Integration and Streamlining Transportation Development and Decision Making: State of the Practice Synthesis Report

Final Report
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ACKNOWLEDGEMENTS

This study was conducted by Jack Faucett Associates (JFA) under contract to the United States Department of Transportation's Federal Highway Administration (FHWA), Office of Real Estate Services. The principal investigators for JFA were Ms. Mary Chou and Ms. Kristin Noyes.

We are grateful to all members of the project Sounding Board and the FHWA for their numerous contributions and guidance throughout the length of the project. Their expertise and accomplishments in the development of transportation solutions were integral to the development of this report.

We also wish to extend our appreciation to members of the State Departments of Transportation (STDs), Metropolitan Planning Organizations (MPOs), Regional Planning Organizations, U.S. Department of Transportation agencies, Canadian Departments of Transportation, International Organizations, and other transportation agencies for their participation in the FHWA Integration Solutions Survey, conducted as part of this

study during the summer of 2002. Their complete and candid responses provided the information necessary to conduct the analysis presented in this report.

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EXECUTIVE SUMMARY

This executive summary highlights the findings of a study of current practices in the development of transportation solutions in State Departments of Transportation (STDs) and other transportation agencies. This "State of the Practice" synthesis report is the first of three products developed for the United States Department of Transportation's Federal Highway Administration (FHWA) project, "Integrating and Streamlining Transportation Development and Decision-making." The project focuses on the integration of the disciplines of planning, environment, engineering and real estate in the development of transportation solutions. Findings in this report were developed based on a review of available literature, an analysis of results from the FHWA Integration Solutions Survey, and the input and suggestions from a Sounding Board of nationwide transportation professionals.

Major Study Finding 1: A review of existing literature revealed that there are disparities among the states in their approaches to the development of transportation solutions.

- The states vary in their recognition of the need for a more integrated approach to transportation decision-making.
- Some states, for example, have developed voluminous documents and procedures brochures detailing the

virtues of an integrated approach to the development of transportation solutions.
- Other states have apparently addressed the issue very little or not at all.

Major Study Finding 2: A group of federal, state and regional level transportation professionals are dedicated to the concept of promoting integration in the transportation decision-making process.

- These "integration advocates," especially those in the real estate and environmental disciplines, are actively involved in promoting the ideas of integrated transportation decision-making.
- Several conferences, professional meetings, and publicly funded research projects have explored the topic of integration and streamlining in the context of transportation planning and development.
- Many written materials have documented examples of better integration of environmental concerns in the transportation planning process.
- Some materials have focused on an earlier and increasing role for the real estate discipline in the development of transportation solutions.
- None of the conferences or written materials has specifically addressed the integration of all four disciplines. This study is the first to focus on the integration of all four disciplines.

Major Study Finding 3: The United States Department of Transportation and certain states - Oregon, Wisconsin, Florida, Pennsylvania, Washington and California, as a few examples - are in the forefront of the movement to promote integration in the transportation decision-making process.

- The U.S. Department of Transportation has also played a visible role in exploring and promoting this concept, hosting forums and funding research projects on the subject.
- The states listed above are not the only states engaging in such activities.
- Professionals from these states more frequently make their individual work or examples from their states available for discussions or papers regarding the topic.

Major Study Finding 4: While there is a fair amount of disparity among states in the processes they use to develop transportation solutions, there are also notable similarities.

- The majority of respondents believe that the most influential factors affecting the development of transportation solutions include:
    - identified impacts on the environment, economy and community;
    - cost of the project;
    - funding; and
    - the complexity or magnitude of the project.
- Respondents from integrated agencies believe that an integrated approach positively impacts their discipline's contributions to the development of transportation solutions.
- In an integrated approach, all disciplines are more involved in the initial planning and scoping phases when alternatives are developed and the preferred solution is identified.
- Increased participation earlier and throughout the process helps to ensure consensus and minimize potential conflicts.

Major Finding 5: Even among states reporting themselves to be non-integrated, respondents recognize value of an integrated approach.

- Of respondents from non-integrated agencies, the majority believe a multi-disciplinary approach is useful and would have a positive impact on their discipline's contribution to the development of transportation solutions.
- The most prevalent reasons why a multi-disciplinary approach was not adopted are perceived increases in workload and the need for additional information and training.

Major Finding 6: Survey results provide a basis for identifying the most frequent types of processes and development styles currently in use in integrated agencies.

- Results show that integrated agencies are more likely to be decentralized and have uniform processes across field units.
- Results show that agencies with either very few or a relatively large number of field units/divisions are less likely to be integrated.
- Results also show that agencies that coordinate with a large number of entities in the formulation of the Statewide Transportation Plan (STP) and Statewide Transportation Improvement Program (STIP) are more likely to be integrated.

Major Finding 7: Integrated agencies are less likely to have a functional discipline project management style.

- The functional discipline project manager style is one in which different portions of a project have a different individual serving as project manager (PM) based on that individual's expertise and the functions performed during the various aspects of the project.
- More frequent project development styles in integrated agencies include single point project managers (cradle-to-grave), phased project managers, or a team of managers.

Additional Findings from Qualitative Survey Responses: Qualitative comments from survey respondents provide more detailed information about the uniform processes utilized in both integrated and non-integrated agencies, as well as the general responsibilities of each discipline throughout different stages of the process.

- While collaboration between the disciplines of planning, engineering, environment and right of way generally occurs when identifying and selecting the preferred transportation solution, a more integrated approach focuses on coordination throughout all phases of the process, from planning to design to operation and maintenance.
- Some of the successful factors identified by agencies with an integrated approach include increased involvement of all disciplines earlier in the process, concurrent development, "cradle to grave" management approach, and increased public involvement.
- Some of the key challenges to implementing a more integrated approach include the merging of the NEPA and planning process, the seemingly conflicting pressure to complete projects quickly and the difficulty of conducting efficient public participation throughout project development.
- Training, education and research were all identified by survey respondents as integral components to the implementation of a successful integrated approach.

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1 INTRODUCTION

Federal transportation and environmental policy in the 1990s, as embodied in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, the Clean Air Act Amendments (CAAA) of 1990 and the Transportation Equity Act for the 21st Century (TEA21), has prompted the need for new planning and decision-making processes in the development of transportation solutions by State Departments of Transportation (STDs) and Metropolitan Planning Organizations (MPOs). These transportation and environmental policies have focused attention on the efficiency of coordinated, multimodal planning to meet the need for transportation services.

Multimodalism ensures that all potential solutions to transportation problems - ranging from those that increase supply of transportation to those that manage demand - are considered within the context of the planning process.

Multimodalism also emphasizes comprehensive and integrated planning as a way to better equilibrate supply and demand while concurrently minimizing externalities such as air pollution, energy consumption, safety and congestion. This new emphasis on utilizing multimodal solutions to achieve our overall societal goals highlights the need for integration among the disciplines of planning, engineering, real estate and environment in the transportation planning process.

Jack Faucett Associates (JFA), an economics and public policy consulting firm, is conducting a project for the United States Department of Transportation's Federal Highway Administration (FHWA) Planning, Environment, and Real Estate Core Business Unit (CBU) entitled, "Integrating and Streamlining Transportation Development and Decision-Making." The goal of the project is to identify successful practices currently employed in the development of transportation solutions by means of integrating the disciplines of planning, environment, real estate, and engineering. The three main products of this project are:

1. This "State of the Practice" synthesis report which identifies current practices in State Departments of Transportation (STDs) and other transportation agencies.
2. A "Best Practices" report developed from site visits to 5 or 6 transportation agencies which will illustrate the best examples of integrating and streamlining in the transportation development and decision-making process.
3. A "Recommendations Report" which will provide recommendations for how the process of transportation decision-making can be improved by better integrating the different disciplines in transportation agencies.

This "State of the Practice" synthesis report constitutes the first of the three main products. The information in this report was developed based upon a review of available literature regarding the development of transportation solutions and the results of the FHWA Integration Solutions Survey. A Sounding Board which included members with expertise in each of the four disciplines provided guidance and support throughout the development of this report. The findings from this report, summarized in the concluding chapter, will serve as a basis for developing the other two main products of this project: the best practices and recommendations reports.

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2 REVIEW OF LITERATURE

JFA conducted an extensive review of existing literature related to transportation decision-making methods and the development of transportation solutions in federal, state and local environments. This review focused particularly on the integration of the real estate, engineering, planning and environment disciplines in this process. It also included a review of integration efforts undertaken by states, cities, counties, planning organizations, federal government agencies and foreign countries.

Efforts to identify relevant studies and information included internet searches, discussions with involved FHWA parties, and discussions with relevant American Association of State Highway and Transportation Officials (AASHTO), Transportation Research Board (TRB) and other transportation-related entity committee members. In addition, JFA consulted with the members of a Sounding Board assembled for this project. The Sounding Board was established by JFA with input from FHWA as a cross-disciplinary group of individuals in the real estate, planning, environment and engineering disciplines. The role of the Sounding Board was to serve in an advisory capacity throughout the duration of the project. The group consisted of 18 members representing various STDs and Federal Highway division offices.[1] The first task asked of the Sounding Board members was to recommend relevant reports or other documents on the subject of transportation decision-making and the roles and interaction of the various disciplines in that process.

The result of the literature search was an annotated bibliography of reports, presentations, guidance documents,

websites, transportation trade journal articles and other materials relevant to transportation solution development. Materials reviewed in the annotated bibliography cover subjects including value engineering, context sensitive design, smart growth, land use, the statewide transportation planning process, NEPA and other environmental guidelines and processes, innovative right-of-way practices, and specific STD streamlining and transportation planning practices and procedures. The complete annotated bibliography is included in Appendix B.

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3 SURVEY METHODOLOGY

JFA conducted a survey of all 52 state departments of transportation and a selection of ten other transportation planning organizations in order to gather useful and accurate data on current practices used in developing transportation solutions. During the development of the survey instrument and the analysis of survey results, JFA corresponded with Sounding Board members for suggestions, advice and feedback.

The following discussion describes the process undertaken by JFA in the development and implementation of the survey. This discussion is divided into three sections:

3.1 Development of Survey Instrument

JFA developed questions for the survey instrument based on a review of relevant literature, input from FHWA, and correspondence with Sounding Board members. The questions were written with the following goals in mind:

- To identify key integrating systems and processes, the scope of these systems and processes, and the documents guiding the integration process;
- To identify key successes and barriers in the implementation of integration efforts;
- To identify the extent of integration and how each discipline relates to and interacts with others in the process; and
- To identify the level of success of these integration processes as perceived by the organizations themselves and how organizations measure their level of success.

A preliminary draft of the questionnaire was submitted for content review by FHWA personnel in the Environmental, Engineering, Planning and Real Estate disciplines. JFA then corresponded with the Sounding Board for advice and guidance in preparing a sensible, clear and appropriate set of questions. JFA conducted a conference call on April 17, 2002 with the Sounding Board to discuss four main issues that arose during the prior review: [2]

1. the definition and use of the phrase "project development;"
2. the scope of the survey in terms of the types of projects on which to focus;
3. a list of project characteristics that influence the project development process; and
4. a list of categories that describe the discipline in which the survey respondent works.

The preliminary draft questionnaire was revised based on input from the Sounding Board and FHWA.

It was determined at the outset of the project that a web-based survey would be the most cost effective survey

method and the one that would obtain the highest response rate. The survey page was created using MS FrontPage software and was housed on the JFA company website. The survey page was formatted with FHWA headers and footers in order to give it the appearance of an FHWA web page.

Finally, the draft questionnaire was pilot tested by the Sounding Board members and revised based on the feedback. The pilot test focused both on the content of the survey and on the functionality of the website and receipt of results. The draft questionnaire was then submitted to FHWA for final review. Through coordination with the FHWA Office of Management and Budget (OMB) liaison, JFA completed the required OMB clearance package and the questionnaire, entitled "FHWA Integration Solutions Survey", was also submitted to OMB for approval. OMB clearance was granted.

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3.2 Identification of Survey Respondents

The list of survey respondents included staff from all 52 STDs and a selection of other transportation organizations. For each STD, up to 4 potential respondents were identified from each of the four disciplines of planning, real estate, engineering and environment. One respondent from each discipline in each STD was identified as the primary respondent for completion of the survey. JFA developed the list of potential STD respondents based on a review of organizational staff charts provided on STD websites and the AASHTO 2001 Reference book. JFA contacted the managers of each of the four FHWA Regional Resource Centers - Eastern, Midwestern, Southern and Western - for assistance in reviewing the contacts and providing suggestions where appropriate STD contacts were not easily identifiable. When information and assistance was unavailable, JFA contacted each of the state departments to determine which employees would be the most appropriate in completing the survey. JFA also received input from FHWA and the Sounding Board members on the identification of survey respondents in STDs and other transportation planning agencies.

The following two contact lists were developed.

1. State Departments of Transportation (STDs)
2. Other Transportation Agencies - Metropolitan Planning Organizations (MPOs), Regional Planning Organizations, US DOT agencies (FHWA and FTA), Canadian Departments of Transportation, International Organizations

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3.3 Implementation of Survey

Upon receiving approval of the survey instrument by OMB, an email notice providing a hyperlink to the web-based survey was sent on July 22, 2002 to the 255 identified respondents. The email specified general project goals and objectives and clearly established the survey as an FHWA project.

The deadline for responses was initially set for August 12, 2002 and then extended to September 20, 2002 in order to achieve a higher response rate. Many respondents were unavailable over the original survey period due to summer vacations. Two subsequent email notices were sent to all respondents as a reminder approximately one week before the initial and revised deadlines. In addition, JFA contacted all non-respondents by telephone in the weeks between the original and extended deadline dates in order to encourage completion of the survey and answer any questions respondents might have regarding the project.

The survey remained on the JFA company website in order to provide JFA the opportunity to make revisions and

track responses. Responses were received directly on JFA's web server and maintained in an Excel spreadsheet throughout the data collection and survey analysis period. In instances when respondents had trouble completing the survey on-line or did not have web access, survey forms were sent and returned by facsimile. A few responses were also taken over the phone when making follow-up phone calls. A 70 percent response rate was achieved.

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4 SURVEY RESULTS

This chapter provides a tabulation and analysis of the results from the FHWA Integration Solutions Survey. As described in the previous chapter, the purpose of the survey was to gather useful and accurate data on current practices in the integration between the disciplines of planning, environment, engineering and real estate in the development of transportation solutions. The following five sections correspond to the grouping of questions in the survey:

While the results of each question are presented sequentially, a discussion of the results is also broken out by those respondents who stated their agency has as integrated approach and those that do not. A copy of the survey is included in Appendix C and definitions of terms used in the survey are provided in Appendix D.

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4.1 Profile of Survey Respondents

Section 4.1 provides an analysis of the first three questions of the FHWA Integration Solutions Survey. Responses to these questions give an overview of survey respondents by (1) discipline and geographic location, (2) the number of field units in each agency, and (3) the number of entities with which each agency coordinates in the formulation of their Statewide Transportation Plan (STP) and Statewide Transportation Improvement Program (STIP). The section concludes with a discussion of the association between integration, number of field units and number of coordinating agencies.

4.1.1 Question 1: What is the primary discipline in which you work?

A total of 154 people responded to the FHWA Integration Solutions Survey. Of the 154 respondents, 146 were employees of State Departments of Transportation (STDs) and the remaining 8 were employees of other types of transportation-related agencies. Efforts undertaken by JFA and FHWA to encourage participation resulted in a 70 percent response rate from STDs. In addition, JFA contacted a number of other agencies and businesses to consider input from people working in different transportation-related settings. A total of 8 responses were received from representatives of theFederal Highway Administration (FHWA), the Federal Transit Administration (FTA), various Metropolitan Planning Organizations (MPOs) and foreign transportation agencies combined. Table 4.1 shows the number and percent of survey responses from STDs and other transportation related entities involved in the development of transportation solutions.

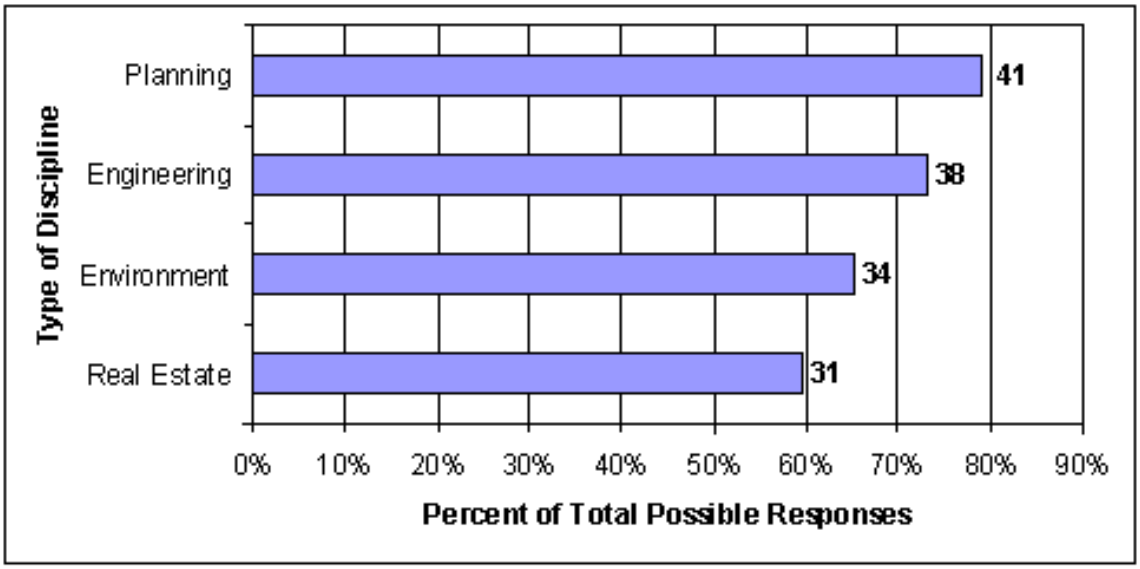
Table 4.1 Number and Percent of Survey Responses from STDs and Other Transportation Related Entities

Type of Respondent	# Responded	# Contacted	% Response
STDs	146	208	70%
Other Transportation Related Entities	8	54	15%
Total	154	262	59%

Response by Discipline

Overall, JFA received input from the majority of people contacted in each of the four disciplines. Of the total number of responses from STDs, JFA received the most input from members of the Planning discipline, with a total of 41 responses and a 79 percent response rate. Members of the Real Estate discipline had the least amount of input with a total of 31 responses; nearly a 60 percent response rate. Chart 4.1 shows the percent of response from each of the four disciplines. Two of the 146 respondents identified themselves as working within the discipline of Management, and as a result, were excluded from Chart 4.1.[3]

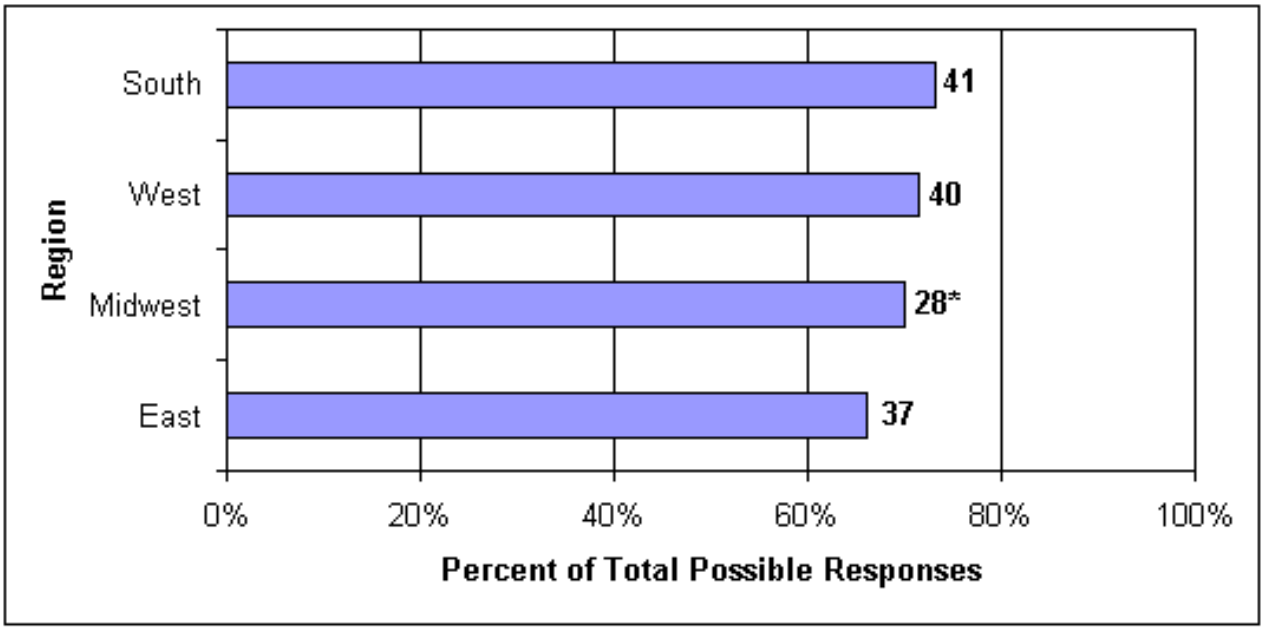
Chart 4.1 Number and Percent of Survey Responses from STDs by Discipline



Response by Geographic Location

JFA conducted an analysis of STD responses by geographic distribution based on the states included in the FHWA Resource Center regions. The four FHWA Regional Resource Centers represent states in the West, Midwest, East and South.[4] JFA received a proportionate number of responses from each of these regions. Chart 4.2 shows the rate of response from STDs within each of these four regions. The greatest response was from the South, with 41 responses or a 73 percent response rate. The smallest percentage in responses was from the East, with a 66 percent response rate (37 responses). At least one response was received from each state, district and territory contacted in this survey effort.

Chart 4.2 Number and Percent of Survey Responses from STDs by Geographic Location



* While the actual number of responses from the Midwest is less than from the East, the percentage of responses received in the Midwest is greater because there are fewer states represented in the Midwest.

4.1.2 Question 2: How many field units (i.e. districts or divisions) are in your agency?

Based on survey responses, over three-quarters of STDs have between 1 and 10 field units. Of the total set of responses, 49 percent responded that their agencies have between 6 and 10 field units while 29 percent responded that their agencies have between 1 and 5 field units (see Table 4.2 below).

Table 4.2 Frequency in Number of Field Units in each Agency

Number of Field Units	Total	Percent of Total
0	2	1%
1 to 5	41	**29%**
6 to 10	70	**49%**
11 to 15	17	12%
16 to 20	1	1%
> 20	12	8%
Total	**143**	**100%***

*Percent may not add up to 100 percent due to rounding.

