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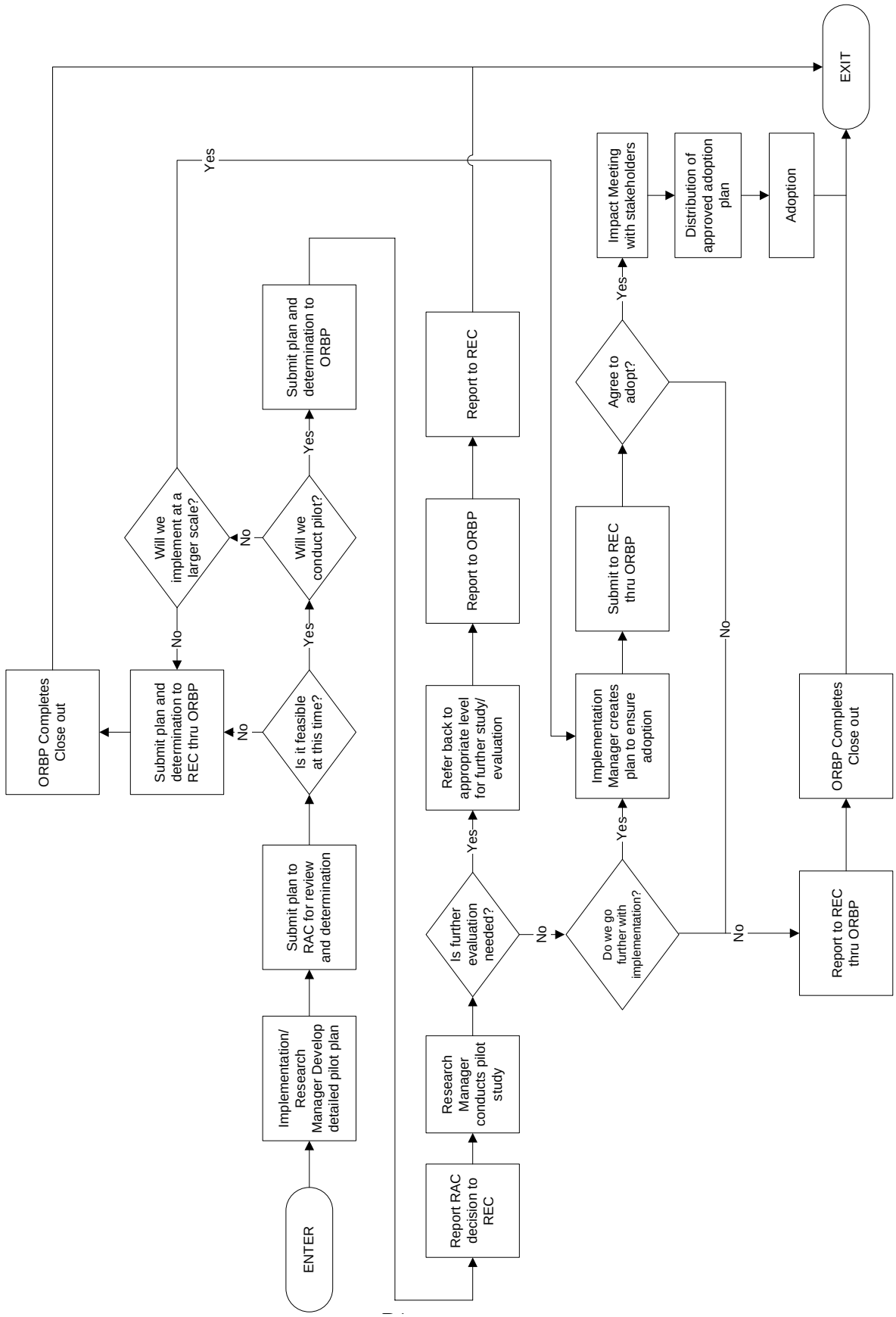
OFFICE OF RESEARCH & BEST PRACTICES

APPENDIX D

Implementation and Technology Transfer

Michigan Department of Transportation

MDOT Office of Research and Best Practices
Adoption Process
Developed and revised by ORBP Team, October 2007



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Research Spotlight

D2

MDOT Research Spotlight

Michigan Department of Transportation | Office of Research & Best Practices

New Dynamic Signage Makes Lane Merges Smoother and Safer

Traffic research helps Michigan DOT explore technologies to positively impact driver behavior and improve traffic flow. Michigan DOT's research program strategically assesses potential new tools for managing traffic and making roads safer and less congested.

