Transportation Applications of Restricted Use Technology (TARUT) Study

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INTRODUCTION & SUMMARY

The MDOT TARUT Study is a three year effort to explore how satellite and other remote sensing data can address the needs of the Michigan Department of Transportation (MDOT). The study, jointly funded by MDOT and the Federal Highway Administration (FHWA), combines data from high-resolution remote sensing systems and other assets with advanced geospatial analysis techniques to examine transportation concerns. The data has come from civil agencies, commercial firms, and the Department of Defence (DoD), as appropriate to meet the study's goals and objectives. The study's focus areas have been on improving asset management databases through remote sensing, analyzing the environmental context of transportation corridors, mapping traffic queues and delays, and estimating traffic volumes via remote sensing.

STRUCTURE OF THE STUDY

The MDOT TARUT Study consists of four phases. The project tasks began, in Phase I, with generation of RADAR and electrooptical data and formulating stakeholder focus group. In Phase II, we conducted the stakeholder focus group meetings designed to link transportation agency needs to restricted use capabilities and remote sensing representative of restricted use technology. In Phase III, the study focused on the four focus areas previously listed, with pilot studies demonstrating how remote sensing technology and geospatial analysis can assist MDOT in meeting its goals and objectives. Based on the successful results of these preliminary phases, under Phase IV we have been developing demonstration desktop GIS tools for the MDOT-selected priority areas of improving asset management databases using highresolution imagery and increasing the efficiency of the wetlands mitigation site selection process using integrated remote sensing and GIS analysis. MTRI has collaborated closely with MDOT staff complete the technical tasks and manage the project to ensure that results are meeting the priorities of a state transportation agency.

ELECTRO-OPTICAL & RADAR DATA SOURCES

This study makes use of a variety of remotely sensed data sources. These have included high resolution multispectral satellite images, multispectral and thermal airborne data, ground penetrating radar data, Synthetic Aperture Radar (SAR) imagery, and SAR-derived topographic data.

Many of these data sources have come from non-restricted sources to expedite progress on the study and to allow for comparison between commercial and products and products derived from restricted use technology.

Figure 1: *Examples of "road furniture" asset management data collected by application of high-resolution imagery; the analysis and data collection process is now captured in a user-friendly desktop GIS tool developed under the TARUT study.*

USE OF GEOGRAPHIC INFORMATION SYSTEMS IN THE STUDY

This study requires extensive use of high- resolution remote

sensing imagery, as well as geographic information system (GIS) based dynamic decision support systems (DDSS) assimilate remote sensing data and ground observations with models. The fusion of high-resolution imagery with in situ (on the ground) observations, coupled with transportation models, produced a useful set of analytical visualization tools for this project.

Figure 2: *Example of a traffic queue analysis being shared through a decision support mapping portal.*

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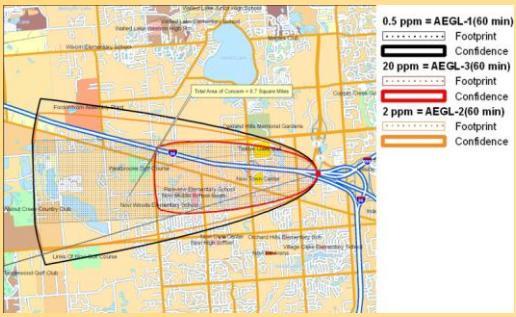
STAKEHOLDER FOCUS GROUPS AND PILOT STUDIES

Early in the study, stakeholders who played an essential role in matching the needs of MDOT and County transportation agencies to the capabilities of remote sensing were identified. The focus group meetings had two objectives: to identify: 1) the highest priority uses of remote sensing and geospatial technology in the transportation sector, and 2) the most promising pilot tests based on stakeholder input. The stakeholders were drawn from MDOT and USDOT (FHWA) employees; regional, county, and local transportation officials; transportation academics and consultants; emergency management personnel at all levels of government; and those familiar with remote sensing technology and data. Areas assessed for pilot studies included:

- Intelligent transportation systems (ITS) and traffic operations
- Asset management
- Homeland security
- Border crossings: efficiency v. security
- HAZMAT shipments
- Traffic safety and congestion

Useful set of analytical visualization tools for this project.

- Environmental data needs
- Inter-modal and multi-modal transportation



Container	Tanker
Quantity	4,600 gallons
Wind Dir.	East
Wind Speed	9 mph
Air Temp	68° F

Number of People Affected in:	
Schools	1,972
Residences	11,039
Commercial	45,803
TOTAL	58,814

Figure 3: *Demonstration of an integrated toolset that analyses the impact of a highway-based chlorine spill on the surrounding local area. The TARUT Study analysis made possible calculations of number of people and businesses affected in addition to the traffic volumes and amount of roads impacted by the plume.*

DEMONSTRATION DESKTOP GEOSPATIAL TOOLS FOR VALIDATION

Two desktop geospatial tools were developed to help MDOT evaluate and validate the pilot study results. MTRI developed a Road Furniture Desktop GIS Tool and a Wetlands Mitigation Site Suitability Tool and demonstrated them to MDOT through an intensive software review and user feedback process. Demonstrations of the tools, and how they can applicable to different states and transportation planning and data collection priorities, are available by contacting MTRI. The road furniture tool integrates an imagery analysis and asset management data collection process into a user-friendly ArcGIS environment that includes managing the data in enterprise-level relational database software such as Oracle Spatial and PostgreSQL through ArcSDE. The wetlands tool enables transportation agency users to evaluate entire large watersheds for the suitability of areas to be wetlands mitigation sites, based on customizable transportation agency priorities. A field version of the tool is available in both ArcGIS and open source versions to enable field checking and real-time assessment of wetland suitability results.

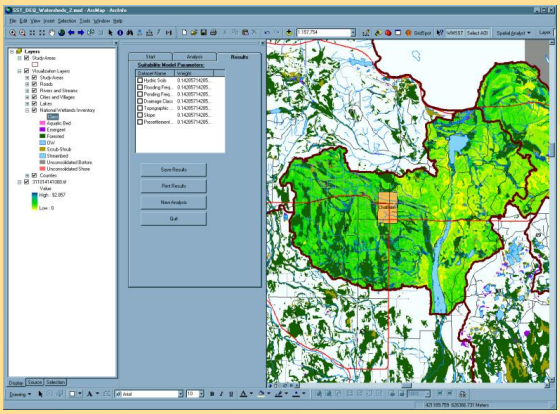


Figure 4: *The Wetlands Mitigation Site Suitability Tool has been used to evaluate 76,000 acres for locatiing the best areas for constructing wetlands mitigation sites. The blue and darker green areas are the most suitable based on soils data, remote sensing-based soil moisture analysis, topography, and historical wetland status.*

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