4.1.3 Question 3: What is the number of entities with which your agency coordinates in the formulation of your Statewide Transportation Plan (STP) and Statewide Transportation Improvement Program (STIP)?

Over three-quarters of STDs coordinate with 1 to 15 agencies in the formation of their STP and STIP. Of the total set of responses, 47 persons (33 percent) responded that their agencies coordinate with 1 to 5 other agencies (see Table 4.3 below).

Table 4.3 Frequency in Number of Agencies with which Each Entity Coordinates in the Formulation of their STP and STIP

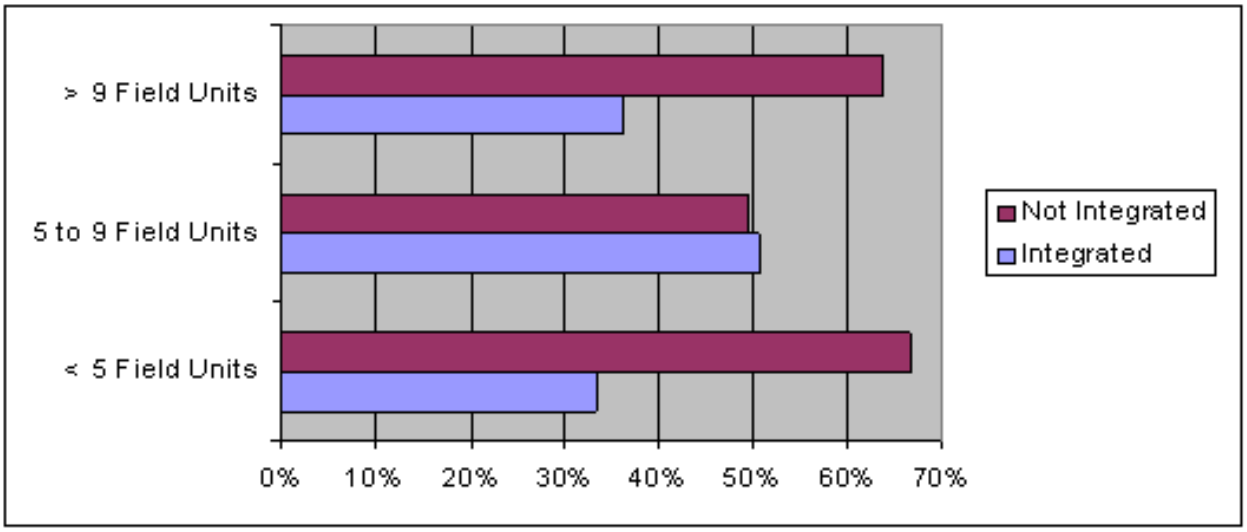
Number of Agencies	Total	Percent of Total
0	2	1%
1 to 5	47	**33%**
6 to 10	29	**21%**
11 to 15	33	**23%**
16 to 20	11	8%
> 20	19	13%
Total	**141**	100%*

* Percent may not add up to 100 percent due to rounding.

4.1.4 Relationship between Integration, Number of Field Units and Number of Coordinating Agencies

There appears to be a relationship between agencies with an integrated or non-integrated approach and the number of field units. As seen in Chart 4.3 below, agencies with greater than 9 field units are less likely to utilize an integrated approach. Those with fewer than 5 are also less likely to use an integrated approach. Perhaps the advantages of integration are difficult to capitalize upon when dealing with a large number of field units. And likewise, those advantages are essentially non-existent when dealing with only a very few.

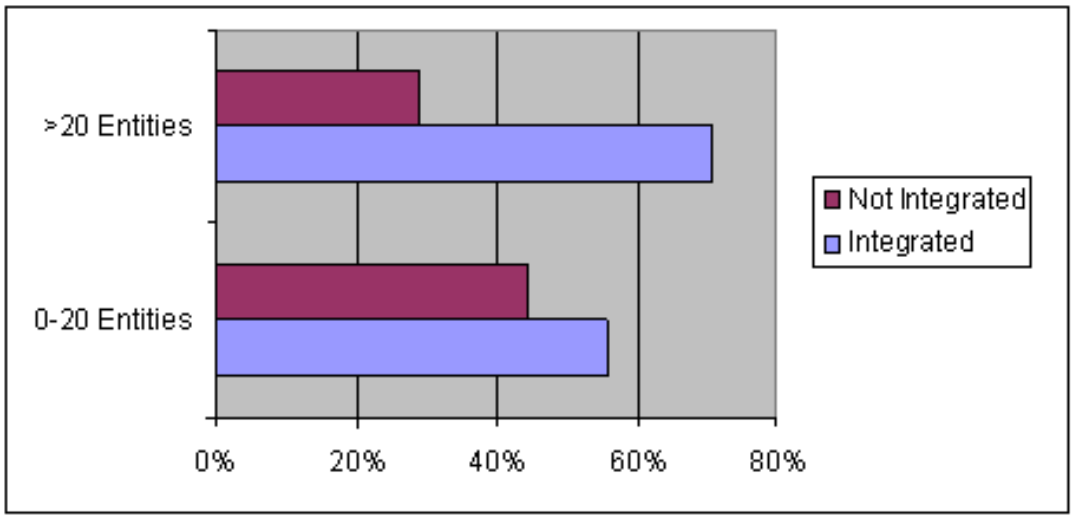
Chart 4.3 Percentage of Integrated Agencies based on Number of Field Units



There appears to be an association between the number of entities with which an agency coordinates in the

formulation of the Statewide Transportation Plan (STP) and Statewide Transportation Improvement Program (STIP) and whether an agency has an integrated or non-integrated approach. As shown in Chart 4.4 below, agencies that coordinate with greater than 20 entities are more likely to be integrated than agencies that coordinate with less than 20 entities.

Chart 4.4 Percentage of Integrated Agencies based on Number of Coordinating Entities



It is possible that agencies which coordinate with a greater number of entities in the formulation of the STP and STIP also coordinate with a greater number of staff members, agencies and public parties in the project development process. As noted by some survey respondents, increased involvement from the public and other entities is integral to developing consensus and reducing potential conflicts in an integrated transportation solution development process. When asked to summarize an agency's process in one or two most successful points, respondents wrote:

- "(1) Early and continuous coordination with resource and regulatory agencies to gain early project buy-in, and (2) Public involvement identifies local concern(s) and helps get buy-in from affected communities." - Environment
- "[G]et the federal agencies and the MPO to buy into this scope of work so that we don't have to change our analysis once we are well into the process." - Planning

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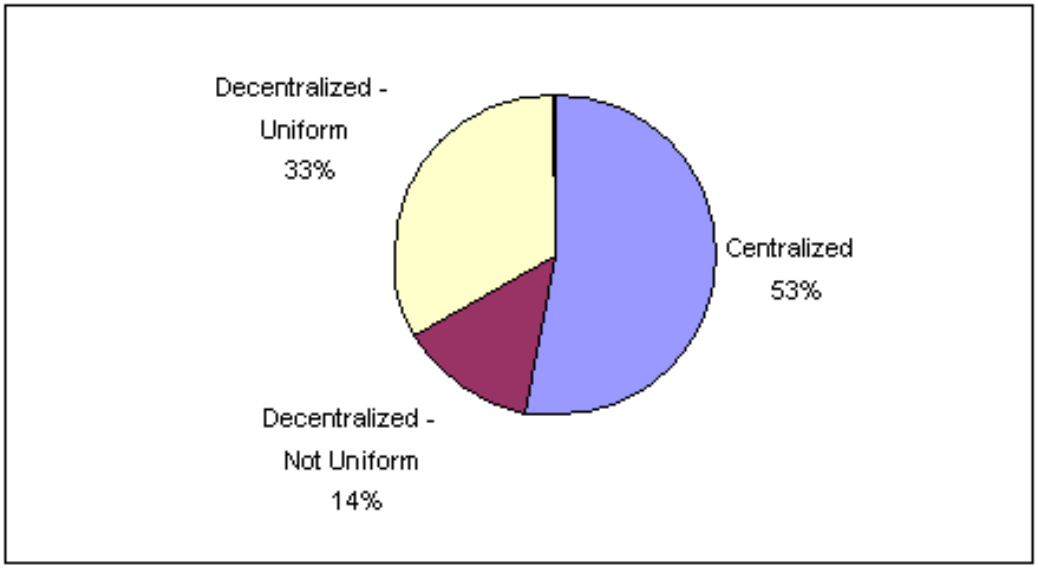
4.2 Current Practices

This section provides an analysis of current practices employed in each agency. Respondents were asked if current practices in their agencies are (A) centralized/decentralized, (B) uniform/not-uniform, and (C) integrated/ not-integrated in their approach(es) to developing transportation solutions. Generally, centralized vs. decentralized refers to the administration of the entities and whether or not decisions are made centrally or at the field unit/ district/division level. Uniform vs. non-uniform refers to whether or not the same practices are followed in each field unit/district/division. Integrated vs. non-integrated refers to the respondent's judgment as to whether the practices employed by their agency integrate the expertise of the four disciplines in question as opposed to a linear process in which one discipline's efforts are handed off to the next with little interaction between them.

4.2.1 Question 4: Is the practice of developing transportation solutions in your agency centralized or decentralized?

The majority of respondents stated that the practice of developing transportation solutions in their agencies is centralized. Of the decentralized agencies, 70 percent stated that procedures were uniform across field units in the development of transportation solutions. Based on these survey results, just over half of the agencies are centralized, and the majority of decentralized agencies have uniform procedures across field units. Chart 4.5 shows the percentage of centralized, decentralized and uniform, and decentralized and non-uniform agencies.

Chart 4.5 Percent of Centralized vs. Decentralized (Uniform vs. Non-Uniform Procedures across Field Units) Agencies



The survey asked respondents who indicated that their agency is both decentralized and lacking uniform procedures across field units to provide further explanation. Some responses from staff that identified their agencies as having a centralized practice also offered some additional comments. Their comments reveal that although their agency practices are centralized, there is some variation based on discipline and size of the project. The following are some of their comments:

- "Major projects are centralized. Minor (special) projects are decentralized." - Maryland DOT
- "It's both, depending on the area. Environmental is totally centralized, construction is mostly decentralized, planning and design are both." - Alabama DOT

The most frequent comments from respondents who indicated that their agency is both decentralized and lacking uniform procedures across field units reveal that while their STDs do have general guidelines and procedures, there is a significant amount of flexibility at the regional and local levels. While some attribute this to a lack of understanding about the transportation planning process, staff unawareness, or inaccessibility to such guidelines, the majority of respondents believe that the freedom to make planning decisions at more local levels provides for more innovative and effective solutions. The following are some of these respondents' comments:

- "Solutions development on the level of aims, principles and guidelines, as well as the research needed, is very much a centralized task, but developing those principles into working solutions for the region concerned is a regional task which is not bound by the central guidelines." - Finnish Road Administration
- "The development of solutions to transportation needs is inherently different in every situation." - Missouri DOT
- "Although we try to maintain consistency, every group has their own goals they need to attain. We also have varied environments, one Region may be urban (Denver), another deals with mainly agricultural style cities, and those in the mountains may deal more with tourism." - Colorado DOT

- "We have guidelines, but since the process is applied by several governmental agencies and their contractors, the product is not as uniform as we would like." - Oregon DOT

4.2.2 Question 5: Can the process your agency follows (e.g. the disciplines involved, the sequence of their involvement and the relative levels of involvement) be described uniformly regardless of the transportation solution being addressed?

Just over half (53 percent) of the respondents replied that the process their agency follows could be described as uniform. The survey prompted those who replied positively to describe the process with respect to their discipline's involvement and the sequence of their involvement, while indicating points of overlap or coordination. An analysis of these comments by discipline is included in Chapter 5.

Of the remaining 47 percent who replied that processes within their agencies could not be described as uniform, the survey prompted them to list up to six factors that most influence the transportation solution development process in order of their likelihood of influencing the process.[5] Approximately 32 different types of factors were listed by respondents.

Two different analyses were conducted with the responses to this part of question 5. The first analysis shows which factors were listed most frequently, irrespective of the order in which they were listed. The second analysis shows which factors were most frequently identified as the number one most influential factor affecting the transportation solution development process.

Most Frequent Factors

Chart 4.6 shows the most frequently listed factors, irrespective of the order in which they were listed. Categorizing all 32 different factors into 10 groups, the five most frequent responses are (1) identified impacts, (2) complexity/ magnitude, (3) cost, (4) public interest, and (5) funding. The most frequent factor (22 percent) listed is identified impacts, which are impacts that a project may have on the environment, economy and community. The second most frequent factor (14 percent) is the complexity or magnitude of the project in terms of design, environment, and interaction with other agencies. Both the third and fourth most frequent factors occurred 13 percent of the time. These factors were project costs including design and acquisition, and public interest, involvement and support. The fifth most frequent factor (10 percent) is funding.

Most Influential Factors

Chart 4.7 shows the factors most frequently listed as the number one most influential factor affecting the process of developing transportation solutions. Of all responses, complexity/magnitude was listed most frequently as the most influential factor (29 percent) affecting the development of transportation solutions. The following five were also listed as the most influential, but not as frequently as complexity/magnitude: cost (17 percent), identified impacts (11 percent), the ability of a project to address a certain need or fulfill a benefit within the transportation system (11 percent), funding (8 percent) and maintenance vs. capital improvement (8 percent).

A comparison between results in Charts 4.6 and 4.7 shows that the following four factors were listed most frequently by respondents as an influential factor, as well as most frequently as the number one most influential factor:

- identified impacts,
- cost,
- funding, and
- complexity or magnitude.

The fourth most frequently listed top influential factor, the ability of a project to address a need or provide a benefit for the transportation system, was not listed as one of the top five most frequently listed factors.

Chart 4.6 Most Frequently Listed Factors Affecting the Transportation Solution Development Process

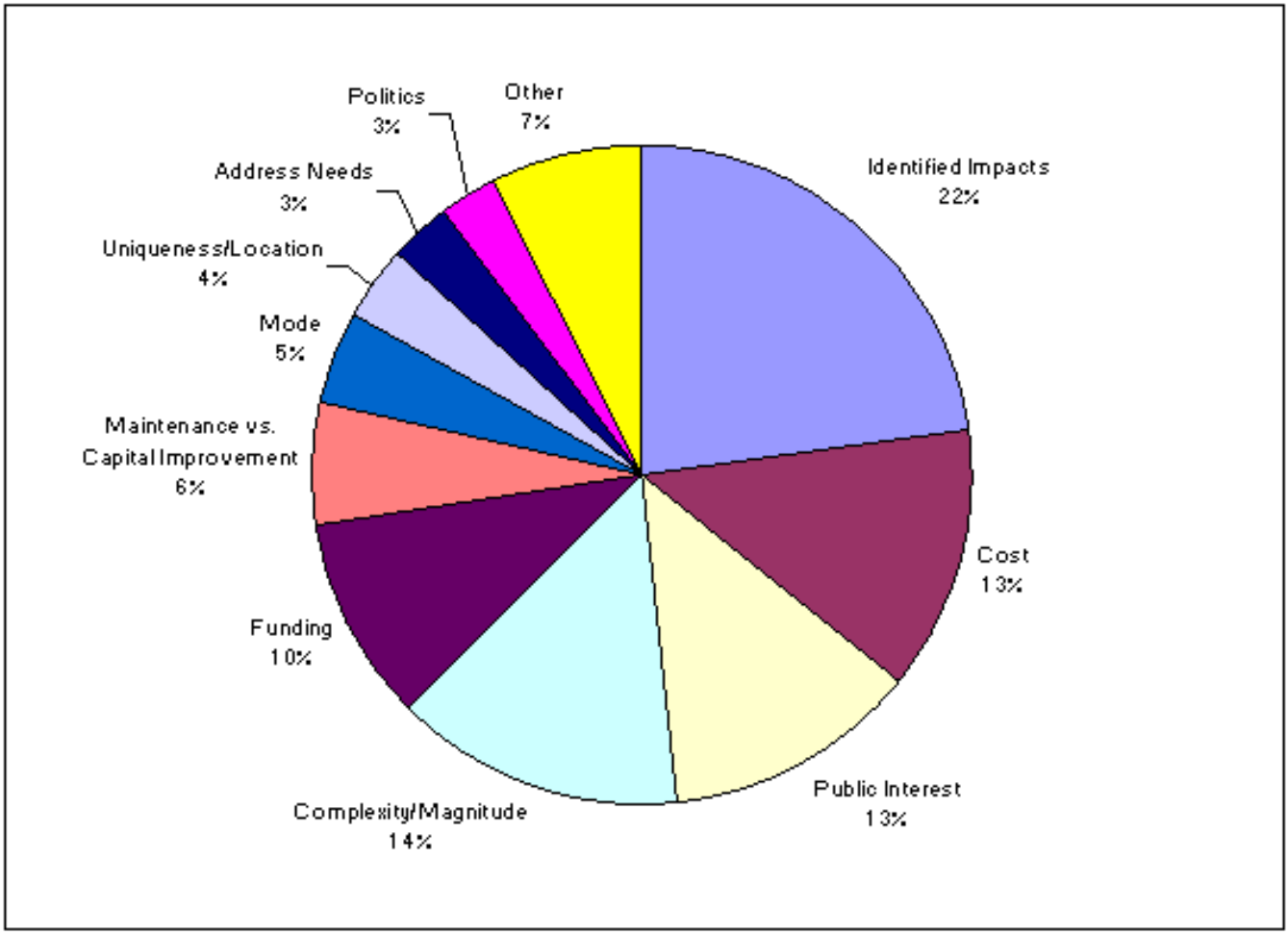
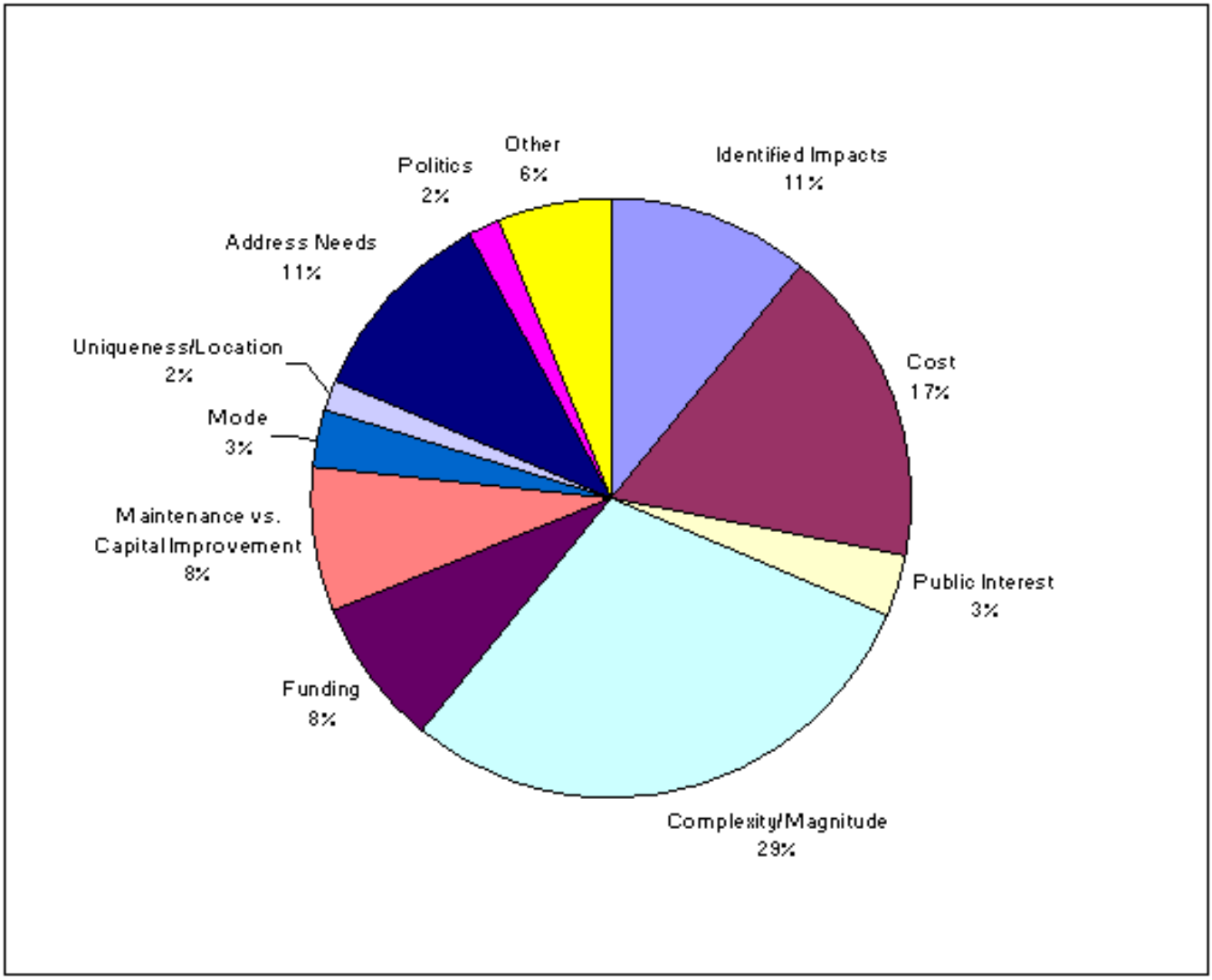


Chart 4.7 Factors Most Frequently Listed as the Number One Influential Factor Affecting the Transportation Solution Development Process



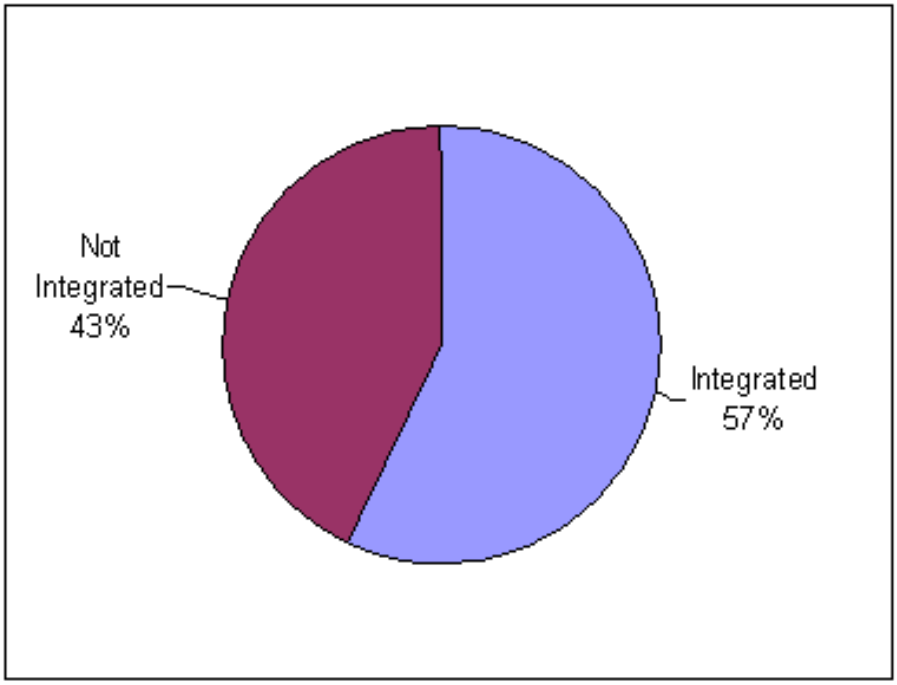
4.2.3 Question 6: Provide more detail on the involvement of your particular discipline in the process of transportation solution development

An analysis of qualitative responses to Question 6 is included in the discussion of practices provided in Chapter 5.

