODUCTION

In 2001, the U.S. Congress earmarked funds for selected projects that supported improvements in transportation efficiency, promoting safety, increasing traffic flow, reducing emissions of air pollutants, improving traveler information, enhancing alternative transportation modes, building on existing intelligent transportation systems (ITS), enhancing integration, and promoting tourism.

A small number of Fiscal Year (FY) 2001 earmarked projects were selected for national evaluation as part of the U.S. Department of Transportation (USDOT) ITS Integration Program. The purpose of the national ITS evaluation program is to investigate the impacts of ITS across the country and to provide insights into the potential strengths and weaknesses of the overall national integration program. Each evaluation is intended to provide information on the benefits and lessons learned of the project to potentially assist other agencies across the nation who may be considering similar deployments. The Great Lakes ITS (GLITS) program in the Detroit, Michigan metropolitan area was among the projects selected for national evaluation. The FY 2001 GLITS program consists of six major projects designed to integrate current ITS functionality and to deploy additional ITS functionality. Two of the six projects within GLITS, the Detroit Airport ITS Integration and the Wayne County Road Information Management System (RIMS), were the focus of the national evaluation under the direction and partial funding by the U.S. Department of Transportation (USDOT) ITS Joint Program Office (JPO).

The USDOT selected Science Applications International Corporation (SAIC) to conduct an independent evaluation of GLITS projects. The evaluation was intended to be a study of system impacts focusing on traffic mobility, safety, and productivity that was expected to result through the integration of traditional asset management, maintenance, traffic operations, and traffic management functions within a high-density travel corridor.

1.1 Justification for National Evaluation

Originally, the Airport ITS Integration and RIMS projects presented a good opportunity for a successful national ITS evaluation because:

- Substantial funding was already in place and many of the institutional challenges associated with ITS deployment have been addressed through a cooperative process rooted in past projects and driven by a regional ITS vision. Inter-jurisdictional data transfer agreements among project stakeholders have been established to address potential institutional challenges.
- The ITS Airport Integration and RIMS projects provided a unique opportunity to examine new areas of ITS integration.
- Measurable benefits were expected from these evaluations. Specifically, the corresponding traffic flow condition and safety performance were expected to be assessed quantitatively, while the information pertaining to roadway conditions and user satisfaction were expected to be assessed qualitatively.

It was perceived that great opportunities exist in this corridor for ITS integration and to broaden the wealth of knowledge regarding ITS. The "lessons learned" during the course of these deployments will prove valuable to other regions considering similar ITS applications.

1.2 Problem Statement

The Detroit metropolitan area is one of the largest cities in the country and has one of the busiest airports. In terms of population, Detroit is ranked the eighth most populated metropolitan area in the United States according to the 2000 U.S. Census.[2] To keep the transportation system and structures (bridges, signs, roadways) repaired, maintained, and operating, Wayne County Department of Public Services (DPS) expends substantial resources annually (approximately $57.6M for operating expenditures in 2005[3]). In an effort to improve the quality and efficiency of maintenance operations, coordination between agencies, and other transportation services, the DPS began the development of RIMS to provide seamless access to over 400 databases and support a variety of GIS-related applications.

The Detroit metropolitan area also has one of the busiest airports. Detroit Metropolitan Wayne County Airport (DTW) is the eleventh busiest in North America (and twentieth worldwide) in terms of total passengers for 2005.[4] As such, the large number of travelers entering and exiting the airport created a need to improve traffic conditions by reducing internal traffic circulation and improving access to freeways and parking facilities. To address this situation, the Airport ITS Integration project was initiated to monitor traffic conditions, respond more quickly to incidents, and provide real-time traffic guidance within the airport.

1.3 Primary Project Goals and Key Hypotheses

The primary goals of the Airport ITS Integration project are to improve the internal circulation and access needs of airport patrons and integrate the roads and freeways surrounding the airport to ensure efficient airport traffic patterns. The evaluation focused on measuring the impacts of the deployment on increasing mobility, public safety, and customer satisfaction and to identify lessons learned. The key hypotheses for the Airport ITS Integration project are:

- Project assumes real-time traffic data will be made available to the traveling public, thereby contributing to increased mobility.
- Improve safety by informing the traveling public well in advance of incidents, potential hazards, and security issues.

[2]From U.S. Census 2000 Ranking Tables for Metropolitan Areas: 1990 and 2000 Website, last accessed on February 19, 2007 at: <http://www.census.gov/population/cen2000/phc-t3/tab03.pdf>.
[3]From Wayne County Department of Management and Budget Website, last accessed on February 20, 2007 at: <http://www.waynecounty.com/mgtbudget/budgetDocs/2005_06/deptPublicSrvs.pdf#pagemode=bookmarks>.
[4]From Airports Council International Website, last accessed on February 19, 2007 at: <http://www.aci-na.org/asp/traffic.asp?art=215>.

- Project assumes that the real-time information made available through ITS technologies to the traveling public on airport conditions (traffic, parking availability, curbside access, and safety) will contribute to increased customer satisfaction.

The primary goals of the RIMS project are to utilize modern communications technologies to improve public safety and modernize transportation services within Wayne County Department of Public Services (DPS) and improve coordination between the DPS, Michigan Department of Transportation (MDOT), and local units of government within the County. The key hypotheses for the RIMS project are:

- Customer satisfaction will increase as the DPS makes more real-time information available.
- The provision of real-time traffic and roadway condition information will contribute to improved mobility by reducing delays and increasing travel time reliability.
- Using a Geographic Information System (GIS), the RIMS will improve DPS operations by increasing awareness of potential problems; efficiently routing public complaints; providing enhanced responsiveness to in-road maintenance; and reducing design time.
- The RIMS will provide real-time information on traffic and road conditions, ultimately improving safety by informing the traveling public well in advance of incidents and potential hazards (including weather).

The *Phase II (baseline) Report for the Great Lakes Intelligent Transportation System Airport ITS Integration Project*[5] describes the baseline data collected to support the independent evaluation of the associated Airport ITS Integration component of the project. The Airport ITS Integration component is a multi-phased effort that includes the project design, deployment of ITS field device, and integration of an airport Traffic Management Center (TMC). This deployment will facilitate an integrated approach to management of on-field traffic and traffic traveling to and from the DTW on the servicing freeways.

In latter phases of the project, the airport TMC will interface with the MDOT regional TMC and MDOT-owned ITS devices. In its final configuration, the airport TMC will be capable of serving as a backup location for the MDOT regional TMC. The project goal is to optimize traffic flow in and out of the airport, as well as to optimize airport landside traffic flow to terminals and short-term parking facilities.

1.4 Background

The Great Lakes International Economic Corridor comprises all of southeast Michigan from Toledo, Ohio to Flint, Michigan. The area is implementing aggressive, multimodal transportation initiatives to further economic activity and growth within the region. The region supports the U.S. auto industry with a complex network of transportation systems including air, freeway, rail,

[5] *Phase II Report for the Great Lakes Intelligent Transportation System Airport ITS Integration Project,* prepared by Science Applications International for the USDOT, April 28, 2006.

and waterway links and hubs that connect Detroit with suppliers and customers in the United States and Canada. To date, ITS has been deployed throughout the Great Lakes International Economic Corridor and significant benefits are being realized in the areas of traffic management, incident response, commercial vehicle management, and response to winter weather conditions.[6] The GLITS program seeks to integrate previously deployed ITS projects and to design, integrate, and deploy future projects in a stepwise effort to meet the transportation demands peculiar to the region.

1.5 GLITS Program Overview

The GLITS Program is a multiphase program of ITS integration projects in the Great Lakes International Economic Corridor. MDOT is the lead for development and management of this multiphase, multijurisdictional program. Currently, other GLITS partners include:

- The Southeast Michigan Council of Governments (SEMCOG).
- Wayne County (WC).
- The Detroit Metropolitan Wayne County Airport (DTW).
- The Road Commission for Oakland County (RCOC).
- The Detroit Department of Transportation (DDOT).
- The Suburban Mobility Authority for Regional Transportation (SMART).

1.5.1 Airport ITS Integration Project

The Airport ITS Integration project was established for the design and integration of systems to serve airport needs. The ITS effort is an integral part of the ongoing DTW expansion. This project will give the Wayne County Airport Authority (WCAA) the ability to monitor traffic conditions, respond more quickly and appropriately to incidents, and provide real-time traffic guidance within the airport. The airport system also will be integrated with the MDOT Michigan ITS Center (MITSC) to enable real-time traveler incident, congestion, and delay information to drivers heading to and departing from the airport.

The project has two phases. The first is the design and deployment of field devices. This includes developing functional requirements and a Plans, Specifications, and Estimate (PS&E) package to cover procurement, device installation, and testing; a communications infrastructure deployment; and software procurement. These efforts will support the build and implementation of an Airport TMC during the second phase. The second phase consists of architectural design and renovation of the new TMC, along with the design and installation of the associated TMC systems and software; and the design and location of security/surveillance and detection systems.

1.5.2 RIMS Project

The RIMS project leverages current physical and information infrastructure by providing an integrated system that will lead to more efficient maintenance of freeway and arterial systems.

[6] *Great Lakes ITS Program (GLITS) Final Evaluation Plan*, prepared by Science Applications International for the USDOT, June 5, 2003.

Travel efficiency should be improved by providing more consistent and up-to-date signage; improved scheduling of operationally integrated maintenance; timely snow and ice removal; and enhanced accuracy of automated traveler information systems.

The expected result is intended to be an improvement in highway capacity to support the region's high volumes of local, commuter, and commercial traffic. As part of the RIMS effort, Wayne County is working to establish an integrated (GIS) that can integrate nearly 400 currently independent databases used for County operations into one data warehouse. This GIS is being funded with 100 percent County funds.

The primary goals of RIMS are to utilize modern communications technologies to improve public safety and modernize transportation services within the Wayne County DPS and improve coordination between the DPS, MDOT, and local units of government within the County.

1.5.3 GLITS Project Components

Phase I of GLITS involves six ITS projects designed to increase transportation efficiency. The six projects include:

- Completing the Southeast Michigan Regional Architecture to support the region's integration plans.
- Completing the RIMS for Wayne County, Michigan.
- Integrating the DTW with area-wide transportation operations.
- Conducting the I-75 Corridor ITS Integration Study to examine the integration and deployment of an area-wide traffic and incident management system on the I-75 corridor.
- Conducting the M-1/Woodward Avenue ITS Integration Study to develop an integration plan for seamless intermodal operations on Woodward Avenue in Detroit.
- Developing plans to establish the region as an ITS "test bed."

Each of these Phase I projects is important for addressing the major transportation issues in the Southeast Michigan region. The first step is to document the current regional architecture and to provide a mechanism for closure on the objective regional architecture as depicted in Figure 1. The other projects flow out of the regional architecture to address the highest priority integration issues facing this region. For example, the RIMS project should provide benefits to the DPS and serve as a resource for other transportation infrastructure and information users within the region.

A second example is the Airport ITS Integration project, which complements the recent DTW expansion. The expansion included opening a second terminal; opening additional interstate access routes; and improvements in the landside transportation management that will be incorporated into the regional traffic management concept.

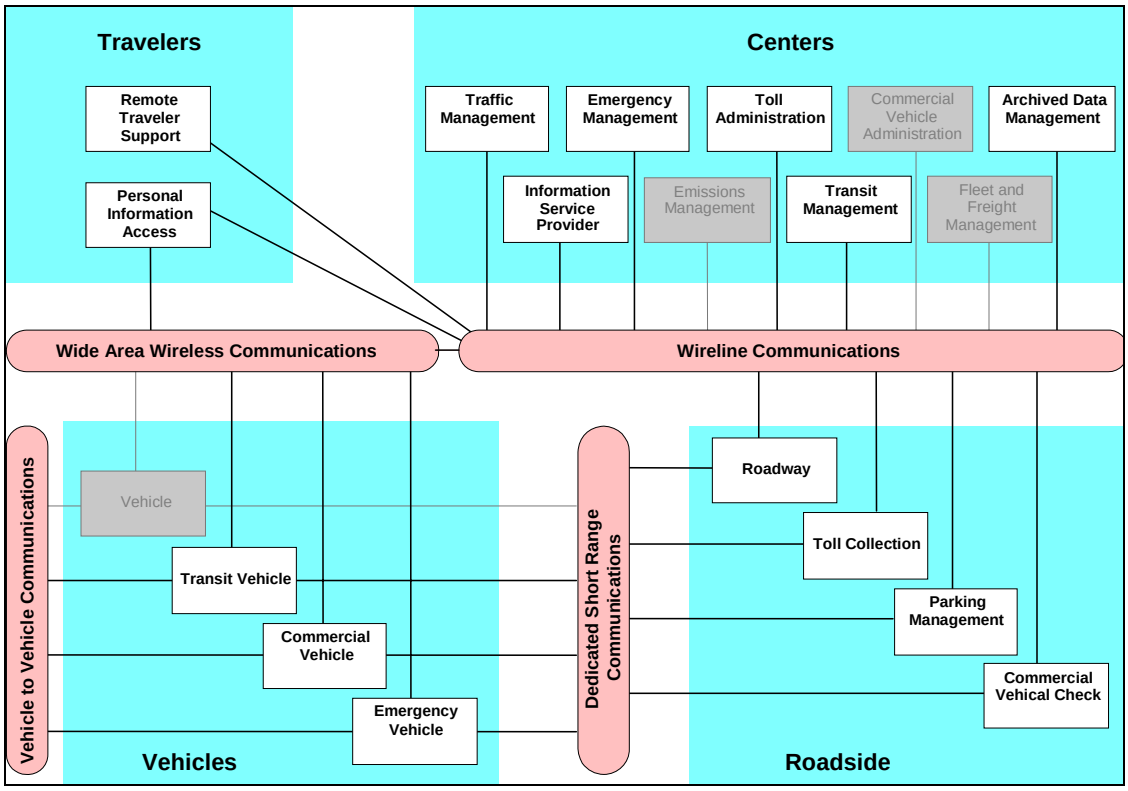


Figure 1. The Southeast Michigan Regional Architecture "Sausage Diagram."

Phase II is focusing on the continued integration of freeway and arterial road operations, enhancing traveler information, intermodal coordination (both passenger and freight), and initial Advanced Traveler Information System (ATIS) "test bed" applications. Phase III will concentrate on further enhancements to the previous deployments, while increasingly integrating commercial vehicle applications and private sector initiatives. In Phase IV, the GLITS stakeholders will procure new arterial management software for State and key local agencies, and a statewide license for freeway management software.

1.6 Evaluation Overview

Initially, the evaluation was intended to be a system impact study to measure or confirm the expected safety, mobility, and customer satisfaction impacts. However, because of unforeseen deployment delays for both the Airport ITS Integration and RIMS projects the evaluation was modified into a case study investigation of key events and the development of lessons learned based on the stakeholders' experiences.

1.7 Evaluation Components

The GLITS project evaluation consists of a case study of system impacts and development of lessons learned based on stakeholder experiences, and recommendations for other jurisdictions and agencies considering a similar deployment. The case study and lessons learned activities included the following tasks:

- Interviews with the GLITS management team.
- Collection of supporting information.
- Development of lessons learned.
- Development of a final Case Study Report.
- Presentation of findings and conclusions to USDOT.

1.8 Report Organization

The remainder of this Final Report document is organized as follows:

- **Section 2: The GLITS Project Overview:** This section provides an overview description of the DTW Airport ITS Integration and RIMS projects.
- **Section 3: Summary of Evaluation Activities:** This section provides a summary of the evaluation activities conducted as part of the independent national evaluation of the Airport ITS Integration and RIMS projects.
- **Section 4: History of Events:** This section describes the key events that affected the deployment of the Airport ITS Integration and RIMS projects. The accounts cited are based on news articles and interviews with the GLITS management team.
- **Section 5: Lessons Learned:** This section describes lessons that were developed from the GLITS project management experiences from 2002 through early 2007.
- **Section 6: Summary and Conclusions:** This section summarizes the events and lessons that were learned from the GLITS project management experiences.
- **Appendix A: Traffic Flow Data.**
- **Appendix B: Air Passenger Counts.**
- **Appendix C: Parking Lot Transactions.**
- **Appendix D: Vehicle Crashes: February 2002 through January 2004.**

2 THE GLITS PROJECT OVERVIEW

This section provides an overview description of the DTW Airport ITS Integration and RIMS projects.

2.1 Airport ITS Integration Project Description

As part of a multi-phased project that includes the deployment of ITS field devices and a TMC, the Airport ITS Integration project facilitates an integrated approach to manage on-field traffic and traffic traveling to and from the airport on the servicing freeways. In latter phases of the project, the airport TMC will interface with the MDOT regional TMC and MDOT-owned ITS devices. In its final configuration, the Airport TMC will be capable of serving as a backup location for the MDOT regional TMC. The overall project goal is to optimize traffic flow in and out of the airport to optimize airport landside traffic flow to terminals and short-term parking facilities to ensure efficient airport traffic patterns.

The DTW is expanding to accommodate current and future demand for air transportation. A new mid-field terminal opened in February 2002. With this 11,500-space parking structure located adjacent to the McNamara Terminal / Northwest World Gateway, the airport now has nearly 17,000 available on-airport parking spaces.[7] This has significantly changed the landside traffic patterns, since operations for the airport's major air carrier (approximately 80 percent of the passengers) are now concentrated in a single, modern facility. This new facility, located about 1 mile from the old terminal, includes an integrated parking garage and passenger/baggage transfer area.

