REGIONAL TRANSPORTATION SAFETY INFORMATION MANAGEMENT SYSTEM (RTSIMS)
Phase II
UPWP Project: 600-0180-09
Task Order SA09-1

Goal

The overall goal of the RTSIMS project is to develop an information management system solution that would enable MAG perform road safety analyses at the regional level to produce reports on historical crash data, and also generate forecasts of likely road safety consequences of future plans. This system is being developed in three phases. Phase I has been completed. The goal of Phase I was to develop a Table of Common Definitions to be used in regional road safety analysis. The Executive Summary of the Phase I Final Report is attached as Appendix A. In subsequent RTSIMS phases these definitions will be used in region wide analysis and local definitions will be used for local crash analysis.

The objective of this particular project is to produce a software application that could be utilized to generate annual reports and custom reports on the state of road safety in the MAG region, based on comprehensive road safety analyses of historical crash data. The reports to be generated by this software solution will be limited to analyses based on reported crash frequency, crash severity, and official population estimates. Future enhancements of this system will include the addition of exposure/traffic volumes and other factors into this analysis. Hence, the system developed should have future enhancement capabilities.

Examples for charts and tables that must be generated through this software application are the Tables and Figures that are shown in the 2005 MAG Strategic Transportation Safety Plan (see MAG website). These charts and tables will be incorporated in future MAG Annual Transportation Safety Reports. They must be produced as a JPEG or PDF files. Appendix B provides a description of all potential Tables and Charts that must be produced.

Project Oversight

The MAG Transportation Safety Committee will provide technical oversight and direction for this project. Project meetings will be held in conjunction with Quarterly MAG Transportation Safety Committee meetings. If needed, additional project meetings will be scheduled.

Task 1: Develop the Software Solution

Solution Requirements

The consultant shall develop the software application with following requirements :

Software Requirements:

Database: SQL Server 2005+
Utilities: SQL Server Analysis Services, SQL Server Reporting Services
Code Development: .Net Framework with VB.net or C# code

Webhosting: IIS 6+

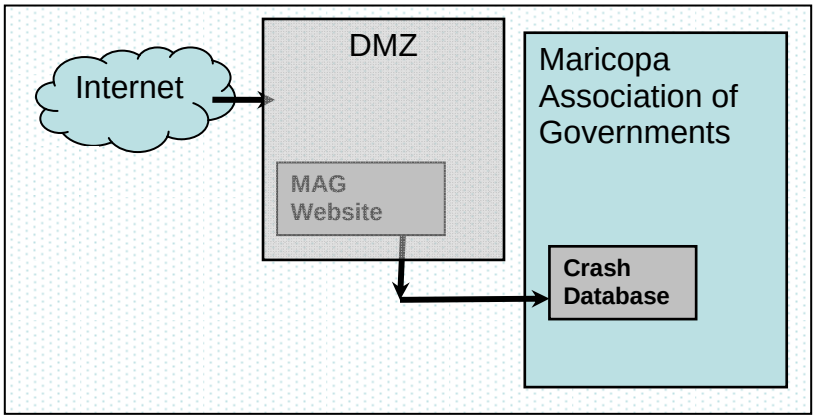
Code Ownership:
MAG will have sole ownership of all program code developed as part of this project.

User Interface:
The system shall have a web-based interface with the latest programming technologies for possible future expansion purposes. The system shall be implemented initially on the MAG network as an intranet application as well as at MAG website hosting location for member agencies to access their data and run queries over Internet.

Users & Security:
The system developed shall be a multi-user system with multiple layers of security to restrict the usage of the system. Access to the system will be limited to MAG staff and to authorized persons from MAG member agencies for carrying out safety analyses. The system will have different levels of security that would permit:

i. Viewing the previously prepared reports
ii. Develop a User Input Screen to Input the Date Range (Multiple Years or Single Year) for Data Analysis.
iii. Creating reports based on custom queries
iv. Selecting bounds for Freeway Crash Summary by milepost
v. Screens to limit member agency user access to their own data and not any other agency's data
vi. Administrator rights and utilities to grant access to reports based on custom queries to others
vii. Utilities to insert the updates to the ALISS database from ADOT

Database Connectivity:
MAG anticipates moving its co-located servers into a locally hosted DMZ prior to the completion of this project. The web interface will be located in the DMZ and that sensitive back-end data will reside on a SQL Server inside the MAG domain to ensure the protection of sensitive data. Access to the SQL Server will be provided via SQL connection.