4.2.4 Question 7: Would you describe your agency's process of developing transportation solutions as a new or non-traditional approach with more integration between any combination of the planning, real estate, engineering and environment disciplines?

Most of the respondents described their agency's process of developing transportation solutions as a new or non-traditional approach with more integration between any combination of the planning, real estate, engineering and environment disciplines. Chart 4.8 shows the percentage of agencies with integrated and non-integrated processes.

Chart 4.8 Percent of Agencies with Integrated vs. Non-Integrated Processes



4.2.5 Type of Procedures and Processes in Integrated Agencies

An agency integrated in its approach to developing transportation solutions is more likely to be decentralized, as shown in Table 4.4. It is possible that the management and systems planning in a decentralized agency requires decision-makers to consider more carefully the interaction between disciplines in the development of transportation solutions. Perhaps also, a decentralized environment fosters more innovative thinking with each field unit or division office serving as an example for different ways of approaching or completing a task. Therefore, decentralization may support integration because it provides more opportunities for disciplines to learn from one another and to collaborate throughout different stages in the project development process. On the other hand, coordination may be more difficult in a centralized agency where decisions are made at the central office or headquarters.

Table 4.4 Percentage of Integrated and Non-Integrated Approach in Centralized and Decentralized Agencies

	% Integrated	% Non-Integrated
Centralized	42%	**68%**
Decentralized	**58%**	32%
Total	100%	100%

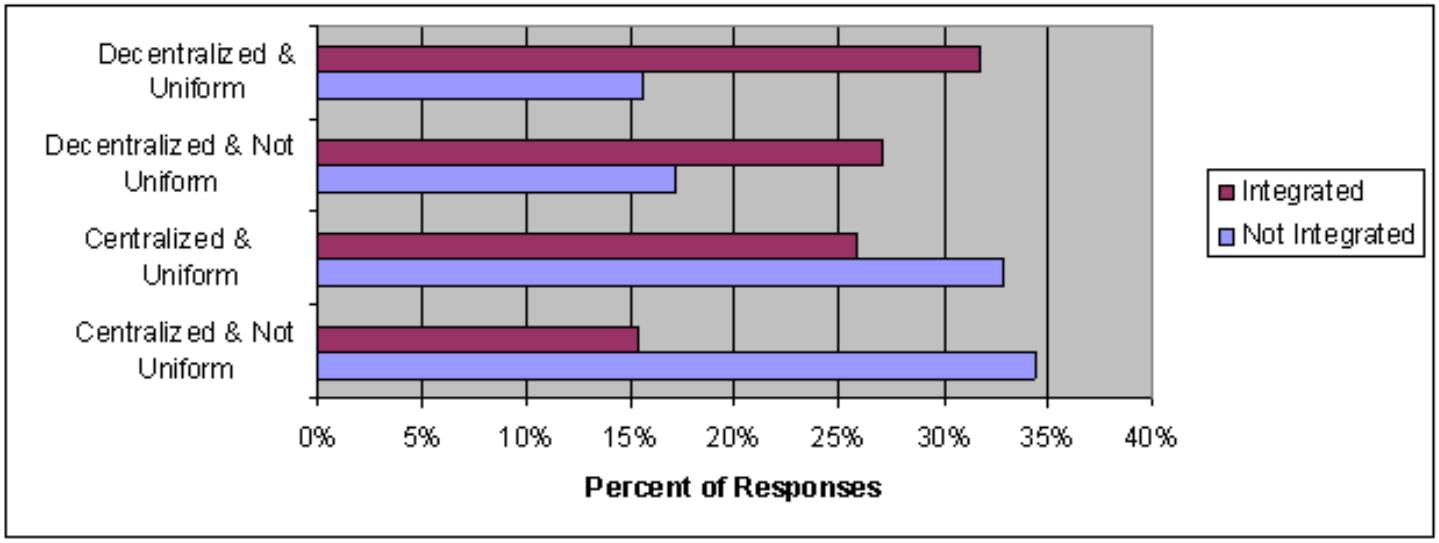
A centralized agency is more likely to be integrated if it has uniform processes regardless of the transportation solution being addressed. It is possible that uniform processes support integration because they provide structure and guidance to the development of transportation solutions when more parties are involved and when interaction between disciplines is increased. Table 4.5 below shows an association between uniform processes and the likelihood of integration in centralized agencies

Table 4.5 Percentage of Integrated and Non-Integrated Approach in Centralized Agencies with Either Uniform or Non-Uniform Processes

	% Integrated	% Non-Integrated
Centralized and Non-Uniform	37%	**51%**
Centralized and Uniform	**63%**	49%
Total	100%	100%

There is a pattern in the frequency of certain processes and procedures in integrated and non-integrated agencies, as shown in Chart 4.9 below. Agencies with decentralized and uniform processes are most likely to be integrated. This likelihood of integration decreases when processes are non-uniform and agencies are centralized. The trend in non-integrated agencies is the opposite. Agencies with centralized and non-uniform processes are most likely to be non-integrated. The likelihood of integration increases when processes are uniform and agencies are decentralized.

Chart 4.9 Percentage of Decision-making Processes in Integrated and Non-Integrated Agencies



Comments from survey respondents suggest that some agencies that describe their approach as integrated are moving towards decentralization and adopting more uniform practices. The following are some comments from integrated agencies:

- "Decentralization began about 3 years ago, [and is] now being speeded up. Our 7 regions are gaining say in individualizing processes to fit their timetable, not necessarily keeping the previous centralized process."
- "[We are] currently in the process of moving towards a decentralized organization. When this is fully implemented, [the] central office will distribute uniformed procedures. Generally guidelines are the same statewide. Locally, there are variations dependent on MPOs and other local government participants.
- "In the planning area, [processes] have not been uniform, but we are currently working on a planning process that will provide uniformity."

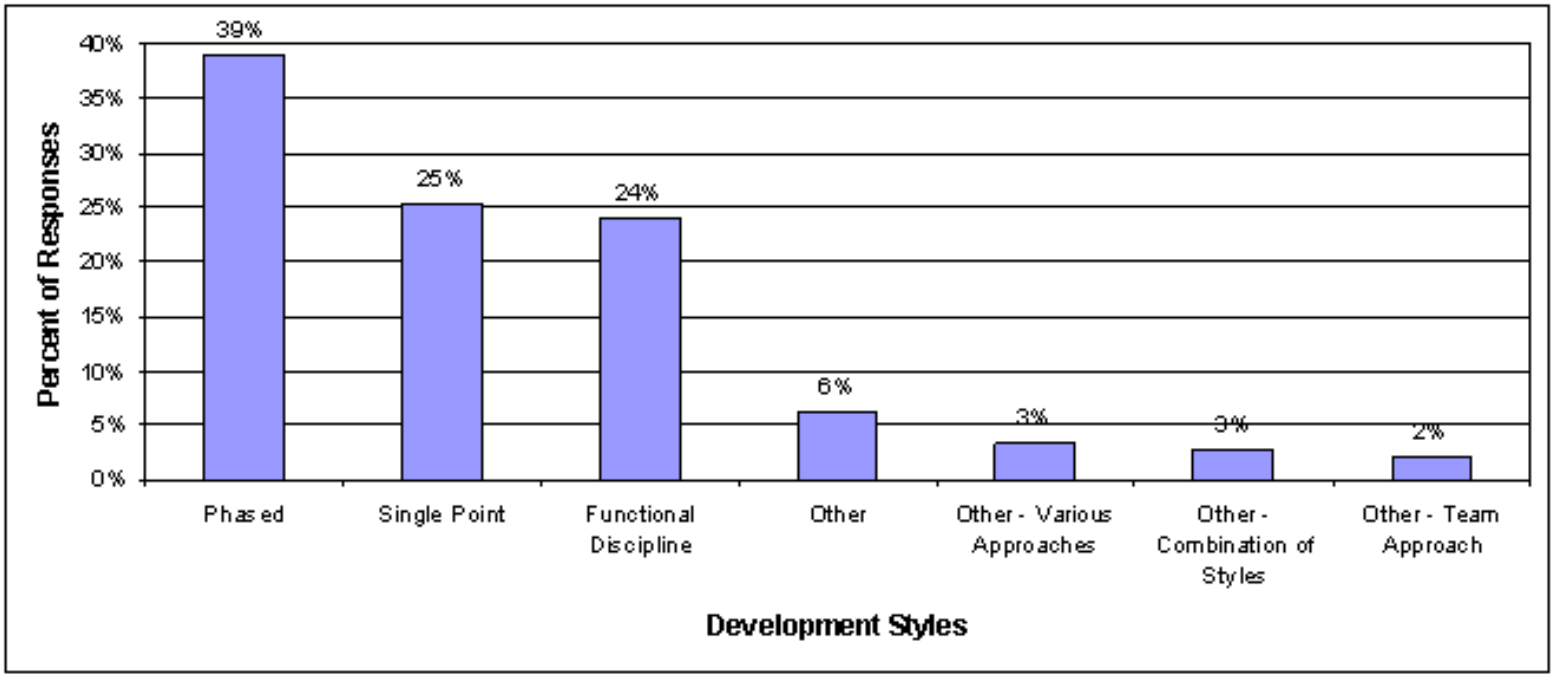
4.2.6 Question 19: Once a project or a transportation solution has been identified, what is your agency's project development style?

Respondents were asked to identify their agency's project development styles from four choices:

(1) *Single point project manager* assigned "cradle to grave" for a total project during all phases of the project;
(2) *Phased project manager*, e.g. scoping manager, design manager, construction manager, etc.;
(3) *Functional discipline project manager*, e.g. bridge, roadway design, geotech, ROW, etc.; and
(4) *Other*, describe

As shown in Chart 4.10 below, "Phased" project managers is the most frequent of project development styles, followed by "Single Point" and then "Functional Discipline" project managers.[6]

Chart 4.10 Development Styles, Percentage of Responses



4.2.7 Project Management Styles in Integrated Agencies

There is an association between an agency's project management style and whether the agency has an integrated or non-integrated approach to the development of transportation solutions. Agencies with functional discipline project managers (e.g., bridge, roadway design, geotech, ROW, etc.) are more likely to be non-integrated, as shown in Table 4.6 below. Agencies with one of the following types of project management styles are more likely to have an integrated approach:

- A *single point project manager*;
- A *phased project manager*;
- A *combination* of two or three of the following management styles - functional, phased and single; or,
- A *team* of managers.

Table 4.6 Percentage of Project Development Styles in Integrated and Non-Integrated Agencies

	Functional	Other Styles
Integrated	41%	**62%**

Non-integrated	**59%**	38%
Total	100%	100%

It appears that functional discipline project managers are less frequent in integrated agencies because these types of project managers only focus on their particular mode or discipline; as a result, collaboration between modes and disciplines may be limited. On the other hand, integrated agencies focus on increased interaction between disciplines as an approach to developing better transportation solutions.

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4.3 Agencies with an Integrated Approach

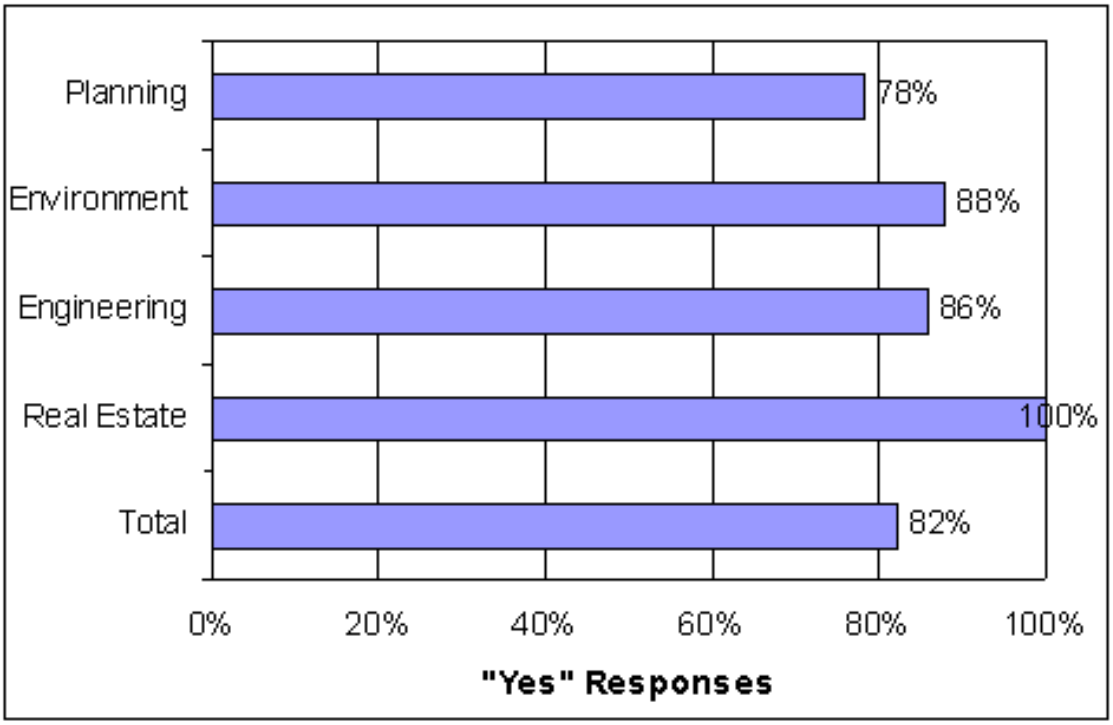
This section provides an analysis of questions directed at agencies that identified themselves as using an integrated approach in the development of transportation solutions. The respondents answered Questions 8-11, which concerned the effects of an integrated approach on their discipline's timing of involvement, level of involvement, effectiveness, and efficiency in the overall process of developing transportation solutions. Responses to Questions 12-15 concerned:

- efforts to measure the new, more integrated approach;
- summation of an agency's integrated approach in 1 or 2 most successful points or practices;
- the entities most consulted with in the development of the more integrated approach; and
- the impediments each agency faced in implementing the approach.

4.3.1 Question 8: Does your agency's new approach affect the timing of involvement of your discipline as compared to a more traditional, stove-piped or linear approach?

Overall, 82 percent of the respondents felt that a more integrated approach affected the timing their discipline became involved in the development of the transportation solution. All Real Estate respondents agreed that their timing of involvement was affected. Engineering and Environmental respondents were about equal in feeling that their timing of involvement was affected. The Planning respondents were the least affected in the timing of their involvement. Chart 4.11 shows the percentage by each discipline responding affirmatively to the issue of timing.

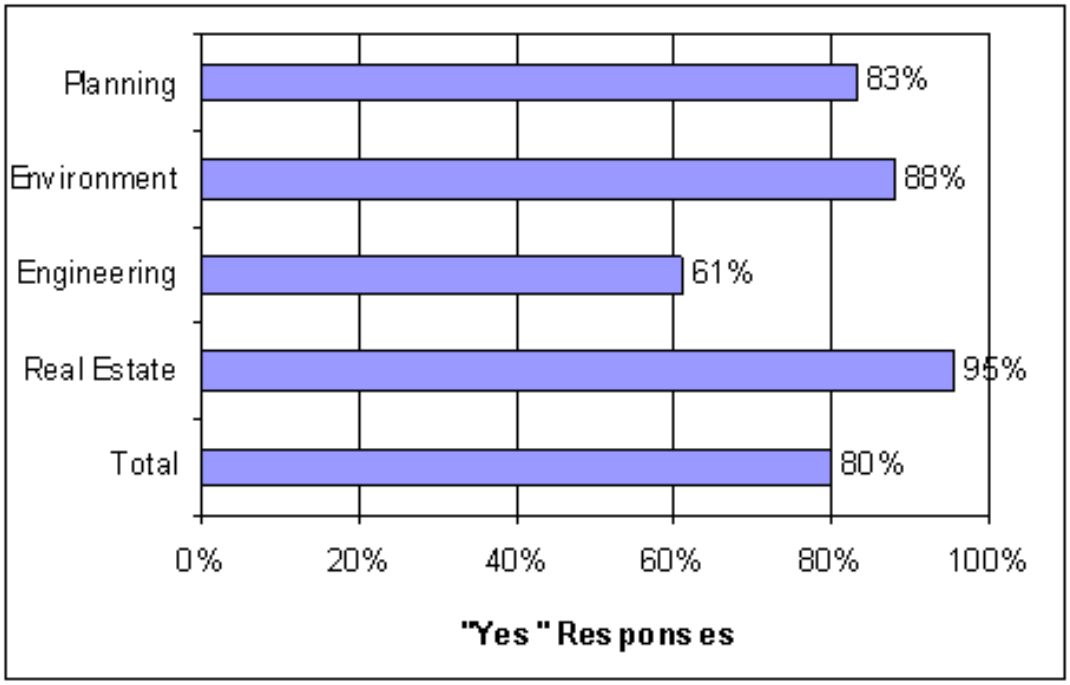
Chart 4.11 Impact of Integrated Approach on Each Discipline's Timing of Involvement in the Development of Transportation Solutions



4.3.2 Question 9: Does your agency's new, more integrated approach affect the level of involvement of your discipline as compared to a more traditional stove-piped or linear approach?

Chart 4.12 shows that 80 percent of respondents thought that the integrated approach affected their level of involvement. The Real Estate respondents overwhelmingly found this to be true. Environment and Planning respondents were close to equal in stating that an integrated approach affected their level of involvement while less than two-thirds of the Engineering discipline respondents stated that an integrated approach affected the level of their discipline's involvement.

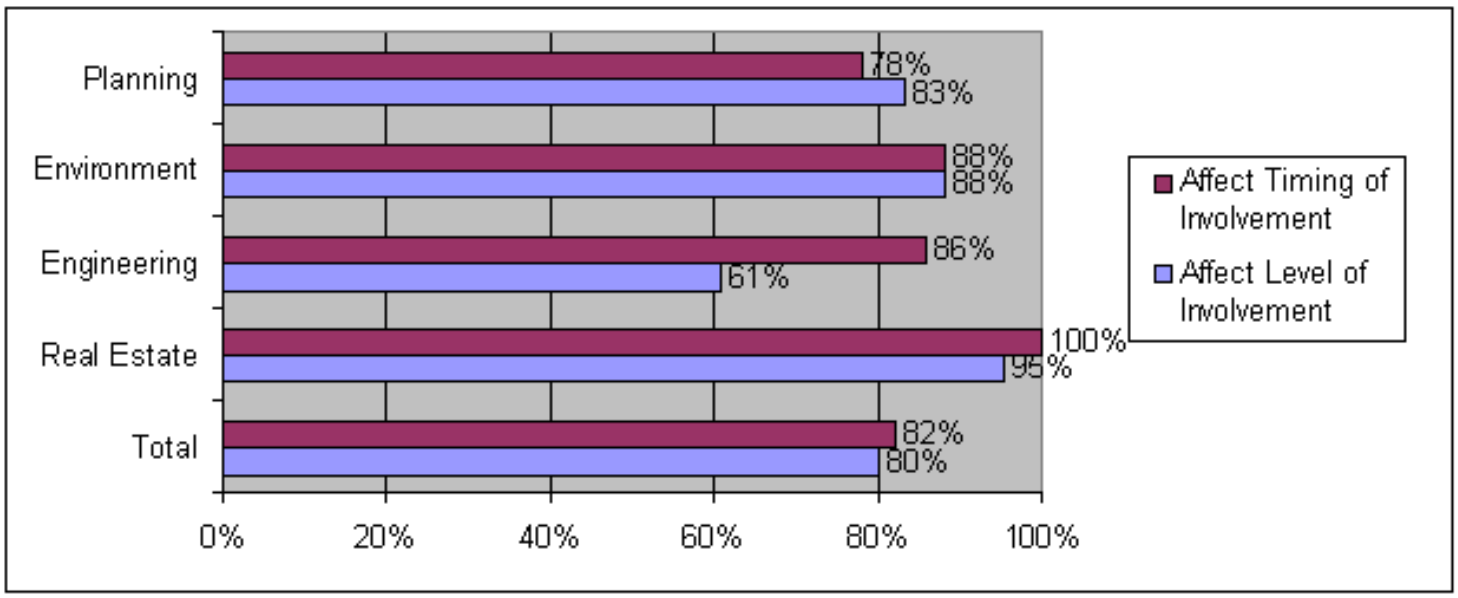
Chart 4.12 Impact of Integrated Approach on Each Discipline's Level of Involvement in the Development of Transportation Solutions



4.3.3 Impact of Integration on the Timing and Level of Involvement of Each Discipline

Overall, the majority of respondents thought an integrated approach affected their discipline's timing and level of involvement in the transportation solution development process. The most frequent comment is that disciplines are more involved earlier on in the process during the planning and scoping phase. Increased collaboration in the project development phase leads to consensus and reduces potential revisions later in the process. In addition, there is an effort to keep members on the project informed on the progress throughout the length of the project. As shown in Chart 4.13 below, there are differences among disciplines in the extent to which an integrated approach affects their timing and level of involvement.

Chart 4.13 Impact of Integration on Each Discipline's Level and Timing of Involvement



The majority of engineers believe an integrated approach affects their discipline's timing (86 percent) and level of

involvement (61 percent) in the development of transportation solutions. However, engineers are the least convinced of the effects on their level of involvement in comparison to the other three disciplines. One possible explanation is that in non-integrated agencies, engineers have greater coordination and more involvement throughout the development process than the other three disciplines. As a result, an integrated approach does not affect their discipline's level of involvement as much as it affects other disciplines.