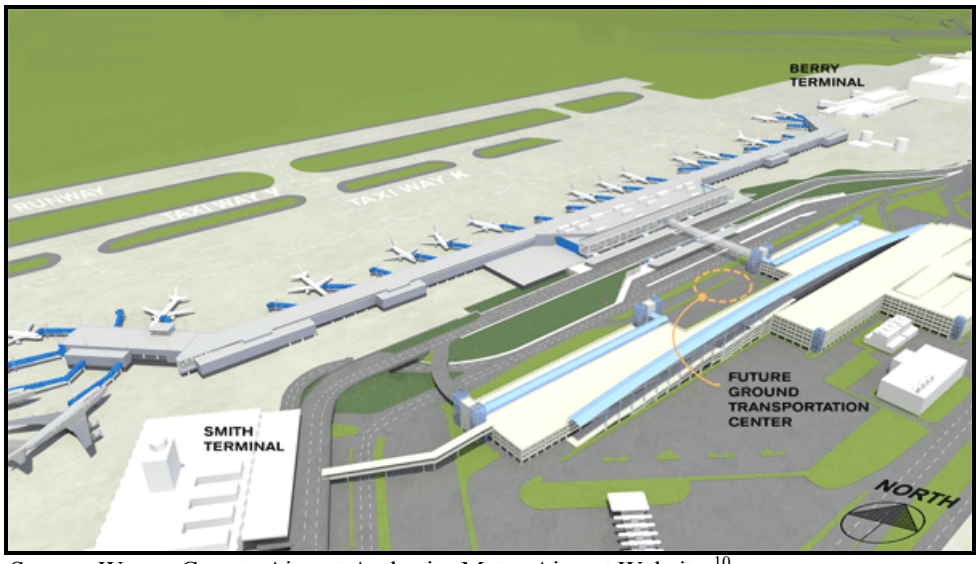
The old terminal will continue to serve the remaining air carriers with terminal facilities, curbside check-in, and a detached parking garage. The new facility will allow landside traffic to be distributed between the two terminal areas. Known as the North Terminal Redevelopment (NTR) project, a planned 26-gate terminal complex is being designed to replace the airport's older Berry and Smith terminal complex. In September, 2003, the Wayne County Airport Authority authorized the sale of up to $825 million in bonds to fund future airport expansion projects. The current authorized project is estimated to be a $418 million project.[8]

When complete, the new North Terminal complex will be used to accommodate DTW's airlines that are currently operating out of the aging L.C. Smith and Berry Terminals. The new terminal will also have a Federal Inspection Station (FIS) to accommodate international flights. A three-level Ground Transportation Center will be constructed adjacent to the blue deck to accommodate all commercial vehicle loading and unloading.[9]

Besides the change in traffic distribution between the two terminals, the Wayne County Airport Authority released building plans in August 2006 to add a second short-term covered parking

[7] North Terminal Project information last accessed from the Metro Airport Website on November 28, 2006: <http://www.metroairport.com/project/>.
[8] Ibid.
[9] Ibid.

structure (see Figure 2). This facility will impact landside traffic patterns due to the overall increase in short-term parking capacity. Figure 3 presents a map overview of the DTW area.



Source: Wayne County Airport Authority Metro Airport Website.[10]

Figure 2. DTW Metro Airport Overview.

Source: Wayne County Airport Authority Metro Airport Website.[11]

Figure 3. Map Overview of the DTW Metro Airport Area.

[10]Aerial view of an artist's rendering of the completed North Terminal, subject to change as the design matures and is finalized. Information last accessed from the Metro Airport Website on November 28, 2006: <http://www.metroairport.com/project/DesignRendering.asp>.

[11]DTW Metro Airport Overview Map last accessed from the Metro Airport Website on November 28, 2006: <http://www.metroairport.com/pdf/maps/metro_area_map.pdf >.

It is anticipated that as the new terminal reaches capacity, parking capacity in the terminal's associated garage may be exceeded and result in traffic diversion to the old parking garage. Using ITS devices to measure garage space availability, real-time parking information will be provided to drivers via on-field dynamic messaging signs (DMS). This information will enable drivers to make appropriate decisions with respect to passenger drop-off/pickup, baggage check-in/pickup, and short-term parking locations.

In addition to on-field changes to terminal and parking facilities, opening the new 6-mile long south access road, Rogell Drive, provided additional airport access from north and south points of entry from two different interstate highways (I-94 and I-275). The highway and surface transportation infrastructure serving the airport terminal and parking areas will be instrumented and managed via combined ITS, safety, security, and parking systems. The need to integrate these systems is critical to ensuring the safety and convenience of airport patrons and highway travelers.

The ITS solution was intended to provide tools designed to address and overcome potential multi-jurisdictional and institutional challenges. Airport patrons drive from all over southeast Michigan, and from as far away as Ontario, Canada, and northern Ohio. In addition, the traffic impacts associated with the airport are often experienced miles away on area freeways and arterial roads. Therefore, to effectively serve airport patrons and to manage traffic at the airport, the ITS solution will include interfaces with the MDOT Freeway Management System and with Wayne County Roads Division. These interfaces must be designed to reflect operational considerations, such as data exchange requirements, shared control (if any), and system security features.

It was expected that the deployed ITS solution should make the transition in and out of the airport environment efficient and safe, while providing information to support the most efficient on-airport routing decisions. The information systems should provide easily understood, intuitive messages for better communication with a wide range of airport patrons, from domestic to international travelers.

2.1.1 Detroit Metropolitan Airport ITS Integration Project – Specific Tasks

The Metro Airport project involves integration at multiple levels between numerous agencies within the Wayne County Airport Authority and with outside agencies. An initial list of participants includes: Metro Airport Roads, Metro Airport Police, Metro Airport Parking, Wayne County Roads Division, and eventually MDOT. The project area encompasses the entire on-field public use road system, all on-field parking facilities, and the passenger drop-off and pickup areas at both commercial terminals. The project's physical boundaries extend down the new South Access Road and the North Access Road to the Wayne County Airport Authority property lines. Information system boundaries will extend onto the I-94 and I-275 highways as airport traveler information is posted on MDOT-operated DMS.

Data will be shared among agencies involved in incident and congestion management on airport property and surrounding highways. It will be necessary to design interfaces between the Metro Airport South access road ITS system and the midfield terminal curbside traffic management and

information system, to include the parking management system, the life safety systems on the south access road, and the Airport Police dispatch system.

Integrating the ITS solution with surrounding freeways will be accommodated through information sharing with MDOT traffic management systems serving the Interstate highways in the airport area. The incorporation of life safety systems and the Airport Police dispatch will be facilitated through ITS control systems in the Metro Airport Traffic Management Center. The integration plans regarding parking management and the midfield terminal will be developed during the ITS design project.

The system will include advance traffic management functions and traveler information capabilities. Equipment such as Closed Circuit Television (CCTV) cameras, loop detectors, and over-dimensional vehicle detectors will be used to monitor traffic conditions and potential problems on the South Access Road. A TMC will be located in the Sheriff's Building to receive the data and video from the surveillance equipment. The TMC will be equipped with control systems to manage traffic signals, lane controls, portal signals at the tunnels, and other traffic management capabilities. Using DMS, Website enhancements, radio, and other highway advisory media systems, airport patrons will be notified regarding impending traffic conditions, parking availability, and other information, as warranted.

2.2 Road Infrastructure Management System Project Description

The RIMS project will integrate information currently gathered and stored in existing databases by various divisions within the Wayne County DPS into one seamless system. Using an interactive Web-based approach, information will be made available to DPS and the traveling public. This information pertains to road conditions, including snow and ice removal requirements and during the critical summer construction months (Pavement Management Application and a Vehicle-Automated Vehicle Location System [AVL]); construction project detours (a Permits and Plan Review Application); and the real-time location of moving DPS maintenance crews (a Maintenance Management System).

Various agencies in Wayne County, Michigan, are working together to establish an integrated GIS that can integrate nearly 400 currently independent Wayne County databases used for their operations into one data warehouse. This GIS is being funded with 100 percent County funds. As one of the most important aspects of Wayne County operations, the RIMS is a management system for planning, designing, building, operating and maintaining the County's roadway infrastructure. The RIMS is needed to improve the integration between these services. RIMS also will enable real-time maintenance vehicles dispatch, and ultimately will be capable of providing real-time transportation information on alternative travel routes and modes to travelers and the media, all accessible via the Internet.

The goals of RIMS are to utilize modern communications technologies to improve public safety and modernize transportation services within DPS and improve coordination between the DPS, MDOT, and local units of government within the County.

In a project update discussing 2006 technology projects, Wayne County Executive Robert A. Ficano's office released the following information about GIS-related database applications for address and demographic referencing information used in conjunction with the RIMS project.

> Through a partnership with local, state, and regional government, Wayne County has combined its 1:1200 scale street centerline file with the powerful attributes of the Michigan Geographic Framework product. Through a conflation process the Wayne County Geographic Framework now includes two valuable referencing tools. The Census Bureau's TIGER files, including address and demographic referencing information, and a Linear Referencing System based on the Michigan Accident Location Index (MALI). The positional accuracy and the plethora of attributes support a variety of GIS-related applications for local, county, regional, state, and national projects.[12]

2.2.1 Wayne County RIMS Project – Specific Tasks

Specific operations included for this development phase include Traffic Signal Control, Freeway Management, Incident Management, and other ITS-supportable operations (including snow and ice removal). The project aims to demonstrate how all four of these operations can be integrated into a single management system by using the enhanced GIS capabilities. The intention is to demonstrate how state of the art GIS technology can be used to modernize DPS operations and enhance the performance of the region's inter-modal transportation systems.

During planning sessions, the DPS GIS Technical Committee (Committee) noted that many of the proposed applications were heavily dependent on the county-wide base map being prepared for the GIS Management Unit. The Committee proposed that this base map be used as the backbone for the future management subsystems identified within RIMS. The base map will consist of digital orthophotography images of the entire county, including road centerline planimetrics with a positional accuracy of +/- 1 foot on the ground. Figure 4 is a sample reference frame contained in the Michigan State Plane Coordinate System.

This reference system will place all regional transportation management agencies (Wayne County, MDOT, and the South Eastern Michigan Council of Governments [SEMCOG]) on an interoperable GIS platform. The common reference system will promote the use of a central data warehouse, which can be displayed accurately on one map and in one location whenever needed. This first map layer will be the foundation to which other applications will be added over a period of several years. The resulting environment is one where road managers act more proactively to maintain smooth traffic conditions and respond more quickly in dispatching work crews to repair problems and re-route traffic should an incident crisis arise.

One of the first uses of the common GIS platform will be Wayne County's sign and signal application. When fully developed, it will incorporate the location of all County-maintained signals, and incorporate remote control access for timing devices and ITS ground loop detectors, with the potential to incorporate CCTV in the future.

[12]Excerpted from the Wayne County Website, DOT GIS Geographic Information System, last accessed on November 29, 2006: <http://www.waynecounty.com/gis/projects.htm#road>.

Source: Wayne County Orthophotography and Planimetric Web Page.[13]

Figure 4. Sample Orthophotography and Planimetric Reference Frame from RIMS Database.

Using these technologies may enable the Traffic Control Division staff to dynamically change traffic light timing sequences to actively manage diversion routes in response to incidents on highways and service drives. These systems will all be tied to the County base map and GIS allowing the Traffic Control Division staff to analyze the situation, run complete routing and "what if" scenarios before making adjustments to traffic control timing devices.

Once the sign and signal application is linked to the County base map, DPS engineers and management will have the ability to view traffic control signals and signs in relation to traffic incidents during freeway management reviews. Integrating these two systems will incorporate the new sign and signal application with the MALI projects already in use and under the direction of SEMCOG. In addition to relating accident information to the County base map, the County Roads Division is initiating a pavement management application using GIS aimed at monitoring and recording pavement conditions for all County-maintained roadways. These combined systems will greatly enhance DPS' planning and design resources.

A key feature of the RIMS is the ability to concurrently link and display roadway record information with real-time information transmitted from County Road Division vehicles during

[13]Sample orthophotography and planimetric reference frame extracted from the Wayne County Website, last accessed on November 29, 2006: <http://www.waynecounty.com/gis/projects.htm>.

weather events. By linking the information gathered by the DPS vehicles in the AVL application with the GIS road network, routing and maintenance problems can be addressed and enable adjustments to be made almost immediately. In addition, this information will be made available via the Internet to local County governments, private business, and the general traveling public.

2.3 Project Deployment Schedules and Funding Resources

The following subsections provide a description of the project deployment schedules and funding for the Airport ITS Integration and RIMS projects. See section 4, History of Events, for a discussion of the events contributing to the deployment delays.

2.3.1 Airport ITS Integration Project Deployment Schedule and Funding Resources

Plans, specifications, and estimates for deploying the Airport ITS Integration project were scheduled for bid issuance by summer 2003. Given Wayne County's 3-month bid and award process, this would allow system implementation to begin in fall 2003 with an anticipated completion date in mid-2004. However, due to a series of events as described in section 4, History of Events, there were delays in the funding and deployment of the project. The deployment is currently anticipated to occur in the summer of 2007.

To date, funding for the Airport ITS Integration project is being derived from portions of four ITS Earmarks (FY 2001 through FY 2004) totaling $4,637,046 from the following Federal resources:

- FY 2001: A portion of GLITS Phase I funds – $2,394,525.
- FY 2002 Detroit, Michigan Airport: $1,240,977 (component of GLITS Phase II).
- FY 2003: Tentatively, a portion of GLITS Phase III – $700,000).
- FY 2004 Detroit Metro Airport ITS: $301,544.

The FY 2001 and FY 2002 funds have been authorized. The FY 2003 and FY 2004 have not yet been authorized.

2.3.2 RIMS Project Deployment Schedules and Funding Resources

The RIMS project was originally planned to be phased in over an 18-month period beginning in the spring of 2003. However, due to the events described in section 4, History of Events, the funding and deployment of the project was delayed. The anticipated completion of the project is now projected to be in early 2009. The project consists of 23 individual steps involving system deployments, testing, enhancements, and integration. As each application is fully integrated with the RMIS, the information will be brought online and become accessible via the Internet to internal users, external agencies, and the public.

To date, following are the funding breakdowns for the RIMS project based on Earmark resources and by fiscal year amounts:

- RIMS (Wayne County): Net total of $6,905,673; ITS portion $4,421,923.
- Three ITS Earmarks (FY 2000, FY 2001, and FY 2002): $4,421,923.
- FY 2000 Wayne County, Michigan: $786,421.
- FY 2001: A portion of Wayne County, Michigan/GLITS Phase I: $2,394,525.
- FY 2002 Wayne County RIMS: $1,240,977.
- FY 2003 non-ITS Earmark (Section 330 for Wayne County RIMS): $2,483,750, for a grand total of $6,905,673.

The FY 2000 through FY 2002 funds have been authorized; FY 2003 Section 330 funds have not.

3 SUMMARY OF EVALUATION ACTIVITIES

This section provides a summary of the originally planned and later modified evaluation activities conducted as part of the independent national evaluation of the Airport ITS integration and RIMS projects.

For the originally planned evaluation, a structured approach was used in developing the plan for evaluating the GLITS ITS Integration project. The original evaluation activities presented here are based on the review of evaluation documents (*GLITS Evaluation Plan* and the *Airport ITS Integration Detailed Test Plan*); project documents (Earmark funds application, MDOT-sponsored research reports, maps, cost estimates, etc.); site visits and meetings; and follow-up discussions with the GLITS management team and stakeholders. Project goals and objectives were used as the basis for developing evaluation objectives, study areas, and the approach for investigating each key hypothesis.

The GLITS project evaluation originally consisted of a study of system impacts. The system impact study was envisioned to measure or confirm the expected outcomes of the system in terms of the safety, mobility, and customer satisfaction impacts. However, because of unforeseen events, changes in project leadership, and various other factors which resulted in deployment delays for both the Airport ITS integration and RIMS projects, significant changes to the evaluation occurred.

The emphasis of the evaluation was modified from a system impact study to a case study investigation of key events and the development of lessons learned based on the stakeholders' experiences. The intent of the new evaluation was to focus on the series of events that contributed to the delays and develop a set of lessons that would be useful for other agencies. In summary, this evaluation is intended to result in a:

- Case Study report of key events influencing the Airport ITS integration and RIMS project deployments.
- Posting of the report on the USDOT electronic document library (<http://www.its.dot.gov/library.htm>).
- Set of lessons learned based on GLITS stakeholders' experiences.
- Posting of lessons on the USDOT ITS Lessons Learned Knowledge Resource (<http://www.itslessons.its.dot.gov/>).

The following sections provide a description of the original evaluation objectives, approach, and study areas and the modified evaluation objectives.

3.1 Original Evaluation Objectives

Initially, the overall evaluation objectives were to provide a quantitative and qualitative analysis of the system impacts of the ITS integrations and to identify lessons learned from the Airport ITS Integration and RIMS projects. The impacts and institutional challenges were to be carefully

explored and documented to help provide guidance for other jurisdictions considering similar deployment and integration projects. In addition, the findings of the evaluation were intended to be used by other agencies assessing the appropriateness of ITS integration as a potential solution to similar problems.

3.1.1 Original Evaluation Approach

The evaluation approach proposed for the original evaluation was based on project performance goals based on the expectations of the project stakeholders and the USDOT's evaluation objectives. For each project, project stakeholders' goals were established through dialogue in the national ITS evaluation nomination process. USDOT evaluation goals were developed to meet the system impact study requirements identified in the evaluation Statement of Work (SOW).

For each goal, in coordination with the project stakeholders, the Evaluation Team developed a key hypothesis to form a basis for testing and measuring the impact of the proposed ITS solutions Each key hypothesis resulted in developing associated measures of effectiveness (MOE) to provide the basis for comparison of "before" and "after" cases. The MOEs provided suggestions for data requirements, which were used in discussion with project stakeholders to identify specific data sources to support the evaluation.

Table 1 and Table 2 present an overview of the original evaluation approaches, including the goals, key hypotheses, MOEs, data sources, and planned analyses associated with the two components of the GLITS project: the Airport ITS Integration and the RIMS projects, respectively.

Table 1. Airport ITS Integration Project Evaluation Approach Overview

Goal	Key Hypothesis	MOE	Data Sources or Requirements	Data Analysis Method
Increase traveler mobility in the area.	Project assumes real-time traffic data will be made available to the traveling public, thereby contributing to increased mobility.	Travel time studies.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived and collected data.
		Roadway volume counts.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived and collected data.
		Vehicle average operating speeds.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived and collected data.
		Roadway and intersection level of service.	Archived data from Wayne County DPS (Roads) and MDOT reports.	Quantitative analysis of archived and collected data.

Goal	Key Hypothesis	MOE	Data Sources or Requirements	Data Analysis Method
Improve the level of safety.	Improve safety by informing the traveling public well in advance of incidents, potential hazards, and security issues.	Reduction in speed variation across high crash frequency freeway sections	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived data; development of forecast based on relationships revealed during data analysis.
		Crash frequency.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived data; development of forecast based on relationships revealed during data analysis.
Improve customer satisfaction.	Project assumes that the real-time information made available through ITS technologies to the traveling public on airport conditions (traffic, parking availability, curbside access, and safety) will contribute to increased customer satisfaction.	Customer perceptions.	Surveys/interviews.	Qualitative analysis of survey/interview responses.

Table 2. RIMS Project Evaluation Approach Overview

Goal	Key Hypothesis	MOE	Data Sources or Requirements	Data Analysis Method
Improve the satisfaction of county residents.	Customer satisfaction will increase as the DPS makes more real-time information available.	Customer perceptions.	Surveys/interviews.	Quantitative analysis of survey/interview responses.
Increase traveler mobility in the region.	The provision of real-time traffic and roadway condition information will contribute to improved mobility by reducing delays and increasing travel time reliability.	Customer perceptions.	Survey/interviews.	Quantitative analysis of survey/interview responses.
		DPS maintenance staff perceptions.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived data; development of forecast based on relationships revealed during data analysis.

