Interim Report
Deliverable 3.3:
Business Needs Identified by the Focus Groups of the Restricted Use Technology Study

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TABLE OF CONTENTS

LISTS OF TABLES

LISTS OF FIGURES

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The Altarum thanks all the focus group chairs and co-chairs for all their hard work in providing leadership to their groups through a demanding process. Their expertise and leadership contributed significantly to allowing Altarum to match pilots to MDOT's business needs. We also thank the two MDOT facilitators, Pam Boyd and Bob Parsons, who displayed outstanding professionalism in facilitating their groups through the focus group process. In addition, we thank Lou Lambert of Cambridge Systematics, whose expertise and experience assisted us in deriving clear, precise, and relevant pilot themes and specific pilots from the focus group results. Finally, we thank all the focus group participants for their generous commitment of time and knowledge to the TARUT Study.

EXECUTIVE SUMMARY

The Altarum Institute, under contract to the Michigan Department of Transportation (MDOT), currently is engaged in a project called the Transportation Applications of Restricted Use Technology (TARUT) Study. This study, an 18-month effort, seeks to apply restricted use technology to the mandates of MDOT. This study makes extensive use of a stakeholder focus group process to identify transportation system needs and applications that restricted use technology can address. To date, the Altarum team has held two rounds of focus group meetings, including the Focus Group Kickoff Meeting held February 7-8, 2006 and a second round meeting with all of the five focus groups held in March 2006. This report, Deliverable 3.3 of the TARUT Study, presents the business needs identified by the focus groups and, in particular, details the promising pilot studies identified by the focus groups and ties them to the data needs and gaps identified as business needs for MDOT and other transportation agencies.

The Focus Group Kickoff Meeting, which included both technical briefings to all stakeholders and five breakout groups (see Table 1 for a list of the five groups, along with the chairs and co-chairs of each group) meeting for three sessions each, successfully identified numerous transportation systems problems, data needs, and information gaps (i.e., business needs) that restricted use technology might address. In synthesizing the results of the Kickoff Meeting in light of the identified needs, the Altarum team developed four broad pilot study themes that could contribute to meeting the business needs identified by the groups. Furthermore, within each of these four pilot theme areas, the Altarum team also outlined three or four specific pilots that could be tested with the goal of testing the ability of remote sensing and restricted use technology to solve transportation system data needs or fill important information gaps. These themes and pilots were further vetted by the Altarum team with the group chairs (and sometimes co-chairs) after the Kickoff Meeting and prior to the second round focus group meetings. The resulting four pilot theme areas, along with the specific pilots associated with each, are listed below.

1. **Assessment of Pavement Condition and Other Assets through Remote Sensing and Advanced Algorithms**
    a. Establish meaningful (high) correlations between pavements assessments obtained via remote sensing and advanced algorithms and standard condition measures used by MDOT currently (i.e., IRI, sufficiency, PASER, distress).
    b. Estimate the effects of truck traffic on pavement condition and highway congestion by using remote sensing to establish, by lane and direction, the volume of truck (perhaps versus car) traffic on MDOT's assets.
    c. Establish a spatially enabled inventory and assessment of non-roadway assets in the MDOT right of way (e.g., culverts, bridges, rumble strips, signs).

2. **Application of High Resolution Data to Environmental Analysis of Transportation**
    a. Complete a site corridor study along US-127, including mapping geology and hydrology, measuring and delineating wetlands, classifying plant communities, identifying animal habitat and connectivity between habitat patches, mapping general land use in the corridor, and estimating impacts on historical properties.
    b. Performing a watershed and wetlands study in the Thunder Bay Watershed, including mapping geology and hydrology, measuring and delineating wetlands, classifying

plant communities, identifying animal habitat and connectivity between habitat patches, and mapping general land use in the corridor.

c. Using remote sensing to collect data and information that will aid in identifying and evaluating potential locations for a new international border crossing across the Detroit River, including analysis of possible plaza sites.

3. Support of ITS and Traffic Operations

a. Link real-time (or near real-time) vehicle tracking data to GIS and spatially enabled traffic flow models to improve traffic operations and enhance congestion avoidance.

b. Apply network-wide sensor data to calibrate and validate existing MDOT network condition models by time of day and geographic location, including analysis of historical patterns.

c. Use derived products to create high resolution road and highway centerline data as an enabler for ITS, VII, and other operations functions.

d. Use sensors (imagery, tracking data, etc.) to estimate queue lengths and/or delay times at international borders, including examination of what delay measures are most useful.

4. Support Origin-destination Data Collection

a. Demonstrate technical ability to track a limited number of vehicles using cellular technology, infrared tags, or other low-cost technology.

b. Successfully track a relatively large number of vehicles (several thousand) in the SEMCOG region.

c. Develop an area-wide O-D matrix for commercial vehicles in the SEMCOG region based on a statistically viable sample of vehicles, with emphasis on the international borders.

Table 1: Focus Groups Topics from the Focus Group Kickoff Meeting

Focus Group Topic	Focus Group Chair	Focus Group Co-chair	Number of Attendees
Asset Management	William Tansil	Ron Vibbert	28
ITS and Operations	Greg Krueger	Gary Piotrowicz, RCOC	20
Environmental Applications	Paul McAllister	Michael O'Malley	10
Traffic Congestion and Safety	Mark Bott	Tom Bruff, SEMCOG	17
Security Applications	Eileen Phifer	Laura Nelhiebel	13

Note: All chairs and co-chairs are MDOT employees, except where indicated.

In identifying the important pilot themes and specific pilots listed above, the five focus groups drew on the expertise of more than 80 transportation experts from MDOT, other state agencies, US DOT, other federal agencies, U.S. Army TACOM, county road commissions, local government, MPOs, universities, public transit providers, and private firms. To achieve their ultimate goal of identifying pilot themes and specific pilots to meet transportation system business needs, participants in the five focus groups went through the process of first identifying the most important (or burning) transportation issues that they face in their positions and then identifying the most critical information needs (or data gaps) that they face in addressing their burning issues. Next, within each of the five groups, the participants prioritized the most important needs/gaps and then began to identify the technical characteristics that restricted use data and products would have to achieve to meet the needs (or close the gaps). While the five

groups differed in how much detail they provided during this last step, all contributed significant information toward identification of the pilot themes and specific pilots detailed above.

In March, the Altarum team reconvened the five focus groups at various times and places, with each group meeting independently of the others. At these March meetings, each group first received another technical briefing from the Altarum team that addressed how restricted use data and products could address the four pilot themes seen as emerging from the Kickoff Meeting.[1] Next, the groups confirmed the accuracy and veracity of a summary of its February meeting notes prepared by the group facilitators and recorders and then reviewed and commented on the pilot themes and specific pilots. For all groups, the participants accepted the summaries as presented (i.e., no changes required), and all groups accepted the four pilot themes as is. One group, the Security Applications group, also recommended a new them focused on transportation corridor studies (see Table 2).

At the March meetings, the groups suggested several changes to the specific pilots to allow the pilots to better reflect the information, data, and business needs of the specific group requesting the change. These suggested changes, organized by focus group topic, are presented in Table 2. These changes include six new specific pilots addressing issues ranging from traffic conditions (real-time, construction zones) to transportation security assessments to air quality monitoring, as well as some minor changes to the specific pilots that emerged from the February Kickoff Meeting.

During the second round focus group meetings, the groups also had the task of prioritizing the pilots. This process resulted in pilots within theme area 3 (Support of ITS and Traffic Operations) being ranked as high priority by three of the groups (ITS and Operations, Traffic Congestion and Safety, and Security Applications), though priorities where split regarding which of the specific pilots within these theme are of the highest priority. The other two groups prioritized the pilots very closely associated with their business needs, i.e., the Asset Management group prioritized theme area 1 and the Environmental Applications group prioritized theme area 2. None of the groups ranked any of theme area 4 pilots (Origin-Destination Studies) as a top priority.

In short, the March meetings built on the results of the February Kickoff Meeting, adding refinements, new perspectives, and more detailed technical requirements. The results of these two meetings have provided the Altarum team with excellent input to use to test high priority promising pilots in anticipation of the third round focus group meetings to be held in May. At this meeting, the groups will be reformed along the dimensions of the pilots, with the new, recombined groups to be tasked with detailing precise requirements, measures of success, and the current costs of obtaining like or similar data or information (or the value of having information or data not at all available today).

[1] Two minor exceptions to the general pattern of the March meetings did occur. First, the Asset Management and Security Applications met on the same date and thus received their technical briefing as a combined group. Like the other group, however, they met independently the rest of the day. Second, due to scheduling conflicts, the ITS and Operations group met in two halves, with the second meeting actually taking place in April. Thus, in total, Altarum held six second round focus group meetings. For all groups, the chairs and co-chairs remained the same as at the Kickoff, with the ITS and Operations group having its chair present at its first meeting and its co-chair at its second meeting.

Table 2: Modifications to the Specific Pilots Requested at Second Round Focus Group Meetings

Focus Group Topic	Suggested Modification to Pilots
ITS and Operations	• Add pilot 2d: Use remote sensing technology to measure and monitor air quality in transportation corridors, especially in response to changes in traffic operations and management in these corridors • Add pilot 3e: Use imagery and sensors to detect queue lengths in static and mobile work zones
Security applications	• Modify pilot 1c to include inventory of environment (built, natural) neighboring roadways • Modify pilot 2a so as to make it not specific to US-127 • Modify pilot 3a to add support of incident and emergency management • Modify pilot 3b to link results to dynamic decision support system • Modify pilot 4a to detect anomalies and exceptions to routing • Modify pilot 4b to expand beyond SEMCOG region • Add pilot theme 5: Use remote sensing and restricted use technologies to thoroughly inventory existing and possible transportation corridors • Add pilot 5a: Use remote sensing and restricted use technology to assess security status (threats, needs, strengths) for transportation corridors • Add pilot 5b: Use remote sensing and restricted use technology to assess environmental security threats and needs in transportation corridors
Traffic Congestion and Safety	• Rephrase pilot 1c: Establish a spatially enabled inventory and assessment of non-roadway assets that affect traffic congestion and safety • Add pilot 1d: Use remote sensing and restricted use technology to collect changing pavement condition data that affect traffic congestion and safety (e.g., road surface/weather, potholes) • Add pilot 1e: Use remote sensing and restricted use technology to collect traffic data, including real-time and planning-level data (e.g., to estimate AADT), plus tracking of selected specific vehicles

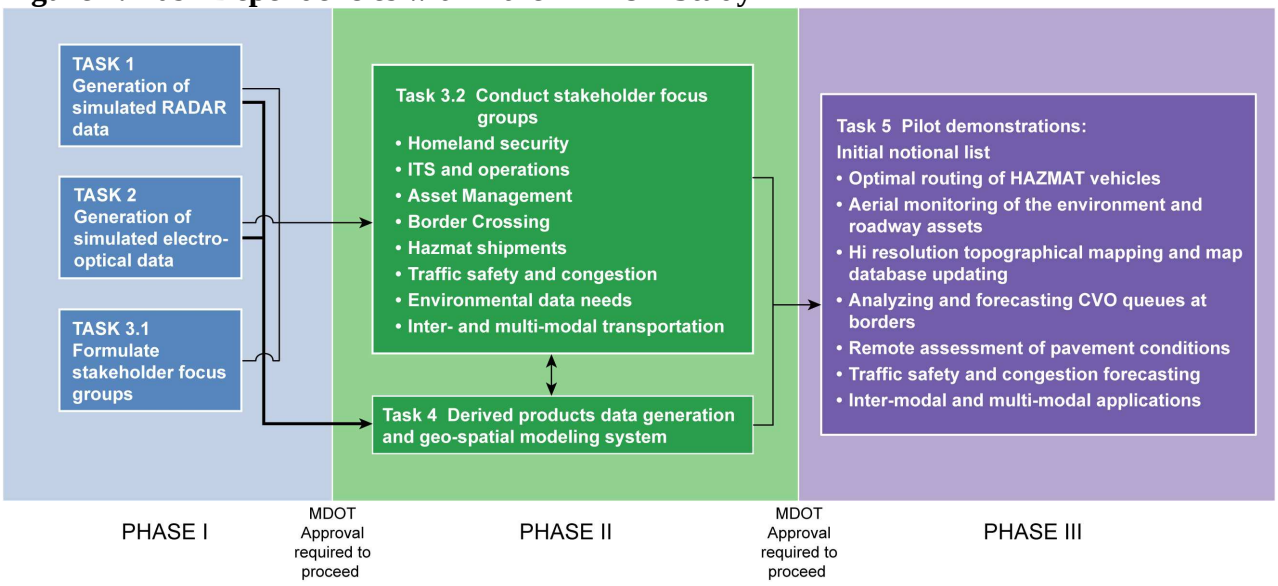
INTRODUCTION

The Transportation Applications of Restricted Use Technology (TARUT) Study is a joint effort between the Michigan Department of Transportation (MDOT) and the Altarum Institute to investigate the use of information derived from restricted-use technologies and data to support the mission and activities of the Michigan Department of Transportation (MDOT) and to estimate the potential usefulness of these technologies during one or more pilot studies. To determine the primary business needs of MDOT as they relate to restricted use technology, Altarum designed a multi-stage focus group process to identify critical transportation system issues that might be addressed by restricted use technology and to detail the technical requirements that such technology must achieve to meet MDOT's business needs. The plan for this focus group process was detailed in Deliverable 3.2 of the TARUT Study and approved by MDOT prior to the start of actual focus group meetings. On February 7, 2006, at the Kellogg Center in East Lansing, Michigan, Altarum and MDOT held the first focus group meeting (dubbed the Focus Group Kickoff Meeting), and this was followed up by second round of focus group meetings held in March 2006, with one supplemental meeting held in April 2006. This report, Deliverable 3.3 of the TARUT Study, primarily serves to present the synthesized results of the Focus Group Kickoff Meeting—i.e., to document the business needs that restricted use technology might achieve in terms of promising pilot studies that, if implemented, would test the ability of restricted use technology to meet MDOT' s mandates technically and economically. Furthermore, this report also presents preliminary analysis and synthesis of the second round focus group meetings, especially describing further refinement of the pilots that emerged from the Kickoff Meeting.

The remainder of this report is organized into two major sections. The first describes the conduct of the two rounds of focus groups that have been held and thus is process oriented. The second presents and discusses the results of the Kickoff Meeting, along with preliminary results from the second round meetings. In addition, this report also contains a Conclusions section and numerous appendices that present the actual templates and forms used in conduct of the focus groups and summaries of the raw results produces by both the Kickoff and second round meetings. The full, raw output of both rounds of focus groups held so far will be provided to MDOT in two separate documents.

