

Texas Department of State Health Services
Trauma Registry Improvement System Assessment

Emergency Medical Services/Trauma Registry Systems Final Report
September 30, 2009

Report Body Only



Document Purpose

This document provides the Texas Department of State Health Services (DSHS) with findings and recommendations from the Trauma Registry Improvement System Assessment (TRISA) Project.

Version	Date	Description/Changes
1.0	9/30/09	Initial release of the final document.

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I. Executive Summary

I. Executive Summary

This section provides an executive summary of the activities, findings, and recommendations contained in the Emergency Medical Services (EMS)/Trauma Registry Systems Final Report.

A. Introduction

The Texas Department of State Health Services (DSHS) has embarked on an effort to assess its current Trauma Reporting, Analysis, and Collection in Texas (TRAC-IT) registry system. This effort, formally called the “Trauma Registry Improvement System Assessment (TRISA) Project,” has stemmed from DSHS and stakeholder concerns over the integrity, usefulness, and viability of the current system.

The overall goal for the TRISA Project is to provide the best registry system for the State of Texas. High-level project objectives include the following:

- Improve stakeholder use and participation.
- Identify new and emerging alternatives for future solutions.
- Establish recommendations for a new statewide registry system that are supported by solid justification and rationale.

As part of the TRISA Project, DSHS engaged MTG Management Consultants, LLC, to provide professional and independent consulting services. During this engagement, MTG worked with the Division for Prevention and Preparedness Services, Injury and EMS/Trauma Registry Group, and their stakeholders to identify the business and technical drivers, processes, and intended outcomes to support recommendations for a new registry system.

The project included an assessment of the existing registry, evaluation of product trends and vendors, consideration of alternatives for future solutions, and the development of recommendations for a new statewide EMS trauma registry system. A summary of the TRISA Project activities, findings, and recommendations follows.

B. Current Registry Assessment

Since implementation of the TRAC-IT registry in 2002, its availability for use has been limited due to recurring stability, reliability, scalability, and performance issues. While many of the stability and reliability issues have now been addressed in the current system, scalability and performance continue to be problematic due to the flaws in the underlying data architecture.

Prior to July 2007, the TRAC-IT registry was found to have suffered significant performance deficiencies. These deficiencies, including significant downtime, non-working reporting

tools, and limited functionality to support user needs, have resulted in a tenuous relationship between the stakeholder groups and DSHS.

Since 2008, system maintenance records provided by DSHS show that availability has been limited only due to scheduled system maintenance, including 19.50 days of maintenance in 2008 (94.6 percent availability) and 16.92 days of maintenance thus far in 2009 (93.1 percent availability). Over the last 6 to 8 months, the DSHS Application Development Group has worked to maintain and stabilize the registry application through a series of HW and SW improvements. They continue to resolve a number of small to medium defects, correct reports, and make small improvements to the functionality of the registry application.

Increasing the performance and scalability of the registry is still limited by the fact that the application is designed to process a single transaction at a time. Upgrading the application to support multiple transactions concurrently would require a complete redesign of the database and application code. There are no plans to completely redesign the application at this time.

EMS and hospital stakeholder participation records provided by DSHS show the number of stakeholder entities participating and submitting records to the TRAC-IT registry increased in the two years after its implementation in 2002, but has since consistently decreased. However, the number of records submitted to the registry has consistently grown since its implementation.

Although recent efforts have been made to improve TRAC-IT operations and performance, stakeholder frustration and dissatisfaction with the registry continues.

C. Stakeholder Needs Assessment

An assessment of stakeholder needs was conducted to understand the specific needs and capture stakeholder requirements for a new registry. The assessment included 19 sessions conducted at 10 locations throughout Texas, and it involved over 200 individuals representing approximately 60 EMS services and 80 hospitals.

The table below reflects the top 10 major topics reported by the stakeholders. These findings represent the functionalities or enhancements that, if included in the new registry, would improve stakeholder participation. The value column represents the percentage of total stakeholder comments received in the survey that were related to the particular topic.

Table 1 –Stakeholder Survey Results

Rank	Finding Topic	Value	Needs – Comments/Description
1	Reports	21.1%	Variety of reporting tools; benchmarking at local/ regional/state level.
2	Ease of Submission	17.9%	Easy-to-use submission methods (local/Regional Advisory Council [RAC]); does not entail more work.
3	Management/Support	11.0%	Communications; training; purpose of registry; involvement.
4	Compatibility	7.9%	Acceptance of data from existing local systems; no new software (SW) to buy.
5	Data Accuracy/ Validity	7.6%	Elimination of duplicates and unused data; provision of error checks.
6	Reliability	7.4%	High availability.
7	Standards	4.8%	Industry standards (National Trauma Data Book [NTDB], National EMS Information System [NEMIS], other).
8	Linkage	4.8%	EMS/hospital sharing of data submission, tracking of outcomes.
9	Technical Support/ Help Desk	3.9%	24x7 support; knowledgeable and understandable operators.
10	Analysis	3.4%	Capability to extract and analyze data.

The majority of the stakeholders expressed serious concerns with regard to the current registry performance as well as DSHS’s ability to operate and maintain the system. Aside from the issues with system performance, many stakeholders feel that DSHS does not listen to them. Failed communications and support deficiencies are critical problems that were found to impact not only stakeholder relations but overall registry participation as well. During the stakeholder sessions, it became very obvious that the recent improvements by DSHS to improve TRAC-IT have done little to change stakeholder perception of the system.

D. Other States Review

MTG surveyed 49 states to qualify states that had desired registry characteristics consistent with the project goals and objectives for Texas. These characteristics included:

- Statewide EMS/trauma registry with a history of success.
- Mandatory submission.
- Proven commercial off-the-shelf (COTS) product.

- Registry that provides linkage between EMS and trauma data.
- State that has similar demographics to Texas (e.g., population, size, density, trauma volumes, rural versus urban areas).
- Registry system that is compliant with NEMSIS and NTDB data standards.

The results of the survey determined that Minnesota, Missouri, and Pennsylvania would be visited, and that formal interviews would be conducted in Nebraska, Alaska, North Carolina, and Mississippi. As a result of the visit and interviews, the project team gained useful information and best practices related to management and organization, registry data quality and validity, COTS systems evolution, registry systems attributes, systems acquisition, historical data migration, registry systems cost, and help desk support.

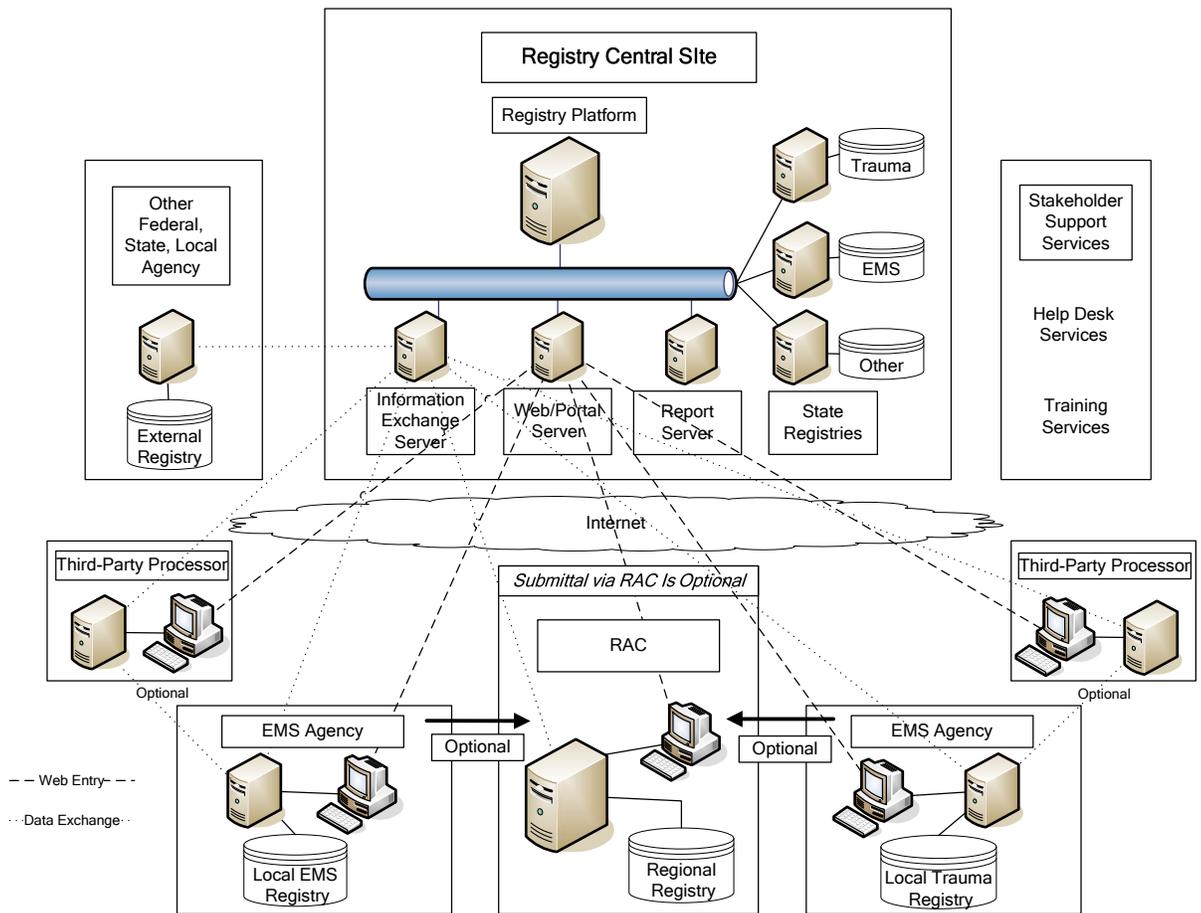
E. Registry Component and Requirements

Conceptual registry solution components were identified based primarily on the team's assessment of the current registry, information gathered from the stakeholders, project meetings, and interviews with other states and product vendors. The logical and functional components defined are listed below and represent the basic building blocks for the new registry.

- | | |
|---|-------------------------|
| ● Registry Platform | ● Help Desk Services |
| ● State Registries (Trauma, EMS, Other) | ● Training Services |
| ● Report Server | ● Local EMS Registry |
| ● Web/portal Server | ● Local Trauma Registry |
| ● Information Exchange Server | ● Regional Registry |
| | ● External Registry |

The conceptual model developed for the new registry to support these logical and functional solution components is illustrated below.

Figure 1 – New Registry Solution Components



In the ultimate design, multiple logical components will likely be implemented through common SW solutions and hosted on common physical hardware (HW) systems.

Functional and non-functional registry requirements were developed based primarily on the requirements identified and confirmed during the stakeholder needs assessment. However, as a result of MTG’s research of other states’ registry solutions, consideration of commercial products available, investigation of market trends, and basic industry best practices, additional requirements were identified to augment the stakeholder baseline. These combined requirements provide a comprehensive baseline for the future registry requirements that meets the documented needs of the stakeholders as well as the goals and objectives established for the TRISA Project.

F. Alternatives Analysis

The alternatives analysis was conducted at two levels. The first level included a high-level assessment of practical solution options identified without constraints of strategic direction or defined needs that may limit ideas. This initial assessment considered six major alternatives, along with optional implementation, acquisition, or operational approaches. To

guide the assessment of the high-level solution options developed for consideration, the following evaluation criteria were established:

Table 2 – Key Evaluation Criteria

Key Evaluation Criteria	Basis for Criteria
COTS Product	Stakeholders provided a clear message that they wanted a tested commercial product, not a custom-developed solution. Stakeholders apparently expressed their desire to obtain a COTS solution prior to TRAC-IT, but the decision was made to develop a custom solution. The history of poor performance related to TRAC-IT strengthens the stakeholders' argument.
Outsourced Solution	Outsourcing the registry operations to a third party is another stakeholder requirement. Stakeholders believe DSHS has demonstrated that it does not have the resources or capability to operate the registry.
Standards-Based	EMS and hospital stakeholders expressed the requirement for an industry standards-based solution. A common concern involved the need for a data dictionary based on the NEMESIS Gold and NTDB standards.
Proven and Reliable	Stakeholders noted reliability issues many times due to the lack of success with TRAC-IT.
EMS and Hospital Linkage	Linkage between EMS and hospital stakeholders is critical to reducing redundant data submittal, improving data accuracy, and enabling tracking of patient outcomes.
Local Registry Compatibility	Stakeholders and RACs should have the ability to use independent SW that seamlessly interfaces with DSHS's system. Smaller organizations should have the option to use the state system in place of a third-party vendor solution.

Using these criteria, the major alternatives and applicable approaches were evaluated and rated with respect to their compliance. The table below illustrates the results of this assessment.

Table 3 – High-Level Alternatives Analysis

Consideration	COTS Product	Outsourced Solution	Standards-Based	Proven and Reliable	Registry Linkage	Registry-Compatible
Build EMS and Trauma Solution						
- Develop In-House	N	N	Y	N	Y	Y
- Hire Third-Party Vendor to Develop	N	Y	Y	N	Y	Y
Buy Integrated COTS Solution						
- DSHS Purchases and Hosts System HW	Y	P	Y	P	Y	Y
- DSHS Purchases Solution, Outsources Operations	Y	Y	Y	Y	Y	Y
- DSHS Outsources Software as a Service (SaaS)	Y	Y	Y	Y	Y	Y
Buy "Best of Breed" COTS Solution						
- DSHS Purchases and Hosts System HW	Y	P	Y	P	Y	Y
- DSHS Purchases Solution, Outsources Operations	Y	Y	Y	P	Y	Y
- DSHS Outsources SaaS	Y	Y	Y	P	Y	Y
Transfer Existing Custom System						
- CDC's Registry Plus	N	P	P	Y	P	P
- Other States' Registries	N	P	P	Y	P	P
Incrementally Update TRAC-IT						
- Develop In-House	N	N	P	N	P	Y
- Contract With Vendor to Update TRAC-IT Components	N	N	P	N	P	Y
Do Nothing						
- Maintain TRAC-IT	N	N	N	N	N	Y

Rating Legend	
Yes	Y
Partial	P
No	N

The evaluation results show that the two alternatives associated with a COTS solution and outsourcing are clear leaders. As a result, the following two solution types were selected for detailed analysis:

- *Integrated EMS and Trauma COTS Solution* – In this case, a single vendor is selected to provide a solution that includes the trauma and EMS registries and all supporting components and services.
- *Best-of-Breed EMS and Trauma COTS Solution* – This solution includes the procurement of separate registries based on the best solution for the specific application, and a central host would integrate the applications.

Best-of-breed solutions may provide richer functionality, the cost savings, operational efficiencies, and improved data sharing can make the integrated EMS and trauma approach very appealing. Using a structured alternative evaluation model, a detailed analysis each alternative was performed. A summary of this analysis is presented in the table below.

Evaluation Category	Weight	Percentage of Total Weight	Alternative Evaluation Scores		
			Alternative 1 – Integrated EMS and Trauma Solution	Alternative 2 – Best-of-Breed Solution	Variance Between Alternatives
A. Desirable Business Operational Impact	30	12.50%	120	105	15
B. IT Operational Impact	30	12.50%	135	60	75
C. Technology Environment	30	12.50%	135	120	15
D. Time to Complete	30	12.50%	120	105	15
E. Functionality	30	12.50%	120	135	(15)
F. Cost	30	12.50%	105	90	15
G. Realized Benefits	30	12.50%	135	90	45
H. Project Resource Impact	30	12.50%	120	60	60
Total Score	240	100.00%	990	765	225

In addition to evaluating the leading alternatives based on their individual merit, MTG assessed different options for operations, acquisition, and procurement as outlined below.

- *Operations strategy:* Outsource or Traditional Operations.
- *Systems acquisition model:* Capital Purchase, Payment Plan or Software as a Service (SaaS).
- *Procurement approach:* Single or Multiple Procurements.

The assessment of these concepts resulted in key decisions that supported the overall recommendations for the future registry.

G. Future State Registry Recommendations

MTG’s recommendations are primarily based on the needs and requirements developed by the stakeholders, DSHS’s direction, and goals and objectives of the TRISA Project.

Based on the evaluation criteria, the overall recommendation supports procurement of an integrated EMS and trauma solution. The detailed analysis found that both of these alternatives were viable solutions to support the requirements and offer significant benefits to DSHS and stakeholders. However, the integrated EMS and trauma COTS solution proved to be the preferred option based on the following:

- Reduced project complexity by virtue of administering one project for both EMS and trauma registries with a single vendor methodology and application framework.
- Increased system registry manageability with only one set of system tools for both registries. This results in fewer support staff, less training, and reduced technology investments/liabilities.
- Streamlined administration of registry operations, one procurement process, one relationship, and one contract agreement with a single vendor.
- Reduced cost by way of establishing and operating a single technical environment (e.g., one database suite as opposed to multiple database suites for two different registries) and reduced implementation and operations cost.
- Increased registry accountability, as DSHS can hold a single vendor accountable for both EMS and trauma registries. This is important because of the integration aspects of both registries. Integration of two different vendor systems would add another layer of complexity; complexity results in greater risk.
- Effective way to implement both EMS and trauma registries that meets DSHS and stakeholder needs in a relatively short amount of time.

Given the overall recommendation of an integrated EMS and trauma solution, the following recommendations for operation strategy, system acquisition model, and procurement approach were provided.

Key Decision	Recommendation	Comments
Operation Strategy	Outsource Operations	The outsourcing option minimizes DSHS's operational support footprint and leverages vendor expertise.
Systems Acquisition Model	Payment Plan	Given the outsource operation, setting up a payment plan to spread costs over time makes good financial sense.
Procurement Approach	Single Procurement	This approach will include an RFP for an integrated solution from a single prime vendor.

In addition to the recommendations based on the registry solution alternatives, project findings suggested a number of recommendations are appropriate related to the program management and coordination. The recommendations address the following topics:

- Program placement.
- State and stakeholder coordination.
- Change management.
- Communication and trust.

The theme of the management recommendations addressed above focuses on improving the working relationships between DSHS and the stakeholder groups. The current working relationships between DSHS and the stakeholders are tenuous at best. If appropriate steps are not taken to successfully improve relations and enable the groups to work together toward common goals and objectives, the performance of the registry will not matter.

H. Recommended Next Steps

To support realization of the solution alternative and management recommendations, MTG suggests the following next steps:

- Establish a Diverse Executive Steering Committee.
- Establish a Registry Work Group.
- Perform Project Delivery Planning.

The first two steps suggested above are key in building working relationships to improve communications and understanding of stakeholder needs and issues. Working together on the project planning and decision making will promote mutual buy-in to the selected solution, active and participative problem solving, and recognition of future successes.

II. Introduction

II. Introduction

This report identifies alternatives and provides recommendations for a new registry solution for the State of Texas. The findings are based on a high-level review of the current Texas EMS and trauma registry, assessment of the stakeholder needs, evaluation of other states' registry solutions, and review of current and emerging best practices and vendor offerings.

This section provides a summary of the project background, project scope and deliverables,

A. Project Background

The Texas DSHS is assessing its current TRAC-IT registry system. This effort has stemmed from DSHS and stakeholder concerns over the integrity, usefulness, and viability of the current system.

The overall goal for the TRISA Project is to provide the best registry system for the State of Texas. High-level project objectives include the following:

- Improve stakeholder use and participation.
- Identify new and emerging alternatives for future solutions.
- Establish recommendations for a new trauma registry system that are supported by solid justification and rationale.

As part of the TRISA Project, DSHS has engaged MTG to provide professional and independent consulting services. During this engagement, MTG worked with the Division for Prevention and Preparedness Services, Injury and EMS/Trauma Registry Group, and their stakeholders to identify the business and technical drivers, processes, and intended outcomes to support recommendations for a new registry system.

B. Project Scope and Deliverables

The project began with detailed planning to ensure mutual understanding of the scope and deliverables expectations. The overall scope of the project included ongoing project management and coordination with the DSHS project manager, evaluation and assessment of existing solutions and alternatives, and development of recommendations for a new registry system supported by solid qualitative and quantitative analysis as well as proven methodologies.

The project included four phases that encompassed the scope of work and associated deliverables as outlined below.

- Phase I – Project Management

The initial phase was critical to ensuring that clear and concise planning documentation was developed and to establishing a mutual understanding of the project goals and objectives. To accomplish this, MTG reviewed the TRISA Project documentation and conducted an initial project meeting with the DSHS project team. Once the project commenced, consistent project management and status reporting was performed to maintain open communications, monitor progress, report and resolve issues, and mitigate risks. Specific deliverables resulting from this phase are listed below.

Deliverable: Project Management Plan

Deliverables: Project Status Reports (Provided Weekly and Monthly)

- Phase II – Evaluation of Current Environment

During this phase, MTG initially performed a high-level business and technical review of current system documentation. The original scope of work for the project included a detailed assessment of the current registry; however, the scope was reduced during contract negotiations to include only a high-level review to address maintainability, consistency, reporting capabilities, and compliance with legislative requirements. Phase II also included gathering and documenting stakeholder requirements for a new registry system and assessing stakeholder participation. The deliverables related to this phase included the DSHS Registry System Evaluation Report.

- Phase III – Evaluation of Other State Solutions

MTG assessed and analyzed trauma registry solutions from other states to consider enhancements to the DSHS and stakeholder requirements defined in Phase II. The related life cycle costs were considered to ensure that system requirements for the future solution can be implemented in Texas within the DSHS budget. During the course of this phase, we primarily worked with and evaluated other states and vendors, and we consulted with industry experts in considering enhanced requirements, applicable standards, and best practices. The deliverables related to this phase support the Other States' Registry Systems Evaluation.

- Phase IV – Development of Recommended Alternatives

In Phase IV, the work performed in the previous phases was combined and integrated into a final recommendations report. During this phase, solution alternatives were considered and their strengths and weaknesses evaluated. Costs and benefits of the potential solution components were assessed and considered in the development of major alternatives. These results were integrated into the final report deliverable with new registry recommendations supported by solid qualitative and quantitative analysis, proven methodologies, and lessons learned from similar projects.

Deliverable: Recommended Alternatives Final Report

MTG delivered the Project Management Plan within the first 2 weeks of the project and provided status reports on a weekly and monthly basis. Pursuant to our agreement with the program, all applicable project deliverables are included in this final report.

C. Document Organization

To complete the scope of work, the sections listed below were developed. Each section reflects the activities and findings of each phase of the project and contains content required for making recommendations.

- *Section III – Current EMS/Trauma Registry Assessment.* To provide a brief context for the recommendations, this section contains a high-level review of TRAC-IT
- *Section IV – Stakeholder Needs Assessment.* This section presents the results of stakeholder input and needs analysis. In addition, Section IV provides stakeholder requirements and priorities for new statewide EMS and trauma solutions.
- *Section V – Others States’ Registry Systems.* Section V is the result of surveying and interviewing key states to identify EMS and trauma registry trends and best practices of other states. In addition to other states, several key vendors were contacted to provide information regarding industry trends.
- *Section VI – Registry Components and Recommended Requirements.* Based upon stakeholder needs and industry best practices, this section presents the recommended conceptual model, registry components, and requirements.
- *Section VII – Recommended Registry Alternatives.* This section provides a high-level review of all possible registry alternatives and addresses why alternatives meet or do not meet DSHS and stakeholder needs.
- *Section VIII – Registry Alternatives Analysis.* Section VIII provides detailed analysis of a single integrated EMS and trauma solution and a best-of-breed solution for the State of Texas. The section describes, presents benefits and implications of, and provides cost information for each alternative.
- *Section IX – Future State Registry Recommendations.* This section summarizes MTG’s recommendations for this project.

III. Current EMS/Trauma Registry Assessment

III. Current EMS/Trauma Registry Assessment

The current registry evaluation includes a high-level overview of the system and business environment. The assessment then focuses on investigating the registry operations, stakeholder use and participation, data validity, and system maintainability.

A. Texas Statewide Trauma Registry System

The trauma registry legislation requires DSHS to develop and maintain a trauma reporting and analysis system to:

- Identify major or severe trauma patients within each healthcare entity in this state.
- Identify the total amount of uncompensated trauma care expenditures made each fiscal year by each healthcare entity in this state.
- Monitor trauma patient care within each healthcare entity and regional EMS/trauma system in this state.

The legislation calls for DSHS and all pre-hospital providers and hospitals in Texas to gather data about trauma injuries in Texas. The purpose is to describe the incidence and distribution of trauma in Texas, as well as the associated costs, and foster strategies to prevent or treat trauma-related injuries.

In response, DSHS developed the Texas EMS/trauma registry, which has been available and in operation in one form or another since 1996. For the purposes of this project and assessment, the focus will be on the current implementation of the Texas EMS/TRAC-IT, a Web-based data collection, aggregation, and reporting solution that was developed and implemented in 2001 and has had at least one major platform upgrade since that time.

1. TRAC-IT Functionality

Functionally (and from a user interface perspective), TRAC-IT is made up of several menu-based functions that provide multiple administrative, data submission, data processing, data correction, system management, and reporting capabilities. These include the following:

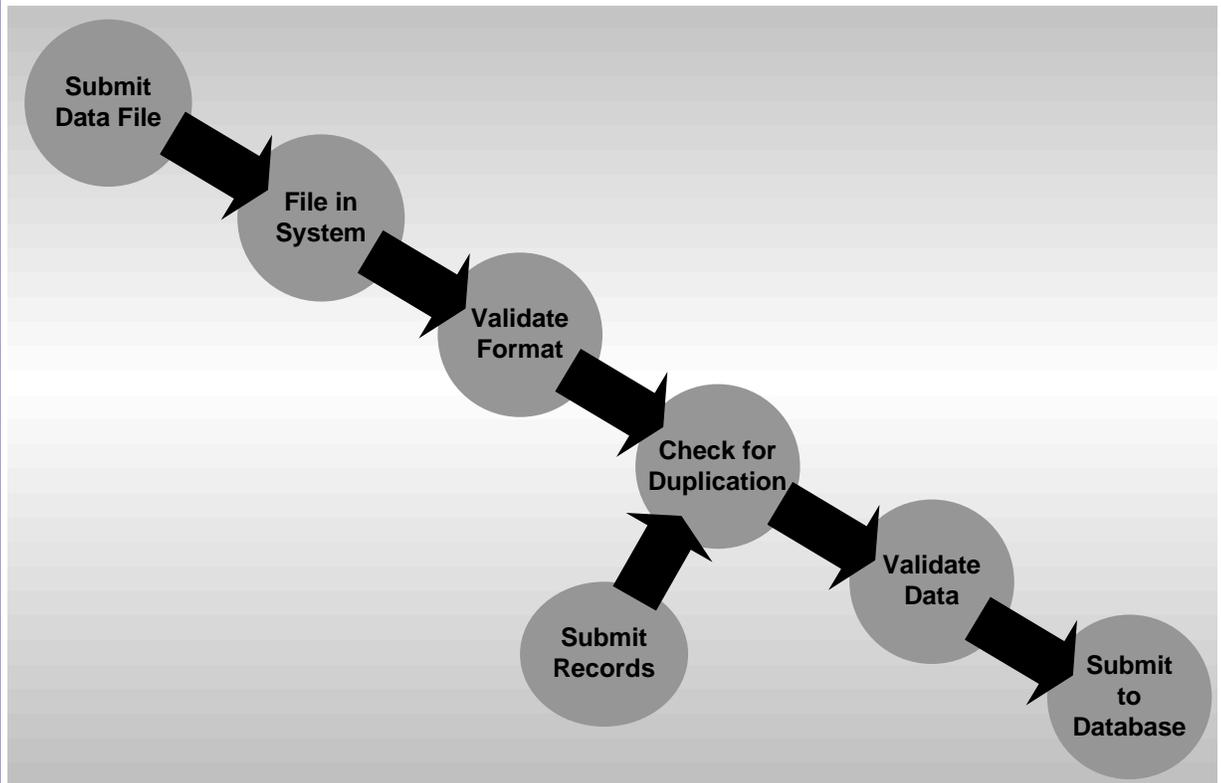
- *Administrative* – Includes login and logout, password changes, general help functions, and access to Frequently Asked Questions (FAQ) documentation.
- *Data Submission* – Includes facilitation of the following methods to submit data for processing and entry into the registry:
 - » *Online File Submission* – Allows users to “upload” a formatted, fixed-length data file for record-by-record processing by TRAC-IT and entry into the registry.

- » *Manual Web Entry* – Allows users to manually enter records via a Web page and submit those records for processing and entry into the registry.
- *Summary of Submissions* – Allows users to retrieve a status summary of submissions; however, information on individual records is not available.
- *Data Correction* – Allows users to perform the following actions on previously submitted data:
 - » *Record Search and Correction* – Search for a previously submitted individual record that was marked for errors and or warnings and make a corrective change(s) to that record.
 - » *Duplicate Record Search and Correction* – Find and resolve issues related to duplicate records.
 - » *Validation Report* – Receive a report on the validity of the data submitted.
- *System Management* – Includes functionality that, depending on a user's role and security settings, facilitates making changes to Entity (hospitals/EMS/DSHS), Personnel, Reporting Period, and/or personal (user) system settings and preferences.
- *Reporting* – This allows users to select and run various aggregate or regional reports, search the database for archived records, and/or make requests for reports.
- *National Database Submission* – Currently, the State of Texas does not submit data from the state registry to any other systems or data repositories.
- *Data Analysis* – Beyond what is currently available in TRAC-IT, data analysis is performed by research staff in the Injury and EMS/Trauma Registry Group.