Goal	Key Hypothesis	MOE	Data Sources or Requirements	Data Analysis Method
Improve winter maintenance activities and construction delays.	Using GIS, the RIMS will improve DPS operations by increasing awareness of potential problems; efficiently routing public complaints; providing enhanced responsiveness to in-road maintenance; and reducing design time.	DPS staff perceptions.	Survey/interviews.	Qualitative analysis of survey/interview responses.
		Maintenance schedules.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived data; development of forecast based on relationships revealed during data analysis.
		Records of lane closures.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived data; development of forecast based on relationships revealed during data analysis.
		Public comments.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived data; development of forecast based on relationships revealed during data analysis.
Improve safety, especially at work zones.	The RIMS will provide real-time information on traffic and road conditions, ultimately improving safety by informing the traveling public well in advance of incidents and potential hazards (including weather).	Crash frequency.	Wayne County DPS (Roads) and MDOT agency reports.	Quantitative analysis of archived and collected data; development of forecast based on relationships revealed during data analysis.

3.1.2 Data Collected and Analyzed

For the RIMS project evaluation, no evaluation data were collected. However, pre-deployment (baseline) data were collected at the DTW for the Airport ITS Integration project evaluation. For the traveler mobility analyses, traffic count data were manually collected for non-peak and peak traffic days at three locations on October 22-23, 2003 and November 26, 2003. The baseline data showed that the majority of inbound and outbound vehicles used the I-94 (northern) access road rather than the I-275 (southern) access road. See appendix A for the analysis relating to traffic flow data for vehicles entering and exiting the DTW.

Air passenger counts for a 15-month period from October 2002 through December 2003 were collected to describe the number of scheduled passengers, air taxi (commuter) passengers, and charter passengers. In addition to total counts, the data were also disaggregated by direction of

travel (arrival or departure) and flight destination (domestic or international). See appendix B for the analysis relating to air passenger counts.

Parking lot transactions for a 2-year period from February 2002 through February 2004 from the Smith/Berry Terminal and McNamara Terminal were also collected and analyzed in support of this evaluation. These parking data, collected by location and parking facility were aggregated into monthly totals and daily averages. See appendix C for the analysis relating to airport parking lot transactions.

For the Safety and Security analyses the DTW Wayne County Airport Authority, Division of Public Safety provided crash data from State of Michigan Traffic Crash Reports. The crash data included all vehicle crashes occurring on the airport roadways and parking areas from February 2002 through January 2004 and were characterized by: Date, Time Period, Location, Road Condition, Type of Crash, and Accident Severity. See appendix D for the analysis relating to airport crash data.

3.1.3 Summary

The evaluation originally was planned to be an investigation of system impacts and the identification of lessons learned based on stakeholder experiences regarding the Airport ITS Integration and RIMS projects. An evaluation approach was developed for each project based on the anticipated project's performance goals. Pre-deployment data were collected for the Airport ITS Integration project but not the RIMS project. Appendices A through D show the preliminary analyses of the airport traffic flow, air passenger counts, airport parking lot transactions, and airport crash data.

Although pre-deployment data were collected at the airport, deployment delays and various other factors (discussed in section 4) resulted in the originally planned evaluation being modified. The modified evaluation focuses on the events that contributed to the delays and the development of a set of lessons learned. The following sections describe the modified evaluation.

3.2 Modified Evaluation Objectives

A new SOW was developed to modify the GLITS evaluation objectives and activities to conduct the evaluation. The modified evaluation consists of a case study of the Airport ITS integration and RIMS projects, and the development of Lessons Learned. As such, the new evaluation activities included:

- Interviews of key personnel at MDOT, Wayne County, and the Wayne County Airport Authority to identify the events, issues, and factors that have influenced the GLITS deployment.
- Collecting supportive information.
- Documenting Lessons Learned according to ITS JPO-prescribed format.
- Delivering Draft and Final Case Study Report.
- Presenting findings toITS JPO.

3.2.1 Conduct Interviews

Interviews with the key personnel at MDOT, Wayne County, and the Wayne County Airport Authority were conducted to identify the events, issues, and factors that have influenced the GLITS deployment. The interviews with key personnel were used to identify, describe, and capture the various factors that have influenced the GLITS deployment. In addition, the interviews were used as inputs for the development of lessons learned.

3.2.2 Collect Supporting Information

Supporting information was collected to investigate, identify, and examine information describing the events and factors that have influenced the GLITS deployment. The type of supporting information examined was:

- Project planning documents or architecture diagrams.
- Maps/photos of airport roadway and construction activities.
- Meeting minutes.
- News articles providing background information or insight into key events.

The information was used to develop a deeper understanding of the key events and factors and was included or cited as appropriate.

3.2.3 Develop Lessons Learned

A series of lessons learned were developed from the management, planning, design and development, procurement, leadership, legal, and human resources experiences of the MDOT, Wayne County, and Wayne County Airport Authority agencies. The lessons learned were written in a format that is compatible with those residing on the ITS Lessons Learned Knowledge Resource Website.

The ITS Lessons Learned Web Page on the ITS JPO Website[14] was used as a reference for additional guidance in documenting and formatting the lessons learned. Potential focus areas for lessons learned will include those identified in Table 3.

[14] ITS Lessons Learned Website resource, last accessed on October 23, 2006 at: <http://www.itslessons.its.dot.gov/>.

Table 3. Lessons Learned Categories and Subcategories

Lesson Category	Subcategories
 Management & Operations	• Operations • Maintenance • System Data & Storage • Evaluation & Performance Measurement • M&O Tools & Models
 Policy & Planning	• Policy • Planning • Architecture • Programming (TIP / SIP) • Planning Tools & Models
 Design & Deployment	• Project Management • Requirements & Design • Standards & Interoperability • Implementation • Quality Assurance & Testing • Design Tools & Models
 Leadership & Partnership	• Leaders & Champions • Partnerships & Agreements • Awareness & Outreach • Media Coordination • Organizational Management & Structure
 Funding	• Federal • State • Regional & Local • Private • Innovative Financing
 Technical Integration	• Functional • Jurisdictional • Legacy Systems
 Procurement	• Work Allocation • Method of Award • Contract Form Contract Type • Terms & Conditions
 Legal Issues	• Intellectual Property • Liability • Privacy Labor • Rules & Regulations • Disputes & Claims
 Human Resources	• Personnel Management • Recruiting • Retention & Turnover • Training

3.2.4 Develop Case Study Report

The Case Study Report documents the events, factors, impacts, and lessons learned that have affected the deployment of the GLITS project.

3.2.5 Presentation of Findings and Conclusions

A briefing to ITS JPO will present a summary of the findings and conclusions. The findings portion will include a summary of key events, factors, and issues that have resulted in deployment challenges and delays. The conclusions portion will include a summary of the lessons learned and an update of the deployment status and institutional/management changes that have occurred to address the issues.

4 HISTORY OF EVENTS

This section is a "best effort" to describe the key events that affected the deployment of the Airport ITS Integration and RIMS projects. Although it is unlikely that a comprehensive, complete description of events can be made, the information and descriptions presented here were obtained from interviews with the GLITS management team, Michigan Legislative session archives,[15] news articles, press releases, archived Evaluation Team briefings and monthly reports to USDOT, and information derived from the Wayne County[16] and DTW[17] Websites.

- Section 4.1 provides a timeline overview of the Detroit Metropolitan Wayne County Airport.
- Section 4.2 discusses key events affecting the deployment of the Airport ITS Integration project.
- Section 4.3 provides a timeline overview of the RIMS project.
- Section 4.4 identifies key events that affected the deployment of the RIMS Project.

4.1 Detroit Metropolitan Wayne County Airport Project Timeline

DTW is a large, busy airport. Covering approximately 6,700 acres of land, DTW has six runways, 139 passenger terminal gates and served 36,389,294 air passengers in 2005 ranking it as the eleventh busiest airport in North America and twentieth in the world.[18] Table 4 provides an overview of the history of DTW's growth and expansion during its nearly 90-year history:[19]

Table 4. Wayne County Airport History

• **1927:** The plan to build a major commercial airport was conceived on April 12, 1927.
• **1928:** A $2 million bond was issued to finance the acquisition of one square mile of land. Called Wayne County Airport, it served as a general aviation facility.
• **1929:** A landing strip was installed along with several maintenance buildings. The Wayne County Airport was dedicated and opened to the public in September. The first "official" landing was February 22, 1930.
• **1940s:** Control of the Airport was assumed by the U.S. Army for use as a staging base for transport of heavy bombers to Europe.
• **1944:** The Wayne County Board of Supervisors authorized a three-fold expansion of Wayne County Airport to enlarge the airport to cover 3.5 square miles. The U.S. Army released Wayne County Airport, thus paving the way for its use as either a primary or secondary airport to serve Detroit and Wayne County.

[15] Michigan Legislature Website last accessed on December 7, 2006, and recorded at: <www.legislature.mi.gov>.
[16] Wayne County Michigan Website last accessed on January 17, 2007 at: <http://www.waynecounty.com/>.
[17] Detroit Metropolitan Wayne County Airport Website, last accessed on December 7, 2006 at: <http://www.metroairport.com/>.
[18] Airports Council International Website, 2005 Final Rankings, last accessed on December 7, 2006 at: <http://www.airports.org>.
[19] Airport history synopsized from highlights, last accessed on November 28, 2006, and recorded at: <http://www.metroairport.com/about/history.asp>.

• **1947:** The Airport was renamed Detroit-Wayne Major Airport.
• **1956:** It was announced that Detroit-Wayne Major Airport would receive $1 million under the Federal Aid-to-Airports program during fiscal year 1957 to begin construction on a $10.4 million expansion program including a new terminal building (L.C. Smith Terminal) and 10,500 foot runway.
• **1958:** The Detroit-Wayne Major Airport was certified as an international jet craft airport by the Civil Aeronautics Administration, which qualified the Airport for 50 percent Federal funds for construction of the long runways needed for jet airliners. The Airport was renamed Detroit Metropolitan Wayne County Airport.
• **1959:** The Federal Aviation Administration proposed new construction at Detroit Metropolitan Airport to accommodate a total of 5,266,000 air passengers in the next 6 years.
• **1966:** Terminal 2 (North Terminal) was constructed.
• **1974:** The Michael Berry International Terminal was completed as part of a $69 million bond issue. Also included were improved lighting and tax**iwa**ys, expansion of the L.C. Smith Terminal, Terminal 2, and new parking.
• **1986:** A $166 million bond issue was approved to finance the Master Plan update at Metro Airport.
• **1996:** Wayne County and Northwest Airlines announce agreement to build a new $786 million Midfield terminal project triggering projected expenditures of $1.6 million in capital improvements at DTW.
• **1999:** Michigan State legislature creates a special House-Senate joint committee to look into alleged problems and customer dissatisfaction with the operation of the airport.
• **2001:** Wayne County sells over $110 million in airport hotel bonds.
• **2002:** The new $1.2 billion state-of-the-art Edward H. McNamara Terminal/Northwest World Gateway opened February 24. This terminal offers 97 gates, more than 80 shops and restaurants, an indoor Express Tram that travels the mile-long Concourse A in less than 3 minutes, international and domestic connections in the same facility, and an 11,500 space parking garage.
• **March 2002:** Senate Bill 690, signed by Governor Engler on March 26, established the Wayne County Airport Authority. The independent Authority will manage Detroit Metropolitan Airport and Willow Run Airport. Both airports will remain Wayne County facilities.
• **January 2003:** Wayne County leadership changes.
• **Mid-2003:** Senior program manager for Airport ITS Integration project changes.
• **2003:** In September, 2003, the Wayne County Airport Authority Board authorized the sale of up to $825 million in bonds to fund future airport expansion projects.
• **2004:** In September 2004, the Wayne County Airport Authority Board approved the hiring of architectural and engineering firm to design a new 29-gate terminal to replace the Davey and Smith Terminals. Re-development planning began in mid-2004, with design, fabrication, and construction effort ongoing at the present time.
• **Fall 2005:** Airport Authority begins demolition/construction for the new North Terminal facility.
• **Mid-2008:** Anticipated grand opening of the newly completed North Terminal facility.

4.2 Key Events Affecting the Airport ITS Project

Discussions, interviews, and research revealed a series of key events that influenced the Airport ITS Integration project. Table 5 shows the key events by chronological order and summarizes the issues and resulting impact.

Table 5. Key Events Affecting the Airport ITS Project

Key Event	Date	Issues	Impact
Michigan State legislature creates a special House-Senate joint committee to look into alleged problems and customer dissatisfaction with the operation of the airport.	Late 1999	Office of the Auditor General (OAG) conducts a series of reviews on competitive bidding; qualifications, responsibilities, and compensation of airport officials; land acquisition, disposal, and development; security; maintenance; contracting practices; and finances, passenger facility charges, bond issues, and capital outlays.	OAG begins audit of airport operations and compliance with applicable laws.
House-Senate joint committee completes 200-page report revealing their findings from the investigation.	October 2001	The Senate report identifies eight general problem areas: (1) approval of contracts; (2) airport competitive contracts; (3) oversight of contractors/subcontractors; (4) contractual remedies; (5) ethical conduct; (6) cooperation with the Wayne County Auditor General; (7) budgetary and accounting practices; and (8) hiring and assignment of Airport Police.	Legislation is introduced to address management and contracting issues and create a new independent authority to operate the airport.
Michigan Senator Glenn D. Steil and others sponsor Senate Bill No. 690.	October 2001		Bill is referred to Committee on Detroit Metro Airport Review.
Senate passes Senate Bill 690.	February 2002		SB 690 goes to House.
House passes Senate Bill 690.	March 2002		SB 690 goes to Governor.
Approved by Governor	March 2002		SB 690 filed with Secretary of State.
Wayne County Airport Authority (WCAA) becomes independent from Wayne County.	March 26, 2002	WCAA under new management and has new priorities. Administration of GLITS Airport funding. WCAA wished to control the funding however could not per state law.	Focus on legislative requirements. Negotiations delay GLITS funding to late-2006.
Wayne County leadership changes.	January 2003		New Wayne County GLITS senior program managers.
Senior program manager for Airport ITS Integration project changes.	Mid-2003		Loss of project champion.
Airport Authority begins demolition/ construction for the North Terminal Redevelopment project.	Fall 2005	Construction to 2008 changes vehicle traffic patterns through airport and includes building a bypass road and ramp.	Change in traffic flow and possibly volume renders baseline data from 2002-2004 unusable.

Two events significantly impacted the deployment of the project: the formation of an independent airport authority and the change in leadership. A third event, construction of a new North Terminal at DTW, affected the evaluation effort in terms of the baseline data which had been collected. These three events are described below.

4.2.1 Formation of Wayne County Airport Authority

One of the earliest events, which had a substantial impact on the Airport ITS Integration project, goes back to late 1999 when the Michigan State legislature created a special House-Senate joint committee to investigate alleged problems and customer dissatisfaction with airport operations. At the request of this special committee, the following reviews occurred:

> …the legislature's Office of the Auditor General conducted a series of preliminary reviews on such subjects as competitive bidding; the qualifications, responsibilities, and compensation of airport officials; land acquisition, disposal, and development; security; maintenance; contracting practices; and finances, including passenger facility charges, bond issues, and capital outlay. Additional reviews by the OAG on those and other related topics followed. This investigation was extended during the 2001-2002 legislative session by the Senate Detroit Metro Airport Review Committee.[20]

In October 2001, a 200-page report by the Senate Detroit Metro Airport Review Committee identified eight general problem areas: [21]

1. A lack of approval of airport contracts by the county commissioners as required by county ordinance.

2. The airport not having competitive bids for airport contracts as required under ordinances, and repeatedly granting extensions, renewals, and amendments to existing contractors in lieu of competitively bidding the contracts.

3. Inadequate and often functionally non-existent oversight of contractors and subcontractors at the airport.

4. Failing to consistently to pursue available contractual remedies when contractors do not meet the terms of their contracts.

5. A management culture that has produced an environment where examples of questionable ethical conduct abound.

6. Airport management consistently thwarting the Wayne County Auditor General's efforts to place auditors on-site to help oversee airport operations and compliance with applicable law.

[20] Legislative Analysis of Public Airport Authority Act Senate Bill 690 (Substitute H-3), House Legislative Analysis Section, March 12, 2002.
[21] Ibid.

7. County-based and airport-based deficiencies in the airport's budgetary and accounting practices that hinder the accountability and dependability of the data reported.

8. Significant problems with the airport police, involving improper hiring and improper assignment of officers.

As a result of the Senate's report, in October 2001, legislation sponsored by Senator Glenn D. Steil was introduced to address management and contracting issues. In addition, the Wayne County Executive, the Governor, and business leaders agreed to the creation of a new independent airport authority to operate the airport. By March of 2002, the legislation, Senate Bill 690, was approved by the legislature and signed into law by the Governor. Effective March 26, 2002, the Wayne County Airport Authority became an independent public airport authority with the power to manage, operate, construct, improve, and maintain the airport facilities.

The impact of the creation of a separate, independent airport authority complicated the planned allocation of funding for the Airport ITS project. Since the airport was an independent authority and no longer part of Wayne County, the County had no legal rights or authority at the airport. Michigan State law required that the agency receiving the GLITS and CMAQ funds, which are highway funds and were programmed with the understanding that they would be used for ITS at the airport, needed to be an eligible government county, city, or village agency (per the requirements of Act 51 of Public Acts of 1951) to administer the highway funds.

As a result, the Wayne County Airport Authority and Wayne County experienced a funding dilemma which resulted in the deployment languishing until both agencies came to an agreement that:

- Wayne County will administer the project.
- Wayne County will release the CMAQ funds for the Airport ITS project.

Negotiations between Wayne County and the Wayne County Airport Authority were completed in late 2006.

4.2.2 Change in Leadership

A second key event, the election of a new Wayne County Executive, resulted in a change in the senior project management for the airport project. In 2003, a new Wayne County Executive was elected and project leadership positions at Wayne County Roads Division and the Department of Technology changed. For the Airport ITS Integration project, the leadership change (in conjunction with other factors such as organizational changes) contributed to the project falling behind the original schedule and having little progress for several years.

The election of a new Wayne County Executive in 2003 resulted in a change of project management at the Wayne County Roads Division. The new management had new priorities, such as managing a budget deficit. As a result, the GLITS Airport ITS project lost much of the early deployment momentum and priority.

The impact of the changes in the political leadership resulted in subsequent changes in project management, personnel changes, and a loss of project champions which likely contributed to delays in the deployment schedule. Project progress can be adversely affected by the loss of key personnel at all levels. Losing a project champion, who is a political appointee, can cause a project to struggle due to the lack of leadership. The loss of key project management or personnel is also likely to slow the work necessary to complete the project.

4.2.3 North Terminal Redevelopment Project Construction

The NTR project which involves the construction of a new North Terminal at DTW had a significant impact on the usability of baseline traffic count and crash data collected in 2002 and 2003. For additional information about evaluation baseline data, see appendix A for the traffic flow data, appendix B for air passenger counts, appendix C for parking lot transactions, and appendix D for airport crash data.