Problem

In a typical work zone that has lane closures, drivers do not merge at a single, defined point. As a result, the haphazard merging of traffic can cause sudden interruptions in traffic flow, longer delays, and the potential for accidents.

Different solutions to this problem have been tried in Michigan, across the United States, and in other countries with varying degrees of success. Each approach includes a defined merge point—either early (well in advance of the lane closure) or late (near the lane closure)—and uses static or dynamic signage.

Approach

Michigan DOT sought to demonstrate the effectiveness of a dynamic late lane merge system (DLLMS). The potential benefits were compelling:

- Late lane merging leaves usable traffic lanes open, which takes full advantage of road capacity to reduce queue lengths in freeway travel lanes.
- Dynamic signage responds to real-time changes in traffic patterns and can be automatically activated only when a merging system is needed.

This system also promises safety advantages as well, taking driver guesswork out of when to merge and thwarting aggressive driving among motorists who would otherwise drive past an early merge point.

Research

Michigan DOT undertook a field study of the DLLMS. This system's network of sensors continuously monitors traffic conditions in a construction zone. The sensors activate the DLLMS when a preset level of congestion is reached. Portable changeable message signs instruct drivers to stay in their current travel lane until reaching a specified merge point.

The DLLMS improves traffic flow and safety for vehicles merging in high-congestion work zones.

The DLLMS carefully takes into account human reaction and response factors in the frequency and complexity of the signage it uses. A typical series of activated signs display the following messages:

- Sign 1 (farthest from the taper). STOPPED TRAFFIC AHEAD / USE BOTH LANES
- Sign 2. USE BOTH LANES / STAY IN YOUR LANE
- Sign 3. TAKE YOUR TURN / MERGE HERE

At the merge point, drivers take turns in a "zipper-like" fashion, tapering from two lanes to one.

continued on back

Project Information

Report Name: *Evaluation of the Dynamic Late Lane Merge System at Freeway Construction Work Zones*

Start Date: April 2006
Completion Date: October 2006
Report Date: September 2007

Research Report Number: RC-1500
Contract Number: 2002-0546/A1
Total Cost: $168,556
Cost Sharing: 20% MDOT, 80% FHWA through the SPR, Part II, Program

MDOT Project Manager

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When the DLLMS is inactive, the signs flash typical construction messages, such as DRIVE SAFELY, MERGE 2 MILES AHEAD, and 45 WHERE WORKERS PRESENT.

To measure the system's effectiveness, Michigan DOT implemented a field study of the DLLMS on three sections of roads under construction in 2006, and compared it to a construction site where the system was not in place. The comparison site used identical signage as the DLLMS displays in its "off" mode. The study measured and analyzed data such as travel time, queue length, traffic speed, and traffic volume. It also recorded work zone traffic characteristics and vehicle merge locations using digital video cameras.

Results

The analysis showed the DLLMS fulfilled its intended function by significantly improving traffic flow. Delays were reduced and average travel speeds were higher at the test sites where the system was in use. Although not demonstrable with this small-scale implementation, investigators expect a measurable reduction in traffic accidents if the DLLMS were put into practice on a larger scale.

As part of this study, researchers also determined the most appropriate implementation strategies for this technology. Benefit-cost analysis provided specific guidelines on where this application can achieve the greatest savings, such as with freeways that experience long periods of high-volume traffic. This economic analysis included the costs associated with installing and operating the DLLMS. By comparison, the study highlighted other traffic configurations, such as in rural locations, where early lane merging may be more appropriate than late lane merging.