The timing of involvement for an engineer may be more affected than the level because involvement is required earlier in the process, during the scoping and planning phases. Some comments from engineers regarding the timing of involvement are as follows:

- "More involvement in the planning phase."
- "We get in on the process very early and are kept informed throughout better."
- "I will have more front end involvement (project development) as well as construction involvement."

An integrated approach affects the timing (100 percent) and level (95 percent) of involvement of the Real Estate discipline the most of the four disciplines. One possible reason is that in a non-integrated agency, the Real Estate discipline has the least amount of involvement in the scoping phase and the least amount of interaction with other disciplines. On the other hand, an integrated approach incorporates Real Estate concerns earlier and to a greater extent throughout the project development process. Some comments from Real Estate respondents include:

- "Real Estate and Utilities are now involved at the start of the project planning process. This allows for greater communication and understanding of the time and cost factors necessary for R/W clearance."
- "[ROW] acquisition is often identified as the critical path for capital projects, therefore it has been given a heightened level of attention within the department."
- "Right of way was not solicited early enough to be effective under the old process."

The majority of planners thought an integrated approach affected their discipline's level (83 percent) and timing (78 percent) of involvement in the development of transportation solutions. While most planners believe their discipline's involvement is required earlier on in the development process, some believe involvement is more continuous throughout the length of the project. The following are some comments from planners regarding their level and timing of involvement:

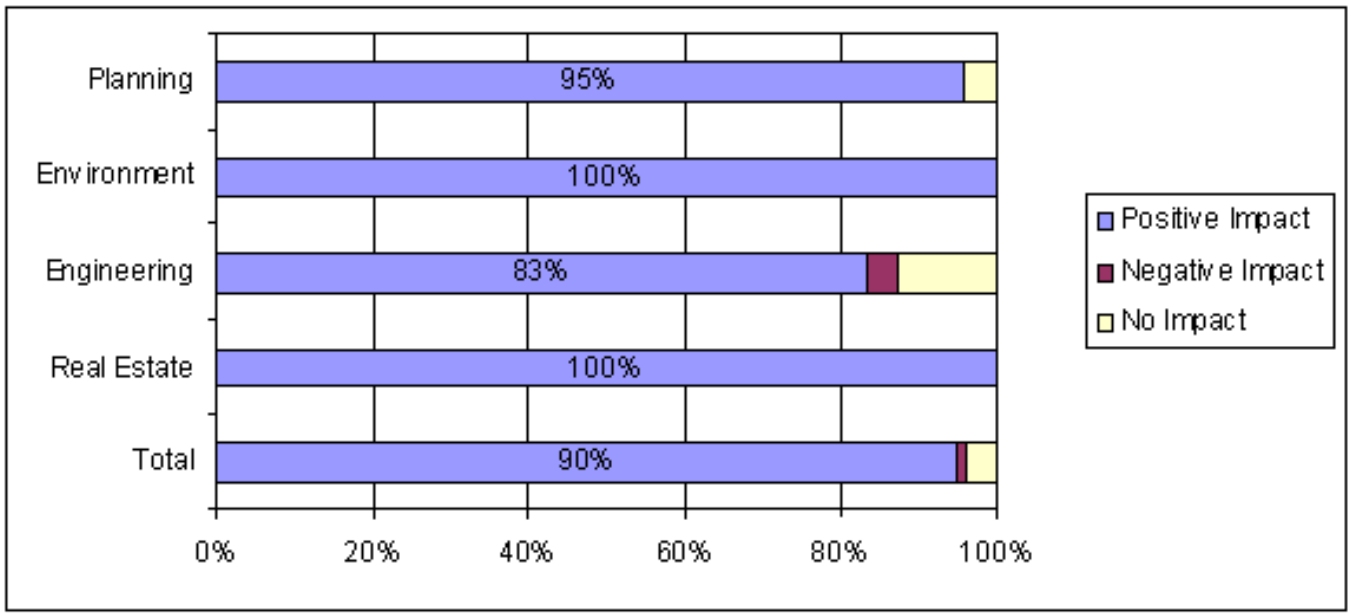
- "More input on project development earlier in the process."
- "Planning is still at the initiation of the process, but is now involved further into the development process than [previously]."
- "We have always been involved at the funding level, but now we are more involved at the project development stage."

4.3.4 Question 10: Does your agency's new, more integrated approach affect the effectiveness of your discipline's contribution to the overall process of developing transportation solutions?

Overall, 90 percent of all respondents indicated that an integrated approach positively impacted the effectiveness of their discipline's contribution. All of the Environment and Real Estate respondents noted a positive impact on the effectiveness of their discipline's contribution.

The responses from the Engineering discipline were more varied; while 13 percent of the respondents felt that there was no impact, 4 percent felt there was a negative impact on their effectiveness. A high percentage of the Planning discipline felt there was a positive impact on their effectiveness, and only 5 percent felt there was no impact. Chart 4.14 shows the percentage within each discipline that thought an integrated approach either had a positive, negative, or no impact on the effectiveness of their discipline's contribution.

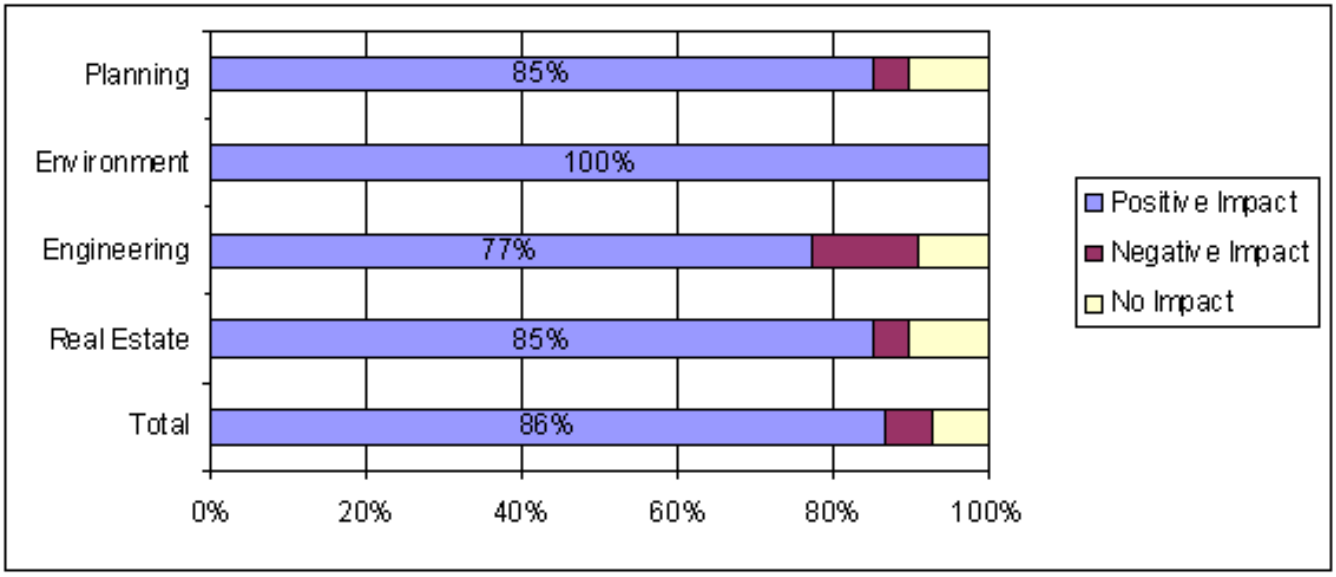
Chart 4.14 Impact of Integrated Approach on the Effectiveness of Each Discipline's Contribution to the Development of Transportation Solutions



4.3.5 Question 11: Does your agency's new, more integrated approach impact the efficiency of your discipline's contribution to the overall process of developing transportation solutions?

Overall, 74 percent of the respondents felt an integrated approach had a positive impact on the efficiency of their discipline's contribution to the overall process of developing transportation solutions. Six percent felt there was a negative impact, and 7 percent felt there was no impact on their efficiency. One hundred percent of respondents in the Environment discipline considered the impact to be positive on the efficiency of their discipline's contribution. The majority of Planning and Real Estate disciplines (85 percent) thought there was a positive impact on their efficiency. The Engineering respondents were the least convinced of the positive impact; of all the disciplines, they had the highest percentage of negative responses. Chart 4.15 shows the percentage within each discipline that thought an integrated approach had either a positive, negative, or no impact on the efficiency of their discipline's contribution to the development of transportation solutions.

Chart 4.15 Impact of Integrated Approach on the Efficiency of Each Discipline's Contribution to the Development of Transportation Solutions

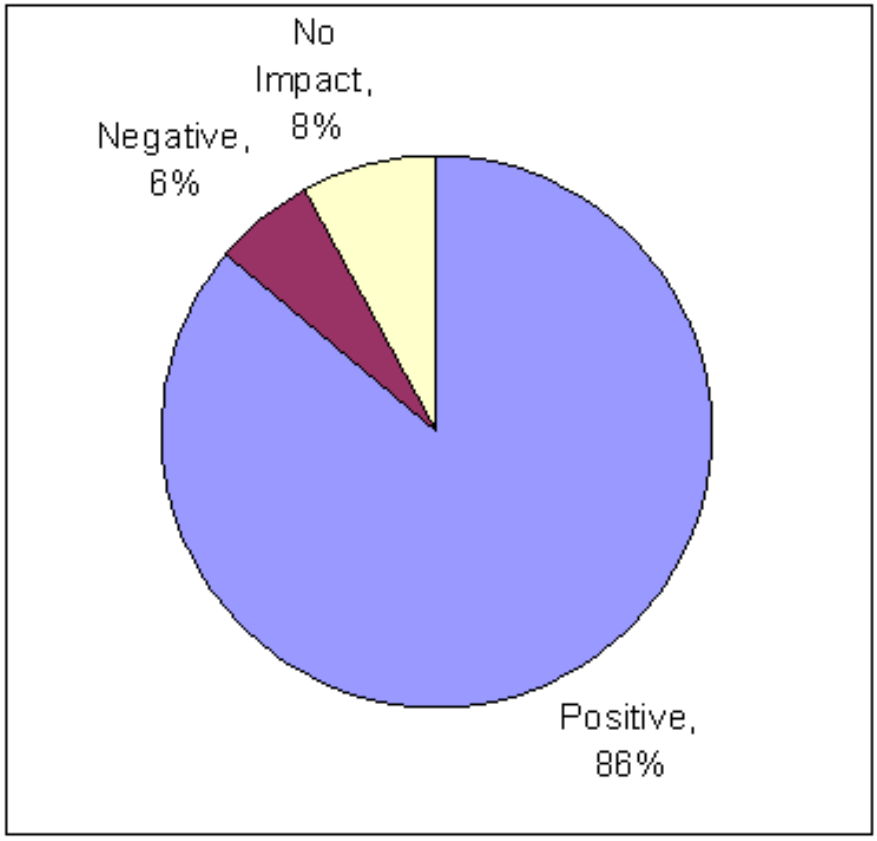


4.3.6 Overall Positive Response to Impacts of Integrated Approach on Development of Transportation Solutions

Respondents feel an integrated approach has a positive impact on the effectiveness and efficiency of their discipline's contribution to the overall process of developing transportation solutions (see Chart 4.16 below). All four disciplines responded similarly. Effectiveness is enhanced because each discipline is more involved in the scoping and planning phase of the project during which alternatives are developed and the preferred solution is identified. Efficiencies also increase with an integrated approach because potential problems from the perspective of each discipline are more likely to be identified early on in the process due to increased multi-disciplinary coordination in the planning phase. Collaboration throughout the project ensures a greater chance of consensus among staff within the department, the public and other agencies; this decreases the potential for conflict and revisions later in the process. Comments about the positive impacts of an integrated approach are as follows:

- "Better scopes of work, project development schedules and design/construction/right of way budgets are identified along with overall improved construction plan quality." - Engineering
- "All modes considered, public involvement early and meaningful, connects transportation and land use." - Planning

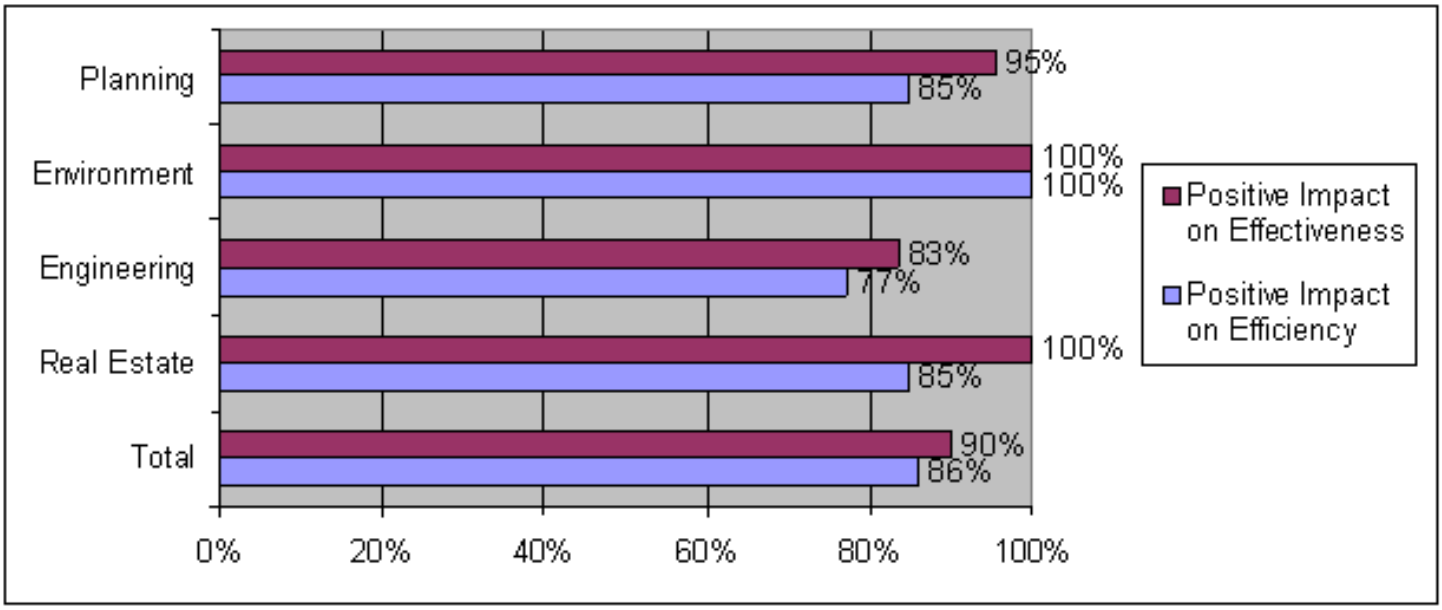
Chart 4.16 Impact of an Integrated Approach on Contributions to the Development of Transportation Solutions



4.3.7 Impact of Integration on the Effectiveness and Efficiency of Contributions to the Development of Transportation Solutions

As a whole, respondents thought that an integrated approach has a positive impact on the effectiveness (90 percent) and efficiency (86 percent) of their discipline's contribution to the development of transportation solutions (see Chart 4.17 below). The smaller percentage of positive responses regarding efficiency may be a result of the greater time requirements during the initial project development phase in an integrated agency. Although more time up front ideally leads to less time later on, some respondents perceive this increase in involvement during the planning phase as a further constraint on already limited resources.

Chart 4.17 Impact of Integration on the Effectiveness and Efficiency of Each Discipline's Contribution



The majority of engineers believe an integrated approach positively impacts the efficiency (77 percent) and effectiveness (83 percent) of their discipline's contribution in the development of transportation solutions. However, engineers are not as convinced of the positive impacts as the three other disciplines. Engineers who responded negatively or neutrally, stated:

- "While the solution may be better and more acceptable, this process does take longer, may be more expensive, and requires more design resources."
- "I do not perceive any change in efficiencies; if anything it requires more involvement at higher levels for a longer duration… resulting in better projects."
- "Engineers are not trained well enough in NEPA to make decisions that can be tested in court… NEPA takes years of involvement to know, and regulations/law is changing yearly."

All respondents from the Environment discipline indicated that an integrated approach positively impacts both the effectiveness and efficiency of their discipline's contributions to the development of transportation solutions. One respondent stated, "[t]he integrated approach is the only way to go." According to these respondents, environmental issues are identified early on and considered throughout the life of the project; this leads to less conflict and rescoping later in the process. Also, the permitting process is streamlined because of better relationships with resource and regulatory agencies. Comments from the Environment discipline are as follows:

- "We are able to assist the project team find solutions that better avoid or minimize environmental impacts, thus reducing the amount and cost of mitigation. By being involved early, we can also suggest solution strategies that can avoid or minimize the type of environmental permit(s) needed, thereby saving time or avoiding delays."
- "Transitions between phases are overlapping more, so that involvement of the various disciplines is more 'seamless' throughout the life of the project."

All respondents from the Real Estate discipline also indicated that an integrated approach positively impacts the effectiveness of their discipline's contribution to the development of transportation solutions. An integrated approach allows the Real Estate discipline to address issues and concerns that would otherwise result in increased design and ROW costs as well as project delays. Early consideration also provides alternatives to acquiring residences and businesses, thus reducing relocations and minimizing impacts on private property owners' land. Some comments from the Real Estate discipline are as follows:

- "Earlier and more in-depth integration of Right of Way into the transportation solution development process,

including plans preparation, results in reduced project costs, fewer late plan changes, better schedule maintenance, and greater satisfaction of property and business owners impacted by the project."

- "With the higher level of ROW staff participation, a broader familiarity with the overall project pipeline process is evident. Staff has a greater understanding of how projects are conceived and ultimately delivered. More importantly, they have gained an awareness of the critical "fit" of the ROW discipline in the bigger picture, and how each separate activity meshes to achieve a successful end product."

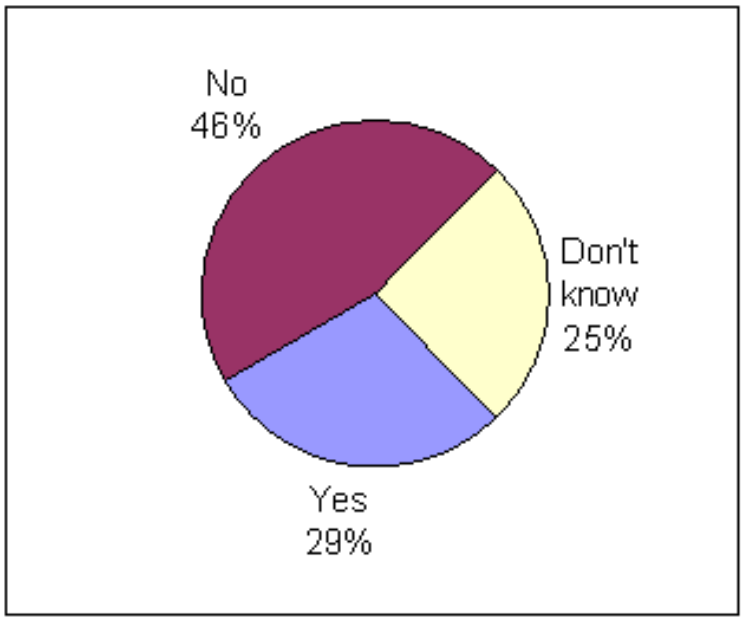
The majority of respondents from the Planning discipline thought an integrated approach positively impacts the effectiveness (95 percent) and efficiency (85 percent) of their discipline's contribution to the development of transportation solutions. Some comments from the Planning discipline in support of these positive impacts are as follows:

- "Better opportunity for refining purpose and need and making a firm linkage to the transportation needs identified in transportation plans."
- "Issues are now brought to the table early in the process that at one time might have been an after thought."
- "Parallel development under [an integrated approach] does risk some duplicate work or more work on what are ultimately rejected alternatives, but the overall process is more efficient at project delivery."

4.3.8 Question 12: Have efforts been taken to measure the results of this new, more integrated approach?

One-third of the respondents confirmed that efforts were taken to measure the integrated approach, about half of the respondents replied that no efforts were taken, and a quarter did not know whether any efforts had been made. Chart 4.18 shows the percentages of agencies that reported measuring the results of their integrated approach.

Chart 4.18 Efforts Taken to Measure Results of the More Integrated Approach



4.3.9 Question 13: Could your agency's integrated transportation solution development process be collapsed into one or two most successful points of practice?

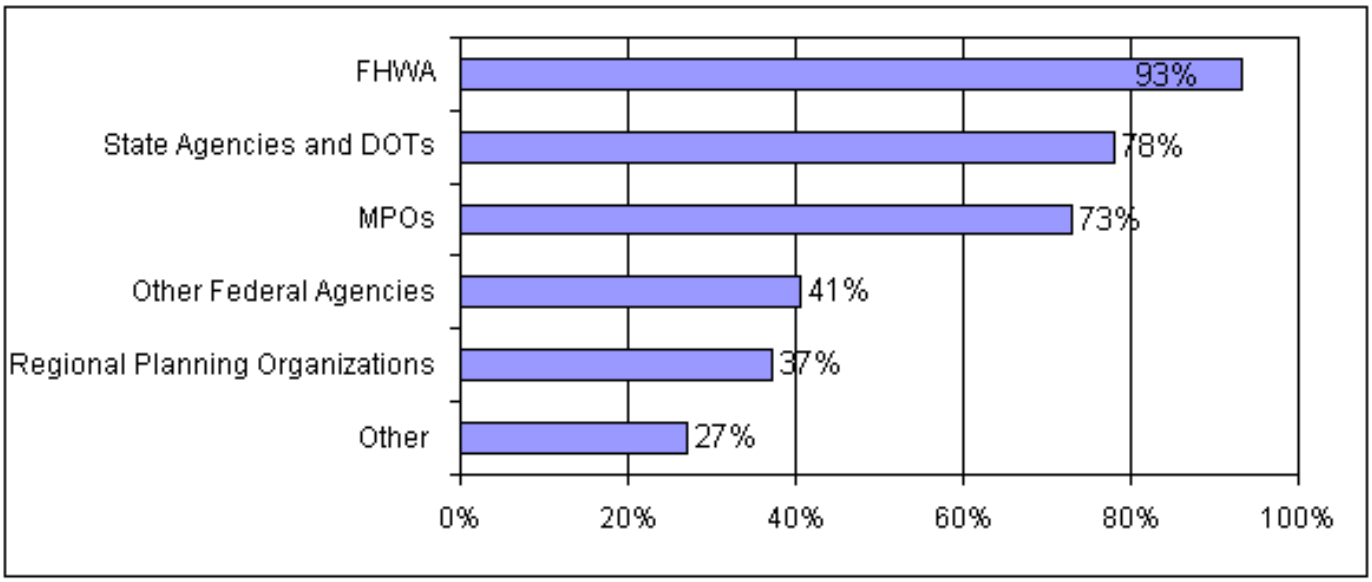
Almost half of the respondents said their agency's integrated transportation solution development process could

be collapsed into one or two successful points or practices. A discussion of these qualitative responses is included in Chapter 5.