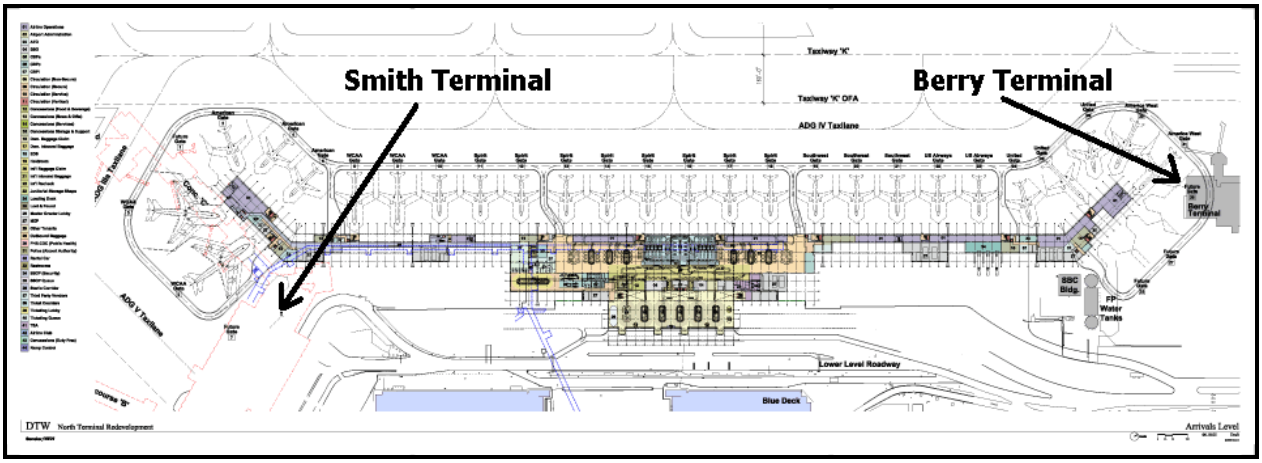
The usability of baseline traffic count and crash data collected in 2002 and 2003 was called into question because of changes to the airport roadways which were made to accommodate NTR construction activity. Since the NTR project involves replacing two older terminal buildings (Smith and Berry Terminals), a bypass ramp was constructed in 2005 to redirect traffic through the airport construction zone. It was unclear how these changes would influence airport traffic patterns and the likelihood for vehicle crashes. Figure 5 displays a map overview of the current DTW roadways and terminal buildings.[22] The Smith and Berry Terminals are shown near the center of the diagram. Figure 6 shows the locations of the Smith and Berry Terminals with a graphic of the NTR project overlaid upon them.[23] The arrows near the far left and right sides of the diagram indicate the location of the Smith and Berry terminals.

Figure 7 presents a schematic of how the temporary Bypass Road was constructed to divert traffic away from the construction site. [24] The upper Rogell Drive that serviced the Smith Terminal Arrivals traffic was closed, and a new vehicle ramp roadway was constructed to bypass the site and connect passengers/drivers to the Smith Terminal. Signage was placed to properly direct traffic.

[22] Detroit Metropolitan Airport Map, last accessed on January 17, 2007: < http://www.metroairport.com/maps/>.
[23] North Terminal Project: Project Site Plan, last accessed on January 17, 2007: <http://www.metroairport.com/project/map.asp>.
[24] Davey Bypass Road schematic showing diversion and road closure during North Terminal construction, last accessed on January 17, 2007: <http://www.metroairport.com/project/Davey_Bypass_Plan.pdf>.

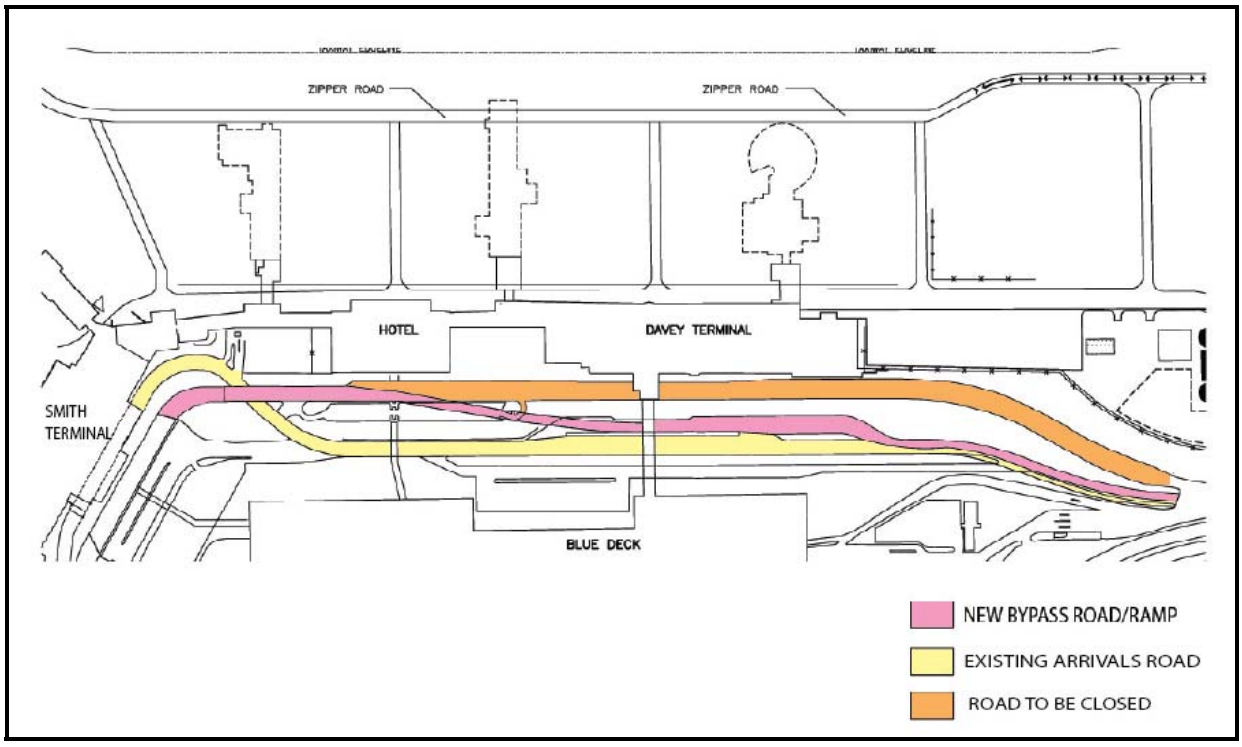
Source: Wayne County Airport Authority Metro Airport Website.

Figure 5. Map Overview of DTW Roadways and Terminal Buildings.



Source: Wayne County Airport Authority Metro Airport Website.

Figure 6. North Terminal Redevelopment Project Overlaid on Smith and Berry Terminals.



Source: Wayne County Airport Authority Metro Airport Website.

Figure 7. Schematic of Davey Bypass Road/Ramp.

4.3 RIMS Project Timeline

The RIMS Project is intended to develop one seamless system which integrates information currently gathered and stored in existing databases by various divisions within the Wayne County DPS. The RIMS asset management program will derive information from a County-level transportation information backbone to increase coordination among the various agencies involved in roadway planning, permitting, maintenance, and snow removal. Table 6 provides an overview of the RIMS project history from October 1999.

Table 6. RIMS Project History

- **October 1999:** Public Law No: 106-69 makes appropriations for FY 2000 Wayne County, Michigan earmark constituting Phase I of RIMS.
- **March 2001:** MDOT submits Application for Participation in the FY 2001 ITS Integration Component of the ITS Deployment Program.
- **August 2001:** FY 2001 ITS Integration Program earmark for GLITS Phase I is authorized by the FHWA Division. This is the first phase of GLITS combines three separate FY 2001 ITS Integration Program earmarks. GLITS I is actually Phase II of RIMS.
- **February 2002:** Wayne County DPS was authorized to begin work.
- **January / February 2003:** Change in Wayne County leadership and project transferred to Wayne County Department of Technology.
- **Mid-2003:** Senior project managers change. New leadership conducts project review to integrate RIMS project with other IT projects. RIMS development effort and RFP processes are delayed.

- **September 2003:** FY 2002 ITS Integration Program earmark approved. GLITS II is actually Phase III of RIMS. All funding has been combined into one project.
- **Fall 2003:** RIMS RFP issued. Award expected in January 2004.
- **Early 2004:** Vendor proposals reviewed and begin selection of best combination of vendors.
- **August / September 2004:** Wayne County Department of Technology sets up RIMS project office to oversee the design and development of the system.
- **Fall 2004:** A non-selected vendor protests. Award to selected vendors postponed pending review by Wayne County Division of Human Relations and Wayne County Corporation Counsel. Expected kick-off of the design phase is expected in January 2005.
- **Early 2005:** Vendor protest resolved. RIMS vendors selected. Negotiations with vendors begin. Vendors request cost and SOW adjustments.
- **December 2006:** Project development re-started.
- **Early-2009:** Phase I of RIMS expected to be operational.

4.4 Key Events Affecting the RIMS Project

Although much of the specific details, issues, and impacts about key events may never be known, three events contributed to RIMS project deployment delays. Table 7 shows the key events by chronological order. The issues and resulting impacts are derived from discussions and interviews with project management, archived Evaluation Team briefings and monthly reports to USDOT, and information derived from the Wayne County Website.[25]

Table 7. Key Events Affecting the RIMS Project

Key Event	Date	Issues	Impact
Change in Wayne County leadership and transfer of project.	Early to Mid-2003	The transfer of project to WCDT results in a project review to integrate with other WCDT plans.	New RIMS project manager. RIMS development effort and RFP process is delayed.
Vendor selection and formal protest by non-selected vendor.	All of 2004	RIMS team must identify the best combination of bidders. Wayne County must review the procurement process for any improprieties.	Procurement delayed while due diligence is conducted to select vendors and handle protest in accordance with State and County procedures.
Vendor negotiations to adjust cost and SOW.	Early 2005	Because of the procurement delay, vendors want cost and SOW adjustments.	Additional procurement delay; development re-started December 2006.

[25] Wayne County Michigan Website, last accessed on January 17, 2007 at: <http://www.waynecounty.com/>.

4.4.1 Change in Leadership

In the fall of 2002, a new Wayne County Executive was elected and took office in early 2003. Also occurring in early 2003, the RIMS project was transferred from the DPS to the WCDT. After the transfer, a review of the RIMS project was conducted to integrate the project elements with other WCDT plans. In addition, the RIMS project received a new project manager at WCDT.

For the RIMS project, the leadership change (in conjunction with other factors such as organizational changes and internal reviews) contributed to the project falling behind the original schedule. This chain of events in early 2003 slowed progress in the development of the RFP necessary to procure vendor services. Under the new management, the project was successfully re-scoped and many aspects of the project were moved from being a GIS project to making GIS the backbone for an asset management and maintenance tracking and scheduling system. After the project was successfully redefined, an RFP was released the last week of October 2003 with an award expected in January 2004.

4.4.2 Vendor Selection and Formal Protest by Non-selected Vendor

Although by the end of 2003 it appeared a contract would be awarded in the beginning of 2004, two events arose that resulted in additional delays. The first event, a longer-than-expected vendor selection period, slowed progress. The second event, a formal protest by a non-selected bidder, effectively halted all progress and prevented any negotiations to finalize vendor contracts.

In early 2004, the longer-than-expected vendor selection period was due to the complexity of the RIMS application which needed multiple vendors to integrate the nearly 400 independent Wayne County databases. As a result, the award was delayed as the RIMS team identified the best combination of bidders to accomplish the range of tasks required in the RFP.

In the summer of 2004, a team of vendors were chosen to perform different elements of the contract tasks. During this time it was anticipated that a kick-off meeting would move to September 2004. However, the official kickoff of the design effort was moved to the first week of January 2005 due to a formal protest by one of the vendors not selected from the pool of bidders.

As result of the formal protest, in the fall of 2004 all progress was halted while the complaint was investigated. According to Wayne County policy, when a formal protest is lodged, the Wayne County Human Relations Division of the Department of Corporation Counsel is required to investigate the merit of the complaint. An award is halted while the investigation is made in accordance with the Wayne County Title VI Plan[26] which complies with Title VI of the Civil Rights Act of 1964, Civil Rights Restoration Act of 1987 (P.L. 100.259), and the Michigan Elliott-Larsen Act. In January 2005, the protest was resolved in accordance with state and county procedures and contract negotiations with vendors began.

[26] Title VI Plan for Wayne County on Wayne County ePurchasing Policies Website, last accessed on January 18, 2007 at: <http://www.waynecounty.com/epurchasing/>.

4.4.3 Vendor Negotiations to Adjust Cost and SOW

In January 2005, the project entered into a period of contract negotiations with the two vendors selected to perform the work. It was hoped that final contract negotiations would be completed by the end of March and that the kickoff would be held in April. However, because of the 1-year delay to finalize the selection of vendors, negotiations between Wayne County and the vendors were necessary to finalize the cost and terms in the SOW.

Like the amount of time required to select vendors, the negotiations and final approval of contracts also took substantially longer than expected. The contracts with the vendors were finalized in 2006 and the RIMS project was re-started in December 2006 with the deployment anticipated to occur in early 2009.

5 LESSONS LEARNED

This section describes lessons that were developed from the GLITS project management experiences from 2002 through early 2007. The lessons are written in a format based on the guidelines residing on the ITS Lessons Learned Knowledge Resource Website.

5.1 Develop a Project Champion Succession Plan

Lesson 1: Develop a project champion succession plan within participating organizations to avoid orphaning a project.[27]

Lesson 1 is based on the Great Lakes ITS project management experience related to a change in political leadership. The lessons and suggestions touch upon issues such as leadership, project champions, and personnel management.

ITS champions are essential for providing the vision and leadership necessary for advancing ITS concepts to fruition. However, if a project loses its champion, progress may be hampered or the project may flounder due to lack of leadership. In the worst case, the project may become an "orphan" waiting to be recognized and adopted by the new leadership. Unlike projects funded through State and local budgets where funds may be reallocated to other projects, ITS Earmark projects can remain orphaned for a number of years because the projects are partially funded and required by Congressional action. Consequently, to safeguard against orphaning a project and losing implementation momentum, the lead agency should develop a project champion succession plan and work with other project stakeholders to protect projects.

The GLITS Airport ITS Integration and RIMS projects have experienced a number of challenges that have delayed the projects. One of these challenges was a change in the political leadership, which affected the leadership within the Wayne County agencies responsible for portions of the Airport and RIMS projects. In 2003, a new Wayne County Executive was elected and project leadership positions at Wayne County Roads Division and the Department of Technology changed. For the Airport project, the leadership change (in conjunction with other factors such as organizational changes) contributed to the project falling behind the original schedule and having little progress for several years. For the RIMS project, the loss of the Project Manager was less disruptive as the Assistant Project Manager moved into the leadership position.

The following are a few related leadership and staffing insights based on the discussions with the GLITS Management team.

- **Develop a succession plan that anticipates changes in the political environment if changes may adversely affect the project.** The election of a new Wayne County Executive in 2003 resulted in a change of project management at the Wayne County Roads Division. The new management had new priorities, like managing a budget deficit.

[27] Lesson ID: 2006-00313 on USDOT ITS Lessons Learned Website, last accessed on January 19, 2007 at: <http://www.itslessons.its.dot.gov/>.

As a result, the GLITS Airport ITS project lost much of the early deployment momentum and priority. Given that changes in the political environment are likely to occur during election years, projects benefiting from politically appointed champions should consider building public support and organizational structures that will foster continued support for the project.

- **Build relationships with organizations that can help identify candidates to fill personnel vacancies before the project is adversely affected.** The contributions of key personnel are as important to a successful project as project champions and senior management. Similarly, the loss of key personnel can be just as detrimental to a project as the loss of a project champion or senior manager. Consequently, project managers should identify and cultivate relationships with other organizations, which may be helpful in identifying qualified candidates to fill personnel vacancies.

- **Prepare for staffing changes and reorganizations that can disrupt project progress.** Whereas changes in the political leadership likely to occur during election years, staffing changes and organizational changes may occur with little notice and can disrupt project progress. For example, prior to the spring of 2002 the Detroit Metropolitan Wayne County Airport was managed by Wayne County. However, in April 2002, the Wayne County Airport Authority became a separate agency responsible for the management and operation of DTW. The Wayne County Airport Authority also had the power to plan, promote, extend, maintain, acquire, purchase, construct, improve, repair, enlarge, and operate the airport. As a result, the Wayne County Airport Authority wanted to control the funding for the GLITS Airport ITS Integration project. However, the creation of the Wayne County Airport Authority was not foreseen at the time the 2001 Earmark funding was granted. Consequently, the formation of WCAA resulted in funding issues because WCAA was not allowed under Federal regulations to control and distribute the highway funds.

Since its inception in 2001, the GLITS project management team for the RIMS and Airport ITS Integration projects have encountered a variety of situations that have challenged the development of the projects. The loss of a project champion due to changes in the political leadership resulted in changes in project management and personnel changes. These changes contributed to delays in the deployment schedule.

This lesson suggests that the project progress can be adversely affected by the loss of key personnel at all levels. Losing a project champion, who is a political appointee, can result in a project which flounders due to a lack of leadership. The loss of key project management or personnel is also likely to slow the work necessary to complete the project. Given the importance of these individuals to the success of the project, the lead agency and other project stakeholders need to consider developing a succession plan which will minimize the effects of losing key champions, management, and personnel.

5.2 Funding Arrangement Delays Can Result in Contract Execution Delays

Lesson 2: Delays in finalizing funding arrangements can lead to delays in executing contracts.[28]

Lesson 2 is derived from the Wayne County and the Authority's experience in securing earmarked funds and executing contracts. The subsequent lessons and suggestions apply to issues such as funding, partnership and agreements, and procurement.

The funding mechanism and its execution have enormous influence on the success of ITS projects. In the case of ITS Earmark projects, since the a portion of the funding is designated by Congressional action, State and local agencies are required to contribute matching funds or the Earmark funding will remain unspent until Congressional action rescinds the funds. Since rescinding funds is difficult and undesirable it is more likely that the project may be delayed until matching funds become available.

Wayne County and the Wayne County Airport Authority have experienced project delays to the RIMS and Airport projects due to various funding related issues. In one case the formation of the Wayne County Airport Authority into an agency separate from Wayne County resulted in funding complications.

In another case, procurement issues delayed the awarding of contracts to procure information technology services to assist in the development of the RIMS software application. The following are a few funding related suggestions based on the GLITS project management team experiences.

- **Explore alternative funding arrangements when changes within stakeholder organizations complicate funding arrangements.** Inter-agency funding arrangements can lead to delays in awarding/executing project contracts. When the Wayne County Airport Authority became an independent entity and was no longer part of Wayne County, the County had no legal rights or authority at DTW. Since GLITS and CMAQ funds, which were programmed with the understanding that they would be used for ITS at DTW, are actually highway funds, under Michigan State law, the agency receiving the funds needed to be an eligible Government county, city, or village agency (per the requirements of Act 51 of Public Acts of 1951) to administer the highway funds. Consequently, the Wayne County Airport Authority and Wayne County experienced a funding dilemma which resulted in the deployment languishing until both agencies came to an agreement on two elements that:

  - Wayne County will administer the project.
  - Wayne County will release the CMAQ funds for the Airport ITS Project.