MDOT and Altarum will engage in two further rounds of focus group meetings, and the ultimate goal of this sequence of meetings is to develop a short list of recommended pilot studies that will test the ability of restricted use technology to effectively meet MDOT's business needs. This process will result in a final focus group report (Deliverable 3.5) that presents these recommendations. Upon MDOT approval or modification of this list, the pilot studies will commence, as shown in Figure 1.

Figure 1: Task Dependencies within the TARUT Study



CONDUCT OF FOCUS GROUPS TO DATE

To date, MDOT and Altarum have held two rounds of focus group meetings within the TARUT Study. The first meeting (the Focus Group Kickoff Meeting) was held at the Kellogg Center in East Lansing, Michigan, February 7-8, 2006. This meeting lasted 1.5 days (all day on the 7th and a half day on the 8th) and included both a technical briefing on electro-optical and RADAR systems by Dr. Robert Shuchman of Altarum and a series of breakout sessions, with the focus group participants (stakeholders) divided into five topical groups. The second round meetings were organized around the same five topical groups and were held in March 2006. Again, they consisted of both technical briefings and breakout sessions. The sections below detail the conduct of each of these two rounds of focus group meetings.

Conduct of Focus Group Kickoff Meeting (February 7-8, 2006)

The Focus Group Kickoff Meeting of the TARUT Study was a 1.5-day event with the primary goals of launching the overall focus group process for the study and identifying critical transportation system issues, data needs, and information gaps facing MDOT and other transportation professionals. This meeting was attended by more than 80 transportation experts, with expertise covering asset management, environmental concerns, intelligent transportation systems, homeland security, traffic congestion, traffic operations, traffic safety, and more. Furthermore, these stakeholders were drawn from a diverse group of organizations, including (a full list of attendees is provided in Appendix A):

- MDOT
- Michigan State Police
- Michigan Center for Geographic Information
- Other state agencies in Michigan
- Federal Highway Administration
- U.S. Environmental Protection Agency (EPA)
- U.S. Army TACOM
- County road commissions
- Southeast Michigan Council of Governments (SEMCOG) and other MPOs
- Local government
- Transit agencies
- Academia
- Industry
- Transportation planning and consulting firms
- Remote-sensing firms

The 1.5 days were divided into a mix of joint briefings on technical aspects of remote sensing and advanced technology held early each morning and breakout sessions that allowed the five topical groups to delve deeply into the transportation system issues faced by professionals working within the five topical areas (the full agenda for the Kickoff Meeting is presented in Appendix A). In addition, on both days, the five topical groups presented their results to all the other groups to allow the groups to benefit from the insights developed by the other groups. The five groups, listed in Table 3, represent a consolidation of the eight groups discussed in Deliverables 3.1 and 3.2, and this consolidation was illustrated in Deliverable 3.2 and agreed to by MDOT. In essence, the inter-modal and multimodal group joined asset management, and the

homeland security, HAZMAT, and border-crossing groups became one group called security applications.

To manage the groups, Altarum and MDOT assigned a facilitator and recorder to each group and appointed one participant (typically an MDOT employee) as the chair of each of the five groups and another participant was made the co-chair of each group. The recorder was charged with recording the output of the group, and the facilitator was charged with leading the groups through the agenda, the forms and templates, and the process in general. The chairs and c-chairs served to provide both domain expertise and intellectual leadership of the transportation topic under their purview. These focus group leaders are listed below in Table 3.

Table 3: Focus Group Chairs, Facilitators, and Recorders for Kickoff Meeting

Topic	Chair	Co-Chair	Facilitator	Recorder
Asset Management (incl. multimodal)	Bill Tansil	Ron Vibbert	Tim Doyle (Altarum)	Liza Liversedge (Altarum)
Environmental Applications	Paul McAllister	Mike O'Malley	Nancy French (Altarum)	Colin Brooks (Altarum)
ITS and Operations	Greg Krueger	Gary Piotrowicz (RCOC)	Bob Parsons	David Schaub (Altarum)
Traffic Congestion and Safety	Mark Bott	Tom Bruff (SEMCOG)	Pam Boyd	Lisa Phillips (Altarum)
Security Applications	Eileen Phifer	Laura Nelhiebel	Greg Leonard (Altarum)	Michelle O'Haver (Altarum)

Note: These are all MDOT employees, except as noted.

During the breakout sessions, the groups were charged with completing several tasks over the course of the 1.5 days. This involved a logical process that led them from identifying problems (or burning issues), data needs, and information gaps to clustering these gaps and needs, and then to prioritizing the clusters relative to their topical area. Finally, in the last session, participants were charged with describing the technical characteristics of restricted use data and products that would allow them to better address their high priority clusters. To assist the facilitators and chairs in leading their groups to completion of these tasks, Altarum provided the groups with worksheets (forms) and report-out templates. In addition, facilitators had available flip charts, sticky notes, markers, etc., that they could use at their discretion to facilitate the breakout sessions. These forms and templates are provided in Appendix A.

At the end of each day's activities, the focus group topic chairs provided a report out to the entire group using the provided templates (or other visual aids that they deemed appropriate). These sessions served to foster interaction between the five groups and to allow cross-fertilization of ideas between groups. This interaction and cross-fertilization were further encouraged through joint lunch time discussions on the first day and a reception after the conclusion of formal focus group activities on the first day.

After the completion of the Focus Group Kickoff Meeting, the Altarum team carefully reviewed all the results from the all the groups and from these distilled the highest priority business needs that the TARUT Study might address in the form of promising pilot study themes and specific pilot studies associated with each. These themes and pilots were then reviewed by the group chairs (and some co-chairs), as well as by MDOT project managers for the TARUT Study (Bill

Tansil, David Schade, and Larry Whiteside). This process resulted in a detailed list of pilot themes and associated specific pilots targeted to meet MDOT's business needs that served as an important input to the second round focus group meetings, and the conduct of these meetings is described in detail in the following section of this report.

Conduct of Second Round Focus Group Meetings (March 2006)

Due to conflicting schedules for focus group participants, the second round focus groups were held at different times and places for each of the five groups, and the precise schedule of completed second round focus group meetings is listed below in Table 4. Identical to the Kickoff Meeting, the second round meetings began with a technical briefing presented by Altarum staff (Dr. Bob Shuchman for all groups except the environmental applications group, which received its briefing from Colin Brooks, Altarum's senior GIS analyst). At these meetings, the technical briefing focused on precise application of remote sensing and other advanced technology to the business needs identified at the Kickoff Meeting. Thus, the second round technical briefing showed some examples of how restricted use technology and products might help address the high priority data needs and information gaps identified at the Kickoff Meeting, providing the participants with an opportunity to imagine what else might be done to meet their needs and what a fuller solution might look like.

Table 4: Schedule of Second Round Focus Group Meetings

Focus Group Topic	Meeting Date	Meeting Location
Asset Management	March 16	Kellogg Center
ITS and Operations	March 27, April 19*	Altarum, RCOC TOC
Environmental Applications	March 22	MDOT Headquarters
Traffic Congestion and Safety	March 15	Altarum
Security Applications	March 16	Kellogg Center

*Note: Due to scheduling conflicts within the ITS and Operations group, two separate meetings were held for this group, thereby allowing higher attendance and input from both the chair and co-chair.

Again, like the Kickoff Meeting, the opening technical briefing was followed by breakout sessions (two, in this case, one late morning until lunch and one after lunch) during which the participants focused on the developed pilot themes and associated pilots and how well these addressed the high priority data needs and information gaps that they identified at the Kickoff Meeting. The groups were then able to further revise, redefine, and add to the pilot themes and pilots when and where they saw the need (the meeting agenda is provided in Appendix B). Based on this possibly revised list of high priority business needs (or pilots), the groups were then asked to detail the technical requirements (e.g., temporal and spatial resolution, cost) that restricted use technology would have to achieve to meet transportation systems. As a stretch goal, the groups were also asked to identify measures of success that could be used to evaluate how well their high priority pilots met their business needs.

To help the groups achieve these objectives, they were led by the same chairs and co-chairs as were present in February, and again all five groups were provided with a facilitator and a recorder. In most cases, the facilitators and recorders remained the same as were present at the February Kickoff, but in several cases one or both of these roles was filled by a different person than the person who filled it in February. In addition, the groups were once again provided with forms to complete, and examples of these are provided in Appendix B. Finally, once again, facilitators had available flip charts, computers, and other aids to use in their facilitation of the

groups. All facilitators, for example, created a matrix of critical needs and gaps versus the suggested pilots as one approach for helping participants prioritize the possible pilots. Some did this via flip chart, while most used computer-driven display to create this visual aid.

Not counting Altarum employees, the second round meetings were attended by 60 participants in total, including a high percentage of Focus Group Kickoff attendees (all second round focus group participants are listed in Appendix B). Once again, these participants represented a broad swath of transportation expertise and wide range of organizations, including:

- MDOT
- Michigan State Police
- Michigan Center for Geographic Information
- Other state agencies in Michigan
- Federal Highway Administration
- U.S. Environmental Protection Agency (EPA)
- U.S. Army TACOM
- County road commissions
- SEMCOG
- Local government
- Transit agencies
- Academia
- Industry
- Transportation planning and consulting firms
- Remote-sensing firms

After completion of the second round focus groups, the Altarum team began revisiting the promising pilot themes and associated specific pilots, including new ones that developed during the second round meetings. This process is ongoing, and further results from these meetings will be available in subsequent reports. Therefore, the following sections, which presents the results of the focus group meetings to date, focuses on results from the Kickoff Meeting and supplements these results with preliminary analysis of the second round meetings.

RESULTS OF FOCUS GROUP KICKOFF MEETING

Working within the five topical groups listed above in Table 3, participants in the Focus Group Kickoff Meeting generated a large number of important transportation problems, data needs, and information gaps—business needs—that restricted use data and technology might be used to address. In this section, the business needs identified by the five groups are discussed and synthesized into promising pilot themes and associated pilot studies that are candidates for testing the ability of restricted use technology to meet transportation agency business needs in Phase III of the TARUT Study. The business needs are presented for each group in the order listed below, and summaries of the raw results produced by each group during the Focus Group Kickoff Meeting are available in Appendix C.

- Asset Management
- ITS and Operations
- Environmental Applications
- Transportation Congestion and Safety
- Security Applications

Business Needs Identified by the Asset Management Group

During the Focus Group Kickoff Meeting, the Asset Management group identified 31 important transportation issues that it would like to see addressed, and it rated six of these as critical (or burning issues). Furthermore, for each of these six burning issues, the Asset Management group developed a fairly detailed list of information gaps that, if met, would improve the ability of transportation agencies to better handle these issues. These six burning issues, along with examples of the information gaps for each, are listed below.

1. Extending the useful life of road surfaces (base conditions, traffic volume, validation of road condition)
2. Determining the impacts of truck traffic on road surfaces (validate axle load assumptions, truck O-D studies, impact of truck traffic on road endurance)
3. Creating a comprehensive inventory of road and highway facilities and conditions locations of signs, signals, culverts, etc.; spatially enabled roadway attribute data, such as number of lanes, age, etc.)
4. Managing data more effectively to improve availability and quality of needed data (assessment of bridge conditions, subsurface structural details)
5. Tracking completed road improvements accurately (ability to see cracks, reliable algorithms, improved orthophotos)
6. Identifying the most appropriate type of improvement (treatment) for specific roads and highways (effects of culvert failures on road, capital v. preventive decision support)

From these burning issues and 25 others that it identified, the Asset Management group prioritized four issue clusters that capture its critical data needs. These were:

1. Road maintenance issue (captures gaps 1 and 2 above and others)
2. Inventory and data maintenance issues (captures gaps 3 and 4 above and others)
3. Programmatic issues (includes gaps 5 and 6 above and others)
4. Level of Service issues (captures a number of other issues not in the six high priority information gaps, such as traffic congestion, re-routing, etc.)

In short, the Asset Management group tended to focus on issues and business needs clearly implied by its name—that is, the group was primarily interested in the data needed to perform asset management functions and in handling and management of that data. For the most part, its needs are fairly long term in nature, and the group felt that it needed only yearly updates for most data needs, with every two years sufficient for some other (such as bridge condition) and every 3-6 months needed to examine the impacts of trucks on the road surface. More details on this group's needs and requirements can be found in Appendix C.

Business Needs Identified by the ITS and Operations Group

The ITS and Operations group identified 41 burning issues and organized these into five high priority issue clusters. It also identified many specific information gaps associated with these clusters, and for all of these the group determined that it needs fairly high frequency updates (anywhere from every 5 to 15 minutes). Thus, the ITS and Operations group developed a far more stringent temporal update business need than was raised by the Asset Management group. This group's high priority clusters, along with example data needs for each, are listed below.

1. System optimization (alternate routing, intersection safety, travel times on arterials)
2. Data management (real-time acquisition of data; data on weather and pavement condition; data handling, sharing; active safety)
3. Incident management (travel conditions, incident data collection, re-routing, disasters)
4. Human factors (data access and travel information for public, parking information, border-crossing data)
5. Human resources and operations (technology adoption, system integration, standards, staffing, training)

Of the specific information gaps identified by this group, it determined that it needs relatively high resolution data (no worse than 15-foot accuracy and much better, 2- to 3-foot accuracy for real-time data collection during incidents) updated every five minutes, in most cases. For some of its gaps, however, it placed only a 15-minute or longer temporal update requirement. These gaps with longer update requirements included queue lengths in rural areas, at border, and in static work zones (15 minutes) and traffic monitoring in rural areas and other areas lacking traditional ITS infrastructure (every 15 minutes to every few hours, depending on season, time of day, and location).

In short, the ITS and Operations group tended to focus on real-time or near-real-time data collection of transportation network data, along with the handling and management of that data. Again, this is quite in line with the needs of ITS and operations mandates, and more precise details regarding the group's data requirements can be found in Appendix C.

Business Needs Identified by the Environmental Applications Group

The Environmental Applications group focused its discussions within four broad topics, and used these as the basis for identifying pressing transportation system needs and for identifying critical information gaps. These four broad topics are listed below.

1. Obtain high quality, quantifiable data that is repeatable, verifiable, and validated that saves the agency time and money (including data related to natural environments, built environment, soils, subsurface conditions, noise, air quality, plant and animal habitat, etc.)

2. Improve communication related to data (e.g., to obtain better visualization tools to demonstrate need for projects, mitigation, etc.
3. Support better decision making (e.g., within project selection, alternatives analysis, etc.)
4. Integrate new technologies into process improvement efforts (i.e., to improve quality of information, save time and money, and integrate existing and new data)

In addition to detailing these four topics, the Environmental Applications group also developed very detailed lists of data requirements for the data needs listed under its focus topic one above. It organized these needs within several categories, and these are listed below with a few examples for each category. The full list can be found in Appendix C as part of the summary of the group's results.