Finally, the study recommended that a larger implementation of the DLLMS should include a media campaign to help familiarize Michigan drivers with this type of merging system.

> *"This system will become even more effective in relieving construction traffic as Michigan drivers get used to late lane merging."*
>
> *Dale Spencley, P.E.*
> *Project Manager*

Value

As a result of this study, the DLLMS is now an option for work zone safety and traffic control in Michigan. When applied appropriately, the system will not only save travel time for motorists, but will provide additional positive effects of increased traffic flow, including lowered fuel consumption and air pollution.

These benefits combine to meet Michigan DOT's mission to enhance its transportation services while maintaining and improving its infrastructure. Research helped point the way to identifying a winning transportation technology in Michigan. ■

Michigan Department of Transportation

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This final report is available online at
http://michigan.gov/documents/mdot/MDOT_Research_Report_RC1500_Part1_209842_7.pdf **or contact 517-636-0305.**
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ORBP Newsletter

D3

Office of
Research & Best Practices
Michigan Department of Transportation • January 2008

Continuous Improvement

Team building and peer exchange efforts provide a clear vision and a refined structure for the transportation research cycle in Michigan

Inside This Issue:

Team Building
New name reflects global reach of research and best practices at MDOT.

Team building exercise helps refine the structure and operation of ORBP.

Mission and vision statements articulate the purpose and direction of the office.

Peer Exchange
Focused effort yields valuable insights into administration of Michigan's Transportation research cycle.

Michigan's transportation research community is healthy and well-respected; retaining staff and communicating with stakeholders will keep it strong.

Results
ORBP team unveils process for implementing research results.

Peer exchange report, updated Research Manual, and new Web site will help maximize the potential of the ORBP.

Team Building

In his book *Path of Least Resistance for Managers* (1999), author Robert Fritz introduces the notion of a structural tension that exists in every organization. He describes this tension as the difference between an organization's current reality and a vision of what is possible for the organization in the future. "Tension creates a state of nonequilibrium," Fritz writes. He goes on to explain that the structure of an organization naturally attempts to restore equilibrium. In other words, structural tension causes movement between an organization's current reality and a vision; either the vision devolves until it resembles the current reality or the current reality evolves to become more like the vision. Structure is the key to making a current reality evolve toward a vision.

Casting Vision, Refining Structure

In early 2005, MDOT's leadership created a vision for an office that would orchestrate and coordinate all of MDOT's research efforts, and monitor both transportation research and operational practices nationwide to make sure valuable innovations and best practices in other places would not go unnoticed. In pursuit of this vision, MDOT's Office of Research and National Best Practices (ORNBP) was established on September 26, 2005. The purpose of the new office was to lead the department's research efforts and to collect and disseminate transportation best practices throughout MDOT, within Michigan and across the country. In late 2007, "National" was dropped from the name. The new name, Office of Research and Best Practices (ORBP), expands the scope and extends the vision for the office. "The name change will better position us to exchange best practices and innovations globally, not just nationally," explained office administrator Calvin Roberts. "It will also enable us to more easily share Michigan's extraordinary transportation research talent and expertise with the global transportation community."

Since 2006, Roberts and his team have been working to align research investments with the Michigan Transportation Plan, which presents goals, objectives, strategies, and policy recommendations to set the direction for decisions and investments on the state transportation system through the year 2030. "Our team was assembled to make the most of every research opportunity within the department," explained Roberts. "We've realized some success, but the diversity of the groups we serve has made it difficult to develop a cohesive strategy. I felt we were missing key structural elements that would enable us

see "Team Building" on page 2

Peer Exchange

Business leader Andrew Carnegie once said, "The range of our collective vision is far greater when individual insights become one." It is perhaps with this in mind that the Federal Highway Administration (FHWA) established the peer exchange program with the Intermodal Surface Transportation Efficacy act of 1991. The program requires that each state department of transportation (DOT) agree to a peer exchange of its Research, Development, and Technology Transfer (RD&T) management process to be eligible for FHWA planning and research funds.

see "Peer Exchange" on page 2

Team Building (continued)

to do more." With this in mind, Roberts arranged with MDOT's Performance Excellence Division in July 2007 to initiate a team-building and strategic planning effort within the office.