2. TRAC-IT Data Flow

The following figure depicts the logical flow of data through TRAC-IT and the critical processing events involved in the submission and storage of data in the registry.

Figure 2 – TRAC-IT Data Flow



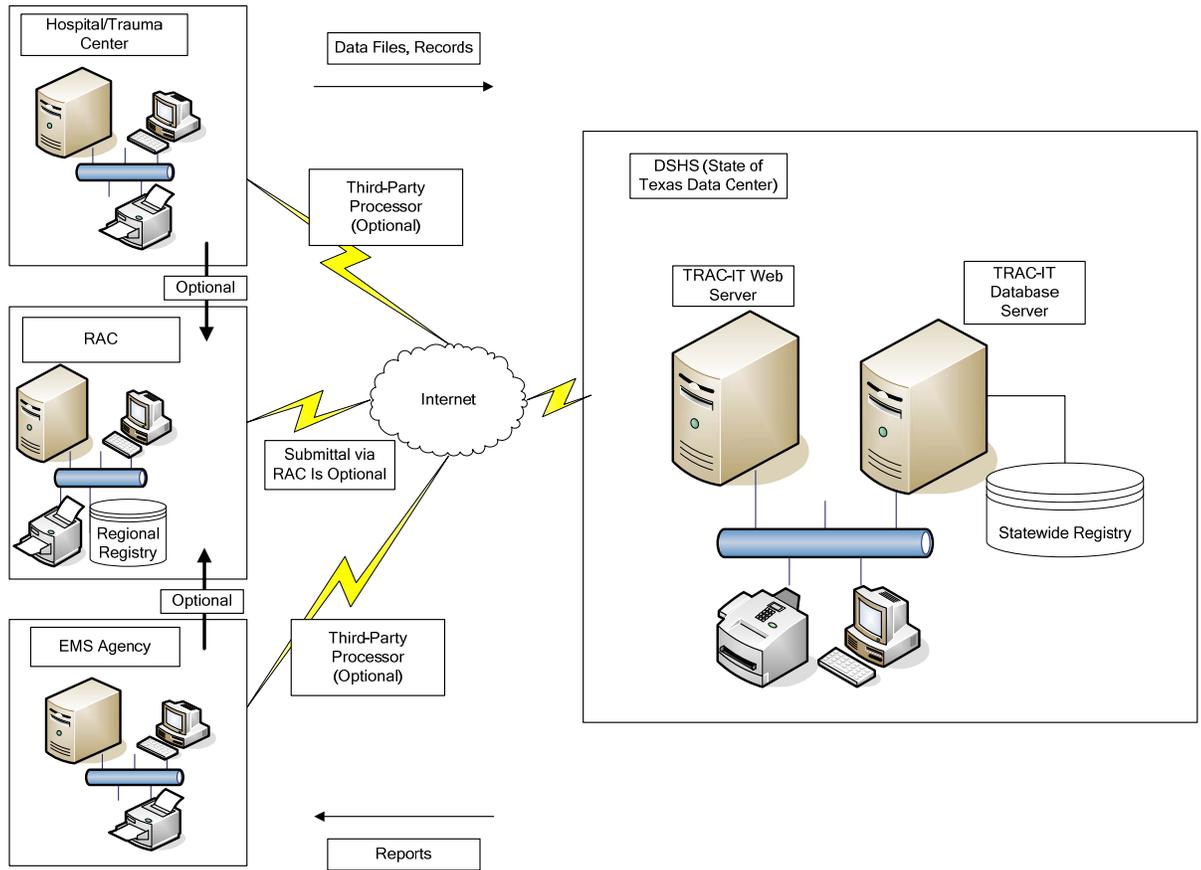
Before a record becomes permanent in the registry, it goes through several stages of processing, including:

- *File Submission* – When a data file is submitted, it is placed in the file system. The file system is polled every minute.
- *Format Validation* – The format of every file submitted to TRAC-IT is validated against accepted definitions or rejected.
- *Submit Records* – Alternatively, users can enter one or more records at a time. Processing is initiated immediately for these types of submissions. In the case of batch submissions, processing is initiated after all records are submitted.
- *Duplicate Checking* – Records are initially checked for duplication based on several matched elements. If the previously submitted record is older, it will be deleted from the database, and processing will continue on the current record.
- *Data Validation* – The fields of each record are validated against predefined rules.
- *Database Submission* – Validated data is then submitted into the database.

3. TRAC-IT Components

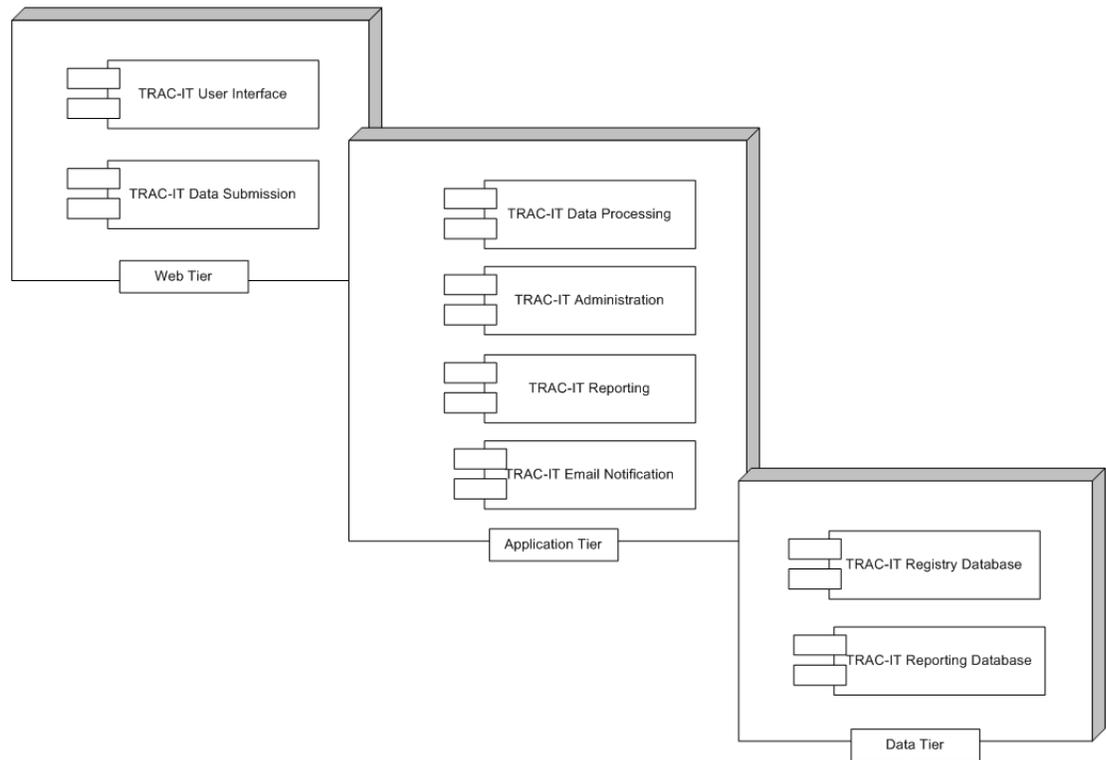
The TRAC-IT registry is deployed on two physical tiers, including a Web server that hosts the logical Web and application tiers and a database server. The physical architecture is illustrated in Figure 3.

Figure 3 – TRAC-IT Physical Architecture



The TRAC-IT logical architecture consists of three tiers, including a Web tier, application tier, and data tier, as depicted in Figure 4.

Figure 4 – TRAC-IT Logical Architecture



Below are descriptions of the individual tiers that make up the TRAC-IT logical tiers.

Logical Web Tier

The Web tier for TRAC-IT provides a user interface for data collection (TRAC-ITDC application), data correction, and administration (TRAC-ITAD application). TRAC-IT supports data collection via the following methods:

- *HTTPS File Upload* – Facilitation of file submission via HyperText Transfer Protocol over Secure Sockets Layer.
- *Manual Record Submission* – Web pages that allow a user to enter records individually and submit them for batch processing.

TRAC-IT administration includes the facilitation of entity, user, facility, rule validation, and report period configuration.

TRAC-ITDC and TRAC-ITAD are custom Microsoft Active Server Page applications developed originally in 2001–2002 and delivered in 2002, and they consist of HTML, JavaScript, and server-side Visual Basic (VB) scripts.

Logical Application Tier

The TRAC-IT application tier consists of components that facilitate scheduling, file processing, reports, e-mail, and printing, including:

- VB scripts:
 - » *TRAC-IT File* – Facilitates the import of files submitted via the TRAC-ITDC applications.
 - » *TRAC-IT Edit* – Facilitates the processing of records imported via TRAC-IT File.
 - » *TRAC-IT MailPrint* – Facilitates the e-mailing of reports generated by TRAC-IT QueuedReports.
 - » *TRAC-IT ReminderNotice* – Facilitates the processing of reminder and delinquency e-mail reminders.
- Libraries, which are modules containing code that is called and utilized by other TRAC-IT scripts, including:
 - » *TRAC-IT DV* – Performs the importing and processing of data file records, including duplication checking, field validation, and report and e-mail generation.
 - » *TRAC-IT QueuedReports* – Performs the queuing and scheduling of reports requested via TRAC-ITAD.
- Third-party applications:
 - » *Oracle SQL*Loader* – Oracle bulk loader tool that facilitates the import of data to and from various data sources (e.g., files) and database tables.
 - » *SAP BusinessObjects Enterprise (Formerly Crystal Reports)* – Facilitates on-demand generation of requested reports.

All VB scripts and Dynamic Link Libraries (DLLs) are written, built, and/or compiled in VB 6.0.

Logical Data Tier

The TRAC-IT data tier consists of the following data repositories that support the statewide EMS/trauma registry:

- *Oracle Database 10g* – Hosts the EMS/trauma registry data and consists of the following two database schemas:

- » *TRAC-IT* – Stores recent submissions of EMS and trauma incidents in 151 tables. The largest table, *EMS_Data_Incoming*, includes 167 columns and 8.7 million rows. On a monthly basis, the transactions in *TRAC-IT* are processed and migrated to *TRAC-IT DW*.
- » *TRAC-IT DW* – Stores historical EMS and trauma incident information for reporting in 109 tables. The largest table, *EMS_Fact*, includes 41 columns and 83.3 million rows of data.

B. Business Environment and Stakeholders

The primary business environment for the *TRAC-IT* registry includes state government services and operations, the Governor’s EMS & Trauma Advisory Council (GETAC), RACs, and the trauma care providers. For purposes of this report, the trauma care providers are considered the registry stakeholders and include hospital and EMS service providers.

1. State Government

Statewide trauma registry activities are directed, managed, and coordinated by members of the Injury and EMS/Trauma Registry Group of the DSHS Prevention and Preparedness Services Division’s Environmental Epidemiology and Disease Registries Section. Injury and EMS/Trauma Registry Group staff are primarily responsible for collecting data that allows DSHS to determine the magnitude of injuries in Texas and for collecting, analyzing, and publishing EMS\trauma data.

In addition to the services performed by the DSHS EMS/Trauma Registry Group, and regulatory work performed by the Division for Regulatory Services/Health Care Quality Section’s EMS/Trauma Systems group, DSHS further hosts and facilitates the GETAC. GETAC’s mandate is to “... assess the need for EMS in the rural areas of the state” and to “develop a strategic plan for refining the educational requirements for certification and maintaining certification as EMS personnel and developing EMS and trauma care system.” GETAC meets quarterly and develops the vision, guidance, and strategy for EMS/trauma systems in the state of Texas.

2. RACs

Support for health services at the local level in Texas is handled via 11 Health Service Regions and special state facilities in Harlingen (Rio Grande State Center) and San Antonio (Texas Center for Infectious Disease). Just as critical to the trauma registry, however, are 22 RACs, whose purpose is to guide the development of trauma systems within their corresponding regions, including:

- Assisting member organizations in achieving high levels of trauma care.

- Performing or encouraging activities designed to promote cooperation between member organizations.
- Facilitating professional education for trauma care providers in the region.
- Providing and facilitating public education and awareness through trauma prevention activities.
- Developing a Regional Trauma System Plan and regional standards of care through the cooperative efforts of member organizations.

State EMS/Trauma Services staff coordinate regularly with RAC members on all aspects of EMS/trauma services, including participation in the state EMS\trauma registry. RACs coordinate and/or manage regional data collection and submission to the registry and in some instances maintain regional registries.

3. Trauma Care Providers

Texas RACs coordinate the efforts of providers in each region. For the purposes of the EMS\trauma registry, providers may be defined as any entity that owns and/or submits EMS or trauma data to the registry. However, these are typically hospitals or EMS providers.

Hospitals

Hospitals that provide trauma services and report trauma information can be classified according to the American College of Surgeons Committee on Trauma (ACS-COT) trauma center classification scheme, which classifies trauma centers primarily based on the following:

- *Level I – Comprehensive Trauma Facility:* A Level I trauma center provides the highest level of surgical care to trauma patients. It has a full range of specialists and equipment available 24 hours a day and admits a minimum required annual volume of severely injured patients. A Level I trauma center is required to have a certain number of surgeons and anesthesiologists on duty 24 hours a day at the hospital, an education program, preventive and outreach programs.
- *Level II – Major Trauma Facility:* A Level II trauma center works in collaboration with a Level I center. It provides comprehensive trauma care and supplements the clinical expertise of a Level I institution. It provides 24-hour availability of all essential specialties, personnel, and equipment. Minimum volume requirements may depend on local conditions. These institutions are not required to have an ongoing program of research or a surgical residency program.
- *Level III – Advanced Trauma Facility:* A Level III trauma center does not have the full availability of specialists, but does have resources for emergency resuscitation, surgery, and intensive care of most trauma patients. A Level III center has transfer

agreements with Level I or Level II trauma centers that provide back-up resources for the care of exceptionally severe injuries.

- *Level IV – Basic Trauma Facility:* A Level IV trauma center provides initial evaluation, stabilization, diagnostic capabilities, and transfer to a higher level of care. It may also provide surgery and critical care services as defined in the scope of services of trauma care. A trauma trained nurse is immediately available, and physicians are available upon the patient's arrival to the Emergency Department. Transfer agreements exist with other trauma centers with higher levels when conditions warrant a transfer.

There are currently over 240 hospitals in Texas that fall within one of these categories.

EMS Providers

EMS services, or pre-hospital trauma care, in Texas are provided by a number of organizations and agency types whose primary goals are to provide safe and rapid transport of injured patients directly to the centers most appropriately resourced to handle the injury, prevent further injury, and initiate resuscitation. This includes (but is not limited to) ambulance services, county and city EMS units, county/city and volunteer fire departments, advanced medical transportation services, acute care organizations, advanced cardiac and trauma EMS specialists, air evacuation teams, and aviation organizations. There are currently over 1,100 EMS entities in Texas.

C. TRAC-IT Registry Assessment

The assessment of the current registry will focus on four areas, including:

- Registry Operations
- Stakeholder Use and Participation
- Data Validity
- Maintainability

The assessment is based on interviews and information collected from program personnel, as well as information and feedback from the perspective of the stakeholders.

1. Registry Operations

In this subsection, MTG assesses the current registry documentation to address usability, consistency of operations, reporting capabilities, and compliance with legislative requirements.

Current Solution Usability and Consistency

Since its implementation in 2002, the usage of the current solution has been limited due to recurring stability, reliability, scalability, and performance issues. While many of the stability and reliability issues have now been addressed in the current system, scalability and performance continue to be problematic due to the flaws in the underlying data architecture. For instance, all updates to EMS records, whether submitted electronically or manually, are funneled daily through a single, extremely large table – currently, this table has approximately 9 million rows. When providers attempt to simultaneously access this table, especially while missing data is filled in automatically, a bottleneck is created that impacts the performance of the entire system. The hospital record set has the same bottleneck, although the impact to performance is less significant due to a smaller number of records. For these reasons, the usage of the current system is estimated at approximately 30 to 40 percent of the expected capacity.

Reporting Capabilities

The current system supports reporting of the information in the data warehouse database through SAP BusinessObjects and BusinessObjects Enterprise (formerly Crystal Reports) 11.0. The data warehouse database stores 10 years of records, and the data for the current year is completely regenerated in the data warehouse database every month from the transaction database. At the end of the year, the data for the previous year is regenerated from the transaction database in the data warehouse, and all records are deleted from the transaction database. As of January 2009, end-of-month and end-of-year processing required 4 days to complete, during which the system was unavailable for data submission or reporting. Recently, this process was changed to generate the views needed for reporting from a snapshot of the transactional database stored in the data warehouse database. The new process is more reliable and has reduced downtime to 1 or 2 days.

Compliance With Legislative Requirements

The policies and business rules that guide registry use and operations are set forth in the following legislation:

- Chapter 92 of the Texas Health and Safety Code (H&SC) sets forth the provisions and definitions for injury prevention and control and requires physicians, medical examiners, and justices of the peace to report certain injuries to the department.
- Chapter 773 of the H&SC requires the department to establish and maintain a trauma reporting and analysis system. This chapter further requires EMS providers in the system to report information on emergency runs to the department with the type and format of the information to be determined by the department. EMS providers and trauma care facilities are also directed to collect and report certain data on trauma incidents.
- Chapter 103 of the Texas Administrative Code (TAC) defines traumatic injury.

- Chapter 157 of the TAC includes rules definitions for trauma, trauma patient, and trauma registry; rules requiring EMS participation in the EMS/trauma registry; and rules requiring designated hospital participation in the EMS/trauma registry. This chapter also defines requirements for EMS providers and hospitals seeking trauma designation and grants the department the power to audit the records of those organizations and reprimand them or suspend or revoke their licenses in certain cases.

The Office of EMS/Trauma Systems Coordination (OETSC) is responsible for enforcing compliance with legislative requirements.

2. Stakeholder Use and Participation

This subsection addresses stakeholder use of and participation in the current registry and it identifies key stakeholder needs that have been reported in order to support improved participation in a future system.

In general, participation in the registry by EMS and hospital providers is minimally enforced by OETSC. Hospitals are required to show proof of participation when they request designation as a trauma facility. EMS providers are required to send data to the registry, and the total number of EMS runs reported to the registry is one factor in a formula that determines disbursement of funds to each RAC. Low participation on the part of entities composing a RAC could negatively impact the amount of funding. However, due to the difficulties in registry operations, OETSC has allowed entities to submit affidavits certifying the number of EMS runs in the previous year.

Current Solution

The assessment of stakeholder participation in the current system will consider two different factors. The first factor is the annual number of individual stakeholders submitting data. This will include both partial and full participation stakeholders of all sizes. The second factor is the overall annual volume of records being submitted by the stakeholders.

Stakeholder Participation

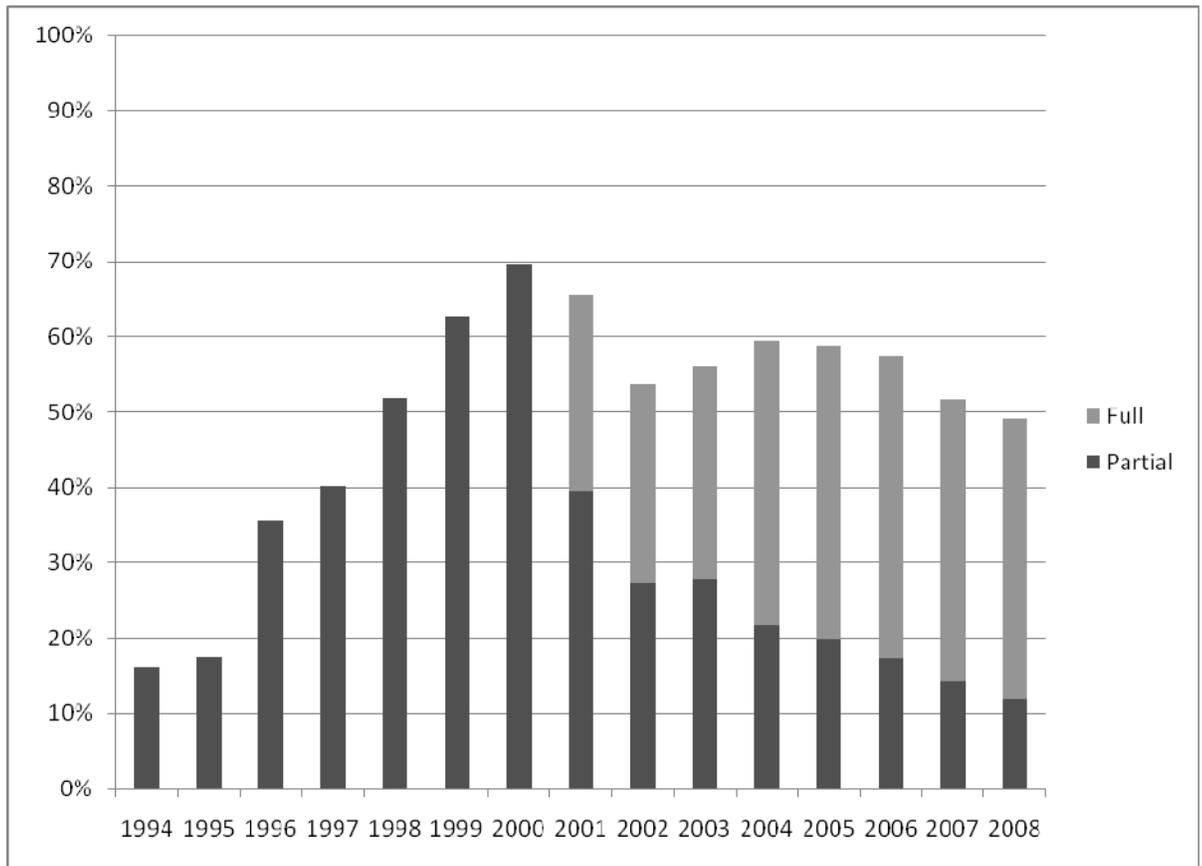
Stakeholder participation is assessed based on data captured by DSHS since 1994, including partial and full participation levels. These levels of participation are defined as follows:

- Partial participation is defined as sending at least one record or no reportable data (NRD) for that year.
- Full participation is defined as sending at least one record or NRD each month for all 12 months.

Full participation data for hospitals is reported beginning in 2000 and in 2001 for EMS providers and acute care hospitals. Overall participation refers to the sum of partial and full participation.

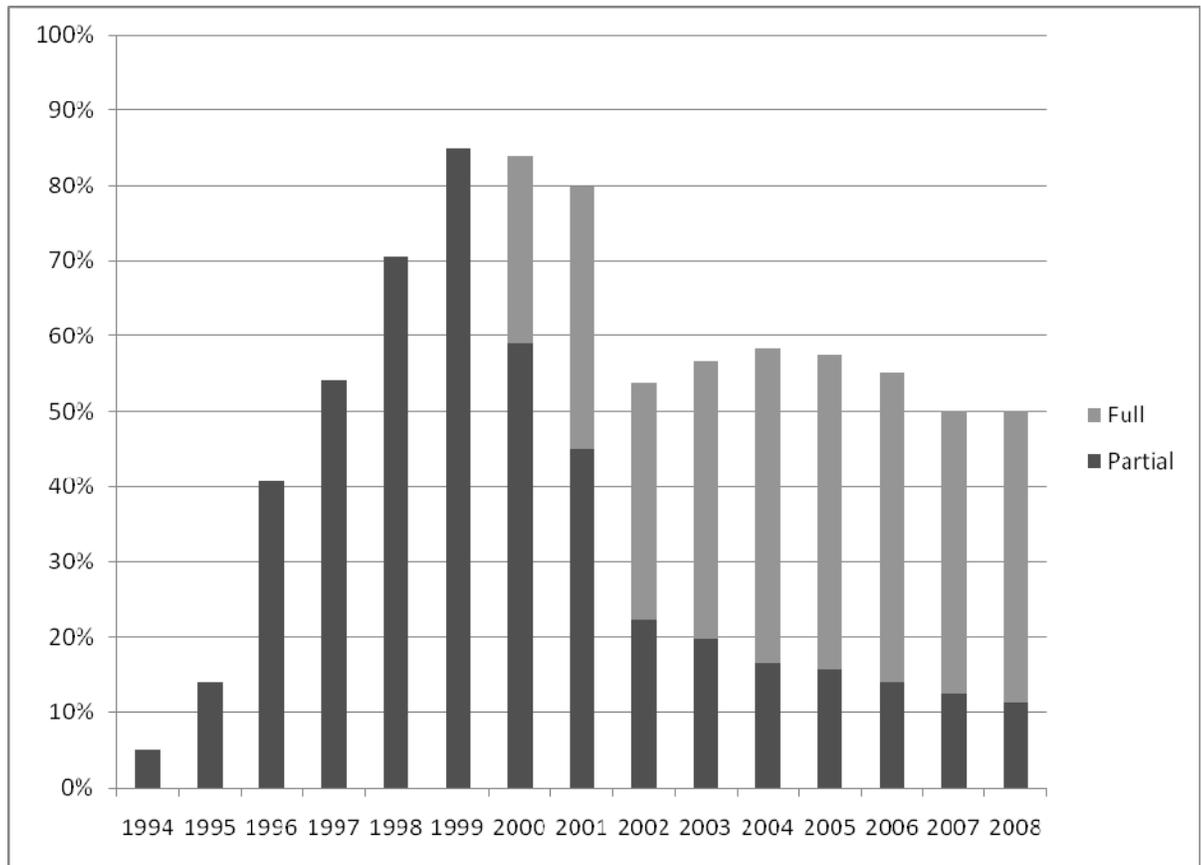
The participation of EMS providers, trauma care facilities (hospitals), and acute care hospitals in the registry from 1994 through 2008 is presented below. When reviewing this information, it is important to remember that the current TRAC-IT registry was implemented in 2002.

Figure 5 – EMS Provider Participation



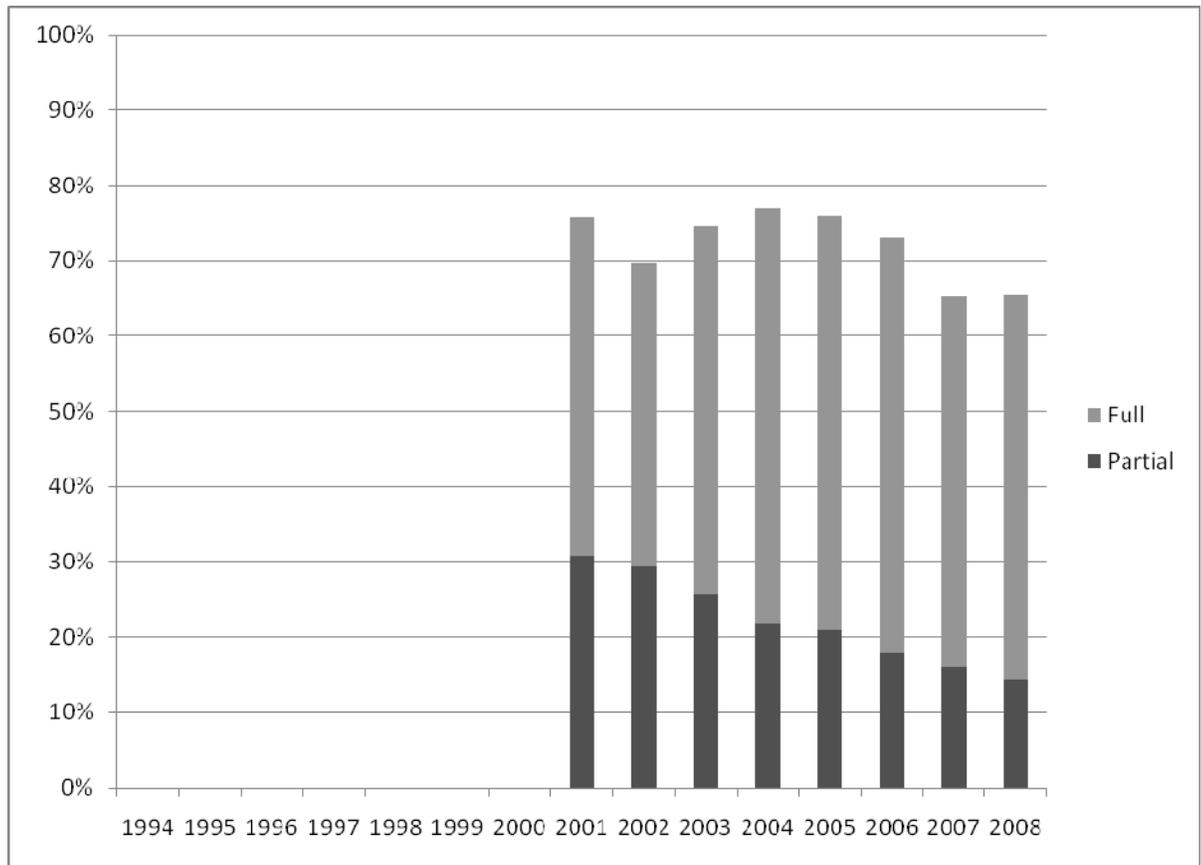
The figure above illustrates the participation of EMS providers in the registry. As of 2008, there were approximately 1,100 EMS providers in the state. Participation peaked at approximately 70 percent in 2000 and decreased sharply from 2001 to 2002. After TRAC-IT was implemented in 2002, there was a consistent increase in full participation from about 25 percent to approximately 40 percent in 2004. Additionally, overall participation increased until 2004. While full participation has held relatively steady since 2004, overall participation has trended lower.