- Subsurface features and sites (soil type, storage tanks, groundwater, geologic features)
- Surface features and sites (presence of threatened, endangered, and invasive species; wetlands; water quality; floodplains; land use; etc.)
- Air quality issues (monitoring at regional and local scales, biohazards and toxic plumes, carbon monoxide levels, dispersion)
- Noise issues (traffic data, surface roughness, noise levels)
- Vibration issues (soil moisture, soil type, subsurface geology, distance)

In short, the Environmental Applications focused on many concerns and business needs unique to its niche within most transportation agencies, including a vast array of data needs on both the natural and built environment—effectively, all the data needed to perform environmental impact assessment of transportation projects and corridors, as well as to support analysis of alternative solutions. Within the area of noise issues, however, some of this group's needs overlapped with those mentioned by the Asset Management group.

Business Needs Identified by the Transportation Congestion and Safety Group
The Traffic Congestion and Safety group focused its efforts within two related categories that directly reflect its two overarching concerns, congestion and safety. These two categories were:

- Collect, process, and analyze accurate and timely traffic data and traffic counts
- Collect, process, and analyze accurate and timely data on driver behavior and mobility

For the former of these two categories, the group defined a need for data sufficient to identify and categorize (e.g., car, truck) individual vehicles and to track road conditions in response to traffic and weather. The group expressed a need to obtain such data only periodically, such as once a year, for planning purposes, but wanted the data broken into finer periods (hourly by month, for example) to enable modeling efforts. Finally, for the purposes of providing traveler information, the group echoed the needs of the ITS and Operations group, expressing a requirement for real-time data.

Within the driver behavior category, the group expressed a business need of being able to detect differences in driving patterns by time of day (e.g., rush hour or not). Again, it concluded that it would need to able to detect and distinguish individual vehicles and that it only needed to obtain the data periodically for most purposes of analyzing and planning, but that more frequent updates would be needed to support traveler information.

In short, the Traffic Congestion and Safety group arrived at very similar business needs for each of two application areas. It also determined that it could accomplish different things (planning, modeling, provision of traveler information) depending on the temporal resolution and update frequency of the data. More specific statements of this group's results can be found in Appendix C.

Business Needs Identified by the Security Applications Group

The Security Applications group was driven by its concerns for homeland security, border crossings, and HAZMAT issues. In response, this group focused its discussions on three major topics and elaborated needs and requirements for two of these topics. The third topic, communications, was not further elaborated on, because the group determined that this topic was related more to organization behavior, inter-agency protocol, and communications technology than to restricted use technology. The two topics that this group elaborated on are listed below, along with data needs and information gaps associated with each.

- Vehicle tracking (overt tracking of certain critical vehicles and routing of HAZMAT vehicles, including consideration of population centers, prevailing winds, network status)
- Operational issues (status of critical infrastructure, including traffic, bridges, etc.; mitigation of incidents, including re-routing, alerts, notices, and coordination; and use of predictive "what-if" models)

In short, this group expressed a strong business need for data related to surveillance of vehicles and infrastructure, as well as on how to make use (operations, models) of such data. As a result, its needs vary from those requiring only low frequency updates (such as location of infrastructure elements and population) to those requiring real-time monitoring, especially once an incident has occurred. More details of this group's results can be found in Appendix C.

Promising Pilot Themes and Pilot Studies Identified by Focus Group Kickoff Meeting

The Focus Group Kickoff Meeting, which included both technical briefings to all stakeholders and five breakout groups (see Table 1 for a list of the five groups, along with the chairs and co-chairs of each group) meeting for three sessions each, successfully identified numerous transportation systems problems, data needs, and information gaps (i.e., business needs) that restricted use technology might address. In synthesizing the results of the Kickoff Meeting in light of the identified needs, the Altarum team developed four broad pilot study themes that could contribute to meeting the business needs identified by the groups. Furthermore, within each of these four pilot theme areas, the Altarum team also outlined three or four specific pilots that could be tested with the goal of testing the ability of remote sensing and restricted use technology to solve transportation system data needs or fill important information gaps. These themes and pilots were further vetted by the Altarum team with the group chairs (and sometimes co-chairs) after the Kickoff Meeting and prior to the second round focus group meetings. The resulting four pilot theme areas, along with the specific pilots associated with each, are listed below.

1. Assessment of Pavement Condition and Other Assets through Remote Sensing and Advanced Algorithms

The first potential pilot them focuses on using remote sensing, along with advanced algorithms, to assess MDOT's physical assets, especially pavements. Through this approach, Altarum and MDOT would seek to demonstrate the ability to streamline statewide data collection and allow

faster, less expensive, and more objective assessment of MDOT assets. Furthermore, by identifying approaches for improving the asset management process, this pilot would also affect traffic safety and congestion by enabling better decisions in the maintenance program. Within this theme area, the Altarum team has also outlined three specific potential pilot studies:

a. Establish meaningful (high) correlations between pavements assessments obtained via remote sensing and advanced algorithms and standard condition measures used by MDOT currently (i.e., IRI, sufficiency, PASER, distress).
b. Estimate the effects of truck traffic on pavement condition and highway congestion by using remote sensing to establish, by lane and direction, the volume of truck (perhaps versus car) traffic on MDOT's assets.
c. Establish a spatially enabled inventory and assessment of non-roadway assets in the MDOT right of way (e.g., culverts, bridges, rumble strips, signs).

2. Application of High Resolution Data to Environmental Analysis of Transportation

The second potential pilot theme area addresses the needs of MDOT's Environmental Section and may be useful to other units of MDOT and the State of Michigan (such as CGI), as well. This pilot focuses on applying a wide range of derived remote sensing products to several needs identified by the Environmental Section. The three specific pilots associated with these theme areas are:

a. Complete a site corridor study along US-127, including mapping geology and hydrology, measuring and delineating wetlands, classifying plant communities, identifying animal habitat and connectivity between habitat patches, mapping general land use in the corridor, and estimating impacts on historical properties.
b. Performing a watershed and wetlands study in the Thunder Bay Watershed, including mapping geology and hydrology, measuring and delineating wetlands, classifying plant communities, identifying animal habitat and connectivity between habitat patches, and mapping general land use in the corridor.
c. Using remote sensing to collect data and information that will aid in identifying and evaluating potential locations for a new international border crossing across the Detroit River, including analysis of possible plaza sites.

3. Support of ITS and Traffic Operations

The third potential pilot theme area focuses on supporting MDOT's ITS efforts and other highway operations activities. This pilot is designed to contribute tools and methods aimed at improving the management and operation of MDOT's infrastructure and thus positively affect traffic congestions and safety, as well as increase the security of MDOT's assets and the traveling public that uses these assets. Within this third theme area, the Altarum team developed four specific potential pilot studies.

a. Link real-time (or near real-time) vehicle tracking data to GIS and spatially enabled traffic flow models to improve traffic operations and enhance congestion avoidance.
b. Apply network-wide sensor data to calibrate and validate existing MDOT network condition models by time of day and geographic location, including analysis of historical patterns.
c. Use derived products to create high resolution road and highway centerline data as an enabler for ITS, VII, and other operations functions.

d. Use sensors (imagery, tracking data, etc.) to estimate queue lengths and/or delay times at international borders, including examination of what delay measures are most useful.

4. Support Origin-destination Data Collection

The fourth pilot theme area focuses on supporting collection of origin-and-destination (O-D) data. If pursued further and successful, this potential pilot would assist numerous units and activities within MDOT by developing techniques for using remotely sensed data (and possibly restricted use algorithms) to collect O-D data across an entire urban area for which traditional methods of O-D data collection (such as stopping cars and surveying drivers on roads and highways) are problematic, because they interfere with traffic flow and can be dangerous for data gatherers. Within this fourth theme area, the Altarum team again has detailed three specific potential pilot studies, and these are described below.

a. Demonstrate technical ability to track a limited number of vehicles using cellular technology, infrared tags, or other low-cost technology.
b. Successfully track a relatively large number of vehicles (several thousand) in the SEMCOG region.
c. Develop an area-wide O-D matrix for commercial vehicles in the SEMCOG region based on a statistically viable sample of vehicles, with emphasis on the international borders.

PRELIMINARY RESULTS FROM SECOND ROUND FOCUS GROUP MEETINGS

In March, the Altarum team reconvened the five focus groups at various times and places. In short, the March meetings built on the results of the February Kickoff Meeting, adding refinements, new perspectives, and more detailed technical requirements. In March, for all groups, the participants accepted the summaries of Kickoff Meeting exactly as presented (i.e., no changes required), and all groups accepted the four pilot themes as presented. One group, the Security Applications group, also recommended a new them focused on transportation corridor studies (see Table 5); see Appendix D for brief summaries of the second round meeting results.

The March groups also suggested some changes to the specific pilots to allow the pilots to better reflect the information, data, and business needs of the specific group requesting the change. These suggested changes, organized by focus group topic, are presented in Table 5. These changes include six new specific pilots addressing issues ranging from traffic conditions (real-time, construction zones) to transportation security assessments to air quality monitoring, as well as some minor changes to the specific pilots that emerged from the February Kickoff Meeting.

Table 5: Modifications to the Specific Pilots Requested at Second Round Focus Group Meetings

Focus Group Topic	Suggested Modification to Pilots
ITS and Operations	• Add pilot 2d: Use remote sensing technology to measure and monitor air quality in transportation corridors, especially in response to changes in traffic operations and management in these corridors • Add pilot 3e: Use imagery and sensors to detect queue lengths in static and mobile work zones
Security applications	• Modify pilot 1c to include inventory of environment (built, natural) neighboring roadways • Modify pilot 2a so as to make it not specific to US-127 • Modify pilot 3a to add support of incident and emergency management • Modify pilot 3b to link results to dynamic decision support system • Modify pilot 4a to detect anomalies and exceptions to routing • Modify pilot 4b to expand beyond SEMCOG region • Add pilot theme 5: Use remote sensing and restricted use technologies to thoroughly inventory existing and possible transportation corridors • Add pilot 5a: Use remote sensing and restricted use technology to assess security status (threats, needs, strengths) for transportation corridors • Add pilot 5b: Use remote sensing and restricted use technology to assess environmental security threats and needs in transportation corridors
Traffic Congestion and Safety	• Rephrase pilot 1c: Establish a spatially enabled inventory and assessment of non-roadway assets that affect traffic congestion and safety • Add pilot 1d: Use remote sensing and restricted use technology to collect changing pavement condition data that affect traffic congestion and safety (e.g., road surface/weather, potholes) • Add pilot 1e: Use remote sensing and restricted use technology to collect traffic data, including real-time and planning-level data (e.g., to estimate AADT), plus tracking of selected specific vehicles

In March, the groups also set priorities for the pilots, each given the opportunity to rank order its top five choices for pilot studies with the most promise of meeting the business needs of the groups. In practice, few of the groups actually chose as many as five high priority pilots, as the groups tended to focus their energies on just a few pilots that they saw as most benefiting their focus topic. Nonetheless, the groups had some overlap in their choices, as shown below in Table 6, which lists each group's prioritized pilots.

Table 6: Highest Priority Pilots for Each Focus Group from Second Round Meetings

Rank Order	Asset Mgmt.	ITS & Ops.	Envir. App.	Traffic Cong. & Safety	Security App.
1	1c	3a	2a	3c	3a
2	1a	3d	2c	3a	3b
3	1b	3e	2b	3b	3c
4	N/A	2d* and 3c	1c	1e*	3d
5	N/A	3b	1b		

* See Table 5 for definition of these pilots new to the second round meetings. All others are as defined in the section that discusses promising pilots.

As shown in Table 6, the pilots related to theme area 3 (Support of ITS and Traffic Operations) were deemed the highest priority by three of the five groups, while the asset management group prioritized theme area 1 (Remote Sensing of Pavement Condition and Other Assets) and the environmental group prioritized theme area 2 (Application of High Resolution Data to Environmental Analysis of Transportation). Furthermore, the pilots within theme area 4 (O-D Studies) were not deemed to be a priority by any of the five groups.

CONCLUSIONS

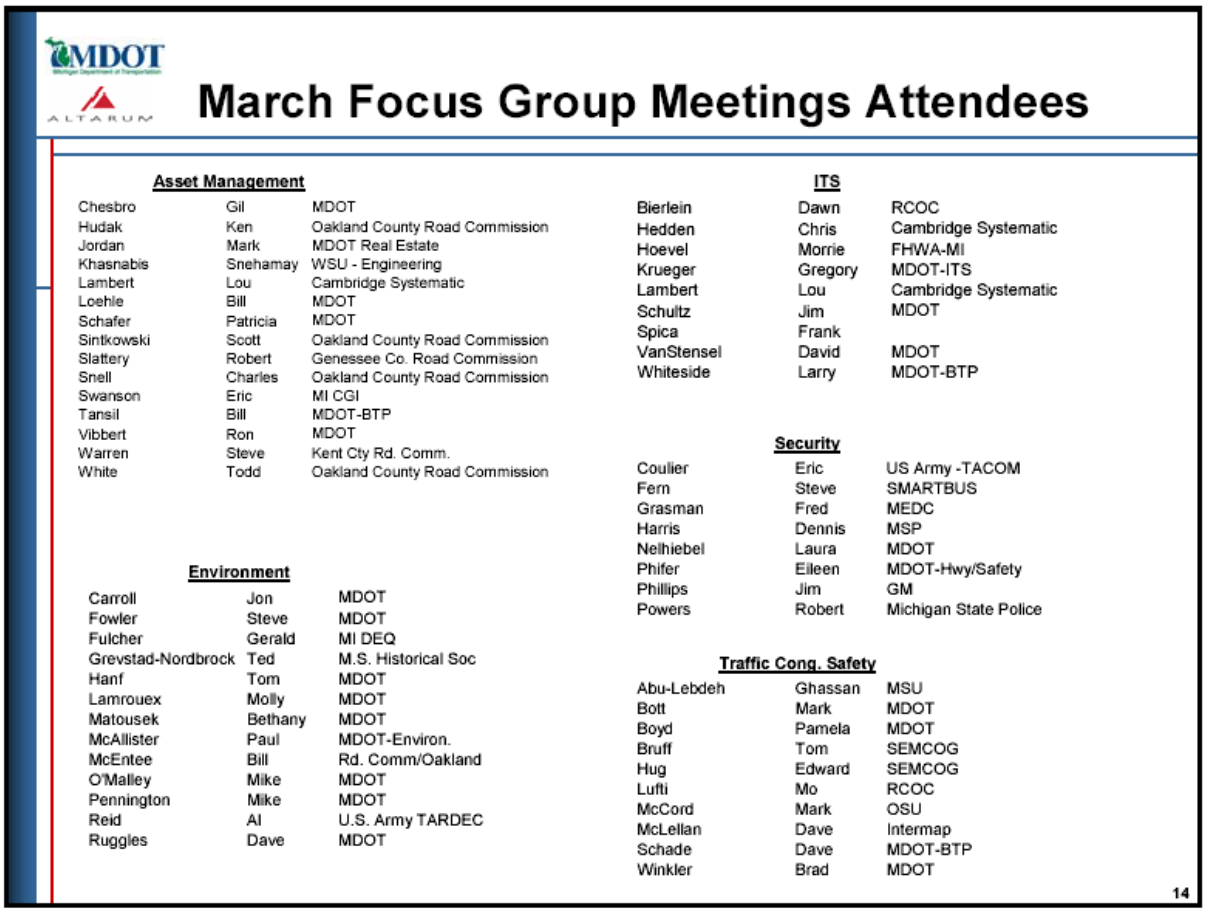
Both of the two rounds of focus group meetings held to date as part of the TARUT Study have been very successful, have provided a clear picture of transportation agency business needs, and have enabled the Altarum team to detail potential pilots with the promise of meeting these needs. The Focus Group Kickoff Meeting, in particular, resulted in elaboration of many transportation system data needs and information gaps that hinder the ability of transportation professionals to address critical issues that they face in their roles. From these critical gaps and needs, the Altarum team derived promising pilot study themes and associated specific pilot studies to meet these business needs.