Customers Provide Clarity

Mark Becker, MDOT performance consultant, guided the ORBP through a series of exercises to help refine structure and operations. The effort began with a process mapping exercise. Through it, the team identified discrete steps involved in administering transportation research. They then listed customers, stakeholders, products and services, and quality characteristics associated with each step. When complete, the process map provided the ORBP team with a visual overview of their sphere of influence. "Identifying who must be satisfied, what they need, and how to serve them provides great clarity for the rest of the process," Becker explained.

ORBP customers include executives, managers, and staff members of federal and state government agencies, colleges and universities, and private companies. "We serve the transportation research community by identifying relevant research needs, administering meaningful research projects, and then implementing valuable research results," Roberts explained. "Serving such a diverse group is challenging. Clear goals, good communication and strong relationships are keys to doing so successfully,"

Mission and Vision

With their focus directed through the process map and firmly grounded on their customers, the team then wrote vision and mission statements, and identified common values among all team members. "A team's mission has to do with the specific products and services delivered to customers," Becker explained. "A team's vision articulates how the individual members of the team see themselves working together to accomplish the mission. The mission is external; the vision is internal. Values determine how the vision is pursued and the mission is accomplished."

The mission of the ORBP includes four focus areas:

1. Coordinate and manage research programs for MDOT;
2. Monitor learning and innovation in development and operation of integrated transportation systems;
3. Promote implementation of learning and innovation throughout MDOT;
4. Encourage research that supports integrated multi-modal transportation and MDOT's strategic goals.

The ORBP's vision is to be a recognized leader in coordinating applied research and implementing results. To do so, the office will:

1. Identify cutting edge research topics;
2. Coordinate development of research projects;
3. Implement research results.

"Our mission and vision grew out of our strength and position as a team," Roberts explained. "We are located in the center of a highly integrated network of dynamic partnerships among transportation professionals."

Here's the Plan

Strategic planning was the final phase of the team building process. "A strategic plan takes into account the internal dynamics of an organization and provides the structure necessary to transform a vision into a new reality," Becker explained. A detailed analysis of strengths, weaknesses, opportunities, and threats (SWOT analysis) was the first step in the strategic planning process. After the SWOT analysis, the team identified things they could do to capitalize on their strengths in order to protect against weaknesses, seize opportunities, and avoid threats.

The team then articulated specific initiatives that would help them accomplish the mission of the ORBP while realizing their shared vision. In addition to techniques for refining operations internal to the team, they also identified strategies and tools for nurturing channels of communication between the team and their customers. As an example of an internal tool, the team has made a commitment to start every meeting with an activity that is designed to stimulate "out-of-the-box" thinking.

"Innovation is a common thread running through the long-range plan for the department, and it's one of our core values," Roberts explained. "These activities will help maintain a culture of innovation on the team."

External tools include a department-wide research database and an annual research conference. The database will ensure that research conducted in each region and transportation service center is shared across the entire state. "The research database will maximize the utility of research investments and prevent duplication of effort," Roberts explained. "It will also promote multimodal research by providing a holistic view of research efforts."

An annual conference will help maintain channels of communication within the transportation community. Interestingly, the inherent diversity of this community, which was one of the main reasons Roberts initiated the team building effort, turned out to be one of the core strengths of the team. "Our network of partnerships among transportation professionals provides us access to a wealth of valuable information," Roberts said. "The refined structure of our team and the new tools we're developing will help us and our customers make the most of every opportunity."