4.3.10 Question 14: Did your agency consult with any other entities in the development of your multi-disciplinary integration approach to the development of transportation solutions?

Overall, 87 percent of the respondents consulted with other entities in the development of their integrated approach to the development of transportation solutions. Of these respondents, 93 percent consulted with the FHWA. Next in popularity of entities with which STDs consulted were other State Agencies (78 percent) and MPOs (73 percent). Other entities consulted included Other Federal Agencies (41 percent), Regional Planning Organizations (37 percent) and Other (27 percent). Chart 4.19 lists the types of planning and transportation agencies consulted for the development of an approach to transportation decision-making.

Chart 4.19 Planning and Transportation Entities Consulted in the Development of an Integrated Approach



List of "Other" Entities Consulted:

- Other transportation providers
- Consultants and Ohio DOT district offices
- Local government agencies
- Local officials
- Other partners
- Planning districts
- Citizens
- Extensive stakeholder participation
- Some localities
- Volpe Center

4.3.11 Question 15: To your knowledge, did your agency face any impediments when implementing the new more integrated approach?

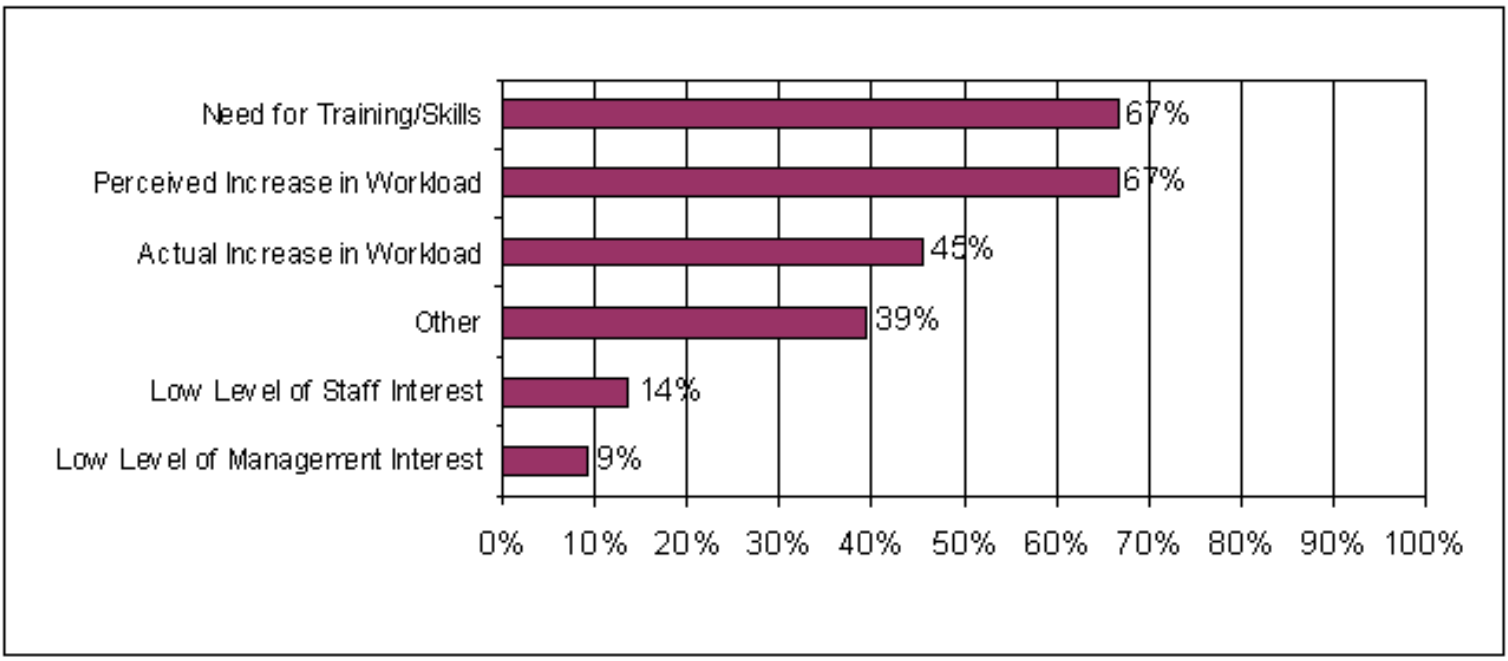
Eighty-four percent of the respondents said they faced impediments when implementing the more integrated

approach. These respondents indicated the following impediments:

- Perceived increase in workload (67 percent),
- Need for training/new skills (67 percent),
- Actual increase in workload (45 percent),
- Other (39 percent),
- Low level of staff interest (14 percent), and
- Low level of management interest (9 percent).

The most common impediments faced when implementing the new approach were the need for training/skills and the perceived increase in workload. The actual increase in workload was considered less of an impediment than the perceived increase in workload, as seen in Chart 4.20 below.

Chart 4.20 Impediments Encountered when Implementing an Integrated Approach



List of "Other" Impediments:

- Lack of staff
- Confusion regarding roles and responsibilities
- Lack of funds: perceived higher plan development cost
- Perceived loss of decision-making power
- Lack of cooperation from some stakeholders
- Conflicting demands on engineering, environmental, and other staff
- Resistance to change: steep learning curve to bring about productive change and disinclination to abandon past practices for new approaches
- Limits regional prerogatives

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4.4 Agencies without an Integrated Approach

This section covers Questions 16-18, which were directed towards agencies that indicated they do not use an integrated approach. Here, we found what respondents from each of the disciplines thought about an integrated approach and why they believe their agencies are not using a more integrated approach.

4.4.1 Question 16: Do you think a multi-disciplinary approach that involves an increased level of integration between the disciplines of planning, real estate, engineering and environment would be useful in the development of transportation solutions?

Of those who responded, 88 percent stated an integrated approach would be useful in the development of transportation solutions while 12 percent stated such an approach would not be useful. Table 4.7 provides a more detailed profile of positive and negative responses by discipline. Over 90 percent of respondents from the Environment and Planning disciplines believe that a multi-disciplinary approach with an increased level of integration between disciplines is useful in the development of transportation solutions.

Table 4.7 Responses Indicating Whether or Not a Multi-Disciplinary Approach is Useful, Percentage by Discipline

	Useful	Not Useful
Engineering	85%	15%
Environment	92%	8%
Planning	91%	9%
Real Estate	83%	17%
Total	**88%**	12%

The survey prompted those who responded positively to provide a description of the ways in which such an approach would be useful. The following list includes responses most frequently noted:

- Reduce time, better efficiency, less redundancy (6 responses)
- Smarter, comprehensive solutions, and higher quality product (6 responses)
- Cost effective (5 responses)
- Better decisions, open-minded decision-making (4 responses)
- Improve communication, cooperation, coordination, information (3 responses)
- More consideration to environmental needs, concerns, and goals (3 responses)
- Better project development (2 responses)
- Early real estate involvement saves time and money (2 responses)

Many people noted that the integrated approach was not a new concept. An engineer from the Washington State Department of Transportation affirmed, "this survey assumes integration between disciplines is ‘new', and that is a false assumption." A planner from the Michigan Department of Transportation stated, "we do not regard any of the concepts in this survey as new. Michigan has had an integrated project-development process for over 25 years, involving planning, engineering, environmental clearance, and real estate."

4.4.2 Question 17: Do you think a multi-disciplinary approach that involves an increased level of integration between the disciplines of planning, real estate, engineering, and environment would positively impact the quality of your discipline's contribution to the development of transportation

solutions?

Of those who responded, 81 percent stated an integrated approach would positively impact the quality of their discipline's contribution to the development of transportation solutions while 19 percent stated such an approach would not have a positive impact. Table 4.8 provides a more detailed breakdown of positive and negative responses by discipline. Over 90 percent of respondents from the Environment discipline were certain that an integrated approach would positively affect the quality of their discipline's contribution.

Table 4.8 Responses Addressing the Impact of a Multi-Disciplinary Approach, Percentage by Discipline

	Positive	Negative
Engineering	75%	25%
Environment	91%	9%
Planning	80%	20%
Real Estate	78%	22%
Total	**81%**	19%

People responding positively to Question 17 were prompted to indicate ways in which they thought an integrated approach might impact the quality of their discipline's contribution to the development of transportation solutions. The following are some responses by discipline:

Engineering

- Improved understanding of total costs and impacts of proposed projects
- Broader perspective with additional expertise to accomplish right-of-way tasks
- More efficient use of staff resources

Environment

- Eliminate required environmental litigation by making design adjustments from the start of the project
- Environmental considerations addressed at project development would create less delays and problems at later stages of the project
- More environmentally friendly projects
- Environmental concerns considered earlier. Currently, they are analyzed late in the process when projects have political and technical momentum
- Solutions would be more comprehensive
- Knowledge of how disciplines fit together and impact each other on projects is essential for better transportation decisions

Planning

- Ability to address issues before they become problems in the latter stages of the project
- Long-range plans have a better chance of meeting needs if all disciplines are involved from the start
- Better decision-making with all disciplines involved
- Reduce tendency for an uni-modal perspective

Real Estate

- Better understanding of the problems associated with land acquisition
- Early involvement of the real estate department would better estimate project cost
- Level of effort is improved and better solutions are achieved

Based on the number of environmental procedural concerns raised by a number of states, it appears the Environment discipline would benefit substantially through a more integrated approach as environmental concerns and issues would be raised earlier in the development of the project. A member of the Nebraska Department of Roads stated, "if we are aware that we are an important part of the planning process, we would seek to achieve a higher level of input. It is frustrating when a solution is selected without thought of the environmental consequences and then we are expected to make the environmental problems go away."

In comparing results of Questions 16 and 17, it seems that although most respondents believe an integrated approach to developing transportation solutions would be useful, fewer are certain such an approach would increase the quality of their discipline's contributions to the process. Of the four disciplines, respondents from Environment were the most supportive of an integrated approach on the development of transportation solutions, as well as on the quality of their discipline's contributions to the process.

Comments from those respondents who stated an integrated approach is not useful and would not have a positive impact on their discipline's contribution indicate their agency's traditional approach is well-established and well-structured to include input from all disciplines when necessary. Comments from these respondents who do not believe an integrated approach would be useful or would have a positive impact on their discipline's contribution include:

- "Have a well established traditional approach."
- "The level of detail of knowledge required in all segments of the process precludes any significant integration. Rather, our disciplines are schooled and guided to ask for key input from other disciplines when needed."

4.4.3 Question 18: Do you have an opinion as to why your agency has not adopted such a process?

Respondents with an opinion as to why their agency has not adopted a multi-disciplinary process were asked to indicate which of five reasons provide an explanation as to why the agency has not adopted such a process. Respondents were encouraged to check all reasons that apply. The frequency of response for these five reasons appears in Chart 4.21 below.[7]

Chart 4.21 Reasons Multi-Disciplinary Approach Not Adopted, Percentage of Responses

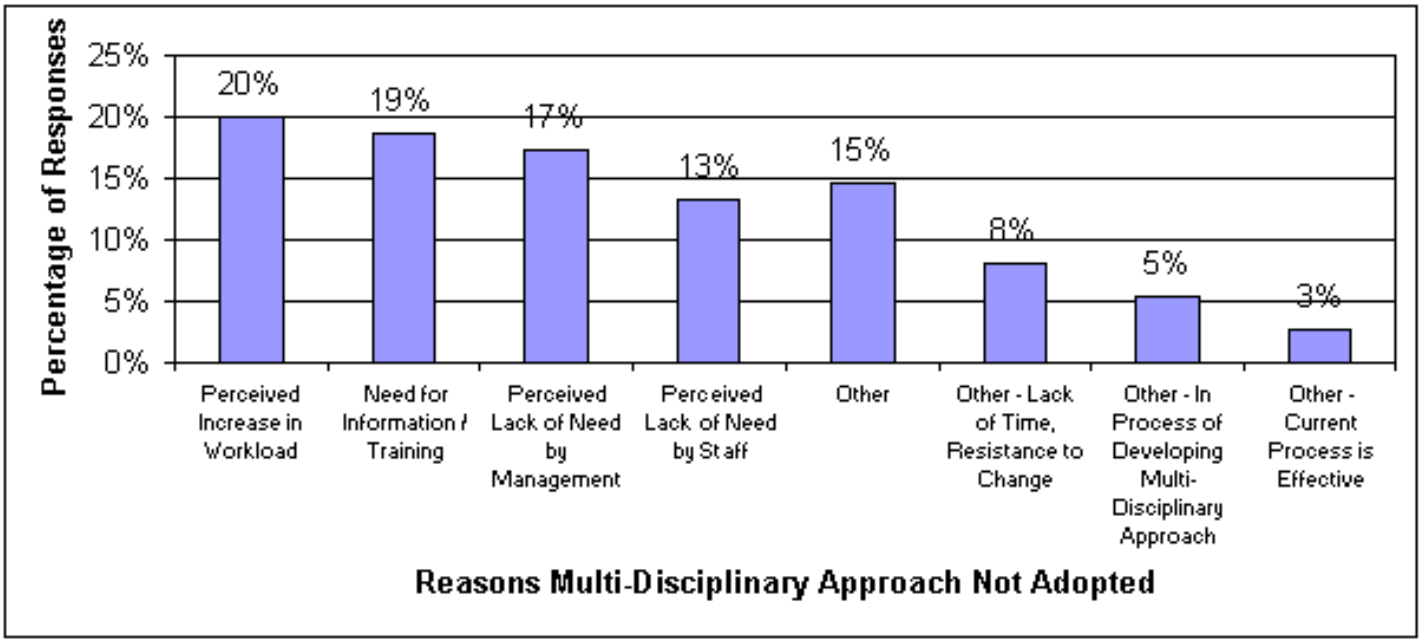

Table 4.9 shows a breakdown by discipline. The frequency of responses to certain reasons varies by discipline.

Table 4.9 Frequency of Responses as to why a Multi-Disciplinary Approach was Not Adopted, Percentage by Discipline

	Perceived Increase in Workload	Perceived Lack of Need by Management	Perceived Lack of Need by Staff	Need for Information / Training	Other
Engineering	25%	8%	25%	17%	25%
Environment	20%	25%	5%	20%	30%
Planning	17%	14%	14%	24%	31%
Real Estate	21%	21%	14%	7%	36%

Among the four factors listed as possible reasons for why an agency has not adopted a multi-disciplinary approach, there is variation by discipline in the relevance of each factor.[8] Of the Engineering respondents, the two most frequent opinions were "Perceived Increase in Workload" and "Perceived Lack of Need by Staff," each receiving 25 percent of responses. The Environment discipline agreed that the "Perceived Lack of Need by Management" was the most common reason as to why their agencies had not adopted an integrated approach. Of the Planning respondents, the "Need for More Information/Training" was considered to be the most prevalent reason their agencies had not adopted a multi-disciplinary approach. The two most common responses by the Real Estate discipline were "Perceived Increase in Workload" and "Perceived Lack of Need by Management," both options receiving 21 percent of the total responses.

TOP

4.5 Other Comments

4.5.1 Question 20: Please provide any comments you may have on an integrated, multi-disciplinary approach to transportation decision-making, including ideas you have on this concept in general or your state's practices in particular.

Generally, respondents commented that integration is a useful approach that will enhance the efficiency of each discipline in the process of developing transportation solutions. The following is a list of comments regarding the integrated, multi-disciplinary approach and the quality of the survey:

General Comments:

- A multi-disciplinary approach is not considered innovative (6 responses)
- Planning, preservation and development of transportation corridors is not supported by NEPA process (1 response)
- Sounds like another way of saying context-sensitive solutions (1 response)

Comments in Support of Approach:

- The approach discourages bureaucracy and encourages team work (1 response)
- Need to make public understand the need for a multi-disciplinary approach as they do not understand the process, instead demanding to see their new road built immediately (1 response)
- Everyone has ownership (1 response)

Comments Critical of Approach:

- Adopting multi-disciplinary approach is a timely and costly process (2 responses)
- Are told to do things cheaper and faster but this approach takes longer and increases cost of solution (1 response)
- This approach is staff intensive (1 response)

TOP

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[3] Of the eight respondents from other transportation-related agencies, 6 responses were from the Planning discipline and the remaining 2 were from the Environment discipline. (back)

[4] The West, East and South regions each represent 14 states/district/territory while the Midwest represents 10 states. A list of states represented by each FHWA Regional Resource Center is listed in Appendix E. (back)

[5] Of these 71 responses, 4 people did not include any factors, and an additional 2 people who noted that processes within their agencies *could* be described as uniform responded by listing factors. (back)

[6] The "Other" category displayed on Chart 4.7 refers to responses that one or two people made but should be considered. These "Other" project development styles include: (1) Single Point Project Manager style currently being developed (1 survey response), and (2) Single Point Manager does not have authority or training to lead projects (2 survey responses). The "Other - Combination of Styles" category includes the combination of a single point project manager style with a functional or phased style, and the combination of phased project manager with a functional style. Refer to Appendix D for a definition of these management styles. (back)

[7] The "Other" category displayed in Chart 4.21 refers to responses that one or two people made but should be considered. These

"Other" reasons are: decentralization discourages integration (2 survey responses), lack of funding (2 survey responses), lack of political support (1 survey response), and negative backlash from local and regional governments who feel land use decisions are not in purview of federal or state officials (1 response). (back)

[8] The Environment, Planning and Real Estate disciplines all chose "Other" more frequently than any of the four factors. For Environment, comments in the "Other" category touched on subjects such as cost, political barriers, time costs, and inflexibility towards change. Despite these comments, there were Environment respondents who were in favor of a multi-disciplinary approach and are applying it to their planning process. For Planning, comments in the "Other" Category included time costs, resistance to change, negative criticism from local and state governments, and lack of staff. The Real Estate discipline chose "Other" more frequently than the other three disciplines, stating that the reasons why their agencies had not adopted a multi-disciplinary approach were due to the lack of time, lack of funding for project managers, and increased real estate costs. Some of these Real Estate respondents indicate their agencies were in the process of implementing a multi-disciplinary approach. (back)

TOP

5 OVERVIEW OF THE CURRENT STATE OF PRACTICE

The survey results indicate that the extent of multi-disciplinary coordination in the development of transportation solutions varies by agency and phase of the project development process. The analysis of survey responses from across the State Departments of Transportation (STDs) showed that the responsibilities of each discipline involved in developing transportation solutions can vary a great deal, while the process itself generally follows a similar order.

This section begins with an overview of the development processes employed by STDs, and the range of roles and responsibilities undertaken by staff from the various disciplines. The role of each discipline is discussed within the framework of the transportation development process, as well as in relationship to each other. An analysis of key success factors and challenges associated with the implementation of an integrated approach follows. This section concludes with suggestions provided by survey respondents for improving coordination between disciplines and enhancing the smooth transition from a linear process to a more integrated approach; a list of manuals and handbooks referenced by survey respondents is also provided.

The observations in this section are based primarily on those survey respondents who indicated they would "describe [their] agency's process of developing transportation solutions as a new or non-traditional approach with more integration between any combination of the planning, real estate, engineering and environment disciplines." Even though 43 percent of survey respondents indicated they would ***not*** describe their agency's process in this way, a review of comments suggests that some of these agencies' approaches ***are*** multidisciplinary and ***do*** involve a certain amount of collaboration. Some of these respondents explained that their agency's multidisciplinary approach is their traditional method of developing solutions; therefore, the process is not "new" or "non-traditional," as described in the survey question. Additional respondents commented that while their agency is in the process of moving towards a more integrated approach, the process is not yet fully implemented. Therefore, responses from some agencies that answered "No" to question 5 of the survey are still included in this analysis.

It is important to note that this section is solely based on comments provided by respondents to the FHWA Integration Solutions Survey; all questions referenced in this section are from the survey.

TOP

5.1 Process of Developing Transportation Solutions

Planning and transportation development processes, as documented in the fact books, manuals and handbooks

developed by many State Departments of Transportation (STDs) generally follow a similar sequence of steps. The following description of these steps was developed based on a review of survey question 5. This question prompted respondents to describe their agency's project development process with respect to the disciplines involved ***if*** their process can be described uniformly regardless of the transportation solution being addressed. It is important to note however, that 47 percent of respondents stated their process cannot be described uniformly. See Section 4.2.2 for a discussion of this survey question.

1. Planning and programming (funding)
2. Preliminary Engineering *
3. Environmental Studies *
4. Design Detail
5. ROW Acquisition
6. Utility Relocation
7. Project Construction
8. Operation and Maintenance

* NEPA Process

While these phases are listed sequentially, there is often overlap between activities conducted in various stages. Survey responses indicated that STDs believe concurrent development efforts generally provide for greater efficiency in the project development process as coordination among disciplines increases. The following section provides an overview of activities conducted in each stage listed above.

During the (1) Planning process, staff work with federal, state, and local officials, community groups and other stakeholders to identify transportation issues/needs, determine project limits and develop scopes of work. Some STD Planning divisions are responsible for ensuring all adequate funds are established for design and construction, and all local and federal permits are obtained.

Following the Planning process, (2) Preliminary Engineering is integrated with (3) Environmental processes to assure that the selected alternative minimizes impacts to the environment and provides a solution that can be engineered successfully.

In the (4) Design phase, engineers prepare detailed design plans, specifications and cost estimates. Design of the physical facility begins, field surveys are performed and construction plans are completed. If the project involves acquisition of additional property, (5) Right of Way is purchased or obtained and (6) utility easements which may be affected are assessed. Plans and specifications are reviewed by Department staff, including those from the planning, traffic operations and engineering divisions. Clearances and approved plans are then processed so that projects can be implemented during the (7) Construction phase. Following construction, (8) Operation and Maintenance keeps the project in good working condition.

While the above general process provides the basic sequence utilized by STDs in the development of transportation solutions, transportation agencies have unique ways of describing their agency's approach. Respondents from the Wisconsin and New York STDs, for example, provided particularly detailed descriptions of their uniform development processes using terminology slightly different from the general process described above. The different ways in which these agencies explain distinct phases in their development process provide some insight into the ways in which STDs think about the development process.

The Facilities Development process in the Wisconsin STD includes five phases:

1. **Concept Definition** - The purpose, need and anticipated solution are determined.

2. **Investigation** - Physical, environmental, and community information about the project is gathered.

3. **Determination** - A final decision is made on the solution to the earlier established need.