During the second round meetings, the groups further refined the pilots in light of transportation business needs and prioritized the pilots according to their ability to meet the groups' critical needs. From this process, three of the pilot theme areas (Remote Sensing for Asset Management, High Resolution Data to Support Environmental Analysis, and Support of ITS and Traffic Operations) emerged as higher priorities, though priorities where split regarding which of the specific ITS and Traffic Operations pilots are of the highest priority. These issues will be addressed in further detail during the third round focus group meetings.

In summary, the results of the two rounds of focus group meetings held to date have provided the Altarum team with excellent input to use to test high priority promising pilots in anticipation of the third round focus group meetings to be held in May. At this meeting, the groups will be reformed along the dimensions of the pilots, with the new, recombined groups to be tasked with detailing precise requirements, measures of success, and the current costs of obtaining like or similar data or information (or the value of having information or data not at all available today).

APPENDIX A: Agenda, Forms, Templates, and List of Attendees from Focus Group Kickoff Meeting (February 2006)

This appendix contains the primary materials used to manage and conduct the Focus Group Kickoff Meeting, including the agenda, the workbook forms used by participants in their breakout sessions, and the report-out templates used by facilitators, recorders, and chairs to present results to the entire group. It also contains a list of all attendees at this meeting.



March Focus Group Meetings Attendees

Asset Management

Chesbro	Gil	MDOT
Hudak	Ken	Oakland County Road Commission
Jordan	Mark	MDOT Real Estate
Khasnabis	Snehamay	WSU - Engineering
Lambert	Lou	Cambridge Systematic
Loehle	Bill	MDOT
Schafer	Patricia	MDOT
Sintkowski	Scott	Oakland County Road Commission
Slattery	Robert	Genessee Co. Road Commission
Snell	Charles	Oakland County Road Commission
Swanson	Eric	MI CGI
Tansil	Bill	MDOT-BTP
Vibbert	Ron	MDOT
Warren	Steve	Kent Cty Rd. Comm.
White	Todd	Oakland County Road Commission

Environment

Carroll	Jon	MDOT
Fowler	Steve	MDOT
Fulcher	Gerald	MI DEQ
Grevstad-Nordbrock	Ted	M.S. Historical Soc
Hanf	Tom	MDOT
Lamrouex	Molly	MDOT
Matousek	Bethany	MDOT
McAllister	Paul	MDOT-Environ.
McEntee	Bill	Rd. Comm/Oakland
O'Malley	Mike	MDOT
Pennington	Mike	MDOT
Reid	Al	U.S. Army TARDEC
Ruggles	Dave	MDOT

ITS

Bierlein	Dawn	RCOC
Hedden	Chris	Cambridge Systematic
Hoevel	Morrie	FHWA-MI
Krueger	Gregory	MDOT-ITS
Lambert	Lou	Cambridge Systematic
Schultz	Jim	MDOT
Spica	Frank	
VanStensel	David	MDOT
Whiteside	Larry	MDOT-BTP

Security

Coulier	Eric	US Army -TACOM
Fern	Steve	SMARTBUS
Grasman	Fred	MEDC
Harris	Dennis	MSP
Nelhiebel	Laura	MDOT
Phifer	Eileen	MDOT-Hwy/Safety
Phillips	Jim	GM
Powers	Robert	Michigan State Police

Traffic Cong. Safety

Abu-Lebdeh	Ghassan	MSU
Bott	Mark	MDOT
Boyd	Pamela	MDOT
Bruff	Tom	SEMCOG
Hug	Edward	SEMCOG
Lufti	Mo	RCOC
McCord	Mark	OSU
McLellan	Dave	Intermap
Schade	Dave	MDOT-BTP
Winkler	Brad	MDOT

14

AGENDA FOR FOCUS GROUP KICK-OFF MEETING

February 7-8, 2006

Purpose of Meeting: To assemble a group of transportation experts to establish a set of detailed requirements for transportation applications of restricted use technology to meet critical transportation needs

Desired Outcomes from Meeting

- Each of five groups identifies the burning issues that it faces in the transportation sphere; identifies information, data, and technique gaps related to these burning issues; and produces detailed requirements for addressing these gaps with restricted use technology

Approach

- Stakeholders obtain concrete and coherent understanding of their role (and their individual group's role)
- Stakeholders gain a basic knowledge of technical capabilities (EO and RADAR, etc.)
- Groups complete a first cut on desirable applications within topical areas—first step toward requirements definition
- Groups gain experience working together and establish group norms
- Groups plan for their future activities

February 7, 2006 (Day 1)

8:15 Check-in and continental breakfast

9:00 Meeting commences

- Bill Tansil of MDOT welcomes attendees and introduces the TARUT Study and the Altarum team
- Ken Baker provides welcome statement on behalf of Altarum

9:15 Mission Statement (Bob Shuchman)

- Importance of TARUT Study to state and national goals and objectives
- Why attendees are important to the process
- Altarum team overviews plans for the 1.5-day meeting
- Altarum team motivates attendees

9:30 EO and RADAR Briefing (Altarum team)

- Altarum staff briefs attendees on EO and RADAR technologies and their capabilities
    - Includes theory and examples

11:00 Focus Group Assignments (Richard Wallace)

- Altarum team gives the breakout groups their overall assignments for the 1.5 days (logistics, deliverables, process)

11:15 Breakout Session 1 (Icebreaking, Introductions, Vision)

- Initial small group activity to get members of the individual groups acquainted with one another and starting to address their mission(s). The primary tasks for this session are to make introductions and to describe visions for the future (next-generation) transportation system

12:00 LUNCH

- Includes MDOT Vision Statement for TARUT Study (Kirk Steudle)

1:30 (Reconvene) Breakout Session 2

- This session picks up where the Introductory Breakout left off. Now that introductions are over and some initial visioning of future transportation systems has been accomplished, stakeholders outline the "burning issues" that affect transportation under their purview (their topical area), as well as in their geographic area); perform a gap analysis to identify data, other information, and technologies/techniques that, if available, would assist in addressing these burning issues (and achieving the vision); cluster issues/gaps, as needed; rank issues/gaps from highest to lowest priority

3:45 Break/Group Chair Prep Time

- Time for a true break for most of the participants and also time for the chairs of the five groups to prepare their thoughts and slides for the report out

4:00 Report Out Day 1

- Group chairs report out to the larger group using standard forms/templates provided by the Altarum team (~10 minutes per group)

5:00 Social Hour (end of formal program for Day 1)

- Drinks, appetizers, etc., to allow for information interaction between participants

6:30 Dinner meeting between Altarum team, Focus Group Chairs, and Facilitators

- Review status of group activities and progress, assess success so far, make adjustments for Day 2 (if deemed worthwhile)

February 8, 2006 (Day 2)

8:00 Continental breakfast

8:30 Featured Technical Presentation: Cutting Edge Remote Sensing Techniques for Transportation

9:30 Breakout Session 3

- Outline detailed requirements for restricted use technology to fill the high priority gaps identified the previous day

11:30 Break/Group Chair Prep Time

- Time for a true break for most of the participants and also time for the chairs of the five groups to prepare their thoughts and slides for the report out

11:45 Report Out Day 2, Next Steps, and Lunch

- Working lunch during which chairs report out for second time and groups establish next steps

1:00 END

BREAKOUT SESSION 1 (DAY 1)

Goal: Acquaint focus group members with one another and start progress on the group's mission for the 1.5 day meeting.

Activities

1. Briefly describe your vision(s) for the next-generation transportation system; what does it look like, what characteristics does it have? Etc.
2. Take a few minutes for introductions. Each member of the group should introduce himself or herself: name, organizational affiliation, and statement of vision.

Time: You have about 45 minutes, until the lunch break, to complete these two activities.

VISION FOR FUTURE TRANSPORTATION SYSTEM

Describe your vision for Michigan's (or the nation's) transportation system twenty years from now in one sentence:

NOTES

BREAKOUT SESSION 2 (DAY 1)

Goal: Develop a prioritized list of important transportation system problems and data needs for your topical area (e.g., asset management, ITS and operations, environmental applications, etc.)/

Activities

- List the most pressing (or burning) transportation issues (the ones that keep you awake at night) that you face in your position
- Clearly define these issues and describe why they are important
- Group these burning issues into logically similar clusters
- Prioritize these groups or clusters from highest to lowest priority
- Detail the data, information, and technology gaps associated with these high priority clusters

Time: You have about two hours to complete these activities. At the end of this period, the group chair(s), aided by the group's facilitator and recorder, will have about 15 minutes to prepare a brief presentation to report out to all the groups.

MOST PRESSING TRANSPORTATION ISSUES THAT I FACE

In my position, the most pressing transportation-related issues are:

1.

2.

3.

4.

The next step is to discuss these issues with your group members. Your group chair and facilitator will lead you through this process.

BREAKOUT SESSION 2 (DAY 1)

CLUSTERS OF ISSUES

As a group, try to form some logical "clusters" of pressing (or burning) issues. For example, you may detect several issues that share data, techniques, personnel, etc. List/describe those clusters here:

If possible, reach a consensus on the most pressing issue clusters that affect your focus area (e.g., asset management, ITS, etc.).

CONSENSUS VIEW ON MOST PRESSING TRANSPORTATION ISSUES

The most pressing (or burning) issue clusters in transportation related to our focus area are:

1.

2.

3.

4.

BREAKOUT SESSION 2 (DAY 1)

GAP ANALYSIS

To better address these most important issue clusters, we need better data, information, technology, and techniques. Define the gaps. Why are they important? Provide additional explanation of these gaps, as needed.

BREAKOUT SESSION 3 (DAY 2)

Goal: Detail the technical characteristics that restricted use technology would need to achieve to close the gaps identified and described for your highest priority issue clusters

Activities

- Revisit your analysis from yesterday afternoon—having had a good night's sleep, do your clusters and priorities still make sense?
- Start with your highest priority cluster and its associated gaps and detail the technical characteristics needed by restricted use technology to address this issue/gap. At a minimum, work out the spatial and temporal requirements for data, but also impose requirements along other dimensions as you see fit (hardware, software, products, etc.).

Time: You have about two hours to complete these activities. At the end of this period, the group chair(s), aided by the group's facilitator and recorder, will have about 15 minutes to prepare a brief presentation to report out to all the groups during a working lunch.

Take a few minutes to review your prioritized list of issues clusters. Do the issue clusters still make sense? Does your rank ordering of these issue clusters still make sense?

UPDATED PRIORITIZED LIST OF ISSUE CLUSTERS

Our five top priorities now are:

1.

2.

3.

4.

5.

BREAKOUT SESSION 3 (DAY 2)

The final job for your group to complete, besides agreeing on a schedule for your next meeting, is to develop technical characteristics for addressing the data, information, and technology gaps associated with your highest priority issues clusters. These characteristics should be as detailed and specific as possible and should concentrate especially on the dimensions that you have seen detailed over the last 1.5 days during the expert presentations. That is, they should look at characteristics such as spatial (how fine-grained) and temporal (how often) resolution, as well as others that are important to your group (e.g., cost, hardware/software concerns, etc.). Start with your highest priority cluster and associated gap(s) and continue working through your top five until time is up.