Peer Exchange (continued)

The peer exchange program is a means for state DOTs to improve research programs through customer input, peer counsel, and identification of best practices. After the first round of peer exchanges were held, the National Cooperative Highway Research

Program (NCHRP) issued a report titled Peer Exchange: a Value-added Program Management Tool (2001). The report described the process for conducting an exchange conference, and it summarized the results of the first round of conferences. The program received wide acclaim from states that participated. Since then, several rounds of peer exchange conferences have been held with continued high levels of success and support.

Focusing the Efforts

The ORBP sponsored a peer exchange of MDOT's research program on December 3–6, 2007. In addition to four members from the ORBP team, the peer exchange panel (see Figure 1) included a representative from Pennsylvania State University, two representatives from the FHWA, and representatives from DOTs in Iowa, Louisiana, South Dakota, Utah, and Washington State. Leni Oman from Washington State served as chair of the panel. CTC & Associates, a technical communications firm from Madison, WI, that specializes in information design for public agencies and civil engineering firms, assisted the ORBP in facilitating the exchange.

The ORBP team assembled the panel based on expertise and experience in the following five focus areas:

1. Developing a research program
2. Identifying research needs
3. Partnering with universities
4. Managing research projects
5. Measuring and reporting performance

The focus areas address current needs within the MDOT research program. "We chose members whose programs followed a path of development similar to ours," Roberts explained. "We were encouraged to realize the great position we're in and we gained tremendous insights into making adjustments to refine our program."