Figure 6 – Hospital Participation



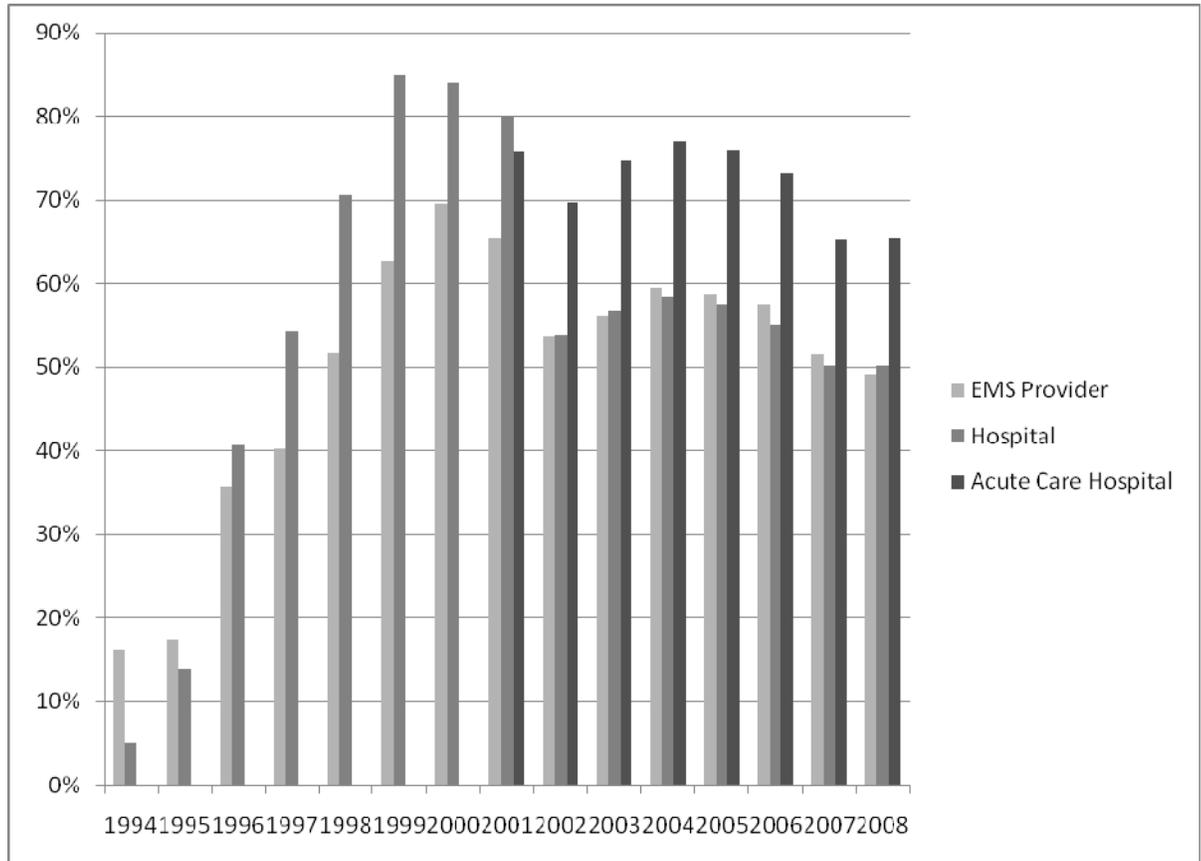
The figure above illustrates the participation of hospitals, the trauma care providers, in the registry. As of 2008, there were approximately 600 hospitals in the state. Participation peaked at approximately 85 percent in 1999 and decreased sharply from 2001 to 2002. Similar to the EMS provider participation, after TRAC-IT was implemented in 2002 there was a consistent increase in overall participation through 2004. Full participation increased from approximately 30 to 42 percent during the same time. While full participation has held relatively steady at 40 percent since 2004, overall participation has trended gradually lower since then.

Figure 7 – Acute Care Hospital Participation



The figure above illustrates the participation of acute care hospitals in the registry. As of 2008, there were approximately 460 hospitals in the state. Since implementation of TRAC-IT in 2002, participation peaked at approximately 78 percent in 2004. During the same time period, full participation grew from approximately 40 to 55 percent. Since then, full participation has held relatively steady, but overall participation has trended gradually lower.

Figure 8 – Participation Summary



The figure above illustrates the relative full or overall participation between EMS providers, trauma care-providing hospitals, and acute care hospitals. Overall participation by acute care providers is generally 15 percent higher than participation by EMS providers and hospitals. This also shows a consistent improvement in all stakeholder participation during the first 2 years of TRAC-IT operations, followed by a declining trend in participation since 2004.

Stakeholder Records

The volume of records submitted to the registry was also considered as a means to review stakeholder participation. To perform this assessment, DSHS provided MTG with the volume of records submitted annually by EMS providers and selected large hospitals from 2000 through 2007.

The EMS provider data showed an average annual increase of approximately 24 percent for records submitted since 2002, the year that TRAC-IT was implemented. The volume of records submitted by selected hospitals increased by an average of about 20 percent per year during the same period. Additionally, the volume increases were fairly consistent throughout the period in both cases.

Even though the number of actively participating stakeholders is decreasing, the consistent increase in record submission volumes suggests that the EMS providers and hospitals with higher volumes continue to use the registry.

Future Solution

MTG’s assessment of stakeholder needs included a survey requesting future registry functions and enhancements that would tend to improve provider participation. Based on the survey results, MTG developed a list of needs that were most requested by the stakeholders to improve their use of and participation in a new registry. The value column represents the percentage of total stakeholder comments received in the survey that were related to the particular topic.

Table 4 – Stakeholder Survey Results

Rank	Finding Topic	Value	Needs – Comments/Description
1	Reports	21.1%	Variety of reporting tools; benchmarking at local/regional/state level.
2	Ease of Submission	17.9%	Easy-to-use submission methods (local/RAC); does not entail more work.
3	Management/Support	11.0%	Communications; training; purpose of registry; involvement.
4	Compatibility	7.9%	Acceptance of data from existing local systems; no new SW to buy.
5	Data Accuracy/Validity	7.6%	Elimination of duplicates and unused data; provides error checks.
6	Reliability	7.4%	High availability.
7	Standards	4.8%	Industry standards (NTDB, NEMESIS, other).
8	Linkage	4.8%	EMS/hospital sharing of data submission; tracks outcomes.
9	Technical Support/Help Desk	3.9%	24x7 support; knowledgeable and understandable operators.
10	Analysis	3.4%	Capability to extract and analyze data.
11	New/Outsourced Solution	3.1%	Replacement of TRAC-IT with a COTS solution; not custom; outsourced from the state.
12	Funding Support	2.3%	State fund changes if required; base funding on participation.
13	Data Dictionary	1.9%	Consistent updates, based on standards (NEMESIS/NTDB).
14	Web-Based Solution	1.1%	Online solution.

Rank	Finding Topic	Value	Needs – Comments/Description
15	Security	0.8%	System security (e.g., Health Insurance Portability and Accountability Act of 1996 [HIPAA]).
16	Other Registries	0.6%	Traumatic brain injury (TBI); spinal cord injury (SCI); cardiac; stroke; submersion (automation of submersion is key).
17	Data Migration	0.5%	Transition of data in existing system.

The detailed analysis related to the stakeholder needs assessment is provided in Section IV.

3. Data Validity

In this subsection, MTG assesses the current registry system for the completeness, accuracy, and timeliness of data contained in the database.

A recent study of 12 required fields in the EMS data set found a valid entry in a minimum of 60 percent and a maximum of 95 percent of the fields evaluated. In some cases, valid entries may be blank or unknown. However, certain optional fields are rarely filled out, often pursuant to hospital or EMS policy.

As assessed by the data stewards, epidemiologists who manage the quality of the registry data, the hospital data set is more complete. It is theorized that the more complete hospital data sets result from better information systems, more specialized staffing, and quality assurance procedures in the hospitals that many EMS providers do not have.

The accuracy of the data sets is much harder to assess. There is little automatic validation and enforcement of data quality since the data set is not normalized, and there is very little referential integrity between tables to ensure consistency of data entries. Instead, validation reports are produced and e-mailed to the entity contact after each submission has been processed, typically within 1 hour of submission, and it is assumed that the entity contacts are providing quality assurance on their submissions. Without access to the original source records, there is no way for the data stewards to know if the submitted information is accurate.

The timeliness of the data available for reporting depends on the monthly processing schedules and the annual quality assurance processes. Complete data for up to calendar year 2007 is available. Data for calendar year 2008 recently closed and is currently being cleaned by the epidemiologists – it should be available in the next 2 to 3 months.

4. Maintainability

In this subsection, MTG assesses the current registry system for maintainability.

The application is currently managed and supported by the 2 full-time equivalents (FTEs) in the DSHS Application Development Group and a full-time contractor that provides certain required skills not available at DSHS.

Support of the application requires the following skills and areas of expertise:

- Microsoft Web development technologies, including Application Server Page (ASP) 3.0, VB 6.0, Vbscript, and Internet Information Services (IIS) 6.0.
- Web development technologies, including HTML, JavaScript, and Cascading Style Sheets (CSS).
- Reporting technologies, including SAP BusinessObjects Enterprise (formerly Crystal Reports) 11.0.
- Oracle database technologies, including Oracle Database 10g and Procedural Language (PL)/SQL.

In addition to application maintenance and updates, DSHS provides technical support to registry users from 8 a.m. to 5 p.m. By agreement in a Memorandum of Understanding, responses to telephone and e-mail support requests are returned within 2 business days in the order in which they are received. Users are notified in advance of scheduled downtimes for maintenance, which are typically one weekend each month from Friday afternoon through Saturday.

The HW and operating system platform and network infrastructure and operations are managed and supported by Team for Texas (a contracted group) and 0.5 FTEs in the DSHS Information Technology (IT) Operations Group. Support of the platform and network requires the following skills and areas of expertise:

- Microsoft server platforms, including Windows Server 2003 and IIS 6.0.
- Oracle database platforms, including Database 10g.
- IBM change and configuration management tools, including IBM Rational ClearCase and ClearQuest.

In 2003, major deficiencies in stability and performance of the application, resulting from defects in the application structure, database design, and HW, became apparent. These defects include a number of design choices that constrain scalability and extensibility. Even at 30 percent of the expected user base, report generation and data validation performance became unacceptably slow after an update of Oracle and SAP BusinessObjects Enterprise (formerly Crystal Reports) in 2006. Incomplete documentation of the original system, particularly the data structures, has also complicated efforts to maintain and improve the system.

System availability was a significant problem prior to July 2007. The system was often unavailable between November 2003 and June 2004. Between December 22, 2006 and July 16, 2007, the system was almost completely unavailable. This downtime resulted primarily from security issues, HW failures, network issues, and backup problems.

Since 2008 however, system availability has been improved and limited only due to scheduled system maintenance. DSHS records outline 19.50 days of maintenance performed in 2008 (94.6 percent availability) and 16.92 days of maintenance thus far in 2009 (93.1 percent availability). Over the last 6 to 8 months, the DSHS Application Development Group has worked to maintain and stabilize the registry application through a series of HW and SW improvements. HW performance and stability was addressed through storage and memory upgrades that enabled a reconfiguration of the way the server uses memory. Reporting performance was improved through the development of stored procedures and the creation of more efficient reports. Recoding of the data import process and cleaning of old tables and data has reduced monthly scheduled maintenance and processing from 4 days to 1 or 2 days. In addition, the Application Development Group continues to resolve a number of small to medium defects, correct reports, and make small improvements to the functionality of the registry application.

Increasing the performance and scalability of the registry is still limited by the fact that the application is designed to process a single transaction at a time. Upgrading the application to support multiple transactions concurrently would require a complete redesign of the database and application code. There are no plans to completely redesign the application at this time.

Finally, the following SW is aging or obsolete and will need to be upgraded:

- Microsoft VB 6.0 is several versions behind the current .NET versions and, as of April 2008, is no longer supported by Microsoft. This upgrade would require significant changes to the existing application code and may need to be deferred until the major redesign described above.
- Microsoft Active Server Page 3.0 was released with Microsoft Windows 2000 and IIS 5.0, which are both now several versions behind. ASP 3.0 has been superseded by ASP.NET.
- Microsoft Windows Server 2003, Service Pack 2, is one version behind and has been superseded by Windows Server 2008.
- Oracle 10.2.0.3 is one version behind and has been superseded by Oracle 11g, which is current.
- SAP BusinessObjects Enterprise (formerly Crystal Reports) 11.0 is one version behind and has been superseded by BusinessObjects Enterprise 12.0.

IV. Stakeholder Needs Assessment

IV. Stakeholder Needs Assessment

In performing the needs assessment, MTG conducted 10 stakeholder sessions throughout the state of Texas. These meetings encompassed the major activities associated with the assessment, and a formal Stakeholder Facilitation Plan was developed in coordination with DSHS to guide the session activities. The final plan was delivered to DSHS on April 30, 2009.

This section outlines the approach and provides the needs assessment results.

A. Approach

MTG approached each session with the stated goal to collect and document stakeholder requirements to enable DSHS to implement the best registry system for the State of Texas, its citizens, and DSHS stakeholders. EMS and trauma hospital stakeholders met in separate sessions to allow for open discussion, as well as the collection of information as it pertains to each group.

1. Session Objectives

- Document requirements for a state EMS/trauma registry.
- Maximize stakeholder participation in developing the requirements.
- Obtain stakeholder justification and rationale for requirements, as applicable.
- Obtain an understanding of stakeholder processes, technology, and constraints.
- Identify new and emerging alternatives for future solutions.
- Ensure that the focus is on a new state registry solution and not issues from the past.
- Improve stakeholder use and participation in the new state EMS/trauma registry.

During the sessions, MTG facilitators captured stakeholder requirements for a new registry, as well as documented various issues they noted with regard to the current system and ideas for the future. Written surveys were also conducted to gather stakeholder input with regard to improving participation in and use of a new registry, the desired frequency for submitting records into the registry, and information related to registry products currently being used locally. A copy of the stakeholder meeting survey form is provided as APPENDIX B.

2. Locations and Participants

The 10 locations selected for the stakeholder meetings were the 8 regional DSHS offices as well as Midland/Odessa and Austin. While stakeholders were invited to attend any of the sessions, these locations were chosen for convenience to stakeholders and to encourage

attendance throughout the state. The table below provides the number of EMS and hospital individual attendees, as well as the services and facilities represented at each session.

Table 5 – Requirements Session Participants

Location	EMS		Hospital	
	Individuals	Services	Individuals	Facilities
Houston	8	6	12	7
Harlingen	11	8	19	8
San Antonio	4	3	7	5
Tyler	10	9	13	9
Arlington	13	10	20	14
Temple	9	8	13	9
Lubbock	6	4	10	9
Midland/Odessa	5	4	12	7
El Paso	12	6	15	6
Austin	<u>7</u>	<u>5</u>	<u>10</u>	<u>6</u>
TOTAL	85	63	131	80

While some of the sessions were smaller than anticipated, those who did attend contributed to the findings.

B. Stakeholder Participation Drivers

During each of the meetings, MTG conducted a survey to determine the key factors associated with a new registry that would entice stakeholders to increase their participation, as well as factors that would tend to decrease participation.

1. EMS Participation Drivers

Based on a total of 252 comments in surveys received from the EMS participants, MTG has identified 19 major factors, outlined in the table below, that will impact EMS stakeholder participation.

Table 6 – EMS Stakeholder Survey Results

EMS Session Comment Category	Percentage	Comments/Description
Reports	21.4%	Variety of reporting tools (local/regional/state).
Ease of Submission	19.0%	Easy-to-use submission methods (local/RAC); does not entail more work.
Management/Support	9.9%	Communications; training; purpose of registry; involvement.
Reliability	9.5%	High availability.
Compatibility	6.3%	Accepts data from existing local systems.
Analysis	6.0%	Capability to extract and analyze data.
Funding Support	5.2%	Base funding on participation; DSHS pays if required.
Standards	4.8%	Generally, NEMSIS Gold Compliant.
Linkage	4.0%	EMS/hospital sharing of data submission, tracks outcomes.
New System	3.6%	TRAC-IT replacement.
Accuracy of Data	2.8%	Eliminates duplicates.
Web-Based Solution	1.6%	Online solution.
Data Dictionary	1.2%	Consistent updates, based on standards (NEMSIS/NTDB).
Data Conversion	1.2%	Transition of data in existing system.
Technical Support/Help Desk	1.2%	Available support (24x7).
Other Registries	0.8%	TBI; SCI; cardiac; stroke; submersion.
Security	0.8%	System security (e.g., HIPAA).
Emergency/Non-Emergency	0.4%	Type designation.
Outsourced Solution	0.4%	Outsourced solution to vendor or other provider.

Many of these EMS participation drivers are also major issues with the current registry.

2. Hospital Participation Drivers

Based on a total of 370 comments in surveys received from the hospital participants, MTG has identified 16 major factors, outlined in the table below, that will impact hospital stakeholder participation.

Table 7 – Hospital Stakeholder Survey Results

Hospital Session Comment Category	Percentage	Comments/Description
Reports	20.8%	Variety of reporting tools (local/regional/state).
Ease of Submission	17.0%	Easy-to-use submission methods (local/RAC); does not entail more work.
Management/Support	11.6%	Communications; training; purpose of registry; involvement.
Accuracy of Data	10.8%	Elimination of duplicates and unused data; provides error checks.
Compatibility	8.9%	Acceptance of data from existing systems; no new SW to buy.
Reliability	5.9%	High availability.
Technical Support/Help Desk	5.7%	Available support (24x7).
Linkage	5.4%	EMS/hospital sharing of data submission; tracks outcomes.
Standards	4.9%	Generally, NTDB; inconsistent SW updates.
New System	2.4%	TRAC-IT replacement; must be improved.
Data Dictionary	2.4%	Consistent updates, based on standards (NEMESIS/NTDB).
Analysis	1.6%	Capability to extract and analyze data.
Web-Based Solution	0.8%	Online solution.
Security	0.8%	System security (e.g., HIPAA).
Other Registries	0.5%	TBI; SCI; cardiac; stroke; submersion.
Funding Support	0.3%	Base funding on participation; DSHS pays if required.

Similar to the participation drivers identified for EMS stakeholders, many of the hospital drivers to improve participation are also major issues with the current registry.

C. Submittal Schedule

The results of the survey found that the EMS groups generally suggested a more frequent submission schedule than the hospitals. However, 57 percent of the overall stakeholder group preferred monthly submittals, as shown in the table below.

Table 8 – Data Submission Schedule Survey

Entity	Daily	Monthly	Quarterly	Annually
EMS	6	44	14	2
	9%	67%	21%	3%
Hospitals	7	48	38	2
	7%	51%	40%	2%
Total	13	92	52	4
	8%	57%	32%	2%

Based on this survey, it is obvious that the stakeholders feel that waiting for an entire year to submit trauma data is not acceptable.

D. Local Registry Solutions

The assessment of the local registry solutions explored stakeholder use of local systems. Stakeholders that reported they had a local registry were asked to identify the type of systems used and their relative satisfaction with them.

As shown in the table below, only approximately one-half of the EMS stakeholders who participated in the survey maintain a local registry, while over 80 percent of the hospitals reported that they had a local registry. With regard to contributions to a regional registry, just over 50 percent of both EMS and hospitals reported that they submitted to a regional registry.

Table 9 – Local Registry Solutions

EMS Responses	Yes	No
Do you maintain a trauma registry?	29	34
	46%	54%
Do you contribute to a regional registry?	28	26
	52%	48%
Hospital Responses	Yes	No
Do you maintain a trauma registry?	72	16
	82%	18%
Do you contribute to a regional registry?	47	40
	54%	46%

The EMS stakeholders participating in the survey reported that TRAC-IT was the most used registry product (used by 19 percent), followed by various commercial products. However, the level of satisfaction with TRAC-IT was reported to be fairly low, while satisfaction with the other products was relatively high.

Table 10 – Local EMS Registry Products

EMS Responses	Level of Satisfaction			Number of Users	Percentage of Users
	High	Medium	Low		
TRAC-IT		3	7	10	19%
Amazon Sweet	3	3	2	8	15%
EMS PRO/Zoll	2	1	2	5	10%
Zoll	3	2		5	10%
Rescue Medic	2		1	3	6%
Rescue Net/Zoll	1	2		3	6%
EMS Charts	2			2	4%
Golden Hour	2			2	4%
Intermedix	1	1		2	4%
Third-Party Collector	1	1		2	4%
Paper		2		2	4%
Innovative Creations	1			1	2%
Pinpoint			1	1	2%
Smart EMS	1			1	2%
Tablet PCR	1			1	2%
MICS			1	1	2%
Run Form 2000	1			1	2%
STATCO		1		1	2%
Custom Development		1		1	2%

Nearly half of the hospital stakeholders reported that they used Digital Innovation, Inc., Collector as their local registry with a fairly high level of satisfaction. One-quarter reported using TRAC-IT, but satisfaction was relatively low.

Table 11 – Local Hospital Registry Products

Hospital Responses	Level of Satisfaction			Number of Users	Percentage of Users
	High	Medium	Low		
Digital Innovation Collector	28	13	2	43	49%
TRAC-IT	1	8	13	22	25%
Trauma Base	10			10	11%
Trauma One/Lancet	7	1		8	9%
NTRACS/Digital Innovation	1		1	2	2%
Pro Med		1		1	1%
Tablet PC	1			1	1%

These findings clearly indicate dissatisfaction with TRAC-IT from both the EMS and hospital stakeholder groups. Additionally, this indicates that there are a number of commercial products available that provide the stakeholders with a generally high level of satisfaction. Several stakeholders clearly stated that a new registry solution must be compatible with these and other current local registry products.

E. Stakeholder Issues and Concerns

During each session, MTG also documented major stakeholder issues regarding the current registry and ideas for the future system. This input was important in the session discussions to understand and capture stakeholders’ needs. Additionally, some of these issues or ideas have also been captured in the stakeholder requirements.

1. Key Issues From EMS Stakeholders

EMS stakeholders have expressed the following issues and concerns related to the current Texas EMS/trauma registry:

- Stakeholders are not happy with the current state EMS/trauma registry and have stated they will not support another custom-built system.
- DSHS does not have the resources to manage the current or future system.
- Stakeholders have questioned what DSHS is doing with the data.
- They expressed that DSHS does not listen to stakeholders.
- The state does not enforce the submission of data from stakeholders.
- Much data is submitted to DSHS; however, stakeholders stress that they receive limited or no data in return from DSHS.
- System warnings and alerts are constantly withdrawn by DSHS.

- Stakeholders are not able to talk with the same person at the state level when issues arise within the system.
- No reports are available from the system.
- The NEMSIS Gold Compliant standard should be the accepted standard for the data dictionary.
- There must be improved linkage between EMS and trauma registry data to reduce or eliminate redundant data entry and allow for the coordination and tracking of patient outcomes.
- Stakeholders are willing to give DSHS one more chance to provide a statewide solution.
- If stakeholders do not receive data in usable report formats, they have warned that they will go to the legislature.
- Large sums of money have been wasted on the current registry.
- Stakeholders have expressed concern that a new state system may cost them to upgrade to a new local or regional solution due to incompatibility.
- Stakeholders would like existing data migrated to the new system.

2. Key Issues From Hospital Stakeholders

Hospital stakeholders have expressed the following issues and concerns related to the current Texas EMS/trauma registry:

- Stakeholders are not happy with the current system.
- Stakeholders believe there is a high cost of running a trauma registry and question why DSHS is participating.
- Stakeholders believe DSHS is not qualified to host the current or future system.
- The system uses an outdated data dictionary.
- Much data is submitted to DSHS; however, stakeholders stress that they receive limited or no data in return from DSHS.
- Stakeholders believe there is duplicate data in the system and inconsistent data submissions.
- There is no linkage with EMS data.
- Hospital stakeholders believe the state registry should be using NTDB as the standard.

- Many of the stakeholders expressed concern that the state will not follow through with this project.
- System warnings and alerts are constantly repressed by DSHS.
- Facilities should not have to pay for system upgrades. Stakeholders have expressed concern that a new system may cost them to upgrade to a new solution due to incompatibility.
- Stakeholders said the system is always down and has a reputation for low reliability.
- The stakeholders feel there is a lack of training on the system.

3. Key Ideas From EMS Stakeholders

EMS stakeholders have provided the following ideas and suggestions related to a new Texas EMS/trauma registry:

- Establish reliable linkage between hospital and EMS data.
- Utilize the NEMESIS Gold Compliant standard for the data dictionary.
- Remove the program from the Division for Prevention and Preparedness Services and place it in the OETSC, where EMS and trauma stakeholder issues are better understood.
- Provide custom reports with data submitted.
- Ensure RACs can submit data on behalf of EMS.
- Provide training for the trauma registry program.
- Do not increase costs for users.
- Work with additional states (e.g., New Mexico) on data transfers.
- Explore a nonproprietary, proven COTS solution.
- Engage stakeholders as part of the solution.
- Consider allowing an entity outside of the state to run the system. For example, this could include outsourcing the statewide registry to a RAC or third-party vendor.
- Allow the system to work with multiple EMS SW products.

4. Key Ideas From Hospital Stakeholders

Hospital stakeholders have provided the following ideas and suggestions related to a new Texas EMS/trauma registry:

- The new registry should be able to run customized reports.

- Provide linkage to all registries (e.g., SCI, TBI, submersions).
- Use NTDB as the standard for the data dictionary.
- Maintain an up-to-date data dictionary.
- Ensure International Classification of Diseases (ICD) codes utilized in the system are up to date.
- Provide a comprehensive FAQ library.
- Build a system that is compatible with the local registry's SW.
- Purchase a hosted system and outsource it to a private company.
- Listen to the stakeholders this time.
- Maintain a comprehensive training program on the new system.
- To better track patient outcomes, consider using a unique identifier to track patient progression from pre-hospital to discharge/death/rehabilitation.

F. Stakeholder Requirements

Collecting requirements for the new registry directly from the stakeholders was a key objective of the needs assessment. The MTG team captured the requirements in a dynamic fashion as we conducted each session. As such, the growing list of requirements was built upon in each session, prioritized, and revised accordingly.

After the sessions were complete, the stakeholder requirements were refined into two types: functional and non-functional. These requirement types were divided into related categories, as outlined below.

- Functional requirements.
 - » Data analysis.
 - » Data submission.
 - » Notification.
 - » Reporting.
- Non-functional requirements.
 - » Data import/export.
 - » Data model.
 - » Integration.
 - » Infrastructure.

- » Security.
- » Support.
- » Training.
- » User interface.

To confirm the refined requirements and priorities, MTG developed a Web-based requirements survey and distributed it to all stakeholders in coordination with DSHS and the RACs. MTG received over 200 responses to this survey that helped specify priorities and provide more detail on selected requirements.

For clarification, an explanation of the information included in the list of requirements is outlined below.

- *Number* – Provides a unique number for each requirement. For ease of identification and tracking, the specific requirement number is preceded by an abbreviation of the category.
- *Category* – Specifies the category in which the specific requirement was placed.
- *Group* – Denotes if the requirement is general or if it relates to the specific needs of EMS or hospital stakeholders.
- *Requirement Description* – Documents the specific requirement identified and approved by the participating stakeholders.
- *Priority* – Signifies the combined priority calculated from input received from the stakeholder requirements survey. Priorities were ranked from 1 (high) through 5 (low).
- *Selected Stakeholder Comments* – Provides feedback received from stakeholders regarding the requirements. If applicable, some of the comments were used to further refine or clarify requirements.

Stakeholder-developed functional and non-functional requirements are outlined in the tables below.

1. Functional Requirements

Stakeholder Requirements: Functional					
Number	Category	Group	Requirement Description	Priority	Selected Stakeholder Comments
DA1	Data Analysis	General	The system shall facilitate data mining capability (e.g., identify data patterns and trends).	1.86	Analysis of the data is CRITICAL. That is the SOLE PURPOSE of inputting the data into the registry. Report generation should be robust and end-user managed/manipulated. Having to request a report from registry staff with a "two-week turnaround" is an ineffective process and non-productive. One of the biggest frustrations with the current system is that data is submitted and reports are not available for up to 2 years later. Data trends and patterns need to be available to help in public education.
DA2	Data Analysis	General	The system shall provide data cubes to allow multi-dimensional analysis.	2.04	Report generation MUST provide for multiple variable analysis.
DA3	Data Analysis	Hospital	The system shall allow analysis to include use of linked data and capability to track outcomes and long term effects.	1.87	The outcome of the patient is the MOST critical objective we are striving for each and every day. Being able to assess if our actions/interventions are leading to improved positive outcomes is IMPERATIVE. Linking records is essential to provide the most accurate picture of the burden of trauma in Texas. This is really needed as too many hospitals play at the stroke game. They want to wear the hat of Primary Stroke Center Certification but do not treat ischemic stroke patients with TPA and if they do their door to needle times are not within the 60 minute expectation. Outcomes are everything to the performance improvement program.
DS1	Data Submission	General	The system must allow manual on-line entry of individual records.	1.94	This is important for smaller/low volume facilities that do not wish to purchase a software product. It must accept electronic uploads for our purposes and be compatible with Digital Innovation Collector. The state should assist every facility to have a "program" of sorts in order to track their data; internet issues can occur at any time but most often a specific program will usually work without internet access.
DS2	Data Submission	General	The system shall allow submission of batch data files.	1.69	Important for facilities that have already purchased software as most of us are unwilling to change vendors.
DS3	Data Submission	General	The system shall allow entry of individual records via voice.	3.57	N/A.