[28] Lesson ID: 2006-00314 on USDOT ITS Lessons Learned Website, last accessed on January 19, 2007 at <http://www.itslessons.its.dot.gov/ >.

- **Utilize clearly defined proposal evaluation criteria to determine procurement awards and reduce the likelihood of contractor protests.** The WCDT intended to award two contracts for RIMS hardware. After soliciting for bids and reviewing the proposals, the agency decided on two vendors. However, a non-selected bidder contested the decision and WCDT was forced to delay the procurement while the Wayne County Purchasing Department, Human Relations Division, and Corporation Counsel Department reviewed the evaluation and selection process. The protest review took about 1 year to resolve. In addition to having a clearly defined set of proposal evaluation criteria, agencies should strive to ensure bidders understand the procurement process, especially the evaluation factors, their relative importance, and the scoring and selection process.

- **Funding requirements from ITS Earmarks can place unexpected burdens on the recipient agencies.** The requirement to provide matching funds to receive the Earmark funding can sometimes cause funds to be diverted from other planned projects. Further, ITS Earmarks can be directed toward County or local agencies that have little or no expertise in building ITS projects or managing unanticipated ITS funds. Finally, Earmark funds for ITS projects may not be as high a priority for County or local agencies which are struggling to fund much needed other improvements (e.g., maintenance and repairs).

Since its inception in 2001, the GLITS project management team for the RIMS and Airport ITS Integration projects have encountered a variety of situations that have challenged the projects' development. Delays in finalizing funding arrangements due to agency reorganizations and procurement issues have resulted in project implementation delays.

This lesson showed how project progress was hampered by issues that affected project funding. Inter-agency transfers of funding incompliance with Michigan State law required Wayne County and the Wayne County Airport Authority to establish an agreement on which agency would administer the funds. Also, this lesson described some of the burdens and responsibilities in receiving ITS Earmark funds and administering funds for procurements.

5.3 Deployment Delays Can Affect Project Deployment Progress

Lesson 3: Recognize that deployment delays can lead to a ripple effect of challenges that affect project deployment progress.[29]

Based on the Great Lakes ITS project management experience with deployment delays associated with the Airport ITS Integration project, the subsequent lesson and suggestions relate to project management and personnel management.

Although the Federal portion of the ITS Earmark funding is nearly free from time constraints, time can be an unexpected adversary to the deployment of an ITS project. The Earmark funding

[29] Lesson ID: 2006-00315 on USDOT ITS Lessons Learned Website, last accessed on January 19, 2007 at: <http://www.itslessons.its.dot.gov/>.

is designated by Congressional action, and as such, the funds can remain unspent for many years until the funds are either expended or Congressional action rescinds the funds. While in some situations this may be beneficial, allowing State and local agencies time to make funding arrangements, procure hardware, and so forth, the passage of time can also lead to a ripple effect of challenges which can slow deployment progress.

Some of the deployment challenges experienced by those involved in the Airport ITS Integration project reveal the consequences of time passage. In FY 2001, Southeast Michigan received the ITS Earmark in the USDOT Appropriations Bill. In April 2002, the Wayne County Airport Authority became a separate agency managed by an independent, seven-member Board of Directors. The creation of a separate independent agency complicated the allocation of funding for the Airport ITS project (under Michigan State law the agency receiving the funds needed to be an eligible government county, city, or village agency to administer the highway funds). Consequently, alternative funding arrangements had to be investigated to identify a method to allow Wayne County to move funding to the Wayne County Airport Authority so that it could complete their portion of the project.

In January 2003, a new Wayne County Executive was elected, and as a result of a change in the political leadership, the Airport ITS project lost a key project leader at Wayne County. For several years, little progress was made as the project had no champion to provide leadership to overcome the funding issue. While these changes were occurring, new priorities at the Wayne County Airport Authority resulted in new projects emerging, one of the largest of which was the $418 million North Terminal Redevelopment project announced in May 2006.

The following time-related suggestions are based on the GLITS Airport ITS Integration project experience.

- **Keep in mind that the longer a project takes to be deployed the greater the likelihood the project will lose key personnel.** In addition to leadership changes due to changes in the political environment, long delays can result in the loss of key personnel due to numerous other factors such as desire to change jobs, retirements, promotions, health considerations, etc.

- **Be cognizant that the longer a project takes to be deployed the more likely stakeholder agencies could reorganize.** Although probably less likely to occur than the loss of key personnel, the GLITS experience has shown that the reorganization of agencies can have a detrimental effect on the project deployment.

- **Realize that stumbling blocks that produce long delays can put a project in competition with other high priority emerging projects.** The long delay for the Airport ITS Integration project pushed the ITS-related deployment activities into the civil construction activities scheduled for building the new $418 million North Terminal. As a result, the Airport ITS Integration project will be required to share the Wayne County Airport Authority staff and coordinate time resources to avoid conflicts with the construction activities—a responsibility that was not foreseen several years ago.

This lesson suggests that deployment delays and the associated passage of time can allow the introduction of new challenges to the ITS project. In essence, the passage of time can affect more than just the deployment schedule; agencies can reorganize, people can change jobs, project priorities change, and important new projects can also compound staff and time burdens on existing agency resources.

6 SUMMARY AND CONCLUSIONS

This section summarizes the events and lessons that were learned from the GLITS project management experiences from 2002 through early 2007. For the GLITS Airport ITS Integration project, two events had a significant impact on the project and consequently led to deployment delays. First, the formation of an independent airport authority complicated the planned allocation of funding for the Airport ITS project. As a result, a delay occurred when negotiations were required to clarify how the GLITS funding would be administered. Second, the change in leadership resulted in a change in project leadership positions within the Wayne County Roads Division. In addition, the changes in project management, personnel changes, and a loss of project champions also likely contributed to delays in the deployment.

For the GLITS RIMS project, three events had a significant impact on the project and resulted in the deployment delays. First, a change in leadership and transfer of project to WCDT slowed the development effort and RFP process while the project is reviewed and integrated with other WCDT plans. Second, vendor selection and a formal protest by non-selected vendor delayed the procurement while due diligence was conducted to select the best combination of vendors and handle the protest in accordance with State and County procedures. Finally, negotiations between the vendors and Wayne County to adjust cost and the SOW resulted in an additional delay.

Three primary lessons were developed based on the GLITS project management experiences from 2002 through early 2007. The lessons are:

1. Develop a project champion succession plan within participating organizations to avoid orphaning a project.

2. Delays in finalizing funding arrangements can lead to delays in executing contracts.

3. Recognize that deployment delays can lead to a ripple effect of challenges that affect project deployment progress.

Although the national evaluation of the GLITS Airport ITS Integration and RIMS projects did not yield quantitative system impacts results, it has resulted in some important lessons that could be shared with stakeholders across the country.

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APPENDIX A: TRAFFIC FLOW DATA

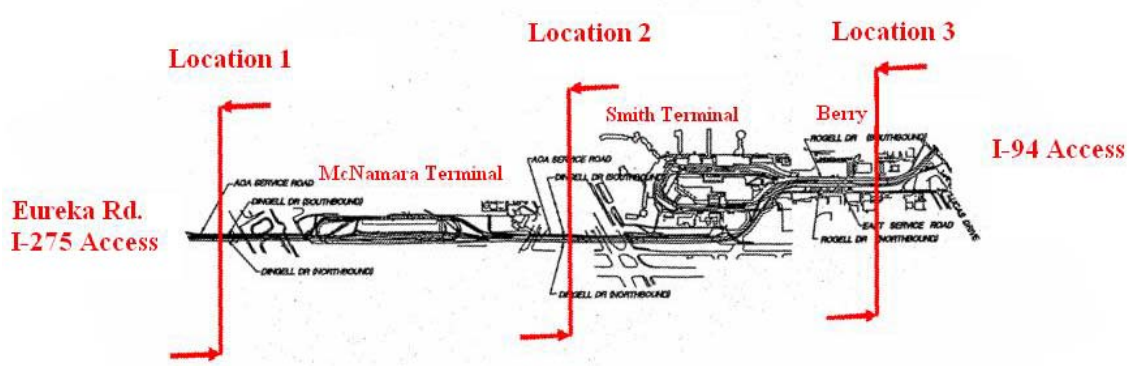
As part of the baseline data collection activities conducted under the Phase I – National Evaluation of Selected FY 2001 Earmarked ITS Integration Program Projects, traffic flow data for vehicles entering and exiting the Detroit Metropolitan Wayne County Airport (DTW) complex was obtained by collecting traffic counts at three locations during two non-peak traffic days (October 22-23, 2003) and the peak traffic day (November 26, 2003) before the 2003 Thanksgiving holiday. Six tube traffic counters were installed to undertake 24-hour collection of vehicle counts.

The traffic counts collected at DTW from October 22-23, 2003 and November 26, 2003 were taken to support the following two objectives:

- Determine the baseline traffic at the airport during non-peak and peak traffic days for:
  - 24-hour day (24-hour count).
  - Morning (AM) and evening (PM) peak periods (approximately 6 to 10 a.m. and 4:30 to 7:30 p.m., respectively).
- Determine the split between the north and south entries/exits for:
  - 24-hour day (24-hour count).
  - AM and PM peak periods.

After implementing the Great Lakes Intelligent Transportation Systems (GLITS) airport components, these baseline data were used to determine if there is a statistically significant response to the GLITS system. These baseline traffic counts have been compared to post implementation data during a time period when significant messages are posted on the Dynamic Message Signs (DMS).

Figure 8 shows the three data collection locations used for the project. Location 1, positioned near the southern entrance to the airport, was the site from where counts were collected for vehicles entering/ exiting the DTW via the Eureka Road/I-275 access. Location 2 captured counts for northbound and southbound vehicles traveling between the Smith and McNamara Terminals. Near the northern entrance, vehicle counts were recorded for vehicles entering/exiting via the I-94 access from Location 3.



Source: Wayne County Airport Authority and SAIC.

Figure 8. Airport Traffic Count Locations.

The following sections describe the results of the DTW study conducted during the two non-peak traffic days (October 22-23, 2003) and the peak traffic day (November 26, 2003) before the 2003 Thanksgiving holiday.

Non-Peak Traffic Days (October 22-23, 2003)

During the non-peak traffic days of October 22-23, 2003, a total of 86,744 vehicles entered the airport and 84,921 vehicles exited via I-94 and Eureka Road access roads. Results for the collection period indicate an average of 43,372 vehicles entering and 42,460 exiting DTW each day. The actual number of vehicles entering and exiting DTW per day is shown in Table 8.

Table 8. Number of Vehicles during Non-Peak Days

Date	Entering	Exiting
Oct. 22, 2003	41,809	41,014
Oct. 23, 2003	44,935	43,907
Total	86,744	84,921

Figure 9 and Figure 10 provide a graphic representation of DTW-related vehicle entering and exiting activity through both I-94 and Eureka Road. In Figure 9, the total number of DTW vehicle entries and exits by time of day are shown. For each 1-hour time period, the number of vehicles entering and exiting the airport is shown. The busiest time of day was found to be between the hours of 1 to 7 p.m., when 2,500 to 3,250 vehicles entered and exited, respectively. In terms of vehicles entering and exiting DTW, the least busy time was found to be between 12 p.m. to 5 a.m., with approximately 100 to 600 vehicles entering and exiting, respectively.

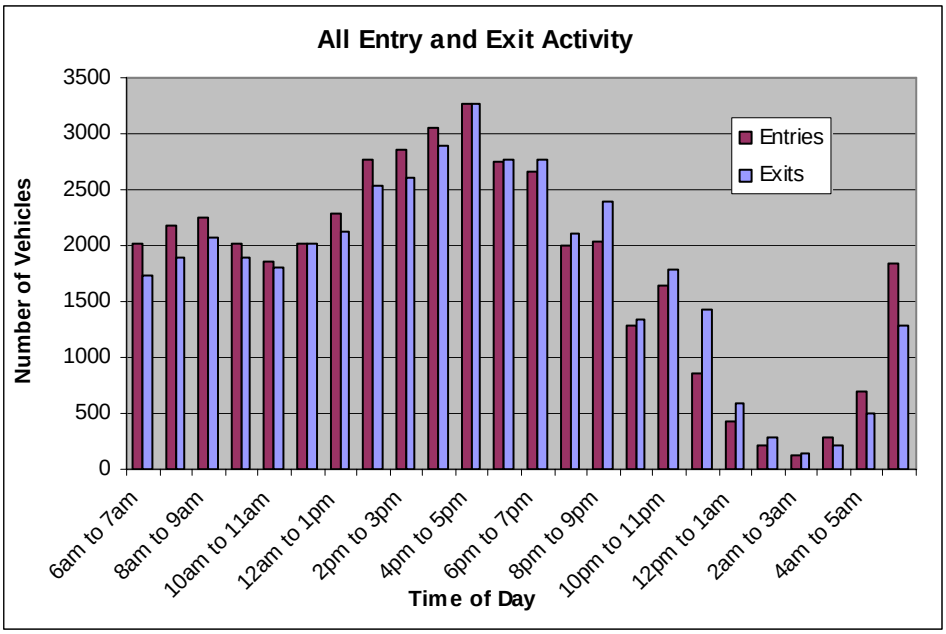


Figure 9. Total DTW Vehicle Entries and Exits by Time of Day.

Figure 10 shows a graph of the percentage of entering versus exiting vehicles by time of day. Depicting the data in this way provides a snapshot of vehicle inflow versus outflow and suggests times when vehicles are either searching for (or leaving) terminal parking spaces. In general, Figure 10 also shows that slightly more vehicles enter the airport during the period from 3 a.m. to 4 p.m., whereas, more vehicles leave the airport from 4 p.m. to 3 a.m.

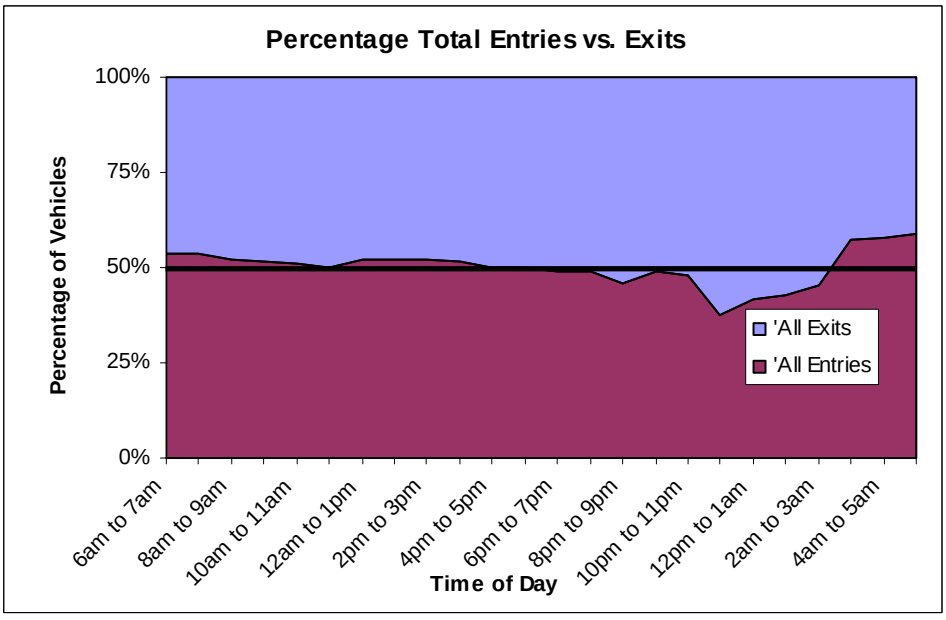


Figure 10. Percentage of Total Airport Entries and Exits by Time of Day.

Morning/Evening Peak Traffic

During the morning peak periods (6-10 a.m.) an average of 8,469 vehicles entered (2,116 vehicles per hour for the period) and 7,592 exited DTW (1,897 per hour for the period). The average number of vehicles per hour entering and exiting DTW using the north and south access roads is shown in Table 9.

Table 9. Number of Vehicles per Hour by Access Road during Morning Peak Period

Access Point	Entering	Exiting	Total
North via I-94	1,478	1,167	2,645
South via Eureka Road	638	730	1,368
Total	**2,116**	**1,897**	**4,013**

Overall, nearly twice as many vehicles used the northern I-94 access compared to the southern Eureka Road access (2,645/1,368 vehicles, respectively). Given the greater proximity to down-town Detroit, about 70 percent (1,478/2,116) of the vehicles entering during the morning peak period used the northern airport access via I-94 versus about 30 percent (638/2116) entering via the southern Eureka Road access. Similar findings were found for exiting vehicles, where nearly 62 percent (1,167/1,897) used the north access route versus 39 percent exiting to the south. During the evening peak periods (3-7 p.m.) an average of 11,718 vehicles entered (2,929 per hour for the period) and 11,688 exited DTW (2,921 per hour for the period). The average number of vehicles entering and exiting DTW per hour via the north/south access roads during the evening peak period is shown in Table 10. The ratio of north/south entries and exits were again found to be similar to the morning peak. During the evening peak period, nearly 65 percent (1,907/2,929) of the vehicles used the northern (I-94) airport access road versus nearly 35 percent (1,022/2,929) that used the southern Eureka Road access. Similarly for vehicles exiting during the evening peak period, about 66 percent (1,938/2,921) of vehicles used the north access versus 34 percent exiting to the south. Table 10 presents the number of vehicles per access road recorded during the Evening peak period.

Table 10. Number of Vehicles per Hour by Access Road during Evening Peak Period

Access Point	Entering	Exiting	Total
North via I-94	1,907	1,938	3,845
South via Eureka Road	1,022	983	2,005
Total	**2,929**	**2,921**	**5,850**

North/South Traffic Morning/Evening Peak Movement

Vehicle counts for northbound and southbound vehicles traveling between the Smith and McNamara Terminals also were collected for the 2-day period. On average per day, 8,203 vehicles headed north and 8,254 vehicles traveled south. During the morning peak (6 to 10 a.m.), a total of 2,029 vehicles (about 507 per hour) headed north and 1,123 vehicles (about 280 per hour) headed south. During the evening peak period (3 to 7 p.m.) the 2 days' total of 2,009

vehicles (about 502 per hour) headed north, and 2,565 vehicles (about 641 per hour) headed south.

Based on time of day, Figure 11 shows the number of vehicles traveling northbound and southbound as measured between the Smith and McNamara Terminals. During the morning peak traffic period, the majority of vehicles are traveling north through the airport. Conversely, the majority of vehicles are traveling south during the 4-7 p.m. portion of the evening peak traffic period, as shown in Figure 12, which presents the percentage of vehicles heading north versus south.