TECHNICAL REQUIREMENTS FOR HIGHEST PRIORITY ISSUE AND GAP

Our highest priority issue cluster and gap(s) are:

Desired technical characteristics to address the gap(s) are:

Spatial resolution:

Temporal resolution:

OTHER (_____)

OTHER (_____)

OTHER (_____)

BREAKOUT SESSION 3 (DAY 2)

TECHNICAL REQUIREMENTS FOR SECOND HIGHEST PRIORITY ISSUE AND GAP

Our second highest priority issue cluster and gap(s) are:

Desired technical characteristics to address the gap(s) are:

Spatial resolution:

Temporal resolution:

OTHER (_____)

OTHER (_____)

OTHER (_____)

BREAKOUT SESSION 3 (DAY 2)

TECHNICAL REQUIREMENTS FOR THIRD HIGHEST PRIORITY ISSUE AND GAP

Our third highest priority issue cluster and gap(s) are:

Desired technical characteristics to address the gap(s) are:

Spatial resolution:

Temporal resolution:

OTHER (_____)

OTHER (_____)

OTHER (_____)

BREAKOUT SESSION 3 (DAY 2)

TECHNICAL REQUIREMENTS FOR FOURTH HIGHEST PRIORITY ISSUE AND GAP

Our fourth highest priority issue cluster and gap(s) are:

Desired technical characteristics to address the gap(s) are:

Spatial resolution:

Temporal resolution:

OTHER (_____)

OTHER (_____)

OTHER (_____)

BREAKOUT SESSION 3 (DAY 2)

TECHNICAL REQUIREMENTS FOR FIFTH HIGHEST PRIORITY ISSUE AND GAP

Our fifth highest priority issue cluster and gap(s) are:

Desired technical characteristics to address the gap(s) are:

Spatial resolution:

Temporal resolution:

OTHER (_____)

OTHER (_____)

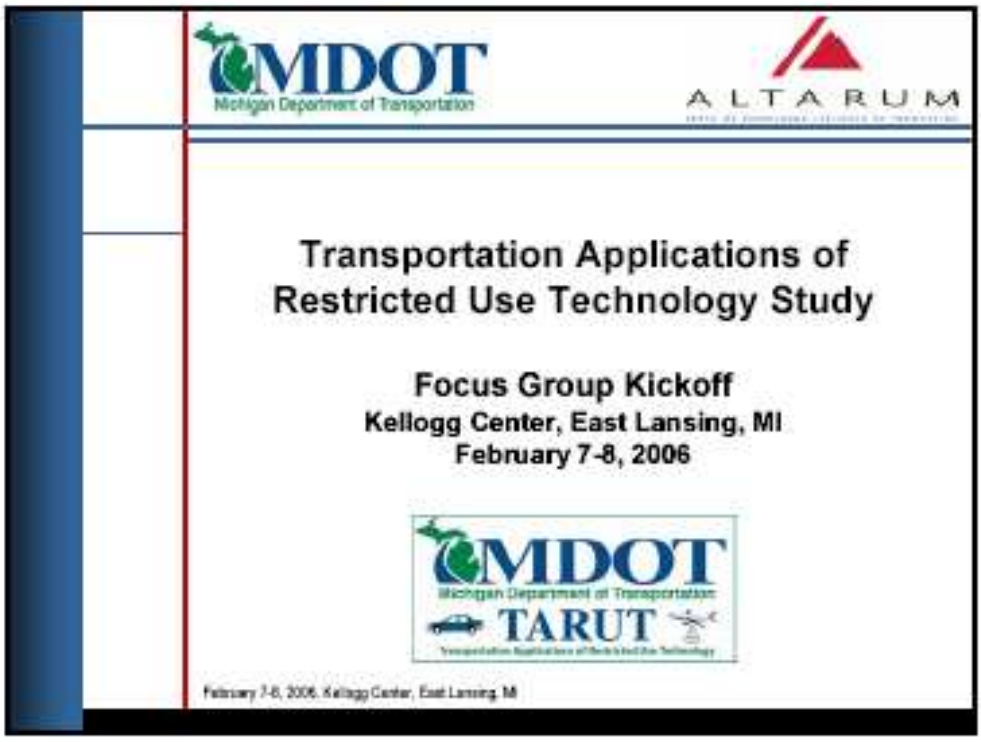
OTHER (_____)

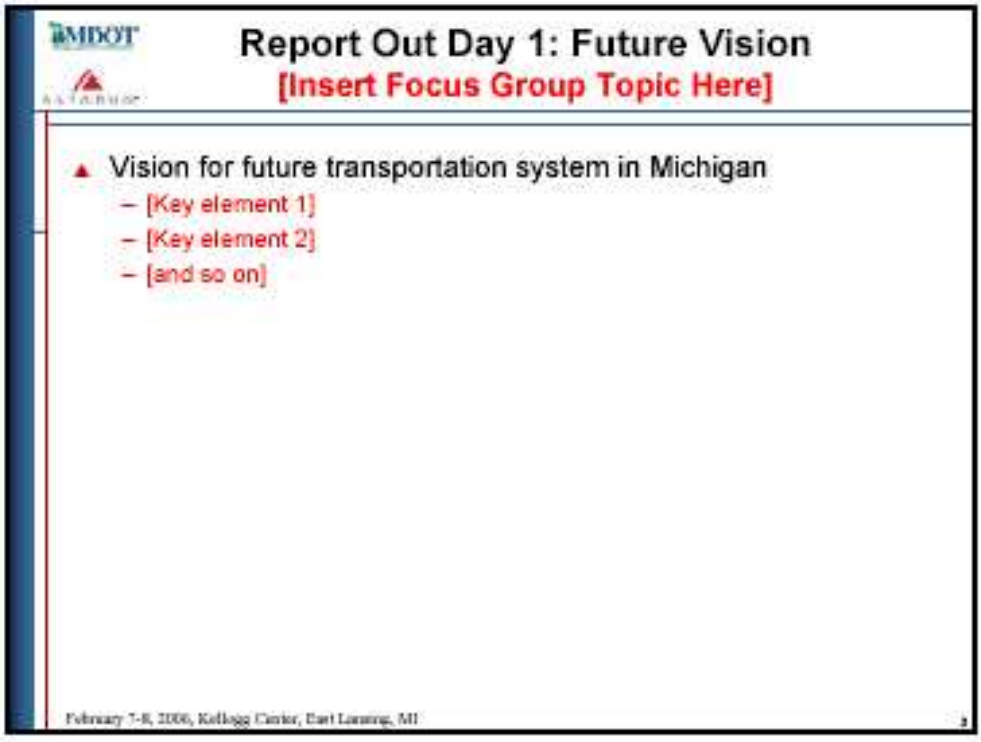
Be sure to settle on your preferred next meeting date. The recommended date is March 15-16 here at the Kellogg Center. Does that work your group? If not, then when and where:

NEXT MEETING DATE

Our next meeting date is:

Location:


MDOT
Michigan Department of Transportation
ALTARUM
Transportation Applications of
Restricted Use Technology Study
Focus Group Kickoff
Kellogg Center, East Lansing, MI
February 7-8, 2006
MDOT
Michigan Department of Transportation
TARUT
February 7-8, 2006, Kellogg Center, East Lansing, MI


MDOT
ALTARUM
Report Out Day 1: Future Vision
[Insert Focus Group Topic Here]
Vision for future transportation system in Michigan
[Key element 1]
[Key element 2]
[and so on]
February 7-8, 2006, Kellogg Center, East Lansing, MI

Report Out Day 1: Burning Issues
[Insert Focus Group Topic Here]

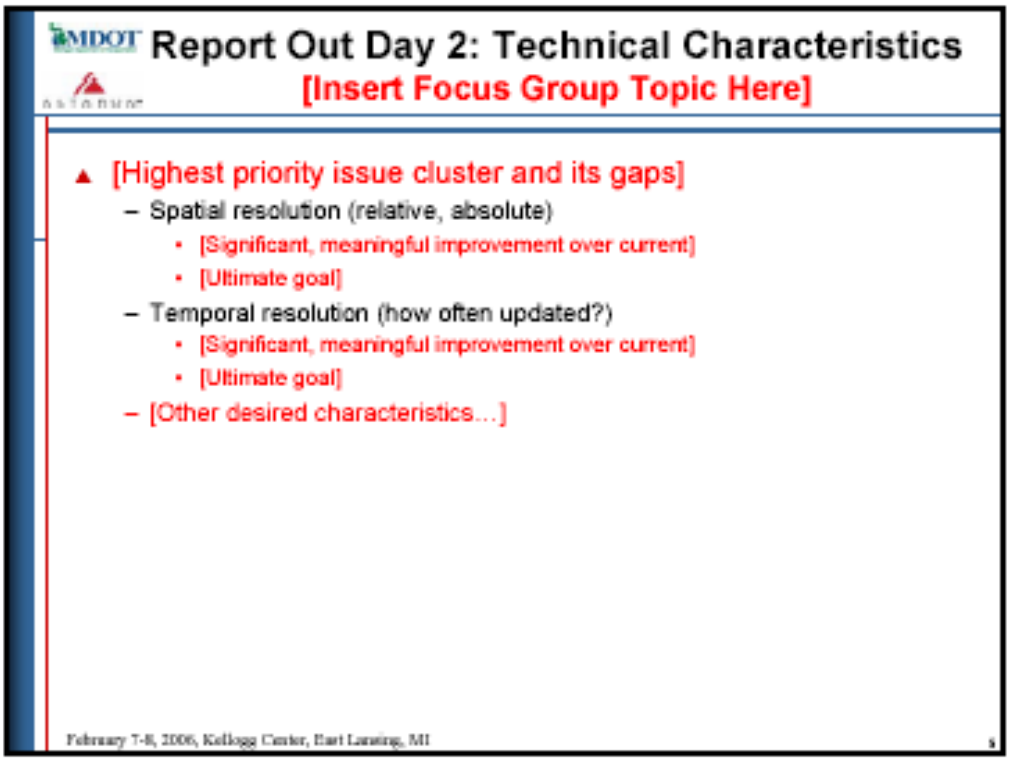
- Burning issues for [focus group topic]
  - [Burning issue 1]
  - [Burning issue 2]
  - [Burning issue 3]
  - [and so on]
- Prioritized and combined issue clusters
  1. [Highest priority issue cluster]
  2. [Second highest priority issue cluster]
  3. [Third highest priority issue cluster]
  4. [And so on]

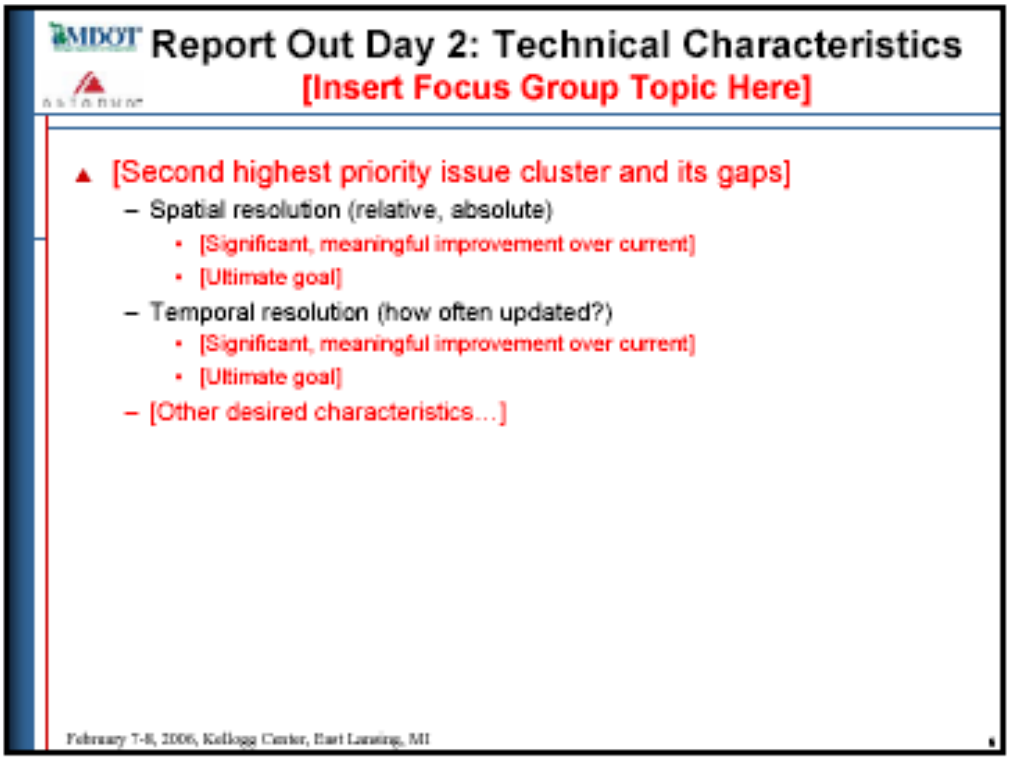
February 7-8, 2006, Kellogg Center, East Lansing, MI 3

Report Out Day 1: Gap Analysis
[Insert Focus Group Topic Here]

- [Highest priority issue cluster]
  - [Define the data, information, technology gap(s) associated with issue: current v. future desired state]
  - [Why is this gap important]
  - [Additional explanation/description, as needed]
- [Second highest priority issue cluster]
  - [Define the data, information, technology gap(s) associated with issue: current v. future desired state]
  - [Why is this gap important]
  - [Additional explanation/description, as needed]
- [Third highest priority issue cluster]
  - [Define the data, information, technology gap(s) associated with issue: current v. future desired state]
  - [Why is this gap important]
  - [Additional explanation/description, as needed]

February 7-8, 2006, Kellogg Center, East Lansing, MI 4


MDOT
Report Out Day 2: Technical Characteristics
[Insert Focus Group Topic Here]
[Highest priority issue cluster and its gaps]
Spatial resolution (relative, absolute)
[Significant, meaningful improvement over current]
[Ultimate goal]
Temporal resolution (how often updated?)
[Significant, meaningful improvement over current]
[Ultimate goal]
[Other desired characteristics…]
February 7-8, 2006, Kellogg Center, East Lansing, MI


MDOT
Report Out Day 2: Technical Characteristics
[Insert Focus Group Topic Here]
[Second highest priority issue cluster and its gaps]
Spatial resolution (relative, absolute)
[Significant, meaningful improvement over current]
[Ultimate goal]
Temporal resolution (how often updated?)
[Significant, meaningful improvement over current]
[Ultimate goal]
[Other desired characteristics…]
February 7-8, 2006, Kellogg Center, East Lansing, MI

Report Out Day 2: Technical Characteristics
[Insert Focus Group Topic Here]

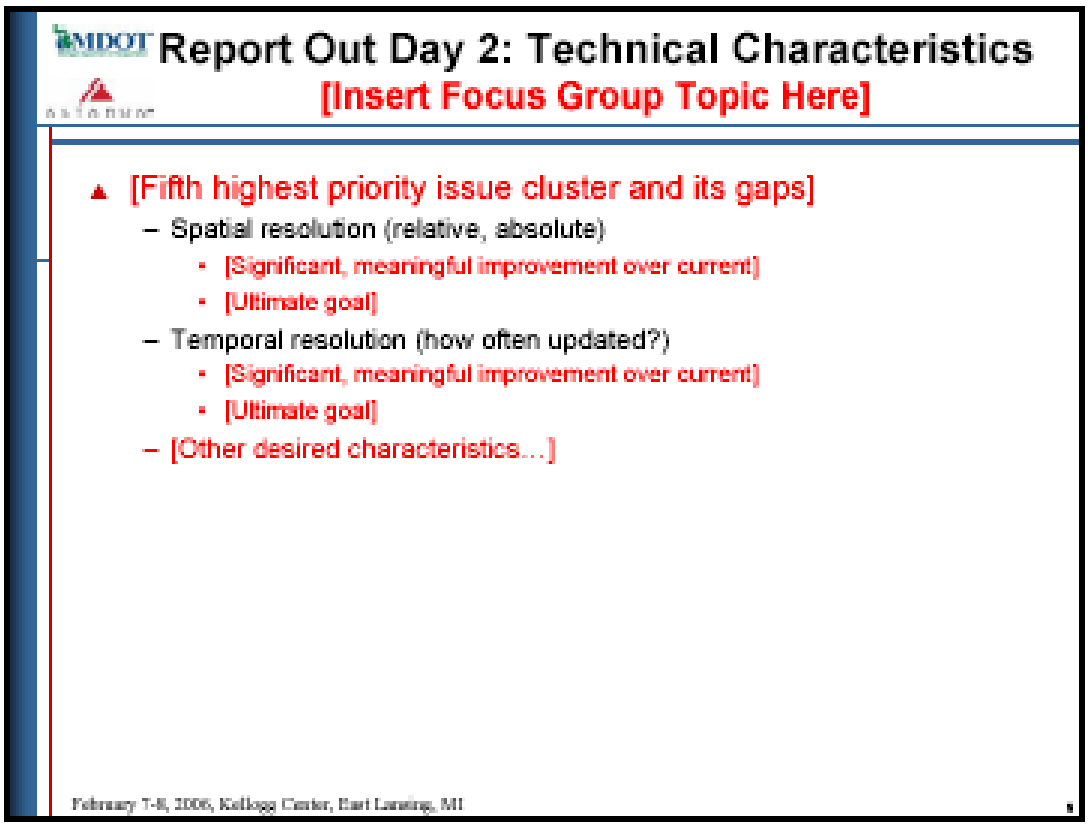
- [Third highest priority issue cluster and its gaps]
  - Spatial resolution (relative, absolute)
    - [Significant, meaningful improvement over current]
    - [Ultimate goal]
  - Temporal resolution (how often updated?)
    - [Significant, meaningful improvement over current]
    - [Ultimate goal]
  - [Other desired characteristics…]