Stakeholder Requirements: Functional

Number	Category	Group	Requirement Description	Priority	Selected Stakeholder Comments
DS4	Data Submission	General	The system shall provide drop down functionality for fields requiring a range of data entry (use pick list wherever possible). Should provide auto-populate when applicable.	1.65	Selection of drop down selection items must consider best practices and involve the experienced EMS/Trauma users. Important for data quality but should accompanied by a robust data dictionary. The definitions of each field and the drop down items should be available by key stroke or click that will give the user the ability to immediately clarify what the data elements mean. Definitions need to be updated immediately/or on the start date whenever a change is issued.
DS5	Data Submission	General	Related to drop down functionality, the system shall allow entry option to include codes or key words to quickly reach desired data entry without having to go through a long list.	1.64	N/A.
DS6	Data Submission	General	Related to drop down functionality, the system shall allow for customizable list for users to limit list specific to them (e.g., list of local hospitals only). Allow customization to include defaults based on dependencies.	1.77	The program MUST allow for each hospital and provider to INDIVIDUALIZE their registry to their environment. Limit the amount of customization to fields that are not required to be reported. DSHS needs to provide monthly updates of applicable facilities and services on the lists.
DS7	Data Submission	General	The system shall allow regional registry submission to support local submission to the state registry.	1.69	This would be fine if RACs are already doing this, but if the RAC has a level of access to the data submitted from their region, there is no need to be the go between. This will allow the vendor to do the necessary data linking and clean up and have the most clean and precise data available to the RAC. This is similar to what NTDB does with hospitals.
DS8	Data Submission	Hospital	The system shall allow submission of data from local to the RAC registry with subsequent automated submission to DSHS (e.g., locals submit once to RAC and can select auto distribution to DSHS, without having to submit the same data another time to the DSHS separately).	1.57	N/A.

Stakeholder Requirements: Functional

Number	Category	Group	Requirement Description	Priority	Selected Stakeholder Comments
DS9	Data Submission	EMS	The system shall allow EMS agencies to not only use it for registry submittal, but to also develop and print out a run sheet to provide to hospitals. The printout needs to allow for narrative and other information that may not be part of the registry submittal.	2.29	Most services have the ability to generate records so for that reason I do not see this as a priority. Run sheet submission capability to the Service's billing agency would be a nice add on. We do an electronic submission to our billing agency that also goes to the hospital. Especially if this would supplant the current requirement to leave a paper record at the hospital when the patient is brought to them. The registry doesn't need to be an electronic patient care record. This is redundant and not needed. It will horribly bog down the registry.
DS10	Data Submission	EMS	The system shall allow for entry of GPS data to be entered and reported in multiple formats (e.g., degree-decimal versus degree-min-sec).	2.71	This is a more specific and accurate way of obtaining location of injury, especially street injuries. Consider possibility of geocoding address at the state level and future linkage with CRASH data.
DS11	Data Submission	Hospital	The system shall close or pre-fill fields if not applicable for the submittal (e.g., if patient did not arrive by EMS, exclude entry of related data).	1.77	This will give uniform null values for conditional fields.
DS12	Data Submission	General	For manual entry, the system shall perform screen edits for each field (e.g., real time correction).	1.81	N/A.
DS13	Data Submission	General	The system shall facilitate amendment and replacement of previously submitted individual records that are found to be incorrect. History of change (including who made it and when) must be maintained.	1.7	N/A.
DS14	Data Submission	General	The system shall provide notification of rejected submittal(s) and must be provided on a timely basis. Provide capability for timely corrections of warnings.	1.5	N/A.

Stakeholder Requirements: Functional

Number	Category	Group	Requirement Description	Priority	Selected Stakeholder Comments
DS15	Data Submission	Hospital	The system shall provide optional submission validation check prior to state registry submittal and allow hospital(s) to correct before final submission.	1.6	This should be to the DSHS or to the RAC if users are submitting to RAC.
DS16	Data Submission	Hospital	EMS and trauma providers should be able to use state registry as a local registry that will allow submittal of data and reporting.	1.65	N/A.
DS17	Data Submission	General	The system shall allow test uploads and must allow functionality through a Web interface. The system must include a test mode that will not impact system operations.	2.36	N/A.
DS18	Data Submission	EMS	The system shall provide the capability for EMS and trauma registrars to save data submitted to the registry on-line on their local system	1.58	Individual providers must have immediate access to their data; either on their local systems or through a real-time access process into the Texas EMS and Trauma database.
DS19	Data Submission	General	The registry must be compatible to allow data upload from the majority of existing Texas EMS and Hospital Trauma Center systems.	1.6	The system MUST be capable of capturing data from every patient transport or hospital visit. There should be NO patient excluded because of "system" interface issues. If there is a technology glitch, it should be fixable. Data acceptance from ALL existing registries is ESSENTIAL. No one should be required to pay for an upgrade or customization to be compatible.
DS20	Data Submission	General	The registry shall support submission and storage of data for Stroke, Cardiac, TBI, SCI, and Submersion.	1.69	A single registry system makes a LOT of sense! Many of the providers entering data and managing their registries are dual/multiple role providers overseeing many of these type programs within their institutions. "One-Stop-Shopping" with the capability to pull out disease-specific information should be a doable process. Would it not be cheaper to build these components as part of a LARGE process, rather than the cost of the individual "stand-alone" components?

Stakeholder Requirements: Functional

Number	Category	Group	Requirement Description	Priority	Selected Stakeholder Comments
DS21	Data Submission	General	If multiple registries are provided in a single solution, the submitter must have the option to select the applicable registry and require entry of only the related data.	1.7	It would be more acceptable if all the data could just be submitted to one database and the individual registries information were retrieved from that database.
DS22	Data Submission	General	The solution must be scalable to allow growth and potential expansion to add other registries.	1.59	N/A.
NOT1	Notification	General	The solution shall provide timely notification to the agency and submitter (and owner, if different) of a record found to be a duplicate entry into the registry.	1.66	Not very important to the facility or agency to know a duplicate record was submitted as long as the state registry deletes and does not use the data.
NOT2	Notification	General	The solution shall provide data quality service notification due to persistent submittal errors. Notification shall be provided to the submitter and include error type (e.g., rejection or duplicate) and specific definition.	1.67	N/A.
NOT3	Notification	General	The registry shall notify the submitter via e-mail to confirm the acceptance or rejection of a record in timely manner (immediate when applicable). If a record is rejected, notification shall include reason for rejection and specific error type and definition.	1.53	N/A.
NOT4	Notification	General	The system shall receive file transfer notification and validation receipt via e-mail. Receipt should go to the submitter (e.g., RAC) and the owner (e.g., local agency) as applicable.	1.57	Notification should go to both the hospital and EMS agency; and if the RAC is submitting (EMS data) then they should get the report as well.
REP1	Reporting	Hospital	The system shall allow for printout of submitted records.	1.61	N/A.

Stakeholder Requirements: Functional

Number	Category	Group	Requirement Description	Priority	Selected Stakeholder Comments
REP2	Reporting	Hospital	The system shall facilitate the search of a previously submitted individual record.	1.47	N/A.
REP3	Reporting	General	The system must have the capability to run queries related to errors and warnings pertaining to submitted records.	1.55	N/A.
REP4	Reporting	EMS	The system shall have the capabilities to run performance reports of individual users.	1.78	N/A.
REP5	Reporting	Hospital	The system shall allow users to run a report to check activities performed by others on their personal records or records submitted by individuals in their group.	2.04	N/A.
REP6	Reporting	Hospital	The system shall provide a completely dynamic query tool that allows search by any single data point.	1.6	Data has to be filtered and masked for security and privacy purposes.
REP7	Reporting	General	The registry shall include development and processing of common reports. As a minimum, include the mandated reports for reporting to regulatory agencies (e.g., American College of Surgeons [ACS]).	1.62	This will prevent confusion, saves time, fewer errors, and increase accuracy.
REP8	Reporting	General	The registry shall allow local agencies to generate aggregated reports at various levels (e.g., Local, RAC, State, National) to allow comparisons of agency performance against other related groups.	1.63	N/A.
REP9	Reporting	General	The registry shall provide ad hoc reporting capabilities.	1.83	N/A.

Stakeholder Requirements: Functional

Number	Category	Group	Requirement Description	Priority	Selected Stakeholder Comments
REP10	Reporting	General	The system must support anonymous reporting on Key Performance Indicators (KPI's), benchmarking elements at the state level (e.g., comparing local performance against the state average, or comparing hospitals by trauma designation level). Should also consider comparison at national level.	1.79	N/A.
REP11	Reporting	General	The system shall support the sharing of reports and query solutions (allow local and regional exchange of report formats).	1.83	N/A.
REP14	Reporting	Hospital	The system shall provide immediate notification of a failed report to the requesting user.	1.55	N/A.
REP15	Reporting	Hospital	The registry shall provide real-time monitoring and viewing of record processing status.	1.75	N/A.
REP16	Reporting	Hospital	The registry shall provide reports in open document format (ODF) and not a proprietary format.	1.82	N/A.

2. Non-Functional Requirements

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
DI1	Data Import/Export	General	The registry shall allow authorized EMS and Trauma providers to download raw data for specific reporting and analysis purposes.	1.95	Raw data available in the research data set must include zip codes. HIPAA concerns may exist depending on what data are selected.
DI2	Data Import/Export	General	The data from current registry shall be migrated into the new registry.	1.69	The quality of the current data is so poor that it is not worth wasting ANY effort on it. I think the Web site should offer the ability to search either the new data, or the old data separately. If the data were combined we would lose the demarcation between the two data sets, and I believe that would be a mistake.
DI3	Data Import/Export	Hospital	Conversion of data from current system should be considered as a separate project so as not to slow down or jeopardize movement to a new registry.	1.76	Current data quality is so poor that NO more resources should be expended on it. I think the projects should be handled together to address problems that come up during development of each. We are non-profit and for a small service like ours shutting the system down for months at a time causes a serious financial burden in order to input data later.
DI4	Data Import/Export	General	The system shall allow export of data to other applications (e.g., Excel or BusinessObjects Enterprise [formerly Crystal Reports]) for selected analysis or reporting.	1.72	Ability to export to excel is important. Include export into SAS or SPSS (statistical software).
DI5	Data Import/Export	General	The system must use Secure File Transfer Protocol (SFTP).	1.51	N/A.
DI6	Data Import/Export	General	The system must facilitate import and export of data via XML.	1.85	N/A.

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
DM1	Data Model	General	The system is required to be compliant with the most current NEMESIS Gold standard.	1.87	80.3 percent of Respondents to this question desired compliance with the gold standard.
DM2	Data Model	General	The system is required to be compliant with the most the current version of NTDB standards.	1.74	Note that some hospitals would report directly and not depend on the state registry to report to the NTDB.
DM3	Data Model	General	The system shall include data field to specify disaster or other related response/transport (e.g., specifying services related to all hazards).	1.86	N/A.
DM4	Data Model	General	The registry solution shall facilitate the prevention of duplicate records.	1.49	This is a major concern for the rural hospitals that transfer patients out to higher level hospitals after the patient is entered into their system. A reliable and accurate method of determining what is a duplicate record must be developed.
DM5	Data Model	Hospital	The system must provide rules for error rejection based on critical errors versus error flagging for non-critical errors. Rules should be well documented with description error notes in data dictionary.	1.63	N/A.
DM6	Data Model	General	The system must support data definition differences between infants/pediatrics and adults.	1.82	DSHS needs to provide clear definition of each classification (e.g., size, weight, age, etc.). If this is an issue, SW should recognize patient category. Would also need a DSHS mandated age for infants/pediatrics and adults. The age ranges vary among different providers.
DM7	Data Model	General	The system must facilitate data warehouse functionality.	1.94	N/A.
DM8	Data Model	General	The system must facilitate linking of corresponding EMS and Hospital registry records.	1.73	This is very important.

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
DM9	Data Model	General	The system shall facilitate linking of corresponding EMS providers to other EMS providers (e.g., ground EMS to air medical).	1.73	This is very important.
DM10	Data Model	General	The system shall facilitate hospital to hospital linkage and should be able to assimilate levels of multi-facility tracking of individual patients.	1.65	This is very important.
DM11	Data Model	General	The system must support variation of linkage (e.g., transport – hospital – transport – hospital).	1.75	This is very important.
DM12	Data Model	General	The system must establish a unique identifier for each trauma patient/incident.	1.59	This may need to consider multiple variables (i.e., multiple records for the same patient) on the same incident. However, solution must support use of a single identifier if one is established through another means. Same for stroke patients.
DM13	Data Model	General	The system shall support American Burn Association (ABA) standards.	1.84	N/A.
DM14	Data Model	General	The system shall support standards related to Stroke, Cardiac, TBI, SCI, Submersion, STEMI, and AHA with expansion ability.	1.73	N/A.
INT1	Integration	General	The registry shall support automated submission of statewide data to the NEMSIS national database.	1.98	N/A
INT2	Integration	Hospital	The registry shall support automated submission of statewide data to the NTDB national database.	2.49	N/A.
INT3	Integration	General	If the facility submits to the state, the DSHS should have the capability to submit to NTDB.	2.14	This must be optional and the hospitals should still be allowed to submit directly to NTDB if desired. Also, the problem with duplication of records must be addressed before this is allowed.

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
INT4	Integration	General	Solution must provide Application Programming Interface (API).	1.96	N/A.
INT5	Integration	General	The system shall expose functionality via Web services.	1.94	N/A.
INT6	Integration	General	System messaging shall be compliant with Health Level Seven (HL7) standards	1.95	N/A.
INT7	Integration	General	The registry shall support the requirements for data linkage and information exchange between selected systems.	1.82	N/A.
INT8	Integration	Hospital	The system shall support linkage to Texas Health Care Information Collection Center (THCIC), vital statistics, TxDOT, DPS and Coroners data.	1.89	There may be issues with THCIC as they do not allow linking of their data.
INT9	Integration	EMS	The system shall support linkage to national weather service, census, National Electronic Disease Surveillance System (NEDSS) in Texas DSHS (notifiable conditions) data.	2.27	N/A.
INT10	Integration		The system shall support interstate linkage (e.g., Oklahoma, New Mexico).	2.66	Only for data pertinent to WMD or CDC issues.
INF1	Infrastructure	General	Facilitate access via high-speed bandwidth.	1.84	N/A.
INF2	Infrastructure	General	System must be available 99.9% of the time.	1.43	N/A.
INF3	Infrastructure	General	Ensure system backup, recovery and restore capability.	1.21	N/A.

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
SEC1	Security	General	The system shall allow secure role-based user login and logout and facilitate management of users by agency.	1.41	N/A.
SEC2	Security	General	System security includes dual authentication and challenge questions for login.	1.72	N/A.
SEC3	Security	EMS	The system shall provide password reset functionality. Allow agency to set requirements for password reset.	1.54	Allow agency to set requirements for password reset. Password reset requirements should be standard.
SEC4	Security	Hospital	If password reset is required (e.g., every 90 days) allow users to reuse previous passwords.	1.96	Reset requirement not preferred, however it may be a HIPAA requirement. If there are facilities where there are limited people putting in data, then the password reset feature should be turned off.
SEC5	Security	EMS	Each agency needs to have the right to determine who can submit data on their behalf and who can receive subsequent information back.	1.45	N/A.
SEC6	Security	EMS	The system shall allow agency defined role based access to specific agency data for other entities (e.g., allow capability for hospital and/or specific Medical Director to see the selected EMS data).	1.74	N/A.
SEC7	Security	EMS	The system shall allow automated desktop log-off based on non-activity is required. Timed log-offs need to consider all activity on the desktop and/or provide a notification message of timeout.	1.9	Useful for users entering data directly and not for users using third party software.
SEC8	Security	Hospital	The system must only allow an authorized entity to update or correct their data.	1.4	N/A.
SEC9	Security	General	The system shall facilitate role-based user management.	1.64	N/A.

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
SEC10	Security	General	Based on role, the system shall allow for management of user accounts. Ensure that the RAC can be defined as one of the roles.	1.71	N/A.
SEC11	Security	General	Based on role, the system shall allow for management of user report access privileges.	1.62	N/A.
SEC12	Security	General	Staff and role designation process should be Web-based and not complex. Designation shall include assignment of new personnel or replacements.	1.52	N/A.
SEC13	Security	General	The system must provide for a sufficient number of administrative roles to accommodate all levels of system access and security.	1.63	N/A.
SEC14	Security	EMS	Computer and network authentication is required for security.	1.6	I believe restrictions beyond a valid logon and password would unnecessarily restrict users from being able to use different computers, or even laptops used off site, from doing data submissions.
SEC15	Security	Hospital	The system must track user account activation and user activity for monitoring use and security purposes. User activity must include specific record access, additions, changes, etc, made by each individual.	1.73	N/A.
SEC16	Security	General	The system must meet current technology and industry security standards (e.g., HIPAA).	1.45	N/A.
SEC17	Security	General	Data encryption is required.	1.54	Data encryption must be compatible with hospital encryption.
SUP1	Support	General	Provide general help functions and access to FAQ documentation. Include a dynamic library of Frequent Asked Questions (FAQ).	1.75	N/A.

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
SUP2	Support	General	Provide toll free help desk with well qualified staff, knowledgeable of EMS and Trauma systems. Call center operators must be fluent in English (or selected language) and understandable (not heavy accents). Provide for performance reporting and tracking of problems, fixes, FAQ's, etc.	1.62	Call centers for training and technical support should be located within the U.S.
SUP2(a)	Support	General	System support operations should be available 24 hours per day, 7 days per week.	1.62	The majority of the respondents who voted specified some level of support was required 24x7. See specific support levels below.
SUP2(b)	Support	General	Help desk support with a live operator must be available during normal business days (Monday through Friday) for 12 hours per day.	1.62	58 percent of Respondents voted for a live operator to be available 12x5 (12 hours per day – 5 days per week). An additional 15 percent desired 12x7 and 27 percent desired 24x7.
SUP2(c)	Support	General	E-mail, Instant Messaging, and Voice mail support must be available 24x7.	1.62	If the live operator is not available, the majority of the respondents favored e-mailing, but the other methods were acceptable.
SUP2(d)	Support	General	If live operator is not available for immediate response, the help desk must reply to messages or e-mails within 4 business hours.	1.62	The 4 business hours requirement supports 63 percent of the votes. For reference, 37 percent of the respondents noted that 2 business hours was a high requirement, 15 percent selected 4 business hours, 30 percent selected 1 business day, and 18 percent selected 2 business days.
TRA1	Training	General	User training shall address, but not be limited to, system functionality, report generation, system administration, and other operations.	1.42	Report Generation, Top Priority.
TRA2	Training	General	User training should be provided through multiple delivery methods (e.g., on-site, on-line training, Web-based tutorials, Webinars, etc.).	1.4	Very important to have on-line and/or Web-based tutorials for those who cannot travel to get in-service or education.
TRA3	Training	General	User training should be accomplished by using a train-the-trainer approach.	1.92	There are some situations where this type of training does not work well. Where I work this was tried a few years ago and it went nowhere.

Stakeholder Requirements: Non-Functional					
Number	Category	Group	Requirement Description	Priority	Stakeholder Comments
TRA4	Training	General	Training should include injury scoring training (e.g., AIS from the Association for the Advancement of Automotive Medicine (AAAM)).	2.08	System should assign the AIS scores to the charts. Let's not forget training review for these also. AIS scoring would extremely increase the amount of time needed for training. Each facility should have someone trained in AIS prior to implementation of solution.
UI1	User interface	General	Provide a public Web site to provide reports related to open records (would not include personal information). Web site would support public awareness, injury awareness/prevention activities, and provide training materials. Aggregated data reports would be available at the ZIP code level.	2.13	N/A.
UI2	User interface	General	The system must be compliant with the Americans with Disabilities Act (ADA).	2.02	N/A.
UI3	User interface	General	The system must be Web-based.	1.44	N/A.

V. Other States' Registry Systems

V. Other States' Registry Systems

The purpose of this section is to provide a comprehensive view of other states' registries and the management strategies employed by peer state organizations. To achieve this, the following objectives have been determined:

- Identify peer agencies that have similar statewide EMS/trauma registry requirements.
- Define the technology employed by those agencies with comparable business models (with a focus on agencies with Web-based, COTS registries).
- Identify registry system components for maintainability, usability, consistency, and validity of data.
- Identify cost estimates for acquisition, implementation, maintenance, and help desk support.
- Identify emerging trends in state registry systems.
- Focus on registries that are compliant with NEMSIS and NTDB data standards.

By learning from other state agencies and adopting and adapting key strategies and solutions, DSHS can position the EMS and trauma registry improvement project for success.

A. Approach

To focus project resources and minimize the impact of the data collection process on Texas DSHS EMS/trauma peers, we distributed an 18-question survey. The survey, which is provided in APPENDIX C, is the tool for narrowing the field of desired state solutions. The survey was sent to 49 states, the District of Columbia, and Puerto Rico. Twenty-seven states made an attempt to complete the quick survey, and most responded to a majority of questions, while others could only answer a few questions, given particular situations.

An agency had to exhibit a number of desired registry characteristics to qualify for a site visit or formal telephone interview. These characteristics are outlined as selection criteria; they include:

- Statewide EMS/trauma registry with a history of success.
- Mandatory submission.
- Proven COTS product.
- The registry provides linkage between EMS and trauma data.

- The state has similar demographics to Texas (e.g., population, size, density, trauma volumes, rural versus urban areas).
- The registry is compliant with NEMSIS and NTDB data standards.

EXHIBIT I, on the following page, provides a snapshot of how surveyed states responded to selection criteria indicating questions. Those states meeting 10 to 15 of the criteria were peer organizations on which we focused. Additionally, to gain a good perspective of vendors, we selected states that worked with the leading vendors. The raw results of the survey are provided in APPENDIX C.

B. Other States Overview

Based on the selection criteria, there were several states that exhibited several desirable characteristics. However, after further examination of recent activities and viable vendor solutions, certain states appeared more attractive than others. The selection of site visitations and formal telephone interviews was based on a combination of state survey responses, implemented COTS solutions, and recent EMS/trauma registry system activities.

Identified for Visits

The following states were selected for site visitations:

- *Minnesota* – While EMS and trauma are the responsibility of two separate organizations in Minnesota, both the Minnesota EMS Regulatory Board and the Minnesota Statewide Trauma System use an ImageTrend, Inc., application for their registries.
- *Missouri* – Of the 27 states that responded to the survey, the Missouri Department of Health and Senior Services, Bureau of EMS, is the only state agency that truly maintains a linked EMS and trauma solution from one vendor. ImageTrend provides a linked State Bridge/Trauma Bridge registry system.
- *Pennsylvania* – Pennsylvania is known as an EMS and trauma program leader in the industry and uses Med Media, Inc., for its EMS registry and Digital Innovation for its trauma registry.

Identified for Telephone Interviews

The second tier of states were contacted for formal telephone interviews:

- *Nebraska* – The Nebraska Department of Health and Human Services uses ImageTrend State Bridge and Field Bridge to capture pre-hospital data and Digital Innovation Collector and NTRACS for the trauma data.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT

STATE SURVEY ANSWERS

Question No.	Questions	Alaska DHSS/IPEMS	Arkansas DOH	California EMS Authority	Colorado DPHE	Indiana DHS/FBSD	Iowa DPH	Kansas EMS	Kentucky BEMS	Maryland IEMSS	Minnesota EMS RB	Mississippi DOH/BEMS	Missouri DOH/BEMS	Montana EMS & Trauma	Nebraska DHHS	Nevada HDEMS	New Jersey DHSS/OEMS	New York DOH/BEMS	North Carolina	Ohio DPS/EMS	Oregon DHS/EMS	Pennsylvania Trauma	South Carolina DHEC	Utah DOH/BEMS	Vermont EMS Office	Virginia DOH/OEMS	Washington	Wisconsin DPH	Wyoming EMS Office
4	Operate Single Statewide Registry	X			X					X			X						X										
5	Total EMS Annual Volume of Data									X							X	X	X	X			X				X		
6	Require Submission of EMS Data	X	X		X	X	X			X	X	X	X	X	X	X		X	X	X		X	X	X		X			X
7	Require Submission of Trauma Data	X	X		X	X	X	X		X		X	X	X	X	X		X	X	X		X	X	X		X			X
8	Real-Time or Monthly Submission																												
	EMS				X	X		X	X	X	X	X	X			X	X		X					X					X
	Trauma	X			X	X				X		X		X					X			X							
9	Plus 80% Data Capture in Registry																												
	EMS				X		X				X		X		X			X	X	X						X			X
	Trauma	X			X							X		X				X	X	X	X	X		X		X			X
10	EMS Registry Is Compliant to NEMSIS	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	Trauma Registry Is Compliant to NTDB	X		X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	COTS Application for Registry	X	X		X		X	X			X	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X
13	COTS Application for Registry																												
	EMS	X			X			X	X		X	X	X				X	X	X			X		X		X	X		X
	Trauma	X					X	X	X		X	X	X	X	X			X	X			X	X	X	X	X	X		X
14	Hosted by Application Provider	X					X	X			X				X									X					
15	Has All Modules	X			X		X	X			X	X																	
16	User Custom and Dynamic Reporting Capabilities	X	X		X	X	X	X			X	X	X	X	X		X		X	X	X	X	X		X				X
17	EMS and Trauma Linkages	X			X							X	X		X			X	X	X									

- *Alaska* – The Alaska Department of Health and Social Services, Section of Injury Prevention and EMS, is in the process of implementing ImageTrend for both EMS and trauma registries. Alaska was also selected because of the geographical similarity with rural locations.
- *North Carolina* – The North Carolina Office of EMS has a combination of an in-house-developed system to capture pre-hospital data and Digital Innovation NTRACS for the trauma registry. The North Carolina EMS Performance Improvement Center also provides a similar data system to South Carolina and West Virginia.
- *Mississippi* – The Mississippi State Department of Health, Bureau of EMS, uses a best-of-breed approach. ImageTrend’s State Bridge and Field Bridge are used for its pre-hospital data, and Digital Innovation Collector is used for its trauma registry.

APPENDIX C contains the follow-up questionnaire used to gather detailed information from site visits and interviews.

Selecting these states for site visits and interviews provided a solid foundation for identifying and understanding industry-leading trends. As outlined above, these states also represent a good mix of market-leading EMS and trauma vendors, thereby providing us with diverse vendor perspectives. Additionally, each state chosen represented different stages in the registry life cycle. For example, Minnesota, Pennsylvania, and North Carolina have veteran systems with several years of operations, Missouri and Nebraska are newly implemented systems with 2 to 4 years of operations, and Alaska and Mississippi are in the process of implementing or have just completed the implementation of modern systems. APPENDIX C contains a profile for each visited and interviewed state. The profile includes statistical data, an organizational and governance overview, and registry system information. Overall trends from these states are outlined in the next subsection.

C. Other States Trends and Best Practices

Upon completion of the state survey, state visits, and interview sessions, the data collected was analyzed to identify successful high-level trends among peer EMS and trauma organizations. In identifying these trends, we recognized common themes and best practices. This also included reviewing vendor market approaches, their current and emerging products, and compliance with industry standards. Considering these trends and best practices supports MTG’s analysis and development of recommendations for the new registry.

The trends identified are organized in the following themes:

- Management and Organization

- Registry Data Quality and Validity
- Industry Standards
- COTS Systems Evolution
- Registry System Attributes
- Systems Acquisition
- Historical Data Migration
- Registry Systems Cost
- Help Desk Support

These trends areas are discussed below.

1. Management and Organization

This subsection identifies the management and organization trends within state-level EMS and trauma registry systems. These trends focus on the organizational structure of EMS and trauma agencies at the state level, advisory committees, and project teams, as well as organizations that have gone through initiatives similar to the TRISA Project. Many of the management and organizational structures identified in this subsection may be adopted and adapted in Texas.

- *Use of Steering Committees and Advisory Boards* – Many peer states use a steering committee or advisory board to guide policy and decisions on the statewide EMS and trauma data collection systems. Decisions made from these types of groups are often aligned with the mission of EMS and trauma entities, as well as applicable legislation. All registry projects of states that were visited and interviewed were directed by or reported to such a group. These committees or boards were generally composed of EMS or trauma practitioners throughout the state and had the following characteristics:
 - » They represent a group of stakeholders (e.g., emergency medical technicians [EMTs], hospital administrators, trauma registrars and coordinators, regional EMS directors).
 - » They have sufficient authority over resources and can make project decisions as needed.
 - » They are often supported and advised by subject matter experts.