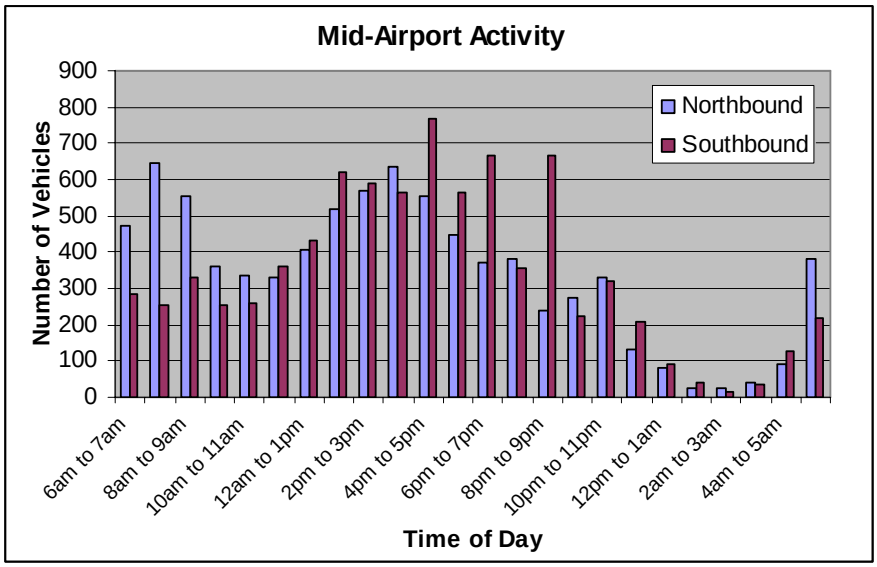


Figure 11. Mid-Airport Northbound and Southbound Traffic by Time of Day.

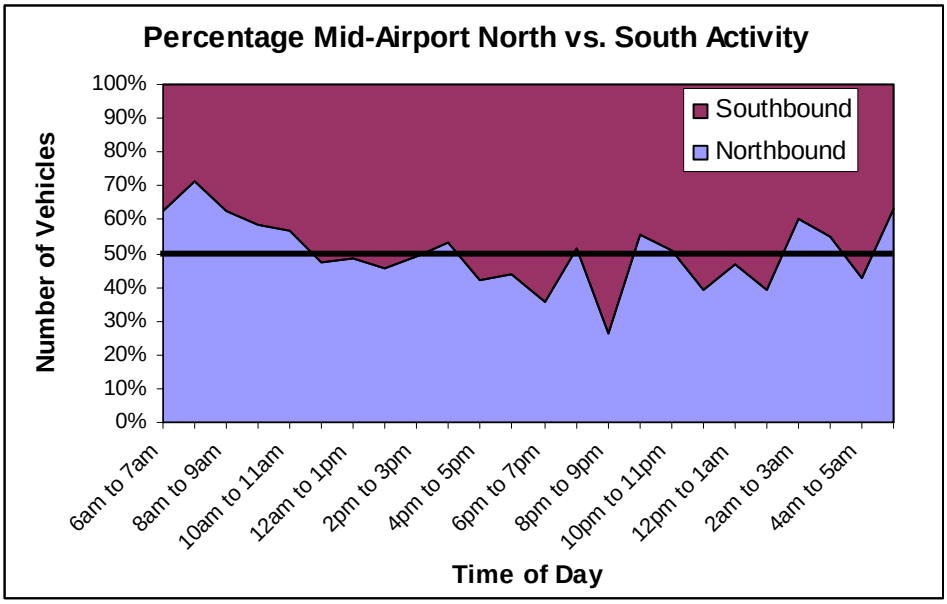


Figure 12. Percentage of Northbound versus Southbound Mid-Airport Traffic.

Peak Traffic Day (November 26, 2003) before the 2003 Thanksgiving Holiday

The vehicle counts collected on November 26, 2003 (the day before the Thanksgiving holiday) provide a baseline snapshot of traffic conditions on a peak traffic day. A total of 47,825 vehicles entered the airport, and 42,262 vehicles exited via the I-94 and Eureka Road access roads. (These figures contrast with the average of 43,372 entering and 42,460 exiting each day during the non-peak traffic day.) Figure 13 shows the total number of airport entries and exits by time of day. The data trend is similar to the non-peak traffic day in that the busiest time of day was found to be between the hours of 1-8 p.m., with from 2,500 to 3,400 vehicles entering and exiting, respectively. In terms of vehicles entering and exiting, the least busy time was found to be between 12 p.m. to 5 a.m., with fewer than 100 vehicles entering and exiting between 3-4 a.m.

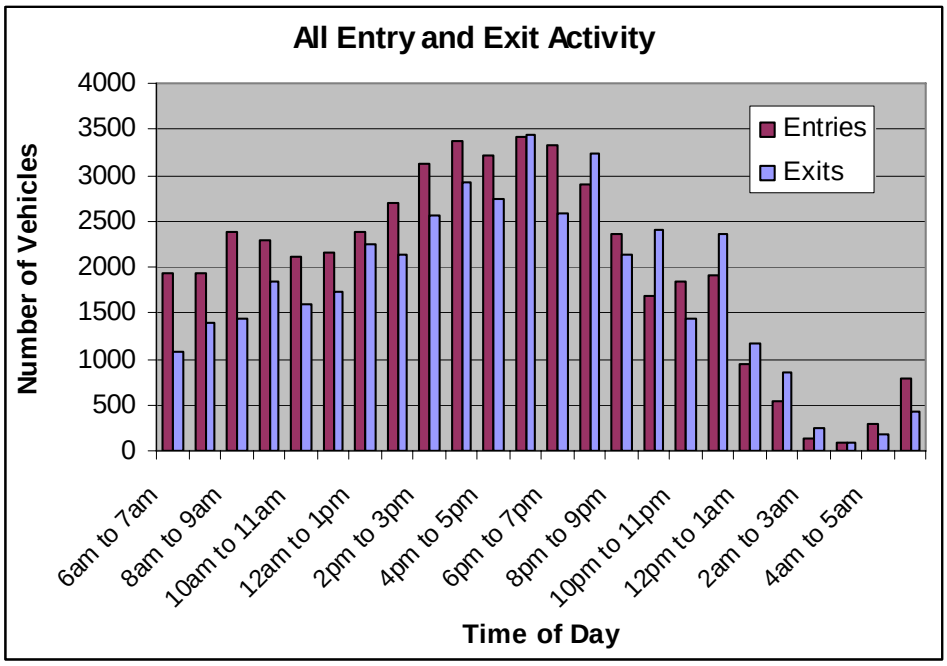


Figure 13. Total Airport Entries and Exits by Time of Day.

The graph shown in Figure 14 shows the inflow/outflow of vehicles. For the most part, more vehicles are entering the airport (inflow) from 6 a.m. through 7 p.m. than are exiting (outflow). Overall, it was found that during the 7 p.m. to 4 a.m. period, there were more vehicles exiting the airport than entering.

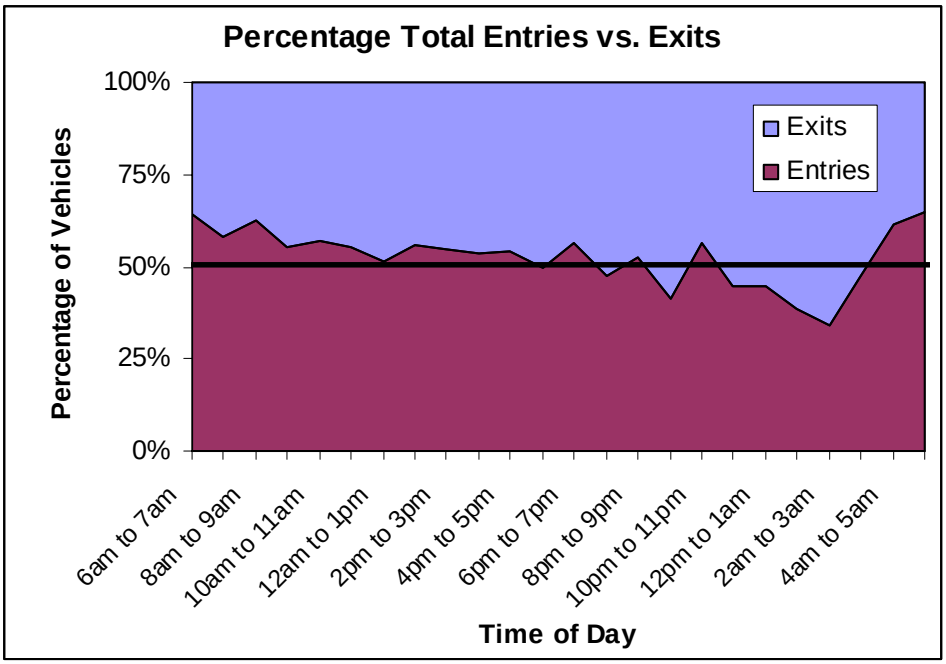


Figure 14. Percentage of Total Airport Entries versus Exits by Time of Day.

Morning/Evening Peak Traffic

During the morning peak periods (6-10 a.m.), a total of 8,547 vehicles entered (2,136 vehicles per hour for the period), and 5,773 exited (1,443 per hour for the period). The average number of vehicles per hour entering and exiting using the north and south access roads is shown in Table 11. Overall, about three times as many vehicles used the northern I-94 access road compared to the southern Eureka Road access (2,752 versus 827). As was previously reported, a greater percentage of vehicles used the northern airport access road via I-94 than the southern Eureka Road access. During the morning peak period about 76 percent (1,634/2,136) of the vehicles entered using the northern I-94 airport access road versus about 24 percent (502/2,136) that entered from the south Eureka Road access. Vehicles exiting during the morning peak period resulted in about 77 percent (1,118/1,443) using the north access versus 23 percent exiting to the south (325/1,443).

Table 11. Number of Vehicles per Hour by Access Road during Morning Peak Period

Access Point	Entering	Exiting	Total
North via I-94	1,634	1,118	2,752
South via Eureka Road	502	325	827
Total	**2,136**	**1,443**	**3,579**

During the evening peak periods (3-7 p.m.) an average of 13,325 vehicles entered (about 3,331 per hour) and 11,668 exited (about 2,917 per hour). The average number of vehicles per hour entering and exiting via the north/south access roads during the evening peak period is shown in Table 12. Once again, about three times as many vehicles used the northern I-94 access road

compared to the southern Eureka Road access (4,756 versus 1,492). During the evening peak period, about 77 percent (2,566/3,331) of the entering vehicles used the northern (I-94) airport access road versus about 23 percent (765/3,331) that entered from the south. About 75 percent (2,190/2,917) of vehicles exiting during the evening peak period resulted in using the north access versus 25 percent exiting to the south. Table 12 presents the number of vehicles per hour by access road recorded during the Evening peak period.

Table 12. Number of Vehicles per Hour by Access Road during Evening Peak Period

Access Point	Entering	Exiting	Total
North via I-94	2,566	2,190	4,756
South via Eureka Road	765	727	1,492
Total	**3,331**	**2,917**	**6,248**

North/South Traffic Movement

Vehicle counts for northbound and southbound vehicles traveling between the Smith and McNamara Terminals on November 26, 2003 are shown in Figure 15. Per day, on average, 17,091 vehicles headed north and 17,854 vehicles traveled south (this contrasts with the counts obtained during the non-peak traffic days which had on average 8,203 vehicles headed north and 8,254 vehicles traveled south). During the morning peak (6-10 a.m.), a total of 2,521 vehicles (about 630 per hour) headed north and 2,930 vehicles (about 733 per hour) headed south. During the evening peak period (3 – 7 p.m.), the 2 days' a total of 4,591 vehicles (about 1,148 per hour) headed north and 4,844 vehicles (about 1,211 per hour) headed south.

Figure 15 shows, by time of day, the number of vehicles traveling northbound and southbound as measured between the Smith and McNamara Terminals. During the morning peak traffic period a slight majority of vehicles are traveling south through the airport (in contrast to October 22-23 non-peak days which showed more northbound vehicles). However, for the evening peak period, no clear trend emerges for northbound or southbound traffic flow. These results are shown graphically in Figure 16, which shows a relatively even split in the percentage of vehicles heading north versus south.

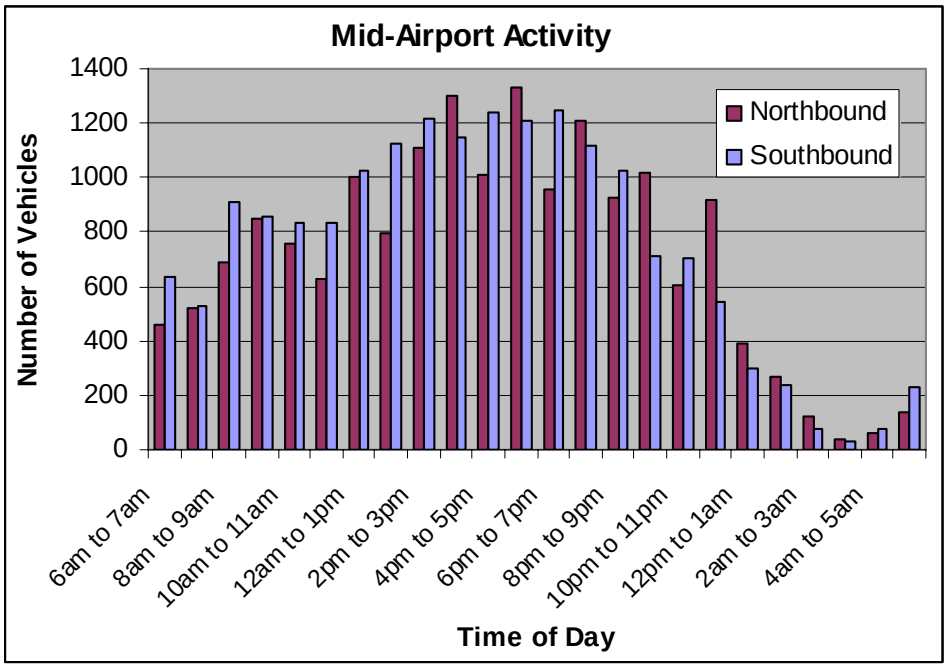


Figure 15. Mid-Airport Northbound and Southbound Traffic by Time of Day.

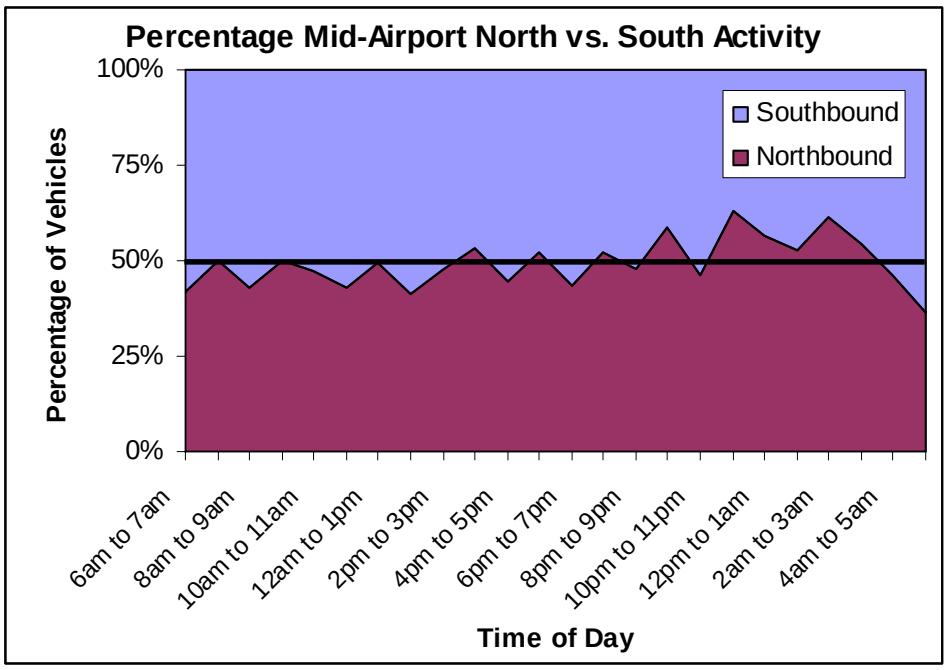


Figure 16. Percentage of Northbound versus Southbound Mid-Airport Traffic.

APPENDIX B: AIR PASSENGER COUNTS

The Wayne County Airport Authority collects and archives air passenger data for internal and external reporting purposes. The air passenger count data supporting this evaluation covers a 15-month period from October 2002 through December 2003. The data describes the number of scheduled passengers, air taxi (commuter) passengers, and charter passengers. In addition to total passenger counts, the data also are disaggregated by direction of travel (arrival or departure) and flight destination (domestic or international).

The air passenger counts from October 2002 through December 2002 and the period from January 2003 through December 2003 are presented in this section. Air passenger counts were derived from the inbound and outbound domestic and international scheduled passenger lists; domestic and international air taxi (commuter) passenger lists, and domestic and international charter passenger lists. These air passenger counts were used to determine a baseline of air travel passengers arriving and departing. After the GLITS ITS airport components are deployed, these baseline data were used to assist in the analysis of travelers entering and exiting the airport and utilizing terminal parking facilities.

Figure 17 shows the total number of passengers by month. For the year, 2003 had a total of 16,151,930 departing passengers and 16,101,567 arriving passengers. January 2003 had the fewest departing and arriving passengers (1,154,604 and 1,100,040, respectively), whereas, July 2003 had the most departures (1,544,549) and arrivals (1,543,024).

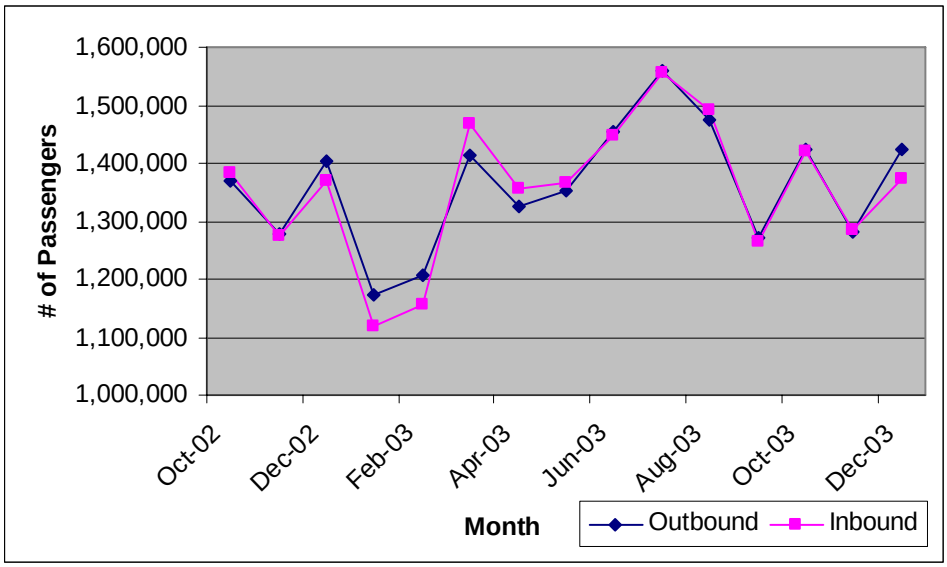


Figure 17. Total Air Passenger Counts for All Types of Flights.

