North Carolina General Assembly
NCDOT Project Delivery Study
Final Report

July 19, 2004

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Executive Summary

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A. Introduction and Overview

This Executive Summary presents the findings from a study of North Carolina Department of Transportation (NCDOT) Project Delivery. This study was commissioned by the Joint Legislative Transportation Oversight Committee of the North Carolina General Assembly, which is authorized by section 29.21 of Session Law 2003-284 to study NCDOT's highway construction delivery process.

1. Project Purpose

This study was conducted to achieve the following major objectives:

- To evaluate policymakers' longstanding concerns regarding NCDOT project delivery.
- To provide an independent, fact-based assessment of the factors causing project delay.
- To identify areas of success and meaningful opportunities for improvement.
- To estimate project delay impacts upon NCDOT's ability to deliver the remaining Trust Fund projects.
- To develop recommendations that can be implemented to yield tangible benefits and cost savings.
- To identify and determine the most significant barriers to project completion, be they permitting, environmental review, right-of-way, utility relocation, or others.
- To evaluate NCDOT project delivery performance and business practices against best practice in state departments of transportation and, where appropriate, other public and/or private agencies.

2. Project Approach

To achieve the study objectives, Dye Management Group Inc. applied the following methodology to get beyond perceptions and deliver fact-based analysis and recommendations:

- Conducted numerous interviews with staff at NCDOT, federal and state resource agencies, and private consulting engineers and construction industry representatives.

- Reviewed existing documentation on policies, procedures, and standard practices.
- Collected and analyzed a large volume of data.
- Evaluated NCDOT against best practice.
- Developed recommendations.

B. Overall Findings and Recommendations

This Project Delivery Study of the North Carolina Department of Transportation addresses NCDOT's performance in delivering an annual construction program that is now in excess of $1 billion per year. The study provides a detailed quantitative analysis based on assembling large data sets that reflect NCDOT's most current experience. The report provides some 26 individual recommendations that address current barriers to timely project delivery and that will enable NCDOT to implement industry best practices for program and project management.

1. Recommendations Overview

The NCDOT requires the introduction of top down department-wide organizational and business improvement changes to increase accountability and provide for "end to end" management oversight and control of project delivery. The study finds a need to provide accountability to the General Assembly, NCDOT customers, and NCDOT business partners for the delivery of projects within scope, schedule, and budget on timelines established through multi-year delivery planning.

The NCDOT does not have direct control or jurisdictional authority over all aspects of the project delivery process. The Transportation Improvement Program (TIP) is developed in coordination with local jurisdictions and Metropolitan Planning Organizations. A number of different state and federal resource agencies play key roles in the environmental process through their regulatory and permitting authority. Many communities and citizens become engaged in and provide input throughout the delivery process. Project delivery can often involve the application of a number of technically sophisticated engineering and environmental disciplines. In short, project delivery can be a complex activity with considerable uncertainty and risk.

The very complexity and number of participants in the process increases the importance of effective project management policies, procedures, and controls. To be most successful in this environment, NCDOT needs to be proactive, provide leadership, and exert influence working with all parties to ensure accountability and responsibility for timely cost effective project delivery. The study provides a series of organizational and business improvement recommendations through which both NCDOT and the resource agencies can establish work standards, timelines, and agreed upon accountabilities to improve project delivery performance. These recommendations address the importance of NCDOT establishing strong proactive

leadership and ownership for managing the delivery of projects within agreed time frames, budgets, and scope.

The recommendations recognize, build on, and ensure that NCDOT yields the benefits from the positive improvements that have been made in the environmental process. The redesigned environmental process affords the potential for greatly increasing predictability and reducing delivery time. This potential can only be realized by NCDOT and the resource agencies establishing stronger accountability mechanisms for completing project delivery tasks on agreed timelines. Within the NCDOT, there has been other positive change and the study identifies over 50 improvement initiatives where work is underway to improve parts of the process; however, these initiatives tend to be fragmented because NCDOT lacks a systemic approach to managing overall project delivery. They can not all be implemented.

2. Findings and Recommendations

The findings and recommendations are listed below:

Predictability, Accountability, and Communications for Project Delivery

Findings	Recommendations
• Poor communications and public accountability for delivery performance. • Little systematic and proactive communication of current delivery status and changes in status.	1.1: Provide proactive and standardized delivery reports at the program and project level to policymakers, customers, and business partners (page 7).
• Limited success in meeting the planned 12-month letting schedule. • Improved letting list stability can reduce construction costs.	1.2: Revise the letting list process to improve accuracy and integrate with a multiyear delivery plan (page 7).
• The TIP has no credibility as a project delivery plan or commitment to NCDOT's customers and partners. • No management mechanisms for establishing and communicating a multi-year delivery plan department-wide.	1.3: Change the TIP structure to improve the ability to deliver projects as planned (page 8).

Overall Project Delivery Process

Findings	Recommendations
• The TIP does not provide NCDOT with a multiyear delivery plan to hold itself accountable for delivering. • The current TIP process makes it extremely difficult to establish a multiyear delivery plan with any level of precision.	2.1 Restructure the TIP so that it includes a development and a delivery component (page 9).
• The specification of roadway cross sections in the Highway Trust Fund legislation and the equity formula provide barriers to timely project delivery.	2.2. In conjunction with the Highway Trust Fund Study committee work, amend statute so that it does not predefine the cross section of intrastate projects as four lanes (page 10).
• In general, construction is delivered on the schedules that are set.	2.3. Evaluate alternative project delivery options and pilot their use through the Turnpike Authority (page 10).
• Alternative approaches are being introduced by states to expedite project delivery. NCDOT has some large design build projects.	

Addressing the Causes of Delay - Environmental Process

Findings	Recommendations
• NCDOT's major business improvement, the Merger 01 process, when implemented, will reduce project delivery time and improve predictability. • NCDOT and resource agencies' management have established effective coordination mechanisms.	3.1. Stabilize and further strengthen the Merger 01 process by: • Establishing documented procedures, guidelines, standards, and training for all process participants. • Providing project coordination and management. • Providing a facilitator for Project Team meetings. • Providing automatic issue escalation if work is not completed within specified timeframes. (Page 12)
• There are no measurable performance objectives or work standards for the environmental process.	3.2. Establish performance targets at the project and organizational levels for environmental activities in NCDOT, DENR, and other resource agencies (page 13).

Addressing the Causes of Delay - Environmental Process

Findings	Recommendations
• Multiple state agencies participate in project delivery under different mandates and the potential for competing goals.	3.3 Establish a core set of state-level environmental objectives for the delivery of projects which addresses environmental excellence within acceptable cost and schedule constraints (page 13).
• NCDOT has many improvement initiatives underway to streamline the environmental process. • Process improvements tend to be fragmented. There is no systemic business case assessment from which improvement initiatives are prioritized. • For many of the process improvements, it is too early to quantify benefits through reduced delivery times.	3.4. Establish department-wide and cross agency (NCDOT and resource agencies) coordination of the various Project Delivery improvement initiatives (pages 13–14).

Addressing the Causes of Delay - Consultant Procurement and Management

Findings	Recommendations
• The current process takes much longer than necessary. It can take 6 months or more to issue a notice to proceed.	4.1. Simplify the consultant procurement process (page 16).
• Engineering consultant contracts are put in place and managed by many different units within NCDOT.	4.2 Establish a centralized procurement function to manage and administer all consultant contracts (page 16).
• There has been a marked increase in outsourced design and therefore effective contract management is of increased importance. • Changes to consultant contracts over $30,000 require Board of Transportation approval which can cause delay.	4.3 Simplify consultant contract approval processes (page 16).

Overall Program Management

Findings	Recommendations
• Accountability for project delivery is fragmented and limited. • There is not a senior management committee or team charged with oversight, management, and control responsibilities for program delivery management. • Currently the management, identification, and resolution of barriers to project delivery tend to be fragmented across functional areas and organizational units.	5.1. Institute a Program Delivery Management Committee to provide oversight, management control, and strategic direction for program management (page 18).
• Current business objectives and performance measures are expenditure based – value of contracts let.	5.2. Establish measurable department-wide strategic objectives for program delivery, an annual business plan for improvements, and management accountabilities for accomplishing them (page 18).
• Management lacks the type of information required for effective program level management.	5.3. Establish a Program Office for project delivery (page 18).

Overall Program Level Human Resource Management and Planning

Findings	Recommendations
• High rates of staff turnover heavily concentrated in the units most critical for project delivery is an important contributor to project delay. • Difficulty in filling specialty positions. • Work standards are required by project type as the basis for managing and forecasting labor needs for project delivery.	6.1. Conduct overall multi-project program delivery resource assessment. Establish management level responsibility for human resource management and assessment and prepare multiyear plan (page 21).
• Loss of senior and more experienced personnel. • Difficulty in filling vacant positions with the right skill set due to pay scales. • Absence of formal or informal succession planning.	6.2. Remove, at least on a temporary basis, restrictions on the maximum amount retired staff can earn to encourage retired engineers and other former NCDOT staff to work full time with NCDOT in temporary positions (page 21).
• There is limited documentation and training on how NCDOT delivers projects for employees new to NCDOT and their current positions.	6.3. Address as a priority the organizational development and training needs of an organization with new and less experienced employees (addressed through Recommendations 7.2 and 7.3) (pages 22–22).

Overall Program Level Human Resource Management and Planning

Findings	Recommendations
• NCDOT does not hold managers accountable for managing headcount and retention. This type of management level accountability is typical of successful organizations.	6.4. Provide line managers with headcount and retention metrics/responsibilities (page 22).
• NCDOT staff turnover is heavily concentrated in key units. • Compensation for key positions is likely below market rate. • Small incentive payments to maintenance employees have had big paybacks.	6.5. Conduct compensation review of key discipline areas, recruitment, and retention strategies. Establish incentive payment mechanisms (pages 22–23).
• There are human resource bottlenecks in some specialized environmental areas.	6.6. Establish process and expectation that program managers monitor, anticipate, and address human resource bottlenecks (page 23).
	6.7. Establish work standards and turnaround times for SHPO and NCDOT activities for historical architecture (Section 106) reviews, estimate annual resource needs, and establish a strategy for bottlenecks (pages 24–25).

Organizational Development to Strengthen the Application of Project Management Principles and Practice

Findings	Recommendations
• NCDOT has made organizational changes that give greater visibility to project management manager positions by establishing two TIP Program manager positions. • Project manager positions in PDEA and Preconstruction are not dedicated to project management and primarily do technical work. • The role, responsibilities, and accountability for project management are not well defined.	7.1. Build on the recent organizational change establishing TIP Program Managers by making current PDEA and Preconstruction project manager positions: Dedicated positions solely to project management, responsible for scope, schedule, and budget management. Separate project management duties from technical work tasks. (Page 25)
• Lack of consistent standardized project management methods and tools.	7.2. Strengthen project management practices by establishing standardized business rules, roles, and responsibilities for project delivery and then codify these in a project delivery manual (pages 26–27).

Organizational Development to Strengthen the Application of Project Management Principles and Practice

Findings	Recommendations
• Few employees have project formal management training. They have not been recruited or promoted based on project management knowledge, skills, and abilities.	7.3. Establish a project management discipline development program for NCDOT employees that recognizes project management as a professional discipline and provides employee development and training to strengthen the project management discipline at NCDOT (pages 26-27).
• The use of dedicated teams is an industry best practice on large complex projects.	7.4. For the most complex and/or highest priority projects, pilot a dedicated delivery team approach (page 27).

Project Management Information, Metrics, Standardized Methods, and Project Management Tools

Findings	Recommendations
• Study findings raise strong concerns about NCDOT's organizational readiness to use PMii. (The new project scheduling system). • Institutionalization of PMii will likely be difficult.	8.1. Conduct an expedited organizational readiness assessment; then establish and implement a change management plan for PMii (pages 29–30).
• There is little management information available for program and project delivery management. • There is no management information used for project cost and budget management and control.	8.2. Design and implement a reporting system for program and project management monitoring and control (page 30).
• NCDOT does not have a set of metrics and tools for measuring, managing, and monitoring project delivery performance. • PMii only addresses project scheduling, and project and program management information is required on project budgets and scope. • There are opportunities to increase the use of standardized tools, templates, forms, and checklists for project management.	8.3. Stabilize the use of PMii to support scheduling and establish a management-level reporting system before further adding to PMii or instituting other information technology projects (page 30).

Utilities and Right of Way

Findings	Recommendations
• The actions of privately owned utilities, over which the NCDOT has no direct control, are causing project delays.	9.1. Establish incentives to induce utilities to relocate their facilities in timely fashion (page 31).

I. Introduction

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The Joint Legislative Transportation Oversight Committee of the North Carolina General Assembly commissioned this Study of North Carolina Department of Transportation (NCDOT) Project Delivery. This study addresses section 29.21 of Session Law 2003-284, a provision that authorizes the Joint Legislative Transportation Oversight Committee to study NCDOT's highway construction project delivery process and those activities of NCDOT's resource agency partners which effect highway construction project delivery. The enacted legislation reflects ongoing policymaker and broader stakeholder interest in understanding the causes of project delay and, more importantly, identifying policy, management, and procedural changes that can improve the efficiency and effectiveness of project delivery.

The most significant policymaker concerns are:

- While NCDOT has been successful in increasing the dollar value of annual lettings since 1998 to above $1 billion per year, there has been little increase in NCDOT's ability to deliver the program or the letting schedule as planned.
- The length of time it takes to deliver Highway Trust Fund projects.[1]
- The need to more effectively manage and deliver the program so that highway dollars are put to use most quickly and cost-effectively for North Carolina taxpayers.

A. Study Objectives

The study was carried out to achieve the following major objectives:

- To evaluate policymakers' longstanding concerns regarding NCDOT project delivery.
- To provide an independent, fact-based assessment of the factors causing project delay.
- To identify areas of success and meaningful opportunities for improvement.
- To estimate project delay impacts upon NCDOT's ability to deliver the remaining Trust Fund projects.
- To develop recommendations that can be implemented to yield tangible benefits and cost savings.
- To identify and determine the most significant barriers to project completion, be they permitting, environmental review, right of way, utility relocation, or others.

[1] These are projects funded through the Highway Trust funded established in 1989. The enabling legislation specified Intrastate and Urban Loop projects among others.

- To evaluate NCDOT project delivery performance and business practices against best practice in state departments of transportation and, where appropriate, other public and/or private agencies.

B. Approach

To meet the objectives of the study, a methodology was employed that gets beyond perceptions by using quantitative and qualitative analyses to develop fact-based recommendations. The findings and recommendations contained in this report are based on the analysis of information assembled through the following means:

- **Structured Interviews.**

  Numerous interviews were conducted to identify issues, evaluate management controls, assess accountability structures, and identify current business procedures in the different areas of analysis. Interviewees included NCDOT managers, process owners, process participants, state and federal resource agencies, and private consulting engineers and construction industry representatives. The 113 formal structured interviews were supplemented with numerous follow-up telephone interviews and consultations.

Exhibit I-1: Interviews Conducted

Organization/Group	Number of Interviews
Board of Transportation Members	4
NCDOT Management and Staff	56
State Resource Agency Management and Staff	11
Federal Resource and Partner Agencies	6
Resource Agency and General Assembly Staff	28
Construction and Engineering Industry Representatives	8

Interviews were conducted using structured interview guides to ensure consistency of the information gathered. The interviews were used to identify data and information sources, identify and determine issues that should be addressed by the review, and provide a control mechanism to ensure that data and information used in the analysis were reliable and relevant.

- **Review of existing documentation on policies, procedures, and standard practice.**

  All documented policies, procedures, and other guidance material available regarding NCDOT's project delivery process were collected and reviewed. This included documentation pertaining to business improvement initiatives.

- **Collection and analyses of data.**

  The analysis approach aimed to build a quantitative data set from which to evaluate NCDOT project delivery performance. This provided a significant analytical challenge. The fragmented and incomplete nature of project specific data is itself a finding and a recommendations area in the study.

  Data were compiled from a variety of sources that included:

  - Monthly let lists.
  - Monthly award results listings.
  - The project master scheduling system.
  - The highway contractor management system.
  - Data compiled from NCDOT's Project Development and Environment Analysis (PDEA) unit project files.
  - Resource agency information on permit issuance and turnaround times.
  - The old (legacy) financial system.
  - Consultant expenditures from the new accounting system.
  - State Office of Personnel.

  Using these data sources, a series of indicators were developed to measure and evaluate performance. To the extent possible, given data source constraints, data were assembled to establish a quantitative information base.

- **Evaluated NCDOT against best practice.**

  In each of the business areas, NCDOT practices were evaluated against industry best practice. The best practice assessment drew upon Dye Management Group, Inc.'s prior detailed best practice surveys and analysis conducted as part of other engagements. This was supplemented in a number of cases by targeted best practice and benchmarking with neighboring states. It was also supplemented by drawing on industry standards for best practice such as those promulgated by the Project Management Institute[2] and other secondary sources that provide comprehensive assessment of best practices.[3]

[2] These are detailed in the Project Management Institute's "Project Management Maturity Model" and the Project Management Body of Knowledge, www.pmi.org.

[3] For example, Project Management National Study Results Conference, April 27-28, 2004, Miami Florida, organized by the Federal Highway Administration and the Florida Department of Transportation.

- **Development of recommendations.**

  An overall framework of management, organizational development, procedural, and reporting systems improvement recommendations are provided. Together these recommendations are intended to provide a pragmatic, readily implementable approach.

  Recommendations are developed that address:

  - Predictability, accountability, and communications for Transportation Improvement Program (TIP) delivery.
  - Overall project delivery process.
  - Specific process improvements to address bottlenecks and the causes of delay in the environmental process.
  - Specific process improvements to address bottlenecks and the causes of delay in consultant procurement and management.
  - Overall program management.
  - Overall program level human resource management and planning.
  - Organizational development to strengthen the application of project management principles and practice.
  - Project management information, metrics, standardized methods, and project management tools.

C. Study Oversight

The study was performed by Dye Management Group, Inc., an independent management consulting firm with specialized expertise in transportation agency project delivery and state departments of transportation business practices, for the North Carolina General Assembly. Study oversight was provided by the Joint Legislative Transportation Oversight Committee and their staff.

D. Study Structure

This report is organized into the following sections:

Executive Summary. This section briefly describes the findings and recommendations from the study of NCDOT's construction project delivery and opportunities for improvement.

Section I. **Introduction.** This section presents the purpose, background, and approach for the study.

Section II. **Findings and Recommendations.** This section provides the overall findings and recommendations.

Section III. **Project Delivery Performance.** This section discusses how well NCDOT is doing in delivering projects from the Transportation Improvement Program (TIP); that is, how long it is taking NCDOT to let projects from the time they are placed on the TIP and how accurate the 12-month let list is as a short-range plan for TIP delivery.

Section IV. **Analysis of Reasons for Delay.** This section provides detailed study findings as to the major reasons NCDOT is encountering delays in delivering projects. Findings are grouped in the categories of delays due to program complexity, environmental requirements, staffing issues, the acquisition of permits, and the use of consultants.

Section V. **Project Management.** This section describes NCDOT's current Project Management practices and provides a comparison of NCDOT's practices against industry best practices both within the transportation industry and as defined by the Project Management Institute.

II. Findings and Recommendations

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This section summarizes the overall findings and recommendations. Additional factual detail and substantiation of the findings are provided in subsequent sections. The findings and recommendations are grouped as follows:

- Predictability, accountability, and communications for TIP delivery.
- Overall project delivery process.
- Specific process improvements to address bottlenecks and the causes of delay in the environmental process.
- Specific process improvements to address bottlenecks and the causes of delay in consultant procurement and management.
- Overall program management.
- Overall program level human resource management and planning.
- Organizational development to strengthen the application of project management principles and practice.
- Project management information, metrics, standardized methods, and project management tools.

A. Predictability, Accountability, and Communications for TIP Delivery

These findings and recommendations address project delivery from the initial concept through the award of a construction contract unless otherwise stated. The study primarily addressed this phase of the project delivery process.

1. Findings

There is a need to improve the predictability, public accountability, and communications regarding the planned timing of project delivery and changes to the delivery plan.

Analysis finds:

- Poor communications and public accountability for delivery performance due to limited reporting of management information and project status information to policymakers and customers.
- Limited success in meeting the planned 12-month letting schedule.

- Widespread recognition that the TIP does not provide NCDOT with an accurate assessment of annual delivery plans.
- No management mechanisms for establishing and communicating a multiyear delivery plan departmentwide to customers and business partners or the accomplishments of such a plan.
- Little systematic and proactive communication of current delivery status and changes in status at the project and program level to policymakers, the public, and business partners.

2. Recommendations

Recommendation 1.1. Provide proactive and standardized delivery reports at the program and project level to policymakers, customers, and business partners.

The program level reports should report performance as measured by the program delivery metrics of schedule, budget, and scope management performance. The intent of this recommendation is to improve communications and accountability to policymakers and the public regarding project status. The reports should be provided to the Joint Legislative Transportation Oversight Committee on at least a quarterly basis. Examples of such measures would include the number and dollar value of projects delivered within the quarter and the fiscal year that they were planned to be delivered in, and the number and percentage of projects delivered within their planned schedules and budgets.

For project level status reporting, the recommendation is to provide summary level information that identifies planned delivery year, projects on schedule, projects at risk of missing schedule, and projects experiencing delay. This type of reporting would be summary level and could be on NCDOT's website to provide "at-a-glance" status overview information similar to, for example, Virginia's "Project Dashboard" (see Recommendation 8.2).

Recommendation 1.2. Revise the letting list process to improve accuracy and integrate with a multiyear delivery plan.

The intent of this recommendation is to address the current situation in which the planned let list changes considerably from month to month and many of the projects let differ from those specified in the published 17-month let list. This tends to undermine NCDOT's credibility among policymakers and partners; it also indicates weak management of delivery. The pressure to meet dollar value delivery targets is understandable, but best practice is to manage delivery from a ready date and then publish a let list from such a ready date. This enables consideration of market conditions, seasonality, combining projects, etc., all of which can result in lower bid prices and financial savings.

An approach to consider is the establishment of a multiyear delivery plan by year, with current year estimates of ready dates. From this, a tentative let list can be built by quarter, looking forward 12 months. With PMii (NCDOT's scheduling system) fully implemented and the basis for project scheduling, the 12-month delivery plan can be established as the current-year portion of a multiyear plan developed from scheduled projects.

Recommendation 1.3. Change the TIP structure to improve the ability to deliver projects as planned (See Recommendation 2.1).

The intent of this recommendation is to change the structure and broaden the function of the TIP. Currently, the TIP serves to obligate funds well, but it falls short when it is viewed by policymakers and NCDOT's customers as a delivery plan or a public commitment to deliver a project within a certain time period. When projects spend many years in the TIP without advancing, NCDOT is subject to heavy criticism. Further, NCDOT is set up for failure to a certain extent because, when a project enters the TIP, it is often impossible to determine the number of years before it will be ready to let.

The recommended change is to revise the TIP process so that there is a development portion and a delivery portion. The delivery element would comprise a multiyear delivery plan for projects after they complete a defined milestone in the delivery process. In the case of projects following the Merger 01 process, NCDOT identifies Concurrence Point 3 (selection of alternative) as a desirable starting point, but for other projects the milestone could be different. This would then allow for more accurate multiyear planning because both schedule and construction cost could be more accurately estimated at this point. This approach would also allow for enhanced multiyear financial planning and cash management because it would provide a multiyear delivery and expenditure component to the current NCDOT cash management system.

The multiyear delivery plan should be cash feasible, which means fundable based on forecast revenue streams. When this plan is established, it will require a one-time rebalancing of current TIP projects based on estimated delivery timelines and costs to construct. Although not quantified in this study, the rebalancing will likely find the TIP over-programmed because construction cost estimates used to establish the TIP represent on average about half the actual construction cost.

B. Overall Project Delivery Process

1. Findings

NCDOT's overall project delivery process makes it very difficult for the agency to be successful. The TIP provides a multiyear delivery plan that focuses primarily on a timeline for the obligation or commitment of funds. Further, these timelines and commitments are established in general terms without the necessary detail or the completion of initial environmental assessments that could provide for more accurate

scheduling. Consequently, in practice, NCDOT does not have a multiyear delivery plan that specifies by year when projects will be ready to let. Interviews indicate a widespread view that the TIP is unrealistic and includes many projects that can not be delivered in the indicated timeframes. Changes in the overall TIP process and the establishment of a multiyear delivery plan for NCDOT to organize delivery around and manage towards could address these issues.

Analysis finds:

- While NCDOT has an effective obligation plan, it does not have an effective multiyear project delivery plan.
- The current TIP process makes it extremely difficult to establish a multiyear delivery plan with any level of precision.
- The business process is not in place to establish a multiyear delivery plan and manage delivery against it.
- The Highway Trust Fund legislation and the equity formula provide barriers to project delivery.

2. Recommendations

Recommendation 2.1. Restructure the TIP so that it includes a development and a delivery component.

The objective of the recommendation is to change the process so that NCDOT does not commit to delivery timelines, costs, and scope until a higher level of project development has been completed than is currently the case. The recommendation establishes a development component of the TIP that involves more planning and environmental screening. The process change would not advance projects into the delivery TIP until there was agreement on the likely environmental conditions to be addressed and the mitigation and design approach to address them.

The intent of the recommendation is to establish the delivery TIP as a multiyear (perhaps 5-year), financially feasible project-delivery plan. The plan would be annually updated and provide the delivery commitment that NCDOT and elements of state resource agencies' performance is managed against. Once projects are in the delivery TIP, their scope, schedule, and budget would be managed and controlled. NCDOT has work underway to implement a new cost estimation process that incorporates risk analysis. In addition, there are cost estimating guidelines that identify appropriate times when cost estimates are updated. These procedures can be used to provide management and control oversight.

Some key considerations to be addressed in the development portion will be the interface between planning and project delivery. It will be important to establish a transparent planning and prioritization process for projects entering the development

phase to most effectively use resources. Ideally, a framework whereby eligibility for the development phase is driven off the identification of projects through state, Metropolitan Planning Organization, and rural planning processes could avoid this problem. NCDOT currently has a pilot project, US 421 Boone, which may provide insight to address this issue.

Recommendation 2.2. In conjunction with the Highway Trust Fund Study committee work, amend statute so that it does not predefine the cross section of intrastate projects as four lanes.

This recommendation addresses a significant delay factor that NCDOT experiences in delivering intrastate highway projects as defined in the statutes pertaining to the Highway Trust Fund which predefine the cross section as a four-lane highway[4]. This mandates a single-design solution which conflicts with the procedural requirements for federal environmental analysis; this can produce virtually unbuildable projects or extremely costly projects, and does not provide the opportunity for community and local input on preferred solutions. The intent of the recommendation is the consideration of legislative change to allow passing lanes, or other alternatives, where it would expedite delivery and result in major cost savings.

Recommendation 2.3. Evaluate alternative project delivery options and pilot their use through the Turnpike Authority

Given NCDOT's labor constraints and other factors, pilot the use of alternative delivery techniques that would entail the private sector performing and managing project delivery as well as construction. A good way to pilot this would be through the evaluation of alternative project delivery approaches for Turnpike Authority project delivery. The intent of the recommendation is to evaluate alternative procurement options and then pilot their use.

C. Specific Process Improvements to Address Bottlenecks and the Causes of Delay in the Environmental Process

1. Findings

NCDOT has implemented a number of business improvements, including improvement of working relationships with state and federal resource agencies. These changes are designed to establish upfront agreement on how environmental impacts will be minimized and mitigated by project designs. The study finds close collaboration with resource agencies that are now actively managing and measuring how long they are taking to issue permits. NCDOT is implementing other improvements in the environmental process that will help improve project delivery performance. However, without bringing greater discipline to the standardization and management of the project

[4] North Carolina General Statute: Chapter 136, Article 14, Section 136-178, Purpose of Intrastate System.

delivery process and the establishment of greater accountability within the environmental process both at NCDOT and among the resource agencies for the length of time, adherence to budgets, and scope management, NCDOT will not reap the benefits from the changes it has made.