February 7-8, 2006, Kellogg Center, East Lansing, MI

Report Out Day 2: Technical Characteristics
[Insert Focus Group Topic Here]

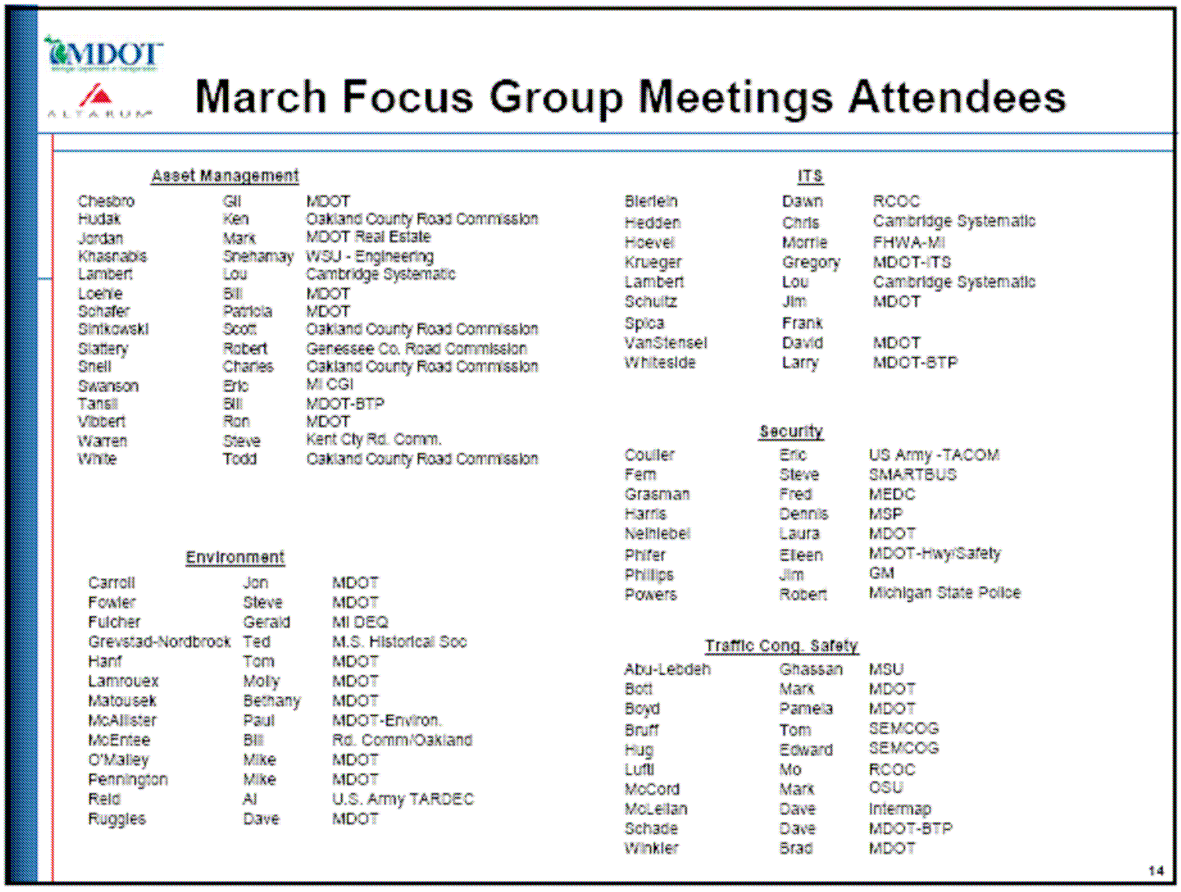
- [Fourth highest priority issue cluster and its gaps]
  - Spatial resolution (relative, absolute)
    - [Significant, meaningful improvement over current]
    - [Ultimate goal]
  - Temporal resolution (how often updated?)
    - [Significant, meaningful improvement over current]
    - [Ultimate goal]
  - [Other desired characteristics…]

February 7-8, 2006, Kellogg Center, East Lansing, MI


MDOT
Report Out Day 2: Technical Characteristics
[Insert Focus Group Topic Here]
[Fifth highest priority issue cluster and its gaps]
Spatial resolution (relative, absolute)
[Significant, meaningful improvement over current]
[Ultimate goal]
Temporal resolution (how often updated?)
[Significant, meaningful improvement over current]
[Ultimate goal]
[Other desired characteristics…]
February 7-8, 2006, Kellogg Center, East Lansing, MI

APPENDIX B: Agenda, Forms, and Templates from Second Round Focus Group Meetings (March)

This appendix contains the primary materials used to manage and conduct the second round focus group meeting, including the agenda and examples of the workbook forms used by participants in their breakout sessions. It also contains a list of all attendees at these meetings.



March Focus Group Meetings Attendees

Asset Management

Chesbro	Gil	MDOT
Hudak	Ken	Oakland County Road Commission
Jordan	Mark	MDOT Real Estate
Khasnabis	Snehamay	WSU - Engineering
Lambert	Lou	Cambridge Systematic
Loerie	Bill	MDOT
Schafer	Patricia	MDOT
Sinkowski	Scott	Oakland County Road Commission
Slattery	Robert	Genessee Co. Road Commission
Snell	Charles	Oakland County Road Commission
Swanson	Eric	MI CGI
Tansil	Bill	MDOT-BTP
Vibbert	Ron	MDOT
Warren	Steve	Kent Cty Rd. Comm.
White	Todd	Oakland County Road Commission

Environment

Carroll	Jon	MDOT
Fowler	Steve	MDOT
Fulcher	Gerald	MI DEQ
Grevstad-Nordbrock	Ted	M.S. Historical Soc
Hanf	Tom	MDOT
Lamrouex	Molly	MDOT
Matousek	Bethany	MDOT
McAllister	Paul	MDOT-Environ.
McEntee	Bill	Rd. Comm/Oakland
O'Malley	Mike	MDOT
Pennington	Mike	MDOT
Reid	Al	U.S. Army TARDEC
Ruggles	Dave	MDOT

ITS

Bierlein	Dawn	RCOC
Hedden	Chris	Cambridge Systematic
Hoevel	Morrie	FHWA-MI
Krueger	Gregory	MDOT-ITS
Lambert	Lou	Cambridge Systematic
Schultz	Jim	MDOT
Spica	Frank	
VanStensel	David	MDOT
Whiteside	Larry	MDOT-BTP

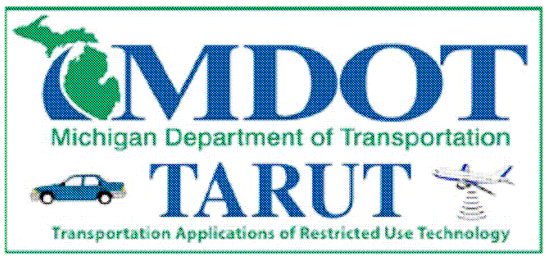
Security

Coulter	Eric	US Army -TACOM
Fern	Steve	SMARTBUS
Grasman	Fred	MEDC
Harris	Dennis	MSP
Nehlebel	Laura	MDOT
Phifer	Eileen	MDOT-HwySafety
Phillips	Jim	GM
Powers	Robert	Michigan State Police

Traffic Cong. Safety

Abu-Lebdeh	Ghassan	MSU
Bott	Mark	MDOT
Boyd	Pamela	MDOT
Bruff	Tom	SEMCOG
Hug	Edward	SEMCOG
Lutfi	Mo	RCOC
McCord	Mark	OSU
McLellan	Dave	Intermap
Schade	Dave	MDOT-BTP
Winkler	Brad	MDOT

14



Agenda:

8:30 Continental Breakfast (Food Provided)

9:00 Introduction
- Previous Meeting Outcomes
- Focus of Meeting
- Technical Overview

10:00 Focus Meeting

12:00 Lunch (Food Provided)

1:00 Resume Focus Meeting

4:00 Action Items
- Schedule of 3rd Meeting in May
- Summarize the Day

4:30 Meeting Ends

BREAKOUT SESSION 1 (MORNING)

Goal: To review the draft of "Promising Pilot Study Areas Emerging from February's Focus Group Kickoff Meetings" and compare it to your group's high priority data, information, and other needs.

Activities:

1. Your facilitator will briefly summarize the materials (notes and report outs) that your group developed in February: Do they still make sense? Are the group's preferences and needs captured accurately? Modify them as needed.
2. Walk through the draft document ("Promising Pilot Study Areas Emerging from February's Focus Group Kickoff Meetings") and compare it to the high priority ("burning") issues, information gaps, and data needs that you developed in February.
3. If needed, modify or add to the list of promising pilots so that they better meet your group's priorities.
4. Rank order (top 5) the promising pilots (including any new or modified ones that you developed) in terms of their ability to meet the high priority needs of your group (Asset management)

Time: You have about two hours, until the lunch break, to complete these four activities.

REVIEW OF FEBRUARY FOCUS GROUP OUTPUT

Notes or comments on your group's products from February:

BREAKOUT SESSION 1 (MORNING)

REVIEW OF DRAFT OF PROMISING PILOT STUDIES

Notes or comments on promising pilot studies:

TOP 5 PROMISING PILOTS FOR ASSET MANAGEMENT GROUP

Our top five pilots are:

1.

2.

3.

4.

5.

BREAKOUT SESSION 2 (AFTERNOON)

Goals: Detail the technical characteristics that restricted use technology would need to achieve to successfully complete your group's highest priority pilots. This includes both detailing requirements for data, information, and products, as well as establishing criteria for success from the perspective of asset management.

Activities:

- Based on your rank ordering of potential pilots from this morning, start with your highest priority pilot and detail the technical characteristics needed by restricted use technology to achieve success from the perspective of asset management. Technical requirements could include spatial and temporal requirements for data, but they could include other requirements, too (hardware, software, analytic techniques, derived products, etc.).
- Develop criteria for success for your top priority pilots from the perspective of traffic safety and congestion. When and where you can, make these criteria as specific and measurable as possible.

Time: You have about three hours to complete these activities.

BREAKOUT SESSION 2 (AFTERNOON)

REQUIREMENTS FOR HIGHEST PRIORITY PILOT STUDY

Our highest priority pilot study is:

Desired technical characteristics, products, data, etc., to come from pilot to meet the needs of asset management group are:

Required data, derived products, other information, etc. Where possible, specify needed spatial and temporal resolution and/or other specific requirements:

Criteria for evaluating successfulness of this top priority pilot from the perspective of the asset management group (specific, measurable criteria are best) are:

BREAKOUT SESSION 2 (AFTERNOON)

REQUIREMENTS FOR SECOND HIGHEST PRIORITY PILOT STUDY

Our second highest priority pilot study is:

Desired technical characteristics, products, data, etc., to come from pilot to meet the needs of asset management group are:

Required data, derived products, other information, etc. Where possible, specify needed spatial and temporal resolution and/or other specific requirements:

Criteria for evaluating successfulness of this second highest priority pilot from the perspective of the asset management group (specific, measurable criteria are best) are:

BREAKOUT SESSION 2 (AFTERNOON)

REQUIREMENTS FOR THIRD HIGHEST PRIORITY PILOT STUDY

Our third highest priority pilot study is:

Desired technical characteristics, products, data, etc., to come from pilot to meet the needs of asset management group are:

Required data, derived products, other information, etc. Where possible, specify needed spatial and temporal resolution and/or other specific requirements:

Criteria for evaluating successfulness of this third highest priority pilot from the perspective of the asset management group (specific, measurable criteria are best) are:

BREAKOUT SESSION 2 (AFTERNOON)

REQUIREMENTS FOR FOURTH HIGHEST PRIORITY PILOT STUDY

Our fourth highest priority pilot study is:

Desired technical characteristics, products, data, etc., to come from pilot to meet the needs of asset management group are:

Required data, derived products, other information, etc. Where possible, specify needed spatial and temporal resolution and/or other specific requirements:

Criteria for evaluating successfulness of this fourth highest priority pilot from the perspective of the asset management group (specific, measurable criteria are best) are:

BREAKOUT SESSION 2 (AFTERNOON)

REQUIREMENTS FOR FIFTH HIGHEST PRIORITY PILOT STUDY

Our fifth highest priority pilot study is:

Desired technical characteristics, products, data, etc., to come from pilot to meet the needs of asset management group are:

Required data, derived products, other information, etc. Where possible, specify needed spatial and temporal resolution and/or other specific requirements:

Criteria for evaluating successfulness of this fifth highest priority pilot from the perspective of the asset management group (specific, measurable criteria are best) are:

APPENDIX C: Summary of Results from Focus Group Kickoff Meeting (February 2006)

This appendix contains brief summaries of the output produced by all five of the breakout groups from the Focus Group Kickoff Meeting held at the Kellogg Center on February 7-8, 2006. These summaries are presented by group in the following order:

- Asset Management
- ITS and Operations
- Environmental Applications
- Transportation Congestion and Safety
- Security Applications

Review of Asset Management Focus Group Meetings in February 2006

Prioritized issue clusters from 31 issues: (6 of which were identified as burning issues)

- ***Road Maintenance Issues***
  (e.g., **1. how extend life of road surfaces; 2. truck traffic impacts on road surface;** setting of spring road restrictions; minimizing road maintenance impacts on traffic ...)
- ***Inventory and Data Maintenance Issues***
  (e.g., **3. comprehensive inventory of facilities and conditions; 4. effective data management to improve data availability and quality;** real time data collection of traffic, road surface temperature, etc. …)
- ***Programmatic Issues***
  (e.g., **5. accurate tracking of completed road improvements; 6. identifying which road needs what type of improvement;** road maintenance activity prioritization …)
- ***Level of Service Issues***
  (e.g., traffic congestion, traffic re-routing; restricted use lane utilization …)