Steering committees or advisory boards are usually chaired by the project sponsor or state EMS or trauma director. These committees also review the project scope,

objectives, approach, budget, schedule, and issues. They also provide overall direction and approval in each of these areas.

- *Separate EMS and Trauma Organizations* – Twenty-one of the states that participated in the state survey maintained separate organizations for managing EMS and trauma systems. Those states that housed their EMS and trauma organization within the same division still maintained separate EMS and trauma applications. While these organizations are separate, in all instances EMS and trauma managers work closely together to eliminate duplicate effort and maximize statewide participation.
- *State Support and Resources* – The majority of the states surveyed provide some level of data collections support services. Most common among states was the allocation of state resources at a regional level. For example, Minnesota has eight regions to which five state resources are assigned, Nebraska has two state resources that cover four regions, and Missouri has eight staff resources to cover six regions. In all cases, these regional resources meet with services and facilities staff on a regular basis.
- *Mandatory Data Submission* – Similar to Texas, the majority of states that responded to the state survey were mandated by state legislation to collect and maintain statewide EMS and trauma data, 85.7 and 81 percent respectively.
- *Ensuring Participation* – There are several ways to enforce participation in EMS and trauma data submission, ranging from individual fines, service fines and suspension, revocation of certification to state funding. However, states had seemingly been most effective in ensuring participation by providing larger services and hospitals with seamless integration, good system support and training, and good reporting and performance improvement metrics.
- *Organization of Project Teams* – States that have been successful in updating their registry systems have employed cross-functional teams. Common resources used in the acquisition and implementation of EMS and trauma systems include:
 - » Project sponsor. Typically the director of the state EMS or trauma organization and/or chairman of the steering committee. Six of the seven states visited and/or interviewed employed a project sponsor who was the agency's director.
 - » Project manager. Typically a manager within the state EMS or trauma organization.
 - » Subject matter experts (for larger projects).
 - » State or internal IT staff.
 - Database administrator.

- Infrastructure/security staff.
- Business analyst (for larger projects).
- Trainer (for larger projects; on smaller projects, the project manager was also the trainer).
- » SW vendor staff.
 - Project manager.
 - Implementation manager.
 - Database administrators.
 - Domain/infrastructure administrator.
 - Programmers.
 - Trainers.

Under direction from a steering committee or advisory board, these cross-functional project teams are able to make sound business and technical decisions and respond quickly to the needs of the project. Historically, decisions on data collection systems have been made by IT organizations and often failed to meet business objectives and desired outcomes.

- *Relationship With Solution Providers* – Relationships with SW vendors have evolved from onetime purchases to true long-term partnerships, where the vendor staff become an important state resource and key asset for EMS practitioners and trauma registrars. As more states move towards a software as a service (SaaS) type of model, traditional buy and implement approaches have become obsolete. The SaaS model allows states to implement each others' best practices and continually expand the SW over time, thus improving all the client applications of the vendor.

These are consistent management and organization trends for DSHS to consider in its process to obtain a new EMS and trauma registry.

2. Registry Data Quality and Validity

In the pursuit to reduce preventable death and disability due to sudden illness or injury, it is critical to enforce good data quality from all participating services and facilities. Having valid information allows state EMS and trauma organizations to perform in-depth analysis and identify trends. When visiting with various states and discussing techniques for maintaining good data quality, several techniques stood out as the most commonly used.

- *Stakeholder Education* – Training stakeholders to use and enter data into the registry system is essential to good data quality. States that have implemented modern reg-

istry systems continually send trainers to educate local users on system basics and shortcuts.

- *Reinforcement of Accurate Input Received and Meaningful Output* – “Garbage in, garbage out.” Several states make an effort to advertise good data entry, which results in usable reports for services and facilities. As staff at local EMS and trauma facilities have learned how to use reporting functions of their statewide registry, those states have experienced increased data quality.
- *Data Field Definitions* – The use of specific terms or language can make consistent data collection difficult. To ensure all EMS and trauma facilities staff understand and use consistent definitions of terms, a data definitions document should be published and distributed; also, whenever possible, it should be integrated within the registry system. EMS and trauma facilities using third-party systems will usually have data input automated; however, they will also have access to the state registry system for isolated input and reporting.
- *System Data Validity Indicators* – Some registry systems use algorithms to perform real-time data validation as data is entered into the system; this allows users to monitor data validity as they populate the registry.

3. Industry Standards

Patient data inclusion criteria for trauma registries are not regulated by any mandated standards at this time and are determined by the organization maintaining the registry. However, much of this is currently driven by available technology, solutions, industry standards, and national data aggregation entities; these include the following:

NTDB

NTDB is the largest and most influential aggregator of trauma registry data, and its goal is to provide information to the medical community, public, and government regarding the current state of care for injured persons in the U.S. NTDB contains over 2 million records from more than 600 trauma centers and is based on the National Trauma Data Standard (NTDS). It should be noted, however, that while NTDB contains pre-hospital data elements as part of its data set, it is considered to be primarily a collection of hospital emergency data.

Currently, no formal compliance testing process exists for NTDB; however, SW developers are encouraged to consult with NTDB about submitting test cases to ensure that submitted data is validated. NTDB works with several client SW vendors to ensure compatibility, including Digital Innovation Collector and NTRACS, ImageTrend, Clinical Data Management (TraumaBase), and Lancet Technology (TraumaOne). APPENDIX C provides a listing of these vendors, their Web site addresses, and their applicable products.

NEMSIS

The goal of NEMSIS is to implement (1) an electronic EMS standard in every local and state EMS information system in every state and territory, which can receive and use a portion of the local EMS data via the XML standard and (2) a national EMS database, which can receive and use a portion of the state and territorial EMS data via the XML standard. NEMSIS is based on the National Highway Traffic Safety Administration's (NHTSA's) Version 2.2.1 data set standard and is a much more recent organizational/standards effort. NEMSIS is currently working on a rollout of Version 3, which will be available initially by the end of 2009.

NEMSIS certifies client SW as either Gold or Silver Compliant based on the following criteria:

- Any SW associated with EMS that provides a mechanism to collect, document, analyze, or otherwise store and use data associated with an EMS event.
- Any EMS data system is compliant at the Silver or Gold level with the NHTSA Version 2.2.1 data set when the following conditions have been met:
 - » The NHTSA Version 2.2.1 EMS data set is used within the EMS data system as defined.
 - » The NHTSA Version 2.2.1 demographic data set is used within the EMS data system as defined.
 - » The NHTSA Version 2.2.1 XML standard is used to, at a minimum, export data from the EMS data system as defined.
 - » A structure within the EMS data system is in place to monitor and prevent any changes within the EMS data system that are not compliant with the defined NHTSA Version 2.2.1 data set.

The stakeholders have communicated that they require the EMS database of the registry to be NEMSIS Gold Compliant. APPENDIX C provides a listing of the vendors and their products that are currently identified by NEMSIS to be Gold Compliant. The vendor Web site addresses are also provided to enable future research.

Health Information Technology Standards Panel

It should be noted that neither NTDB nor NEMSIS are Standards Development Organizations (SDOs) or a part of the American National Standards Institute (ANSI). Recently, however, the Health Information Technology Standards Panel (HITSP), a cooperative effort between private and public sector health organizations to harmonize the integration standards, has completed Version 2 of the IS 04 – Emergency Responder Electronic Health Record Interoperability (ER-EHR) Specification, which defines specific standards required to

track and provide needed information regarding care, treatment, or investigation of emergency incident victims to on-site emergency care professionals, medical examiner/fatality managers, and public health practitioners.

Health Level Seven, Inc.

The HITSP ER-EHR use cases further incorporate the Health Level Seven, Inc. (HL7) Continuity of Care Document (CCD) Clinical Summary, which is used to provide initial clinical information to the emergency responders and is used at each handoff of care to provide clinical information to the emergency care department, to provide definitive care, and for the transfer or final disposition of the episode of care. Additionally, NEMSIS is working toward full incorporation of its Version 3 into HL7 by 2011 (at which point NEMSIS will no longer exist, only EMS standards within HL7).

4. COTS Systems Evolution

The manner in which agencies are acquiring statewide registry systems has changed over the previous 10 years, shifting away from in-house, custom-developed, client/server solutions to vendor-provided, Internet-based systems (often referred to as Web-based COTS). Nearly 80 percent of those surveyed use a COTS system for their registries, and a few others are in the process of acquiring a COTS application. This shift in method is a result of the following factors:

- Allows agencies to deliver immediate functionality in a relative quick frame.
- Allows the use of modern technology to provide the application to mobile and sometimes remote locations.
- Allows agencies to quickly achieve national reporting standards.
- Allows agencies to incur the cost of the solution over several years.

Vendor applications can often be customized to meet the unique needs of the agency. In addition, customization allows the use of specific terms or language that may be unique to the state, while keeping data values that map back to national submission standards. In-house, custom-developed solutions appear less likely to be NEMSIS-compliant and often do not have the ability to provide federal reporting.

5. Registry System Attributes

There are a number of EMS and trauma registry systems available in the market today. In fact, there are 41 NEMSIS Gold Compliant and 40 NEMSIS Silver Compliant SW systems. However, many of these systems were cultivated at the local level and are limited to providing services at that level. Only a select few registry systems and vendors have the

capacity to meet the needs of State of Texas and its stakeholders. This subsection discusses the attributes of registry systems.

Basic Components

Registry systems have new levels of functionality that provide local organizations and users with not only the ability to collect and view information electronically, but they also enable the states to perform detailed trending analysis and federal reporting. Key components of all statewide registry system include the following:

- *Central Repository* – The central repository is the core component of the registry system. The central repository is made up of a database for storing all data received. Business rules such as role-based access and data security are typically captured and enforced here.
- *Information Exchange Engine* – Critical to making these systems work at the state level is the information exchange engine. This is the mechanism with which different applications can communicate to one another, providing the necessary protocols for mapping data from one system to another. Data standards are often reconciled here.
- *Web Portal/Field Application* – The Web portal/field application is a graphical user interface (often over the Internet) by which users can connect directly to the central repository to enter, update, and view registry data.
- *Report Engine* – The report engine is the component that enables users to create and display reports. Many report engines allow users to choose from a number of standard reports, as well as create ad hoc reports.

There are a number of additional modules and services that can be added to these four basic building blocks; these are further discussed in subsection VI.A – Registry Solution Components.

Data Dictionary Compliance

SW vendors in this market take an 11-step process to certify their systems under the NEMIS standard. Achieving NEMIS Gold and Silver Compliant status is a result of following the NHTSA Data Dictionary, which contains 424 data elements. For Silver Compliant, the SW must be tested and meet, at a minimum, the required 83 national data elements; to be Gold Compliant, the SW must be tested and meet all 424 data elements outlined in the latest version of the NHTSA Data Dictionary. Every state visited and interviewed indicated that their system was NEMIS Gold Compliant; however, it was required that additional state data elements be added to their registry systems.

For trauma, SW products target the NTDB data standard. While there is no formal compliance testing process for NTDB, in order for a system to participate at the national level, the SW must be able to implement the XML and XML Schema Definition (XSD) that accurately define and transfer the NTDS data set. Every state visited and interviewed indicated that their systems currently were, or that they were working toward becoming, compliant with NTDB standards.

System Integration and Interoperability

As SW products, EMS and trauma registries are very different applications and have different purposes. In all surveyed states, EMS and trauma registries were kept separate. This can be attributed to the different data requirements for each registry. While state registries have overlapping data requirements and clear integration points, no single system exists in the market for both EMS and trauma registries. Keeping these registries in separate databases is advised and should be considered as a best practice; however, these registries should also have integration points. In selected cases across the nation, only four states (Alaska, Missouri, Nebraska, and North Carolina), or 15 percent of those surveyed, have a successful track record with separate, but truly integrated EMS and trauma registries. Achieving this type of integration has provided clear operational efficiencies and participation advantages in these states.

Just as important as integration between EMS and trauma registries is the connection between disparate third-party EMS and trauma systems to the statewide registry or the concept of systems interoperability. This is especially true in a state like Texas, where there are very large stakeholder entities and regions that have invested time and money into their own SW system. Systems interoperability allows these stakeholders with large services and facilities to continue using their own system, while “in the background,” data is seamlessly uploaded to the statewide registry system. Systems interoperability provides all stakeholders with the flexibility to do what is right for their organization, and as a result, the state achieves greater participation and buy-in to the submission of data. Adversely, systems interoperability tends to be a large implementation risk as communication between SW vendors is often an issue; but if it is managed closely, it is well worth the effort and added requirements.

System Operations

Operationally, there are several different strategies used to administer a COTS registry system. These strategies provided the states with varying levels of responsibility, control, cost, and risk. Most common among states surveyed are:

- *Traditional Operations* – In this strategy, states purchase SW, and SW maintenance, from a qualified vendor, then deploy and host all system components on state servers. As a result, the state is responsible for system performance and uptime; this

requires a high level of responsibility for registry system support. However, this strategy does offer the state a fair amount of overall control.

- *Outsourced Operations* – Under this strategy, the state would outsource all system operations to the solution provider. In this model, the solution provider licenses and hosts an application for a fixed annual cost. This strategy is popular with peer organizations across the nation, as vendors stay competitive by offering flexibility, talented, responsive implementation and support staff, and high-quality systems with the “latest and greatest” reporting tools. These systems are often built on Web-based platforms and include tools that allow for quick installation and easy maintenance.

Both of the strategies above provide advantages and disadvantages; these will be considered within the Texas context in subsequent sections of this document.

6. Systems Acquisition

Vendors in this market appear to be very flexible in how they sell their systems. As a result, purchasing a COTS registry system can happen in several different ways. The most popular among peer states are two models: the capital purchase model, where the state pays for the entire system up front, and the payment plan model, where system costs are amortized over a period of time.

Capital Purchase Model

In a capital purchase model, the state would procure the nonexclusive rights to a registry system and all associated support and maintenance services. The state would assume a majority of the system life cycle cost during the first year ownership, with lower annual maintenance cost. Many of the state contracts are structured for this type of an agreement, as it can be considered a typical SW purchase; however, some modification may be need to take advantage of continue product growth and upgrades. Some implications associated with the model include:

- High initial outlay and lower annual operational cost.
- Nonexclusive, ownership rights to all source code of purchased SW.
- Reduced dependency on the SW vendor (but only with regard to SW, not services).

Payment Plan Model

In this model, the state would take the cost of a registry system and spread it over a period of time; a 5- or 10-year agreement is most often used. This type of agreement would lower the initial cost barrier and allow a state to get a system with less initial funding. However, a state adopting this approach will need to structure an appropriate contracting vehicle and

develop a consistent and reliable stream of funding for the amortization period. Because of the implementation cost, the first year will still be more expensive than subsequent years, but significantly less than with the capital purchase model. Some implications associated with the payment plan include:

- There is a lower initial outlay and a consistent annual cost.
- DSHS retains ownership after the agreement period and is then free to “walk away” from the vendor or contract for a lower maintenance agreement.
- The registry is dependent on recurring funding; there is a risk that funding may not be available in subsequent years.
- Many states have an issue with not actually owning the source code of the SW for a period of time.

Software as a Service Model

Software as a Service (SaaS) is a newer approach in this market for acquiring registry services. Basically, the vendor funds the start-up in order to gain a profitable residual on the back end, while the client organization obtains services with little to no monetary commitment up front. It can be considered a “pay as you go” plan, where an organization would set up an agreement with a vendor to provide all system and service components for a cost per transaction. Used in the right situation, both the vendor and the client organization win.

In the case of the EMS and trauma market, a state can enter an agreement with a vendor for a cost per record downloaded to the statewide registry. Transaction rates per record typically range from \$0.40 to \$0.95. Vendors will commonly set parameters or thresholds for minimum transactions per month. At these rates, SaaS only makes sense for local services with low volume that cannot afford a large initial outlay. Some implications associated with the SaaS model include:

- The SaaS provides a low barrier to entry but high cost for high volumes.
- The vendor maintains rights to the SW; the state has the flexibility to walk away from the system at any time.
- The registry is dependent on recurring funding; there is a risk that funding may not be available in subsequent years.
- Many states have an issue with not actually owning the SW source code.

These acquisition models are commonly used by other states to gain different advantages. For larger states, such as Texas, a capital purchase or payment plan model makes sense as the SaaS model is very costly with a high volume of transactions.

7. Historical Data Migration

When updating or changing technology systems, the migration of historical data is always an enormous concern, as there are often many unknown variables that can affect the overall success of implementation. While the actual transfer of data can be automated, the entire data migration process can be very labor-intensive. Planning, design, and verification activities are needed to ensure that translation of data between systems is done accurately. Data migration usually includes the following phases:

- Plan and design.
- Format and extract.
- Upload.
- Verify.

These phases are often repeated several times to identify and prevent any erroneous data loss during the process. Data cleansing is commonly performed between the format and extract phase and the upload phase to improve overall data quality and eliminate redundant data. However, data cleansing is often time-consuming and tedious.

In the EMS and trauma industry, organizations have very different views on data migration. Some states have opted not to migrate historical data, some approach it incrementally, and still others complete a full cleanse and transfer data before the new registry system is fully deployed. Of the states we interviewed and surveyed, Missouri had very poor data quality in its legacy system, and Minnesota had no previous legacy system; both chose not to migrate historical data. In so doing, these states saved a great deal of time and money for other areas of need. Limited access to legacy systems and query services can often minimize the effect of not migrating historical data.

Of those surveyed, several states have been successful in migrating historical data (Alaska, Georgia, Mississippi, and North Carolina). Common among these states' data migration efforts was the significant involvement of program and technical resources for planning, formatting, extraction, and cleansing.

Other states approach the monumental effort incrementally after having deployed their EMS and trauma registries. It has taken Nebraska nearly a year to plan and design data conversion and format and extract historical data for a single hospital. Oregon has some ongoing unresolved issues and obstacles that have delayed its data migration effort upward of a year. Aside from the risks and unseen project obstacles, data migration efforts vary greatly in terms of required scope, time frame, and cost. This is the result of several factors:

- Data quality.

- Existing database and file structure.
- Data volume.

Cost figures from other states and vendors varied greatly, from as low as \$25,000 to \$250,000 to unknown ongoing internal costs. Because of the considerable volume of Texas’s historical EMS and trauma data, these numbers may not make sense. We would expect that a significant data migration effort will be required for DSHS to transfer existing historical data. DSHS will need to provide detailed information about data, database schemes, and file structures to vendors for better estimates and then weigh its options for dealing with historical data.

8. Registry Systems Cost

As part of the state survey, we attempted to collect initial and annual costs for registry systems; however, states were not as forthcoming with this type of information as we had hoped. The table below outlines the cost information we did receive.

Table 12 – Other States’ Cost Information

State	Initial Outlay	Annual Cost
Colorado		
EMS Registry	Unknown	\$275,000 for Both
Trauma Registry	Unknown	Not Disclosed
Indiana		
EMS Registry	\$100,000	\$150,000
Trauma Registry	Not Disclosed	Not Disclosed
Kansas		
EMS Registry	\$485,000	\$89,000
Trauma Registry	Not Disclosed	Not Disclosed
Minnesota		
EMS Registry	Not Disclosed	\$200,000
Trauma Registry	Not Disclosed	Not Disclosed
Mississippi		
EMS Registry	\$340,000	\$24,000
Trauma Registry	Not Disclosed	Not Disclosed
Missouri		
EMS Registry	\$1,200,000	\$52,000

State	Initial Outlay	Annual Cost
Trauma Registry	Not Disclosed	\$52,000
North Carolina		
EMS Registry	\$500,000	\$900,000
Trauma Registry	Not Disclosed	\$150,000
Pennsylvania		
EMS Registry	Not Disclosed	Not Disclosed
Trauma Registry	\$60,000	\$250,000
Oregon		
EMS Registry	\$260,000	\$260,000 and 1 FTE
Trauma Registry	\$750,000	\$750,000 and 2 FTEs
Utah		
EMS Registry	\$450,000	\$69,000
Trauma Registry	Not Disclosed	\$100,000
Virginia		
EMS Registry	\$1,400,000	\$149,000
Trauma Registry	\$1,000,000	\$185,000
Wyoming		
EMS Registry	Not Disclosed	Not Disclosed
Trauma Registry	\$24,000	\$24,000

NOTE: The costs in the table above were provided by the states in a survey and should be considered estimates, as these numbers have not been validated.

As shown in the table above, the cost of these statewide registry systems varies greatly from state to state, largely because of the size of the state and overall data volume. However, several other key factors help determined the cost of the registry system; these include:

- Data volume.
- Number and size of facilities.
- Number of concurrent users.
- Scope of registry functionality (additional registries or modules).
- Level of support and help desk services.
- Amount of desired training.
- Hosting cost.

For the State of Texas, it would be more reasonable to review costs provided by selected vendors with these key factors accounted for. The table below contains “ballpark” cost estimates.

Table 13 – Registry Cost Estimates

Cost Category	Initial Outlay		Annual Recurring	
	Low	High	Low	High
A. EMS and Trauma SW	\$ 650,000.00 to \$ 1,250,000.00			
B. Implementation Cost	150,000.00 to 250,000.00			
C. Data Migration	75,000.00 to 250,000.00			
D. Training	35,000.00 to 65,000.00			
E. Hosting			\$ 85,000.00 to	\$ 350,000.00
F. Support and Help Desk			130,000.00 to	250,000.00
Estimated Cost Range	\$ 910,000.00 to \$ 1,815,000.00		\$ 215,000.00 to \$ 600,000.00	

NOTE: The amounts in the table above are approximate cost estimates from vendors with only general information regarding the Texas registry.

There are many factors that affect the overall cost of an EMS and trauma registry system; in addition, each cost category outlined in the table above has a number of variables. Below, we briefly describe each cost category and the high-level variables that were considered when drafting estimated cost numbers.

- A. *EMS and Trauma SW* – This cost category includes all SW associated with the EMS and trauma registries. This would include Web portal; exchange engine; reporting and data mining; and crash, stroke, SCI, TBI, submersion, and air medical functions.
- B. *Implementation Cost* – This cost category includes expenditures for setting up the system to operate within the DSHS environment. This includes technical infrastructure configuration, customization of additional data elements outside the NEMSIS NHTSA Version 2.2.1 data set and NTDB data dictionary Version 1.2.5, tailoring of reports, system fine-tuning, testing, and deployment.
- C. *Data Migration* – This includes cost for migrating historical data in TRAC-IT to the new system. However, very little information about data quality, database and file structure, and data volume was provided to the vendors when requesting cost numbers. Cost may vary greatly when scope of work and TRAC-IT details are provided.
- D. *Training* – Costs in this category include 30 training sessions throughout Texas to provide user and systems training.
- E. *Hosting* – This cost category includes cost for a vendor to host the entire technical infrastructure to support all registry components.

- F. *Support and Help Desk* – The figures in this cost category include varying degrees of user help desk, SW maintenance, and IT support.

Costs outlined here are approximate estimates based on information we received from several vendors. Vendors received very little information about Texas’s EMS and trauma program, so cost estimates may vary from actual bids to a Request for Proposal (RFP) with a well-defined scope of work, program and technical context, and proposed implementation strategy. It should be understood that there are many variables when factoring the overall cost of a registry system; until a formal RFP is released, these are “best guess” estimates.

9. Help Desk Support

An important component of a successful statewide registry is the utilization of a good help desk. A help desk provides assistance to both non-technical and technical users with system access, passwords, and troubleshooting issues and problems. Help desks often have several different levels of support; these include:

- *First Level* – This is considered the first contact, where a majority of the support needs are addressed. At this level, help desk resources are equipped to answer commonly asked questions and address rudimentary system issues, such as system access or how to run reports.
- *Second Level* – Issues that cannot be resolved at the first level of support are escalated and often require additional technical resources to address the problem.
- *Third Level* – This level of support is mainly for the state staff and deals with specific deficiencies or functional changes, often resulting in updates to the registry or source code.

States typically provide a help desk for all system users via a toll-free number or e-mail. Staffing these help desks can employ several different approaches. Commonly used approaches are outlined below.

- *Solution Provider Help Desk* – The state can pay a monthly fee for the SW vendor to assume all responsibility for the help desk. In this market, SW vendors have highly talented, technical resources with many years of EMS or trauma experience who understand business issues and have the knowledge to troubleshoot most system issues. These resources are often overqualified for the first level of support; although in lieu of hiring in-house staff, states can enter into a formal service level agreement and pay the premium for a fully covered help desk.
- *State Help Desk* – States can choose to provide first- and second-level help desk support with internal staff with very little vendor involvement. This approach is often

used by larger states with devoted program and IT resources available for support services. Resources are often responsible for providing support to a specific region of the state and are in constant contact with stakeholders.

- *Combination Help Desk* – Most states used a combination of state and vendor staff for their help desk. In this approach, states will act as the first level of help desk assistance, helping users with access, password, and functional-related questions. However, if issues extend beyond the capabilities of the state personnel, it will be escalated to the vendor. Additionally, in a combination help desk, the vendor is used to provide after-hours assistance.
- *Third-Party Help Desk* – Some states may choose an independent third party to provide help desk support; however, this type of support is limited to a more technical infrastructure and often will lack EMS and trauma program expertise.

As discussed above, a good help desk can make a real difference in the successful adoption of the statewide registry. Making it as easy as possible for stakeholders to use the registry system will increase overall acceptance.

VI. Registry Components and Recommended Requirements

VI. Registry Components and Recommended Requirements

The activities and results documented in the previous sections were key contributors to developing the registry component model and finalizing the recommended requirements.

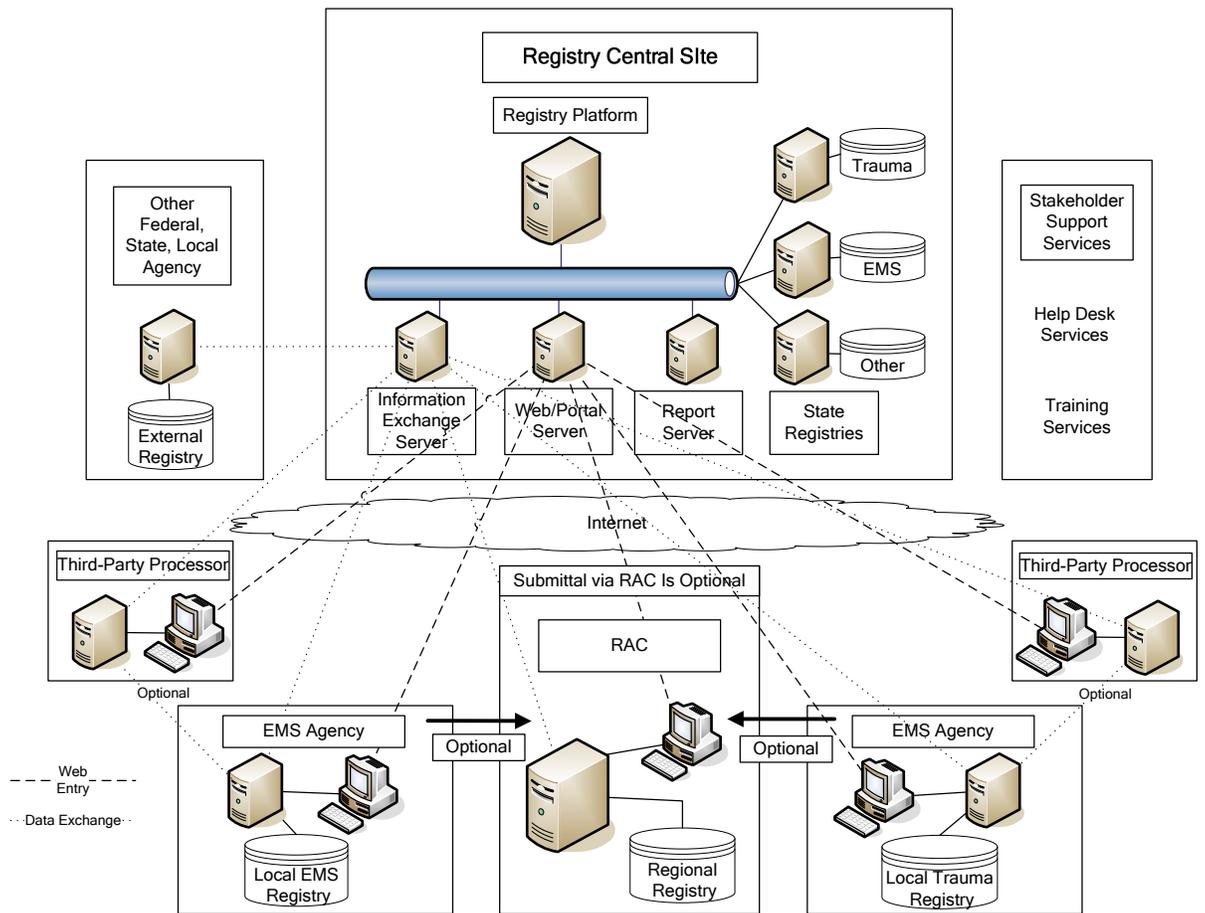
- *Registry Solution Components* – The conceptual registry solution components identified in this subsection are based primarily on the team’s assessment of the current registry, information gathered from the stakeholders, project meetings, and interviews with other states and product vendors.
- *Recommended Requirements* – Stakeholder requirements collected during the needs assessment provided the baseline for recommended requirements that were expanded with information gained from other states, vendor interviews and surveys, market trends, and basic best practices.