Analysis finds:

- **NCDOT and resource agencies' management have established effective coordination mechanisms.**

  NCDOT and resource agency managers have established close working relationships to coordinate and better manage the resource needs for environmental review and permitting. The process improvements developed to streamline the environmental process have built-in coordination mechanisms.

- **North Carolina would benefit from the establishment of state-level policy objectives and performance measures for capital program delivery.**

  In addition to NCDOT, there are a number of other state, local, and federal agencies that are involved in the project delivery process. At the state level there would be strong benefit from establishing an overall set of policy objectives and performance metrics for delivery that incorporate environmental, quality of life, economic, and other delivery objectives. In this way, while NCDOT is primarily responsible for delivery, there can be overall statewide objectives that address environmental and other processes that are owned by all agencies and addressed in their business plans.

- **NCDOT has implemented many initiatives and embarked on other others to streamline the environmental process.**

  It is possible to point to over 50 separate improvement initiatives that NCDOT has proposed, implemented, or has underway that are aimed at improving the delivery process. However, there is limited enterprise (departmentwide or cross agency) coordination or prioritization of these efforts and no overall department-level or cross agency work plan which outlines and manages the dependencies (resources, scheduling, etc.) among these various initiatives.

- **For many of the process improvements, it is too early to quantify benefits through reduced delivery times.**

  Many of the descriptions of the improvement initiatives detail significant improvements already made. Among the potentially most significant improvements are:

  – The establishment of the Ecosystem Enhancement Program (EEP).

  – The development of the refined Merger Process (Merger 01).

- The development of green sheets that clearly identify and summarize environmental commitments for a project.

- **The Merger 01 process is viewed favorably by NCDOT and resource agency staff.**

  There is a general belief that the Merger 01 process will improve the predictability of project delivery schedules once a project reaches the point of having a preferred alternative (Concurrence Point #3). There is concern, however, that it is taking too long to reach Concurrence Point #3, because issues are front-ended that previously were not addressed until the permitting process was initiated. Primary areas of concern raised during interviews included:

  - A larger number of potential alternatives are being studied during the Merger 01 process for some projects than may be necessary, including some alternatives which clearly may not be feasible for technical, cost, or community preference reasons.
  - There is a need for a trained facilitator to lead Merger 01 discussions; currently, the NCDOT Project Manager is often asked to wear multiple hats in the Merger 01 meetings, such as representing the DOT views and community views from public involvement sessions, and also serving as facilitator.
  - There is a lack of defined timeframes for issue resolution. Staff appear reluctant to invoke the dispute resolution process since they need to continue to work together in the future, yet the lack of clearly defined timeframes for resolving issues creates the risk of issues sitting for significant periods of time.

2. Recommendations

Recommendation 3.1. Stabilize and further strengthen the Merger 01 process by:

- Establishing a procedures manual that specifies roles, responsibilities, and work products. Such a manual would include documented end-to-end procedures, guidelines, standards, and training for the Merger 01 process to all process participants. This includes, among others, NCDOT staff, DENR, US Fish and Wildlife, the Environmental Protection Agency (EPA), U.S. Army Corps of Engineers, SHPO, FHWA staff, and consultant engineers.
- Providing project coordination and management support (see Recommendation 7.1 through 7.4 on project management).
- Providing a facilitator for Project Team meetings.
- Providing additional structure to issue escalation through time-based triggers, with issues being escalated, for example, after the parties have worked together in good faith for 60 calendar days and/or two meetings have been conducted to resolve an issue.

The intent of this recommendation is to stabilize, reinforce, and provide organizational development support for the Merger 01 process. The recommendation should be implemented in conjunction with Recommendations 7.1 through 7.4.

Recommendation 3.2. Establish performance targets at the project and organizational levels for environmental activities in NCDOT, DENR, and other resource agencies.

Performance targets should be established for each project and for each activity within the environmental review process. In addition, a limited set of annual targets should be set for environmental review and project development at the overall department level. These targets should be carefully chosen to encourage staff to achieve desired results, and should drive important process improvement initiatives. Clear targets and consistent criteria and calculation methods for measuring performance against the targets should be established.

In addition, best practices should be developed to assist managers and staff in achieving the targets. Since cycle time is of primary concern to the Department and the General Assembly, indicators which most clearly relate to cycle time should be selected.

For example, if excessive time is being spent by projects completing Concurrence Point 4A (Avoidance and Mitigation), a target might be set to complete that Concurrence Point within 60 days. Each Project Manager should be accountable for meeting the project-level targets. Division-level directors should be accountable for achieving department-wide targets.

Recommendation 3.3. Establish a core set of state-level environmental objectives for the delivery of projects which addresses environmental excellence within acceptable cost and schedule constraints.

The intent of this recommendation is to define broad multi-agency objectives with respect to delivery and an associated score card. The intent is to make all agencies responsible for environmental excellence in highway building. This will require multi-agency agreement on acceptable cost and schedule constraints.

Recommendation 3.4. Establish department wide and cross agency (NCDOT and resource agencies) coordination of the various Project Delivery improvement initiatives.

The intent of this recommendation is to ensure that business improvement initiatives are coordinated and prioritized across functional areas. This is to ensure that NCDOT and its resource agency partners focus on the improvements that will have the greatest overall business benefits and address any dependencies between them. Implementation can occur by:

- Using recommended Program Delivery Management Committee (see Recommendation 5.1) to serve as a single multi-agency, cross functional

executive team to provide coordination, direction, and priority setting to all of the 50 plus Project Delivery Improvement initiatives.

- Assigning responsibility to the Project Delivery Program Office (see Recommendation 5.3) to manage, coordinate, and report status on all of the various Project Delivery initiatives.
- Establishing priorities through the Program Delivery Management Committee for these various initiatives. Consideration should be given to the impact of change on production and the need to stabilize the overall environment as part of this priority setting exercise.
- Establishing a detailed department-wide program level work plan which reflects these priorities and shows dependencies between activities and then reports status monthly to the Program Delivery Management Committee and periodically to other entities such as the Board of Transportation.

D. Specific Process Improvements to Address Bottlenecks and the Causes of Delay in Consultant Procurement and Management

1. Findings

Engineering consultants are heavily involved in delivering the program. They perform a variety of design, environmental, and specialized functions. This increased role is expected to continue. Therefore, the knowledge, skills, and abilities required to manage engineering consultants and the supporting policies and procedures have become an important element of NCDOT project delivery.

Between 2001 and 2003, 198 projects let (39 percent) involved engineering consultants at a total cost of $25.5 million. Data indicate a steady increase in their use. Currently, management roles and responsibilities for selecting, negotiating, and managing the consultant procurement process are fragmented. NCDOT is making changes to consolidate consultant procurement. The study finds that there are significant opportunities to reduce the time it takes to select and negotiate contracts. In a number of cases, the process takes as long as an average of nine months. By adopting practices used by other states, this can be reduced by up to eight months.

- **Compared to best practice, NCDOT spends a significant amount of time in contract negotiations and detailed management of consultant contracts.**

  From consultant selection to notice to proceed usually takes from four to nine months, with a small number of projects taking up to 18-24 months longer. NCDOT typically negotiates all aspects of contracts on a line item basis, negotiating on both hours, staff level proposed, and rates for the particular staff level. This negotiation process takes additional time and often delays approval of the contract by the Board of Transportation and the issuance of a notice to proceed.

Analysis finds:

- **Negotiations on cost and technical scope are performed by line project managers.**

  NCDOT project staff are responsible for negotiating all aspects of a consultant agreement including both technical scope, proposed resourcing, and cost. Best practice recommends that the project staff focus on negotiating scope and that trained, experienced procurement staff focus on the financial and contractual aspects of the negotiation.

- **Consultant contracts (project specific contracts, on-call contracts for specific functional expertise, etc.) are issued by numerous units within NCDOT.**

  A number of NCDOT units procure consultant services and manage various contractual vehicles including project specific and on-call contracts. NCDOT has proposed a Consultant Services unit within the Director of Construction function to help coordinate some of these efforts. As of May 2004, it is our understanding that this function will maintain a common consultant vendor file and a list of projects consultants who are performing for NCDOT, but will not be a centralized procurement function for NCDOT.

- **Consultant contracts are often issued for specific functional skills needed within a project versus turnkey contracts.**

  While turnkey contracts are issued, very often NCDOT may issue multiple consultant contracts for a particular project. For example, NCDOT may outsource the roadway design, but perform the Hydraulics and Bridge work in-house or choose to have a second consultant perform the bridge work through a project specific or on-call contract. In addition, PDEA may contract with one firm for work needed through completion of the EIS and conceivably Roadway Design may contract with a different firm to complete final design. This use of multiple firms and contracts within a single project creates additional complexity for NCDOT and the various firms and requires NCDOT to act as the integrator or Program Manager across the work of multiple consultants.

- **Changes to consultant contracts over $30,000 require Board of Transportation approval.**

  Whereas Construction Contract awards are only presented to the Board of Transportation (BOT) once, with NCDOT management having wide latitude to issue change orders against approved contracts, all consultant contracts over $30,000 and all changes to consultant contracts greater than 10 percent of the original contract value require BOT approval. This required BOT approval can substantially delay moving forward with a scope change on a project and thus impact the overall project schedule. In addition, it is questionable whether there is value in taking up BOT meeting time to address small, incremental scope changes to projects.

2. Recommendations

Recommendation 4.1. Simplify the consultant procurement process.

- Focus on negotiating contracts at the level of total scope (total effort and total budget) versus the level of individual line items, with the goal of reducing by 50 percent time spent negotiating individual agreements.
- Require engineering consultants to submit rates annually (as they do currently with overhead) to allow individual project negotiations to focus primarily on technical scope.

Recommendation 4.2. Establish a centralized procurement function to manage and administer all consultant contracts.

NCDOT should build upon the centralized consultant coordination function being established under the Director of Construction to create a more structured, centralized procurement function which would have responsibility for coordinating all procurements across all Project Delivery functions. This group would be responsible for issuing all procurements for both project specific and on-call contracts, receiving responses from potential consultants, coordinating the review of proposals by NCDOT technical project staff and managing the administrative and financial details of all contract activities. This function would also receive responses to task orders under on-call contracts and facilitate review of task order responses by the appropriate NCDOT technical staff.

The establishment of such a function will allow line project managers to focus on managing the technical aspects of project scope. As noted in Recommendation 4.1 above, this centralized procurement function would be responsible for negotiating the financial aspects of procurement, essentially the application of rates agreed to annually to a technical scope of work as finalized between the NCDOT line project manager and the consultant. This function would also be responsible for coordinating the administration and financial management of scope changes.

Recommendation 4.3. Simplify consultant contract approval processes

The Board of Transportation should delegate authority to NCDOT senior management (perhaps the Project Delivery Management Committee detailed in recommendation 5.1) to approve larger consultant contracts (possibly up to $200,000) and scope changes up to a larger, predefined percentage of the original contract value (for example 25 percent). Through this approach, NCDOT management could then report on actions taken at the next Board of Transportation meeting and allow project activities to proceed, rather than having project activity stop pending Board approval. This would be similar to construction contracts (significantly larger dollar amounts) where the Board approves the initial award of a contract, but NCDOT management has wide authority to approve change orders to the contract during the construction project. In addition, reducing the time the Board spends on approval of engineering contracts will allow the valuable Board time now used on this function each month to

be focused at a more strategic level, including reviewing the status of the highest priority projects and/or those projects considered to be at risk based on performance against plan (scheduled and budget).

E. Overall Program Management

These findings and recommendations address project delivery through the award of a construction project unless otherwise stated. The study primarily addressed this phase of the project delivery process.

1. Findings

There is a need for NCDOT to establish a more systematic or cross-functional approach to program delivery management and oversight at the senior management level. NCDOT has taken steps in this direction at the project level with the establishment of two TIP program manager positions and the partial reassignment of two other staff in the Director of Preconstruction and State Highway Administrator's Office to similar project coordinating activities. At the program management level, this means managing delivery across all the activities and disciplines required to deliver projects from a more integrated perspective. This also involves establishing a set of strategic objectives for program delivery, assigning management responsibilities for meeting them, and detailing the associated accountability mechanisms.

Analysis finds:

- NCDOT line managers have initiated many beneficial improvements from the perspective of their business area but NCDOT lacks an ongoing management mechanism to coordinate, prioritize, and determine the relative business benefits of improvements.
- There is not a senior management committee or team charged with the ongoing oversight, management, and control responsibilities for program delivery management.
- Currently the management, identification, and resolution of barriers to project delivery tend to be fragmented across functional areas and organizational units.
- Management lacks the type of information required for effective program- level management.

2. Recommendations

Recommendations 5.1. Institute a Program Delivery Management Committee to provide oversight, management control, and strategic direction for program management.

The intent of this recommendation is to integrate the overall management of delivery across the functional areas and disciplines that are required to deliver an individual project. To be successful, the team would need to include the appropriate senior management and be the NCDOT decision-making body regarding program delivery objectives, management, control, and oversight.

Recommendations 5.2. Establish measurable departmentwide strategic objectives for program delivery, an annual business plan for improvements, and management accountabilities for accomplishing them.

The intent of this recommendation is to position NCDOT to develop a stronger project delivery culture in which the organization as a whole takes on the ownership of the same set of strategic objectives for delivery, which are then reflected in their work priorities. They then should align their business improvement priorities against the strategic objective. Under this recommendation, the program delivery management team would own the accomplishment of the strategic objectives. They would also establish and approve the annual business plan for improvements. Individual line managers would then be accountable for accomplishing the improvements. This approach will integrate the management across the different functions and ensure that change initiatives address what is most important for the accomplishment of the strategic objectives. This will allow prioritization and budgeting for improvements across the functional areas. This is important because there are a limited number of change initiatives that can be absorbed by the organization and it is best to focus on those that have the least risk and greatest benefits.

Recommendations 5.3. Establish a Program Office for project delivery.

The function of such an office is not to run or manage individual projects but to be responsible for developing the project management discipline, controls, and procedures. The recommended program delivery office will own the overall policy, procedures, standards, and other support mechanisms. The office would provide program delivery management analysis to support the Program Delivery Management Team, support project managers/technical managers, and perform the organizational change management necessary to address many of the issues and recommendations in this study.

The function of the recommended Program Office is to provide program level and end-to-end project delivery information regarding barriers, bottlenecks, and risks concerning project and program delivery. The Office would own the procedural business rules through which projects are developed as opposed to the technical standards whether they are design, environmental, or other. Similarly, the Program

Office would develop and coordinate the application of performance metrics and project delivery management and control procedures.

The types of functions that the NCDOT Program Office would perform include:

- Providing lead staff support to the Program Delivery Management Committee.
- Reporting status against and updating multiyear delivery plans as changes to schedule and budget are approved.
- Developing, in conjunction with NCDOT and resource agency senior management and Human Resources staff, human capital management plans in support of agreed to the state level project delivery work plan.
- Monitoring and reporting project delivery metrics and progress against the multi-year delivery plan.
- Developing and publishing the management scorecard on a regular basis and providing information to NCDOT and resource agency senior management, the Board of Transportation, and the General Assembly.
- Owning the development, maintenance, and promulgation of the project delivery procedures manual.
- Designing, developing, and implementing management reporting and control tools (i.e., projects missing or at risk of missing key milestone dates, Merger Concurrence Point not reached in specified timeframe, etc.).
- Establishing and guiding implementation of a program and project level quality assurance and risk management process.
- Maintaining an inventory of all project delivery process improvement initiatives (environmental and other) and monitoring the ongoing progress of these initiatives based on priorities set by the Project Delivery Management Committee.
- Developing, monitoring, and updating the program-level work plan for all approved project delivery improvement initiatives to manage priorities and the resource interdependencies of these initiatives.
- Developing position description and leading implementation of enhanced Project Manager function/position at NCDO.
- Developing the NCDOT Project Manager Academy.
- Coordinating ongoing support and establishing priorities for enhancements of the PMii tool.
- Owning organizational development initiatives that strengthen the project management culture.

The unit would identify human resource bottlenecks in advance, evaluate options for addressing them, and bring recommendations to the Program Delivery Management

team. In addition, the unit could assess different improvement initiatives across technical areas to identify actions in one that might reduce time or save costs in another. These recommendations can be implemented most effectively if NCDOT strengthens the application of project management principles and standardizes project delivery processes and metrics (see Recommendations 7.2 and 7.3).

F. Overall Program Level Human Resource Management and Planning

1. Findings

There is an acute need for NCDOT to address human resource planning systematically at the program level. NCDOT is experiencing difficulties in retaining and recruiting staff in key units. There are bottlenecks in the project delivery process due to shortages of specialized expertise. There is little systematic program-level, human resource management and planning based on the quantified assessment of labor required to deliver the program and long-range trends in these labor requirements.

Analysis finds:

- **High rates of staff turnover in the units most critical for project delivery, which is considered an important contributor to project delay.**

  In the past three years, some key units have lost over 15 percent of their employees. In all cases, recruiting has lapsed so that vacancy rates are 20 to 40 percent. NCDOT staff turnover has been identified by a number of interviewees as being a significant issue impeding project delivery. Many interviewees are concerned that NCDOT is practically a training ground for private engineering firms, with staff remaining four to five years and leaving after achieving their Professional Engineering designation. The rate of turnover was identified as an especially critical issue in the Project Development and Environmental Analysis Branch (PDEA) and the Roadway Design Branch.

- **Loss of senior and more experienced personnel.**

  Interviewees point to the loss of NCDOT's intellectual capital through the retirement of experienced staff. Staff members with 20 to 30 years of experience are leaving NCDOT, and these departing staff members are typically replaced by staff with substantially less experience. This has exacerbated the retention issues.

- **Difficulty in filling specialty positions.**

  NCDOT has consistently experienced difficulties in recruiting and retaining specialty positions which perform critical path functions within the Project Delivery process. Two examples are Historical Architects (who may not typically see working for a Department of Transportation as their first choice of employer)

and biologists certified to perform mussel screenings and surveys who have left for the private sector once they have attained key certifications.

- **Difficulty in filling vacant positions with the right skill set due to pay scales.**

  Interviews with NCDOT and DENR line managers consistently cited their view that a lack of salary competitiveness is a major barrier to being able to attract and retain qualified staff. This salary disparity was not only with the private sector, but also with Federal and local government agencies.

- **Absence of formal or informal succession planning.**

  There is an absence of either formal or informal succession planning at NCDOT. A number of examples were cited where no proactive planning, including temporary back-fill strategies, appears to be taking place to address potential succession in mission-critical positions.

2. Recommendations

Recommendation 6.1. Conduct overall multi-project program delivery resource assessment. Establish management level responsibility for human resource management and assessment and prepare multiyear plan.

This recommendation involves NCDOT conducting program-level human resource management and planning. The approach would establish work standards that specify the labor required to deliver PMii scheduled projects following the standardized project delivery process. This information could then be used to resource load the recommended delivery TIP (see recommendation 2.1) which could then be compared to NCDOT staffing levels to determine labor needs and bottlenecks.

The plan should also establish the basis for addressing any long-term trends in the amount of labor and the technical disciplines required by NCDOT for project delivery. It should also include an assessment of how to most effectively apply consultant labor based on these needs. Issues to address are the levels of staffing required in technical disciplines to maintain core competencies and other factors. The plan would also include strategies for managing employee recruiting and retention issues.

Recommendation 6.2. Remove, at least on a temporary basis, restrictions on the maximum amount retired staff can earn to encourage retired engineers and other former NCDOT staff to work full-time with NCDOT in temporary positions.

This temporary measure is designed to address the difficulty that NCDOT is experiencing in filling vacant positions that are critical for project delivery. Increased use of retired staff lessens impact of exodus of knowledge capital in the short term. As of May 2004, legislation to remove this cap is currently pending in the General Assembly.

Recommendation 6.3. Address as a priority the organizational development and training needs of an organization with new and less experienced employees (addressed through Recommendations 7.2 and 7.3).

These recommendations establish a core set of standardized project delivery processes and improved documentation of these processes. In addition, there needs to be structured training and team building for new hires. The intent of the recommendation is to provide procedures documentation that new employees can use as a basis for performing their jobs. Currently, there is no procedures manual. Such manuals are not technical but procedural, describing the roles, responsibilities, and accountability for project delivery activities. Development of standardized project delivery processes and project delivery manuals will lessen the impact of learning curve for employees with less knowledge and experience.

Recommendation 6.4. Provide line managers with headcount and retention metrics/responsibilities.

The purpose of this recommendation is to ensure that line managers report on performance with respect to filling positions and retention. The intention is to elevate the importance of personnel management for line managers and to define their roles and responsibilities for NCDOT to meet its overall human resource management and planning objectives. An issue to be addressed as part of implementation is how to elevate human resource management by technical managers within the constraints that NCDOT operates under. In this area, as in a number of others, NCDOT may need to pursue changes to statute to implement the recommendation most effectively.

Recommendation 6.5. Conduct compensation review of key discipline areas, recruitment, and retention strategies. Establish incentive payment mechanisms.

This review could incorporate NCDOT's recent salary review but should also identify areas where legislative change regarding compensation, classifications, and incentive payment programs would have business benefits. Although NCDOT may be constrained by statewide practices, among the approaches whose feasibility should be examined are:

- Student loan pay-off programs based on years of service for in-demand and difficult to recruit skill areas such as biology and historical architecture.
- Automatic pay step increase (supplement) for attaining critical certifications for biologists and other scientists.
- Establishing incentive payment mechanism pools for project team members for meeting project schedules and budgets funded by partial savings in construction costs today versus in the future. The bonus program implemented on a limited basis for maintenance workers in the past, for example, helped to substantially improve crew productivity.

- Establishing incentive payment mechanisms for NCDOT middle management and resource agency staff based on meeting program level work plan goals.
- Automatic salary step increases for achieving in-demand certifications (mussel surveys, etc.) to encourage resources attaining critical certifications to remain with the State.
- Requirements for staff to pay back training costs if they leave within one year after getting a certification that NCDOT paid for.
- It is recognized that some of the changes to use incentives will require legislative action. However, the General Assembly action enabled NCDOT to make small incentive payments in the maintenance which have yielded very large savings.

Recommendation 6.6. Establish process and expectation that program managers monitor, anticipate, and address human resource bottlenecks.

The intent of this recommendation is to ensure that resource constraints due to conditions external to NCDOT, such as market conditions which affect the availability of private sector partners or changes in regulatory requirements, are managed in advance. Managing these external risks should be the program manager's responsibility.

Examples of this type of program management responsibility would include:

- **Mussels.**
  - Meeting with licensed mussel specialists in neighboring states to encourage them to establish operations in and compete for business in North Carolina. For staff certified in other states, there would be a substantially reduced time to gain licenses in North Carolina.
  - Allowing NCDOT staff to perform mussel screenings would expedite those projects where mussels are not identified during the screening process. This would better focus consultant resources on those projects actually requiring mussel surveys.
- **Right of Way Appraisal.**
  - Requiring adherence to specific response times for providers to remain on on-call contracts. This approach would require on-call service providers to commit to a timeline within 5 days. After 5 days, the next vendor would be asked. As part of managing these resources, establish a review mechanism would be established that rates timeliness of response to service needs. If on-call appraisers do not meet certain thresholds, they would be removed from consideration for a fixed period of time.

Recommendation 6.7. Establish work standards and turnaround times for State Historical Preservation Office (SHPO) and NCDOT activities for historical architecture (Section 106) reviews, estimate annual resource needs, and establish a strategy for bottlenecks.

This recommendation should be implemented in conjunction with Recommendations 3.1, 3.2, and 3.4 to establish work standards and turnaround times for review and approval activities by all resource and regulatory agencies. In the specific area of the work of SHPO to address bottlenecks, the recommendation identifies the following elements for implementation by SHPO and NCDOT:

- Establish work standards and turn around times for SHPO review. These should be part of the job requirements for any positions funded by NCDOT so that the business benefits of funding the positions can be measured and the labor force requirement accurately assessed.
- Evaluate staffing needs in this area at both NCDOT and SHPO as part of the program level human resource management. This will provide a forward assessment by year to help determine whether staffing needs are temporary or permanent.
- Based on the prior analysis steps listed above, provide additional needed positions within NCDOT or at SHPO funded by NCDOT.

G. Organizational Development to Strengthen the Application of Project Management Principles and Practice

These findings and recommendations address the need to establish a stronger project management culture and apply project management principles within NCDOT and to the tasks performed by the resource agencies.

1. Findings

NCDOT faces the need for organizational development that strengthens the application of project management principles while, at the same time, addressing the high level of turnover and loss of experience among the project delivery staff. This situation makes the recommended organizational development more important and yet at the same time more difficult. Within NCDOT, there is fairly weak accountability for, and ownership of, project delivery against planned schedules, scopes, and budget. NCDOT has initiated changes by establishing project management responsibilities within PDEA and preconstruction; however, considerable change is necessary to establish a stronger project management culture and develop the project management discipline within NCDOT. For example, from the time a project enters the TIP through letting, there is no systematic process for establishing a project delivery budget and schedule and then managing to this across all project phases.

Analysis finds:

- NCDOT has made organizational changes that give greater visibility to project management by establishing the TIP Program Manager positions in PDEA and Preconstruction; however, incumbents of these positions are more information gatherers and expediters than line project or program managers with clear authority and responsibility. Thus, organizational development is now needed that specifies more fully what it means to be a project manager and how projects will be managed, and responds to the following issues:
- The lack of consistent and standardized project management methods and tools.
- The lack of defined and documented project delivery process that specifies roles, responsibilities, and accountabilities for project schedules, scope, and budget.
- The absence of recruiting, training, and professional development programs for project management knowledge, skills, and abilities.
- The large turnover among the more experienced project delivery staff that has impacted organizational knowledge regarding individual projects and NCDOT's practices.

2. Recommendations

Recommendation 7.1. Build on the recent organizational change establishing TIP Program Managers by making current PDEA and Preconstruction project manager positions:

- **Positions dedicated solely to project management responsible for scope, schedule, and budget management.**
- **Separate project management duties from technical work tasks.**

The purpose of this recommendation is to build on the recently instituted organizational changes by dedicating these positions to project management. The recommended change addresses study conclusions that there is simply too much project coordination, project communications, and interim deliverable management required to keep projects moving for project managers to be doing detailed technical work as well as managing the project. The project managers will provide the primary point of contact for the project and manage the deployment of technical and other resources through the delivery process. The positions should be held clearly accountable and responsible for project schedule, scope, and budget management. To accomplish their role, project managers would deliver projects by applying standardized procedures and using the scope, schedule, and budget management controls and procedures developed through Recommendation 7.2. In implementing this recommendation, it is important not to reduce the current level of technical staff resources.

Recommendation 7.2. Strengthen project management practices by establishing standardized business rules, roles, and responsibilities for project delivery and then codify these in a project delivery manual.

The intent of this recommendation is that NCDOT establish documented policies and procedures for project delivery. These should address roles, responsibilities, policies, and procedures for project delivery. The results when codified in a project delivery manual will provide a guide for NCDOT employees. In addition, the procedures and responsibilities need to be understood, communicated to, and applied consistently across different organizational units. The need for this is magnified by the high turnover of employees. At present, it is difficult for new employees charged with managing a project to know if they are delivering or managing a project according to NCDOT's procedures.

NCDOT has recently initiated work involving Transportation Planning and PDEA to develop this type of a manual. The initiative should include all components of project delivery from project inception through construction, and focus on establishing standardized business rules for project delivery, roles, and responsibilities. The manual should identify tools for project managers to use and standardized status reporting methods. In addition, this manual should be completed as soon as possible as a top priority of NCDOT and its partner resource agencies.

Recommendation 7.3. Establish a project management discipline development program for NCDOT employees that recognizes project management as a professional discipline and provides employee development and training to strengthen the project management discipline at NCDOT.

The knowledge, skills, and abilities required to be a successful project manager can be very different from those required to be a good engineer. NCDOT does not have in place mechanisms to recruit and develop employees based on project management skills. Nor do they have employee classifications that address the project management discipline, recognize professional certification, and require continuing education such as for accountants or engineers. The intent of this recommendation is for NCDOT to recognize the importance of developing the project management competency of its employees. The recommended approach is to provide professional development and training through the following elements:

- **Training for project managers, technical managers, and NCDOT partners on NCDOT's project delivery procedures as developed through Recommendation 7.2.**

  The procedures developed and documented through Recommendation 7.2, will specify roles and responsibilities for project delivery. They will explain how projects are delivered the NCDOT way. Training and communication will be required so that NCDOT and its business partners have a common view and understanding of this.