Information Gap Examples on the 6 Identified Burning Issues:

1. **Extent Life of Road Surfaces Example – Validate Road Preventive Maintenance**
   Validate road condition
   One mile segments
   Rutting (¼ inch or more)
   Base conditions (up to 12 ft deep)
   Traffic use and volume information
   Data needed annually

2. **Truck Traffic Impacts Example – Need to Know What is Happening on the System**
   Validate axel loading assumptions
   Truck origin/destination studies
   Type and weight of trucks
   Truck impacts on surface endurance
   Need network wide information
   Data needed every 3-6 months

3. **Comprehensive Inventory Example – Transportation Feature Location & Condition**
   Signs, signals, guard rails, culverts…
   Attributes (e.g., number of lanes, age of feature, performance of feature…)
   How keep inventory current?
   Network wide, event generated updates

4. **Effective Data Management Example – Need data on bridge Condition**
   Assessment of structural issues
   Data for federal inspection
   Capital vs. preventive improvements
   Subsurface Structural Details
   Condition assessment every 2 years

5. **Tracking Improvements Example – Need Data (Aerials) on Road Improvements**
   Must “see” cracks
   Need reliable algorithms
   Improved orthophotos
   Confirmation of significant changes
   Network wide information
   Annually (typically summertime)

6. **Needs for Road Improvements – Causes of Drainage on Pavement (culvert failure)**
   How culvert failure impacts roads
   Detect failure before occurrence
   Requires resolution up to 30 ft deep
   Required on event driven basis

ITS and Operations Summary from February Focus Group Meeting

Prioritized Issue Clusters (from 41 burning issues):

- ***Systems optimization***
  (e.g., alternate routing, intersection safety, optimization, arterial travel times, performance standards, parking mgmt., make use of what we have)
- ***Data management***
  (e.g., real-time acquisition, data on pavement conditions, weather, market opportunities, processing, handing & sharing data, active safety, costs)
- ***Incident management***
  (e.g., collection of data, investigations, travel conditions, alternate routing, disasters)
- ***Users or human factors***
  (e.g., data access, travel info, stimulate interest, find parking, efficient border crossing)
- ***Human resources or operators***
  (e.g., adopting technology, integration into system, appropriate use, standards, staffing, training, create markets)

Data and Information Gaps:

Specific Gap	Cluster	Spatial Needs	Temporal Needs
Queue lengths in rural areas, border crossings, static work zones	Sys. optim. Data mgmt. Incid. mgmt.	object: 15’	frequency: 15 min delivery: <5 min
Queue lengths in moving operations	Sys. optim. Data mgmt. Incid. mgmt.	object: 15’	frequency: 5 min delivery: <5 min
Traffic monitoring in rural areas and areas w/o traditional ITS infrastructure	Sys. optim. Data mgmt. Incid. mgmt.	object: 15’	frequency: 15 min to 4 hrs delivery: <5 min
During-event data collection & post-critique	Sys. optim. Data mgmt. Incid. mgmt. Operators	object: 2-3’	frequency: 5 min delivery: <5 min
No access to data to determine how alternate routes are working	Data mgmt. Incid. mgmt.	object: 15’	frequency: 5 min delivery: <5 min
Automated analysis of imagery & artificial intelligence	Data mgmt. Operators Users	NA	frequency: NA delivery: NA
Performance measures & validation	Sys. optim. Data mgmt. Incid. mgmt. Operators	object: 15’	frequency: 5 min – 24 hrs delivery: <5 min
Access to real-time data	All clusters	2 – 15’	frequency: 5 min – 24 hrs delivery: <5 min

Environmental Applications Summary from February Focus Group Meeting

Future Transportation System Vision

– Better, more integrated, more proactive transportation planning that is efficient and environmentally friendly.
– An efficient, adaptable, and multi-modal system that fits with its surroundings (environmentally, culturally, aesthetically) and provides for good land stewardship during planning, construction, and in operation.
– A system that allows for the use of comprehensive & integrated environmental data from a variety of sources, in a user-friendly format, available early in the planning process and accessible throughout the lifetime of the system.

Most Pressing Transportation Issues (not in priority order)

1. Obtain good quantifiable data that is repeatable, verifiable, and validated, and saves time & money. Be able to analyze the data for efficient decision making and predicting projects' effects. Data and analysis related to: archaeological sites, historic buildings, relic foundations, and historical planned landscape features.
   - Subsurface anomalies incl. geologic features, underground tanks, soil contaminations
   - Existing wetlands and hydric soils
   - Suitable wetland mitigation sites
   - Plant communities, habitat types, and general land use
   - Wildlife corridors
   - Above & below ground hydrology and drainage patterns incl. bathymetry
   - River-crossing construction
   - Use and efficiency of transportation system (roads and facilities) incl. vehicle types, counts, density
   - Environmental impact assessments, incl. old projects with inadequate EIS
   - Air toxics monitoring
   - Noise and vibration issues

2. Data Communication: Be able to communicate the purpose of and need for projects, alternatives analysis, mitigation development, and environmental impact especially through good visualization tools. Help with agency-to-agency collaboration, public communication, informing political decision making, and external design & developments teams.

3. Decision Making: Supporting better decision making for project selection, alternatives analysis, and environmental impact analysis using best current environmental data.

4. Process Improvement: Be able to integrate new technologies into Process Improvement efforts. Benefits would be:
   - Improving the quality of information
   - Saving time & money
   - More accurate information
   - Ability to integrate existing & new types of data and obtain a larger sample of data.

Gap Analysis

1. Being able to gather & analyze data
   - Validating professional judgment with timely data
   - Be able to accomplish new tasks that MDOT can't currently do
   - Data gaps exist in:
     - Archaeological site data
     - Wetlands mitigation locations
     - Threatened & endangered species
     - River-crossing data
     - Underground storage tanks
     - Historic buildings
     - Landscape evaluations
     - Land-use change analyses
     - Air quality parameters
     - Viewshed analyses
     - Etc.

   Why important: For regulatory and statutory needs; customers want to know you have good data.

2. Communicating data with multiple stakeholders
   - Gaps in visualization techniques.
   - Effective communication of complex data
   - Sharing data that meets clearly understandable metadata standards
   - Securely sharing data
   - Improving data sharing ability with stakeholders

   Why important: Stakeholders and customers should be able to understand the data being used for decision making.

3. Improving decision making
   - Gaps are the previous two bullet points, having good data & analysis and being able to communicate them effectively. This is the ultimate goal – to make the best decision.

4. Improving processes
   - Processes can be improved with access to better data & analyses, better communication, and improved decision making.

Technical Characteristics for Data and Analysis Gaps

1.A. Identifying subsurface features and sites

- ▲ Soil type (multiple factors)
- ▲ Vegetation (multiple factors)
- ▲ Fine-scales surface condition (roughness)
- ▲ Storage tanks
- ▲ Utilities
- ▲ Groundwater
- ▲ Maritime archaeology
- ▲ Historic building outlines
- ▲ Context of archaeological sites to surrounding landscape
- ▲ Geologic features

- Example spatial & temporal resolution needs:
  - Soils – existing spatial resolution is fine for many purposes, but more up-to-date soils data are needed. Finer resolution may be needed.
  - Vegetation – resolution need varies by project type, activity, and level of interest. 1/10 acre minimum mapping unit for some MDOT project studies. Very fine scale for individual projects.
  - Subsurface sites – has to be better than 30m Landsat
  - Resolution needs will vary for all our issues depending on the project type, area covered, and what is being investigated

1.B. Identifying surface features and sites

- Threatened & Endangered Species
- Invasive species
- Wetlands
- Structures – historic & contemporary
- Floodplains
- Drainage patterns
- Manmade landscapes
- Wildlife issues
- Vegetation/plant communities
- Water quality, quantity
- Viewsheds
- Land use
- Light pollution
- Surface contamination
- Surface geology
- Example spatial & temporal resolution needs:
  - Wetlands: 1/10 acre example
  - Land-use: Better than traditional land-use maps (such as ones based on Landsat data)
  - "I need to see what I need to see."

1.C. Air quality issues

- Monitoring
- Regional & local scales
  - Sources strength
  - Dispersal/movement
  - Duration
  - Particulate matter
  - Ozone monitoring
  - Carbon monoxide
- Higher resolution than limited existing data
  - Real-time picture
- Biohazards and toxic plumes

1.D. Noise issues

- Traffic data
- Surface roughness
- Surface type
- Adjacent roadside conditions
- Level (dBA)
- Nearby local land-use & vegetation
- Traffic characteristics
- Baseline measurements

1.E. Vibration issues

- ▲ Soil moisture
- ▲ Soil type
- ▲ Subsurface geology
- ▲ Distance

Traffic Congestion and Safety Summary from February Focus Group Meeting

Collect, process, and analyze accurate and timely data/traffic counts
Traffic characteristics: flow, counts, classification, queues, speed, geometrics, trips (origin/destination), incident management, pavement surface condition, emissions, peak vs. off-peak, occupancy

- Spatial resolution (relative, absolute)
    - Traffic counts and flow (enough to see individual vehicles, i.e., 1 meter)
    - Vehicle classification (best possible, 15-30 cm)
    - Road surface, congestion mapping, weather (low, thermal, EV synoptic satellite)
    - Geometrics (medium/high, pass to pass coherent satellite/LIDAR)
- Temporal resolution (how often updated?)
    - Varies based upon application
    - Once per year (planning)
    - Short period (modeling, periods of day)
    - Real-time (traveler information)
- Other – turning data into information
    - Gather, warehouse, process, analyze, disseminate
- Other – resources (cost, full-time employees)

Collect, process, and analyze accurate and timely data/driver behavior and mobility
Difference in driver patterns (i.e., 6-8 AM vs. after 10 AM)

- Spatial resolution (relative, absolute)
    - High resolution
- Temporal resolution (how often updated?)
    - Varies based upon application
    - Once per year (planning)
    - Short period (modeling, periods of day)
    - Real-time (traveler information)
- Other – more of a result of post-processing data (i.e., modeling)
- Other – use of data collected by vehicle

Security Applications Summary from February Focus Group Meeting

At the end of the session, three major sub topics had emerged: vehicle tracking, operational issues, and communications. Some details of the vehicle tracking and operational issues subtopics can be more directly addressed by remotely sensed data and information systems. The communications subtopic addressed very important issues but those issues are best addressed by technologies other than remote sensing systems, so therefore its details are not listed here. This summary provides those details that can be addressed in some manner by remote sensing systems.

- Vehicle Tracking
  - Overt tracking
  - HAZMAT path maintenance
    - Spatial and temporal
    - Status of path
    - Prevailing winds
    - High risk population centers
    - Critical/sensitive infrastructure
    - Network status
- Operational Issues
  - Critical Infrastructure status (non-HAZMAT)
    - Traffic conditions, system conditions, bridges, leaks
  - Mitigation of Incident Impact
    - Re-routing
    - Alerts (downwind, for example)
    - Status notices
    - Identification of affected populations
    - Coordination during incident
    - Separation achieved by some scheme (people and vehicles)
    - High priority people and vehicles, e.g., low risk
    - Cleared and uncleared
  - Predictive what-if models

APPENDIX D: Summary of Results from Second Round Focus Group Meetings (March 2006)

This appendix contains brief summaries of the output produced by all second-round focus group meetings held in March 2006. It also contains a sixth brief summary from the additional meeting of the ITS and Operations group on April 19, 2006. Due to scheduling conflicts within the ITS and Operations group, this second meeting was held to permit a larger number of stakeholders to participate. These summaries are presented by group in the following order:

- Asset Management
- ITS and Operations (from both meetings)
- Environmental Applications
- Transportation Congestion and Safety
- Security Applications

Summary of Asset Management Focus Group Meeting
March 16, 2006

Overview of pilots:

Pilot Number	Clusters	Pilot Number	Clusters
1a	1, 3	3a	3
1b	4	3b	1
1c	3	3c	3
2a	3	3d	1, 4
2b	3	4a	1, 4
2c	3, 4	4b	1, 4
		4c	1, 4

The group engaged in a pilot brainstorming activity that asked the following questions:
What can be "seen" with remote sensing technology within a given segment of road?

- Spatial scale: 15 mile segment of road with 500m on each side
- What features can be obtained in a cost-effective manner?
- Include a change detection analysis from year to year (change of both inventory and condition)

Can road improvements (from where to where and what types of improvement) be determined from remotely sensed data?

Three top priority pilots (from highest to lowest):

Pilot 1c – Establish a spatially enabled inventory and assessment of non-roadway assets in the MDOT right-of-way (e.g., culverts, bridges, rumble strips, signs).
The group identified the list of items (Rumble strips, Sign existence and types/location, Obstacles, Topography of road, Driveway location and number per mile, Guardrail, Fences, Drainage structures (ex. culverts), Number of lanes and lane widths, Surface type, Road cross section (pavement type), All structures within the right of way, Composition of pavement including depth, Road centerline mapping, and Inventory of road improvements) to establish an inventory of roadway assets. The group then concluded that it might be more beneficial to select a segment of road (15 miles long with 500m on each side) to determine what features could be sensed remotely. Such an examination might prove more productive than developing an exhaustive list of items which would be time consuming to compile.
Annual time frame
Success criteria includes: comparison with existing inventories and field inspections

Pilot 1a – Establish meaningful correlations between pavement assessments obtained via remote sensing and advanced algorithms and standard condition measures used currently by MDOT.
The group discussed year-to-year detection of changes in pavement condition (as well as asset inventories and AADT). They were also interested in detecting what types of roadway improvements could be sensed remotely.
Time frame for data collection 10 years ago or less
Success criteria includes: cost dependent

Pilot 1b – Estimate the effects of truck traffic on pavement condition and highway congestion by using remote sensing to establish, by lane and direction, the volume of truck traffic on MDOT's assets.
Data: Volume, density, percentage, Weight, Type (AASHTO category), Can we predict road deterioration times, Urban and rural, Location on road section, and Lane use
Document temporal dynamics (shift from M-F traffic to 7 days a week; seasonal)
Success criteria includes: traffic monitoring guide criteria; federal requirements (?)

Summary of ITS and Operations Focus Group Meeting
Altarum Institute
March 27, 2006

Overview of pilots:

Pilot Number	Relevant Clusters	Pilot Number	Relevant Clusters
1a	1, 2, 3	3a	1-5
1b	3	3b	1-5
1c	2, 3	3c	2, 4
2a	None	3d	1-5
2b	None	4a	1-5*
2c	None	4b	1-5*
		4c	None

* If data can be collected in real-time

Created a new pilot referred to as '3e,' which is similar to 3d, but substitutes static work zones for the international border crossing. This pilot also relates to clusters 1-5.