Figure 18 shows the average number of daily inbound and outbound passengers. For 2003, a typical or average day resulted in roughly 74,000 to 100,000 total passengers arriving and departing the airport. The average number of outbound passengers ranged from about 38,000 to 50,000 per day; the number of inbound passengers ranged from about 36,000 to 50,000 passengers each day.

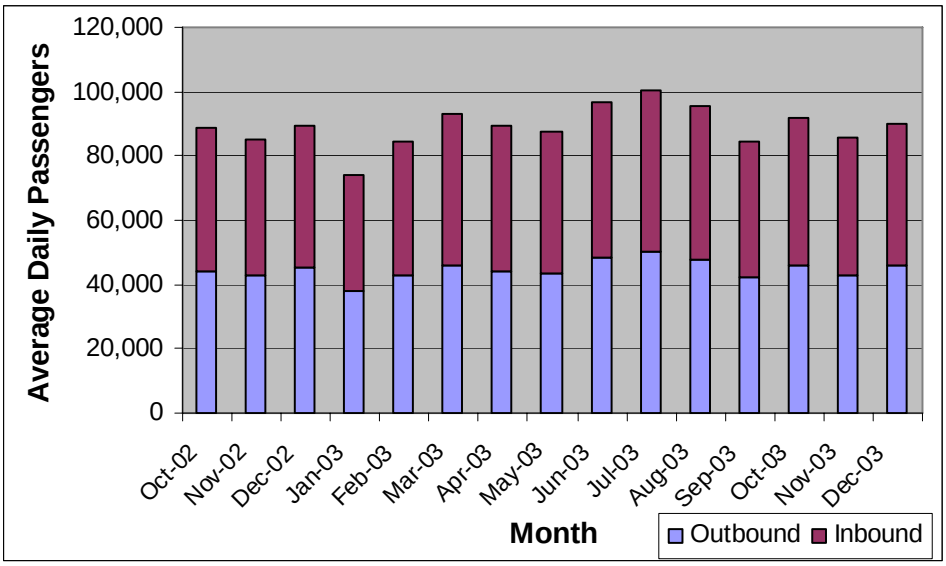


Figure 18. Average Daily Inbound/Outbound Passengers per Month.

APPENDIX C: PARKING LOT TRANSACTIONS

The Wayne County Airport Authority collects and archives parking revenues and transaction counts. The February 2002 through February 2004 data from the Smith/Berry Terminal and McNamara Terminal were provided in support of this evaluation. These parking data, collected by parking facility and location, are aggregated into monthly totals and daily averages. The Smith/Berry Terminal and McNamara Terminal parking facilities consisted of short-term, long-term, economy, and valet parking spaces. Table 13 shows the parking facilities and number of parking spaces available near the Smith/Berry and McNamara Terminals as of February 2004.

Table 13. Number of Parking Spaces Available

Parking Facility	Parking Spaces
Smith/Berry Terminal:	
• Marriott Short-Term Lot	70
• Berry Short-Term Lot	65
• Yellow Lot	677
• Green Lot #1	1,223
• Green Lot #2	925
• Red Lot	457
Blue Deck:	
• Economy	4,195
• Long-Term Parking	1,521
• Short-Term Parking	65
Total Smith/Berry Terminal =	**9,198**
McNamara Terminal Garage:	
• Long-Term Parking	9,097
• Short-Term Parking	744
• Valet Parking	430
Total McNamara Garage =	**10,396**
TOTAL =	**19,469**

The Smith/Berry Terminal and McNamara Terminal parking lot payment transactions for the period from January 2002 through February 2004 are described and summarized in this section. The payment transaction data consisted of counts of monthly transactions from short-term, long-term, economy, and valet parking facilities. After the GLITS airport components are deployed, these baseline data will be used to examine the impact of traveler information on parking availability at the terminal parking facilities.

In 2002 and 2003, there were a total of 2,309,273 and 2,515,599 transactions, respectively. Table 14 shows the number of parking transactions in 2002-2003 by parking terminal. Despite a 15-percent decrease in transactions at Smith/Berry, a nearly 35 percent transaction growth at the McNamara Terminal resulted in an overall growth of just less than 9 percent between 2002 and 2003.

Table 14. Number of Parking Transaction per Year by Parking Terminal

Parking Terminal	2002	2003	Change
Smith/Berry	1,196,468	1,014,659	-15.1 percent
McNamara	1,112,805	1,500,940	+34.9 percent
Total	**2,309,273**	**2,515,599**	**+8.9 percent**

Figure 19 shows the total number of parking transactions by month. The top line (green) represents the total number of transactions. The four lines below the top line shows the monthly parking transactions the types of parking transactions (short-term, long-term, economy, and valet) that contributed to the total. In general, short- and long-term transactions were the most common transactions and contributed the most to the total transaction count.

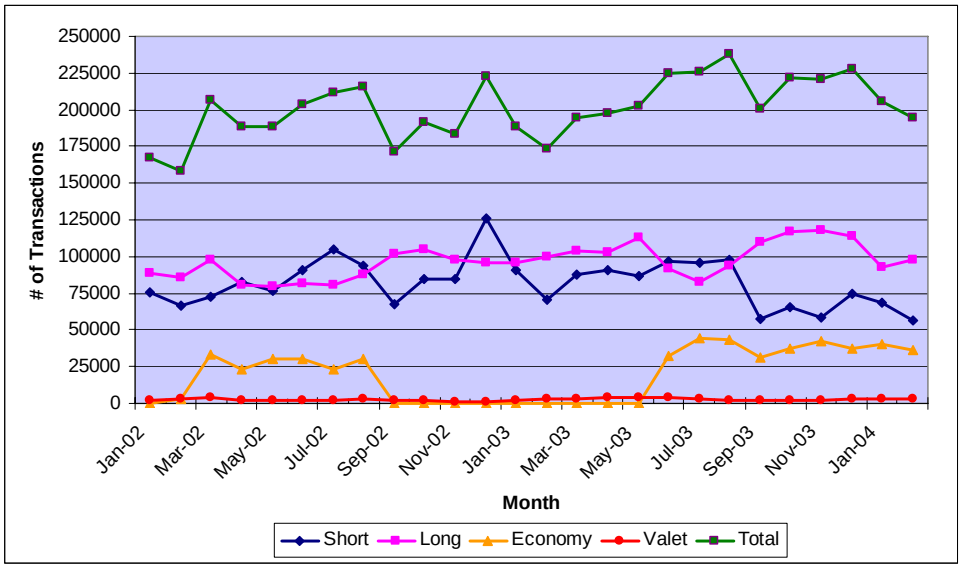


Figure 19. Parking Transactions per Month.

Figure 20 shows the total number of parking transactions by month at the Smith-Berry Terminal. Once again, the top line (green) represents the total number of transactions and the remaining lines below the top line shows the short-term, long-term, economy, and valet monthly parking transactions. In general, short-term and long-term transactions were the most common transactions until about June 2003 when the economy parking lot became operational and reduced the number of long-term transactions.

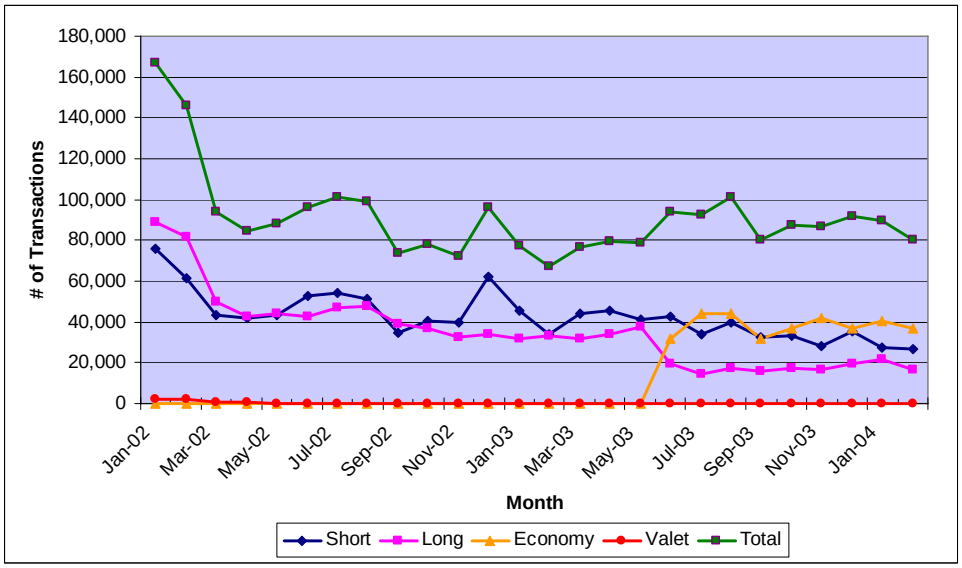


Figure 20. Parking Transactions at Smith-Berry Terminal.

Figure 21 shows the total number of parking transactions by month at the McNamara Terminal. Because the McNamara parking facility opened in late February 2002, the parking transactions in January and February do not represent an entire month of transactions. From March 2002 through August 2002, economy parking was available; however, beginning in September 2002, economy parking was discontinued. This resulted in an increase in long-term parking transactions and no significant change in the number of short-term transactions. In the fall of 2003, a change in the mix of available short- and long-term parking increased the number of long-term transactions and reduced the number of short-term transactions.

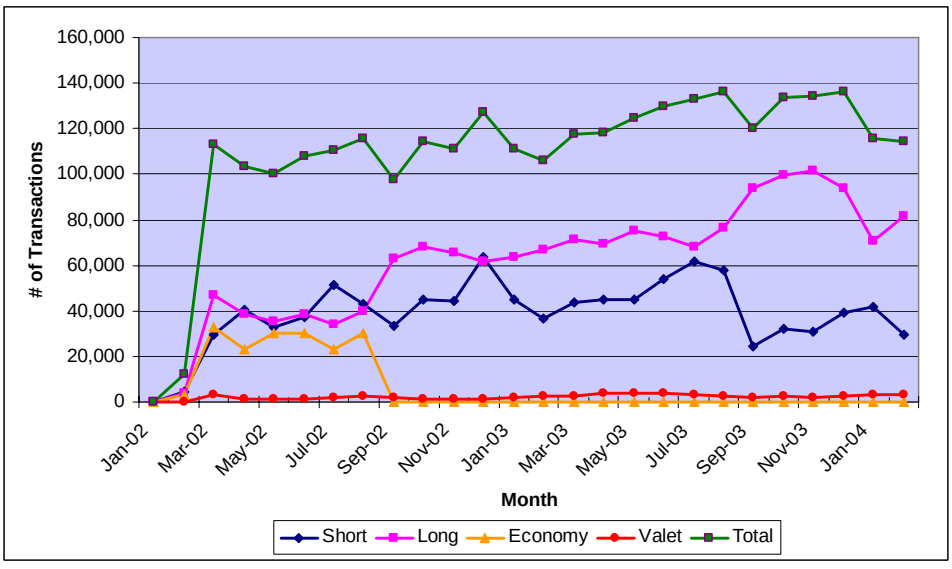


Figure 21. Parking Transactions at McNamara Terminal.

The erosion in the number of transactions also can be seen in the average number of daily transactions shown in Figure 22. Prior to the McNamara parking facility opening, the average number of daily transactions at Smith-Berry was about 5,200 transactions. After the McNamara

parking facility opened, the number of Smith-Berry transactions fell to approximately 3,000 per day, and remained constant through 2003. Conversely, the McNamara transactions grew from about 3,000 transactions in early 2002 to about 4,000 transactions by mid-2003.

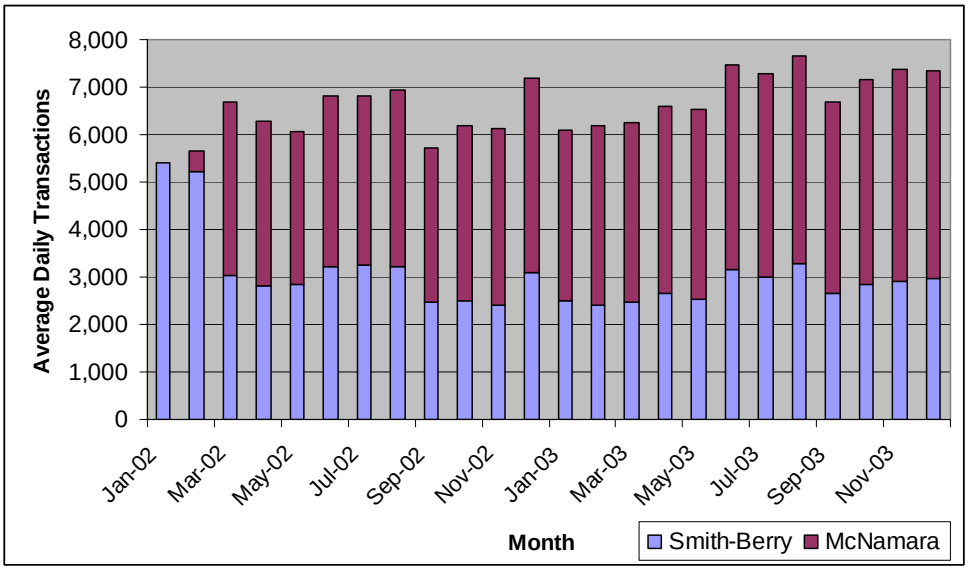


Figure 22. Average Daily Transactions.

APPENDIX D: VEHICLE CRASHES: FEBRUARY 2002 THROUGH JANUARY 2004

The Wayne County Airport Authority, Division of Public Safety, provided crash data from State of Michigan Traffic Crash Reports. The crash data included all vehicle crashes occurring on the airport roadways and parking areas. The crash statistics cover a 2-year period from February 2002 through January 2004, and provided data that characterized crashes by: Crash Date; Time Period; Location; Road Condition; Type of Crash; and Accident Severity.

Specific crash information was coded to ensure privacy and facilitate analysis and presentation of summary statistics. Table 15 shows the crash statistics template used to consolidate the Traffic Crash Report data as reported by morning (AM), mid-day, early evening (PM), or Night (after 7:01 p.m.). Specifically, time was categorized into one of four time periods: AM Peak (6 to 9 a.m.), Mid-day, PM Peak (4 to 7 p.m.), or Night. Table 15 presents a template regarding the crash statistics pertaining to date month, day, year, crash type, and level of severity.

Table 15. Crash Statistics Template

Crash Date Month/ Day/ Year & Time Period	Location	Zone Code	Road Condition	2-Year Crash History								
				Crash Type						Crash Severity		
				Rear End	Angle	Head On	Side Swipe Opposite Direction	Side Swipe Same Direction	Run Off Road	PDO	Injury	Fatal

Location of crash was recoded into one of five airport zones: I-275 Access Road area; McNamara Terminal area; Smith Terminal area; I-94 Access Road area; or Green/Yellow Surface Parking Lots.

Road condition as reported in the original crash report was denoted as: Dry; Wet; Icy; Snowy; or Slushy.

One of six different crash types was indicated to identify how the crash occurred: rear-end; angle; head-on; side swipe-opposite direction; side swipe-same direction; or run off road.

Crash severity also was defined as either: property damage only (PDO), injury, or fatal.

The vehicle crashes on the airport roadways and parking areas during the 2-year period from February 2002 through January 2004 are presented in this section. These baseline analyses provide a snapshot characterizing the crashes in terms of the number per year (and month), location, time of day, road conditions, type of crash, and severity. The graphs presented in this section often provide both a count of the frequencies and the percentage of the total occurrence. This is done to not only show the magnitude of a particular category but also its contribution to the total number of occurrences. These baseline data will be used in the Phase III After analysis

to determine if the number and severity of vehicle crashes on the airfield roadways are reduced following deployment of the GLITS integration components.

Yearly and Monthly Crashes

Although the number of crashes in 2002 and 2004 consists of data for partial years, Figure 23 shows the total number of crashes by year. For the 24-month base case period there were a total of 325 total crashes; in February through December 2002 there were 160 crashes (about 49 percent of the total); January through December 2003 had 148 crashes (about 45 percent); and January 2004 had 17 crashes (about 5 percent).

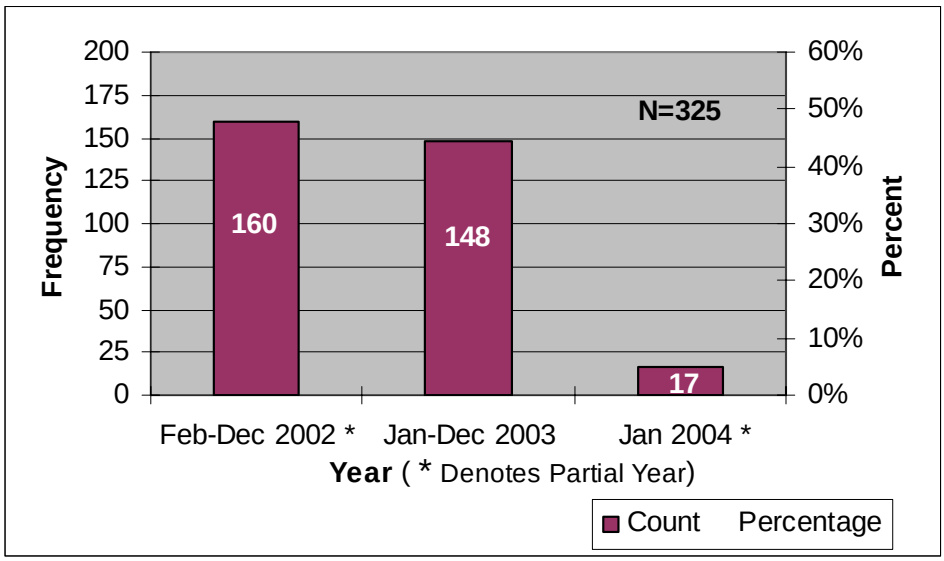


Figure 23. Crashes by Year.

Reviewing the total crashes per calendar year is not the most interesting view of airport roadway and parking lot crashes. A more insightful view of crashes is the number of crashes by month as shown in Figure 24. The individual bars show the number of crashes for each of the 24-month baseline period. The dashed line depicts the average number of crashes per month (about 13.5). In this view the variability (or range) for certain months between years are readily apparent. Several months are above and below the average crash rates.