- **An annual NCDOT project delivery academy.**

  This academy would provide an annual North Carolina specific project management curriculum that covers NCDOT's policies, procedures, and revisions.

- **Project manager's training requirements.**

  This element identifies a core set of training courses that new NCDOT project managers would be required to attend over a fixed time period. The requirements could be established by the program delivery management support unit. The courses would address the basic elements of the project management discipline and address the leadership, project team management, and communication skills (the softer skills) that are key to success. It is anticipated that project managers would attend commercially provided courses that are periodically available in the state and that, on occasion, NCDOT would purchase the course offerings.

- **Provide support and recognition for Project Management Institute certification for project managers.**

  This element of the recommendation involves establishing a mechanism for supporting project management institute certification by NCDOT project managers. This would further develop project management as a recognized discipline at NCDOT.

Recommendation 7.4. For the most complex and/or highest priority projects, pilot a dedicated delivery team approach.

This recommendation is an extension of the TIP Program Manager positions that have been established. For complex projects, team members would be drawn from key functional units and assigned to project delivery teams, with clear accountability for project activities in their functional areas and with a clear reporting relationship to the assigned project manager. Functional resources would report back to their functional units on a matrix basis only, essentially from a quality assurance perspective.

H. Project Management Information, Metrics, Standardized Methods, and Project Management Tools

1. Findings

There is very little consistent and reliable management information regarding project scope, schedule, and budget that NCDOT management can use to provide oversight and control of program delivery. In many cases, basic project management information relating to a project's estimated costs or delivery schedule and actual schedule is not available. Further, this lack of information impedes the systematic identification and removal of barriers to the timely delivery of projects.

Analysis finds:

- **That there is little management information available for program and project delivery management.**

  As illustration, it required a major research effort and much assistance from NCDOT staff to develop the information reported in this study. Even then it is not possible to fully evaluate NCDOT's project delivery outcomes against scope, schedule, and budget.

- **NCDOT does not have a set of metrics for measuring, managing, and monitoring project delivery performance.**

  In the most basic terms, a purpose of this study has been to evaluate project delay; however, there is no basis for evaluating project delay because there is no organizational agreement or statement of how long a project should take. More broadly, NCDOT has not established a set of project management or overall program delivery metrics. The sole measure used and reported on the website is the dollar value of construction let.

- **NCDOT senior management, technical managers, and project managers have differing understandings and expectations about the outcome from PMii implementation.**

  NCDOT has made a large investment in implementing a new project management information system (PMii) to support project scheduling. NCDOT staff do not have a common understanding of the role of PMii, or near-term risks and benefits of its implementation. In short, PMii has been implemented as a scheduling system. It assumes that NCDOT projects will be delivered following a set of business rules and procedures that we are not convinced are understood well enough to be followed on all projects.

  While PMii will provide a robust tool for project scheduling, there is uncertainty regarding the readiness of project managers and technical managers to use it to manage schedules. If trained, they can use it to report schedule accomplishment and consequently track status. PMii will not provide the information required to support resource loading, budget, and cost management.

- **Study findings raise strong concerns about NCDOT's organizational readiness to use PMii.**

  In short, PMii is a technically sophisticated system and is being implemented to support the project scheduling system. It is not clear, however, that the organizational change management has occurred that NCDOT project managers and technical managers need to be ready to use PMii to support project management. It is also not clear that NCDOT is ready to institute the business changes explicit within PMii across the organization. For example, PMii has established a number of scheduling paths for different types of projects based upon different networks.

- **Institutionalization of PMii will likely be difficult.**

  PMii initially went into production beginning in mid-May 2004. To date, the dedicated PMii team has consisted primarily of retired NCDOT staff and outside consultants, with only one full-time NCDOT team member. As of mid-May, many of the NCDOT project managers who are the most likely candidates to use PMii are not familiar with the project delivery process, delivery network, and milestones upon which it is based. It appears that there are a number of business improvement and organizational change issues affecting PMii that still need to be resolved. For example, who will use PMii and what are the expectations for how they will use it.

- **PMii only addresses project scheduling, and project and program management information is required on project budgets and scope.**

  To manage individual projects and overall program delivery, NCDOT managers, and especially the recommended Program Delivery Management Committee (see Recommendation 5.1) require the following types of information:

  – Estimated construction costs of project at major milestones. This involves preparing a periodic update of the estimated construction costs because costs change during project delivery. Updated cost information across the program of projects will support financial planning, programming, federal funds management, and scope management.

  – Labor resource budget to accompany project schedules for major project delivery work activities. To manage individual projects as well as the overall program, the recommended NCDOT program delivery management team needs to know in at least a broad sense the amount of labor required by discipline and when. This knowledge of labor needs would be used to establish and manage preconstruction budgets and ensure there are no bottlenecks.

  There is currently no mechanism or plan for developing this information even though it is an important requirement for strengthened program and project management.

- **Opportunities to increase the use of standardized tools, templates, forms, and checklists for project management.**

  Standardized tools such as templates for key deliverables available online offer great opportunities to improve project delivery efficiency and expedite delivery. Implementation of Recommendation 7.2 calling for the establishment of a project delivery procedures manual should be extended to establishing deliverable templates that different technical disciplines, as well as all design consultants, could use.

2. Recommendations

Recommendations 8.1. Conduct an expedited organizational readiness assessment; then establish and implement a change management plan for PMii.

The intent of this recommendation is to address the risk factors identified through this study regarding the use of PMii to support improved project management. The change management plan to be successful needs to ensure that changes in business practices for PMii are defined and implemented. Further, where changes in work performance and procedures are necessary for PMii to provide the basis for project delivery scheduling and execution, a plan for expedited implementation should be established. Strong consideration should be paid to making the recommended Program Management Office the business owner for PMii and associated project scheduling support.

Recommendation 8.2. Design and implement a reporting system for program and project management monitoring and control.

This recommendation is to provide for the monitoring of project status against schedule, budget, and scope. PMii implementation will not provide this information. The recommended approach is to monitor the status of projects against no more than seven major milestones and to provide exception level reporting. The system would require all project managers to measure and report status using a consistent methodology at these milestones. This type of information would provide rolled-up multi-project, program-level information on the cost to deliver the projects as programmed, updated project delivery schedules, and other key information. The information could then be used by the Program Delivery Management team to support their oversight role for project control. In addition, summary-level project status information should be provided on NCDOT's website like Virginia does with their "Project Dashboard."

The recommended reporting system requires the prior implementation of Recommendation 7.2 which establishes standardized business rules, roles, and responsibilities for project delivery. The reporting system would store and report the standardized project status information using the procedures specified by this recommendation. NCDOT has work underway to design and implement a high-level reporting system. This should be expedited and reports provided in short order in advance of any automation.

Recommendation 8.3. Stabilize the use of PMii to support scheduling, establish a management-level reporting system before further adding to PMii or instituting other information technology projects.

This recommendation will enable the PMii team to focus on production support and enable NCDOT to use a project scheduling system effectively. It also recognizes that any further information technology initiatives should be business-driven with quantifiable benefits based on the reduction in cost and project delivery time

anticipated from their implementation. Projects should be identified and prioritized through the recommended Program Delivery Management Committee.

I. Utilities and Right of Way

1. Findings

- **Some 13 percent of projects were let with limitations of operations which can delay construction.**

  The main reason that projects are being let with limitations of operation is due to utilities not being moved from the right of way prior to letting. This can occur for a number of reasons. Projects let with limitations of operations because utilities have not relocated have an average delay in the start of construction of 2 months.

- **The actions of privately owned utilities, over which the NCDOT has no direct control, are causing project delays.**

  Privately owned utilities in North Carolina must bear the costs of engineering utility relocations as well as their construction costs when they are in the state owned right of way. Private utilities' own financial considerations and management practices have made it more difficult for these utilities to relocate their facilities in a timely fashion.

2. Recommendations

Recommendation 9.1: Establish incentives to induce utilities to relocate their facilities in timely fashion

Utilities' priorities and timing for meeting their legal obligations to relocate prior to construction do not always align with NCDOT's. Some utilities cite the financial burdens they face as constraints on delivering all of the relocations for which they are responsible. Both incentives and disincentives should be used to reduce delays and the attendant cost overruns associated with slow utilities relocations.

Incentives could include paying part of the costs of utilities relocation. For instance, the NCDOT might pay for (or contribute as in kind services) the engineering required prior to physical relocation. The utility would be responsible for the cost. The approach is not unprecedented; it has been used with some success in Maryland. Though this approach would involve additional costs for NCDOT, it would improve its control over the project delivery process.

The recent AASHTO publication entitled "Right of Way and Utilities Guidelines and Best Practices" provides additional areas of best practice that NCDOT should evaluate the business case for implementing.

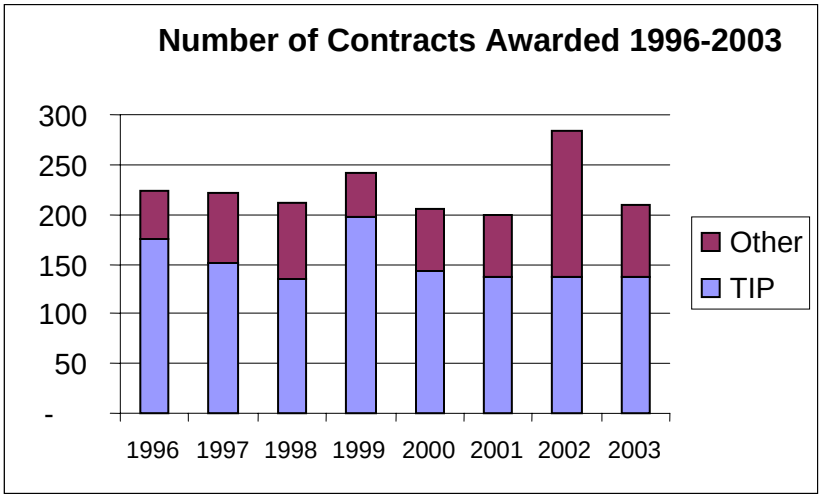
III. Project Delivery Performance

This section describes the study findings in regards to the accuracy and predictability of the TIP and the 12-month let list, NCDOT's performance in budget and scope management, the tracking of preconstruction and construction schedule and budget against plan, and environmental streamlining and permitting metrics.

The NCDOT delivers on an annual basis over $1 billion in construction contracts per year. The information most frequently reported is the number and dollar value of contracts let. The values for the period between 1996 and 2003 are shown in Exhibit III-1 and Exhibit III-2 below.

The number of TIP projects is distinguished from all constriction projects. Non-TIP projects include "Moving Ahead" projects, secondary road improvement program, and Senate Bill 1005 among others.

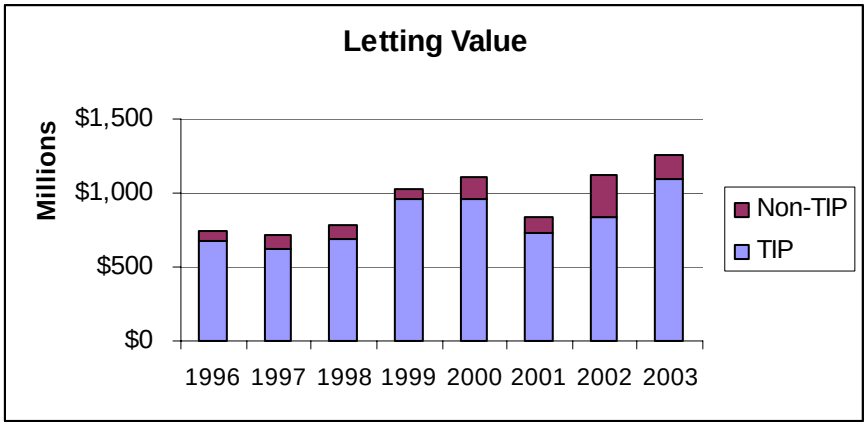
Exhibit III-1: Construction Contract Awards, 1996 to 2003



Source: NCDOT project award data http://www.ncdot.org/business/

The non-TIP projects tend to be smaller in dollar value. The dollar value of TIP projects was at its greatest in 2003.

Exhibit III-2: Value of Construction Contract Awards, 1996 to 2003



Source: NCDOT project award data http://www.ncdot.org/business/

The information presented in these exhibits indicates an increase in the overall amount of projects delivered. This study evaluates how long it is taking to deliver the TIP projects and the overall effectiveness with which NCDOT is meeting its delivery commitments as detailed in the TIP and 12-month letting list. The following sections provide detail on the results of this analysis.

A. TIP and the 12-Month Let List

This section provides baseline information that addresses:

- How long it is taking from the time projects first enter the TIP to the time they are let.
- The accuracy of the 12-month letting list as a short-range plan for TIP delivery.

The TIP is NCDOT's programming document. Programming is the process by which projects are selected and funds committed. The major work activity is the selection of projects for inclusion in the six-year TIP and the annual update. The selection of projects is constrained by the availability of funds. The availability of funds is determined by the eligibility of projects for federal funding and/or highway trust funds and the highway trust fund equity formula.

In short, the TIP process has been used primarily to manage the obligation of funds, providing a plan by fiscal year for obligating funds.

1. Issues

The following are the principal issues that have been raised regarding the time it takes to deliver projects:

- Concern regarding the length of time from inclusion in the TIP to delivery.

- Lack of clarity regarding the TIP as a mechanism for committing funds rather than program delivery planning.
- The limited relationship between the planned/published TIP and actual delivery dates.
- Concern regarding the accuracy of the 12-month let list as a short-range delivery plan.
- Concern that NCDOT cannot be successful in meeting TIP schedules for reasons outside its control.

Projects are programmed and delivery dates identified before it is possible to establish a level of precision. This lack of precision adversely impacts NCDOT credibility and creates a culture in which employees believe the TIP is not very accurate as a delivery plan and, therefore, that it is organizationally acceptable to change delivery dates frequently with only limited accountability for those changes.

A major reason for these challenges is the lack of budget and schedule predictability at the time of programming of the project into the TIP, because at this stage the level and extent of the environmental document required is not known.

2. Approach

The analytical approach involved evaluating the following indicators:

- The length of time from when a project first entered the TIP to its let date for a sample of 484 projects[5] let between January 1, 2001 and December 31, 2003.

  This indicator was measured by identifying the year and month when projects first entered the TIP from hard copy documents maintained by NCDOT. Adjustments were made to account for those occasions when projects were split or combined during the delivery process.

- The number of projects listed in the 12-month let list that let within a quarter (3 months) of their planned let date.
- The number of projects let later than 1 year after their planned let date as shown in the 12-month let list.

3. TIP delivery

- Some 59 percent of projects take upward of 8 years to let after they enter the TIP.

  Exhibit III-3 provides summary data by type of project on the length of time from when projects first enter the TIP until they are let. This chart may include some projects that enter the TIP as post year dates with no assigned funding. This

[5] Throughout the report, the sample size for various elements of the analysis differs. This is because adjustments were made to exclude projects where data were not available or the data appeared inaccurate. Adjustments were also made to account for the splitting or combining of projects during the delivery process.

will tend to increase the average length of time taken. However, NCDOT's customers see a project that just "sits" in the TIP and equate this with delay.

Exhibit III-3: Length of Time from Year of TIP Inclusion to Let Date – 430 Projects Let January 1, 2001 to December 31, 2003.

	Number of Years									
	0-4 Years		4-8 Years		8-12 Years		> 12 Years		Total	
Type of Project	No.	%	No.	%	No.	%	No.	%	No.	%
Bridge	1	1	98	40	134	55	9	4	242	100
Interstate	21	61	5	15	2	6	6	18	34	100
Rural	35	38	5	5	14	15	46	42	92	100
Urban	7	10	14	23	20	33	21	34	62	100
All projects	54		124		170		82		430	

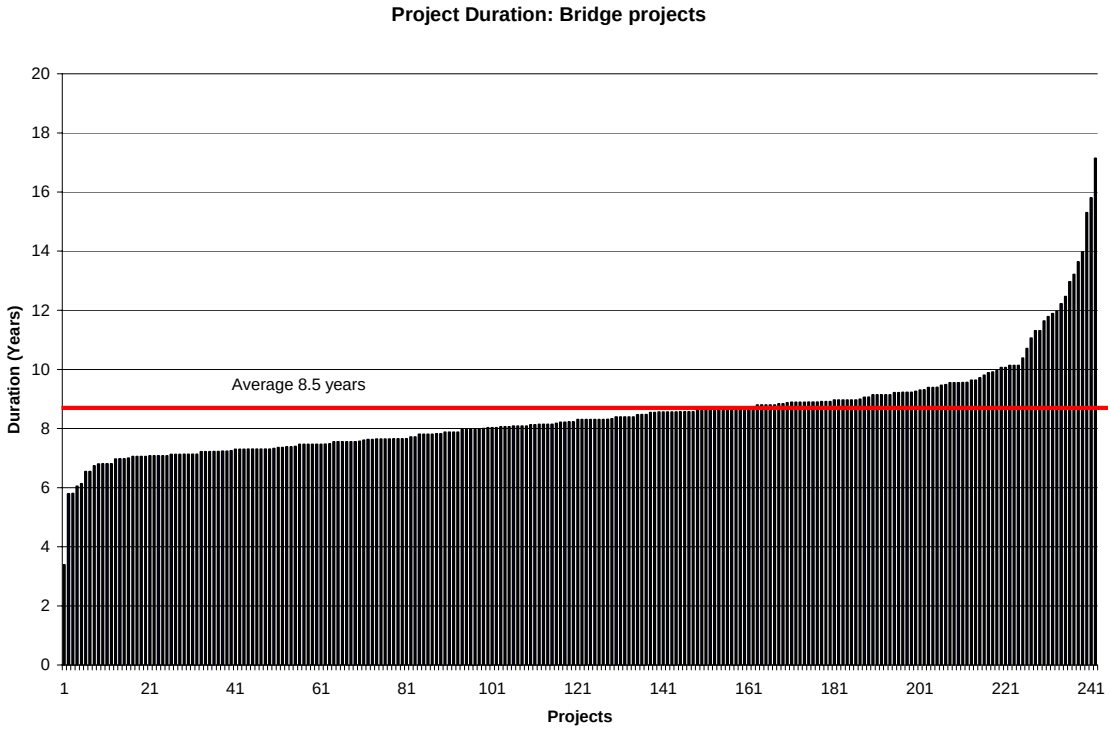
Source: Project Master Scheduling System, TIP Programming Key, and NCDOT files.

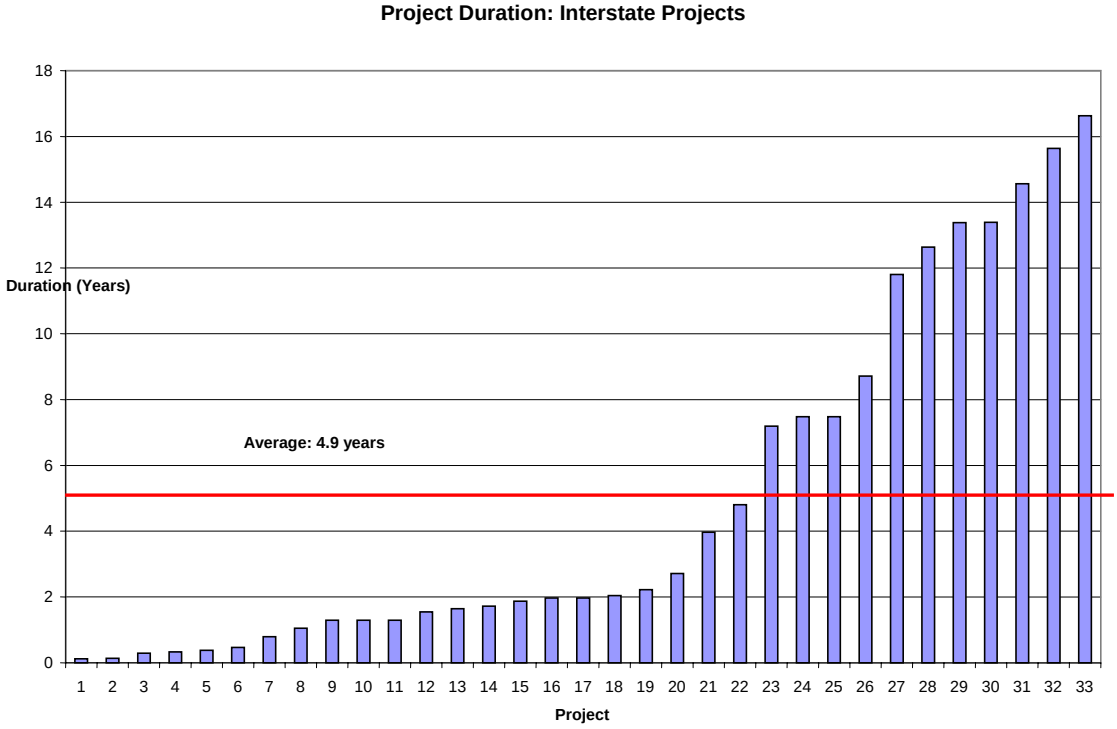
Duration by Project Type (TIP to let date):

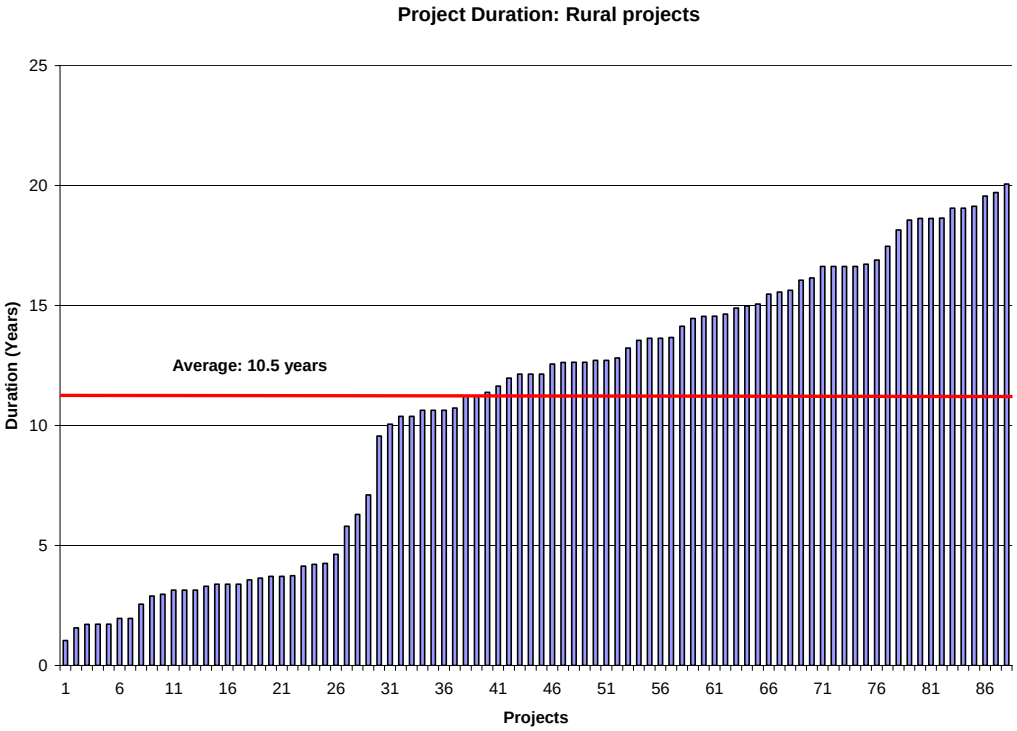
- Rural and urban projects are taking the most time; a third of all urban projects take over 12 years.

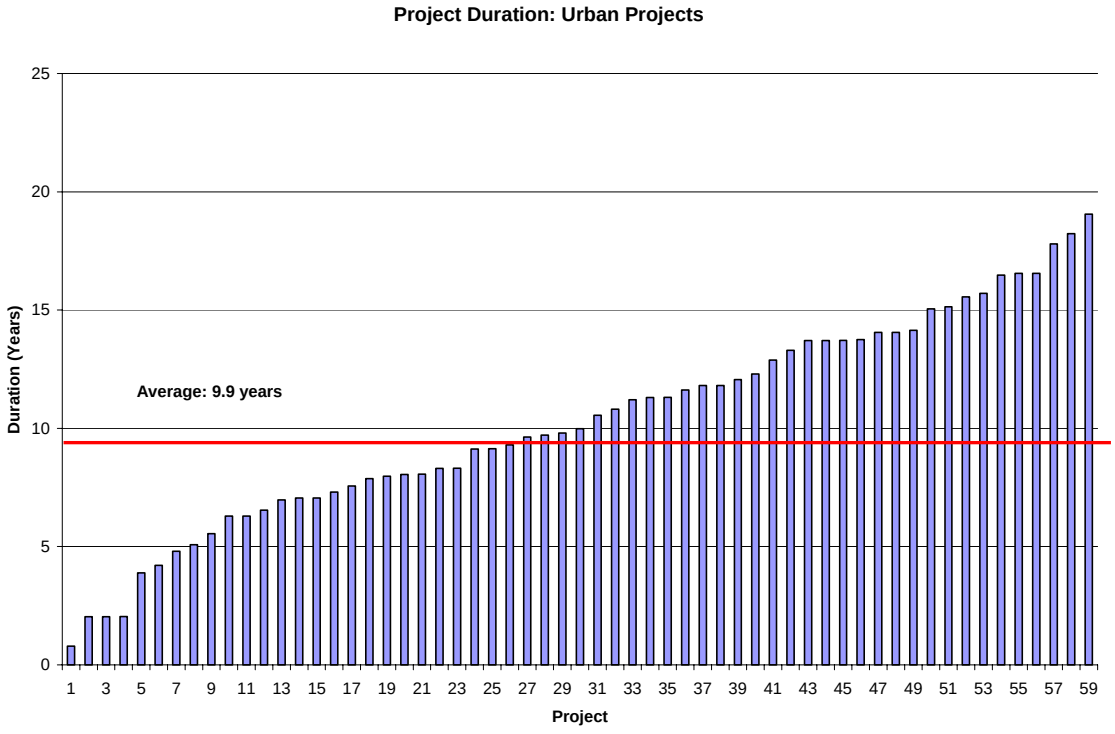
  Exhibit III-4 shows the distribution of project durations from TIP inclusion to let date by type of project. Over two-thirds of rural projects took over 10 years and over one-half of all urban projects took 10 years.

Exhibit III-4: Distribution of Project Durations from TIP Inclusion to Let Date









Source: Project Master Scheduling System, TIP Programming Key, and NCDOT files.

4. Delivery of the 12-Month Let

Every month, the NCDOT scheduling unit publishes a 12-month let list containing a month by month list of the TIP numbers and the dollar value of projects to be let. This listing is the 12-month delivery plan for NCDOT and is updated every month. The 12-month let list provides the organization-wide focus for NCDOT's work in completing the final project delivery tasks necessary to enable projects to be delivered in the planned time frame. NCDOT performs a 13th month review that is designed to keep projects off the let list that are not ready.

The let list also is a published delivery plan for NCDOT's customers and business partners. There has been repeated concern on the part of these organizations regarding NCDOT's performance in meeting the delivery commitments specified in the let list.

a. Analysis Approach

The analysis approach was designed to evaluate NCDOT's performance in meeting the planned letting schedule (let list). The following analysis steps were undertaken:

- To determine if projects were let according to schedule, a project's letting schedule or planned let date was compared to award date using the following indicators:
  - The number and percent of projects awarded within one quarter (three months) of the planned let date. This was established as a reasonable benchmarked because it should be possible to forecast delivery within three months, one year in advance of the project.
  - The number and percent of projects awarded with more than one year delay.

The following data sources were used:

- Monthly let lists July 2001 through February 2003.
- Monthly award results August 2001 through April 2004.

Monthly let list information was provided by NCDOT personnel whereas award results were obtained from the NCDOT Web page (http://www.doh.dot.state.nc.us/preconstruct/highway/dsn_srvc/contracts/letting.htm).