Although ITS focuses on real-time situations, the group is willing to forego real-time collection/analysis for the pilot projects. If the pilots demonstrate that the technology is feasible, then a cost estimate should be made for implementing a real-time operational system.

Four top priority pilots (from highest to lowest):

3a. Vehicle tracking for GIS & models:
Limit area of interest to triangle bounded by I-75, US127, I-94
Monitor major roads Thursday-Saturday in July/August
Collect data at 15-minute intervals
Be able to distinguish cars from trucks and estimate speed
Faster, better, and cheaper than present methods.

3d. Queue lengths at international border crossing:
Location: Blue Water Bridge (both directions)
Measures: Types of vehicles, number of open booths, length of queue, # of trucks in secondary inspection
Data to be collected at 15-minute intervals
More accurate, positive financial impact, improved border crossing, and increased productivity.

3e. Queue lengths in static work zones:
Be able to distinguish cars from trucks
Measure queue length by lane, number of lanes open, set up time, and traffic volume and speed
Should be done during construction season (April-November) with heavy traffic; location TBD
Data to be collected at 15-minute intervals
Better safety, better signage, and will help make decisions for work zone scheduling.

3b. Calibrate and validate existing MDOT models
Could be used to test Paramics WMU model in Kalamazoo Co.
Conduct during typical week and non-typical week and capture weekday vs. weekend patterns
Collect density of cars and trucks and their speeds
Data to be collected at 15-minute intervals
Potentially huge application across all of MDOT; reduces costs of calibration/validation; improves model accuracy.

Summary of ITS an d Operations Focus Group Meeting
RCOC, April 19, 2006

Overview of pilots:

Pilot Number	Clusters	Pilot Number	Clusters
1a	1, 2, 3 (ok)	3a	1-5 (ok)
1b	1, 2, 3 (alt. truck routing)	3b	1-5 (ok)
1c	2, 3 (ok)	3c	2, 4 (1)
2a	None(ok)	3d	1-5 (ok)
2b	None(ok)	*3e (+mobile)	1-5 (ok)
2c	None(ok)	4a	1-5* (ok)
*2d	1	4b (more interesting)	1-5* (ok)
.		4c	None (ok)

* Redefined (see below)

New Pilot - 2D. - Emissions over roadway, CMAQ (NOx, O3, CO2, Particulate)
3e. – add the mobile work zones

Four top priority pilots (from highest to lowest):
Priority 1a – 3a: Linking real time vehicle tracking data to GIS and spatially enabled traffic flow models to improve traffic flow models to improve traffic operations and enhance congestion avoidance. (rural).
Priority 1b – Oakland County Specific - Arterial (urban).
Spatial: Rural and urban are different areas of study.
Temporal: (hind cast): 15-min intervals, Thursday (typical workday), Friday (up north traffic), Saturday (typical weekend), would like to see a 24/7 week (Arterial), and school/non school (arterial).
Location in Oakland County to serve as basis for this pilot is: I-75, I-696, and M-5 .
Success criteria includes: Queue lengths reduced, and reduction in congestion/delay/travel time.

Priority 2 – 2d: New Pilot – Emissions
Temporal: Low/Med/High traffic volumes (Ozone development curve should be accounted) 6am-8pm, weekday, summer, one-day Tues-Thurs, 15-min. intervals desired.
Spatial – 25 ft. above rd. surface, 30 ft. res., 2000 ft. swath.
Location in Oakland County to serve as basis for this pilot is: Corridor (e.g., Orchard Lake – 11-15 Mile Rds.).
Success criteria includes: Improved air quality, before and after data should be acquired, EPA acceptance, and traffic moving.

Priority 3 – 3e: New Pilot – Queue length in static and mobile work zones.
Spatial: distinguish the different lanes, length, set-up time, traffic volume and speed.
Temporal: Construction season, heavy traffic, at 15 min intervals.
Location in Oakland County to serve as basis for this pilot is: May – Next Year - Crooks rd (south of 59).
For moving construction – target of opportunity.
Success criteria includes: Traveler information (AVL), and crash reduction.

Priority 4 – 3c: Use derived products to create high resolution road and highway centerline data as an enabler for ITS, VII, and other operations functions.
Spatial: 5 cm Resolution – Elevation (few mm resolution).
Temporal: 1-yr, No Snow.
Location in Oakland County to serve as basis for this pilot is: Corridor: I-696, M-5, 12 Mile.
Success criteria includes: Better safety, sufficient to support VII applications, and faster/better/cheaper.

Priority 5 – 3b (weaker fifth priority): Calibrate and validate existing MDOT Models
Spatial: Arterial – Road type (would like to track gravel rd. traffic)
Temporal: One 14-hour flight, 5 min. intervals.
Location in Oakland County to serve as basis for this pilot is: The whole county (Oakland).
Success criteria includes: Reduce cost, improve validation, a useful model for RCOC (at a county level)

Summary of Environmental Applications Focus Group Meeting
MDOT, March 22, 2006

Overview of pilots:

Pilot Number	Clusters	Pilot Number	Clusters
*1a	4, 2, 1, 6, 7, 5	3a	3, 4, 6, 7, 2 (WQ)
1b	4, 5, 3, 6, 7, 1 (hyd)	3b	2 (park and ride)
1c	1, 2, 6, 7	3c	NA
2a	1, 2, 6, 7	3d	3
2b	1, 2, 6, 7	4a	6, 7
2c	1, 2, 3, 4, 5, 6, 7	4b	6, 7
		4c	6, 7, 2

Note: Red – Higher Priority; Blue – Lower Priority
* Redefined (see below)

1a: 4, 2 (soil), 1 (soil), 6 (NEPA), 7 (NEPA), 5 (by identifying soil type)
1c: Help define the study location and non-roadway asset by adding – vegetation, ponds, unique habitat types, historical resources
2b: Asset Management Crossover
2c: Ground truth
3d. Cross over to 2c

Five top priority pilots (from highest to lowest):

2a: Complete a site corridor study along US-127, including mapping of geology, hydrology, wetlands, vegetation, habitat connectivity, corridor land use, and impacts to historical properties.
Data: Animal connectivity, wetland boundaries, game habitat, plant communities, historical properties, and archeological. Extent ranges from 100 ft to 16 miles long. Temporal resolution also varies by data types.
Success criteria includes: Data in a format that can be manipulated for presentations and, making a decision easier and less reliant on contract workers, level of effort out in the field decreased, more complete bids due to more accurate MDOT needs, sharing the data with the contractors to reduce the cost of the bids, and accuracy based on ground truthing.

2c: Collect information that will aid in identifying and evaluating potential locations for a new international border crossing across the Detroit River, including possible plaza sites.
Required data: Identify salt mines, identify water species (e.g., mussel, sturgeon), before/after pictures, T&E habitat, good places for piers, and traffic counts.
Spatial Resolution: 6in to 30m; Extent: Zug Island to Amb. Bridge.
Success: Underwater features – as high of resolution as on land features; Comparing what is being gathered and what can be gathered, Data available in a format that can be visualized and utilized by MDOT, public and other agencies, Help more in decision making process, and Provide a spring board for further development. Note: MDOT wouldn't mind being able to ID contamination spills in the future, Locating underwater features:, and transportation characteristics are parallel to pilot 1b.

2b: Performing a watershed and wetlands study in the Thunder Bay Watershed, including mapping of geology, hydrology, vegetation, habitat connectivity, and corridors.
Required Data: Geographic MLS data, Geographic plat maps, historical wetlands, surveys, topography, fine resolution DEM, and extinct stream beds
Spatial Resolution: 30 m, in the extent of Thunder Bay Watershed and finer scales at mitigation sites.
Success: Locate a suitable site using 1 map (easier, cheaper, less field time) and integrating archeological info more accurately.

1c: Establish a spatially enabled inventory and assessment of non-roadway assets in the MDOT right-of-way.
Data: Surface and subsurface features (e.g., environmental/geological/archeological/hydrological/utilities).
Extent: road corridor (generally 500m on each side), 10 miles (small town urban and a little rural)
Temporal: 1/yr (now the data is collected every 10 years, maybe re-evaluated every 3 years), some at certain time of year (May for wetlands).
Success criteria includes: Better resolution than what they have now, need to be able to analyze data with an object classifier (90% accuracy), mapping that allows for more efficient use of time in the field, **MAIN OBJECTIVE**, *Need to have nearly 100% accuracy of where wetlands are (without omission errors).*

1b: Estimate the effects of truck traffic on pavement condition and highway congestion by using remote sensing to establish, by lane and direction, the volume of truck traffic on MDOT's assets.
Spatial Resolution: 0.10 mile, at an on demand basis (weekly/monthly)
Success criteria includes: Validate the models by supplementing "real" data. It will help make the models more accurate in the long run and supplementing the counts that are being done (not enough staff), and It will improve "6 and 7" of the burning issues. Notes: Vibration, pollutant loading (ADT), Prefer to use true counts vs. SEMCOG models. Peak Hour Volume (a.m./p.m. peaks) will indicate air pollution and noise.

Summary of Traffic Congestion and Safety Focus Group Meeting
Altarum Institute, March 15, 2006

Desired Outcomes of Pilot Projects:

- Asset Management
  - Create an inventory
    - Pavement condition inventory
    - Truck traffic inventory
    - Improving data collection activities
  - Identify areas of safety improvements
  - Integrate data with MITS data
- ITS and Traffic Operations
  - Tracking vehicles within a certain timeframe (for example, every 2 seconds)
  - Develop historical travel patterns
  - Real-time information for travelers
- O&D Collection
  - Validate current models for traffic forecasts and improve them
  - Create a better O&D matrix
  - Focus technology on high volume roads
  - Better border crossing data
- Application of High Resolution Data to Environmental Analysis
  - Lowest priority for Traffic Congestion and Safety, but good application possibilities
- Traffic Congestion and Safety Focus Group Pilots
  - Establish a spatially enabled inventory and assessment of roadway and non-roadway assets that affect traffic congestion and safety
  - Collect changing pavement condition data that affect traffic congestion and safety (e.g. road surface/weather, potholes)
  - Collect traffic data
    - Real-time
    - Planning level
    - Specific vehicle tracking

TCS has combined, redefined, and simplified the pilots. The three top priority pilots are ranked in order below.

3c: (re-defined) Establish a spatially enabled inventory and assessment of roadway and non-roadway assets that affect traffic congestion and safety

- Required data: rumble strips, guardrails, number of lanes, shoulder type and width, geometry, median type, road alignment and elevation (passing zones), within the road right-of-way, etc.
- Temporal resolution: annually, current data collected sporadically
- Spatial resolution: visibility of features (AASHTO standards for passing zones)
- Criteria for success: effectiveness and accuracy

3a-b: Collect changing pavement condition data that affect traffic congestion and safety (e.g. road surface/weather, potholes)

- Required data: coefficient of friction, weather, road hazards (water, ice, potholes, construction zones, objects)
- Temporal resolution: near real-time, seasonal for coefficient of friction
- Spatial reporting resolution: 500 feet
- Criteria for success: effectiveness and accuracy

New: Collect traffic data

- Required data: volume, speed, classification, gap, density, weight, lane occupancy, location, turning movements; support AADT estimation
  - Real-time (congested areas)
    - Temporal resolution: five minutes
    - Spatial resolution: that necessary to collect the required data
  - Planning level (system-wide)
    - Temporal resolution: 15 minutes for priority corridors; annually for others
    - Spatial resolution: that necessary to collect the required data
  - Specific vehicle tracking
    - Temporal resolution: variable based on application
    - Spatial resolution: that necessary to collect the required data
- Criteria for success: effectiveness and accuracy

Summary of Security Applications Focus Group Meeting
Kellogg Center, March 16, 2006

Overview of pilots:

Pilot Number	Relevant Clusters	Pilot Number	Relevant Clusters
1a	NA	3c	8, 10
1b	1, 3	3d	3, 4, 6, 7
*1c	7, 8, 9, 11	*4a	5, 1, 3, 2, 10
*2a	9	4b	5, 12, 1, 3
2b	NA	4c	5, 1, 3, 7, 2, 10
*2c	11	**New Pilots**	
*3a	2, 10, 6, 12	*5a	11, 7, 9, 10, 8
*3b	1, 3	*5b	

* Redefined (see below)

Redefinition Key
1c: Neighboring Environment
2a: Drop 127, but a corridor study important in new themes
2c: Natural and built environment
3a: Support in incident and emergency management
3b: Result to decision making and link to DDSS
4a: Identify anomalies/exceptions
5a: Security Corridor Study
5b: Environmental Corridor Study

Security focused its needs by wanting to tap into data flow already being discussed by other groups/delineated by the pilot themes. Security does not want a stand alone system for incident events. It would be useful for existing data (used for other resources) to be provided to deal with incidents.

Four top priority pilots (from highest to lowest):
**3a. Vehicle tracking for GIS & models. (Support in incident and emergency mgt)*
Frequency – Every 5 minutes in emergency situations
Temporal – Real time
Spatial Resolution – Identify a vehicle type and make; count;
Spatial Extent – 10 mile (5 miles from incident as center point)

**3b. Calibrate and validate existing MDOT models. (Result to decision making and link to DDSS)*
DSS integrates data across sources (less restricted use – and readily available).
Desired data – Truck weight tracking, density of traffic, identify low risk trucks, plume and evacuation models
Spatial Resolution – Should be able to see/count axles
Temporal – Speed of vehicle and be able to count axles

**3c. Use derived products to create high resolution road and highway centerline data as an enabler for ITS, VII, and other operations functions.*
Spatial Extent – 2 ½ Miles from the center line (total 5 miles wide using the roadway as the center line)
Pixel Size – 30 cm
Frequency – Planning (yearly is okay), near real time during incidents, and as frequently as tbd.

**3d. Queue lengths at international border crossing.*
Linear distance to the last car or truck in queue; meter data would be fine.

- Frequency – GM would like to know if there was a 1 hour delay, exceed point is a 4 hour delay. Depends on situation, e.g., emergency is realtime.

Length of time to get through from a defined point (using a single vehicle as a study)

- * Note: Customs are independent when it comes to opening booths

Spatial resolution is to the 401, ideally – 20 mi

**Criteria for Success for all– 5 min frequency in urban areas, less frequent in rural areas (equivalent to land/surface type), and identify hazmat plaques defined by at least color, reduction in time of reaction to incidents. Meet or beat what is already in place.