Archive of Queries & System Log:
The system shall be able to store custom queries and maintain a log of system usage.

User Input Screens:

- To input the desired weighting scheme for calculating the Severity Index. The Severity Index is the ratio of weighted sum of crashes by crash severity to total number of crashes. This ratio can be used to rank high crash locations.
- To input and modify a local agency's definition of intersection related crashes when querying at agency level.
- To create custom queries and summarize them based on any variable or group of variables in the Database

This task involves fully developing a software solution with the capability to generate all of the reports listed in Appendix B. This solution may involve custom software for handling data analysis queries from the MAG crash database archive, that is based on ALISS. The users of this software solution will be able to choose how the results from these queries are to be displayed, as Line Graphs, Tables, and Pie Charts etc. End users shall also be able to run queries on the database in one of two ways:

(1) using local definitions that were identified in RTSIMS Phase I project and,
(2) using regional definitions for the entire region.

Deliverables:

1. Mock-up screens, work flow diagram and functional specifications will be delivered to MAG in **1 month**
2. The prototype system will demonstrated, delivered and installed at the MAG Website for review by MAG staff and Transportation Safety Committee members. A Draft Users Manual will also be delivered at this time.
3. The install setup should be packaged with out any static paths.

Estimated Duration: 4 Months

Software Review Period – one month: During this period the software will be subjected to a complete review by MAG staff and interested Transportation Safety Committee members. MAG staff and the interested committee members will be the initial end users of the system. They can review the software solution at their convenience from their desk. The current ALISS database 1999-2007 database will be made available for the purpose of this review. It is anticipated that this review may lead to some software modifications.

Task 2: Review and Finalization of Software
The consultant will modify the software and the completed system based on the review comments. The modified software and revised documentation will be delivered and installed on the MAG website.

Deliverables: Delivery of finalized software, documentation and installation at MAG.

Documentation includes

1. Administrative Guide including Account Management and Training
2. Final Entity Relationship(ER) diagram with Database Scripts
3. Well Documented Code Including Stored Procedures
4. User's Guide and Online Help

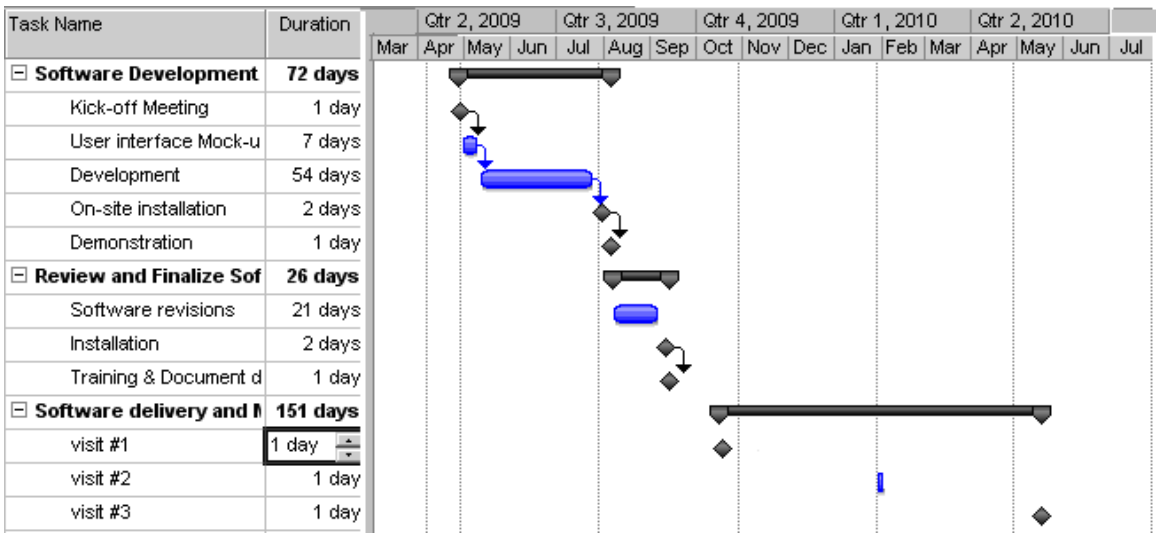
Estimated Time: 2 months

Task 3: Software Delivery and Maintenance

If any software problems arise during the first 12 months after the system is delivered and installed at MAG, the consultant will troubleshoot and correct the problems. The modified software and any revised documentation, that might result due to such problems will be delivered and installed as necessary to restore all system functions.