When the letting schedule was compared to the award date, analysis found an average 17-day lag between the time a project is actually let and the time it is awarded. In other cases, projects are advertised but proposals rejected. These projects typically are re-advertised and awarded the following month. To account for these cases and to provide a wider window for delivery success a project was

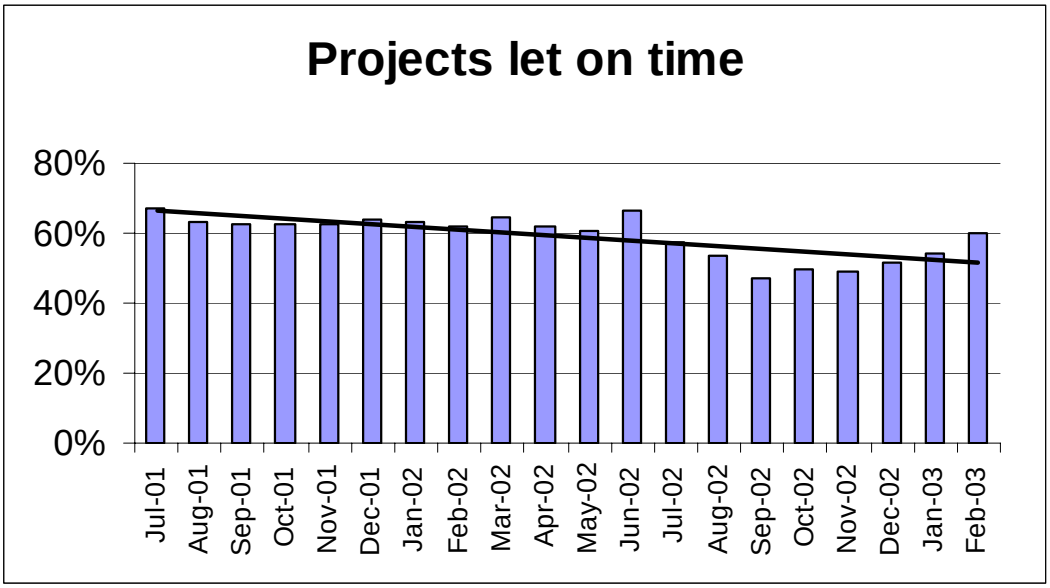
considered to be let within the planned delivery schedule if it was awarded within one quarter (three months) of the published letting date.

b. Findings

- **60 percent of projects are let within one quarter of their planned delivery date.**
  - Overall NCDOT's performance in meeting the planned letting schedule has remained fairly constant.
  - The number of advanced projects was not significantly large to impact the letting accuracy.
  - Projects that were advanced averaged only 1.3 months ahead of schedule letting across all months.

  Exhibit III-5 measures NCDOT's performance in delivering projects specified on the let list within one quarter of the specified month. Each bar in the graph represents the performance in delivering that month's letting schedule. Let list performance was computed by dividing the number of projects awarded within 3 months of the planned date by the total number of projects. For example, for the first month (July 2001), the total number of projects from August 2001 through July 2002 awarded within three months of each planned month divided by the total number of projects in the July let list (93/150) to indicate a 62 percent success rate. Exhibit III-5 indicates a slight decline in the accuracy of each month's let list.

Exhibit III-5: Let List Delivery Performance (projects awarded within three months of planned delivery month) by Let List – July 2001 to February 2003

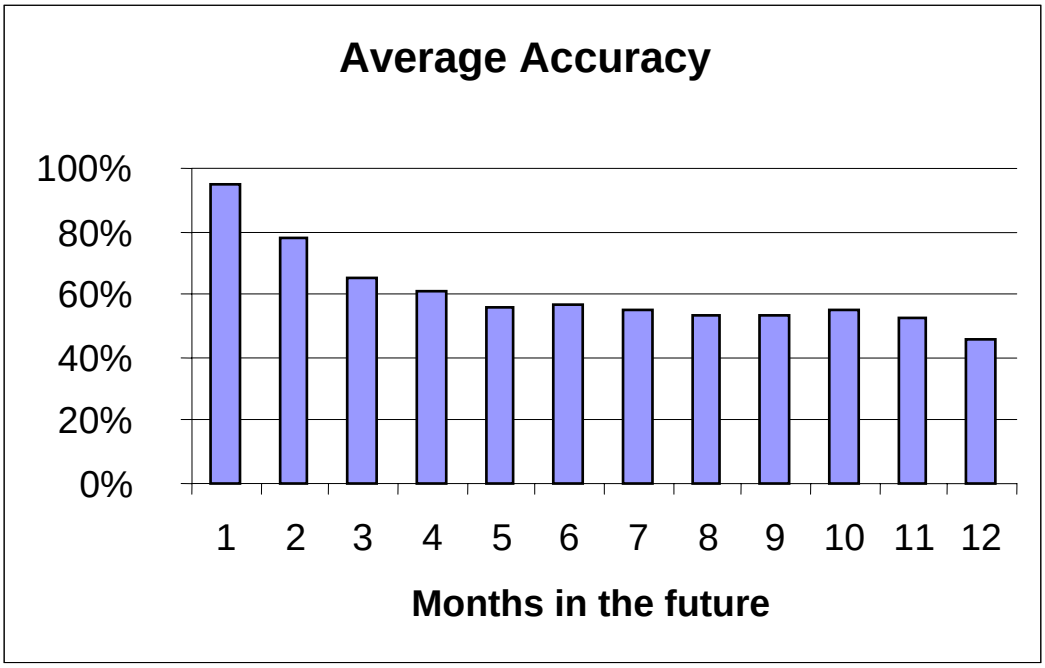


Source: NCDOT let lists, published award dates.

Each let list includes projects that are expected to be let in the next twelve months. It is expected that NCDOT should be able to plan more accurately for the first month compared to the twelfth month because it is much closer. Exhibit III-6 shows the accuracy of let lists each month in the future. Again, the performance standard measured is projects awarded within three months of the planned let month. The analysis approach took the average performance for all let list projects from July 2001 through February 2003.

Exhibit III-6 can be interpreted as follows: across all let lists some 96 percent of projects that were planned to be let the next month were awarded within three months of the following month. Whereas only 42 percent of projects that were planned to be let 12 months out were let within 3 months of that target.

Exhibit III-6: Average Let List Delivery Performance (projects awarded within 3 months of planned delivery month) by Month in the Future



Source: NCDOT let lists July 2001 to February 2003, published award dates.

- **A large minority of projects are not delivered within the planned 12 months of the letting schedule.**

  Previous exhibits show that a large number of projects are not let according to the planned letting schedule. To assess the magnitude of extensive delay, the percentage of projects in each let list with more than 12 months of delay were computed. Exhibit III-7 shows a small trend increase in these heavily delayed projects.

- **Improved letting list stability will enable NCDOT to manage the timing of lettings to get lower bids and save money.**

  One consequence of the lack of predictability in project delivery is that the size of NCDOT's letting varies considerably from month to month. In 2003, for example, the lettings for most months were very small (less than $50 million), with a small peak in July and then two largest lettings in November and December as NCDOT pushed to boost the overall value of lettings for 2003.

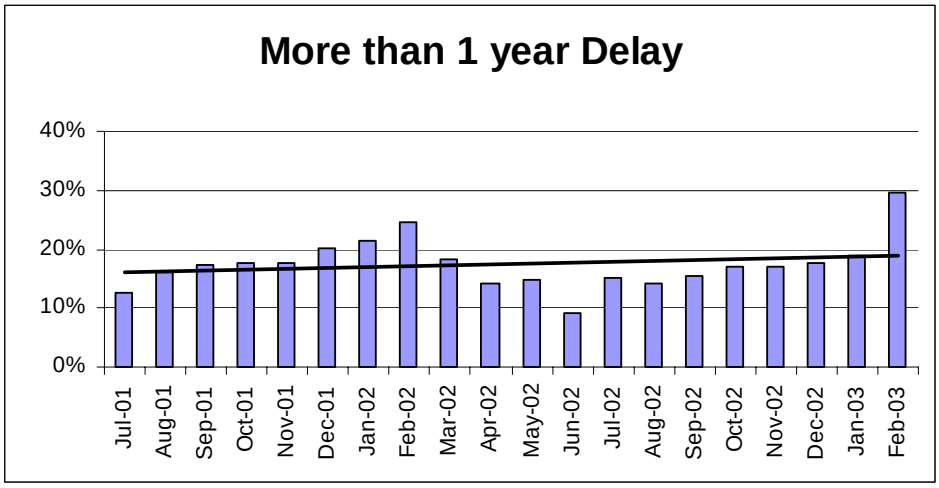
  Under best practice NCDOT would deliver projects to a "ready date," not a letting date, and then manage the timing of the lettings to increase competition. NCDOT would also be able to obtain better pricing by advertising some projects at what would otherwise be a slower time period. Lettings with a large number of projects such as in November and December of 2003 have the potential to create a number of problems including:

- Quality control issues in the bid package as Design Services is unable to spend as much time as is ideally desirable reviewing and doing a quality assurance review on the package for each project. This increases the risk of incurring additional cost to NCDOT through contractor claims and change orders.
- Potential as some projects are rushed to letting to bid projects with limitations of operations (for example utilities not yet re-located) that can delay the start of the project or cause a contractor to work around issues on the project site. This increases the risk of incurring additional cost to NCDOT through contractor claims and change orders.
- Potential for reduced competition as even the largest contractors only have the physical capability to submit so many bids each month. By having a very large number of projects let in a single month, contractors can be selective and there may be fewer bids per project.

- **Permitting delays are frequently cited as the reason, but the cause is more systemic.**

  NCDOT has a process through which the causes of delays in the letting schedule are recorded. The permitting process is frequently listed as the reason for delay. For example, of 113 intrastate, rural, and urban project lettings delayed between 2001 and 2003, 40 percent were attributed to permitting. In practice, the study finds that the resource agencies turn around completed application packets in fairly short order. The reason for delays is that there are many different deliverables that are required to complete a permit application. These need to be in-hand and ready in order for the NCDOT Office of Natural Environment unit to prepare a complete packet. The permit application is at the end of the process and delays in preceding activities can be the real cause of delay. In addition, work is required concurrently by different functional units such as right of way and design, among others, to make changes and revisions so that all the deliverables are ready for permit application. It falls to the Office of Natural Environment to manage this coordination and write the permit application.

Exhibit III-7: Percentage of Projects Not Awarded Within 12 Months of Planned Letting by List - July 2001 to February 2003

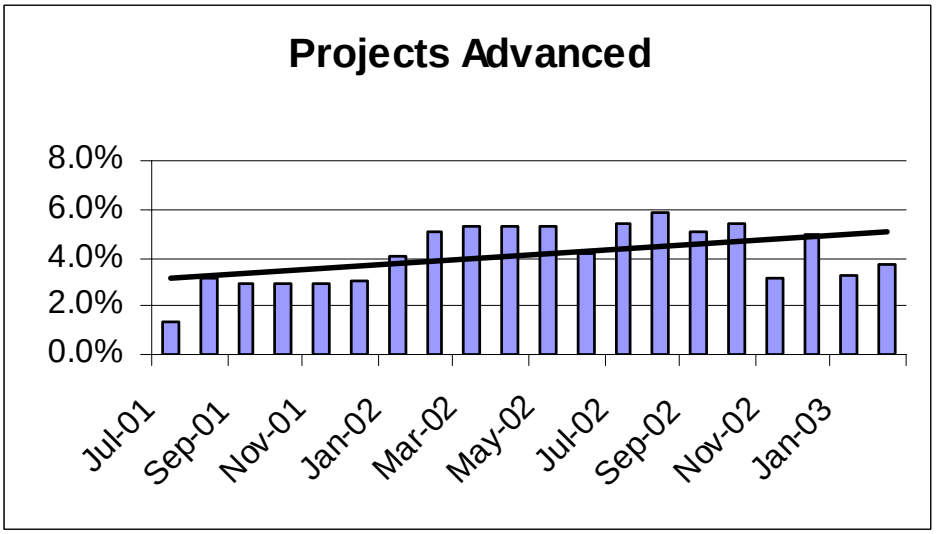


Source: NCDOT let lists July 2001 to February 2003, published award dates.

- **A small number of projects are advanced.**

  As previously defined, a project is considered on time if it was awarded within two months after or before the published let date. On occasion, projects get advanced in the letting schedule due to permitting approval or right of way clearance. Exhibit III-8 shows the small percentage of projects in each let list that were awarded before the planned letting schedule, including those that were awarded one month before schedule.

Exhibit III-8: Projects Advanced



Source: NCDOT let lists July 2001 to February 2003, published award dates.

B. Budget, Scope Management, and Preconstruction Expenditures

There were significant challenges in establishing a data set for a quantitative evaluation of the extent to which NCDOT projects are delivered within the scope, schedule, and budget that were initially set. The analysis approach aimed to evaluate projects let between January 1, 2001 and December 21, 2003.

1. Analysis Approach

The following approach was taken:

- A data set was established to analyze all projects let between January 1, 2001 and December 21, 2003. The analysis took care to remove projects that may have been split or combined and missing data. This resulted in a data set that comprised 347 out of the 511 projects let during this period.
- Project scope management was measured by comparing the initial engineer's estimate and the award amount to the first time a construction estimate was recorded against the project in the TIP.

2. Findings

- **Preconstruction Project Budget**

  NCDOT does not have the practice of establishing a preconstruction budget for projects nor does NCDOT manage project budgets and expenditures during preconstruction. A preconstruction budget would include all the costs for developing a project so that it can be let.

  Analysis of data sources, the chart of accounts, and interviews revealed a high level of difficulty in performing project level cost analysis. This provides a further indication that in the preconstruction phases of project delivery there is very little project cost accounting and financial management controls.

- **Scope Management**

  The scope of a project is identified and a preliminary construction cost estimate based on this scope is generated in order to include a project in the TIP. Generally, for Trust Fund projects, the broad scope of the project is largely determined by the Trust Fund legislation.

  Estimated cost to construct is used as an indicator of scope management. To assess construction estimate escalation during the preconstruction process, the first estimate for each project was compared to the award amount and analyzed. This was the only milestone that could be identified. Exhibit III-9 shows the

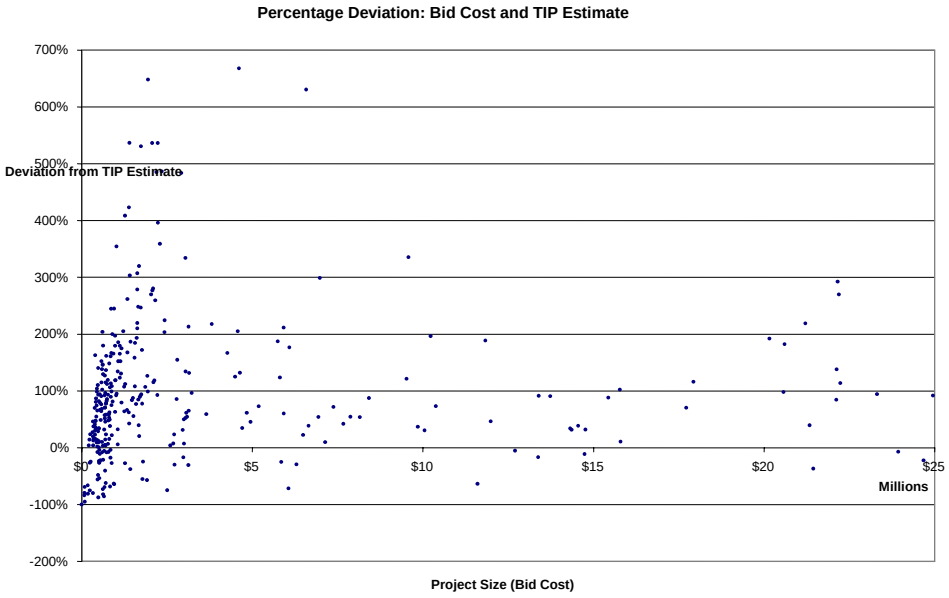
difference between the construction award amount and the original construction estimate when the project first entered the TIP.

Exhibit III-9: Increase in Construction Costs from TIP Entry to Letting, 343 Projects Let, January 1, 2001 to December 31, 2003

Project Type	Total Original Construction Estimate	Total Bid Cost	Total Increase	Average Increase
Bridge (190 projects)	$98,325,000	$214,558,170	$116,233,170	118%
Intrastate (22 projects)	187,917,000	332,501,638	144,584,638	77%
Rural (79 projects)	642,951,000	1,073,468,341	430,517,341	67%
Urban (40 projects)	233,780,000	501,967,691	268,187,691	115%
Total let 2001-2003 (330 projects)	**$1,162,973,000**	**$2,122,495,840**	**$959,522,840**	**83%**

Source: Project Master Scheduling System, Highway Contractor Management System (HiCAMS).

Exhibit III-10: Difference between Construction Estimate When Entered TIP and Award Amount, 347 Projects Let January 1, 2001 to December 31, 2003



Source: PMSS (Project Master Scheduling System)

- **Across all projects, the award amount is 83 percent higher than the initial TIP entry amount.**

  The data presented in Exhibit III-9 indicate that on average, projects are let for 83 percent more than the estimated construction cost when they first enter the TIP. The increase in expected construction costs can be attributed to inflation, scope creep, inadequate initial estimate, or inadequate project definition. Care must be taken, however, in interpreting the data. The original estimates are established in advance of design, in some cases a number of years, and do not factor in inflation. In addition, the original estimates are not developed through a standardized process designed to increase their accuracy, and the nature of design is such that there are uncertainties affecting cost that can only be identified during design.

- **Preconstruction Expenditure or Budget Management**

  NCDOT does not establish a preconstruction budget for projects and then manage to that budget. The practice is to authorize preconstruction expenditures. While it was possible to obtain expenditure transactions for the projects in the data set, it was not possible to readily aggregate the data to summarize at the project level preconstruction expenditures. This indicates that NCDOT does not manage project budgets and is discussed at more length in Section V.

C. Construction Time

Although the major focus of this study is an assessment of preconstruction project delivery, this section provides a quantitative analysis of how long highway construction takes in North Carolina. The analysis performed does not evaluate NCDOT construction management practices or project delivery management during the construction phase. The intent is to provide information on how long construction takes.

Three elements of the construction process in North Carolina are evaluated:

- The time required to complete projects.
- The number of scheduled construction days to complete a project compared to the number of planned construction days.
- Use of non-traditional contracting.

1. Construction Duration

All construction work is contracted and performed by private contractors. The vast majority of expenditures are contractor payments. In addition, NCDOT provides construction engineering that includes project management, construction inspection, and quality assurance. On some projects, state forces are used to undertake certain

activities. Between 1996 and 2003, NCDOT awarded 1,796 contracts for highway construction with a total award amount of $7.6 billion.[6] Given the large dollar volume, small improvements in performance can yield large dollar savings.

a. Approach

To assess how long construction projects are taking, 347 transportation improvement program projects that were completed between November 2000 and April 2004 were analyzed. This data set analyzed was obtained from the Highway Contractor Management System (HiCAMS). This is a management system that supports construction administration, field operations, and material testing within the North Carolina Department of Transportation.

Construction duration was measured between the following milestones:

- Work start date.
- Project acceptance date.

To conduct this analysis, projects were grouped into the following four categories that are used by NCDOT to group TIP projects:

- Bridge
- Intrastate
- Rural
- Urban

Enhancement, Ferry, and highway hazard projects were not considered in this analysis because data for only a relatively small number of these projects completed between November 2000 and April 2004 are in HiCAMS.

b. Findings

- Some 41 percent of construction projects completed between November 2000 and April 2004 took less than one year and 25 percent took over two years.
- There is a wide range in the duration of construction projects as summarized in Exhibit III-11. Although a large number of construction projects are completed quickly, many take upwards of 2 years. This is illustrated by the high standard deviation which can be interpreted as follows: about 68 percent of the bridge projects are completed within plus or minus 231 days of the average duration of 404 days.

[6] These are contracts in these calendar years; includes TIP and non-TIP.

Exhibit III-11: Construction Duration by Type of Project, November 2000 to April 2004

Type	Number of projects	Average Duration (Days)	Standard Deviation[7]	Construction Expenditure
B – Bridge	171	404	231	$196,473,296
E - Enhancement	1	89	N/A	$847,920
F - Ferry	4	377	78	$13,703,750
I - Intrastate	34	272	256	$165,171,885
R - Rural	82	693	432	$672,534,550
U - Urban	44	753	330	$231,831,645
W – Highway Hazard	9	272	171	$8,530,231
Total	**345**			**$1,289,093,277**

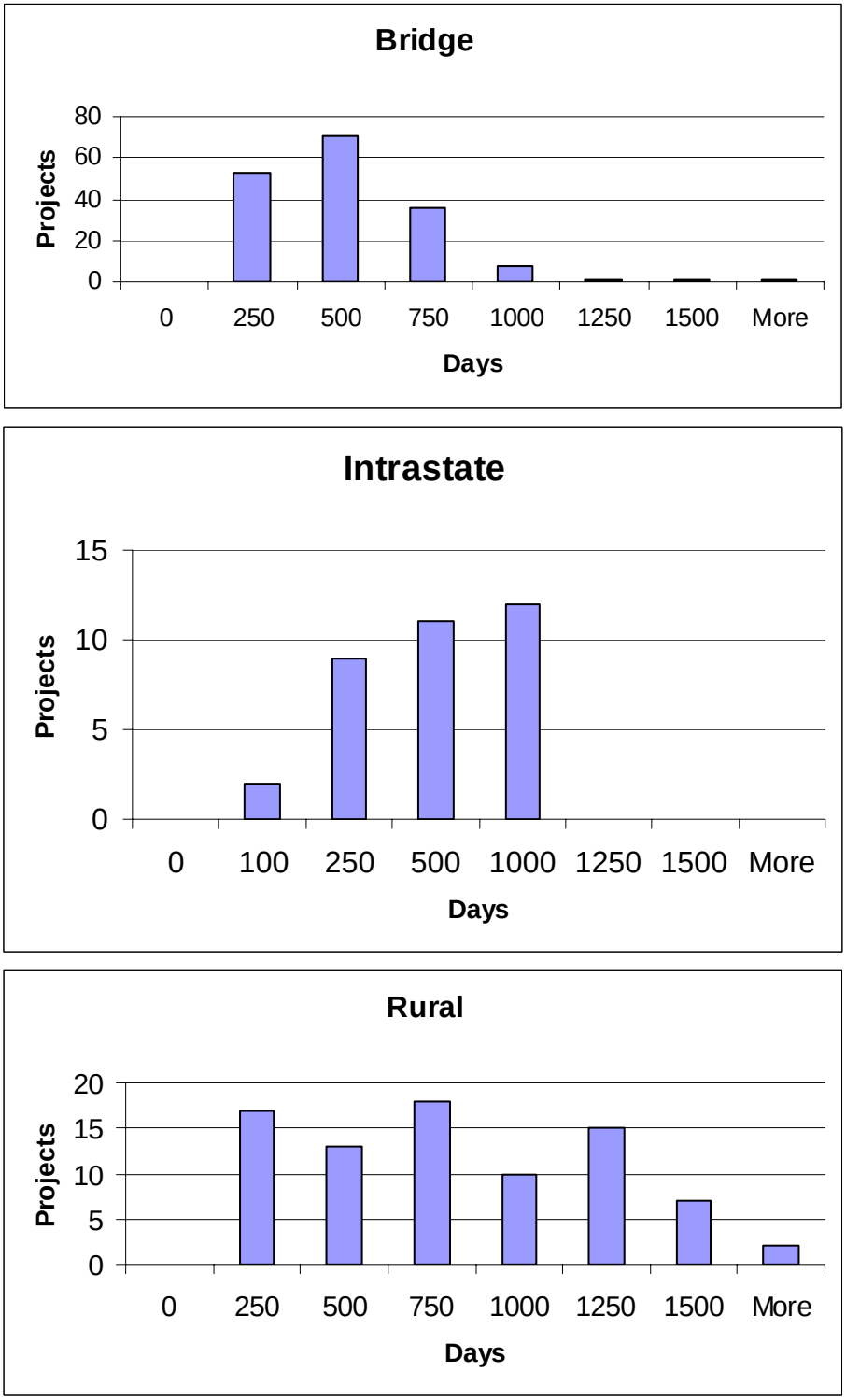
Project Type	Number of Projects, Duration (months)				
	0-12	12-24	24-36	36+	Total
Bridge	84	72	12	3	171
Intrastate	18	11	5	0	34
Rural	27	16	24	15	82
Urban	7	12	17	8	44
Total	136	111	58	26	331

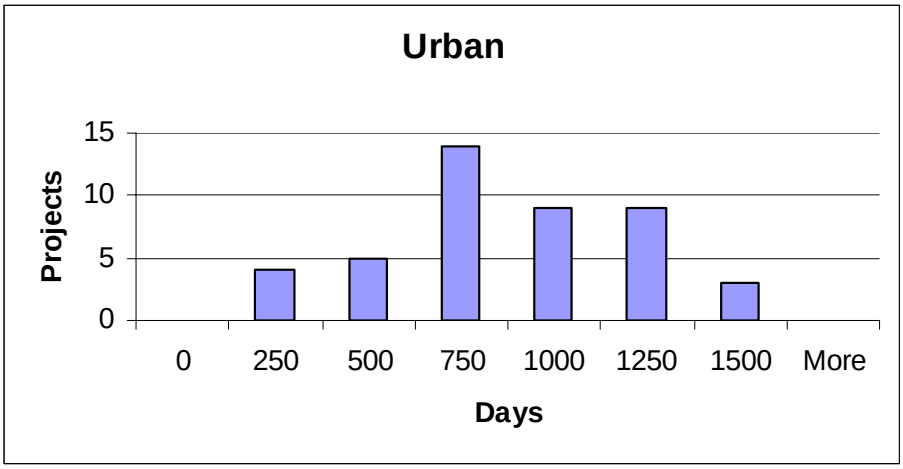
Source: Highway Contractor Management System, (HiCAMs)

Exhibit III-12 provides a more disaggregated view of the duration of construction by type of project.

[7] Standard deviation measures the distribution of projects around the average. For example, bridge projects have a standard deviation of 231 days.

Exhibit III-12: Construction Duration by Type and Number of Projects, November 2000 to April 2004





Source: Highway Contractor Management System, (HiCAMs)

2. Schedule Performance

NCDOT's traditional design bid-build construction contracts typically specify a certain number of calendar days to complete the project. These are the days that a contractor is able to work on the project. This type of contract provides the contractor so many normal working days to complete the project, and accounts for days on which the contractor is unable to work due to seasonal or weather limitations.

a. Approach

Using the same project groupings described above, the following indicator for construction schedule performance was used:

- The original completion date specified in the construction contract was compared to the actual completion date. (The acceptance date is set as the indicator.)

In applying this indicator, it was assumed that a project would be on schedule if the difference between the scheduled number of days and the actual number of days were less than five percent of the scheduled number of days.

b. Findings

- **Some 68 percent of construction projects were completed on time or early; however, 16 percent were completed 4 or more months late.**

  Exhibit III-13 compares the planned project completion date with actual project completion for 331 construction projects completed between November 2000 and April 2004.

Exhibit III-13: Construction Schedule Performance, November 2000 through April 2004

Schedule Delay Profile	Number	Percent
Projects on Schedule	109	33
Total Projects Completed Early	116	35
Total Projects Completed Late	106	32
Under 1 month	14	4
1 to 2 months	18	5
2 to 4 months	20	6
Over 4 months	54	16
Total	**331**	**100**

Source: Highway Contractor Management System

- **Urban projects have experienced pronounced delays during construction.**

  As shown in Exhibit III-14, some 68 percent of urban projects were completed late and 45 percent of urban projects were completed more than 4 months late.

Exhibit III-14: Construction Schedule Performance by Type of Work

	Bridge		Intrastate		Rural		Urban	
	No.	%	No.	%	No.	%	No.	%
Project on schedule	64	37	14	41	27	33	4	9
Total Projects Completed Early	70	41	7	21	29	35	10	23
Total projects completed Late	37	22	13	38	26	32	30	68
Under 1 month	10	6	2	6	1	1	1	2
1 - 2 months	8	5	3	9	3	4	4	9
2 to 4 months	7	4	2	6	6	7	5	11
Over 4 months	12	7	6	18	16	20	20	45

Source: Highway Contractor Management System.