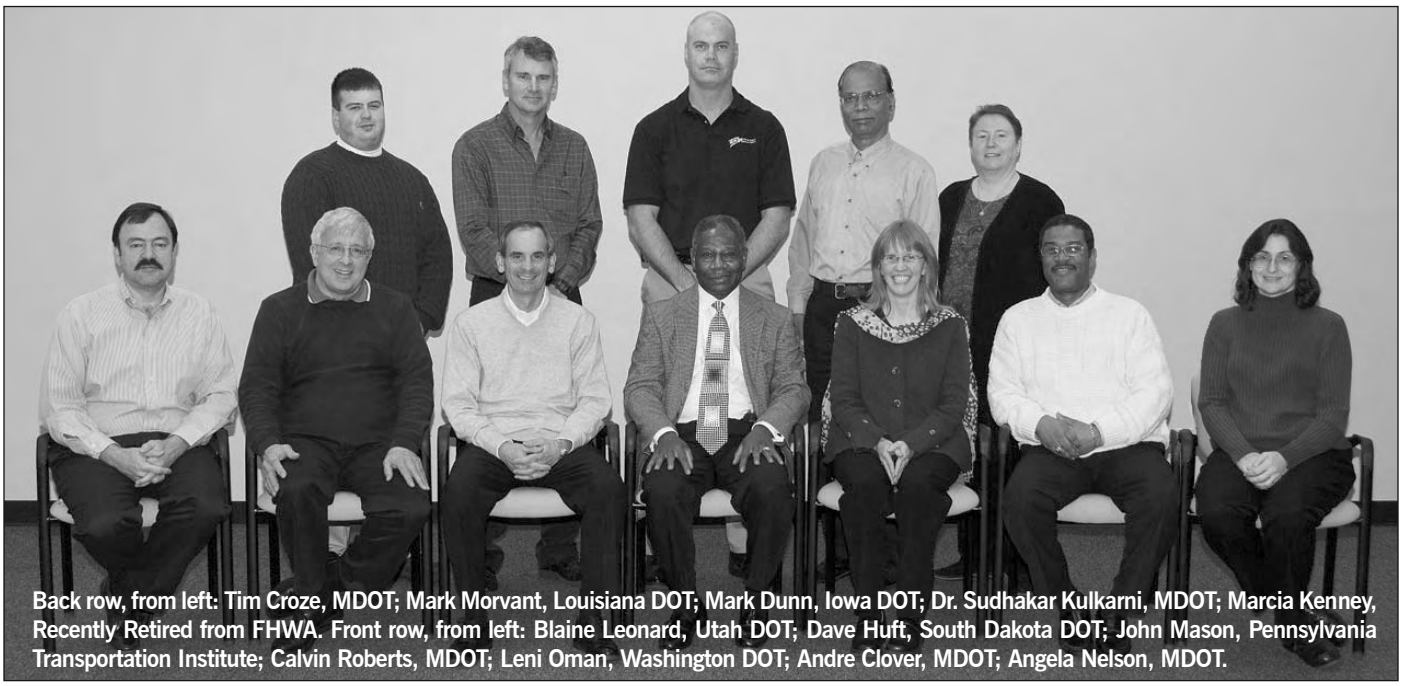
Research a High Priority

The structural integrity of MDOT's research program, as identified by the panel, can be attributed to the deep interest in research among technical staff throughout the department and among universities, consultants, and industry professionals across the state. Michigan is home to a vibrant transportation research community and MDOT has a reputation for credible research that is regularly applied in other states. With six internationally known universities in the state, including two University Transportation Centers (UTCs) and an effective Local Technical Assistance Program (LTAP), MDOT has access to a wide range of valuable research and technology transfer facilities, services, and capabilities. In addition, the FHWA division office in Michigan is very supportive of MDOT's research program; the program regularly capitalizes on federal funding opportunities.

The panel also identified cultural strengths of the ORBP. Specifically, support of research by the highest levels of MDOT leadership, and commitment among the core ORBP staff to align the program with the direction of the department as a whole is a strong foundation for continued success. The ORBP's emphasis on pursuing research topics that cover all areas of transportation research, not just materials and construction, is evidence of this alignment.

Retention, Communication and Relationships

Areas where the ORBP team could face challenges in the future include maintaining technical expertise in-house; collecting, tracking and communicating research results; and nurturing the relationships that are necessary to continue the success and expansion of the program.



Back row, from left: Tim Croze, MDOT; Mark Morvant, Louisiana DOT; Mark Dunn, Iowa DOT; Dr. Sudhakar Kulkarni, MDOT; Marcia Kenney, Recently Retired from FHWA. Front row, from left: Blaine Leonard, Utah DOT; Dave Huft, South Dakota DOT; John Mason, Pennsylvania Transportation Institute; Calvin Roberts, MDOT; Leni Oman, Washington DOT; Andre Clover, MDOT; Angela Nelson, MDOT.

Figure 1. Peer Exchange Panel.