The registry components and recommended requirements are detailed below.

A. Registry Solution Components

The conceptual model developed for the new registry includes multiple logical and functional solution components, as illustrated in the following figure:

Figure 9 – New Registry Solution Components



The model is divided into the six major types of components, as outlined below. The solution components are identified and have been listed within their respective component type. These logical and functional components represent the basic building blocks for the new registry. In the ultimate design, multiple logical components will likely be implemented through common SW solutions and hosted on common physical HW systems.

- Registry Central Site Components
 - » Registry Platform
 - » State Registries (Trauma, EMS, Other)
 - » Report Server
 - » Web/Portal Server
 - » Information Exchange Server
- Stakeholder Support Services Components

- » Help Desk Services
- » Training Services
- EMS Agency Component
 - » Local EMS Registry
- Hospital Component
 - » Local Trauma Registry
- RAC Component
 - » Regional Registry
- Other Federal, State, and Local Agency Component
 - » External Registry

Each component of the conceptual model is described below.

1. Registry Central Site Components

Registry Platform

The central site provides the secure and reliable infrastructure and HW and operating system platforms required to support the overall solution.

State Registries (Trauma, EMS, Other)

The state registries will include multiple logical databases for trauma incidents, EMS incidents, and other specialties (submersion, cardiac, stroke, etc.). While the databases will share a common relational database management system and links between databases, trauma, EMS, and other specialties will be kept logically separate to enable distinct access controls for each database.

Report Server

The report server component provides report generation capabilities available for both central site and remote users. Central site users will have access to ad hoc reporting capabilities. Remote users will have access to reports on the report server and accessible through the Web/portal server.

Web/Portal Server

Web interfaces for submission of data to the registries, as well as reporting, will be provided by one or more Web applications running in a common Web application server framework.

Users will access all of the applications through a common Web/portal interface. The Web/portal server will also provide a separate public portal for external communications.

Information Exchange Server

The information exchange server component will provide three types of messaging capabilities:

- File upload capabilities to receive batch data submissions securely through data exchanges from local trauma and EMS providers and regional systems.
- Automated XML/Web service-based data exchanges from the state registries to and from local trauma and EMS providers and regional systems.
- Automated XML/Web service-based data exchanges from the state registries to other federal, state, and local agencies.

The information exchange server will be extensible to provide data in additional formats as needed in the future.

2. Stakeholder Support Services Components

Help Desk Services

A help desk services organization will provide response to and resolution of user issues.

Training Services

A training services organization will provide training to users of the registry services.

3. EMS Agency Component

Local EMS Registry

Many local EMS providers will have a local database of trauma incidents to support local reporting and submission to the state EMS registry.

4. Hospital Component

Local Trauma Registry

Many local trauma providers will have a local database of trauma incidents to support local reporting and submission to the state trauma registry.

5. RAC Component

Regional Registry

Some local trauma and EMS providers will use a common regional database of trauma incidents to support local and regional reporting and submission to the state trauma registry.

6. Other Federal, State, and Local Agency Component

External Registry

Other federal, state, and local agency components, including TBI and SCI registries, will receive data from the state registries for import into their own databases or worksheets.

* * * * *

A cross-reference of which requirements are addressed by these solution components is provided in APPENDIX D.

B. Recommended Requirements

The requirements identified and confirmed during the stakeholder needs assessment provide a comprehensive baseline for the future registry requirements. However, as a result of MTG's research of other states' registry solutions, consideration of commercial products available, investigation of market trends, and basic industry best practices, we have identified additional requirements to augment the stakeholder baseline. These functional and non-functional requirements are presented in the table below.

Table 14 – Best Practices Requirements

BEST PRACTICES REQUIREMENTS		
Category	Registry Component	Requirement Description
Integration	Information Exchange Server	The system should provide bidirectional data exchange interfaces that comply with Web service standards, including Simple Object Access Protocol (SOAP) and Web Services Description Language (WSDL). Compliance with the Web Services Interoperability (WS-I) Basic Profile 1.0 or higher is preferred.
Integration	Information Exchange Server	The system should provide bidirectional data exchange interfaces that comply with Web service security standards. Compliance with the Web Services Security (WS-Security) specification 1.0 or higher is preferred.
Reporting	Report Server	The report server must interface with the Web/portal server to generate common reports as requested by Web users.
Security	Web/Portal Server	The registry applications on the Web/portal server must be developed in modern, market-leading software development framework (e.g., Java 2 Platform, Enterprise Edition [J2EE], Microsoft.NET).
Security	Web/Portal Server	The Web/portal server must include a modern, market-leading Web application server (e.g., Oracle, IBM WebSphere, IIS/ ASP.NET).
Security	Web/Portal Server	The portal must support single sign-on between registry applications/systems.
User Interface	Web/Portal Server	The Web/portal server must include portal server features, including the ability for users to access multiple registry applications/systems from a single Web page and support for a common look and feel across applications.
User Interface	Web/Portal Server	The Web/portal server must interface with the report server to publish pre-configured (canned) reports as requested by Web users.
Data Import/Export	State Registries	The registries must be hosted on a modern, market-leading relational database management system with a complete set of supporting tools for database administration independent of the registry applications (e.g., Oracle, Microsoft SQL Server, IBM DB2).
Data Import/Export	FTP Server	The FTP server must support the automatic validation of received data submissions and loading of the submissions into the appropriate registries.
Support	Help Desk Services	The help desk should provide resolution of most issues within 4 business hours after notification.

Combining the stakeholder baseline and these additional requirements provides a comprehensive list of functional and non-functional requirements that meet the documented needs of the stakeholders as well as the goals and objectives established for the TRISA Project. The complete set of recommended requirements is presented in APPENDIX D. The table specifies the group that identified the requirement and references the specific solution component that is intended to address the requirement.

VII. Recommended Registry Alternatives

VII. Recommended Registry Alternatives

The purpose of this section is to identify the most feasible alternatives to be considered for a new EMS and trauma registry. It is anticipated that the alternatives will include a blend of product, operational, and acquisition solutions. We will use a three-step process to identify the candidate solutions for the new registry.

- *Identify Possible Registry Solutions* – This initial step basically combines a high-level brainstorming session and ideas presented to the project team during the process of identifying practical solution options without constraints of strategic direction or defined needs that may limit ideas.
- *Consider Strategy and Needs* – In this step, the overall strategy, stakeholder needs, and direction for the registry are considered. Key decisions that have been communicated and needs expressed are identified to eliminate possible solutions from consideration.
- *Determine Candidate Solution Alternatives* – The final step is to outline the alternatives that support the strategic direction and needs of the community and select recommended alternatives for detailed consideration and evaluation.

The results of the selection process are documented below.

A. Possible Registry Solution Considerations

To achieve the DSHS vision for an EMS and trauma registry system, a number of different options may be considered. Based on our review and analysis of other state systems and vendor products, we have identified six major alternatives for consideration. Additionally, optional implementation, acquisition, or operational approaches have been identified. These alternatives and approaches include the following:

- Build EMS and trauma solution.
 - » Develop in-house.
 - » Hire third-party vendor to develop.
- Buy integrated COTS solution.
 - » DSHS purchases and hosts system HW.
 - » DSHS purchases solution, outsources operations.
 - » DSHS outsources SaaS.
- Buy best-of-breed COTS solution.
 - » DSHS purchases and hosts system HW.

- » DSHS purchases solution, outsources operations.
- » DSHS outsources SaaS.
- Transfer existing custom system.
 - » CDC's Registry Plus.
 - » Other states' registries.
- Incrementally update TRAC-IT.
 - » Develop in-house.
 - » Contract with vendor to update TRAC-IT components.
- Do nothing.
 - » Maintain TRAC-IT.

The evaluation and assessment of these alternatives and respective approaches are addressed in subsections that follow.

B. Strategic Direction and Needs

To support assessment of the high-level solution options developed for consideration, evaluation criteria were established. Criteria development was guided by:

- Goals and objectives set for the TRISA Project.
- Stakeholder input obtained during the needs assessment.
- Interviews and discussions with DSHS management and staff.
- DSHS communications to stakeholders.
- Other feedback and best practices information obtained during the project.

As a result, six key decisions and needs have been established as the evaluation criteria for selecting the best alternatives for detailed evaluation. Each key criterion is identified in the table below, along with an explanation regarding the basis for the criterion's selection.

Table 15 – Evaluation Criteria

Key Evaluation Criteria	Basis for Criteria
COTS Product	Stakeholders provided a clear message that they wanted a tested commercial product, not a custom-developed solution. Stakeholders apparently expressed their desire to obtain a COTS solution prior to TRAC-IT, but the decision was made to develop a custom solution. The history of poor performance related to TRAC-IT strengthens the stakeholders' argument.
Outsourced Solution	Outsourcing the registry operations to a third party is another stakeholder requirement. Stakeholders believe DSHS has demonstrated that it does not have the resources or capability to operate the registry.
Standards-Based	EMS and hospital stakeholders expressed the requirement for an industry standards-based solution. A common concern involved the need for a data dictionary based on the NEMIS Gold and NTDB standards.
Proven and Reliable	Stakeholders noted reliability issues many times due to the lack of success with TRAC-IT.
EMS and Hospital Linkage	Linkage between EMS and hospital stakeholders is critical to reducing redundant data submittal, improving data accuracy, and enabling tracking of patient outcomes.
Local Registry Compatibility	Stakeholders and RACs should have the ability to use their existing SW to seamlessly interface with the DSHS system. Smaller entities should have the options to use the state system in place of a third-party vendor solution.

It is important to note that these evaluation criteria will be considered in the high-level selection of solution alternatives and approaches. While they may drive the assessment of the overall solution direction, they are not meant to reflect a relative priority or replace any of the requirements developed for the solution. In fact, any selected alternative will be expected to satisfy all requirements developed.

An objective evaluation using these criteria is performed in the next step to select the alternatives recommended for detailed evaluation.

C. Recommended Alternatives

A high-level evaluation was performed to assess each alternative's overall compliance with the criteria. The possible solution alternatives were assigned a rating based on their compliance with the established criteria. To keep the ratings simple and as objective as possible, we considered the following three-score process:

- Yes (Y) – This rating was assigned if the alternative obviously met the criterion or could meet it with little or no risk.
- Partial (P) – This rating was assigned if the alternative did not currently meet all aspects of the criterion but could meet most or all aspects with little or no risk.
- No (N) – This rating was assigned if the alternative clearly did not meet the criterion.

The table below presents the results of the high-level evaluation.

Table 16 – High-Level Alternatives Analysis

Consideration	COTS Product	Outsourced Solution	Standards-Based	Proven and Reliable	Registry Linkage	Registry- Compatible
Build EMS and Trauma Solution						
– Develop In-House	N	N	Y	N	Y	Y
– Hire Third-Party Vendor to Develop	N	Y	Y	N	Y	Y
Buy Integrated COTS Solution						
– DSHS Purchases and Hosts System HW	Y	P	Y	P	Y	Y
– DSHS Purchases Solution, Outsources Operations	Y	Y	Y	Y	Y	Y
– DSHS Outsources SaaS	Y	Y	Y	Y	Y	Y
Buy Best-of-Breed COTS Solution						
– DSHS Purchases and Hosts System HW	Y	P	Y	P	Y	Y
– DSHS Purchases Solution, Outsources Operations	Y	Y	Y	P	Y	Y
– DSHS Outsources SaaS	Y	Y	Y	P	Y	Y
Transfer Existing Custom System						
– CDC’s Registry Plus	N	P	P	Y	P	P
– Other States’ Registries	N	P	P	Y	P	P
Incrementally Update TRAC-IT						
– Develop In-House	N	N	P	N	P	Y
– Contract With Vendor to Update TRAC-IT Components	N	N	P	N	P	Y
Do Nothing						
– Maintain TRAC-IT	N	N	N	N	N	Y

Rating Legend	
Yes	Y
Partial	P
No	N

The evaluation results show that the two alternatives associated with a COTS solution and outsourcing are clear leaders. The following discussion addresses each alternative with respect to its compliance with the criteria:

1. Build EMS and Trauma Solution

The major issue with in-house development or hiring a third-party vendor to develop a custom solution is that it does not support the requirement for a COTS product. Additionally, a custom system cannot be considered proven and reliable, especially considering the past issues with TRAC-IT. The opportunity to outsource a third-party, custom-developed system may exist, but this alternative still failed in at least two of the major criteria.

2. Buy Integrated COTS Solution

The integrated COTS solution rated high in all areas when the approach considered complete outsourcing. The approach that involved DSHS hosting the system HW rated outsourcing and proven and reliable as being only partially satisfied.

3. Buy Best-of-Breed COTS Solution

The best-of-breed COTS solution rated mostly high in all areas when the approach considered complete outsourcing. Similar to the integrated COTS alternative, the approach that involved DSHS hosting the system HW rated outsourcing as being only partially satisfied. However, proven and reliable was rated only partial in all cases because of the potential issues associated with dissimilar solutions and multiple vendors.

4. Transfer Existing Custom System

Transferring an existing system that is proven and reliable could prove to be a viable alternative. However, it was assumed that it could not be a COTS solution or it would be purchased directly from the vendor. The other criteria were considered to be only partially met due to the lack of specific information.

5. Incrementally Update TRAC-IT

Attempting to upgrade the current TRAC-IT registry to satisfy the new requirements failed the criteria related to COTS, outsourcing, and proven and reliable. For these reasons, this is not a viable alternative solution.

6. Do Nothing

Maintaining the status quo is always a consideration; however, it is obviously not an acceptable alternative given the stakeholder needs and strategic direction of DSHS.

* * * * *

Based on this assessment, we recommend the alternatives to procure an integrated COTS solution or best-of-breed COTS solution for further evaluation. Additionally, optional implementation, acquisition, or operational approaches should be explored in the alternatives analysis.

VIII. Registry Alternatives Analysis

VIII. Registry Alternatives Analysis

This section of the document presents an evaluation of the two alternatives for updating Texas's EMS and trauma registry; addresses key decisions; and, in the end, recommends the best approach. Also presented is a cost-benefit analysis (CBA) that identifies the estimated onetime and recurring costs associated with each viable approach.

A. Approach

When looking to acquire a COTS solution, organizations must select a product(s) that aligns with the overall strategy, maximizes business outcomes, and improves customer service while minimizing impact to daily operations, risk, cost, and implementation time. As a result of the high-level analysis of the conceptual solutions and products being offered in this market, we will focus our detailed alternatives analysis on two solution types.

- *Integrated EMS and Trauma Solution* – In this case, a single vendor is selected to provide a solution, including the trauma and EMS registries and all supporting components and services.
- *Best-of-Breed Solution* – This solution would include the procurement of separate registries based on the best solution for the specific application, and a central host would integrate the applications.

Acquiring a solution in this market is not as simple as making the decision between an integrated EMS and trauma solution or best-of-breed solution; several major decisions need to be accounted for when determining the best approach for Texas. After the evaluation of the two leading viable alternatives, we will analyze the following decision points:

- Operations strategy.
 - » *Outsource Versus Traditional Operations* – These options consider the decision to outsource or use a combination of outsourced and in-house support for key system components. Each option impacts cost for SW, SW maintenance, help desk support and training, and HW and server maintenance.
- Systems acquisition model.
 - » *Capital Purchase Versus Payment Plan Versus SaaS* – Texas can purchase the nonexclusive rights to a system up front, defer a high initial cost and amortize it over a 5-year period, or enter a true SaaS agreement. Overall, this decision affects how system life cycle cost is funded.
- Procurement approach.
 - » *Single Procurement Versus Multiple Procurements* – Administering one procurement process can result in an RFP that requests a single vendor with an

integrated solution or allows vendors to bid on all or any components of the RFP (primarily EMS and trauma). DSHS may also run two separate procurement processes to acquire an EMS and a trauma registry independent of one another.

As for the integrated EMS and trauma solution and best-of-breed alternatives, there are relative strengths and weaknesses within the Texas context. MTG used a structured evaluation model to assess these viable solution types.

1. Evaluation Criteria

This subsection presents the evaluation model and associated rating and scoring methodology. The evaluation model is divided into the eight categories below, each composed of a number of subcategories.

Table 17 – Selected Evaluation Criteria

ID	Description
A	<i>Desirable Business Impact</i> – Since any system implementation will require changes to the program, this category assesses whether the changes will be desirable or beneficial to the EMS and trauma program and stakeholder operations in terms of process and data flow.
B	<i>IT Operational Impact</i> – This category explores the technical resources and support requirements associated with operating the alternative technology environment.
C	<i>Technology Environment</i> – This category addresses the anticipated life span of the technology, the currency of the technology solution, the variety of technologies employed, the impact on technology infrastructure, and the flexibility and adaptability of the solution.
D	<i>Time to Complete</i> – This category explores the time commitment required for change and realized benefits and the ability to spend allocated funds within the designated time frame.
E	<i>Functionality</i> – This category addresses the alternative’s ability to meet stakeholders’ functional needs.
F	<i>Cost</i> – This category identifies the cost to implement and maintain the alternative system.
G	<i>Realized Benefits</i> – This category evaluates both the tangible and intangible benefits of the solution.
H	<i>Project Resource Impact</i> – This category assesses the impact that the alternative will have on DSHS program and IT resources as systems are developed and implemented.

2. Scoring and Weight

For the purpose of this analysis, the eight categories are roughly equal in importance so that, utilizing a scoring system where the total number of points is 240, each area receives 30 points, with the points being equally distributed among subcategories. The table below demonstrates the distribution of total points among areas and subcategories.

Table 18 – Selected Scoring Weight

Category/Subcategory	Category Weight	Subcategory Weight
A. Desirable Business Operational Impact	30	
A.1 Impact on EMS and Trauma Stakeholders		15
A.2 Operational Impact on DSHS		15
B. IT Operational Impact	30	
B.1 Staffing Impact		15
B.2 Application Support		15
C. Technology Environment	30	
C.1 Long-Term Viability		15
C.3 Impact on Existing Technical Environment		15
D. Time to Complete	30	
D.1 Length of Time		15
D.2 Funding Timeline		15
E. Functionality	30	
E.1 Ability to Meet Requirements		15
E.2 System Tools		15
F. Cost	30	
F.1 Cost to Implement		15
F.2 Cost to Operate		15
G. Realized Benefits	30	
G.1 Tangible Benefits		15
G.2 Intangible Benefits		15
H. Project Resource Impact	<u>30</u>	
H.1 DSHS and IT Resource Requirements		15
H.2 Impact on Stakeholders		<u>15</u>
Total Weighting for Each Alternative	240	240

B. COTS Advantages

As indicated in Section VI, the considerations relative to buying a COTS solution are the most viable alternatives. However, before evaluating the differences between the two COTS options, we should outline the distinct benefits of opting for a COTS solution. They include:

- *Provide a Cost-Effective Way to Achieve Desired Functionality* – Products offered in the market provide all of the necessary functionality to support EMS and trauma programs. Vendors invest tens of thousands of man-hours in their systems and constant improvement of products to stay competitive. In addition, these products are already configured to meet federal standards and are easily customizable to meet Texas legislative obligations.
- *COTS Vendors and Systems Provide Best Practices* – Vendors keep their products current with changing market conditions. They hire the best and brightest in the EMS and trauma industry to ensure their products are well built and make sense for practitioners within the industry. Organizations can reengineer the business processes around new application SW, resulting in more efficient operations.
- *COTS Vendors Have Streamlined Implementation Paths* – It is in the vendors' best interest to implement their systems with precision and quickness. They have knowledgeable implementation teams that understand the products and have experience installing the applications across the nation. Many vendors have framework-based implementation architectures that allow for a structured and predictable definition of business rules.
- *COTS Vendors Provide Ongoing Application Support* – Vendors offer warranty support for their applications. This covers the major functionality of the systems and provides a significant service to supplement the regular operational maintenance of the applications. Vendors take responsibility for fixing major problems using knowledgeable staff familiar with the applications. This would reduce the pressure on existing DSHS IT staff to make system changes.
- *Increased System Flexibility* – A new, modern system will increase the flexibility of adding registries or changing existing processes without having to make major SW changes.
- *Minimize Risk* – DSHS can leverage a vendor's skills to deploy the application and reduce overall project risk.

These characteristics set the overall tone and management direction for updating the Texas EMS and trauma registry. MTG used a structured evaluation model to assess two buy options.

C. Alternatives Comparison

The analysis focused on two alternatives for implementing a statewide EMS and trauma registry solution. There are positive and negative aspects of both alternatives. The alternatives are as follows:

- *Alternative 1 – Integrated EMS and Trauma Solution.* In this alternative, Texas would select a single qualified vendor to provide an integrated EMS and trauma solution.
- *Alternative 2 – Best-of-Breed Solution.* In this alternative, Texas would orchestrate the acquisition of separate EMS and trauma registries.

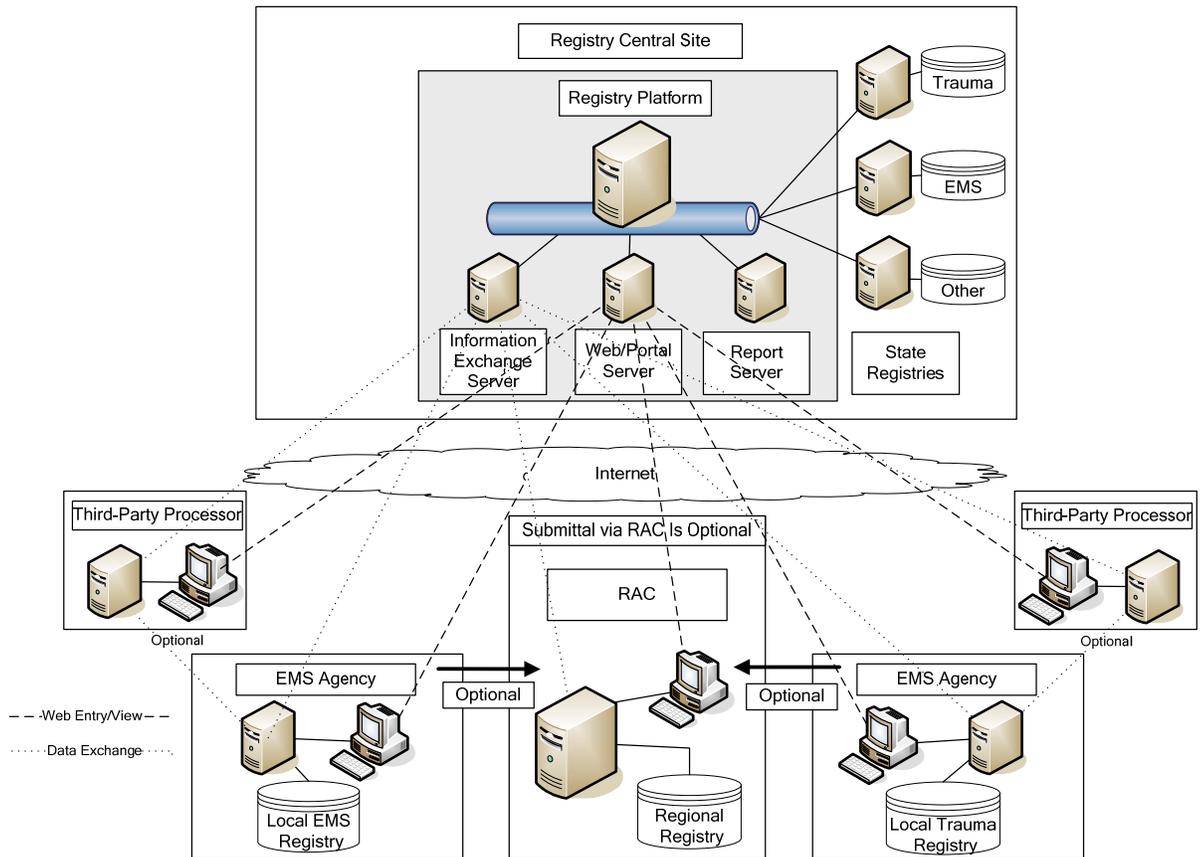
Traditionally, the best-of-breed option provides richer functionality, thereby satisfying more users. However, the cost savings, convenience, and efficient data sharing can make the integrated EMS and trauma approach very appealing. Below we provide a brief description, evaluation, benefits, and implications of each alternative.

Alternative 1 – Integrated EMS and Trauma Solution

In this alternative, Texas would enter a formal procurement process to acquire the services of a single qualified solutions vendor to provide all system and service components. The solutions provider would assume all responsibility for providing a fully integrated EMS and trauma solution. To do so, the solutions provider would take Texas DSHS through a full implementation life cycle, which includes requirements validation, system configuration, testing, system deployment, and user training. This type of effort will require a high level of involvement on the part of DSHS program and technical staff and well-structured management oversight to ensure project outcomes are satisfactorily realized.

Figure 10 provides a high-level depiction of what an integrated EMS and trauma solution would look like within Texas.

**Figure 10 – Alternative 1 – Integrated EMS and Trauma Solution
Conceptual Model**



Evaluation

EXHIBIT II contains an evaluation of this alternative using the criteria outlined earlier.

Overall, this alternative appears to provide DSHS with an edge, as the integrated EMS and trauma solution offers desired tools for meeting business needs, with minimal disruption to program operations. Because the vendor is responsible for EMS and trauma integration, it minimizes DSHS's overall project risk and project complexity. This alternative is also aligned with DSHS's strategic direction and desired outcomes. Benefits and implications for this alternative are outlined below.

Benefits

- *Reduced Project Complexity* – By administering one project for both EMS and trauma registries with a single-vendor methodology and application framework, DSHS can dramatically reduce project complexity. While there are a lot of interdependency activities within a single project, it is always easier to manage these con-

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
ALTERNATIVE 1 – INTEGRATED EMS AND TRAUMA SOLUTION

Evaluation Categories	Rating	Score	Weight	Weighted Score	Explanation
A. Desirable Business Operational Impact					
A.1 Impact on EMS and Trauma Stakeholders	1 2 3 4 5	4	15	60	<ul style="list-style-type: none"> - Provides stakeholders a single point of reference for both registry systems. - Minimizes system profiles and login credentials mandated for stakeholders requiring both EMS and trauma registry access. - Requires possible compromise on registry functionality, due to stakeholders' integration emphasis.
A.2 Operational Impact on DSHS	1 2 3 4 5	4	15	60	<ul style="list-style-type: none"> - Provides consistent vendor personnel and single process for EMS and trauma staff managing both EMS and trauma registries. - Offers the State of Texas the expertise of a single solution vendor in successfully integrating and linking different vendor applications to the state registry.
<i>Desirable Business Operational Impact Total</i>			30	120	
B. IT Operational Impact					
B.1 Staffing Impact	1 2 3 4 5	4	15	60	Requires IT staff to work with only one vendor for both EMS and trauma registries.
B.2 Application Support	1 2 3 4 5	5	15	75	Minimizes software and hardware support, help desk, and training operations with one system to support.
<i>IT Operational Impact Total</i>			30	135	
C. Technology Environment					
C.1 Long-Term Viability	1 2 3 4 5	5	15	75	<ul style="list-style-type: none"> - Offers integrated solutions by vendors who use modern and repeatable methodologies for developing EMS and trauma registries. - Requires DSHS to set up only one agreement to ensure software stays up to date and uses the latest industry standards.
C.3 Impact on Existing Technical Environment	1 2 3 4 5	4	15	60	<ul style="list-style-type: none"> - Reduces complexity of multiple trauma registries to one system. Integration solutions have the capability to seamlessly connect with existing software systems. - Affords large stakeholders with different software the opportunity to migrate to the state solution or integrate for a single system for both EMS and trauma.
<i>Technology Environment Total</i>			30	135	
D. Time to Complete					
D.1 Length of Time	1 2 3 4 5	4	15	60	Presents the opportunity for a relatively short deployment period. Vendors with an integrated solutions can quickly tailor and deploy a system in 10 to 18 months.
D.2 Funding Timeline	1 2 3 4 5	4	15	60	Allows Texas to work contact and schedule details with a single vendor, although payment models can vary with an integrated solution.
<i>Time to Complete Total</i>			30	120	

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
ALTERNATIVE 1 – INTEGRATED EMS AND TRAUMA SOLUTION

Evaluation Categories	Rating	Score	Weight	Weighted Score	Explanation
E. Functionality					
E.1 Ability to Meet Stakeholder Requirements	1 2 3 4 5	3	15	45	<ul style="list-style-type: none"> - Reduces redundant data entry by allowing a user to preview EMS data and transfer only relevant fields to the Trauma registry. - The solutions has the option to support submission and storage of data for Crash, Stroke, Cardiac, TBI, SCI, and Submersion. - Offers better reporting and trending analysis by affording stakeholders the ability to conduct analysis across pre- and posthospital care information.
E.2 System Tools	1 2 3 4 5	5	15	75	Presents a single set of system tools that manage all system policies, rules, and permissions.
<i>Functionality Total</i>			30	120	
F. Cost					
F.1 Cost to Implement	1 2 3 4 5	3	15	45	<ul style="list-style-type: none"> - Produces cost savings when implementing one integrated solution (onetime costs for project activities, such as UAT, training, deployment). - Implementing an integrated system is larger, and vendors may build in a higher cost buffer to compensate.
F.2 Cost to Operate	1 2 3 4 5	4	15	60	<ul style="list-style-type: none"> - Costs less to operate a single server environment than multiple environments. - Offers probability of same tools and ancillary software as opposed to a several different kinds of software (e.g., Database vendor).
<i>Cost Total</i>			30	105	
G. Realized Benefits					
G.1 Tangible Benefits	1 2 3 4 5	5	15	75	<ul style="list-style-type: none"> - Requires reliance on only one vendor to provide complete integration between EMS and trauma registries. - Leverages single solutions providers' expertise and other states' EMS and trauma best practices.
G.2 Intangible Benefits	1 2 3 4 5	4	15	60	<ul style="list-style-type: none"> - Achieves stakeholders' desired outcomes, resulting in higher participation. - Increases the state's ability to provide better service to stakeholders.
<i>Realized Benefits Total</i>			30	135	
H. Project Resource Impact					
H.1 DSHS and IT Resource Requirements	1 2 3 4 5	4	15	60	<ul style="list-style-type: none"> - Results in only one implementation project to manage. - Minimizes the dependence on third parties to integrate solutions as one vendor is held responsible.
H.2 Impact on Stakeholders	1 2 3 4 5	4	15	60	Reduces stakeholder disruptions with one integrated solution.
<i>Project Resource Impact Total</i>			30	120	
TOTAL WEIGHTING			<u>240</u>		
TOTAL ALTERNATIVE SCORE				990	

straints within the boundaries of one project, as opposed to managing them across multiple projects.