3. Use of non-traditional construction project delivery

Almost all NCDOT's projects are delivered through what is referred to in the industry as a traditional design-bid-build process. This study mainly focuses on the preconstruction or design portion of this process. For almost all projects NCDOT awards highway construction contracts to the lowest responsive bidder. However,

nationally there has been an increase in the use of other project delivery mechanisms and the use of other construction contracting mechanisms. There is a growing body of experience nationally in the use of alternative project delivery mechanisms such as design-build, general engineering consultants, program, and construction management among other approaches for highway project delivery. While the application of these techniques in North Carolina merits more detailed consideration, the scope of this study has been to assess the extent to which any of these techniques are being used.

a. Approach

The use of non-traditional contracting and alternative project delivery mechanisms was quantified by determining the number of projects and their dollar value in the past four fiscal years.

b. Findings

The number of contracts and their dollar value that apply innovative contracting features or alternative project delivery are summarized in Exhibit III-15 below.

Exhibit III-15: Use of Non-Traditional Contracting at NCDOT (July 2000 through July 2004)

Projects	Number	Value ($ Million)
Design-build	7	357.7
A + B Bidding	7	303.3
Incentives/Disincentives	0	0
Lump Sum Bidding	5	3.0
No Excuse Bonus	5	373.0

Source: NCDOT

In the last three years, NCDOT has started to use some of the non-traditional contracting techniques. Design-build, A+B bidding, and no excuse bonuses are all techniques which are intended to increase the timeliness of project delivery. In comparison to other states, NCDOT is using design-build heavily and is using A+B bidding selectively.

- **Construction incentives and disincentives**. Within the statutory requirements governing construction procurement, NCDOT can include incentive/disincentive provisions for early contract completion. They can provide a bonus for early completion and a penalty for late completion. This technique has been used in 35 states nationally and on 5 occasions in the last 3 fiscal years in North Carolina. Using a “no excuses bonus” a contractor will receive a bonus for completion in advance of a set date.

There are no excuses, such as weather delays, and there are no disincentives, only liquidated damages.

These provisions can enable NCDOT to provide strong incentives for reducing project time where traffic inconvenience and delays have large costs to the public. Incentive/disincentive amounts can be based upon traffic safety, traffic maintenance, and road user delay costs. The disincentive makes it more important for the contractor to complete projects on time.

- **Innovative and nontraditional contracting**. Innovative and nontraditional contracting refers to construction procurement in which factors other than the low bid are considered. Examples include:
  - Cost plus time, called A + B bidding, includes time with an associated cost in the low bid process. "A" is the traditional bid item and "B" is the completion time bid by the contract; a dollar value per day is then set by the state. This type of bidding is used in 28 states and has been used on 7 occasions in North Carolina in the past 3 fiscal years. This type of contract provision is meant to reduce the impact of construction upon road users. These user impacts are the costs of extra travel time due to construction delay and accidents in construction zones. This cost plus time approach can yield safety and road user cost benefits.
  - Lane rental provisions include an estimated fee for the time a contractor occupies or obstructs part of the roadway, which is deducted from monthly progress payments. The goal is to reduce road user impacts during construction. NCDOT has not used this type of provision; however, such contract provisions are used in a number of other states.
  - Performance-related specifications and construction warranties specify how a finished product should perform over time. These can include physical durability, functional characteristics, user safety, and environmental impact. We understand that NCDOT is interested in using such provisions but that this may require statutory change.
- **Design-Build and alternative project delivery techniques.** NCDOT currently delivers most projects through a traditional Design-Bid-Build approach. Alternative project delivery techniques fall into two main categories. First are design/build techniques in which NCDOT selects a single contractor to both design and build the project. Upon construction, NCDOT assumes responsibility for operation and maintenance. In this model, NCDOT provides all the financing. Second are multi-consultant or program delivery models in which a general engineering contractor oversees consultant design work which is then let for construction at a certain level of design completion.

D. Environmental Process

There are a number of high profile examples of projects where the environmental process and permitting have resulted in considerable delays. The Monroe Bypass, the Clayton Bypass, or the New Bern Bypass are projects that have been delayed due to significant issues and/or litigation around the environmental process. Within NCDOT and among NCDOT's partners and customers there is a general view that the length of time it takes to complete the environmental process is a major explanation for project delays and the overall project delivery time.

In addition, because of the sequential nature of much of the project delivery process, care must be taken in attributing the cause of delay on individual projects. For example, NCDOT maintains a listing of all letting schedule changes and describes the reasons for the change, e.g., a permit has not been issued or right of way is not cleared. Clearing right of way in itself may not be the cause of delay, because it could be that by the time the project was at the final right of way acquisition stage, there was insufficient time left to perform the right of way tasks. In this case the reason for delay would be in the preceding tasks, but could appear to be due to right of way.

Much information and people's frame of reference are based on individual projects or anecdotal sources. The purpose of this section is to provide a quantitative basis of information from which to understand how long the environmental process is taking to complete and how long permits are taking to issue. Therefore, to provide perspective on the contribution that the environmental process plays to project delivery time and project delay, the following information is detailed:

- The length of time to complete environmental documentation.
- The length of time to issue permits.

1. Length of Time to Complete Environmental Documents

This section provides descriptive statistics on how long it is taking to prepare environmental documents and to issue permits. The environmental process falls naturally into two distinct periods. First, there is the preparation of the appropriate environmental document, whether it is an Environmental Impact Statement (EIS), an Environmental Assessment (EA), or a Categorical Exclusion (CE). As will be shown, the level of the document required has a great influence on the time needed to prepare it with an EIS requiring from about 2 years to over 14 years, an EA requiring from a few months to over 7 years, and a CE from a few weeks to over 5 years.

a. Approach

To assess how long it takes the NCDOT to complete environmental clearance for projects, the study approach was to focus on all projects let for construction between January 1, 2001 and December 31, 2003. Ideally, the length of time it

took to complete the environmental process for each of these projects would be known, and then we could compare the actual time to complete to the time planners had projected it to take in order to determine the extent of delays. However, NCDOT does not currently maintain readily accessible information of this type for each project. Therefore, to support our analysis, the Project Development and Environmental Analysis Branch (PDEA) assembled data from their project files into a data set that we could use to determine how long environmental clearance takes. Of all projects completed between January 1, 2001 and December 31, 2003, PDEA was able to assemble environmental information for 460. Based on this data, we were able to establish the beginning date and ending date of environmental documentation for 342 projects.

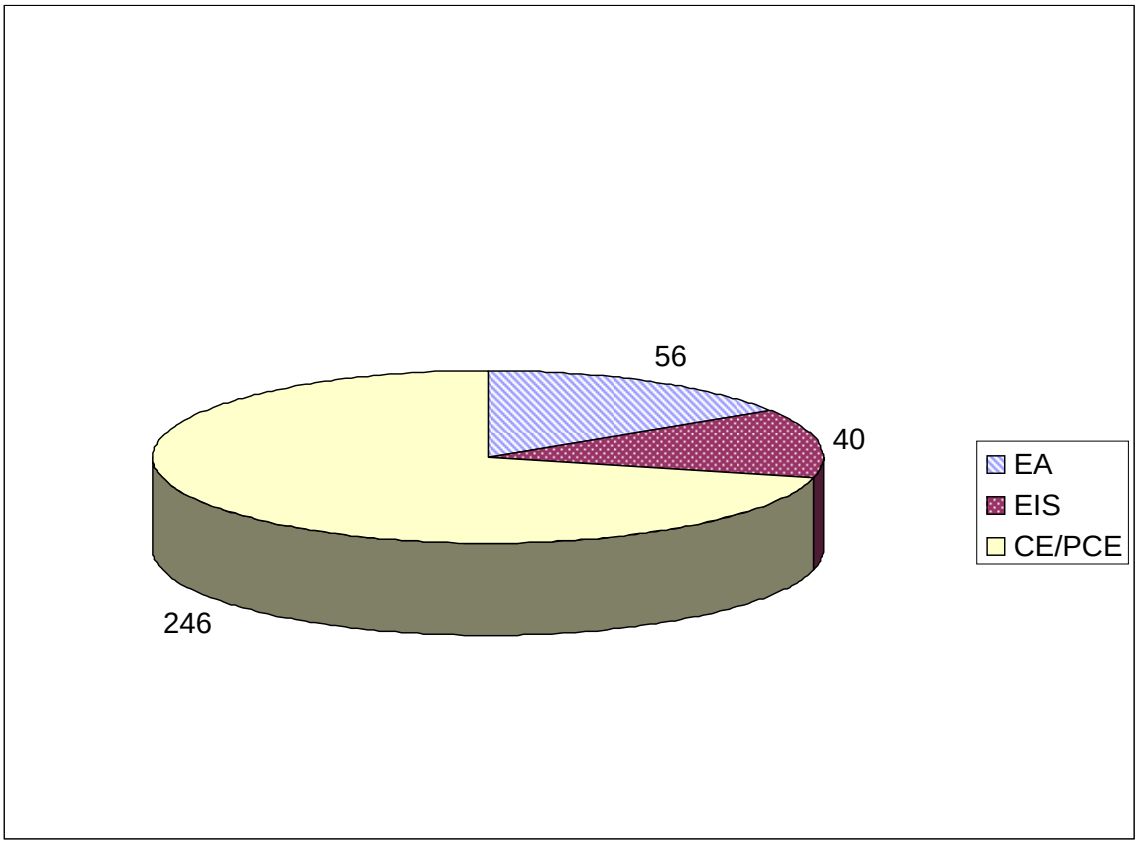
b. Level of Environmental Documents

The level of the environmental document required is a major determinant of the time it takes to provide environmental clearance. For the 460 projects for which data was assembled by PDEA:

- Twelve percent required an Environmental Assessment or Supplemental Environmental Assessment (EA/SEA).
- Nine percent required an Environmental Impact Statement (EIS).
- Fifty-three percent required a categorical exclusion or programmatic categorical exclusion (CE/PCE).
- Twenty-six percent required a 4(f) or P4(f)/min or no environmental document at all.

Exhibit III-16 shows the number and level of environmental document required on the 460 projects in the data set for which data is available. Between January 2001 and December 2003, 460 Projects were let. Environmental permits were required for 425 of the projects let. Complete data was obtained for only 342 of the projects let that required environmental permits. The following chart shows the distribution of these 342 projects.

Exhibit III-16: Environment Document Breakdown - 353 Projects Let 2001 to 2003



Source: Data set compiled from NCDOT, PDEA project files.

c. Findings

The following measures were used as indicators:

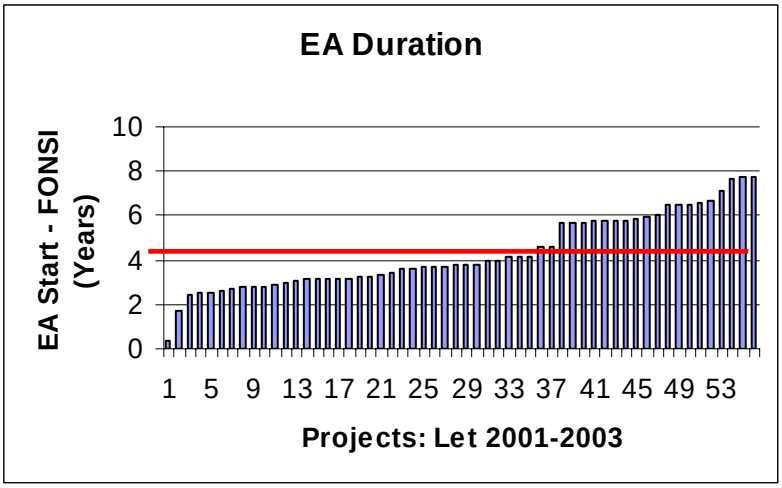
- **Start and completion date of the environmental document.**

  As the intent of this analysis is to evaluate at the aggregate level, some anomalous projects were excluded from the data set because they fell outside the normal boundaries and were not representative of the whole.

(1) Environmental Assessment Duration

- **Environmental Assessments (EAs) are performed usually by NCDOT staff.**
- **Environmental Assessments are taking on average 4.3 years to complete.**

Exhibit III-17: Environment Assessment Duration - Projects Let between 2001 and 2003



Source: Data set compiled from NCDOT, PDEA project files.

Exhibit III-17 shows the length of time it took to complete the EAs on 56 projects let between 2001 and 2003. The average duration of an EA is 4.3 years. Almost 4 percent of EAs take 1 to 2 years, 52 percent of the EAs take 2 to 4 years, 26 percent take 4 to 6 years, and 18 percent take 6 years or more.

- **Environmental assessments are taking twice as long in North Carolina as benchmarks states.**

  As part of the comparison of NCDOT to other agencies, a number of states were asked to provide information on the average time taken from the start of an environmental assessment to completion measured by a finding of no significant impact (FONSI). Comparison states provided a range but are completing the documents in a shorter period of time. Florida in particular observed that they have reduced their documentation requirements and are doing fewer EAs through agreement with FHWA and their resource agencies. Exhibit III-18 compares NCDOT to these other states.

Exhibit III-18: Reported Average Time to Complete Environmental Assessment

Interviewed States	Average Time
Mississippi	18 months to 24 months
Texas	6 months to 12 months
Kentucky	12 months to 24 months
Florida	24 months to 30 months. Florida has FHWA type 2 categorical exclusion. Consequently, they do not do a lot of EIS or EAs (4 to 6 a year).
Virginia	6 months to 12 months
North Carolina	4.3 years (all projects let 2001 to 2003)

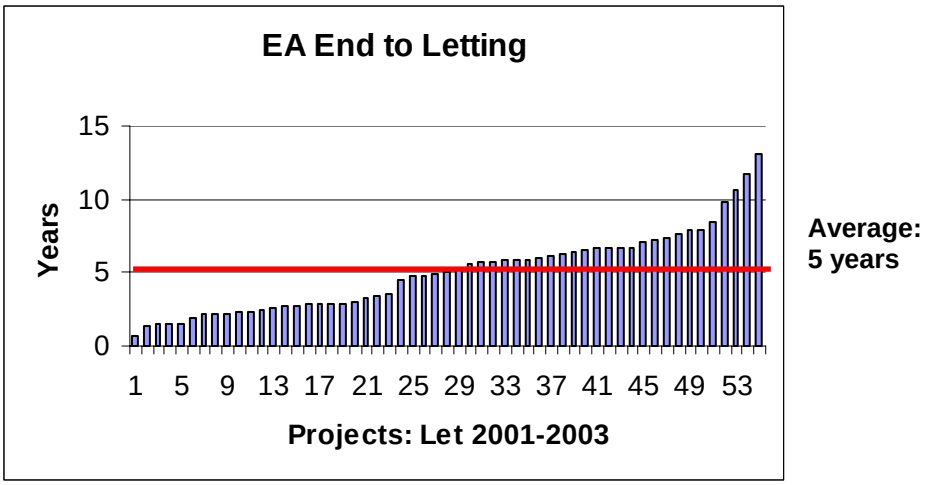
Source: Dye Management Group, Inc. telephone interviews of other states

(2) Environmental Assessment Completion to Letting

- **It is taking on average five years from the completion of an EA to letting.**

  Exhibit III-19 shows the length of time it took to let after the completion of the EA for 55 projects between 2001 and 2003. The average length of time is 5 years. For almost 11 percent of projects it takes 1 to 2 years, 31 percent of the EAs take 2 to 4 years, 24 percent take 4 to 6 years, and 34 percent take 6 years or more.

Exhibit III-19: Environmental Assessment Completion to Let Date Duration



Source: Data set compiled from NCDOT, PDEA project files and Project Management Scheduling System (PMSS).

(3) Environmental Assessment Completion to the Issuance of Final Corps Permit

Projects usually require more than just a United States Army Corps of Engineers (USACE) permit in order to gain environmental clearance. The USACE permit is the final permit showing that environmental work is completed and the project may proceed. Therefore, the date of the issuance of the USACE permit is used as the date of completion of the environmental process. The original data set contained 24 projects for which this data was available.

- **It is taking on average 4.1 years from the completion of an EA to the USACE permit issuance.**

Data were obtained for the length of time taken from the completion of the EA to the final issuance of a Corps of Engineer's permit on the 24 projects with Corps permits for which data were compiled. The average length of time from completion of the EA to issuance of the USACE permit is 4.1 years. For 3 of the projects it took 1 to 2 years, for 9 of the projects it took 2 to 4 years, 3 projects took 4 to 6 years, and 7 projects took 6 years or more.

(4) Environmental Impact Statement (EIS) Duration

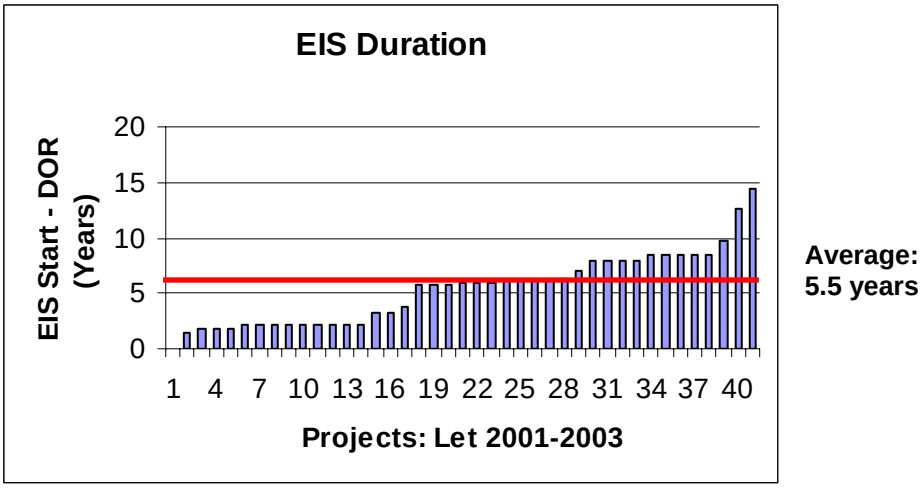
EISs are usually prepared by consultants.

- **Environmental Impact Statements are taking on average 5.5 years to complete, which is in line with experience in other states.**

Exhibit III-20 shows the time (in years) it takes from EIS start to EIS finish (Record of Decision or ROD) for the 40 projects let between January 2001 and December 31, 2003 that required an EIS.[8] The average duration is 5.5 years, which compared favorably to a comparable national average (FHWA: Environmental Streamlining Initiative).

[8] The start of study letter is the starting point for the measurement of time taken.

Exhibit III-20: Environmental Impact Statements Duration – Projects Let 2001 to 2003



Source: Data set compiled from NCDOT, PDEA project files

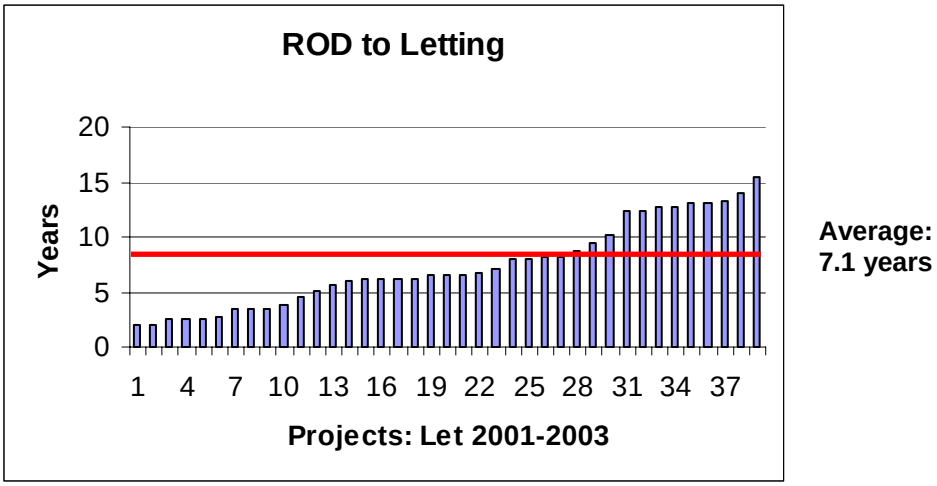
(5) Environmental Impact Statement Completion to Let Date

- **It is taking on average 7.1 years from the completion of an EIS to letting.**

Exhibit III-21 shows the length of time taken to let a project from the completion of the EIS on 39 projects let between 2001 and 2003. The average length of time is 7.1 years. For just 3 of the projects it took 2 years, 8 of the EISs took 2 to 4 years or less, and 29 took 6 years or more.

The lengthy time from completion of an EIS to letting is one of the issues that the Merger01 process has been designed to address by involving the resource agencies more closely up front as part of the EIS process so issues that may not have been raised until later in the process (closer to the permit application) are now addressed up front. With the full implementation of the Merger01 process, NCDOT expects to see the length of time from ROD to letting significantly reduced.

Exhibit III-21: EIS Record of Decision



Source: Data set compiled from NCDOT, PDEA project files

(6) Environmental Impact Statement Completion to the Issuance of Final Corps Permit

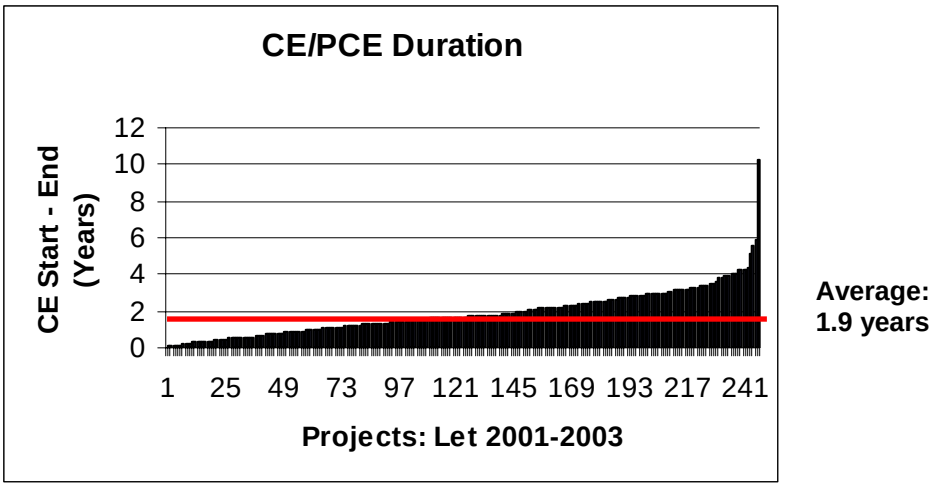
Using the latest permit issue dates for the projects that have multiple permit dates the time it takes to get a USACE permit after EIS completion is measured. From the original data set there were four projects for which data were available.

It had taken from four to eight years from the completion of the EIS to the final issuance of a Corps of Engineer's permit on the four projects with Corps permits for which data were compiled.

(7) Categorical Exclusion and Programmatic Categorical Exclusion Duration

Using data indicating start date and completion date for categorical exclusions the time taken was determined for 246 projects. The length of time taken is depicted in Exhibit III-22.

Exhibit III-22: Length of Time to Complete Environmental Process for Projects with a Categorical Exclusion and Programmatic Categorical Exclusion



Source: Data set compiled from NCDOT, PDEA project files

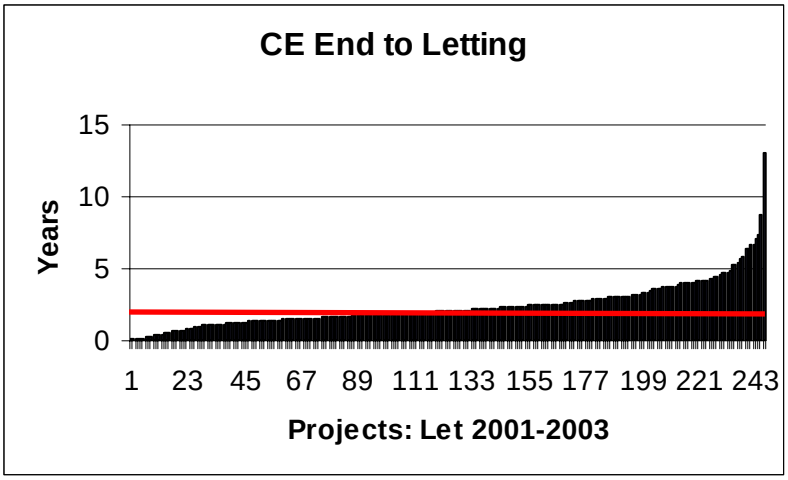
- The average time from CE/PCE start to finish was 1.9 years.

As depicted in Exhibit III-22, for the 246 projects analyzed, after outliers were excluded, the average length of time for the environmental process defined as CE/PCE start to finish was 1.9 years. The large range is most likely due to the different types of categorical exclusions. Typically, the programmatic categorical exclusion is more straightforward and involves 0.8 years; whereas, the 211 categorical exclusions involve 2 years. The data were not compiled in such a way that allowed a distinction in the analysis between the different levels of categorical exclusion.

(8) Categorical Exclusion and Programmatic Categorical Exclusion - Time from Completion to Let Date

The length of time from the completion of a CE/PCE to the let date for the project was calculated. The results are shown in Exhibit III-23. Excluding outliers, on average it took 2.4 years from completion of the environmental document to let date. Some 48 percent of the projects took less than 2 years whereas 52 percent took over two years.

Exhibit III-23: CE/PCE End to Let Date Duration

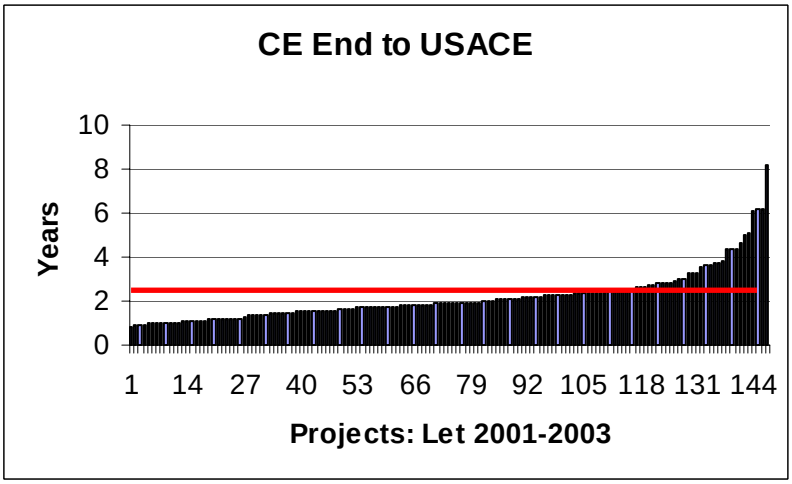


Source: Data set compiled from NCDOT, PDEA project files

(9) Categorical Exclusion and Programmatic Categorical Exclusion Duration from Completion to Issuance of a Corps Permit

153 projects out of the 246 which fell into the CE/PCE category required an Army Corps of Engineers permit. For these projects the average length of time from completion of the environmental process to permit issuance was 2.1 years and the median length 1.9.

Exhibit III-24: CE End to USACE



IV. Analysis of Reasons for Project Delay

■

This section provides detailed study findings regarding the major issues and reasons widely hypothesized to have caused project delay.

The issues, findings, and the associated recommendations are grouped into the following categories:

- The complexity of NCDOT's program and the extent of new construction.
- Uniqueness and extent of North Carolina's environmental requirements.
- Staff shortages, employee retention, and human resource management.
- Permit review and issuance.
- Consultant procurement and management.

A. Complexity of NCDOT Programs and the Extent of New Construction

The scope of work for this study, interview results, and prior documents identify the uniqueness of North Carolina's transportation program as a major factor contributing to the length of time it is taking to deliver Highway Fund projects and the program as a whole.

1. Issue Area: North Carolina has a unique mix of new location projects that are subject to delay due to their complexity and potential environmental impacts.

A frequently stated reason for NCDOT's project delivery delays is the unique complexity of Highway Trust Fund project.