Deliverable: Delivery of finalized software, documentation and installation.

Schedule and Timeline



Executive Summary

The Maricopa Association of Governments (MAG) has embarked on developing a Regional Transportation Safety Information Management System (RTSIMS) that will serve as the primary crash data analysis tool for MAG. The RTSIMS will provide an efficient and user-friendly interface for performing various statistical analyses to gain a better understanding of transportation safety in the region. Development of the RTSIMS will be accomplished in three phases. This report documents the results of the final task of the first phase. This task involved a workshop to which representatives from all MAG member agencies, and other key stakeholders were invited. The workshop goal was to review the different definitions of data fields and data attributes associated with the Accident Location Information Surveillance System (ALISS) database used by MAG and MAG member agencies. The differences in definitions were identified in the penultimate task and are described in Technical Memorandum 3.

Although the prefererred terminology is “crash” instead of “accident” these are both used interchangeably in this document.

The primary issues that the workshop focused dealt with the following definitions:

- Eight of the twenty-four interviewed MAG member agencies had some guidelines /definitions that they used in their crash analysis. These eight entities have a distance-based threshold or a definition different from that of ADOT for identifying “intersection related crashes pertaining to a given intersection. These thresholds vary between 50 feet to 250 feet from the center of the intersection.

- The left-turn accidents were identified either based on “Manner of Collision” or based on “Direction of Travel” in Arizona Traffic Accident Report form. A general distinction between left-turn accidents and angle accidents used by the MAG member agencies is the fact that the vehicles involved in left-turn accidents should have been traveling in opposite directions while the vehicles involved in angle accidents would have been traveling in adjacent directions

The workshop resulted in a consensus among participants on common definitions. The following common definitions were agreed upon by all of the participants, to be used by MAG and optionally by its member agencies.

Intersection-Related: A traffic accident where the first harmful event (1) occurs on an approach to, movement through, or exit from an intersection (2) has resulted from an activity, behavior, or control related to the intersection.

Based on the information provided on the quality control measures used by ADOT in determining whether a crash is “intersection related”, the participants agreed that the “intersection related” crashes will be identified based on the “intersection_related” variable in ALISS and a distance based logic need not be used for this purpose.

ADOT Traffic Records representatives explained that the left turn crashes are defined as crashes involving a left-turning vehicle and another vehicle traveling in the opposing direction (e.g. southbound vehicle for northbound left-turning vehicle). But the Manual of Instructions for use with State of Arizona Traffic Accident Report Forms suggests that left-turn crashes are those crashes that involve one or more left-turning vehicle(s). Since the definition used by ADOT Traffic Records for a left-turn crash differs from the definition in the Manual of Instructions, it was agreed to define a left-turn crash as follows:

Left Turn Crash: Crashes involving a left-turning vehicle and another vehicle traveling in opposing direction. Some may appear to be angle or head on.

Other definitions were adopted from the Manual of Instructions for use with State of Arizona Traffic Accident Report Forms and are also presented in *Appendix F*.