4. **Final Design** - The plan, specification and estimate (PS&E) is prepared.

5. **Pre-Contract Administration** - The PS&E is made ready for letting.

In New York State, the transportation development process is divided into four major phases. Those phases in sequential order are as follows:

1. **Planning** - The major output is the Statewide Transportation Improvement Program; individual projects are described in Initial Project Proposals (IPPs). The Planning phase consists of coordination with MPOs, where applicable.

2. **Scoping** - On a project development level, IPPs are carried forward into the Scoping Phase, which is still managed by departmental Planning personnel. In the Scoping Phase it is decided whether or not to conduct a corridor study. An Expanded Project Proposal (EPP) documents the project to Design.

3. **Design** - The Design Phase consists of compliance with NEPA and permit applications. Design prepares Plans, Specifications and Estimates (PS&E) which along with permits are forwarded to Construction.

4. **Construction** - The project is constructed.

Many survey respondents indicated that in their effort to streamline the transportation development process, activities in different phase are conducted concurrently. Ideally, concurrent development leads to a better product as increased collaboration results in a solution that sufficiently addresses concerns of each discipline relative to all proposed alternatives. In response to question 7 of the survey, respondents described overlapping activities that occur between phases of the development process in their respective agencies.

In the North Carolina STD, for example, the planning and design phases overlap at least until the right of way acquisition begins; and permitting and design overlap during right of way acquisition. In the Ohio STD, the right of way acquisitions phase runs concurrent with the final design steps. Following the completion of design and acquisition, the project moves through the estimating and project advertisement process, to the contract awards process and finally out to construction.

A respondent from the West Virginia STD described the extent of concurrent development employed in the state this way, "Once given approval, the project or program is given to the appropriate party for development. Initially, it would be sent to the environmental and historical section for review. It would at the same time be sent to the permitting section for their initiation of the permit work. Project development would begin at the same time and would be completed as much as possible while waiting on the other processes. The right of way would be notified along with the utilities relocation specialists. Discussions occur with the environmental and historical through the permitting sections along with the designers concurrently. At the same time we have designers working with the right of way and utilities."

Even survey respondents who identified their agency as non-integrated noted a certain amount of collaboration between different disciplines throughout different stages in the development process. Table 5.1 below provides a description of how the various disciplines contribute to each phase in the process. The basis for this description was provided by a respondent from the Puerto Rico STD.

Table 5.1 Role of Disciplines in Each Phase in the Project Development Process

Phase	Description and Disciplines Involved
(1a) Early Planning (Long-Range)	Mostly transportation planners and some engineers, traffic and environmental study personnel participate in preliminary assessment of transportation needs and the potential impacts of solutions that address those needs.
(1b) Project Programming and budgeting (setting priorities)	Mostly engineers, planners and some financial staff with expertise in budgeting are involved in this process, decisions are influenced by top ranking public officials, politicians, and special interest groups. (in Oregon and California STD, this process includes environmental specialists)
(2) Preliminary Design & Engineering	Mostly engineers and surveyors are involved in consultation with the environmental study personnel, as well as architects, geologists, hydrologists and others when applicable.
(3) Environmental studies	Involves mostly personnel from the disciplines of engineering, planning, biology, archaeology, and historic preservation, but may also involve personnel with expertise in real property acquisition (i.e. property appraisers) and relocation of families, businesses and institutions, as well as from the disciplines of architecture, landscape architecture, geologists, lawyers, among others, if applicable (i.e. lead-base paint and asbestos removal and disposal).
(4) Final design	Mostly engineers, who may consult as necessary with those involved in environmental studies (i.e. to address the compliance with environmental commitments or assess mitigation alternatives not previously considered) and real property acquisition.
(5) Property Acquisition **(6) Relocation Assistance**	Mostly involves acquisition and relocation assistance personnel such as property appraisers and relocation assistants, but may involve personnel with expertise in civil rights and other areas.
(7) Construction	Mostly involves engineers and engineering assistants, but also involves personnel with expertise in construction safety, accounting, and other disciplines mentioned above (i.e. those with expertise in disciplines associated to environmental studies, particularly in cases where environmental commitments are in effect).
(8) Operation and Maintenance	Mostly involves personnel with expertise in transportation facility maintenance, traffic counting, auditing, and other disciplines. For cases in which environmental or other commitments are in effect, personnel with expertise in those fields, as applicable.

TOP

5.2 What are the Roles and Responsibilities of Each Discipline?

The survey revealed generally the duties and responsibilities of staff within each discipline as well as the extent of integration between the disciplines. It was found that certain activities including holding and attending public

participation meetings, and acquiring and negotiating permits require the participation of all disciplines. Whereas collaboration between the disciplines of planning, engineering, environment and right of way traditionally occurs when determining the preferred transportation solution, a more integrated approach emphasizes coordination throughout all phases of the process. With this emphasis, STDs have undergone organizational changes such as integrating the planning and environment divisions, combining design and project development, and enhancing input from the ROW discipline throughout the entire process. The extent of integration was also noted by several respondents to be proportional to the size of the project. As stated by one survey respondent, "the process is mostly integrated only when projects are large, otherwise it's a wasted of effort."

The four subsequent sections provide a description of the typical role of staff from each of the four disciplines as described by respondents who identified their agencies as having an integrated process. As noted in the introduction to this chapter, there is a certain amount of collaboration between disciplines even in agencies identified in the survey as non-integrated. Consequently, a few descriptions are provided by survey respondents who consider their agencies' approach to transportation decision-making as non-integrated.

5.2.1 Planning

Throughout all activities conducted as part of the transportation development process, planning acts as a liaison to the public and elected officials. Planners serve as project points of contact with the community to keep community stakeholders notified of project status. Responsibilities of the Planning division generally run from the early, long-range planning efforts through to the project development process.

In the integrated agency, the Planning division takes the lead in developing long-range transportation plans. At this level of involvement, planners are responsible for identifying major project purpose and need, as well as identifying transportation investment goals, objectives, and directions.

Planning staff also arrange the process for developing and selecting the transportation solution. They collaborate with the disciplines of engineering, environment and right of way in order to identify solutions and potential alternatives to address the needs identified in the long-range planning process. A team approach is also utilized to determine the costs and investment plan for the system. Planning staff generally work with the public, local governments, MPOs, and others to verify the need and develop potential solutions. When projects are prioritized based upon need and funding availability, the Planning division works with community groups, the public and local governments to develop the final list of priority projects.

Planning is particularly involved in the initial phases of project development, conducting feasibility studies, and participating in corridor and concept selection. In the Michigan, Connecticut and District of Columbia STDs, Planning divisions are responsible for conducting environmental analyses and clearances, and obtaining required permits and approvals. Planners may also coordinate with the Department's project implementation teams to ensure proper design and construction.

5.2.2 Engineering

Engineers are responsible for the design of the transportation structure, which includes conducting photogrammetry activities, developing pavement, roadway, hydraulic, geotechnical and structure design, setting the proposed horizontal and vertical alignment, identifying right of way to be secured, attending and holding field inspections, and participating in public involvement or public hearings.

As preliminary engineering and environmental studies are conducted to meet NEPA requirements, the Design division is often responsible for all work completed during this initial phase. Engineers provide geometric layout assistance to ensure that a safe facility with minimal impact to the surrounding environment can be built. In the Colorado STD, for example, engineers have ultimate authority during the NEPA process in a new system called

Total Project Leadership (cradle to grave). In the Minnesota STD, engineers are responsible for providing liaison activities between the Districts and other agencies during the environmental documents preparation and approval process. In the Nevada STD, the Design division is responsible for securing permits and approvals for various project elements, as well as certifying project compliance with certain State and Federal mandates.

An engineer from the Ohio STD highlighted the importance of "true preliminary engineering in the early phases of planning and environmental development [as] a critical component" to the success of an integrated approach. The respondent stated that the division's current insufficient level of PE work results in a lack of understanding of the real impacts and design complications, which are often not discovered until the detailed design phase.

Management level engineers are responsible for oversight of a range of project development activities, from detailed design to construction. In the Delaware STD, project development and design units are combined into a single unit. Engineers in the Minnesota STD have developed a Project Management System that lays out each job activity for that particular type of project, with duration times so the District knows if it is on track to meet its scheduled letting. In the South Dakota STD, engineers participate in long range transportation planning, but take the lead role during the scoping process after projects are identified. The office is responsible for distributing project information for review by staff from other disciplines, scheduling meetings to determine the best solution for a particular project, and refining the initial scope as more issues are identified and/or resolved. In the West Virginia STD, transportation engineer responsibilities include managing and providing engineering guidance to the design and construction of the proposed project. This includes securing right of way and permits, managing construction, participating and conducting public input meetings, and supervising plan development for some projects.

5.2.3 Environment

Responsibilities of staff within the Environmental division stem from the early stages of planning, to concept development, project development, and finally design and construction. Environmental staff provides input into the development of the long-range transportation plan. In the Maryland STD, for example, the environmental division is responsible for identifying potential issues such as Smart Growth and assisting in the development of the purpose and need statement. In the Louisiana STD, the reorganization of environmental specialists from the design to planning division has provided the environmental division with greater oversight on project solutions. In this way, environmental considerations occur on the front end of the process before more detailed design is accomplished.

Environmental staff tasks include preparing environmental inventories, leading the NEPA process for the development of the EIS, and ensuring environmental compliance with all pertinent state and federal environmental laws and regulations. Environmental staff are also responsible for addressing cultural issues, and applying for and negotiating permit issues with resource and regulatory agencies.

Public involvement includes participating in public meetings (advisory task force meetings, workshops, public informational meetings, public officials meetings, etc.), resource agency meetings, in-house project review meetings, etc. Environmental staff conduct public hearings, coordinate issues and concerns with affected property owners and local governments, and generally work to gain public support for a project.

Survey respondents who identified their agencies as having non-integrated processes also described the responsibilities of environmental staff as continuing beyond completion of the Record of Decision (ROD), a document that presents the basis for selecting and approving a specific transportation proposal. In Wyoming, the environmental division is responsible for establishing advisory teams to ensure EIS obligations are met during the design phase; providing construction expertise for environmental compliance in the field; providing post construction monitoring of all mitigation sites; and working with maintenance for maintaining with environmental compliance. In the New Mexico STD, environmental staff help develop solutions to minimize and mitigate impacts during final design if environmental, community, and/or cultural resource impacts have been identified. As in

Wyoming, the New Mexico environmental division ensures the fulfillment of environmental commitments as determined by the EIS, during the construction phase.

5.2.4 Right of Way

A survey respondent from the Right-of-Way (ROW) discipline described the division's role as "looking at the design in regards to the human factor." ROW specialists address questions such as: Who does the project impact? What amenities are affected? Can these amenities be replaced? How much will relocations cost? Can we assure that everyone is treated fairly and equitably in this process?

The tasks of the ROW division include identifying limits of existing right-of-way, determining right-of-way needs of the proposed project, and identifying property needed for permanent acquisition or temporary occupancy during construction. Upon determining ROW needs, the division contacts private owners or government agencies with jurisdiction over the involved property and initiates the acquisition process or negotiates a lease or right-of-entry.

In an integrated agency, ROW participation in project development decisions begins in the early phases of concept development, feasibility assessment and scope development. As members of cross-functional scoping teams, ROW input identifies significant impacts in terms of cost and relocation, and recommends mitigating alternatives. These alternatives can vary from avoiding certain parcels, to acquiring lesser property interests, or in the case of necessary major impacts, acquiring entire properties instead of partial takings. These alternatives and supporting information are useful during environmental and public hearing processes.

ROW staff involvement continues during preliminary engineering and environmental scoping in order to identify any issues that may affect the design and schedule for the project. In the Florida STD, ROW is involved in the review of project plans at several milestone stages including pre-plan, 30 percent, 60 percent, and 90 percent of plan completion.

Participation of ROW staff during public meetings to describe processes and answer questions is an integral component of the discipline's responsibilities. Currently, the Idaho STD is transitioning to an integrated, multi-disciplinary approach. On major projects, headquarters ROW staff conducts both pre- and post-acquisition meetings with design, environmental, district staff, and consulting engineers. These meetings identify project layout and all right of way related issues. Problems are anticipated and schedules are coordinated so that right of way activities can proceed in tandem with other activities instead of sequentially.

TOP

5.3 What are the Successful Factors in Integration Efforts?

This section provides examples from the survey of activities, processes and strategies used by STDs in achieving an integrated approach to transportation decision-making. There are key factors that appear to contribute to a successful implementation of an integrated approach. Agencies currently evaluating their approach consider implementing a combination of factors in achieving the desired goal. A respondent from the New York STD noted the agency's recent incorporation of Context Sensitive Design philosophy, environmental ethics, and asset management principles to improve and attain a more integrated, rather than stove-piped, analysis and decision making approach. Several other states, as mentioned in the section below, have also developed and implemented unique concepts and processes to improve their development process. However, as stated by a New York STD respondent, the process is one of continuous evaluation and improvement.

5.3.1 More involvement, earlier in the process

In describing the most successful points of an integrated approach, many survey respondents stated that increased involvement of disciplines earlier in the development process would lead to better solutions. Along these lines, the California STD supports the concept of "change control" in which there is more up front involvement by the various disciplines with, ideally, less repetition further along in the project. This concept is based on the idea that after the environmental document is approved, only design and construction remains. This means that traffic, structure design, substructures design, geometrics etc. would be known to such detail that no design changes would require revisions to environmental documents or permits. As stated by one California STD respondent, "this requires a great deal of multi-disciplinary integration."

Agencies also utilize the "concurrent engineering" approach which sets requirements for all design disciplines to be involved much earlier in the process. Under Virginia STD's traditional approach, design plans were generally approved at approximately 65-70 percent plan completion and any "late stage" design changes required a significant amount of rework. With this approach, many of the disciplines including Environmental, Real Estate, and Utilities would do only minimal work until after design approval. Under Virginia's new process, the objective is to approve the design at approximately 40 percent plan completion. This requires all of the disciplines to be involved much earlier in the process.

5.3.2 Concurrent development and milestones

As described in a previous section, concurrent development of traditionally sequential operations such as detailed design, environmental clearance and ROW acquisition is expected to effectively shorten the critical path towards successful project delivery. Although parallel development does present the risk of some duplicate work or more work on what are ultimately rejected alternatives, the overall process is often expected to be more efficient in the end.

The Ohio STD recognized the lack of overlapping involvement between planning, environmental and design in the state's former development process. A member of the Ohio STD described that under their traditional approach, independent decisions were often made without the full knowledge of impacts. In addition, complications were sometimes created for operations downstream of planning (i.e. environmental and design). The Ohio STD currently has a strategic initiative underway which addresses the concern of producing a streamlined development process that involves disciplines from planning, environmental, design, construction and maintenance at the appropriate times to ensure equitable solutions are addressed. The state's former, linear process often lacked the necessary overlap and communication efforts between different disciplines to maximize the overall best solution.

To ensure that all staff is knowledgeable about and in accordance with the project's status and progress, integrated STDs require agency concurrence at project milestones. Concurrence eliminates or greatly reduces "surprises" late in a project. The Maryland STD , for example , requires agency concurrence at 3 key milestones during the Planning phase: (1) Purpose and need; (2) Alternatives retained for detailed study; and (3) Selected alternative and conceptual mitigation. The agency is also developing a process where, for certain projects, 30 percent of the final design is completed at the same time as Location Approval is received.

5.3.3 Multidisciplinary core teams

For many STDs, a multidisciplinary team approach is integral to the development of transportation solutions. With input from various disciplines throughout the different phases of project development, problems that could potentially stall or halt a project could be identified and resolved earlier in the process, before final design and construction. The complexity of a given project and the extent of social, economic and environmental issues and impacts dictate the level of involvement from various team members. There are a number of different ways in which these teams are organized:

- In the Missouri STD, for example, a core team generally includes a Project Manager and members

representing Design, Environmental/Cultural Resources, Right of Way, Construction, Maintenance, Traffic, Bridge, and Public Affairs.

- In the Delaware STD, core teams consist of staff from planning, project development, design and construction. Staff from real estate, utilities, environment, traffic, etc., support all teams.

A member of the Nevada STD described the state's recent establishment of a Project Team concept as a way to better define a project prior to preliminary design being commenced. The Nevada respondent stated, "by having more input from the various divisions throughout the entire process, it is hoped that fewer problems due to lack of input will be encountered along the way." The state is also developing a multi-disciplinary team to review newly recommended projects for feasibility, cost, scope, etc. before they are added to the STIP.

5.3.4 "Cradle to Grave" Approach

"Cradle to grave" describes one approach to project development in which a single person, or a team of persons, is responsible for managing the project from inception to completion. Such an approach ensures that staff working in each phase of the process is aware and supportive of project commitments and decisions. It also provides an opportunity for staff to conduct a review of the process, discuss alternative solutions to problems encountered, and share best practices ***after*** project completion. A member of the Missouri STD stated, "While it was intended that the project team stay intact cradle to grave, this has not always been the case. I believe we've lost some of the benefits of the team involvement when the construction personnel don't know what commitments were made earlier, or reasoning behind certain features. It also prevents folks from learning from their mistakes and sharing best practices when the final result of the project isn't reviewed by the team that developed it."

The assignment of a single project manager provides a central contact for members of the community, as well as internal agency staff on the project. In major projects that involve numerous complex issues, a single project manager is integral to tracking concurrent activities and monitoring the project schedule. In the Texas STD, a staff member described the single project manager cradle to grave process as one that provides everyone from agency personnel, to the general public, to the press, with a contact who can access the best and most accurate information on all project details. The Texas STD member also stated that a "higher degree of trust evolves between the many involved parties as most get to know one another on a more personal basis."

Some STDs assign more than one project manager to each project, in conjunction with multi-disciplinary teams. In the Iowa STD, a team leader is assigned to guide a multi-disciplinary team with "cradle to grave" responsibilities for the project during all phases of development. However, the team leader changes as the project moves from corridor-concept selection to the detailed design phase.

In the New Jersey STD, there is an effort by the department to keep cross-functional scoping teams together from design through construction in order to provide continuity of decision making as projects mature through the process. A staff member indicated that previously, teams were largely disbanded once the project entered the design phase.

A lack of connection between earlier and later, particularly construction, phases, in the development process is a concern among other agencies as well. A member of the Ohio STD described the agency's previous process as one that "lacks a connection between construction and design as a means to identify and recycle changes to design methods, thus improving appropriate construction opportunities." While Ohio did monitor preventable and non-preventable construction change orders, the agency did not under their previous system, have the mechanisms in place to recycle the successful results and educate those on the design mistakes made. The Ohio STD plans to include such mechanisms in the project development process currently under development.

To assist single-point project managers on especially large or complex projects, STDs have developed software

programs for tracking the status of the project. These systems indicate exactly how much work has been completed, who is involved and what still needs to be done in a project. A respondent of the Tennessee STD noted the state's utilization of a new project planning and resource management software package that not only tracks a project, but has the ability to flag problems and change the project schedule.

5.3.5 Combine Project Development with Asset Management

For the past several programming cycles, the Michigan STD has integrated its project- and program-development process with its asset management approach. Michigan has set pavement-condition goals, and the annual program is developed in accordance with strategies chosen by each region for achieving the goals. Michigan has benefited from combining the usual disciplines of project development (planning, engineering, environmental, and real estate) with the budgetary function and the maintenance/accounting science of pavement and bridge management. As a result, the agency is now exporting this approach to Michigan's city and county road agencies, with a unified asset management program and centralized data repository for the entire state. The agency's future efforts will focus on integrating user-benefits measures into the process, such as travel speed and predictability.

5.3.6 Integration of Land Use and Transportation Planning

Land use planning and transportation planning are conducted in concert within the state of Oregon. All Oregon communities with a population of 10,000 or more must have a Transportation System Plan as part of their required Comprehensive Land Use Plans. As a result, Oregon STD's corridor system planning for regional and statewide highways must be negotiated with the local Transportation System Plans for compatibility and incorporation into local plans. Incorporation into local plans is required before approval to do final design and construction. Although discussed as an ideal multi-disciplinary approach, a survey respondent from the Nevada STD described the difficulty of coordinating transportation planning with land use planning because land use decisions are controlled by local governments.

5.3.7 Public Involvement

Early and continuous communication with the public is integral to ensuring that a project satisfies the needs of the users and preserves the environmental, scenic, aesthetic, historic and natural resource values of the community. Consequently, it is an important feature of an integrated approach to transportation decision making. The Connecticut STD, for example , has implemented a public participation program. During the development of the STIP, public information meetings are held to solicit local input. At 30 percent completion of design, an informational meeting or formal public hearing is held to introduce the proposed project design to the public and to again solicit input. All further public contact results from public inquiry; however, for some large or politically sensitive projects, additional meetings are offered including meetings dedicated to the Rights of Way process. Although survey respondents from other agencies do not make specific references to public involvement programs, many emphasize the importance of public participation throughout the development process. Respondents from the Kentucky, South Carolina and Utah STDs identified early and continuous public involvement as one of the most successful points or practices in an integrated transportation solution development process.

TOP

5.4 What are the Challenges to Implementing a More Integrated Approach?

Survey responses indicated there are some challenges and difficulties in the implementation of a more integrated approach. One such challenge is that an integrated approach necessitates more communication and a greater understanding of the different development phases and roles of each discipline. According to one member of the

Texas STD, for example, the level of detailed knowledge required in all segments of the process precludes any significant integration; "Rather, our disciplines are schooled and guided to ask for key input from other disciplines when needed." Qualitative comments from a number of survey respondents show a certain degree of frustration in some of the processes and requirements of an integrated approach. This section provides a description of some opinions by survey respondents regarding the challenges of a more integrated approach.

5.4.1 NEPA and Planning

The NEPA process requires collaboration between disciplines and public involvement as agencies develop transportation solutions. With its provisions for the assessment of secondary and cumulative impacts, analyses of projects require context sensitive solutions and commitments on the part of localities as well as states in the delivery of transportation infrastructure. The NEPA process also requires meetings with individual stakeholders and pro-forma public hearings instead of organized, structured and facilitated community meetings to plan and design communities with the goal of maximizing social and economic sustainable development and environmental protection.

While a member of the Indiana STD described the merging of the NEPA and planning processes as one of the most successful points of the agency's transportation solution development process, staff members from several other agencies view the combination of the two less favorably. An Alabama STD respondent who identified the agency as having a non-integrated process, stated that NEPA is an engineering and environmental process, not a planning and environmental process. The respondent explains, "Planners need to establish needs, not solutions. The engineers and environmentalist need to develop the best solution to the need. Don't put NEPA into the planning process. The planners need to conduct inventories and studies that identify where the transportation needs are (i.e. traffic studies to determine where added capacity is needed, bridge inventory and inspections to determine which bridges need to be replaced). It is the engineer's and environmentalist's job to determine how best to provide the added capacity or replace the bridge in a way that provides safe and efficient transportation that is compatible with the environment."