- **NCDOT's program is heavily weighted towards complex, higher risk, and longer duration projects.**

  Interviewees believe that North Carolina has a unique project mix in comparison to other states and that project delivery is further complicated by the environmentally sensitive areas where many projects occur. The complex mix arises because the highway trust fund includes construction in new locations and the predefined widening to four lanes of a number of highways. These types of projects typically take the longest time and have the highest potential for more significant environmental impacts.

- **NCDOT is difficult to compare to other states due to the extent of new construction in the program.**

  There is a concern that NCDOT is difficult to compare to other states because the State's program is more difficult to deliver due to the extent of new construction and the level of environmental documents that are required for these projects.

a. Analysis Strategy

The analysis approach involved:

- Using comparative, state-level data to identify the extent to which North Carolina's program is dominated by new construction and new location work as compared to other states.
- Comparing the number and level of environmental documents produced by NCDOT in comparison to other states.

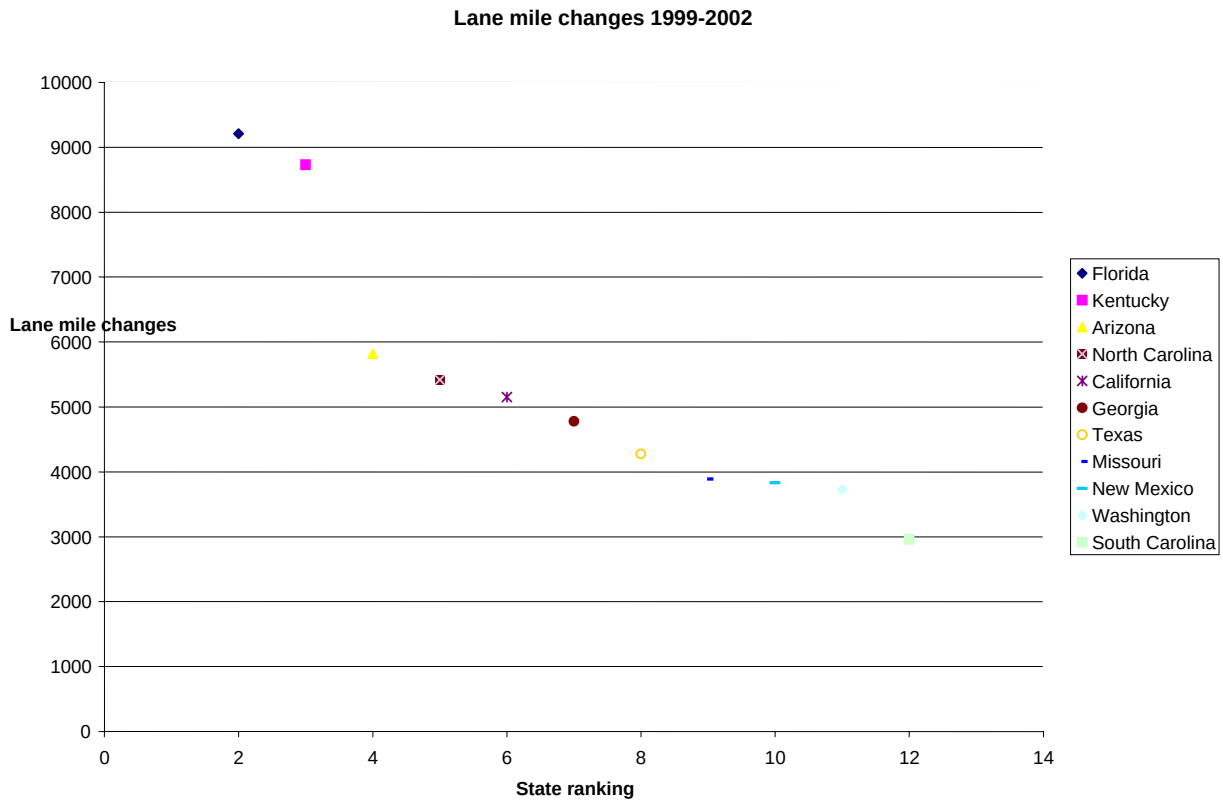
b. Findings

(1) Extent of new construction

- **North Carolina's program is among the most heavily concentrated on new construction in the nation.**

  In the period 1999 through 2002, North Carolina ranked fifth nationally in the number of lane miles added and eighth in the percentage growth in the system. These findings are summarized in Exhibit IV-1, Exhibit IV-2, and Exhibit IV-3, and confirm that the North Carolina program involves the more difficult project types.

Exhibit IV-1: Growth in Lane Miles in North Carolina Compared to Other States – 1999 to 2002



Source: FHWA Office of Highway Policy Information (OHPI). Highway Statistics 1999-2002.

(2) Functional Lane Miles

- **North Carolina's program expenditures are heavily concentrated on new construction projects.**

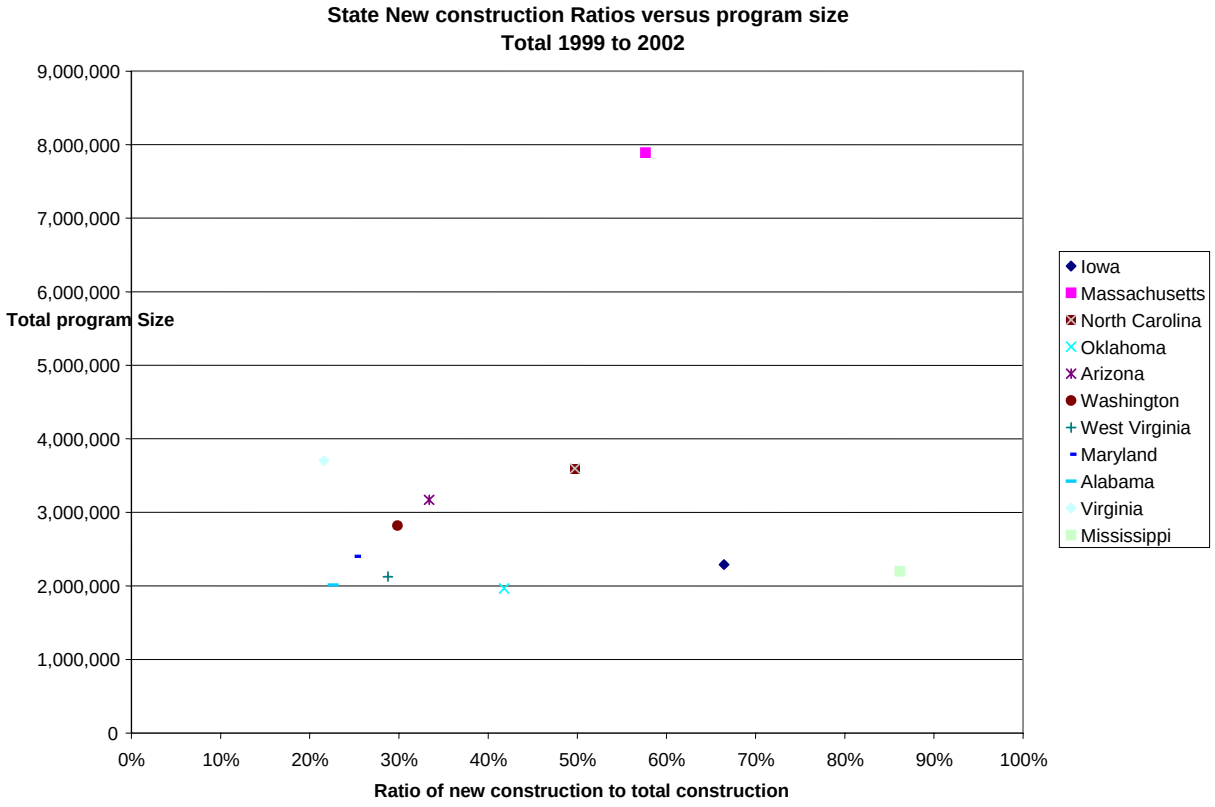
  In the period 1999 through 2002, North Carolina ranked eighth nationally in total project expenditures for new construction projects, and fourth in the percentage of the program expenditures on new construction. In this period, 50 percent of all construction expenditures were on projects that involved new construction. Typically, these types of construction projects involve the most complex community, environmental, and engineering issues.

Exhibit IV-2: North Carolina's New Construction Expenditures Compared to Other States – 1999 through 2002

State	New Construction	Total	Rank on Total New Construction Descending	Percentage of Total New Construction	Rank on Percentage Descending
Mississippi	1,515,215	2,196,564	2	86	1
Iowa	1,166,756	2,289,699	5	66	2
Massachusetts	3,978,837	7,890,463	1	58	3
North Carolina	**$870,095**	**$3,597,059**	**8**	**50**	**4**
Oklahoma	686,097	1,965,718	9	42	5

Source: FHWA Office of Highway Policy Information (OHPI). Highway Statistics 1999-2002.

Exhibit IV-3: North Carolina's New Construction Expenditures by Program Size Compared to Other States, 1999 through 2002



Source: FHWA Office of Highway Policy Information (OHPI). Highway Statistics 1999–2002.

It should be further noted that during this time period the proportion of expenditures on projects defined as new construction has increased.

For all roads classified above rural and urban collectors, new construction grew from 41 percent in 1999 to 54 percent in 2002 of NCDOT's construction expenditures. This indicates that in the preceding years the projects were increasingly the more complex new construction projects.

(3) The number and level of environmental documents

New construction projects are more likely to require higher levels of environmental analysis. Exhibit IV-4 compares North Carolina to the other states identified as good comparisons because these states, like North Carolina, have high concentrations of new construction projects.

Exhibit IV-4: Number of EIS and EAs Underway in Benchmark States

State	Environmental Impact Statements	Environmental Assessments
Florida	7	5
Texas	17	74
Mississippi	3	19
Iowa	4	5
Tennessee	17	6
Utah	15	14
New Mexico	2	18
Pennsylvania	21	14
Virginia	1	18
Kentucky	1	49
North Carolina	20	85

Source: FHWA, data reported by states to Division Offices. EA totals may include some for which there is a FONSI.

The data shown in Exhibit IV-4 indicate that North Carolina prepares a large number of environmental documents compared to other states. In the area of environmental assessments, North Carolina has the highest number underway. Many states, most notably Florida, are working to reduce the length of EAs and address more of the issues through a CE. NCDOT should explore opportunities for reducing the number of EAs as Florida has done.

B. Staff Shortages, Retention, and Human Resource Management

There is a widespread perception that NCDOT and the resource agencies have experienced a high level of staff turnover that is an important factor impacting the efficient and timely delivery of projects. We have grouped these staff issues into three broad areas:

- First, NCDOT and the resource agencies are experiencing difficulties in recruiting and retaining staff.
- Second, there are bottlenecks in the project delivery process due to shortages of specialized expertise.
- Third, there is the need to conduct program-wide human resource management and planning.

1. Issue Area: Staff Retention and Recruiting

The following issues were identified regarding loss of experienced staff.

- **High rates of staff turnover due to difficulty in retaining professional engineers and environmental scientists is considered an important contributor to project delay.**

  NCDOT staff turnover was identified by a number of interviewees as being a significant issue impeding project delivery. Many interviewees are concerned that, to a large extent, NCDOT is in practice a training ground for private engineering firms with staff remaining four to five years and leaving after achieving their Professional Engineer designation. Concern about the rates of turnover was identified as being an especially critical issue in the Project Development and Environmental Analysis Branch (PDEA) and the Roadway Design Branch.

  Loss of personnel and turnover was not, however, identified through our interviews and data analysis nor determined to be as significant an issue for resource agencies.

- **Loss of senior and more experienced personnel.**

  Interviewees point to the loss of NCDOT's intellectual capital through the retirement of experienced staff. A number of staff with 20 to 30 years of experience have or are leaving NCDOT and these staff members are typically replaced by staff with substantially less experience. This has exacerbated the retention issues.

- **Difficulty in filling vacant positions with the right skill set due to pay scales.**

  NCDOT and Department of Environment and Natural Resources (DENR) line managers consistently cited their view that a lack of salary competitiveness is a major barrier to attracting and retaining qualified staff. This salary disparity was not only with the private sector, but also with federal and local government agencies.

- **Differential salaries between NCDOT and DENR.**

  Interviews with several DENR managers highlighted the inequity between salary levels for engineering positions in the two agencies. NCDOT recently conducted an engineering market study and was given permission by the Office of State Personnel to make adjustments in salary ranges. NCDOT was also able to fund these salary adjustments. DENR, leveraging the NCDOT study, was also given permission to make similar salary adjustments. However, DENR was not given the necessary funding to actually make the adjustments. This has created pay equity issues between similar engineering positions at NCDOT and DENR and has resulted in DENR losing some staff to NCDOT.

a. Analysis Approach

To evaluate the extent to which recruiting and retention is a significant issue affecting project delivery the following indicators were used for NCDOT:

- The number of vacant positions by organizational unit for those units which have project delivery responsibilities as a primary function.
- The length of time positions have been vacant.
- The length of time employees have been in their current positions.
- The number of years employees have been with NCDOT.
- Assessment of salary comparisons.
- Assessment of whether the NCDOT study of pay will address the issue.

b. Findings

- **Project delivery personnel make up just over a quarter of NCDOT's total workforce[9].**

  Project delivery personnel comprise approximately 27.2 percent of NCDOT's total workforce distributed across design organizations, right of way, planning, and environmental preliminary engineering. These personnel are responsible for all the activities involved in developing a project from when it is included in the TIP through to letting. Exhibit IV-5 provides data on project delivery full-time equivalent (FTE) positions for calendar years 2001 to 2003.

[9] Project delivery is defined to include all preconstruction or the following NCDOT units: all design units, right of way, contractual services, planning and environmental preliminary engineering, and divisions with design engineering among others.

Exhibit IV-5: Project Delivery Full-Time Equivalent (FTE) Positions, Calendar Years 2001 to 2003

	Project Delivery		NCDOT		
Calendar Year	FTE Positions End of Calendar Year	Percentage of all positions	Full-time Positions	Vacant Positions	Total Positions Including Vacants
1/01 to 12/01	3,920	29.3%	11,998	1,360	13,358
1/02 to 12/02	3,740	28.0%	12,011	1,342	13,353
1/03 to 12/03	3,282	24.4%	12,102	1,374	13,476
Annual Average	**3,647**	**27.2%**	**12,037**	**1,359**	**13,396**

Source: North Carolina State Office of Personnel, Employee Activity Listing

- **Project delivery units have experienced turnover; however, it is most heavily concentrated in key organizational units.**

  NCDOT employees and resource agency managers point to high rates of NCDOT staff turnover as a significant contributor to project delay. Detailed analysis of the number of separations, number of positions, and vacant positions by organizational unit over the past three calendar years finds that overall turnover rates are not particularly high; however, there have been very high rates of turnover in key units that have the principal responsibilities for managing projects.

  Exhibit IV-6 provides summary data on the number of separations. Overall there were some 253 separations out of an average of 3,151 employees. This is a separation rate of 8 percent over the 3-year period.

Exhibit IV-6: Project Delivery Units Employee Separations and Recruiting, Calendar Years 2001 to 2003

Preconstruction Units	Separations	New Hires	# FTE's Changing Positions[10]	3 Yr. Average FTE Positions Start of Calendar Year	3 Yr. Average FTE Employees Start of Calendar Year	Separations as a Percentage of FTE Employees at Beginning of Year	Vacancy Percentage Start of Calendar Year	Turnover Percentage of 3 Yr. Average	Total Lost Service Months Due to Separations (2001 to 2003)
Preliminary Engineering Related[11]	53	63	116	886	750	7%	15%	15.68%	-6863
ROW and Contractual Services	40	12	52	669	596	7%	11%	8.74%	-6941
Design Organizations	160	112	272	2238	1805	9%	19%	15.01%	-24236
2003 Total	**253**	**187**	**440**	**3794**	**3151**	**8%**	**17%**	**13.98%**	**-38040**

Source: North Carolina State Office of Personnel, Employee Activity Listing

[10] Includes separations, reallocations, demotions and transfers.

[11] Administrative (Chief Engnr Offce, Chief Engnr-Prgm Devel, Chief Engr-Stwide Plng (HPR/PR), Planning and Envir-Prelim Engr, Chief Engr-Facil Design, Engnr Trainee Program, Planning and Environmental, and Engin Automation Unit).

- **NCDOT has not been able to fill positions to replace those lost.**

  Over the past three years NCDOT has not replaced lost employees. During this time period 187 positions were filled to replace the lost 253 vacated positions as shown in Exhibit IV-6 above. Overall the management issue appears to be the need to fill positions more expeditiously as opposed to high overall rates of turnover.

- **New employees have less experience.**

  According to data provided by the NCDOT Personnel unit data the majority of reasons NCDOT staff gave for separating employment was better employment and retirement service. Employees hired to fill these vacated positions routinely did not have comparable experience or no experience to his or her predecessor. Exhibit IV-7 below shows that for calendar years 2001 to 2003, an average of 12,649 service months were lost to separations in NCDOT employment. This total amounts to an average of 128 service months or 11 service years of experience lost for each separation. As such, NCDOT encounters knowledge gaps, which impacts the amount of time it takes to address processes and procedures, communicate and resolve issues, as well as other decision-making activities.

Exhibit IV-7: Number of Separations by Cause 2001 Through 2003

Calendar Year	Number of Separations	Separation Type = Better Employment	Separation Type = Retirement Service	Separation Type = Other	Total Lost Service Months Due to Separations	Average Lost Months Per Separation	Average Lost Years Per Separation
1/01 to 12/01	130	43	35	46	(18,662)	143.6	-12.0
1/02 to 12/02	103	35	24	32	(13,789)	133.9	-11.2
1/03 to 12/03	52	10	14	2	(5,497)	105.7	-8.8
3 Yr. Average					**(12,649)**	**(128.0)**	**(11.0)**

Source: North Carolina State Office of Personnel, Employee Activity Listing

- **Employee turnover is most heavily concentrated in some key sections that causes delay.**

  Study findings provide strong indication that high turnover rates and the slow rate of filling vacant positions impacts project delivery. Among the NCDOT units experiencing the highest employee turnover rates are those that play a key role in managing project delivery.

  Based upon a review of preconstruction units' human resource data, central office and Division level design service organizations have experienced the

highest number of employee separations (160) for calendar years 2001 to 2003. However, due to the time elapsed for filling or recruiting qualified employees, these units have experienced a 19 percent vacancy rate for this time period.

For the time period 2001 to 2003, the preconstruction units that have experienced the highest percentage of separations versus the total number of FTE employees at the beginning of the calendar year and highest vacancy percentages at the start of the calendar year, and resultant average lost years per separation are listed in Exhibit IV-8 below.

Exhibit IV-8: Units Experiencing the Greatest Turnover

Section Name[12]	Percentage of Separations Versus Total FTE Employees at Beginning of Year (2001 to 2003)	Vacancy Percentage Start of Calendar Year (2001 to 2003)	Average Lost Years Per Separation (2001 to 2003)
Planning and Environment-Prelim Engr	11%	13%	3.9
Contractual Services	15%	20%	2.3
Highway Design, Design Serv	11%	19%	5.6
Highway Design, Roadway Design	13%	17%	3.6
HGHWY Des-Loc and Surveys	23%	50%	4.9
HGHWY Des-Geotechnical	14%	31%	10.7
HGHWY Des-Structure Design	15%	38%	9.9

Source: North Carolina State Office of Personnel, Employee Activity Listing

During calendar years 2001 to 2003, Division 10, Design Engineering in Albermarle, experienced the highest separation of employees (43 percent). The Highway Design-Location and Surveys Unit had a 50 percent vacancy rate for this period. In terms of lost service years per separation, the Highway Design Geotechnical Unit was impacted the greatest losing 10.7 years of experience.

[12] NCDOT personnel data does not always match exactly with the current organizational structure.

2. Issue Area: Bottlenecks in the Project Delivery Process Due to Shortages of Specialized Expertise

The following issues were identified as causing bottlenecks in project delivery:

- **Shortage of specialist staff resources in several key areas.**

  Interviewees identified a shortage of specialist staff which is creating bottlenecks and causing project delays. Areas having shortages include:

  – Office of Human Environment, specifically the Historical Architecture section.

  – Mussel surveyors.

a. Analysis Approach

The circumstances around the bottlenecks were evaluated through:

- Conducting interviews with NCDOT and resource agency managers.
- Assessing management approach to resolution of the issues.

b. Findings

- **NCDOT has little proactive identification and program level management of specialized resource needs.**

  NCDOT has little information or management processes for the early identification of specialized resource constraints that allows them to apply program level and project management techniques to reduce the risk of delay. These resource constraints arise from time to time, but there is a limited program delivery management function that allows responsible program managers to identify bottlenecks in advance as risks to project delivery and prepare resolution options for executive action.

- **Staffing levels in the Historical Architecture group within the Office of Human Environment have been difficult to maintain.**

  The Historical Architecture group within the Office of Human Environment, which works in conjunction with the State Historical Preservation Office (SHPO) to conduct Section 106 reviews, has recently had as many as four vacant positions. In addition, the Moving Ahead projects have substantially increased the workload for historical reviews.

  NCDOT has encountered difficulties recruiting staff to assist in historical reviews. Suitable staff requires specific regional experience (someone who has a historical preservation background from the Midwest or Southwest, for example, would not necessarily have experience specifically relevant to North Carolina). However, there are only two schools in the Southeast

which offer the appropriate curriculum. In addition, there appears to be some reluctance for trained historical architects to work for state departments of transportation versus other more traditional employers (such as Colonial Williamsburg for example). Likewise, there is a limited career path for staff with a historical architecture background in a primarily engineering organization.

- **NCDOT is responding to the current shortages of licensed mussel surveyors which has delayed some projects.**

  NCDOT currently has no staff licensed to conduct either initial mussel screenings or more detailed mussel surveys, resulting in significant delays to a large number of projects. If a project impacts a stream in a protected watershed, it must have at least an initial mussel screening, which essentially represents a yes/no evaluation of the presence of mussels. If mussels are found, a more detailed mussel survey is then required, which has been cited as a cause for delay on a number of projects.

  To address this shortage, NCDOT, FHWA, US Fish and Wildlife, and the State Wildlife Resources Commission are working to develop a rider to an existing exotic shell permit to allow selected NCDOT staff to perform at least the initial mussel screening. This would enable projects with no mussel issues to move forward more rapidly. There is an immediate need for final approval and roll-out of this approach.

  The mussel survey process is highly specialized and requires approximately 18 months of training for initial licensing, with additional training and licensing required for each additional species of mussels. Thus, while some current NCDOT staff are seeking licenses, there will be a significant gap in coverage before NCDOT staff obtain the appropriate certifications.

- **Limited private sector capacity to perform mussel surveys.**

  There are currently only two private sector firms licensed to perform mussel surveys in North Carolina. This has resulted in a substantial backlog of mussel survey work since consultants are now required to perform both mussel screenings and the more detailed mussel surveys. This resource limitation has been complicated by the increased demand for mussel screening work by NCDOT Division staff as a result of the Moving Ahead projects. The result is a situation where both TIP projects and Moving Ahead projects are essentially competing with each other for scarce resources. This has caused additional delays to a number of projects in both the TIP and Moving Ahead programs.

- **Constraints on timely availability of appraisal firms increase right of way acquisition cycle time.**

  Due to the heavy private sector demand for appraisal services, NCDOT has found it difficult to get appraisal firms to respond to their right of way work on a timely basis. Appraisal firms prefer to address commercial business first and tend to use less profitable and more paperwork intensive NCDOT work as a fill-in activity. This trend has been exacerbated by the surge of refinancing activity over the last 18 months.

3. Issue Area: Need for Program Level Planning and Management of Human Resources

In common with other transportation agencies, the nature, amount, and type of work required to deliver NCDOT's program successfully has changed considerably over the past 15 years. Among the variables driving this change are:

- The use of new technologies for survey work, design work, and other activities.
- The increased complexity and numbers of participants in the delivery process, especially for the environmental process.
- The use of contracted resources for design, right of way, geotechnical, and environmental activities.

Together, these program level factors are changing the amount and type of labor required to deliver the program. For example, in the past, departments of transportation employed large numbers of design technicians as drafters. Over time, through the use of computer added design and the standardization of design templates, fewer but more skilled labor hours are required for detailed design work.

Within functional areas, the knowledge, skills, and abilities required of the labor force have changed. For example, survey work can now require the use of sophisticated technology. Project engineers performing project management need strong communication, consensus building, and leadership skills as well as engineering skills. Another example of the change in labor force needs is that with the increased private sector involvement in the delivery of projects through the use of design consultants, private appraisers, and other companies, NCDOT requires employees with the skills associated with procurement, negotiation, and contract management.

The key issue for NCDOT is whether it has program level human resource planning and management practices to proactively plan for and address these changing labor force needs. In addition, NCDOT needs to do program level planning to meet the needs arising from labor force transitions due to retirements and the varying experience levels (in number of years) of NCDOT employees.

a. Analysis Approach

- Assess current NCDOT practices.
- Evaluate NCDOT against contemporary best practice.

b. Findings

- **Need for stronger program level human resource planning.**

  A consistent finding across the issue areas evaluated is the need for stronger program level management across the functions and disciplines involved in project delivery. This finding applies in the area of human resource management. At present, NCDOT does not have an overall program delivery human resource plan. Human resource needs and bottlenecks are identified at the line manager level and usually when they become an operational barrier.

  At the program level, broader labor force planning is required to manage recruitment, retention, and career development across the disciplines. This planning is needed to meet overall FTE needs by functional area and make adjustments over time. The overall balance of resources across functional disciplines will continue changing as the way projects are designed and built changes to manage the increased role of the private sector in project delivery.

- **Absence of formal or informal succession planning.**

  There is an absence of either formal or informal succession planning at NCDOT. A number of examples were cited where no proactive planning appears to be taking place to address potential succession or even temporary back-fill strategies in mission critical positions.

- **PMii can be used to support program level human resource planning.**

  The PMii has established a network of all activities that are required to deliver a project. The PMii implementation work includes a duration work standard that sets the length of time each activity should take. To support human resource planning, a work standard can be applied which sets the number of hours or person days required to perform the activity. These standards can then be applied across the program to determine total labor needs. These types of data would then provide an analysis tool to evaluate labor needs over the next 5 years and compare them to NCDOT's current staffing.

C. Uniqueness and Extent of North Carolina's Environmental Requirements

The complexity of the environmental process and the level and type of environmental analysis required to deliver NCDOT's transportation program have long been cited as the

most significant barriers to project delivery in North Carolina. The conventional wisdom is that addressing federal and state environmental laws and regulations, while protecting the environment, results in additional delays and costs to the delivery of projects. To a certain extent, much of the information that has been used to inform policy debate has generally been based on individual project experience and project experience is often one of major delays attributed to the environmental process.

This study, while focused more broadly than just on the environmental process, provides broader program level and multi-project level consideration of North Carolina's performance in managing the environmental process to deliver projects in a timely manner. The study issues are grouped into four broad areas:

- Complexity of environmental and permitting process.
- Recognition of the extent of NCDOT's process improvements to date.
- Remaining process improvement needs and priorities.
- Role of statewide and executive management performance objectives and metrics.

1. Issue Area: Complexity of Environmental and Permitting Process

Interviews identified the following issues regarding the complexity of the environmental process:

- **Belief that the complexity of the environmental and permitting process and project delivery in general is not understood by policymakers and stakeholders.**

  Interviewees believe that there are many misconceptions about the environmental process. Many in NCDOT are concerned that policymakers and stakeholders do not always recognize the complexity of the process and the constraints that it imposes on project delivery. In turn, some policymakers and stakeholders question whether the complexity of the process is merely an excuse or actually is an insurmountable obstacle preventing NCDOT from meeting project delivery goals.