- *Vendor Accountability* – DSHS will have the leverage to hold one vendor accountable for both registries. This is important because of the integration aspects of the registries. Integration of two different vendor systems would add another layer of complexity, and complexity results in greater risk.
- *System Registry Manageability* – DSHS/IT operations will need to learn to manage only one set of system tools for both registries. This can also mean fewer support staff, less training, and reduced technology investments/liabilities.
- *One Procurement and One Contract* – DSHS/IT would only need to administer one procurement process and one contract agreement with a single vendor. From RFP development to award of apparent successor, a formal state procurement process for a line-of-business system averages 4 to 6 months, with an additional 1 to 2 months, at minimum, for contract negotiation.
- *Project Timeline* – This alternative affords DSHS the most expedient way to implement an integrated EMS and trauma registry system that meets its DSHS and stakeholder needs. Solution providers have the capacity to ramp up repeatable processes and infrastructure to configure and implement of registry systems.
- *Streamlined Interoperability With Statewide EMS and Trauma Registries* – Texas can rely on a single solutions provider to offer expertise on integrating and linking different vendor applications to the statewide registries. Communication between multiple vendors serving local services and the state registry is hard enough; adding a second statewide registry can complicate things and would be more labor-intensive.
- *Integrated Registry That Can Result in Cost Savings* – Establishing and operating a single technical environment with one set of ancillary SW (e.g., one database suite as opposed to multiple database suites for two different registries) and system tools reduces implementation and operations cost.

Implications

- *Limits on Potential Solution Providers* – Only a handful of vendors provide both EMS and trauma registry applications. Additionally, only two vendors would have the capacity to handle a project of this scale.
- *System Compromise* – Going with a single vendor to provide both EMS and trauma registry systems may result in a compromise of one registry. Vendors in this market may have a leading product in either the EMS or trauma segment; however, no one vendor provides a superior product in both segments. Stakeholders may be affected by receiving a system that is not known to be the industry leader.

- *High Level of Dependence on One Vendor's Staff to Provide All Support Services –* DSHS becomes heavily reliant upon one vendor to provide both EMS and trauma registries. Problems with the vendor can cause issues for both registry systems as opposed to just one.

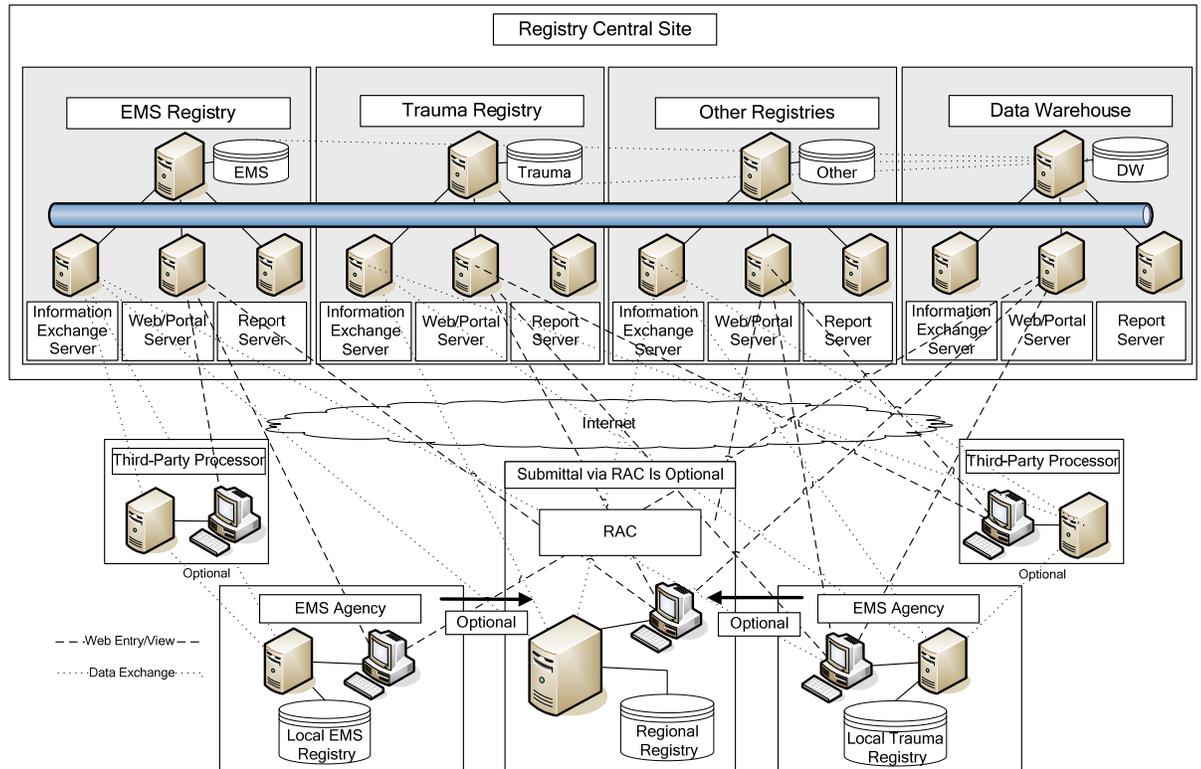
Alternative 2 – Best-of-Breed Solution

In this alternative, Texas would orchestrate the acquisition of separate EMS and trauma registries. By taking a best-of-breed approach, Texas could acquire the best-fit EMS and trauma registries separately and not be limited by a single vendor. Vendors within the emergency data system COTS market have different strengths and weaknesses when it comes to EMS and trauma product and service offerings. No one vendor provides a superior product in both the EMS and trauma registry segments. This approach would allow for separate formal evaluation of each product and how well each fits the needs of DSHS.

While getting the best-fit, leading application to meet desired needs, a traditional obstacle of this type of solution is the integration with other SW. In this alternative, DSHS/IT operations or a systems integrator would be required to lead the integration effort of the EMS and trauma registries. Using a third party unfamiliar with these systems can be risky for this type of project, especially when success may be measured by the seamless integration of these two registries.

Figure 11 provides a high-level depiction of what a best-of-breed solution would look like within Texas.

**Figure 11 – Alternative 2 – Best-of-Breed Solution
Conceptual Model**



Evaluation

EXHIBIT III contains an evaluation of this alternative using the criteria outlined earlier. This alternative provides DSHS with the best solution for each registry; however, leading the integration effort would be an issue. Benefits and implications for this alternative are outlined below.

Benefits

- *Stakeholders Receive the Best SW Product for Their Respective Registries* – There is no single vendor that provides the best-of-breed EMS and trauma registries, as there are often trade-offs. In the best-of-breed alternative, DSHS will be able to acquire the individual registry systems from two separate vendors that best meet the needs of stakeholders.
- *Leverage Multiple Vendor Perspectives* – DSHS will be able to leverage multiple vendors' expertise for EMS and trauma best practices. Implementation of a new technology system is always an opportunity to realize process and work flow changes. DSHS and stakeholders can evaluate industry best practices and implement those that make sense for their environment. Having multiple vendor relationships allows DSHS to obtain varied perspectives.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
ALTERNATIVE 2 – BEST-OF-BREED SOLUTION

Evaluation Categories	Rating	Score	Weight	Weighted Score	Explanation
A. Desirable Business Operational Impact					
A.1 Impact on EMS and Trauma Stakeholders	1 2 3 4 5	4	15	60	<ul style="list-style-type: none"> - Provides stakeholders with the best applications for their registries. The compromises needed for a single integrated system are not required. - Offers two different systems for those needing to access to both EMS and trauma registries for information.
A.2 Operational Impact on DSHS	1 2 3 4 5	3	15	45	Requires DSHS to manage two different applications for EMS and trauma registries.
<i>Desirable Business Operational Impact Total</i>			30	105	
B. IT Operational Impact					
B.1 Staffing Impact	1 2 3 4 5	2	15	30	Presents the possibility that DSHS/IT operations may need to acquire additional staff to maintain and support two separate systems.
B.2 Application Support	1 2 3 4 5	2	15	30	<ul style="list-style-type: none"> - Requires DSHS to support two different applications. - Obligates DSHS/IT operations to be responsible for coordinating integration and interoperability of multiple applications.
<i>IT Operational Impact Total</i>			30	60	
C. Technology Environment					
C.1 Long-Term Viability	1 2 3 4 5	5	15	75	<ul style="list-style-type: none"> - Offers vendors' modern and repeatable methodologies for developing EMS and trauma registries. - Requires DSHS to set up multiple relationships and agreements to ensure software stays up to date and uses the latest industry standards.
C.3 Impact on Existing Technical Environment	1 2 3 4 5	3	15	45	Obliges IT operations to acquire hardware and prepare infrastructure to multiple systems.
<i>Technology Environment Total</i>			30	120	
D. Time to Complete					
D.1 Length of Time	1 2 3 4 5	3	15	45	Requires more time as implementing multiple systems takes longer than an integrated system. A project planning consideration is the timing of multiple projects. Simultaneous projects require more project staff, and the projects will have high dependencies between them, which increase project complexity and risk.
D.2 Funding Timeline	1 2 3 4 5	4	15	60	Necessitates that DSHS coordinate with multiple vendors with different contracts.
<i>Time to Complete Total</i>			30	105	

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
ALTERNATIVE 2 – BEST-OF-BREED SOLUTION

Evaluation Categories	Rating	Score	Weight	Weighted Score	Explanation
E. Functionality					
E.1 Ability to Meet Stakeholder Requirements	1 2 3 4 5	5	15	75	- Provides stakeholders with the best solution for their registry needs. No compromises made because of the need to integrate two registries. - The solutions has the option to support submission and storage of data for Crash, Stroke, Cardiac, TBI, SCI, and Submersion.
E.2 System Tools	1 2 3 4 5	4	15	60	Offers the possibility of different products from different vendors; thus, system tools will vary.
<i>Functionality Total</i>			30	135	
F. Cost					
F.1 Cost to Implement	1 2 3 4 5	3	15	45	- Likely results in a higher cost as the cost of implementing of multiple systems tends to be higher. - Presents the possibility of DSHS running two separate, but linked, projects. This may result in two different teams or a longer implementation period.
F.2 Cost to Operate	1 2 3 4 5	3	15	45	Probably results in a higher operation cost than an integrated system.
<i>Cost Total</i>			30	90	
G. Realized Benefits					
G.1 Tangible Benefits	1 2 3 4 5	3	15	45	Leverages multiple vendor expertise and other states' EMS and trauma best practices.
G.2 Intangible Benefits	1 2 3 4 5	3	15	45	Achieves stakeholders' desired outcomes, which should result in higher registry participation.
<i>Realized Benefits Total</i>			30	90	
H. Project Resource Impact					
H.1 DSHS and IT Resource Requirements	1 2 3 4 5	1	15	15	Requires that DSHS/IT lead or acquire the services of a systems integrator to lead the integration and interoperability effort of multiple applications. Both approaches carry a large amount of risk.
H.2 Impact on Stakeholders	1 2 3 4 5	3	15	45	Presents possible negative impact on stakeholders by both systems' implementations.
<i>Project Resource Impact Total</i>			30	60	
TOTAL WEIGHTING			<u>240</u>		
TOTAL ALTERNATIVE SCORE				765	

- *Loosely Coupled EMS and Trauma Registry Systems Reduce System Dependency Issues* – Having two different systems can reduce risk with respect to inter-system dependencies. If there are issues with one registry, both are not affected as using separate systems allows compartmentalization of system problems and isolates issues to both EMS and trauma registries.

Implications

- *Multiple Vendors, Multiple Contracts* – DSHS will need to set up multiple relationships and agreements to ensure all SW is supported, stays up to date, and uses the latest industry standards.
- *Two Systems Will Result in the Need for More DSHS Resources* – In this alternative, DSHS will have to manage two different applications for the EMS and trauma registries. IT operations will need to acquire HW and prepare infrastructure for multiple systems. Additionally, DSHS/IT operations may need to acquire additional staff to maintain and support two separate systems.
- *Integration and Interoperability* – Under the best-of-breed alternative, DSHS/IT operations will be responsible for coordinating the integration and interoperability of multiple applications. With multiple vendors, DSHS/IT will need to lead or acquire the services of a systems integrator to lead the integration and interoperability effort of multiple applications. Either way, this can be a big risk.
- *Implementing Multiple Systems Will Require More Time* – Administering two registry system implementations will take more time than would a single integrated solution as processes, such as testing, training, and deployment, will be repeated, and temporary solutions would have to be built in place of the other registry. If Texas chooses to run both projects at the same time, more project staff will be required, and project dependencies will significantly increase project complexity and risk.

D. Key Decisions

After evaluating the best solution types, DSHS will need to make other important decisions that impact how the department approaches the acquisition, implementation, and management of the EMS and trauma registry system.

1. Outsourced Operations Versus Traditional Operations

As mentioned in Section V, Other States' Registry Systems, there are several common models for managing operations of a registry system. In the case of Texas, two models stand out as key operations alternatives:

- *Outsourced Operations* – In this strategy, DSHS would outsource all system and service components relative to the EMS and trauma registries. As a result, an out-

sourced strategy would have very little technical impact on DSHS and rely heavily on the vendor to provide technical infrastructure, user help desk, and all other support services.

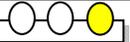
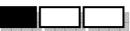
Outsourced Registry Operations	Ownership/Responsibility
Registry SW	Vendor
Hosting and Operational Infrastructure	Vendor
SW Maintenance and Support	Vendor
User Help and Support	Vendor

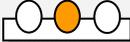
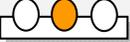
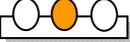
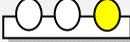
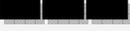
- Traditional Operations** – This strategy would include a combination of outsourcing and in-house support for key system components. DSHS would pay licensing fees for SW, SW maintenance, user help desk support, and training and would retain HW and server maintenance and support in-house.

Traditional Registry Operations	Ownership/Responsibility
Registry SW	State
Hosting and Operational Infrastructure	State
SW Maintenance and Support	Vendor
User Help and Support	State and Vendor

Combining these operations strategies with each solution type changes how stakeholders, DSHS, and IT operations are impacted. Overall project risk and responsibilities are major factors for determining the best overall alternative. The table below provides a brief outline of each alternative as well as an operations strategy.

Table 19 – Alternative Risks

Alternatives	Solution Provider(s)	Texas	
		DSHS	IT
1a: Integrated EMS and Trauma Solution (Outsourced)	Single vendor responsible for all system and service components.	DSHS is responsible for key state decisions and supports vendor with service.	IT serves as adviser on technical evaluation and implementation.
	Risk Indicator:  Responsibility: 	Risk Indicator:  Responsibility: 	
1b: Integrated EMS and Trauma Solution	Single vendor responsible for supplying SW, service, and maintenance	DSHS makes business decisions regarding the solution.	IT is responsible for managing and maintaining technical infrastructure and

Alternatives	Solution Provider(s)	Texas	
		DSHS	IT
(Traditional)	components.		technical implementa- tion.
	Risk Indicator:  Responsibility: 	Risk Indicator:  Responsibility: 	
2a: Best-of-Breed Solutions (Outsourced)	Multiple vendors are responsible for all system and service components.	DSHS is responsible for managing all service contracts (EMS vendor, trauma vendor, and Department of Information Resources (DIR)).	IT coordinates all vendors to provide integrated points and data bridging.
	Risk Indicator:  Responsibility: 	Risk Indicator:  Responsibility: 	
2b: Best-of-Breed Solutions (Traditional)	Multiple vendors supply SW, service, and maintenance components (separate EMS and trauma registries).	DSHS makes business decisions for each solution.	IT coordinates and manages all vendors to provide integrated solutions and is responsible for managing and maintaining technical infrastructure and technical implementation.
	Risk Indicator:  Responsibility: 	Risk Indicator:  Responsibility: 	

As we weigh the options of an outsourced or traditional operations strategy, we can expect different risks and responsibilities for DSHS. In general, in an outsourced strategy DSHS would minimize its operational responsibility and, as a result, transfer overall risk to the vendor. As DSHS responsibility increases with a traditional operations strategy so does overall risk. Additionally, going with best-of-breed solutions, DSHS will ultimately be responsible for overall integration; thus, risk and responsibility will increase.

2. Capital Purchase Versus Payment Plan Versus SaaS

Whether a state is considering an integrated EMS and trauma solution or best-of-breed approach, it will need to think about how to fund the total cost of registry ownership. While there are several models for doing this, the most common in the EMS and trauma market are the capital purchase, payment plan, and SaaS models. These are outlined below.

- *Capital Purchase* – DSHS would purchase the nonexclusive rights to a registry system and all associated support and maintenance services. As a result, DSHS

would assume a majority of the system life cycle cost during the first year of ownership with lower annual maintenance cost.

Registry Operations	Obligation
Registry SW	First Year in Full
Hosting and Operational Infrastructure	First Year in Full
SW Maintenance and Support	Ongoing Payment
User Help and Support	Ongoing Payment

- Payment Plan* – DSHS could defer a high initial cost and amortize cost over a 5- to 6-year period. This type of arrangement would lower the initial cost barrier and allow DSHS to own a system over 5 to 6 years with less initial funding.

Registry Operations	Obligation
Registry SW	5 Years in Full
Hosting and Operational Infrastructure	Ongoing Payment
SW Maintenance and Support	Ongoing Payment
User Help and Support	Ongoing Payment

- SaaS* – A pay-as-you-go plan (the SaaS agreement) would allow DSHS to pay for setup costs and incur a lower monthly fee for EMS and trauma registry system services. The monthly fee is based on cost per transaction or record downloaded to the statewide registry. DSHS and the vendor would mutually agree upon a monthly service level, regardless of transaction rate. Additionally, under this type of agreement DSHS never owns the SW and can walk away from the system at any time. As in all cases, the service entities and hospitals still own the data.

Registry Operations	Obligation
Registry SW	Lower Monthly Payment
Hosting and Operational Infrastructure	Lower Monthly Payment
SW Maintenance and Support	Lower Monthly Payment
User Help and Support	Lower Monthly Payment

Ultimately, this decision can be made by understanding the funding available to DSHS and whether there are any limitations on the funding (e.g., spend it or lose it). If DSHS receives funding for the entire system in Year 1, then a capital purchase makes sense. However, if DSHS makes arrangements to get smaller amounts of funding for several years, then a payment plan or SaaS may make sense.

3. Single Procurement Versus Multiple Procurements

Texas will need to decide how it procures its COTS registry system. The decisions made above will ultimately impact how DSHS acquires the systems.

- *Single Procurement* – Texas would administer one procurement process to acquire the resources needed for a new EMS and trauma registry. This would include a single procurement with one RFP with tightly coupled requirements that request a single vendor with an integrated solution.
- *Multiple Procurements* – Texas would administer two separate procurement processes to acquire EMS and trauma registries independent of one another. This would allow the evaluation of each registry to be independent of the other.

The selected procurement method will impact the duration and complexity of the overall process.

E. Cost-Benefit Analysis

This subsection presents the detailed CBA for each alternative strategy. The CBA evaluates onetime and recurring cost estimates over a 5-year period for each alternative included in this study. The analysis is focused on SW costs, estimates of onetime project costs, and tangible benefits that may be expected as a result of implementing the alternative. A consistent approach and structure are used for each alternative. This general structure is outlined in the sample form below.

Table 20 – Sample CBA Form

Alternative: _____
Operation Strategy: _____
Funding: _____

CBA						
External Costs	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
EMS and Trauma Software	1 \$ -					\$ -
Implementation Services		-				-
Migration Services		-				-
Training Services	2 -					-
Hosting						
Support and Maintenance	3 \$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total External Costs	\$ -	\$ -				
Internal Costs						
Internal Implementation Cost	4 \$ -					
Internal Data Migration Cost						
Hardware	5 -			\$ -		\$ -
Internal Support and Maintenance	6 -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Internal Costs	\$ -	\$ -				
TOTAL EXPECTED COSTS	\$ -	\$ -				
Tangible Benefits						
Increased Revenue						
Cost Savings						
Cost Avoidance						
Other: _____						
TOTAL EXPECTED BENEFITS	\$ -	\$ -				
TOTAL EXPECTED NET COST	\$ -	\$ -				
5-YEAR TOTAL COST OF OWNERSHIP	\$ -					

Assumptions:

- 1.
- 2.
- 3.

For each cost analysis, we used the elements outlined below.

- *Title* – The title provides the alternative, operations strategy, and funding with which cost are associated.
- *External Costs* – Costs associated with the COTS vendors for SW, implementation services, migration services, training services, SW hosting (when applicable), and support and maintenance. All numbers in our cost comparison are the high-end estimates we received from the vendors.
- *Internal Costs* – Costs associated with internal IT operations to assist with the implementation and support of the system(s). It is of note that no program staff costs are outlined here.

- *Tangible Benefits* – Monetary value for realizing quantitative financial benefits. We found that all benefits to the state were considered intangible, and as such, no quantitative financial benefits are outlined.
- *Total Expected Net Cost* – An annual total of net cost after accounting for benefits. This can also be used to view the alternative’s annual burn rate or annual operational costs.
- *5-Year Total Cost of Ownership* – Cost in this field is the total bottom-line system life cycle cost for a 5-year period. Some vendors may also offer a 10-year period; however they may not provide an interest-free payment agreement.
- *Assumptions* – Rationale for specific information or numbers that make up the table are outlined here.

MTG’s model provides a cost analysis, quantitative benefit analysis, cost-benefit summary, and life cycle cost information similar to the Texas DIR Project Delivery Framework tools. It is also worth noting that no inflation was built into the model; thus, general impact of the cost changes can be easily observed.

1. Cost Comparison

Using the high-end cost estimates provided by leading vendors, we outlined costs for several scenarios of both alternatives, starting with the most common and basic approach (capital purchase/traditional operations) and finishing with the most progressive approach (SaaS). The table below provides an overview of costs for the alternatives and how they are impacted by different operation strategies (traditional or outsourced) and funding structures (capital purchase, payment plan, or SaaS).

Exhibit	Alternative	Operations Strategy	Funding	Year 1 Cost	Annual Cost	Total Cost of Ownership (5 Years)
IV	1 – Integrated EMS and Trauma	Traditional Operations	Capital Purchase	\$2,195,000	\$310,000	\$3,475,000
V	2 – Best of Breed	Traditional Operations	Capital Purchase	\$2,850,000	\$240,000	\$4,670,000
VI	1 – Integrated EMS and Trauma	Outsourced	Payment Plan	\$1,085,000	\$620,000	\$3,625,000
VII	2 – Best of Breed	Outsourced	Payment Plan	\$1,620,000	\$800,000	\$4,880,000
VIII	1 – Integrated EMS and Trauma	Outsourced	Capital Purchase	\$1,965,000	\$400,000	\$3,625,000
IX	2 – Best of Breed	Outsourced	Capital Purchase	\$2,680,000	\$550,000	\$4,880,000
X	1 – Integrated EMS and Trauma	Outsourced	SaaS	\$1,955,000	\$1,430,000	\$7,675,000

The exhibits discussed below present individual cost tables.

- EXHIBIT IV outlines costs for executing a capital purchase of a traditional operation for an integrated EMS and trauma solution. This would result in a large initial outlay in Year 1 and would require internal IT operations support staff. While this strategy

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
INTEGRATED SOLUTION, TRADITIONAL OPERATIONS, CAPITAL PURCHASE

Alternative: Alternative 1 – Integrated EMS and Trauma Solution
Operation Strategy: Traditional Operations
Funding: Capital Purchase

CBA							
External Costs		<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Total</u>
EMS and Trauma Software	1	\$ 1,100,000					\$ 1,100,000
Implementation Services	2	250,000					250,000
Migration Services	3	250,000					250,000
Training Services	4	65,000					65,000
Hosting							
Support and Maintenance	5	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 750,000
Total External Costs		\$ 1,815,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 2,415,000
Internal Costs							
Internal Implementation Cost	6	\$ 80,000					
Internal Data Migration Cost	7	\$ 60,000					
Hardware	8	80,000			\$ 40,000		\$ 120,000
Internal Support and Maintenance	9	160,000	\$ 160,000	\$ 160,000	160,000	\$ 160,000	800,000
Total Internal Costs		\$ 380,000	\$ 160,000	\$ 160,000	\$ 200,000	\$ 160,000	\$ 1,060,000
TOTAL EXPECTED COSTS		\$ 2,195,000	\$ 310,000	\$ 310,000	\$ 350,000	\$ 310,000	\$ 3,475,000
Tangible Benefits							
Increased Revenue							
Cost Savings							
Cost Avoidance							
Other: _____							
TOTAL EXPECTED BENEFITS		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
TOTAL EXPECTED NET COST		\$ 2,195,000	\$ 310,000	\$ 310,000	\$ 350,000	\$ 310,000	\$ 3,475,000
5-YEAR TOTAL COST OF OWNERSHIP		\$ 3,475,000					

Assumptions:

1. Integrated EMS and trauma software with Crash, Stroke, SCI, TBI, Submersion, and Air Medical.
2. Implementation services includes customization of data elements, system components, and reports
3. Rough estimates vendors were not provided existing database details.
4. Combined training for 30 sessions around the state.
5. Vendor help desk support and software maintenance at 14% with State hosting.
6. 2 FTEs at 50% for 1 year.
7. 1 DBA at 50% for a 1 year.
8. Purchase seven servers with OS at \$11,000 per server and \$3,000 buffer and 3-year update plan.
9. 2 FTEs for technical support.

GENERAL NOTE:

To enable consistent evaluation, costs for implementation of all registry components (EMS, trauma, other) are included in Year 1. Additionally, applicable hosting, support and maintenance costs for a complete year are included in Year 1. This is assumed conservative and costs may vary based on implementation schedule and system deployment.

offers the lowest 5-year total cost of ownership, internal costs are rough estimates, as these specific costs were not made available to us.

- EXHIBIT V provides costs for acquiring best-of-breed solution via a capital purchase and using a traditional operation strategy. Again, with a capital purchase strategy DSHS would have a large initial outlay, and even more so with best-of-breed solutions, which would include at least two different vendors operating two different projects. Additionally, more DSHS staff will be required to assist with implementation and support of the two-registry environment.
- EXHIBIT VI outlines the payment plan model for an outsourced integrated EMS and trauma solution. This strategy effectively spreads costs over a 5-year period while minimizing DSHS operational support of the EMS and trauma registries. After Year 1, DSHS will be required to pay \$650,000 annually; however, this option allows DSHS to get an integrated system now as opposed to waiting until it received \$2,000,000. Costs also drop after the fifth year upon signing another agreement with the vendor.
- EXHIBIT VII outlines the payment plan model for an outsourced best-of-breed solution. Setting up payment plans for best-of-breed solutions is possible; however, managing relationships and service level agreements can be a real juggling act. Additionally, we can expect cost to be higher because of the project cost and independent efforts by each vendor.
- EXHIBIT VIII outlines a capital purchase for an outsourced integrated EMS and trauma solution. In this approach, DSHS would pay the SW cost in Year 1 (and own the SW), while outsourcing all other components.
- EXHIBIT IX outlines a capital purchase for an outsourced best-of-breed solution. In this approach, DSHS would pay the SW cost in Year 1 (and own the SW), while outsourcing all other components.
- EXHIBIT X outlines a true SaaS approach. In this approach, DSHS does not own any of the registry components, except for the data. As a result, DSHS enters a termed licensing agreement for its EMS and trauma registry system and can walk away at any time. After configuration and deployment of the system, DSHS pays a consistent monthly fee for services.