Another survey respondent indicated some conflict between the NEPA and planning process. Staff from the Arizona STD explained, "The planning, preservation and development of transportation corridors is not supported by the NEPA process. The purpose and need for future facilities can not always be justified at the level of detail that exists for projects currently programmed for construction. Environmental impacts and mitigations being required by resource agencies is different for current raw land as compared to the future developed land that is going to occur."

While some STD staff members have concerns about the idea of integrating planning with the NEPA process, others who are making the transition note the difficulties, as well as potential solutions, to such a process. A member of the Louisiana STD Environmental Section stated that, "while we may be moving to a 'one overall cradle-to-grave manager' concept, there is not a clear understanding of the NEPA process by others outside of my Section to allow this. The Environmental Section has not received additional personnel to handle this change in approach, and this has caused a few problems in making a smooth transition. We are trying to develop a manual of practice to assist others in our Department in what is required in the planning and environmental phases of the project development process."

5.4.2 Priority of Completing Project Quickly

Although an integrated approach is ostensibly intended to shorten the overall length of project delivery, the approach does require more involvement and time commitment in the initial stages. A member of the Colorado STD stated, while the "Department understands integration may be desirable, the highest priority is on building projects quickly. Recently authority and accountability over project implementation was decentralized with increased authority provided to project engineers. As a result, each project is implemented differently with different

approaches to issues that reflect the values of the individual engineer as opposed to any overriding department philosophy. This decentralization of responsibility and authority does respond to the primary goal of implementing projects quickly." A survey respondent from the Illinois STD expressed interest in a multi-disciplinary approach, but requested additional research and case studies indicating the success of such an approach since its implementation is "extremely staff intensive."

5.4.3 Difficulty obtaining Public Involvement

Two survey respondents expressed frustration with the difficulty of successfully involving certain members of the community in the process and gathering public input in a time-efficient manner. A member of the Kentucky STD explained that limited utility company participation prevents the development of solutions that minimize impacts. A member of the Iowa STD described one of its larger stumbling blocks as developing projects within budget and schedule while coordinating with external entities. These entities include "multiple federal agencies all of whom feel their federal action is the most important," as well as other agencies involved in the decision-making process. A member of the South Dakota STD also stated that the "Department needs to extend the preliminary investigation and scope out 6 to 10 years prior to proposed lettings depending on the type of project. In urban settings we need more time. This would allow more public information meetings and information gathering from them and local agencies to integrate into the solution to the highway improvement."

5.4.4 Land use issues

While Oregon has an integrated land use and transportation planning process, a staff member from the Nevada STD described frustration in merging the two as an "idealistic" multi-disciplinary approach. The respondent stated, "In Nevada, land use decisions are controlled completely by local government. We do consider land use and the environment in our approaches to solutions but it is not what I would call revolutionary." The respondent explained the possibility of negative backlash from local and regional governments who feel land use decisions are not appropriately the responsibility of federal or state officials.

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5.5 What is Needed to Improve the Integration of Disciplines within Each State?

Of the respondents who indicated they faced impediments when implementing a more integrated approach, one of the most frequent impediments selected (67 percent) was the need for training and new skills. Similarly, the second most frequent response (19 percent) from respondents with an opinion as to why their agency did not adopt a more integrated process was the need for information and training. A review of qualitative responses supports these findings, which are discussed in greater detail in Sections 4.3.10 and 4.4.3. Agency staff highlight education and research as key elements in the successful development and implementation of an integrated approach to developing transportation solutions. With the pressure of building a road "as soon as possible" and "in-budget," it is important to have transportation practitioners and the public understand the inter-related aspects of the multiple disciplines as they work to reach a transportation solution.

An Oregon STD staff stated, "Environmental practitioners have to be coached to develop course data that is meaningful to the broader decisions at hand during planning stages. The public and local government needs to be educated as the project develops concerning the importance and relevance of environmental decision making in the transportation development process."

Survey respondents also requested additional research to conduct an assessment of the integrated process in order to better assess the strengths and weaknesses of these approaches. A member of the Illinois STD stated, "This [integrated] approach, while allowing for the widest amount of input and the least chance for problems, is

extremely staff intensive. We will need to see some real success stories from our process in order to justify all of the time spent."

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5.6 Documents Used to Guide Integration

Some agencies have developed, or are in the process of developing, guidelines and manuals that clearly explain the amount and type of integration between disciplines throughout different stages of the project. Well-defined roles and processes are integral in a process in which activities are conducted concurrently, with more collaboration between different agency divisions or sections. A New York STD staff member stated that, "On paper we have a single point project manager, but the assignment is to get something built fast. They don't have the authority or the training to do real planning and design in a context sensitive manner. An Illinois STD member expressed difficulty in determining "where that fine line falls between planning and project development."

A list of process-related STD guidelines, charts and manuals currently available or in-production is provided below. This section is based on input from respondents to the FHWA Integration Solutions Survey, so it is not intended to represent a comprehensive list of all process-related materials produced by STDs. Descriptions of materials were also provided by survey respondents.

Indiana STD

Indiana's Project Development Process is available on the following webpage: http://www.fhwa.dot.gov/indiv/pdpproc.htm

Iowa STD

The Iowa STD has a "Can-Do" process institutionalized via a process manual. The agency expects the 2nd revision/edition of the manual to be completed in 2 or 3 months. (Survey response received July 31, 2002.)

Kentucky STD

The agency's acquisitions and utility relocation process described by Statewide Policies and Procedures

Louisiana STD

Louisiana's processes are governed by the Secretary's policy and procedures manual, as well as the Engineering Design System (EDSM).

Maryland STD

The department recently developed a linear chart plotting the flow of a project. The chart identifies relationships between the various disciplines; explains what is required of each discipline to accomplish its mission; defines who you rely on for information and who relies on you for information; and provides understanding about who is impacted by a delay in their completion of their part of the process.

New York STD

Individual projects are guided by the Department's Scoping and Design Procedure Manual.

Ohio STD

The Ohio STD is currently in the process of developing a 14-step process. The process covers early planning through post construction. The process begins with an assessment of who needs to be involved; then moves to what technical analysis needs to be done; then looks at alternatives including all different modal alternatives; then moves on to environmental assessments which can be simple or move on to more complex environmental assessments, etc. Preliminary information on the process on Ohio STD's planning website.

Oregon STD

Transportation development in Oregon is guided by the Oregon Transportation Plan, and the Oregon Transportation Planning Rule, an Administrative Rule that guides the transportation element of the Oregon Land Use Planning Goals and Guidelines.

Vermont STD

A detailed Project Development Process manual can be accessed at the following webpage: http://www.aot.state.vt.us/projdev/Sections/PDManual/01mantabl.htm

Washington STD

The agency is now documenting its planning to project delivery process in a manual, which will lead directly into the design manual.

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6 SUMMARY AND CONCLUSION

This concluding chapter summarizes current practices in the development of transportation solutions in State Departments of Transportation (STDs) and other transportation agencies. This "State of the Practice" synthesis report is the first of three products developed for the United States Department of Transportation's Federal Highway Administration (FHWA) project, "Integrating and Streamlining Transportation Development and Decision-making." Findings in this report were developed based on a review of available literature, an analysis of results from the FHWA Integration Solutions Survey, and the input and suggestions from Sounding Board members.

6.1 Findings from Literature Review

A review of existing literature revealed that there are disparities between the states in their approaches to the development of transportation solutions. More specifically, the states vary in their recognition of the need for a more integrated approach to transportation decision-making. Some states, for example, have developed voluminous internal guidance documents as well as glossy brochures geared towards the general public (their customers) detailing the practices and describing the virtues of an integrated approach to the development of transportation solutions. Other states have apparently addressed the issue very little or not at all.

The literature search also revealed that there is a core group of federal, state and regional level transportation professionals, especially those in the real estate and environmental disciplines, dedicated to the concept of integration in the transportation decision-making process and very involved in promoting the idea. Several conferences, professional meetings, and publicly funded research projects have explored the topic of integration

and streamlining in the context of transportation planning and development. None of these forums, however, specifically addressed the integration of the four disciplines that are the focus of this study. As mentioned above, there were many materials exploring the better integration of environmental concerns in the transportation planning process. There were also some that focused on an earlier and increasing role for the real estate discipline in the development of transportation solutions, but none other than this study, that addressed the process of integrating the four disciplines.

Finally, the literature search revealed that there are certain states - Oregon, Wisconsin, Florida, Pennsylvania, Washington and California, for example - that are in the forefront of the movement to promote integration in the transportation decision-making process. That is not to say that these are the only states engaging in such activities, but professionals from these states more frequently make themselves or examples from their states available for discussions or papers regarding the topic. The U.S. Department of Transportation has also played a visible role in exploring and promoting this concept, hosting forums and funding research projects on the subject.

6.2 Findings from FHWA Integration Solutions Survey

Results from the FHWA Integration Solutions Survey reveal that while there is a fair degree of disparity among states in the processes they use to develop transportation solutions, there are also notable similarities. The majority of respondents believe that the most influential factors affecting the development of transportation solutions include identified impacts on the environment, economy and community; cost of the project; funding; and the complexity or magnitude of the project. Additional similarities exist among those states with an integrated versus non-integrated approach, as described below.

Overall, respondents from integrated agencies believe an integrated approach positively impacts their discipline's contributions to the development of transportation solutions. In an integrated approach, all disciplines are more involved in the initial planning and scoping phases when alternatives are developed and the preferred solution is identified. Increased participation earlier and throughout the process helps to ensure consensus and minimize potential conflicts.

Of respondents from non-integrated agencies, the majority believe that a multi-disciplinary approach is useful and would have a positive impact on their discipline's contribution to the development of transportation solutions. The most prevalent reasons why a multi-disciplinary approach was not adopted are the perceived increase in workload and the need for information and training.

Survey results also provide a basis for identifying the most frequent types of processes and development styles currently in use in integrated agencies. Results show that integrated agencies are more likely to be decentralized, but with uniform processes implemented across field units. It is possible that decentralization provides more opportunities for disciplines to collaborate throughout different stages of the process while uniformity provides sufficient structure and guidance in the development of solutions when more parties are involved. Results show that the non-integrated agencies tend to have either a very few or a relatively large number of field units/divisions. It is possible that the benefits of an integrated approach are minimal when an agency has too few or too many field units. However, results also show that a greater number of integrated agencies versus non-integrated agencies coordinate with a relatively large number of entities in the formulation of the Statewide Transportation Plan (STP) and Statewide Transportation Improvement Program (STIP).

In terms of project development styles, integrated agencies are less likely to have a functional discipline project manager in which different portions of a project have a different individual serving as project manager (PM) based on that individual's expertise and the functions performed by the various aspects of the project. More frequent project development styles in integrated agencies include single point project managers, phased project managers, or a team of managers.

Qualitative comments from survey respondents provide more detailed information about the uniform processes utilized in both integrated and non-integrated agencies, as well as the general responsibilities of each discipline throughout different stages of the process. While collaboration between the disciplines of planning, engineering, environment and right of way generally occurs when identifying and selecting the preferred transportation solution, a more integrated approach focuses on coordination throughout ***all*** phases of the process, from planning to design to operation and maintenance. Some of the successful factors identified by agencies with an integrated approach include increased involvement of all disciplines earlier in the process, concurrent development, "cradle to grave" management approach, and increased public involvement. Some of the key challenges to implementing a more integrated approach include the merging of the NEPA and planning process, the seemingly conflicting pressure to complete projects quickly, and the difficulty of conducting efficient public participation throughout project development. Training, education and research were all identified by survey respondents as integral components to the implementation of a successful integrated approach.

6.3 Next Steps

Following this review of the literature and survey results, 5 transportation entities will be selected for direct site visits. These visits, along with this "State of the Practice" synthesis report, will form the basis for a report of best practices of integration and streamlining amongst the engineering, planning, real estate and environment disciplines in the transportation development and decision-making process. A final report will provide recommendations for how the practice of transportation decision-making can be improved by better integrating the various disciplines within transportation agencies and how FHWA can help to facilitate these practices.

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7 APPENDICES

Appendix A. List of Sounding Board Members

List of Sounding Board members as of February 2002.

Name	Title	Employer
Thomas B. Brigham	Director, Division of Planning	Alaska DOT & Public Facilities
Carol D. Cutshall	Director, Bureau of Environment	Wisconsin DOT
Andras (Andy) Fekete	Manager, Bureau of Environmental Services	New Jersey DOT
Gerald Gallinger	Director, Real Estate Services Office	Washington DOT
Rob Hanson	Assistant Manager, Project Development Branch	North Carolina DOT
David Y. Harris	Transportation Planning Specialist, Office of Planning and Environment	FHWA Florida
Timothy M. Hill	Administrator	Ohio DOT
Wayne W. Kober	Environmental Specialist	AASHTO
Richard W. Lee	Super-Valve Engrg/Utilities	New York State DOT

James E. Lewis	Rights of Way Administrator, Bureau of Engineering and Highway Operations	Connecticut DOT
John Merriss	Manager, Policy Division of Transportation Development	Oregon DOT
Frank Pafko	Area Manager for Metropolitan Division	Minnesota DOT
Neil J. Pedersen	Planning Director	Maryland DOT
Larry Piche	Chief of Environment	Illinois DOT
Lloyd Rue	Safety Traffic and Design Engineer	FHWA Montana
G. Alexander Taft	Executive Director	AMPO
Kenneth M. Towcimak	Director, Office of Right of Way	Florida DOT
Larry Velasquez	Director, Engineering Design Division	New Mexico State Highway and Transportation Dept.

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Appendix B. Annotated Bibliography from Literature Review

Borkenhagen, Keith. *Value Engineering: An Incredible Return on Investment* . Public Roads Magazine. Retrieved November 27, 2001 from http://www.tfhrc.gov/pubrds/septoct99/valu-eng.htm .

This paper provides a description of what Value Engineering (VE) Analysis is and the history of its use by the Federal Highway Administration and FHWA's mandates for its use by the states under certain circumstances. The paper also provides a few specific examples of projects that illustrate the value of value engineering.

Value Engineering is a concept that is somewhat related to the integration approach being explored by this project. VE is a team-oriented, multi-disciplinary, systematic tool that is very useful for identifying, analyzing and solving problems. Understanding techniques such as VE analysis that are already being used by state DOTs is helpful to this project because it provides a context within which to discuss the integrated decision-making techniques promoted by this project. This document provides a good background discussion of the VE process and its utility.

Context Sensitive Design Website , **Federal Highway Administration** https://www.fhwa.dot.gov/planning/css/ .

This website provides a definition of context sensitive design (CSD), its history, principles, implementation actions, descriptions of projects undertaken by pilot states, efforts undertaken by lead organizations, and other state and other organization efforts implementing CSD. Beyond this information, the site provides links to the pilot states; related publications, presentations and sites; and information about CSD conferences/meetings/training opportunities.

Context-sensitive design is a concept that is somewhat related to the integration approach being explored by this project. Context sensitive design involves a collaborative, interdisciplinary approach in which citizens are part of the design team. It is a philosophy that considers the impact a travelway will have on the area it traverses, including the people who live, work or pass through the area. Understanding project development techniques,

such as context sensitive design, that are already being used by state DOTs could be helpful to this project in providing a context within which to discuss the decision-making techniques promoted by this project. This document provides much useful information about what CSD is, how its use has evolved and real-world examples of its implementation. Moreover, it demonstrates the commitment to and belief in this technique by the Federal Highway Administration, AASHTO and many state DOTs.

Draft Script on Smart Growth **, Federal Highway Administration. Forwarded via email from Glenn Bridger.**

This document defines what the terms "Smart Growth" and "sprawl" mean to FHWA and the relationship between these concepts and the provision of transportation services in general. Generally, the document concludes that Smart Growth and sprawl mean different things to different people and groups, but that transportation is some how involved regardless of your definition. Moreover, FHWA believes that it is up to state and local officials to decide how best to address their unique set of land use, transportation, population, housing and other circumstances and that it is FHWA's role to help them once those decisions have been made. FHWA strongly believes that land use decisions are state/local decision and should remain that way. The ways in which FHWA can provide assistance to their state and local customers include providing technical assistance and training concerning the linkages between transportation and land use.

This document is of little direct relevance to this project but it does address the issue of the integration/ coordination between transportation plans (part of the transportation decision-making process) and land use plans. Many of the concepts discussed in the definition of smart growth such as "managing and operating existing highway, transit and other transportation modes to maintain or improve performance for each mode without adversely affecting neighborhoods or urban centers" or "knitting transportation improvement projects and public/ private investments so that they merge as seamlessly as possible into the communities" are related to the overall concept of utilizing the expertise of as many different involved disciplines as early in the process of the development of any sort of transportation solution as possible.

European Right of Way and Utilities Best Practices **, U.S. Department of Transportation, Federal Highway Administration, February, 2002.**

This paper presents the findings from an international scanning tour of right of way (ROW) and utility coordination practices in four European countries. This identified practices that could be implemented in the U.S. to improve the ROW and accommodation of utilities by ensuring timely procurement and clearance of highway right of way and adjustment of utilities. The intended audience is state and local agencies that could use this information to potentially adopt European ROW and utilities techniques and best practices to enhance their ability to streamline delivery and improve the quality of ROW services. This paper is part of the National Strategic Plan to enhance communities through highway transportation projects using innovative acquisition of ROW, sensitive and effective relocation of affected residences and businesses, and relocation and accommodation of utilities with minimal impact and disruption to the communities.

The findings and observations cover: appraisal & acquisition, compensation & relocation, training, utilities, project development. With appraisal & acquisition, there was an underlying philosophy of sensitivity to the needs of the property owner. All countries also had a framework for compensation similar to that in the U.S.; however, their compensation included provisions for payment for land acquired, damages to remaining property and relocation reimbursements. With training, requirements varied in each of the countries; however, all placed great emphasis on formal training and continuous employee development. With utilities, the strategies used were improved coordination, cooperation and communication. Jurisdiction-wide master agreements with each utility company were used to avoid having to develop new utility agreements on every project. Several of the countries established ROW and Utilities Databases, including GIS, for project development, tracking, and management. Of particular interest in this paper, several of the countries adopted a project management approach for project development, which included the use of multidisciplinary teams. Practices include ROW participation beginning at the planning

stage, budget and schedule commitments with a sign-off by functional representatives and project managers, and accountability for delivery on these commitments.

This document provides useful background information on the right of way and utilities practices in Europe and ways in which they can be applied in the US.

Examples of Statewide Transportation Planning Practices **, U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration, January, 1995.**

This paper presents examples from several states of innovative statewide transportation planning approaches and practices as developed under the requirements of ISTEA. The intended audience is other state transportation planners with the hope being that, with this information, states will be better able to assess their own efforts and make modifications as deemed necessary to improve or streamline their own practices. This document, in conjunction with four other studies undertaken by FHWA, FTA, and/or NCHRP, will result in a broad set of documentation of good ISTEA transportation planning practices.

Eight categories of planning factors were developed. Efforts by States demonstrating unique and quality practices and approaches under each of these categories are described in this paper. The 8 categories are: Coordination of Statewide and Metropolitan Planning (Florida and Iowa presented as exemplary); Form and Content of Statewide Transportation Plans and Improvement Programs (Florida and Texas discussed); Comprehensive Transportation Planning (Washington and Wisconsin discussed); Management Systems (California, Colorado, Missouri, and New Jersey described); Public Involvement (Idaho, Iowa and Wisconsin described); Social. Economic and Environmental Issues (Oregon, Washington and Wisconsin presented); Transportation Systems Management and Operations (Arkansas, Washington and Wisconsin presented); Investment and Finance Issues (Colorado and Wisconsin presented as exemplary).

This document provides useful background information on the transportation planning process and the ways in which it can be flexible to different state circumstances.

FDOT Streamlining, More Efficient Transportation Decision Making While Protecting the Environment, Efficient Transportation Decision Making (ETDM) Process **. Florida Department of Transportation. Retrieved from http://fdotenvironmentalstreamlining.urs-tally.com/Library/ETDM%20Process%20Description%201100.pdf** .

The State of Florida Department of Transportation, working in conjunction with the Federal Highway Administration and other Federal, State and local agencies, developed a refined and improved methodology for effecting improved transportation decisions. This document explains FDOT's new process that redefines how the State of Florida will accomplish transportation planning and project development within its current statues and regulations. The new methodology is called the Efficient Transportation Decision Making Process (ETDM) and it creates linkages between land use, transportation and environmental resource planning initiatives through early, interactive agency involvement. This process is expected to improve decisions and greatly reduce the time, effort and cost of developing transportation solutions. A key aspect of the ETDM process is the establishment of an Environmental Technical Advisory Team (ETAT) which performs two major screening events during planning - one is the Long Range Transportation Plant (STRP) screen and the other is the Transportation Improvement Program (TIP) screen.

The ETDM website provides other information about the ETM process including an interactive database system, the ETAT's NEPA review and other components of the process. The website is helpful to this project in terms of providing a specific example of a process being developed and implemented by a state considered to be on the forefront of integration in the transportation decision-making process.

Finnish Road Administration Environmental Policy and Action Plan 2001-2005 **, Finnish Road Administration, Helsinki 2001, Finnra Publications Sales, telefax int. +358 204 22 2652, email julkaisumyynti@tiehallinto.fi .**

This document is the Finnish Road Administration's management statement on environmental aspects of its development of an efficient and flexible transport system. The plan is a basis for programming and is further defined and implemented in the Road Administration product guidelines - for maintenance, investments and traffic management. The document defines the Road Administration's environmental policy which it states, is in accordance with the principles of sustainable development.

The plan covers the Road Administration's environmental policy principles of action; strategic planning; procurement practices including planning and design, construction and maintenance and day-to-day maintenance; road network management; and development. The plan includes documentation of extensive consultation with other organizations in the formulation of the plan. These organizations include regional environment centers, regional councils, museums, nature protection districts and province administrations, the Ministry of Transport and Communications, the Ministry of the Environment, the Finnish Road Association, the Association of Finnish Local and Regional Authorities, the National Research and Development Center for Welfare and Health, the Finnish Environmental Institute, the Finnish Nature Protection Association, the Finnish Council for Natural Resources, the Confederation of Finnish Industry and Employers, the Sami Delegation, the Finnish Trucking Association, the Finnish Marine Administration and the Finnish Road Enterprise.