- **Concern that state law and state agencies' practices exceed federal requirements.**

  Policymakers are concerned that there are requirements in state laws that exceed federal requirements and that these may be contributing to project delays. A specific issue that has been raised is that 9 species of mussel are listed as endangered by Federal agencies whereas 44 species are designated by the State as either endangered, threatened, of special concern, significantly rare, or assumed to be extirpated from North Carolina. A second issue is the impact which analysis for secondary and cumulative impacts is having on the time required to complete environmental studies. These additional requirements are primarily the result of new, administrative interpretations by DENR which

substantially increased demands for information to be provided by NCDOT on secondary and cumulative impacts.

a. Analysis Approach

- General description of the environmental process as it affects transportation projects.
- Identification of selected laws and regulatory requirements that exceed Federal requirements.

b. Findings

- **NCDOT's project delivery addresses a complex set of requirements.**

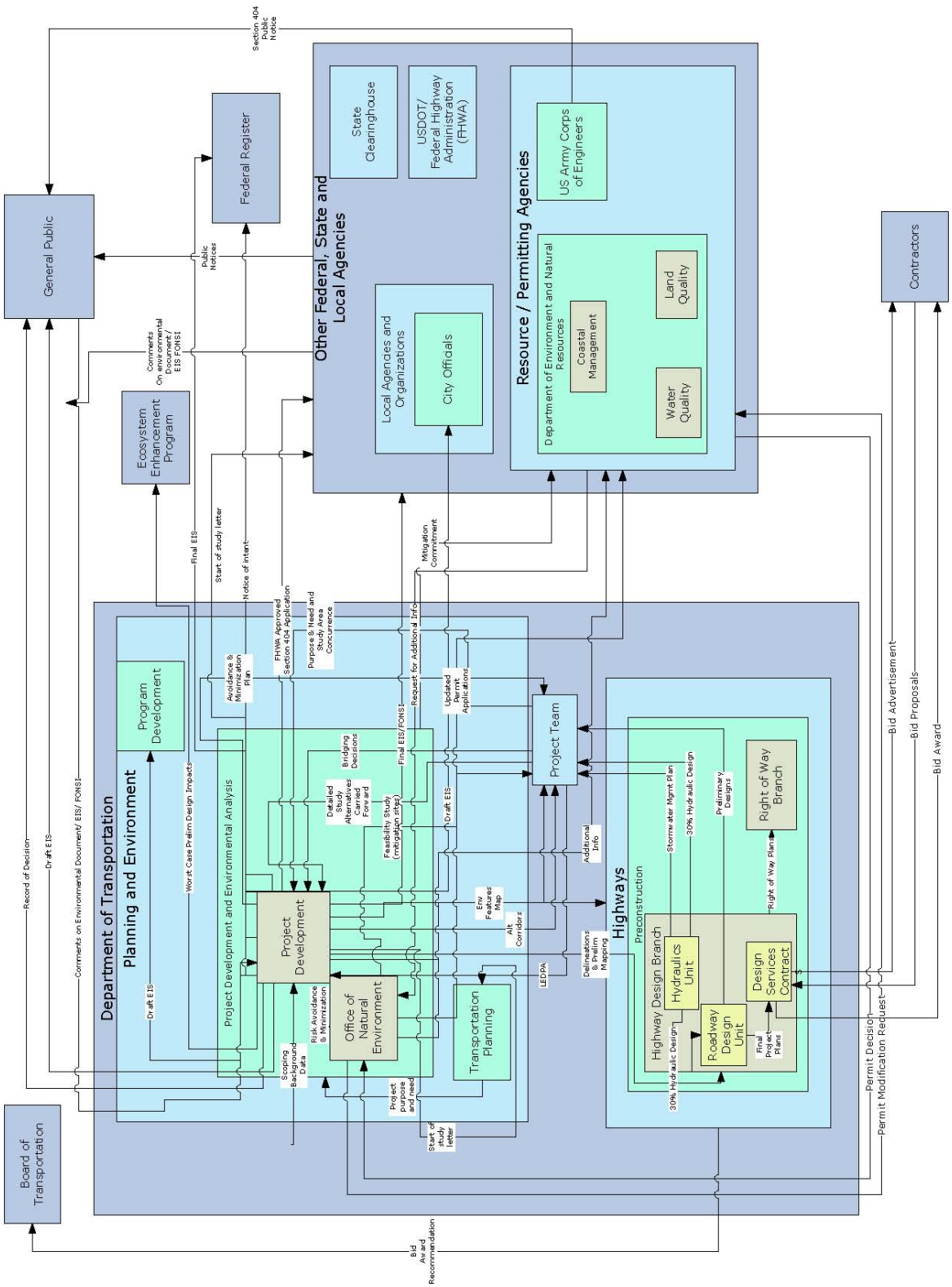
  NCDOT's project delivery process must meet the requirements of a complex set of Federal and state environmental laws and regulations.

  Many of the environmental laws and regulations that affect preconstruction, such as the National Environmental Policy Act, have been in place over 20 years. NCDOT has built into its project delivery process and practices the work activities, procedures, and standards to meet these requirements and reduce environmental impacts. Regulatory oversight of these practices is performed by other state and federal agencies.

  There are multiple state and Federal agencies, multiple disciplines, and complex technical steps involved in the environmental process.

  Exhibit IV-9 details the work flow and participants involved in the environmental process, clearly demonstrating its complexity.

Exhibit IV-9: Work Flow and Participants in Environmental Process



The purpose of the environmental process is to assess a project's possible environmental impacts and identify steps to avoid, minimize, and mitigate them.

Every project must go through some form of environmental analysis. Federal regulations require projects be classified in one of three environmental classifications. Each classification then dictates the level of assessment to take place and the type of environmental document that must be prepared. In addition, there is a separate classification, usually referred to as Section 4(f), that applies to transportation projects that abut federally owned parks, recreation areas, wildlife refuges, and historic sites.

Environmental requirements are summarized in Exhibit IV-10 below.

Exhibit IV-10: Environmental Documentation Classifications and Requirements

Classification	Reason	Document	Notes
Class 1	Actions that significantly affect the environment.	Environmental Impact Statement	Highest, most detailed level of analysis.
Class 2	Actions that do not individually or cumulatively have environmental impacts.	Categorical Exclusion	Takes on several forms and ranges in complexity. Must provide enough analysis to demonstrate no significant impacts.
Class 3	Actions for which the significance of the environmental impact is not clearly established.	Environmental Assessment	Documentation limited to those areas that have potential for significant impacts, but where affects are unknown. If significant impacts will occur, then an EIS must be prepared.
4(f) this can apply to any one of the three Classes	Minimize harm. No feasible alternative.	4(f)	Completed in addition to other documents when a publicly owned park or recreation area, wildlife refuge, or historic site may be affected.

Within NCDOT, PDEA has the primary responsibility for identifying regulatory environmental requirements, producing the appropriate environmental documentation, and obtaining necessary environmental permits for each project.

- **Indirect and cumulative impacts analysis requirements have increased the analysis effort required on each project.**

  In 2000, based on the outcome of an administrative hearing, the Department of Environment and Natural Resources (DENR) was requested by the Environmental Management Commission to develop more detailed requirements for the analysis of indirect and cumulative impacts as part of the permit application process. The requirements to consider indirect and cumulative impacts had always been part of the permitting process, but until a permit was challenged administratively using indirect and cumulative impacts as a basis, limited attention had been given to this area.

  The analytical requirements, to document as comprehensively as possible the indirect and cumulative impacts from proposed NCDOT projects, has resulted in thousands of additional hours of analysis for NCDOT staff and consultants. This effort appears to be required as a comprehensive indirect and cumulative impact analysis is viewed within both NCDOT and DENR as an essential component for sustaining judicial review of a permit approval. In addition, this issue is not confined to North Carolina, with a number of states now addressing increased work load based on the impact of analysis required for indirect and cumulative impacts. However while the impact in other states is only with the NEPA process, NCDOT is also having to address this as part of the permit application.

  Because the indirect and cumulative impact analysis required for the permit application can be completed once a preferred alternative it should not delay the let date of a project provided the resources are available to do this work. However, NCDOT has a shortage of resources with the skills to perform such analysis requiring work planning across multiple projects.

- **NCDOT and DENR should continue to work together to define best practice and improve efficiency in regards to analysis for indirect and cumulative impacts.**

  NCDOT and DENR are continuing to work to refine the agreed set of best practices for secondary and cumulative looking for ways to minimize the burden on NCDOT, while still providing an appropriate level of rigor to the analysis in the event of judicial review. NCDOT and DENR should continue this process. In addition, as part of this effort, the agencies should work together to identify and define analytical tools or other methods which can help to streamline the analysis effort and reduce the overall time spent on performing the indirect and cumulative impact analysis. Likewise, NCDOT and DENR should work together to educate communities on the impact of local land use planning on the transportation process and the potential benefits of enhanced local land user planning in terms of reducing indirect and cumulative impacts and thus facilitating the implementation of the transportation program.

2. Extent of North Carolina's Environmental Process Improvements

NCDOT and the resource agencies have implemented a series of business improvements designed to make project delivery more predictable and streamlined.

- **NCDOT in partnership with the resource agencies has implemented process improvements that will yield benefits in coming years.**

  There is a concern by many interviewees that credit needs to be given where credit is due. They believe that NCDOT has made a number of changes in its processes and business practices to better deliver projects and protect the environment. However, due to the time it takes to deliver projects, NCDOT has not reaped the full benefits from these improvements.

- **NCDOT has taken action to strengthen working relationships with resource and permitting agencies.**

  In addition, a number of interviewees identified the establishment of strong collaborative working relationships across agencies that have overcome a historic belief that NCDOT does not have a strong environmental ethic.

- **North Carolina has established a multi-agency and interjurisdictional process for the early stages in the project delivery process.**

  A critical issue raised by many interviewees is the extent of the change initiatives that have been implemented to facilitate interagency agreement and to make environmental review and regulation timelier without compromising the state and NCDOT's environmental ethic. There is a strong belief that much positive change has been implemented and that this study should separate fact from fiction regarding what causes project delay.

- **Need to improve the process for making participants more accountable for timely decision-making.**

  The issue raised by both resource agencies and NCDOT management is that the current process does not provide a timeline for decision making. For example, the participants in the Merger 01 process need to commit to an agreement in a more timely fashion.

a. Analysis Approach

The approach taken to evaluate the issues involved the following:

- **Interviews with NCDOT, FHWA, and North Carolina resource agencies' staff.**

  The purpose of the interviews was to obtain input on the issue areas and to help assess how things work in practice. Interviews were held with NCDOT staff involved in the environmental process.

Interviews were also held with representatives from state and federal resources agencies that have regulatory authority and review responsibilities for protection of environmental resources and the granting of environmental permits. Federal Highway Administration staff from the Division office in Raleigh were also interviewed in connection with their environmental review and concurrence responsibility with Federal regulations for Federal funding.

- **Evaluation of documented policies and procedures.**

  Documented policies and procedures governing NCDOT's environmental process were reviewed. Care was taken to understand what represents current practice and new procedures that are being implemented.

b. Findings

(1) Business Improvement Initiatives

- **NCDOT has implemented and embarked on many initiatives aimed at streamlining the environmental permitting process.**

  It is possible to point to over 50 separate improvement initiatives focused on the environmental process that NCDOT has proposed, implemented, or has underway that are aimed at improving the delivery process. There does not appear to be an overall management process for identifying improvements across the entire process and prioritizing them based on their relative impacts on project schedules and costs.

  Beginning in 2001, NCDOT identified and inventoried a number of environmental stewardship and streamlining initiatives that have been proposed. Many of these initiatives have begun; several of them have been completed.

  These initiatives fall into two major categories:

  – Initiatives whose purpose is to streamline the environmental permitting and project delivery processes.

  – Initiatives whose purpose is to improve the NCDOT's environmental stewardship.

  Our analysis focuses on the former set of initiatives; that is, those intended to streamline the permitting and project delivery processes. A list and brief description of those initiatives is presented, and their

status is summarized. In addition, project delivery improvement initiatives that were identified but not pursued are examined. For these initiatives, this report examines any barriers to pursuing them that might be removed by making additional resources available or eliminating legislative or regulatory constraints.

Attachment A lists these initiatives. The "status" described for each initiative is the status as of fall 2003. Data presented in this report for each initiative includes the initiative title, a brief description of the initiative (where available), and the initiative's status. Each initiative has been further classified as current, past, or future. Current and past initiatives are those which were identified as completed or in process. Future initiatives are those which had not yet started as of fall 2003.

- **For many of the process improvements, it is too early to quantify benefits through reduced delivery times.**

  Among the potentially most significant improvements are:

  – The establishment of the Ecosystem Enhancement Program (EEP).

  – The development of the refined Merger Process (Merger 01).

  – The development of green sheets to clearly identify and summarize project environmental commitments.

  Implemented effectively, all of these initiatives can be expected to have a positive effect on project delivery. The benefits from these changes will not be immediate because many projects in the delivery pipeline were developed under prior business practices. Support for these initiatives should continue, and their impact on project delivery should be tracked using a limited number of metrics to determine the extent to which they improve cycle times or impact project costs.

  To identify the anticipated project delivery team benefits from NCDOT process improvements, the delivery time work standards established in PMii were contrasted to the actual time taken on projects let between 2001 and 2003. This is depicted in Exhibit IV-11 below and is explained as follows:

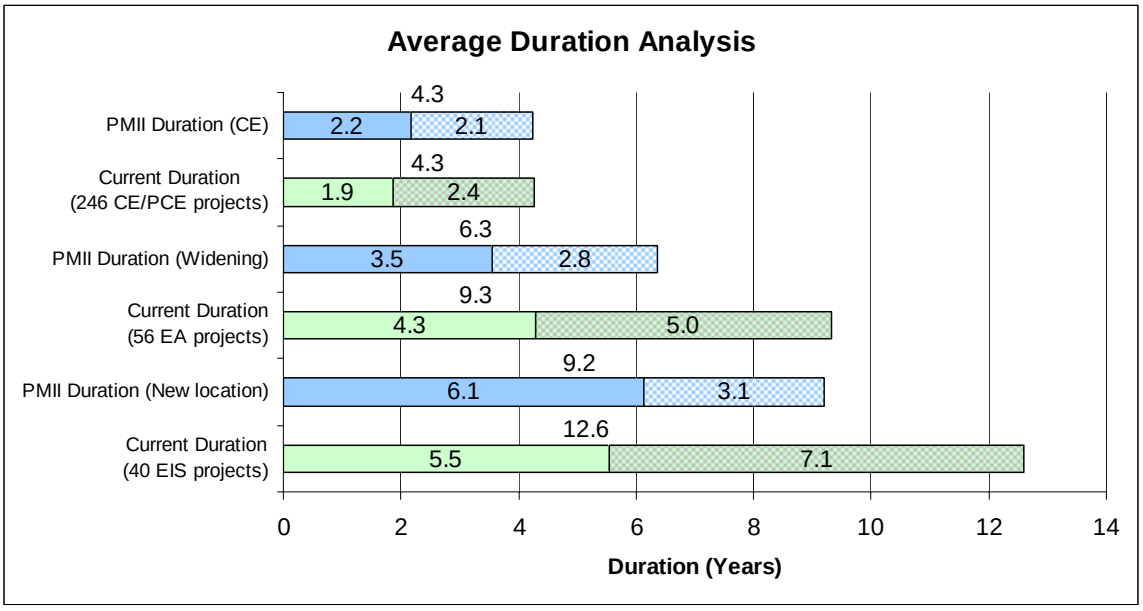
  – This study was able to quantify how long projects took and break that out into two components. First, from inception through completion of environmental document and then second, from the completion of environmental document through letting.

  – This study was able to distinguish between projects requiring three classes of environmental documents

- The results are depicted in the exhibit as actual duration. For example, the actual duration of all projects requiring a categorical exclusion was 4.3 years with it taking 1.9 years through the environmental process and then 2.4 through letting.
- PMii is a scheduling system that has established work standards for how long project delivery activities should take. It is based upon delivering projects following the Merger01 process and other improvements.
- PMii average durations were identified for three classes of projects as grouped in PMii, these are categorical exclusion, widening, and new location.
- These are then aligned in the exhibit although there is not a direct match all widening projects do not involve environmental assessments but it is reasonable to assume that new location will.

This exhibit shows that, if the Merger01 process is successfully implemented, North Carolina will reap real benefits in the time it takes to deliver projects. It also supports the recommendations regarding having a development and a delivery TIP because all most all projects could then be delivered within a five-year window.

Exhibit IV-11: Comparison of PMii Delivery Times to Actual



- **NCDOT has identified additional future process improvement initiatives.**

  NCDOT has also identified six additional initiatives for implementation to improve the environmental process. They are listed in Exhibit IV-12. At present, it does not appear that any of these initiatives are facing regulatory or funding barriers.

Exhibit IV-12: NCDOT's Environmental Streamlining Initiatives

Initiative Title	Brief Description	Status
Regional Community Impact Assessment Study		Unknown
Proposed General Environmental Permits for Maintenance and Operations for Environmental Streamlining (Nationwide 401's)	Many of the Department's maintenance/operations projects require individual permits before construction can take place. The General Permit (GP) initiative, if implemented, will allow the Department to construct projects that have minimal environmental impacts without first acquiring individual permits. After the projects are complete, DOT will provide post-construction notification.	The GP is being developed.
Partnership with WRC and USFWS on Goose Creek Secondary and Cumulative Impacts		Unknown
DENR Permit Fee - Charge Account:	This initiative will be to setup some type of charge account or debit system such that the Department can provide payment to the Division of Water Quality (DWQ) for permit applications and permit modifications without writing a separate check for each individual occurrence.	The process is currently being developed by the two departments.
Flexible Mitigation Strategies	A means to provide alternative methods to prescribe ratios as established by the regulatory agencies.	"Wish List" stage (planning/developing/concept/ thought/negotiating)
Linked Land Use and Transportation Planning	Note: an abbreviated department process improvement effort is underway to better address this initiative and implementation should occur mid 2002.	Unknown
Development and Implementation of Environmental Management Systems (EMS)	To develop and implement Environmental Management Systems (ISO 14001) in various areas of the Department for the following benefits: (1) cost savings/cost avoidance and improved use of available resources, (2) regulatory oversight eased as regulatory agencies gain confidence in DOT's environmental management processes (i.e., trust), and (3) more timely regulatory reviews. An EMS is an organizational structure and associated responsibilities and procedures to integrate environmental considerations and objectives into the on-going management decision-making processes and operations of our organization. An EMS offers the means for DOT to meets its challenges of timely program delivery with environmental excellence.	To begin Summer 2004

* Data is missing or incomplete.

Of the future initiatives described in Exhibit IV-12, the following show the greatest potential for improving project delivery:

- The Environmental Management Systems initiative can provide the Department with an important set of measurable goals and a long-term strategic direction. This can provide the foundation for significant improvements in project delivery cycle time and costs.
- In addition, the General Environmental Permits initiative appears to have potential to improve cycle times for maintenance and other relatively low-impact highway improvement activities.

3. NCDOT Environmental Process Improvement Issues Requiring Resolution

An important consideration for study analysis is that NCDOT has underway a large number of significant change initiatives as detailed above. Many of these initiatives have been implemented to better manage and improve the predictability of project delivery. Although the study concludes that these initiatives represent large positive steps towards improving the process, it is important for this study to assess the outstanding risks and issues with the environmental process.

Interviews with NCDOT, DENR, and other managers and staff identified the following outstanding issues:

- **Project cycle time is too long and uncertain.**

  The current projected time to deliver projects at a new location under the new improved process is 9.5 years. This is seen by many as too long. Others consider this an unrealistic timeline and doubt that it can be achieved in the next few years. This creates dissatisfaction among local constituents who want to see roads built and improved more quickly. It can also increase the overall cost of a highway project.

- **Increasingly complex requirements for environmental compliance.**

  The analysis and documentation required for environmental compliance has significantly increased over the past 5 to 10 years. This includes addressing indirect and cumulative impacts and community effects, as well as more stringent procedures and analysis and increased documentation required to meet prior standards. All of this requires more time, and in some cases higher levels of expertise and certification in very specific scientific areas, such as protected species.

- **Lack of ongoing training, documentation, and coordination for implementing the Merger01 Process.**

  The Merger01 Process has been in place for a little over 12 months. NCDOT and its environmental process partners have not worked any projects through all of its components. A few projects have been implemented using its predecessor Merger

process. To date, however, there is no set of documented end-to-end guidelines or standards for the process. There is no ongoing training program in place to provide staff with a clear understanding of the process and its components. Training and documentation is being provided for the new project scheduling system (PMii) being implemented to support Merger01. However, that material focuses on the mechanics of recording information in PMii, not on the business processes and procedures which the tool is intended to support. Finally, there is no overall coordinator role in place to monitor the implementation of the process, answer staff questions, and report on environmental implementation, impacts, and improvements to management within the various agencies involved.

- **Timing issues in submitting and completing permit applications.**

  Applications are sometimes submitted to DENR with insufficient time for approval; for example, a permitting agency might require six months for review and approval of a permit and the requesting branch within NCDOT submits the application five months before approval is needed. On the other hand, NCDOT reports delays by some permitting agencies in reviewing and approving the application. Within NCDOT, headquarters staff sometimes is not able to provide a timely response to Division-level project staff on scoping documents and issues. This indicates that there is not a clear, mutual agreement and understanding among NCDOT headquarters staff, Division-level project staff, and some permitting agency staff about cycle times for response and permit approval.

- **Lack of clear, shared expectations regarding permits and other project development requirements.**

  In many areas of environmental compliance, there is a lack of clarity and agreement between requesters and reviewers about expected cycle times and quality. For example, consultant reports and analyses sometimes do not meet the quality expectations of NCDOT managers who contract for the work, and some permit applications do not contain information required by DENR staff to review and approve them.

- **Gaps in staff and contractor experience, consistency, and availability.**

  NCDOT staff turnover is relatively high. This is most problematic when those leaving the Department, or PDEA, are managers overseeing contracts. Highly experienced staff are retiring, leaving less experienced staff to complete the work. There is limited support for these new staff; current procedures manuals are outdated and rarely used, although individual tools and guides have been developed. Training and support is limited. There are limited “career path” opportunities for engineers within the environmental area. There is no concerted effort to do succession planning.

- **Need for improved project management continuity.**

  A number of interviewees at NCDOT and the resource agencies pointed to a lack of project management continuity on projects due to both turnover and organizational structure. Most specifically, midway through a project, the project management shifts from the Planning and Environment Division to the Highway Division. A change in management can also occur when a project manager changes jobs. Project history and key issues are not always well understood by the new project manager, creating a significant continuity issue for the project and sometimes resulting in delays or rework.

- **Lack of consistency in facilitating Project Team meetings.**

  Project Team meeting facilitation is currently done by one or more members of the team. This allows the facilitator to bring significant knowledge of technical issues to the discussion, but does not guarantee that person is an experienced facilitator. Since the facilitator is a participant in the process, and typically has a vested interest in the outcome of discussions, it can be difficult to ensure that all points of view are fairly represented or that the discussion continues to move toward consensus. This results in some meetings running very well and achieving desired results in a timely way, while others require two or three sessions to resolve the issues at hand. Change in leadership midway also creates a continuity problem, with the new leader not being as familiar as some of the team members with key project issues and status. Since team meetings are a critical component of the Merger Process, this can create significant delays in the process.

- **No comprehensive, integrated information source regarding project sites.**

  There is no integrated source of information about environmental, historical preservation, community, and other factors important to planning, scoping, and designing a highway project. This leads to significant time investment in unearthing disparate conditions which affect a project, delays caused because high value resources and high risk situations are not discovered until midway through a project, and risk of rework because important issues are not discovered until the project is near completion.

- **Delays in escalating issues.**

  Although the Merger01 process allows for escalating issues when they cannot be resolved within the Project Team, that mechanism is not being used consistently. In some cases, there is reluctance to escalate issues in a timely way. This creates unnecessary delays in the process.

a. Analysis Approach

The approach taken to evaluate the issues involved the following:

- **Interviews with NCDOT, FHWA, and North Carolina resource agencies' staff.**

  The purpose of the interviews was to obtain input on the issue areas and to help assess how things work in practice. Interviews were held with NCDOT staff involved in the environmental process.

  Interviews were also held with representatives from state and federal resources agencies that have regulatory authority and review responsibilities for protection of environmental resources and the granting of environmental permits. Federal Highway Administration staff from the Division office in Raleigh were also interviewed in connection with their environmental review and concurrence responsibility with federal regulations for federal funding.

- **Evaluation of documented policies and procedures.**

  We considered the new Merger01 Process to be the current, as-is process. Because this process is very new, and in fact has not been implemented completely by a project to-date, the issues identified are based on either historical experience outside the process or on best practices for process management in general.

  Documented policies and procedures governing NCDOT's environmental process were reviewed. Care was taken to understand what represents current practice and new procedures that are being implemented.

  In order to analyze the preconstruction phase of the NCDOT project delivery process, the Merger01 Process was reviewed using a combination of documents. This included the "Merger01 Process Information" document published on March 21, 2003, as well as the "Project Networks with Activities and Activity Elements" reports produced by the PMii Project. In addition, business process maps for the activities and activity elements presented in the "Project Networks" reports were reviewed. These were used because they reflect the best available documented source for a defined process through which NCDOT projects are to be delivered.

- **Organizational interactions mapping.**

  To better understand organization-level responsibilities and interactions, and to identify possible gaps and breakdowns in the project delivery process, a map of organizational interactions was developed. This map depicts the work products which are produced in support of the project delivery process, and the organizations which produce and receive each work product. This organizational interaction map is contained in Exhibit IV-9.

b. Findings

- **Project delivery is a highly complex process with a long cycle time.**

  In general, the project delivery process as it currently operates is complex, depends on the review and approval of studies and other documents by a variety of individuals from different agencies and interest groups (whose expectations and responses are not always known or predictable), and has a long overall cycle time (usually exceeding five years). Further, there are not a set of work standards governing maximum duration and labor required for specific activities. This makes the process highly susceptible to delays, cost overruns, errors, and rework.

- **Multiple and complex responsibilities on the part of some organizations (especially PDEA's Project Development Unit).**

  PDEA's Project Development Unit is responsible for developing, coordinating, and delivering a large number of work products within the project delivery process. These work products typically require coordination with a number of NCDOT work units outside PDEA and non-NCDOT organizations. This creates a risk that work products may be incomplete or late, that bottlenecks may result, or that there be a poor distribution of work load (that is, some staff working overtime while other staff are not fully used).

- **Key decisions focused in an interagency group, requiring development of consensus within that group.**

  The Project Team is made up of individuals representing a number of agencies, both within and outside North Carolina State government. Key decision points (called "Consensus Points") require that these individuals, representing the constituencies to which they are accountable, reach agreement on key issues and approve the next step within the process. With no single organization or person accountable for keeping the process moving and for making decisions where there are conflicting priorities among participating agencies, keeping the project on schedule can require extraordinary good will and sophisticated negotiation skills on the part of participants. This has many benefits for the quality of decisions, but contributes to the risk of schedule delays. At present there are no expectations set regarding timeline for making decisions.

- **Lack of clearly established and communicated performance goals.**

  NCDOT has established broad goals for its project development process to include the number of projects let during the coming year and the dollar value of these projects in total. In particular, there are no elapsed-time or cycle time targets for individual projects; estimates made at the beginning of the project appear to be for planning purposes only and are not linked to an accountability structure. Without clearly articulated, and consistent,

performance targets, there can be confusion and frustration among staff about how to demonstrate the quality, timeliness, and cost effectiveness of their work. In addition, this can contribute to a disconnection between those delivering work products and those receiving them, regarding the timeliness and quality of the product.

- **Siloed processes.**

  There are some indications that within PDEA, and possibly other organizations (DENR/Water Quality, CAMA), there is a tendency to have work products travel up the chain of command before they are delivered to customers, and to tightly control information flowing to other parties at the expense of efficiency of the overall process. This may lead to sub-optimizing processes within the work unit at the expense of the overall process.

Overall, the concepts and approach that NCDOT has taken to improve the environmental process agrees with best practice in other states. Additionally, the changes that are being implemented represent considerable process change. At this stage, our findings indicate that NCDOT should be cautious in revising the Merger 01 Process but focus on stabilizing the new process and developing the organizational capacity, management controls, and tools to oversee the new process. NCDOT needs to develop an experience base implementing the process. In our recommendations, we focus on strategies for strengthening that process and its components, rather than on any wholesale redesign of the process.

4. Statewide Ownership of Environmental Objectives

Interviewees note that NCDOT and other state agencies work together to deliver the state's transportation program. In particular, the permitting agencies work to issue the required permits and the resource agencies participate in the environmental process. Many are concerned that finger-pointing or attributing delay to specific agencies is not productive; rather, there needs to be a common approach to managing the delivery of the state's transportation program while accomplishing the state's environmental policy objectives at the same time.