For purposes of the study, we outlined cost structures that are most commonly used by other states and vendors. However, vendors in the market appear to be very flexible to any funding situation and welcome the opportunity to work with DSHS to find the right funding structure.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
BEST-OF-BREED SOLUTION, TRADITIONAL OPERATIONS, CAPITAL PURCHASE

Alternative: Alternative 2 – Best-of-Breed Solution
Operation Strategy: Traditional Operations
Funding: Capital Purchase

CBA							
External Costs		Year 1	Year 2	Year 3	Year 4	Year 5	Total
EMS Software	1	\$ 750,000					\$ 750,000
Trauma Software	2	500,000					500,000
Implementation Services	3	400,000					400,000
Migration Services	4	300,000					300,000
Training Services	5	120,000					120,000
Hosting							-
Support and Maintenance	6	200,000	200,000	200,000	200,000	200,000	1,000,000
Total External Costs		\$ 2,270,000	\$ 200,000	\$ 200,000	\$ 200,000	\$ 200,000	\$ 3,070,000
Internal Costs							
Internal Implementation Cost	7	\$ 160,000					\$ 160,000
Internal Data Conversion Cost	8	\$ 60,000					
Hardware	9	120,000			\$ 60,000		180,000
Internal Support and Maintenance	10	240,000	\$ 240,000	\$ 240,000	240,000	\$ 240,000	1,200,000
Total Internal Costs		\$ 580,000	\$ 240,000	\$ 240,000	\$ 300,000	\$ 240,000	\$ 1,600,000
TOTAL EXPECTED COSTS		\$ 2,850,000	\$ 440,000	\$ 440,000	\$ 500,000	\$ 440,000	\$ 4,670,000
Benefits							
Increased Revenue							
Cost Savings							
Cost Avoidance							
Other: _____							
TOTAL EXPECTED BENEFITS		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
TOTAL EXPECTED NET COST		\$ 2,850,000	\$ 440,000	\$ 440,000	\$ 500,000	\$ 440,000	\$ 4,670,000
5-YEAR TOTAL COST OF OWNERSHIP		\$ 4,670,000					

Assumptions:

1. EMS software.
2. Trauma software with Stroke, SCI, TBI, Submersion, and Air Medical.
3. Two vendors implementing two registries, twice the implementation cost, independent of each other; \$150,000 - \$200,000 per vendor.
4. Independent efforts to migrate historical data to each registry – \$200,000 for EMS and \$100,000 for trauma.
5. Training for both EMS and trauma – 50 sessions around the state.
6. Vendor-provided help desk – \$100,000 for EMS and \$100,000 for trauma, about 16% of software cost.
7. 2 FTEs for 1 year.
8. 1 DBA at 50% for 1 year
9. Purchase 10 servers with OS at \$11,000 per server and \$9,000 buffer and 3-year update plan.
10. 3 FTEs to support.

GENERAL NOTE:-

To enable consistent evaluation, costs for implementation of all registry components (EMS, trauma, other) are included in Year 1. Additionally, applicable hosting, support and maintenance costs for a complete year are included in Year 1. This is assumed conservative and costs may vary based on implementation schedule and system deployment.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYST
INTEGRATED SOLUTION, OUTSOURCED, PAYMENT PLAN

Alternative: Alternative 1 – Integrated EMS and Trauma Solution
Operation Strategy: Outsourced
Funding: Payment Plan

CBA							
External Costs		Year 1	Year 2	Year 3	Year 4	Year 5	Total
EMS and Trauma Software	1	\$ 220,000	\$ 220,000	\$ 220,000	\$ 220,000	\$ 220,000	\$ 1,100,000
Implementation Services	2	150,000					150,000
Migration Services		250,000					250,000
Training Services	3	65,000					65,000
Hosting	4	250,000	250,000	250,000	250,000	250,000	1,250,000
Support and Maintenance	5	150,000	150,000	150,000	150,000	150,000	750,000
Total External Costs		\$ 1,085,000	\$ 620,000	\$ 620,000	\$ 620,000	\$ 620,000	\$ 3,565,000
Internal Costs							
Internal Implementation Cost							\$ -
Internal Data Migration Cost	6	\$ 60,000					
Hardware							-
Internal Support and Maintenance							-
Total Internal Costs		\$ 60,000	\$ -	\$ -	\$ -	\$ -	60,000
TOTAL EXPECTED COSTS		\$ 1,145,000	\$ 620,000	\$ 620,000	\$ 620,000	\$ 620,000	\$ 3,625,000
Tangible Benefits							
Increased Revenue							
Cost Savings							
Cost Avoidance							
Other: _____							
TOTAL EXPECTED BENEFITS		\$ -	\$ -	\$ -	\$ -	\$ -	-
TOTAL EXPECTED NET COST		\$ 1,145,000	\$ 620,000	\$ 620,000	\$ 620,000	\$ 620,000	\$ 3,625,000
5-YEAR TOTAL COST OF OWNERSHIP		\$ 3,625,000					

Assumptions:

1. Integrated EMS and trauma software with c Crash, Stroke, SCI, TBI, Submersion, and Air Medical amortized for a 5-year period at no interest.
2. Less cost for vendor to implement on its own hosted site.
3. Combined training for 30 sessions around the state.
4. Hosting and support services, including HW maintenance.
5. Help desk support and software maintenance, about 14% of software cost
6. 1 DBA at 50% for 1 year

GENERAL NOTE:

To enable consistent evaluation, costs for implementation of all registry components (EMS, trauma, other) are included in Year 1. Additionally, applicable hosting, support and maintenance costs for a complete year are included in Year 1. This is assumed conservative and costs may vary based on implementation schedule and system deployment.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
BEST-OF-BREED SOLUTION, OUTSOURCED, PAYMENT PLAN

Alternative: Alternative 2 – Best-of-Breed Solution
Operation Strategy: Outsourced
Funding: Payment Plan

CBA							
External Costs		Year 1	Year 2	Year 3	Year 4	Year 5	Total
EMS Software	1	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 750,000
Trauma Software	2	\$ 100,000	100,000	100,000	100,000	100,000	500,000
Implementation Services	3	400,000					400,000
Migration Services	4	300,000					300,000
Training Services	5	120,000					120,000
Hosting	6	350,000	350,000	350,000	350,000	350,000	1,750,000
Support and Maintenance	7	200,000	200,000	200,000	200,000	200,000	1,000,000
Total External Costs		\$ 1,620,000	\$ 800,000	\$ 800,000	\$ 800,000	\$ 800,000	\$ 4,820,000
Internal Costs							
Internal Implementation Cost							\$ -
Internal Data Migration Cost	8	\$ 60,000					
Hardware							-
Internal Support and Maintenance							-
Total Internal Costs		\$ 60,000	\$ -	\$ -	\$ -	\$ -	\$ 60,000
TOTAL EXPECTED COSTS		\$ 1,680,000	\$ 800,000	\$ 800,000	\$ 800,000	\$ 800,000	\$ 4,880,000
Benefits							
Increased Revenue							
Cost Savings							
Cost Avoidance							
Other: _____							
TOTAL EXPECTED BENEFITS		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
TOTAL EXPECTED NET COST		\$ 1,680,000	\$ 800,000	\$ 800,000	\$ 800,000	\$ 800,000	\$ 4,880,000
5-YEAR TOTAL COST OF OWNERSHIP		\$ 4,880,000					

Assumptions

1. EMS software amortized for 5 years at no interest.
2. Trauma software with Crash, Stroke, SCI, TBI, Submersion, and Air Medical amortized for 5 years at no interest.
3. Two vendors implementing two registries; twice the implementation cost independent of each other; \$150,000 - \$200,000 per vendor.
4. Independent efforts to migrate historical data to each registry – \$200,000 for EMS and \$100,000 for trauma.
5. Training for both EMS and trauma – 50 sessions around the state.
6. Vendors host registries independent of one another – \$175,000 each per year. Includes HW maintenance.
7. Vendor-provided help desk – \$100,000 for EMS and \$100,000 for trauma, about 16% of overall software costs.
8. 1 DBA at 50% for 1 year

GENERAL NOTE:

To enable consistent evaluation, costs for implementation of all registry components (EMS, trauma, other) are included in Year 1. Additionally, applicable hosting, support and maintenance costs for a complete year are included in Year 1. This is assumed conservative and costs may vary based on implementation schedule and system deployment.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYST
INTEGRATED SOLUTION, OUTSOURCED, CAPITAL PURCHASE

Alternative: Alternative 1 – Integrated EMS and Trauma Solution
Operation Strategy: Outsourced
Funding: Capital Purchase

CBA						
External Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Total
EMS and Trauma Software	1 \$ 1,100,000					\$ 1,100,000
Implementation Services	2 150,000					150,000
Migration Services	250,000					250,000
Training Services	3 65,000					65,000
Hosting	4 250,000	\$ 250,000	\$ 250,000	\$ 250,000	\$ 250,000	1,250,000
Support and Maintenance	5 150,000	150,000	150,000	150,000	150,000	750,000
Total External Costs	\$ 1,965,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 3,565,000
Internal Costs						
Internal Implementation Cost						\$ -
Internal Data Migration Cost	6 \$ 60,000					-
Hardware						-
Internal Support and Maintenance						-
Total Internal Costs	\$ 60,000	\$ -	\$ -	\$ -	\$ -	60,000
TOTAL EXPECTED COSTS	\$ 2,025,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 3,625,000
Tangible Benefits						
Increased Revenue						
Cost Savings						
Cost Avoidance						
Other: _____						
TOTAL EXPECTED BENEFITS	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
TOTAL EXPECTED NET COST	\$ 2,025,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 3,625,000
5-YEAR TOTAL COST OF OWNERSHIP	\$ 3,625,000					

Assumptions:

1. Integrated EMS and trauma software with c Crash, Stroke, SCI, TBI, Submersion, and Air Medical paid in year 1.
2. Less cost for vendor to implement on its own hosted site.
3. Combined training for 30 sessions around the state.
4. Hosting and support services.
5. Help desk support and software maintenance, about 14% of software cost.
6. One DBA at 50% for 1 year.

GENERAL NOTE:

To enable consistent evaluation, costs for implementation of all registry components (EMS, trauma, other) are included in Year 1. Additionally, applicable hosting, support and maintenance costs for a complete year are included in Year 1. This is assumed conservative and costs may vary based on implementation schedule and system deployment.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT
BEST-OF-BREED SOLUTION, OUTSOURCED, CAPITAL PURCHASE

Alternative: Alternative 2 – Best-of-Breed Solution
Operation Strategy: Outsourced
Funding: Capital Purchase

CBA							
External Costs		Year 1	Year 2	Year 3	Year 4	Year 5	Total
EMS Software	1	\$ 750,000					\$ 750,000
Trauma Software	2	500,000					500,000
Implementation Services	3	400,000					400,000
Migration Services	4	300,000					300,000
Training Services	5	120,000					120,000
Hosting	6	350,000	\$ 350,000	\$ 350,000	\$ 350,000	\$ 350,000	1,750,000
Support and Maintenance	7	200,000	200,000	200,000	200,000	200,000	1,000,000
Total External Costs		\$ 2,620,000	\$ 550,000	\$ 550,000	\$ 550,000	\$ 550,000	\$ 4,820,000
Internal Costs							
Internal Implementation Cost							\$ -
Internal Data Migration Cost	8	\$ 60,000					-
Hardware							-
Internal Support and Maintenance							-
Total Internal Costs		\$ 60,000	\$ -	\$ -	\$ -	\$ -	\$ 60,000
TOTAL EXPECTED COSTS		\$ 2,680,000	\$ 550,000	\$ 550,000	\$ 550,000	\$ 550,000	\$ 4,880,000
Benefits							
Increased Revenue							
Cost Savings							
Cost Avoidance							
Other: _____							
TOTAL EXPECTED BENEFITS		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
TOTAL EXPECTED NET COST		\$ 2,680,000	\$ 550,000	\$ 550,000	\$ 550,000	\$ 550,000	\$ 4,880,000
5-YEAR TOTAL COST OF OWNERSHIP		\$ 4,880,000					

Assumptions

1. EMS software paid in year 1.
2. Trauma software with Crash, Stroke, SCI, TBI, Submersion, and Air Medical paid in year 1.
3. Two vendors implementing two registries; twice the implementation cost independent of each other; \$150,000 – \$200,000 per vendor.
4. Independent efforts to migrate historical data to each registry – \$200,000 for EMS and \$100,000 for trauma.
5. Training for both EMS and trauma – 50 sessions around the state.
6. Vendors host registries independent of one another – \$175,000 each per year.
7. Vendor-provided help desk – \$100,000 for EMS and \$100,000 for trauma, about 16% of overall software costs.
8. One DBA at 50% for 1 year.

GENERAL NOTE:

To enable consistent evaluation, costs for implementation of all registry components (EMS, trauma, other) are included in Year 1. Additionally, applicable hosting, support and maintenance costs for a complete year are included in Year 1. This is assumed conservative and costs may vary based on implementation schedule and system deployment.

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYST
INTEGRATED SOLUTION, OUTSOURCED, SaaS

Alternative: Alternative 1 – Integrated EMS and Trauma Solution
Operation Strategy: Outsourced
Funding: SaaS

CBA							
External Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Total	
EMS and Trauma Software						\$	-
Implementation Services	1 \$ 150,000						150,000
Migration Services	250,000						250,000
Training Services	2 65,000						65,000
Hosting	3	\$ -	\$ -	\$ -	\$ -		-
Support and Maintenance	4 1,430,000	1,430,000	1,430,000	1,430,000	1,430,000		7,150,000
Total External Costs	\$ 1,895,000	\$ 1,430,000	\$ 1,430,000	\$ 1,430,000	\$ 1,430,000		\$ 7,615,000
Internal Costs							
Internal Implementation Cost						\$	-
Internal Data Migration Cost	5 \$ 60,000						-
Hardware							-
Internal Support and Maintenance							-
Total Internal Costs	\$ 60,000	\$ -	\$ -	\$ -	\$ -		60,000
TOTAL EXPECTED COSTS	\$ 1,955,000	\$ 1,430,000	\$ 1,430,000	\$ 1,430,000	\$ 1,430,000		\$ 7,675,000
Tangible Benefits							
Increased Revenue							
Cost Savings							
Cost Avoidance							
Other: _____							
TOTAL EXPECTED BENEFITS	\$ -		\$ -				
TOTAL EXPECTED NET COST	\$ 1,955,000	\$ 1,430,000	\$ 1,430,000	\$ 1,430,000	\$ 1,430,000		\$ 7,675,000
5-YEAR TOTAL COST OF OWNERSHIP	\$ 7,675,000						

Assumptions:

1. Less cost for vendor to implement on its own hosted site.
2. Combined training for 30 sessions around the state.
3. All hosting and support services included.
4. All services associated with an Integrated EMS and trauma software at \$0.65 transaction fee per record at 2.2 million annually.

2. Benefits

EMS and trauma registries, as well as other healthcare registries such as cancer and birth defects registries, are used in public health as population-based diagnosis tools. As such, the tangible versus intangible benefits are not usually broken down and discussed. Rather, the overall benefits are automatically assumed. That said, from a business perspective, the benefits to be considered with any registry alternative include tangible and intangible benefits. Tangible benefits can be quantified and are based on specific parameters and values. An example of a tangible benefit may include actual cost savings resulting from ceasing operations of an existing system or reduction of staff due to improved operations or outsourcing. On the other hand, intangible benefits are qualitative and cannot be readily quantified. For example, an intangible benefit gained from a new registry may be increased stakeholder participation and data collection, resulting in improved health outcomes or lives saved. These benefits provide obvious value, but it is very difficult to place a specific monetary amount on them.

Fully operational EMS and trauma registries include many well-documented intangible benefits associated with providing statistics and reports to identify trends and support the development of programs that improve care and save lives. However, MTG's research of other states and solution vendors did not reveal tangible benefits associated with EMS and trauma registries that have been specifically quantified and regularly accepted. As an alternative, MTG considered the major tangible benefit from a new registry to be the cost savings resulting from ceasing the operations and maintenance associated with the current TRAC-IT system. Upon request to DSHS for the actual costs, we discovered that a full cost accounting specifically for TRAC-IT was not readily available due to many different organizational units within DSHS. Therefore, we were unable to accurately quantify and substantiate the full cost-savings benefit.

As a result, for this CBA MTG assumed that since each selected alternative would be implemented to meet all solution requirements, each would also provide the same associated benefits and cost savings. Therefore, the financial analyses on the CBA forms completed for each alternative do not include stated values for tangible benefits. This approach allows for the same financial comparison of the alternatives for a new registry and enables development of associated recommendations.

The only financial analysis that cannot be performed without actual costs of TRAC-IT operations and maintenance to represent cost savings and specific tangible benefits is identification of the return on investment (ROI) and payback period. However, these are easy calculations once the TRAC-IT cost data is made available.

IX. Future State Registry Recommendations

IX. Future State Registry Recommendations

This section provides recommendations for evaluation and ranking of registry system alternatives. It outlines the key decision points for the alternatives and the impact of each point. Also, this section provides recommendations for management, including the project manager and steering committee, to keep in mind when implementing the selected registry solution.

A. Recommended Alternatives and Ranking

Using the evaluation criteria outlined previously, MTG was able to analyze each alternative as it relates to DSHS. This analysis uses a scoring system related to the criteria to assess and compare alternatives. EXHIBIT XI provides a summary analysis of each alternative. As shown in the exhibit, the integrated EMS and trauma solution rated slightly higher than the best-of-breed solution on every evaluation criterion. There are large discrepancies between IT operational impact, realized benefits, and project resources. This is a direct result of the impact and added responsibility DSHS would assume during the implementation, support, and maintenance of two different registry systems. Clear advantages for the integrated EMS and trauma solution include:

- Reduced project complexity by virtue of administering one project for both EMS and trauma registries with a single vendor methodology and application framework.
- Increased system registry manageability with only one set of system tools for both registries. This results in fewer support staff, less training, and reduced technology investments/liabilities.
- Streamlined administration of registry operations, one procurement process, one relationship, and one contract agreement with a single vendor.
- Reduced cost by way of establishing and operating a single technical environment (e.g., one database suite as opposed to multiple database suites for two different registries) and reduced implementation and operations cost.
- Increased registry accountability, as DSHS can hold a single vendor accountable for both EMS and trauma registries. This is important because of the integration aspects of both registries. Integration of two different vendor systems would add another layer of complexity, and complexity results in greater risk.
- Effective way to implement both EMS and trauma registries that meets DSHS and stakeholder needs in a relatively short amount of time.

EXHIBIT XII presents a graphic that compares the alternatives. It is worth noting that the alternative that covers the most space is considered to provide the best overall solution.

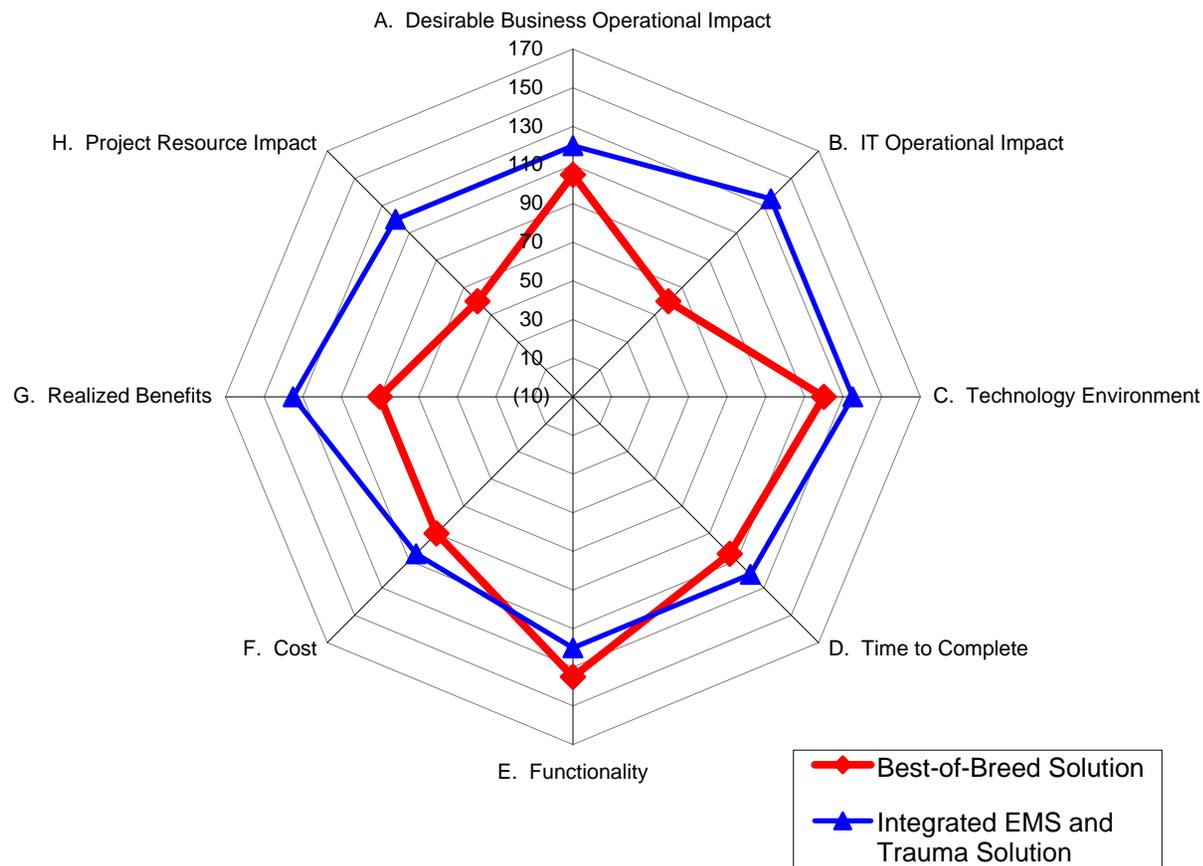
TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT

SUMMARY COMPARISON

Evaluation Category	Weight	Percentage of Total Weight	Alternative Evaluation Scores		
			Alternative 1 – Integrated EMS and Trauma Solution	Alternative 2 – Best-of-Breed Solution	Variance Between Alternatives
A. Desirable Business Operational Impact	30	12.50%	120	105	15
B. IT Operational Impact	30	12.50%	135	60	75
C. Technology Environment	30	12.50%	135	120	15
D. Time to Complete	30	12.50%	120	105	15
E. Functionality	30	12.50%	120	135	(15)
F. Cost	30	12.50%	105	90	15
G. Realized Benefits	30	12.50%	135	90	45
H. Project Resource Impact	<u>30</u>	<u>12.50%</u>	<u>120</u>	<u>60</u>	<u>60</u>
Total Score	240	<i>100.00%</i>	990	765	225

TEXAS DEPARTMENT OF STATE HEALTH SERVICES
 TRAUMA REGISTRY IMPROVEMENT SYSTEM ASSESSMENT

ALTERNATIVE COMPARISON



In addition to the alternatives evaluation, there are several key decisions that greatly impact the overall direction of how Texas should procure a new EMS and trauma registry system. The decision table below outlines the alternatives/key decisions being considered, summarizes related impacts and indicates the selected recommendation.

Table 21 – Alternatives Decision Table

Alternatives/Key Decisions	Key Points and Impact Summary	Recommendation
<i>Solution Type</i>		
1. Integrated EMS and Trauma Solution	<ul style="list-style-type: none"> • Single vendor to provide EMS and trauma registries. • Vendor responsible for linkages between EMS and trauma. • Estimated cost impact of \$3.5 million to \$4.0 million over a 5-year life cycle. 	✓
2. Best-of-Breed Solution	<ul style="list-style-type: none"> • Multiple vendors to provide EMS and trauma registries. • Requires more DSHS project involvement as linkages between EMS and trauma will fall on DSHS. • Estimated cost impact of \$4.5 million to \$5.0 million over a 5-year life cycle. 	
<i>Operations Strategy</i>		
1. Outsourced	<ul style="list-style-type: none"> • Vendors to provide all registry components and support services. • Minimizes DSHS operational footprint for managing the EMS and trauma registries. • Estimated cost impact of approximately \$150,000 to \$250,000 more than the traditional operation strategy over 5 years. 	✓
2. Traditional	<ul style="list-style-type: none"> • Vendor to provide SW and HW maintenance, DSHS to provide hosting and support. • More DSHS project involvement and in-house support required. 	

Alternatives/Key Decisions	Key Points and Impact Summary	Recommendation
System Acquisition Model		
1. Capital Purchase	<ul style="list-style-type: none"> • Larger initial financial outlay to procure registry, but lower annual operations costs. • Estimated cost impact of \$2 million to \$3 million in the first year. 	
2. Payment Plan	<ul style="list-style-type: none"> • Smaller initial outlay to procure registry, but higher annual operations costs. • Estimated cost impact of \$1.1 million to \$1.6 million in the first year. 	✓
3. SaaS	<ul style="list-style-type: none"> • Monthly service fee. • DSHS never owns SW or HW. • Estimated cost impact of \$120,000 per month or \$1,955,000 in the first year. 	
Procurement		
1. Single RFP for Single Solution	<ul style="list-style-type: none"> • Minimizes complexity. • Limits possible solutions and vendor bids. • Provides the quickest path for procurement. 	✓
2. Single RFP With Multiple Solutions Options	<ul style="list-style-type: none"> • Maximizes the procurement effort. • Will result in more proposals. • Provides an opportunity to see and evaluate all available options when binding contracts are on the line. • Allows DSHS to be flexible. 	
3. Multiple RFPs	<ul style="list-style-type: none"> • Provides flexibility to evaluate each registry individually. • Time-consuming. May require more project staff to develop RFPs and participate in the procurement process. • Simultaneous projects may result in increased dependencies and risk. 	

Given the overall recommendation of an integrated EMS and trauma solution, the recommendations for system operations, acquisition, and procurement are outlined below.

- For the operations strategy, we recommend the *outsourcing* option to minimize DSHS's operational support footprint and leverage vendor expertise.
- For the system acquisition model, given the outsourcing direction, setting up a payment plan to *spread registry system costs over time* is recommended.
- For procurement, a *single procurement process* is recommended that will include a single RFP with tightly coupled requirements for an integrated solution from a single prime vendor.

B. Management Recommendations for the Future Registry

In addition to the recommendations based on the registry solution alternatives, project findings suggest a number of recommendations regarding program management and coordination are appropriate. These recommendations are discussed below and primarily focus on improving the registry performance related to overall business environment and stakeholder participation.

- *Program Placement* – Movement of the EMS/trauma registry operations from within the Environmental Epidemiology and Disease Registries Section to OETSC should be considered. Stakeholders have expressed specific concerns with current operations and believe their needs and issues are better understood by OETSC.
- *State and Stakeholder Coordination* – MTG recommends that DSHS and the stakeholders establish a combined executive steering committee and relevant sub-committees and work groups as DSHS moves forward with procurement of a new system. The committee and work group members should be actively involved in the decisions related to alternative selection and solution evaluation, as well as the development of strategic planning for the registry implementation, future operations, and direction.
- *Change Management* – MTG recommends that DSHS develop and implement a change management plan to ensure the entire registry community understands the rationale and business imperative for the new registry and is prepared for the change. The challenges of implementing a new registry to improve business operations and efficiencies are abundant, and there are countless instances when projects have failed to deliver anticipated benefits. These failures are often related to the lack of preparing the community for change and fully embracing the benefits of change, as well as managing change and setting expectations. A change management plan developed by a diverse group of active stakeholders should also include the training and marketing tools to promote use and acceptance of the new solution.

- *Communication and Trust* – The project team found many incidences in the current environment suggesting poor communication and lack of trust between DSHS and stakeholders. “The state doesn’t listen to us!” was a common statement made by stakeholders during the needs assessment activities. A specific effort to determine the best approach to repair these problems should be considered immediately.

The theme of the management recommendations addressed above focuses on improving the working relationships between DSHS and the stakeholder groups. The current working relationships between DSHS and the stakeholders are tenuous at best. If appropriate steps are not taken to successfully improve relations and enable the groups to work together toward common goals and objectives, the performance of the registry will not matter.

C. Recommended Next Steps

To support realization of the solution alternative and management recommendations addressed above, MTG suggests the following next steps:

- *Establish a Diverse Executive Steering Committee* – As an initial next step toward improving communications, DSHS and EMS and hospital stakeholders should establish an executive steering committee including representatives from each group. A mutually agreed-upon charter and direction for the registry procurement, management, and operations should be developed and approved by the committee.
- *Establish a Registry Work Group* – A work group with representatives from DSHS, EMS providers, and hospitals should be established. The work group would report to the steering committee, and its initial task would be to review the TRISA report and take final recommendations to the steering committee for approval. The work group would also provide ongoing oversight of the planning, procurement, implementation, policy development, and operations and management of the new registry.
- *Perform Project Delivery Planning* – Depending on the approved approach for the new registry, detailed project planning is recommended based on the Texas Project Delivery Framework. The framework provides guidelines to support successful business justification, project planning, solicitation and contracting, project implementation, and benefits realization.

The first two steps suggested above are key in building working relationships to improve communications and understanding of stakeholder needs and issues. Working together on the project planning and decision making will promote mutual buy-in to the selected solution, active and participative problem solving, and recognition of future successes.