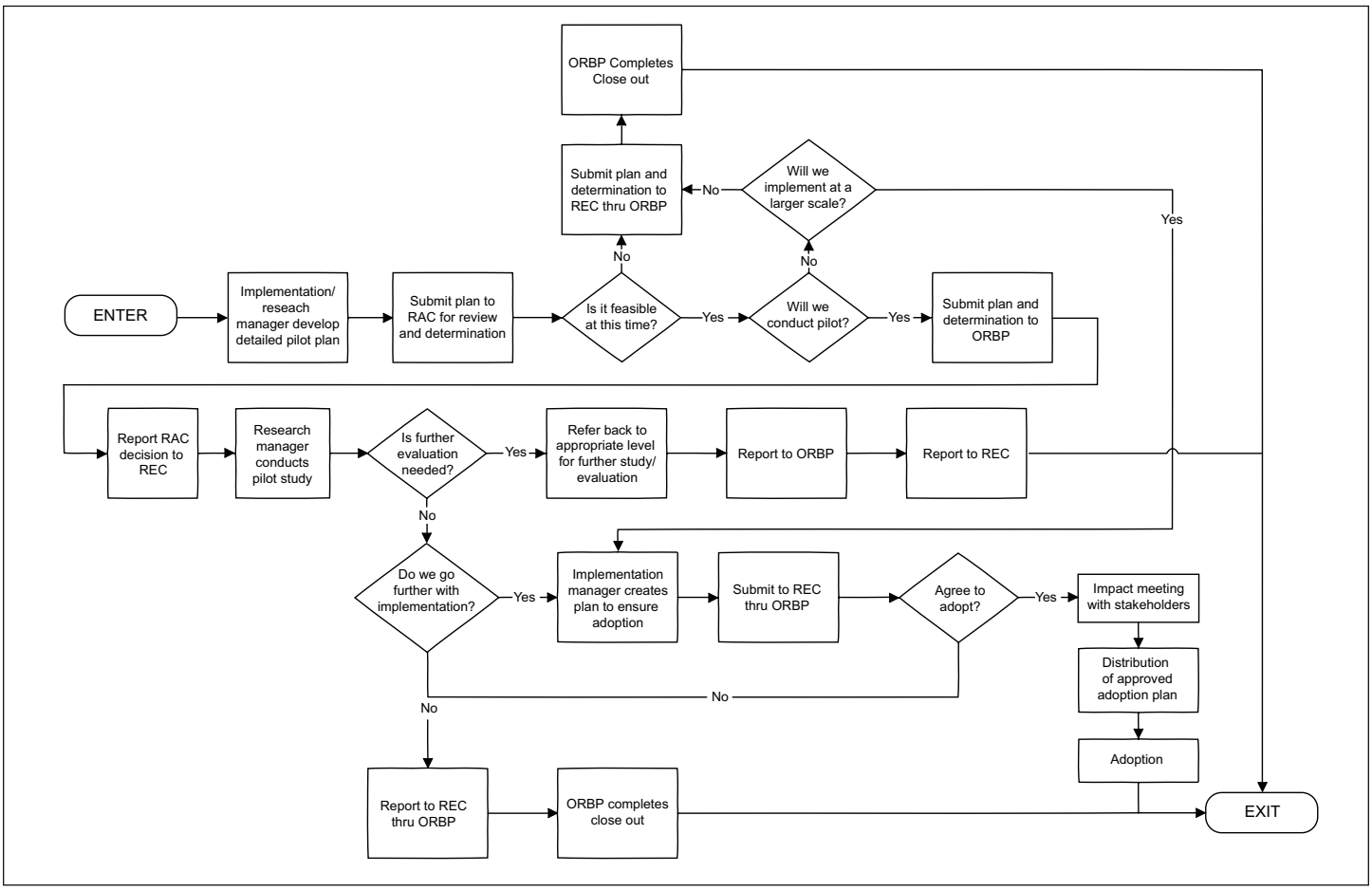


Figure 2. Overview of the Research Adoption Process.

Team Building + Peer Exchange = Results

Based on results of the team building effort and advice from the peer exchange, the ORBP team established a detailed plan for implementing research results (see Figure 2). This plan, referred to as the *adoption process*, will help principal investigators, project managers, and research managers develop implementation plans during the origination phase of a research project. "This piece of the transportation research cycle makes adoption of results a part of normal department operations, which will maximize the return on our research investments," Roberts said.

Next Steps

To finalize this exciting period of self-examination and planning for the ORBP, and to take steps toward pursuing the full potential of Michigan's research program, the team will complete three immediate projects. The first will be to publish a report that summarizes the peer exchange effort. The report will include specific observations and suggestions from the panel about how to achieve success in each focus area.

The second and third projects both address the need for good communication within the transportation research community. A research Web site is in development through the ORBP. The Web site is currently available to the ORBP team; plans are in place to make it available outside of MDOT. An update of the department's Research Administration Manual is scheduled to be released in February 2008. The manual was last updated in 2003, and does not reflect the new strategy for administering research in the state. "The new research manual will provide comprehensive guidance for all groups and individuals at all phases of the research cycle," explained Roberts.

References

Fritz, R. 1999, *The Path of Least Resistence for Managers*. San Francisco, CA: Berrett-Koehler Publishers.

Harder, B.T., 2001, *Peer Exchange: A Value-added Program Management Tool*. National Cooperative Highway Research Program, Project No. 20-7/Task 125, March 2001.

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