Though this document focuses only on the integration between transportation development solutions and environmental considerations, it does highlight the types of efforts undertaken by transportation entities outside of the U.S. with regard to coordination of effort and integration of environmental considerations in the development of transportation solutions. The introduction to the plan mentions that the plan's fundamentals will be further defined and implemented in the Administration's guidelines for maintenance, investments and traffic management. Perhaps these other guidelines indicate an overlap in the coordination of environmental considerations with other areas involved in the development of transportation solutions.

This document was recommended for review by a member of this project's Sounding Board. One of the plan's principal authors is a member of a group called the World Road Association (PIARC). PIARC deals with road infrastructure planning, design, construction, maintenance and operation and was founded in 1909. PIARC has 97 national or federal government members, 2,000 collective or individual members in 129 countries, and over 750 experts in 20 standing Technical Committees. The official languages of PIARC are French and English and its central office is located in PARIS, France. Members of PIARC were identified as potential respondents for the survey being conducted under this project.

Guide to the Transportation Decision Making Process **. NEPA Process Improvement Team Handbook, April 12, 2000. Washington State Department of Transportation. Retrieved from http://www.wsdot.wa.gov/eesc/environmental/programs/regcomp/nepa/docs/NEPA_processguidance.pdf** .

This paper documents the Wisconsin State Department of Transportation's (WSDOT) effort to improve the application of the National Environmental Policy Act (NEPA) during the early states of long-range planning for transportation projects. WSDOT chartered a Transportation Decision Making Process Improvement Team (PIT) to develop and test the new process. The PIT surveyed WSDOT's major customer's to determine how WSDOT and FHWA were meeting their needs in terms of communication, competence, consistency, clarity, decisiveness, flexibility, input at right points, integrity, reliability, speed, safety and value.

The revised process developed in WSDOT involves: integrating planning and NEPA by moving NEPA to the start of the planning process; creating a Project Management Team (PMT) of WSDOT and FHWA to manage project logistics; creating a Steering Committee; establishing consensus points for various decisions made by Steering

Committee; establishing concurrence points for agencies, local governments and tribes with jurisdiction over certain project and permitting decision; and developing a public outreach plan. Most notably to this project, the PMT is a multi-disciplinary management team that oversees the development of corridor studies. The PMT concept was developed in order to improve decision making by reducing the gaps often encountered as projects are "handed-off" from one discipline to another. The PMT has representation from at a minimum, the planning, design and environmental disciplines. The document provides detailed descriptions of the roles and responsibilities of the various components of the new process.

This document provides an excellent example of a new, more integrated approach to transportation decision making being implemented by a state DOT.

Innovative Practices to Reduce Delivery Time for Right-of-Way in Project Development, A Synthesis of Highway Practice **, NCHRP Synthesis 292, Project 2-5 FY 1998; Topic 30-04. Transportation Research Board, 2102 Constitution Ave., NW, Washington 20418, 2000. Retrieved from http://trb.org/trb/publications/nchrp/synth292_1.pdf**

This report documents a study performed by a consultant specializing in public sector real estate practices. Its audience is federal and state departments of transportation administrators, supervisors and staff as well as the consultants that work with them in the project development process.

The study investigates specifically the right-of-way function as an element of the transportation project development process. It examines the delivery of right-of-way and property interests for project construction and mitigation activities and reports on successful strategies employed by State Departments of Transportation to accelerate this process. The primary source of information for the report is a survey mailed to right-of-way managers of transportation agencies in all 50 states, Puerto Rico and the District of Columbia. In addition, right-of-way managers in five states (California, Iowa, Utah and Washington) provided detailed information through in-person interviews about innovative and successful approaches implemented by their agencies in the delivery of right-of-way services.

This study is very applicable to the current project both in terms of subject matter and methodology. The survey questions provide useful examples of terminology and practices followed by STD right-of-way staff in the project development process. The conclusions of this study substantiate the premise that including the right-of-way discipline in an integrated approach towards transportation decision making is an effective strategy for advancing the goals and missions of a state transportation agency.

Integrating Right of Way and the Environment for Better Results **, October 16, 2001. Live Webcast presented by Center For Transportation and the Environment, Institute for Transportation Research and Education, North Carolina State University. Webcast viewed via http://carey078.itre.ncsu.edu/CTE/Presentations/TC26-16October2001/archive_16October2001.html** .

This national satellite broadcast featured a panel discussion, led by CTE Senior Research Associate Janet Myers (former ROW director for Maine DOT). The panel explored the right-of-way and environmental aspects of transportation programs and opportunities for enhancing program performance. Topics covered included: how right-of-way and the environment interface with other project development activities, including planning and design; common pitfalls to avoid; and how the project development process can be improved including tools to build flexibility and efficiency into the right-of-way and environmental functions.

Panelists included: Cynthia Burbank, Program Manager, Planning, Environment and Right-of-

Way, Federal Highway Administration; Carol Cutshall, Director, Bureau of the Environment, Wisconsin Department

of Transportation; Deolinda Jones, Right-of-Way Manager, Oregon Department of Transportation; Nancy Maieski, Director, Bureau of Highway Real Estate, Wisconsin Department of Transportation; Michael Replogle, Transportation Director, Environmental Defense, Lori Sundstrom, Environmental Service Manager, Oregon Department of Transportation, Kenneth Towcimak, Director, Office of Right-of-Way, Florida Department of Transportation, Gary Winters, Chief, Division of Environmental Analysis, California Department of Transportation.

Though the webcast addressed primarily integration between only the disciplines of right-of-way and environment, it provided useful information on specific efforts currently being implemented by the states represented in the panel in the area of increased integration in the transportation decision-making process. It highlighted issues important to the states and provided ideas for questions related to current efforts to be included in the survey. Due to the interactive nature of the webcast (viewers could submit comments and questions) it provided an opportunity to introduce this project effort to individuals who later became part of the project's Sounding Board.

Integrating Right of Way and Environment in Project Development **, Presentation by Cynthia Burbank as part of Webcast entitled *Integrating Right of Way and the Environment for Better Results* , October 16, 2001. Presented by Center For Transportation and the Environment, Institute for Transportation Research and Education, North Carolina State University. Retrieved from http://www.itre.ncsu.edu/cte/burbank.pdf . and http://www.itre.ncsu.edu/cte/burbank_talkingpoints_oct16.html**

Ms. Burbank's presentation at the CTE webcast describes the typical or formerly accepted "stove-piped" project development process. This process is characterized by each participant in the process handing off their portion to the next participant with little interaction between all parties. This process is juxtaposed in Ms. Burbank's presentation with the "new" way of delivering projects which is represented by an overlapping series of waves. The waves included in her graphic include planning, environment, right-of-way, final design and construction, and operations. Ms. Burbank provides several points highlighting why it is important to involve right-of-way staff earlier in the project development process. She also provides two examples of projects in which FHWA was involved where there was an innovative use of real estate and right-of-way expertise in the successful development of the project.

Ms. Burbank's presentation provides good graphical interpretations of two different project development processes - the stove-pipe project development process and the wave process. Her comments and participation in the webcast exemplify FHWA, Office of Planning, Environment and Real Estate's commitment to promoting integration amongst many disciplines in the transportation decision-making process.

Project Development Guidebook **, Oregon Department of Transportation, Office of Project Delivery, Project Systems Unit, September 2000** .

This guidebook is designed to provide citizens, organizations, elected official and ODOT management and staff with key information about how transportation projects are developed within ODOT. The Guidebook details the project development activities, which are the planning and design steps of a project. They cover all major activities between the time a project is first identified as an idea through the time it is documented in a set of plans and specifications to be bid upon by contractors that seek to build it. Specifically, the Guidebook details the four project development phases which are: planning and management systems, program development, project alternative selection, and project design. The Guidebook is intended to provide information about project development at a number of levels for readers with varying levels of knowledge and interest. To achieve this, it is separated into two sections entitle General Approach and Specific Approaches.

This Guidebook is extremely helpful in developing a definition of "project development" in terms of that phrases use in the survey for this project. The Guidebook provides a framework under which to discuss the overall process that is the subject of the survey. The Guidebook is also useful to this project in terms of providing a specific example of a process being developed and implemented by a state considered to be on the forefront of integration

practices in the transportation decision-making process.

Research Needs for Transportation and Integrated Environmental Decision Making **, Prepared for the Transportation Environmental Research Needs Conference of the TRB, March 21-23, 2002.**

This paper is intended to highlight the unmet research needs in the area of environmental analysis and the practice of policy-making, regulating and integrating the needs of both the environment and the nation's transportation systems. Recognizing this is a huge topic, the paper develops a matrix to illustrate the complexity of the field, propose techniques for managing that complexity and to list some of the more urgent questions that need to be addressed. The basic premise of the paper is that research is needed in the best ways to measure, manage, and motivate the achievement of society's environmental and transportation objectives. The matrix proposed consists of 8 dimensions including: 1) the level of analysis (policy, management, technical), 2) the level of organization involved (federal, local, etc.), 3) desired end use of research (lobbying, industry best practice, etc.), 4) the objectives being met (economic, social, environmental), 5) the timeframe of the subject being researched (short, medium or long term impact or effect), 6) the various planning and development process steps (design, construction, operation, etc.), 7) modes of transportation (air, water, rail, road, etc.) and 8) the various environmental media (air, water, etc.).

Though generally related to transportation decision making, this paper is not particularly relevant to this project effort.

Right of Way Quality Management System, The Journey of Five States, **July 28, 1999. U.S. Department of Transportation, Federal Highway Administration, Washington, DC.**

This paper describes the types of management systems and best management practices present within State Departments of Transportation right-of-way (ROW) divisions. It also makes recommendations on how to plan, implement and measure a management system. Finally, the paper profiles 5 state ROW divisions in various phases of implementing their management systems. The states investigated are Wisconsin, Pennsylvania, Florida, Louisiana and Oregon.

This paper is focused on strategic planning and management efficiency efforts rather than transportation project development. It is not relevant to this project beyond providing a background on the organizational structure of five states that could at some point be further investigated under this project.

Sound Land Use Implementation Plan November 1 - October 31, 2002 , **Pennsylvania Department of Transportation.**

This paper documents the efforts undertaken by PennDOT over the period November 1 - October 31, 2002 to meet the state's goals of incorporating the principles of the state's land use policy into their plans, projects, and programs and policies as defined in the state's *Interagency Land Use Team Supplementary Report* of August 2000. The Report requires that Commonwealth agencies develop an Implementation Plan for incorporating land use principles into all agency programs and policies. The Plan must contain the following three items: 1) education of agency staff, 2) incorporation of local land use planning into agency decision and 3) identification of actions likely to have significant impact on land use. This document details the 8 sound land use actions that have been completed within the last year, are underway or on-going, and future actions to be implemented within the next year. Actions under each of the three items are briefly described.

The coordination between transportation and land use is a concept that is somewhat related to the integration approach being explored by this project. Land use issues involve developing methods and policies that improve or sustain environmental quality and other quality-of-life considerations while allowing for enhanced economic and social progress. Understanding project development techniques, such as land use policies that are already being

used by state DOTs could be helpful to this project in providing a context within which to discuss the decision-making techniques promoted by this project. This document provides a good example of the ways in which a particular state is addressing its land use policy and how that policy interacts with its other policies, programs and actions. For example, under the category of Educating Agency Staff, PennDOT lists activities such as conducting a conference that highlighed and promoted land use and transportation best practices, developing other conferences to communicate the integration of land use and transportation planning, and developing internal agency training courses on the concept of integrating land use/transportation decision-making.

Statewide Transportation Planning Under ISTEA **(n.d.), U.S. Department of Transportation. Retrieved from http://www.fhwa.dot.gov/hep10/state/guide5.pdf** .

This document provides a detailed description of the transportation planning process under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Statewide planning under ISTEA, as explained in this document, is multi-faceted, includes consideration of all modal options (e.g. highway, transit, rail roads), and is characterized by input and participation from stakeholders and the public. This document provides a discussion of the two principal products of the statewide planning process; the statewide transportation plan and the statewide transportation improvement program (STIP). The purpose, time-line, coordination requirements, inputs and content of these plans are detailed.

In addition to the discussion of the planning products, this document describes four key elements or planning factors that are part of ISTEA and how their integration into the planning process contributes to the development of a comprehensive transportation plan. These planning factors include: management systems (including performance and asset management systems), major investment studies in metropolitan planning areas, environmental considerations, and linking transportation and air quality planning.

Finally, the document provides a discussion of transportation financing techniques and a sample of communication tools utilized by various states. Interspersed throughout the document are state-specific examples of the implementation of various planning techniques required under ISTEA.

Again, in the context of this project, this document provides a useful and detailed background of the transportation planning process and examples of representative processes implemented by specific states.

Summary of Peer Exchange on Improving Transportation Decision-making through Planning, NEPA and Project Development Linkage, Baltimore, Maryland May 22 - 23, 2001 **, June 8, 2001, U.S. DOT Volpe Center. Forwarded via email from Glenn Bridger.**

On May 22 nd and 23 rd , 2001, the U.S. DOT hosted a Peer Exchange in Baltimore, Maryland for state DOTs to share information about how they are linking the planning, NEPA and project development processes in order to improve transportation decision-making. There were 17 people in attendance including planning and environment representatives from seven state DOTs (California, Florida, Indiana, Maryland, North Carolina, Oregon and Washington); representatives from U.S. DOT Federal Highway Administration (FHWA) Office of NEPA Facilitation, FHWA Office of Metropolitan Planning, FHWA Office of Statewide Planning, FHWA Easter Resource Center, Federal Transit Administration (FTA) Office of Planning and Volpe Center; a representative from the Center for Transportation and the Environment; and one facilitator.

This paper presents a summary of the findings of this meeting including: 1) Factors for Success - institutional and technical factors common to states that can be used in developing new approaches to transportation decision-making; 2) State Strategies - a review of the particular strategies implemented by the seven participating states to improve decision-making; 3) Opportunities for Improvement -ways in which FHWA and states need to work together to improve the linkage between planning and NEPA; 4) Proposed Next Steps - a series of next steps identified by the group to further educate each other and the U.S. DOT of on-going efforts to improve the

transportation decision-making process.

Though this paper is geared specifically towards the linkage between transportation planning and environmental issues, there are still many points applicable to the concept of integration in transportation decision-making in general. Similar to the document focusing on the contribution of the Right-of-Way discipline to transportation decision-making, this document provides an excellent background discussion of the environmental issues critical to transportation decision-making and the insights and concerns of individuals working in that discipline. Specifically, some of the efforts documented under the State Strategies section are useful. Some of the strategies described in that section involve disciplines in addition to planning and environment, providing an excellent context for the formulation of survey questions about such strategies.

***Thinking Beyond the Pavement: A National Workshop in Integrating Highway Development With Communities and the Environment* , University of Maryland Conference Center, May, 1998** .

This brochure presents the topics covered and conclusions drawn at a national workshop held in Maryland in May of 1998 on the topic of Context Sensitive Design (CSD). The conference included 325 invited participants from 39 states and the District of Columbia. Participants included chief engineers, senior designers and planners from 29 state departments of transportation, representative of national transportation organizations, and a variety of stakeholders from government, the private sector and citizens' organizations. The brochure details the goals of the workshop, what the workshop developed, the workshop participants' vision of quality of excellence in transportation design and of the characteristics of the process that would yield excellence. The workshop also presented case study examples from around the country of projects involving CSD. Various types of projects were described including: freeway design, suburban and rural roads, the commercial arterial, bridges and their approaches and a small town Main Street. The brochure summarizes a few of these case study examples. The workshop produced a list of specific implementation recommendations, along with who should undertake them. These are listed in the brochure.

Context-sensitive design is a concept that is somewhat related to the integration approach being explored by this project. Context sensitive design involves a collaborative, interdisciplinary approach in which citizens are part of the design team. It is a philosophy that considers the impact a travelway will have on the area it traverses, including the people who live, work or pass through the area. Understanding project development techniques, such as context sensitive design, that are already being used by state DOTs could be helpful to this project in providing a context within which to discuss the decision-making techniques promoted by this project. This document provides a useful working definition of CSD and good case study examples of its implementation. Moreover, it demonstrates the commitment to and belief in this technique by the Federal Highway Administration, AASHTO and many state DOTs.

***Transportation Decision Making - Policy Architecture for the 21 st Century* , U.S. Department of Transportation , July 28, 2000 . Retrieved November 7, 2001 from http://ostpxweb.dot.gov/policy/tpa/Table_of_Contents.htm**

This document describes the national and international level issues that affect transportation decision making and provides a framework for future decision making based on changes brought about by globalization. It addresses the decision-making roles of the both the public- and private-sectors and establishes a framework for making decisions specifically aimed at future outcomes to and impacts on the U.S. transportation system in 2025.

The document contains a discussion of the evolution of public sector transportation decision making including a review of Federal transportation policy development. This includes an overview of recent developments in public sector decision making including discussion of the various transportation Acts and other national regulatory reforms and their impacts on urban transportation decision making, state and regional transportation decision making, national transportation decision making and private sector transportation decision making.

The document is aimed at the general public and provides a useful overview of the issues involved in transportation planning and policy development at any level. It provides a context for the research goals of this project in relation to overall U.S. DOT goals and efforts.

Transportation Projects: From Idea to Construction, Project Development Process **, Oregon Department of Transportation, Office of Project Delivery, Project Systems Unit.**

This booklet is a brief introduction to the project development process that is fully documented in the Oregon Department of Transportation's (ODOT) *Project Development Guidebook* . The booklet defines project development as practiced by ODOT and highlights the first four phases of the lifecycle of transportation projects in Oregon, which are collectively known as project developments. These phases included: planning and management systems, program development, project design alternative selection, and project design. In addition to describing the main activities that are conducted under each of these four phases, the booklet explains the other 10 processes that - much like extended activities - overlap the other activities and last throughout the project development. These processes include: project decision structure, project financial plan, intergovernmental agreement, public input and involvement, environmental, project scoping, project teaming, right-of-way, review and permitting. The booklet also describes the two types of participants in the project development process: those that are an ODOT work unit and those that are not. Several specific participants falling under these two categories are listed. Finally, included in the booklet is a description of the five principal types of projects: modernization, bridge, preservation, safety, and operations.

This booklet is extremely helpful in developing a definition of "project development" in terms of that phrases use in the survey for this project. The booklet provides a framework under which to discuss the overall process that is the subject of the survey.

The Value Engineering (VE) Process **and** ***Job Plan*** **. U.S. Department of Transportation, Federal Highway Administration. Retrieved on November 27, 2001 from http://www.fhwa.dot.gov/ve/veproc.htm and http://www.fhwa.dot.gov/ve/vejob.htm** .

These FHWA websites explain the Value Engineering process, the projects to which is should (and must) be applied and its utility in finding and eliminating unnecessary costs in a project. The eight phases of a VE analysis and the activities that should take place under each are detailed in these two documents. Each phase is discussed in terms of its objective, the key questions addressed, the techniques used and the specific tasks undertaken.

Value Engineering is a concept that is somewhat related to the integration approach being explored by this project. VE is a team-oriented, multi-disciplinary, systematic tool that is very useful for identifying, analyzing and solving problems. Understanding techniques such as VE analysis that are already being used by state DOTs could be helpful to this project because it could provide a context within which to discuss the decision-making techniques promoted by this project. This document provides a good background discussion of the VE process and its utility.

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Appendix C. Definitions of Survey Terms

The survey uses several terms that are unique to the FHWA Integration Solutions Survey and/or to the transportation community. This section provides definitions for those terms as they are used in the survey.

Centralized - a type of administrative process in place in a transportation agency where agency-wide decisions, policies, procedures, processes, etc. are made, established and monitored by a central unit, location or

headquarters. It is used in the survey in contrast to a decentralized environment.

Decentralized - a type of administrative process in place in a transportation agency where agency-wide decisions, policies, procedures, processes, etc. are made, established and monitored at the field unit (e.g. district or division) level. It is used in the survey in contrast to a centralized environment.

Functional Discipline - a project management style in which different portions of a project have a different individual serving as project manager (PM) based on that individual's expertise and the functions performed by the various aspects of the project, e.g. a bridge PM, a roadway design PM, a geotech PM, a right-of-way PM, etc.

Integrated (or Integrated Process) - the decision-making process in which the players (in this case the disciplines explored by the survey) coordinate their expertise throughout the development of a transportation project or throughout certain portions of the project development. The timing of each discipline's contribution(s) overlaps with those of the other disciplines. The process is a more iterative one (as compared to the linear process) where various disciplines are consulted and resulting changes are made before the process moves on to the next step.

Linear - used in the survey synonymously with the term "stove-piped" to describe a decision-making process in which the players (in this case the disciplines explored by the survey) contribute their expertise during one particular part of the process and pass that interim result on to the next discipline to use in the next phase of the process with little to no interaction between the disciplines. The process moves in only one direction with little to no overlap in the efforts of one discipline with the others. The linear process is juxtaposed in the survey with the integrated process.

Phased - project management style in which each phase of a project, e.g. scoping, design, construction, etc. has a separate individual serving as manager.

Single Point - project management style in which one project manager is assigned to lead a project from beginning to end, throughout all project phases and functions. Also called "cradle to grave" project management.

Stove-piped - used in the survey synonymously with the term "linear" to describe a decision-making process in which the players (in this case the disciplines explored by the survey) contribute their expertise during one particular part of the process and pass that interim result on to the next discipline to use in the next phase of the process with little to no interaction between the disciplines. The process moves in only one direction with little to no overlap in the efforts of one discipline with the others. The linear process is juxtaposed in the survey with the integrated process

Transportation Decision-making Process - used synonymously in the survey with "transportation solutions", this is the process including all planning phases, design/development, construction/implementation, and maintenance of a transportation system improvement. It refers to all or any mode of transportation.

Transportation Solutions - used synonymously in the survey with "transportation decision-making process", this is the process including all planning phases, design/development, construction/implementation, and maintenance of a transportation system improvement. It refers to all or any mode of transportation.

Uniform - the situation where transportation decision-making processes are followed similarly, if not exactly the same, in all districts/divisions/field units of a transportation-related entity and on all projects, regardless of the type or of any other project attribute.

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Appendix D. List of States Represented by Each FHWA Regional Resource Center

The **Western Resource Center** represents the following 14 states: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.

The **Eastern Resource Center** represents the following 14 states: Connecticut, District of Columbia, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont, and West Virginia.

The **Southern Resource Center** represents the following 14 states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, New Mexico, Oklahoma, Puerto Rico, South Carolina, Tennessee, and Texas.

The **Midwestern Resource Center** represents the following 10 states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin.

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