Appendix B

Reports To Be Generated:

Regional Road Safety Report:

1) **All Roads:**
   All Crashes Frequency: Severity by Year for last 8 yrs
   All Crashes Frequency: variation by month, by weekday
   All Crashes Frequency: Severity by collision manner
   All Crashes Frequency: By Jurisdiction by Year
   For a year:
   - By Severity by Hour of Day
   - By Severity by Day of Week
   - By Severity by Month of Year
   - By Collision Manner
   - Severity by Age
   - Severity by Sex

2) **Freeways:**
   All Crash Frequency: Severity by Year by Freeway for last 8 yrs
   For a year:
   - By Severity by Hour of Day
   - By Severity by Day of Week
   - By Severity by Month of Year
   - By Collision Manner
   - By Freeway by Severity
   - By Freeway by Severity by Milepost
   - Severity by Age
   - Severity by Sex

3) **Arterials & Local Roads**
   Crash Frequency: Severity by Year on Arterials and Local Roads for last 8 yrs
   Crash Frequency: By Severity by Hour of Day
   Crash Frequency: By Severity by Day of Week
   Crash Frequency: by Collision Manner
   Severity By Age
   Severity by Sex
   Identify and Plot Top 100 Intersections and for Crashes Ranked by
   - All Crashes
   - Injury Crashes
   - Fatal Crashes
   - Crash Severity Index (User Input for Weights by Crash Severity)

4) **Pedestrian Crashes**
   Pedestrian Crashes Frequency: Severity by Year for last 8 yrs
   For a year:
   Pedestrian Crashes Frequency:
   - By Severity variation by month,
   - By Severity variation by weekday
   - By Severity variation by hour
   - By age and sex

   Identify and Plot Top 10 intersections for pedestrian crashes based on data for last 3 years

5) **Bicyclist Crashes**

Bicycle Crashes Frequency: Severity by Year for last 8 yrs
For a year:
Bicycle Crashes Frequency:

- By Severity variation by month,
- By Severity variation by weekday
- By Severity variation by hour
- By age and sex

Identify and Plot Top 10 intersections for Bicyclist crashes based on data for last 3 years

6) **Younger Driver Crashes**

Younger Driver Crash Involvement Frequency: Severity by Age by year

7) **Older driver crashes**

Older Driver Crash Involvement Frequency: Severity by Age by year

8) **Crash Involvement by Gender**

Crash Involvement by Gender Frequency: Severity by Sex for most recent year

9) **Large Truck Involved Crashes**

Freeways:

a) Frequency by Severity by Year
b) Frequency by Freeway Corridor by Day of Week

Arterials:

a) Frequency by Severity by Year
b) Frequency by Jurisdiction

10) **All At Grade Locomotive Crossing Involved Crashes**

Crashes Frequency: Severity by Year for last 8 yrs
For a year:
Crashes Frequency:

- By Severity variation by month,
- By Severity variation by weekday
- By Severity variation by hour
- By age and sex

Identify and Plot Top 10 locations with Locomotive Crashes

- All Crashes
- Injury Crashes
- Fatal Crashes
- Crash Severity Index (User Input for Weights by Crash Severity)

Member Agency Road Safety Report:

1) **Arterials & Local Roads**
   Crash Frequency: Severity by Year by non-Fwy for last 8 yrs
   For a year:
   - Crash Frequency: By Severity by Hour of Day
   - Crash Frequency: By Severity by Day of Week
   - Crash Frequency: by Collision Manner

   Severity by Age
   Severity by Sex
   Identify and Plot Top 100 Intersections for Crashes Ranked by
   - All Crashes
   - Injury Crashes
   - Fatal Crashes
   - Crash Severity Index (User Input for Weights by Crash Severity)

2) **Pedestrian Crashes**
   Pedestrian Crashes Frequency: Severity by Year for last 8 yrs
   For a year:
   Pedestrian Crashes Frequency:
   - By Severity variation by month,
   - By Severity variation by weekday
   - By Severity variation by hour
   - By age and sex

   Identify and Plot Top 10 intersections for pedestrian crashes based on data for last 3 years

3) **Bicyclist Crashes**
   Bicycle Crashes Frequency: Severity by Year for last 8 yrs
   For a year:
   Bicycle Crashes Frequency:
   - By Severity variation by month,
   - By Severity variation by weekday
   - By Severity variation by hour
   - By age and sex

   Identify and Plot Top 10 intersections for Bicyclist crashes based on data for last 3 years

4) **Younger Driver Crashes**
   Younger Driver Crash Involvement Frequency: Severity by Age by year

5) **Older Driver Crashes**
   Older Driver Crash Involvement Frequency:
   - Severity by Age by Year

6) **Crash Involvement by Gender**
   Crash Involvement by Gender Frequency:
   - Severity by Sex for most recent year