To determine if there are statistically significant differences in the number of crashes per month, a Chi-square statistic was used to compare the actual and expected number of crashes. Using an expected number of crashes per month of 13.5 (the average number of crashes per month for the 2-year period), the Chi-square statistic indicated that the difference between actual and expected number of crashes was large enough to be statistically significant ($\chi^2 = 42.3846$, $p=0.0082$) for certain months. Although the Chi-square test does not indicate the particular month(s), closer examination of Figure 24 clearly shows that May 2002, July 2003, and December 2002 were considerably different from the average crash rate. These differences suggest that the variability may be due to some additional factor(s) inflating (or deflating) the number of crashes. At this point in the analysis, a deeper investigation into these crashes is needed to produce a reasonable explanation.

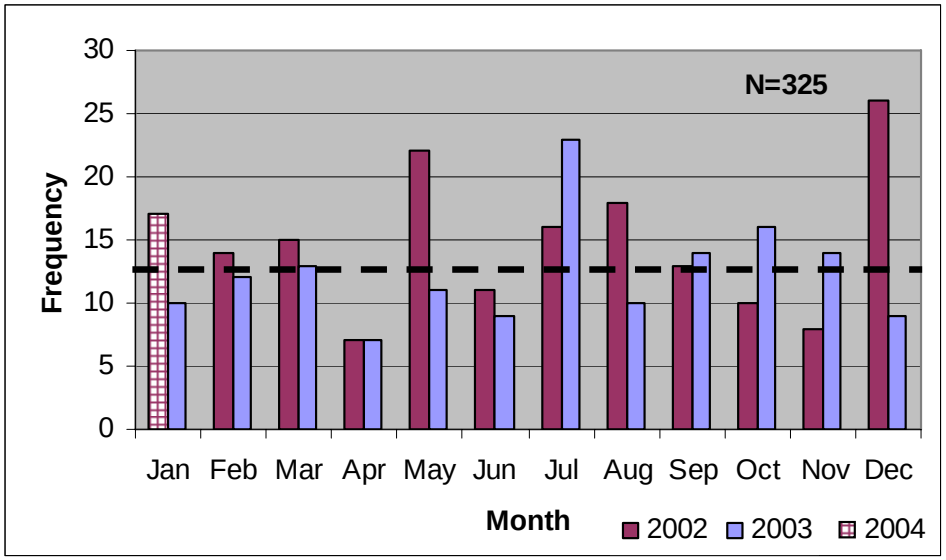


Figure 24. Crashes by Month and Year.

Figure 25 shows the average number of crashes by month of the year. This graph shows how many crashes (on average) occurred during particular months. By averaging the number of crashes per month (in effect combining the months for both years), the highs and lows for particular months becomes less extreme and provides another way to estimate of the number of crashes per any given month.

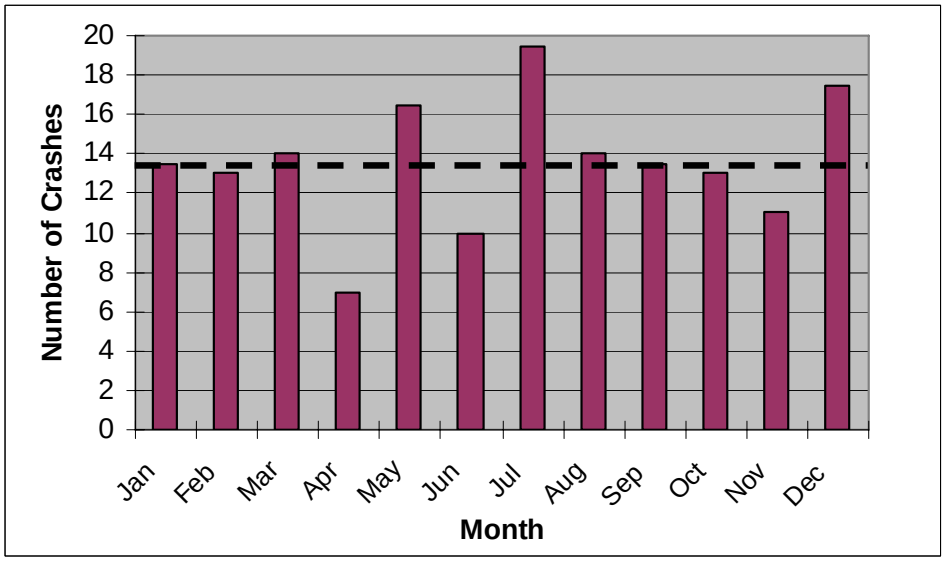


Figure 25. Average Monthly Crashes.

To determine if the actual number of crashes was statistically different from the expected (average) number of crashes, a Chi-square statistic was again calculated. The Chi-square statistic indicated that the actual number of crashes did not differ enough to be statistically significant at the 0.05 level of significance ($\chi^2 = 18.1262$, p=0.0787). Consequently, averaging over 2 years

dampened the extreme months and resulted in an estimate of baseline crashes that were more in line with an expected number of crashes.

For the analysis in Phase III of the evaluation, the difference in number of Before and After crashes will be investigated in a similar fashion to determine the statistical reliability of the differences. In addition, factors such as use of ITS technologies, air passenger counts, month of the year, location, time of day, and road conditions will be examined to determine possible explanations for changes in the number of crashes.

Location of Crashes

The crash locations were recoded into one of five airport zones: I-275 Access Road area; McNamara Terminal area; Smith Terminal area; I-94 Access Road area; or Green/Yellow Surface Parking Lots. Figure 26 shows the location of crashes. For the 325 crashes recorded over the 2-year period, most crashes (55 percent) occurred in the I-94 access road location. Given the higher utilization of the I-94 access road (about 2:1 during non-peak traffic days and 3:1 on peak traffic days) the higher percentage of crashes is not surprising. The other locations had substantially fewer crashes: McNamara Terminal area (18 percent); Smith Terminal area (17 percent); I-275 access road (10 percent); and Green/Yellow Parking Lots (<1 percent).

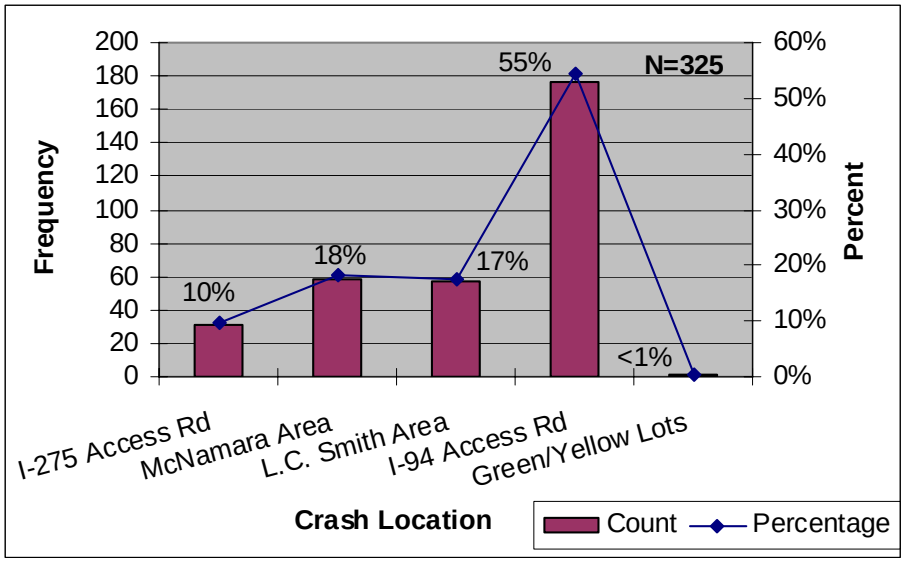


Figure 26. Location of Traffic Crash.

Time Crashes Occurred

The reported time of crashes occurred were categorized into four time periods: AM Peak (6-9 a.m.), Mid-day, PM Peak (4-7 p.m.), or Night. Figure 27 shows the number and percentage of crashes by time period. As shown in Figure 27, most crashes occurred during the Mid-day period (34 percent), followed by PM Peak (28 percent), AM Peak (20 percent), and Night (18 percent).

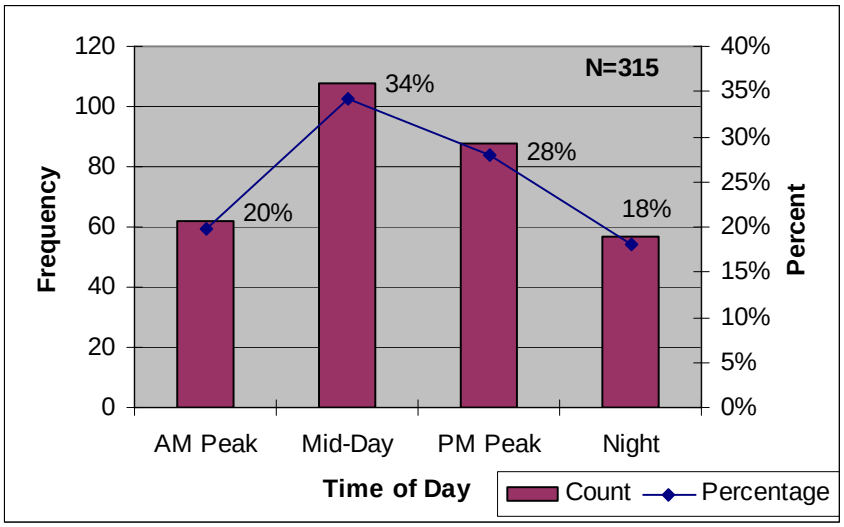


Figure 27. Time of Day Traffic Crash Occurred.

Road Conditions During Crashes

The road condition as reported in the original crash report was classified into five categories: Dry; Wet; Icy; Snowy; or Slushy. Figure 28 shows number and distribution crashes. About 75 percent of crashes (244 out of 325) occurred when the roadway was dry; about 19 percent (62 of 325) of the crashes occurred when the road was wet; and another 6 percent occurred when the road was icy, snowy, or slushy. However, comparing these figures to archived weather conditions suggests weather was not a primary factor in crashes.

During the 24-month baseline period (February 1, 2002 through January 31, 2004) there were a total of 242 days with rain (about 33 percent), 119 days with a trace or more of snow (about 16 percent), and a total of 354 days with either rain or snow precipitation (about 48 percent).[30] However, although about 48 percent of the days had some precipitation, a disproportionate number of crashes occurred when the road condition was dry (about 75 percent). Therefore, poor road surface conditions due to snow or rain were not deemed to be a primary factor in crashes as evident in the reported road conditions in the original crash report data.

This conclusion seems to be supported in Figure 29 which shows the number of crashes per month plotted with the number of precipitation days per month. The dashed line indicates a perfectly proportional fit between number of precipitation days and the number of crashes. As seen in the figure the number of crashes is not perfectly proportional to the number of precipitation days. In fact, after calculating correlation coefficient to measure the relationship, the results indicate that there is a weak relationship (r=0.1057) between crashes and precipitation.

[30] Based on archived weather conditions for Detroit Metropolitan Airport available at The Weather Underground Website: <www.wunderground.com>.

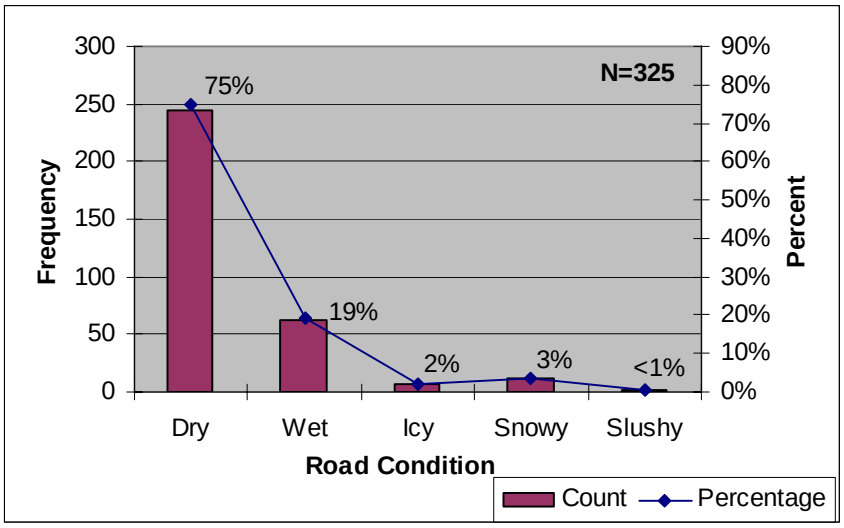


Figure 28. Road Condition During Traffic Crash.

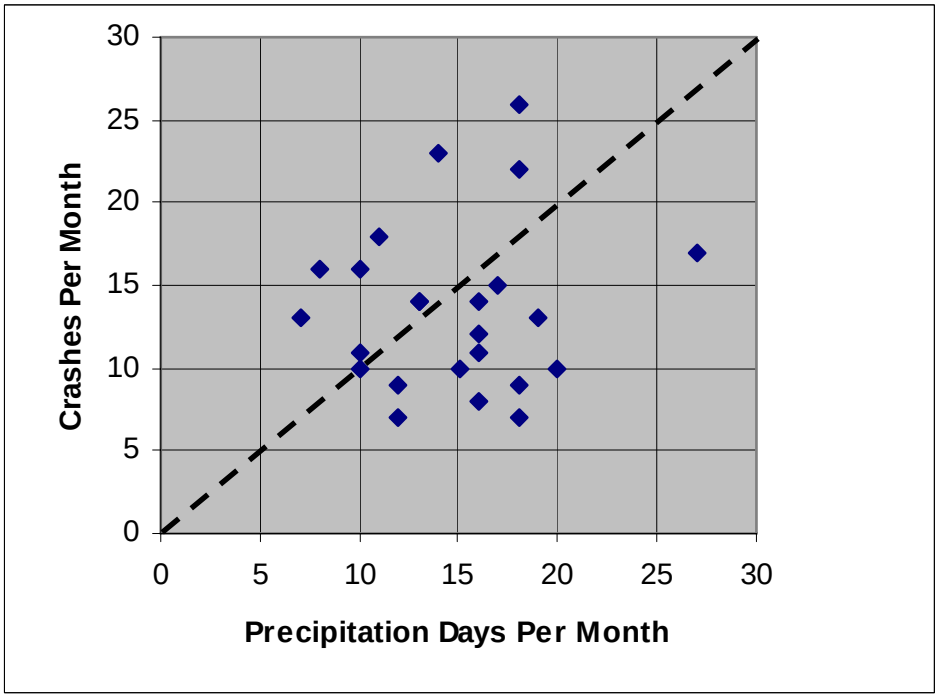


Figure 29. Monthly Crashes versus Precipitation Days.

Type of Crashes

Six different crash types identified how the crash occurred: rear-end; angle; head-on; side swipe, opposite direction; side swipe, same direction; or run off road. Figure 30 shows the frequency and distribution of crash types for 294 out of 325 crashes (31 crashes were excluded due to missing crash type designations).

With about 40 percent of all crashes, a rear-end type crash was the most common. The second most common type, at about 35 percent, was a side-swipe with both vehicles traveling in the same direction. Those that were found to occur about 10 percent or less included: angle (10 percent); run-off road (7 percent); head-on (5 percent); and side swipes in opposing directions (2 percent).

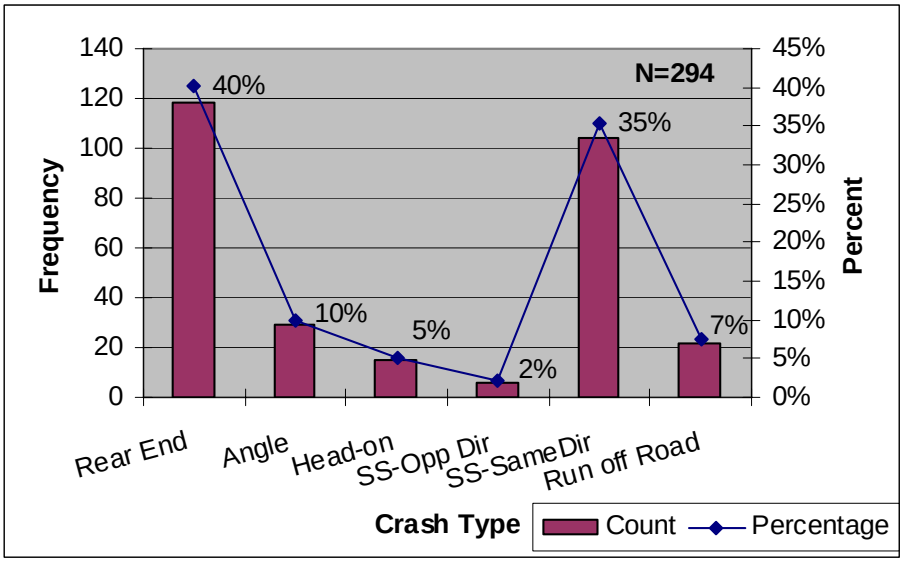


Figure 30. Type of Traffic Crash.

Severity of Crashes

The severity of crashes was classified into either PDO, injury, fatal, or PDO/injury. Figure 31 shows the frequency and percentage of 324 traffic crashes (one crash was excluded due to missing a crash severity). The majority of crashes (288 crashes) or 89 percent was PDO. Injury crashes accounted for about 10 percent of the total crashes. With 1percent or less, fatal or PDO/injury crashes were the least common.

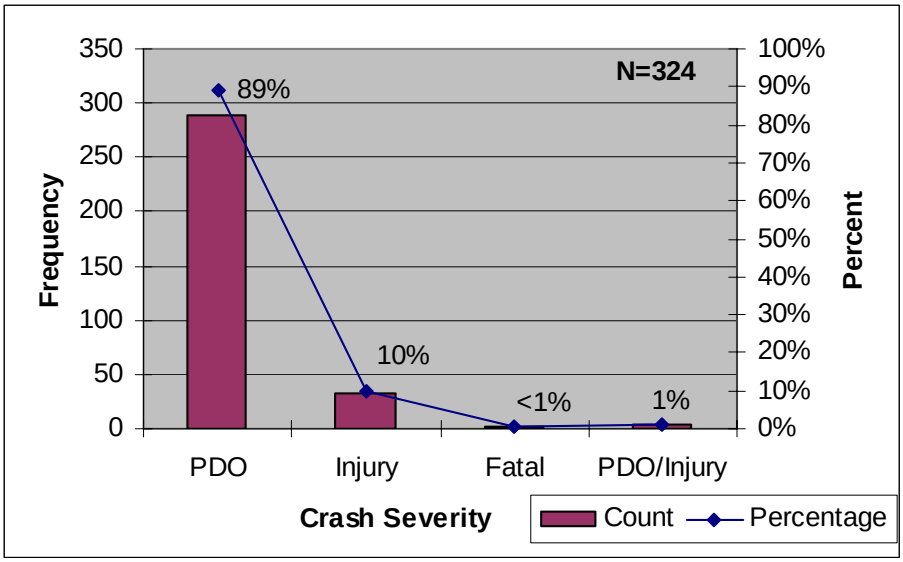


Figure 31. Severity of Traffic Crashes.