Among the issues raised are:

- **Need to recognize what NCDOT has control over and what it does not.**

  While this study focuses mainly on NCDOT, interviewees pointed out that many elements of project delivery resulting in delay and uncertainty involve work that NCDOT does not perform. Interviewees noted that competing and different mandates of other agencies should be evaluated as part of this study. Some interviewees noted that how NCDOT manages projects and responds to this lack of direct control is a critical issue.

- **Need to consider the policy objectives and business plans of other agencies that impact project delivery.**

  A key issue arising from the role of other agencies with regulatory authority over NCDOT projects at the state level is how their policy goals and objectives can best be reconciled and coordinated with those for NCDOT to meet the state's overall policy goals. For example, is the efficiency or timeliness with which regulatory tasks are performed addressed in the business planning of the regulatory agencies? Different agency roles and responsibilities could be clarified.

- **Need to assess whether more can be done with the programmatic delegation of authority.**

  NCDOT has implemented programmatic agreements for LE evaluation forms and section 4(f) evaluation forms. Best practices review finds that programmatic agreements and the programmatic delegation of authority are opportunity areas for reducing delivery time. As part of implementing this study's recommendations, NCDOT should continue to be proactive and identify any areas in which statutory change would remove barriers to the programmatic delegation of authority.

- **Need for management and policy consideration of the costs and benefits of different mitigation actions.**

  NCDOT often takes costly action to mitigate certain environmental impacts when spending the same amount of money elsewhere would produce a much greater environmental benefit. This leads to a broader public policy question. For example, if $5 million buys 98 percent of the mitigation for a project, but $5 million more is required for the next 1.5 percent, then it might be better to spend the first $5 million on a different type of environmental mitigation, perhaps one not directly tied to the project, which would have a greater social benefit.

a. Approach

The following approach was taken:

- Interviews with NCDOT and resource agency managers to identify and assess issues.
- Review of policies, plans, and management practices.

b. Findings

- **NCDOT and resource agencies management have established effective coordination mechanisms.**

  NCDOT and resource agency managers have established close working relationships to coordinate and better manage the resource needs for

environmental review and permitting. The process improvements developed to streamline the environmental process build in coordination mechanisms.

- **North Carolina would benefit from the establishment of state-level policy objectives and performance measures for capital program delivery**

  In addition to NCDOT, there are a number of other state, local, and federal agencies that are involved in the project delivery process. At the state level, there would be strong benefit from an overall set of policy objectives and performance metrics for delivery that incorporate environmental, quality of life, economic, and other delivery objectives. In this way, while NCDOT is primarily responsible for delivery, there can be overall statewide environmental objectives that are owned by all agencies and addressed in their business plans.

D. Permitting Process

A number of different permits are required depending upon the location and nature of individual projects. In general, different permits require differing levels of design detail and accompanying deliverables.

1. Issues

Among the issues identified regarding permitting are:

- **Need to assess the extent to which the permitting process outside of NCDOT is causing delay.**

  There has been a lack of systematic information to determine the extent to which the permitting process is causing delay. Delay can arise for two main reasons; first, following defined procedures in itself takes a long time and, second, there are insufficient staff to process permits, which causes backlogs.

- **Tendency to attribute blame, especially in the past, to other agencies.**

  Interview results indicate that some NCDOT staff have a tendency to blame the permitting process for the delay because it is outside of their immediate control. In turn, the resource agencies point to NCDOT for providing incomplete permit applications and also changing the personnel working on permit issues which cause loss of continuity and a failure to recognize when issues have been resolved.

- **Limited recognition of the beneficial outcome from improvement initiatives.**

  There have been a series of business improvement initiatives, implemented by NCDOT in partnership with the permitting agencies, to reduce the time it takes to process and approve permit applications. These initiatives include NCDOT providing funding for 6 positions within the Division of Water Quality (4 added

with Fiscal Year 2004) and 2 positions within Coastal Management to provide a dedicated resource to process NCDOT permit applications. All together, NCDOT now funds 22 positions in Federal and State of North Carolina resource agencies.

2. Analysis Approach

Our analytical approach for addressing these issues included the following steps:

- Interviews with State and Federal permitting agency managers.
- Interviews with NCDOT staff.
- Review of documented process improvements.
- Assembly and analysis of permit issuance turnaround time data.

3. Findings

- **There are coordinated and common objectives between agencies for the efficient, timely, and accurate processing of permit applications.**

  The resource agencies recognize that there needs to be a timely and predictable process for issuing permits. This is an objective that is managed to because the resource agencies report processing time for permit applications.

- **For many types of permits, the processing time is a relatively small percentage of the total time required to deliver projects.**

  Exhibit IV-13 provides summary information on the overall time it takes to issue different types of Corps of Engineers permits. The overall duration measures from when the agency first received the application the processing time in some cases is less. This is because the resource agencies record both when they receive the application and when the application is complete and can be processed.

Exhibit IV-13: Length of Time to Issue Permits, by Type of Permit, 2001 to 2003

Type of Project/ Permit	0-60 days Number	0-60 days Percentage	61-150 days Number	61-150 days Percentage	150+ days Number	150+ days Percentage
Bridge projects (71 permits)	61	86%	8	11%	2	3%
Rural and Urban projects (37 permits)	20	54%	10	27%	7	19%
All Projects (114 permits)	86	75%	18	16%	10	9%
IP Permits (15 Permits)	1	7%	6	40%	8	53%
NW Permits (99 permits)	85	86%	12	12%	2	2%
All Permits (114 permits)	86	75%	18	16%	10	9%

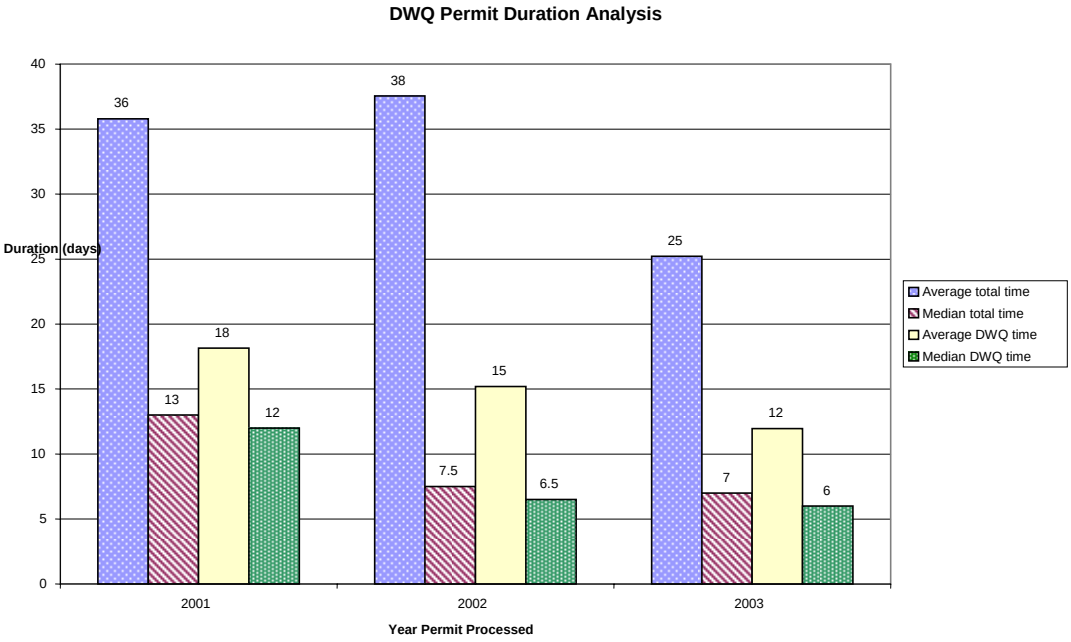
Source: Department of the Army, Corps of Engineers, Wilmington District

The Exhibit indicates that, for many types of permits, the average processing time is relatively small when compared to the total time required to deliver projects. This suggests that reducing permit processing time will not contribute greatly to reducing project delivery times.

- **It appears that permit processing time has been reduced for some types of permits.**

  In the case of Division of Water Quality permits, it appears that there has been a reduction in processing time as shown in Exhibit IV-14. The total processing time fell from an average of 36 days in 2001 to 25 days in 2003. Comparable data was not available from other agencies.

Exhibit IV-14 Time to Process DWQ Permits 2001 to 2003



- **Submission of completed applications can reduce permitting time in some cases.**

  Interview results further identified the resource agencies' perspectives on opportunities for reducing the turnaround time from receiving an application to issuing the permit. In particular, if a permit application is not complete, it needs to be returned to the NCDOT project manager prior to being processed. This creates delay. The resource agencies believe the permit application should be completed in its entirety with all the information required for evaluation before being submitted.

  A number of the resource agencies distinguish in their record keeping between when the application was submitted and processing time. Their view is that their performance should be evaluated for processing completed applications.

- **NCDOT has funded dedicated positions in select resource agencies to help ensure necessary turnaround.**

  NCDOT has attempted to expedite permit processing and also make resource agency staff available for Merger01 discussions and other improvement initiatives by funding dedicated positions in various resource agencies. Exhibit IV-12 shows the positions which NCDOT has funded within various resource agencies as of March 2004.

Exhibit IV-15: NCDOT Funded Positions in Resource Agencies

	Position	Date of Original Contract Establishing Position
NC Department of Environment and Natural Resources		
1	DWQ – Wetland Specialist	7/15/90
2	DWQ – Transportation Permit Coordinator	3/3/99
3	DWQ – Project Reviewer	9/26/00
4	DWQ – Project Processing Coordinator	9/26/00
5	DWQ – Regional Permit Coordinator	4/30/01
6	DWQ – Regional Permit Coordinator	4/30/01
7	DWQ – Stream Mapping Coordinator	9/12/03
8	DWQ – "NC Moving Ahead" Coordinator	9/12/03
9	DWQ – Transportation Permitting Unit Supervisor	9/12/03
10	DWQ – Regional Highway Certification Coordinator	9/12/03
11	DWQ – Regional Highway Certification Coordinator	9/12/03
12	DWQ – Highway Permit Coordinator	9/12/03
13	DWQ – Regional Highway Certification Coordinator	9/12/03
14	WRP – Implementation/DOT Coordinator	4/30/01
15	WRP – Implementation Specialist	4/30/01
16	WRP – Implementation Specialist	4/30/01
17	DCM – Transportation Projects Coordinator	3/3/99
18	DCM – Transportation Projects Coordinator – Field	9/26/00
19	DCM – Coastal Management Representative	9/12/03
20	DCM – Transportation Projects Coordinator	9/12/03
21	NCDENR – Director, Highway Environmental Evaluation Program	7/15/90
22	NHP – Information Systems Specialist	4/10/00
NC Wildlife Resources Commission		
1	Stream Restoration Biologist	6/11/98
2	Habitat Conservation Biologist – Eastern NC	7/15/90
3	Habitat Conservation Biologist – Western NC	10/31/00
NC Department of Cultural Resources		
1	Archaeological Technician	7/15/90
2	Preservation Technician	7/15/90
3	Preservation Specialist	7/15/90
US Fish and Wildlife Service		
1	Biologist – Raleigh Field Office	12/16/97
2	Biologist – Asheville Field Office	11/8/99
3	Biologist – Raleigh Field Office	Not Available
US Environmental Protection Agency		
1	Scientist	7/25/01
2	Scientist	Not Available

E. Consultant Procurement

NCDOT makes extensive use of planning and design consultants in all phases of the project delivery process from project identification through the environmental process and design. In addition, the use of consultant services has increased over the last several years. In 2003 the consultant engineering group executed $19.1 million of design consultant contracts whereas in 2001 only $2.8 million were executed. For all projects let between 2001 and 2003, 198 incurred some consultant charges, and the total expenditure on engineering consultants on these projects was $25.5 million.[13]

Consultant services are procured by a number of different units within NCDOT on both a project basis where a consultant submits a letter of interest on a specific scope of work and on an on-call basis where a consultant qualifies for a master contract based on qualifications and then receives work through task orders off this contract which are issued by NCDOT on an as needed basis to perform specific support areas within a project.

1. Issues

A number of representatives of private consulting engineering firms and some NCDOT staff have expressed concerns that NCDOT's procurement process takes too long and is not efficiently managed. Interviewees cited lengthy delays in the issuance of a notice to proceed and the start of project activities. In addition, concerns were raised by both NCDOT staff and private sector representatives that the use of project procurement models in which a consultant performs some work and NCDOT some work or in which multiple consultants perform difference pieces of the project increases overall project risk and limits NCDOT's ability to hold a single firm accountable for project budget and schedule.

2. Analysis Strategy

The analysis approach involved:

- Reviewing current NCDOT procurement procedures.
- Conducting detailed interviews with staff in Design Services and project managers responsible for overseeing consultant contracts in PDEA and Roadway Design.
- Conducting detailed interviews with several consultant engineers.
- Analyzing data provided by PDEA and Roadway Design showing selection date, date of Board approval and Notice to Proceed date for select projects over the last three calendar years.

[13] $25.5 million is the total consultant expenditures on 511 projects let 2001 through 2003. These were charges against codes 54421001, 54431003, 54431004, and 52199012 which capture all consultant charges to projects prior to letting.

- Quantifying consultant expenditures on projects let calendar years 2001 through 2003.

3. Findings

- **NCDOT's consultant procurement process can be lengthy and cumbersome adding as much as 5 months to delivery time.**

  Of the 17 contracts awarded in 2003 by the consultant engineering group, the shortest time from selection to a notice to proceed was four months with a number of projects taking longer. All of the consultant engineers interviewed for this study indicated that they found NCDOT's consultant procurement process to be extremely time consuming and inefficient. For the most part, they also found NCDOT's process to be more complicated and unnecessarily lengthy in comparison to the consultant procurement processes used by other states in which they work. This finding was also validated when NCDOT's process was compared to those of other states who provided information to the Florida Department of Transportation and FHWA's National Project Delivery Study.

  Specific examples cited by consultant engineers regarding the cumbersome nature of the process included:

  – Negotiation of effort at individual line items as opposed to negotiating the total project effort. This included spending significant amounts of time negotiating small four to five hour differences in effort for individual line items which sometimes have very few overall hours (20–30 hours total).

  – NCDOT's requirement to provide rates and negotiate rates for each procurement rather than submitting rates annually as a number of states do and then limiting negotiation to technical scope with rates applied based on the staff mix agreed to perform the finalized scope.

  Discussions with NCDOT project managers confirmed these practices for the most part. A number of NCDOT staff indicated that they believed the consultant costs saved through extended negotiations is worth the time being spent by NCDOT staff. However, it does not appear that any delay in a consultant starting project activities is worth the savings in consultant costs in terms of overall project cost once the likely increase in construction costs for each month that the letting of the project is delayed and/or the cost in missed user benefits from the project being completed are factored into the equation.

- **A number of units procure consultant services**

  While project specific procurements are primarily issued by Design Services and the consultant engineering unit within PDEA, on-call consultant procurements are issued and the contracts administered by Planning, several units within

PDEA, several units within the Preconstruction branch, and some Divisions. Individual Divisions have also been issuing project specific contracts over the last year in support of the North Carolina Moving Ahead initiative.

The issuance and administration of contracts across various units creates inherent inefficiencies, duplication of effort and potential for confusion. Examples include resources in each unit devoting some portion of their time to contract administration versus the function being performed centrally by trained contract specialists and different standards being applied to engineering consultants by each of the units overseeing procurements. For example, wide swings in expectations between different divisions contracting Moving Ahead work was cited by the consulting engineers interviewed for this study.

The Division of Highways has taken steps to begin to address these problems by establishing a Consultant Coordination function within the Director of Construction's office. However, it is our understanding as of May 2004 that this function will serve more as an information clearinghouse for units procuring consultant services and that this group will not be a centralized consultant procurement function.

- **There has been a marked increase in the use of consultants; therefore managing consultants is now an important skill set for NCDOT to develop.**

  NCDOT needs to strengthen its capacity to manage consultants on a consistent basis departmentwide applying best practice. Engineering consultants play an increasingly important role in project delivery and are now NCDOT's partners in the delivery process. Some 39 percent of projects let between 2001 and 2003 involved consultant labor to some extent. In the consultant engineering unit in PDEA alone consultant awards have increased from $2.7 million in 2001 to 11.7 million and 19.1 million in 2002 and 2003 respectively. The human resource analysis presented in Section B above indicates that with the number of vacancies in production positions increasing that this trend will continue.

  Given the increased use of consultants; it is important that NCDOT project delivery managers recognize that project procurement and consultant management are project management disciplines that need to be developed with consistent and standardized procedures and the development of the knowledge, skills, and abilities of NCDOT employees as consultant managers. These are different skill than being a "good engineer" and employees responsible for managing consultants need standardized procedures, tools, and training.

  With the increased use of engineering consultants in project delivery in many departments of transportation there is a well defined body-of-knowledge regarding best practice. In short, the goal is to be able to hold consultants accountable for scope, schedule, budget, and quality on a project by project basis just as NCDOT wishes to hold itself accountable. At the program level NCDOT

has a strong interest in cost control and ensuring that consultant resources are deployed in the most cost effective way.

- **Requirements for Board of Transportation approval can delay the start or progress of consultant work.**

  Any consultant contract over $30,000 or a change in contract value greater than 10 percent requires approval by the Board of Transportation before a notice to proceed can be issued. This limit was $10,000 up until two years ago. Several examples were cited during interviews by consultant engineers and NCDOT staff where this requirement for Board approval delayed the start of a project or the start of a new task on an existing project by one to two months. However, Board of Transportation approval for consultant contracts and change orders is typically quite perfunctory, with very few issues raised by the Board. Thus, it is unclear what the value of waiting to have the Board review and approve a consultant agreement is versus notifying the Board on a regular basis of actions approved by senior management on the Board's behalf.

- **There are often substantial delays between the time of Board approval of a consultant contract and the issuance of a Notice to Proceed.**

  Several of the consultant engineers and NCDOT staff interviewed for this study also cited examples of situations where a notice to proceed was delayed significantly even after Board approval was received. One example was given of an 18 month delay in a notice to proceed. The reasons for additional delays following Board approval are likely various, including situations where the start of work by one consultant is dependent on successful completion of another phase by another consultant or an NCDOT staff function. However, these substantial delays make it difficult for consultant engineering firms to effectively do resource planning and unnecessarily increase the engineering firm's cost of business (and ultimately the cost NCDOT has to pay for private engineering services).

- **NCDOT often acts as an integrator of multiple consultants, creating additional risk and complexity.**

  While some projects are contracted out on a turn-key basis, with a single prime contractor having responsibility for performing all project delivery activities, on a large number of projects, only certain portions of the project are given to consultants and/or multiple consultants are used to perform different pieces of the project work. Some typical examples include:

  – Consulting firm performing roadway design, with NCDOT performing bridge design and hydraulics work.

  – Consulting firm performing roadway design, with another consultant performing bridge design work on a project specific contract and NCDOT performing hydraulics work.

- Consulting firm performing roadway design, with another consultant performing bridge design work on a project specific contract and a third consultant performing hydraulics work on an on-call contract.

In each of these situations illustrated above (and there could be many permutations and combinations across PDEA and Preconstruction), NCDOT is required to play the role of integrator and coordinate the work of its own units and all of the consulting firms involved. It also increases the number of participants in the process. In this situation, NCDOT and only NCDOT can really be held accountable for project delivery schedules. It is difficult to hold any of the consulting firms accountable when they are dependent either on NCDOT staff or the staff of another consultant to perform activities on the project's critical path.

F. Utilities and Right of way

A number of issues were identified by interviewees regarding right of way and utilities.

1. Issues

- **Utility clearance is cited as a bottleneck in the process.**

  Interviewees raised the issue of projects being let with limitation of operations due to right of way and utilities not being cleared prior to letting. The reasons identified are utilities not relocating in a timely fashion for a number of reasons and NCDOT is letting projects this way due to the pressure to let projects, plus the requirements of the equity formula. The analysis implications are that we should assess both these areas because they have cost and schedule impacts.

- **Human resource constraints.**

  The shortage of qualified appraisers willing to do NCDOT work was identified as a cause of project delay. NCDOT has taken some actions to address this.

- **Opportunities for doing right of way work earlier.**

  The acquisition of more complex parcels or the earlier acquisition of parcels which are dependencies for utility re-location prior to the completion of all design activities were identified as potential opportunities by several interviewees. It was also noted, however, that the right of way requirements often change after initial right of way plans have been developed (and right before letting) due to changing permit conditions (an increase in the required size of a buffer, for example).

2. Analysis Approach

The analysis approach involved:

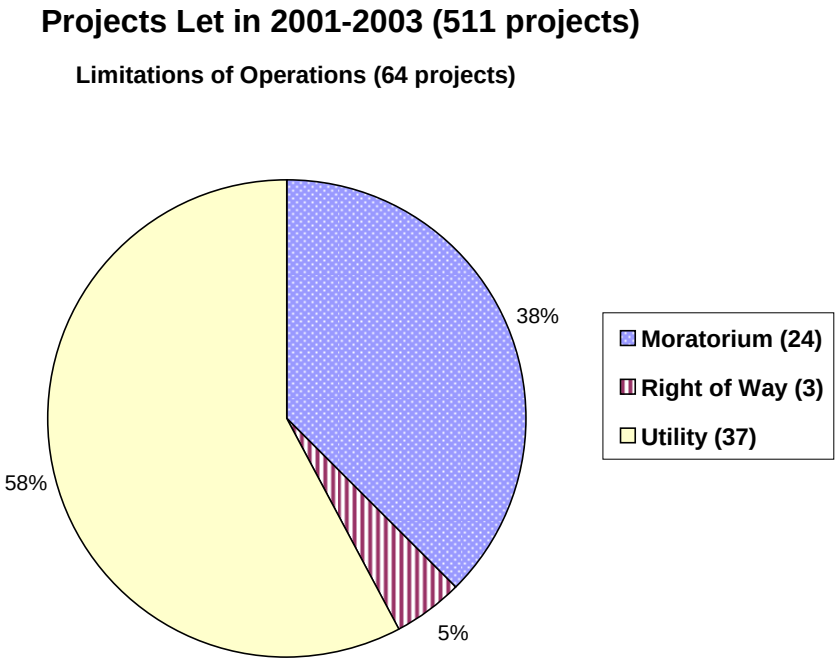
- Identifying the number of projects let between January 1, 2001 and December 31, 2003 with limitations of operations by reason.
- Quantifying the construction delay, measured by delay to construction start date from award date in months.
- Quantifying the number of projects required the condemnation of one or more right of way parcels.
- Quantifying how long projects took from right of way plans to the acquisition of all right of way.
- Interviewing process owners and managers.

3. Findings

- **Some 13 percent of projects were let with limitations of operations which can delay construction.**

  The main reason that projects are being let with limitations of operation is due to utilities not being moved from the right of way prior to letting. This can occur for a number of reasons. Exhibit IV-16 indicates the number of projects let with limitations of operations and the reason.

Exhibit IV-16: Projects Let With Limitations of Operations by Reason, January 1, 2001 to December 31, 2003

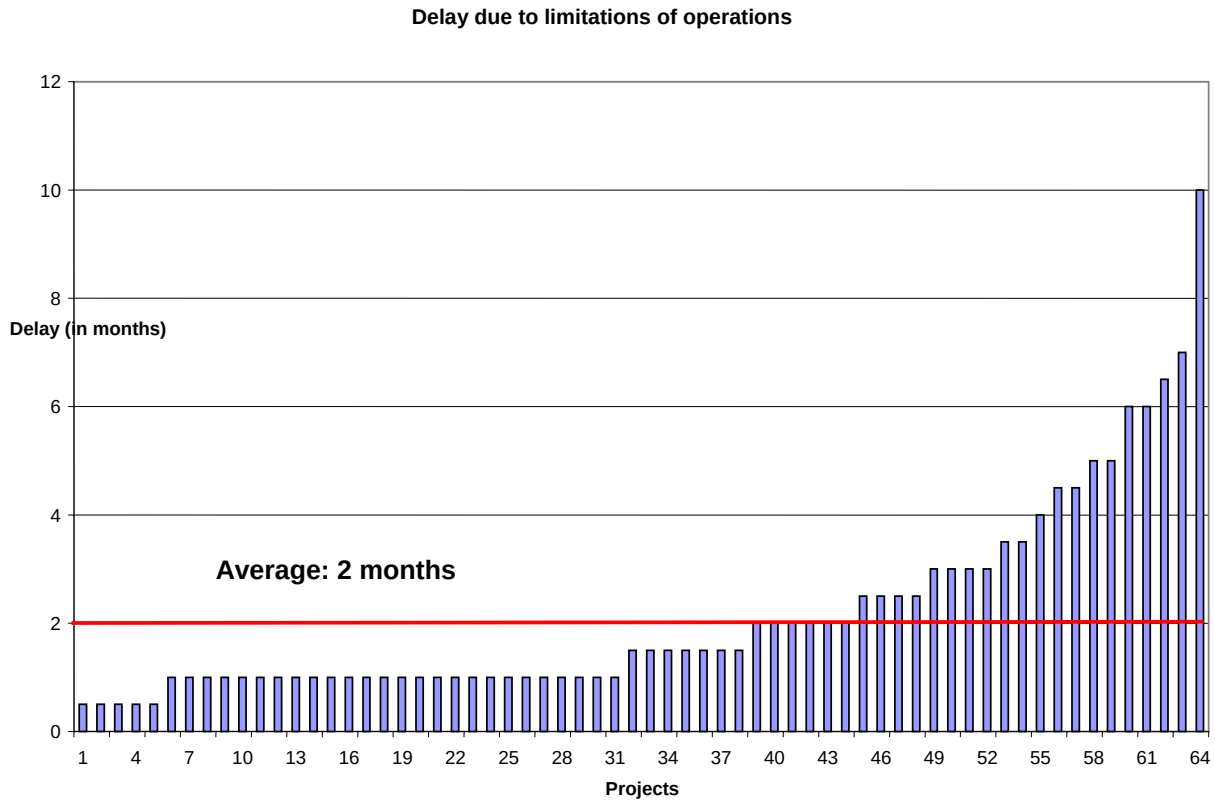


Source: NCDOT Right of way.

- **Projects let with limitations of operations have an average delay in the start of construction of two months.**

  When projects are let with limitations of operations there can be delays in the start date of construction and or impacts on the scheduling of the construction work. These limitations can delay construction and increase the cost of construction. Delays on the start of construction ranged from less than one month to seven and ten months for the two most impacted projects.

Exhibit IV-17: Construction Delay Due to Limitations of Operations



Source: NCDOT Right of Way.

- **The actions of privately owned utilities, over which the NCDOT has no direct control, are causing project delays.**

  Privately owned utilities in North Carolina must bear the costs of engineering utility relocations as well as their construction costs when they are in the state owned right of way. Private utilities' own financial considerations and management practices have made it more difficult for these utilities to relocate their facilities in a timely fashion.

  The responsibility for the design and physical relocation of utilities necessitated by a highway project is borne by private utilities. NCDOT has found it increasingly difficult to motivate private utilities to perform the relocation engineering and relocations in a timely fashion. The NCDOT Right of Way and Utilities managers believe the utilities' own financial pressures are part of their unpredictable response time.

- **Most projects involving right of way acquisition require condemnation**

  Study analysis finds that of 175 projects let between July 2001 and June 2003 that involved right of way acquisition some 81 required the condemnation of one

or more parcels. This is not surprising given that intrastate projects and loops require large amounts of property.

a. Background – Right of Way Acquisition

NCDOT must acquire the land, buildings or real property rights (such as easements) needed for highway construction and improvements. This acquisition of right of way involves appraisals, negotiations, and contracts.

Right of way clearance is a complex, expensive, and time-consuming aspect of project delivery. A large project may involve transactions for hundreds of separate parcels, each of which requires negotiations with the owners, whose rights are protected by state and federal law. Because policy and state law require right of way for transportation projects to be cleared before beginning construction (although this does not always happen in practice), it is on the critical path for delivering projects on time. Failure to clear right of way in a timely manner can add to delivery times.

The single most important law governing acquisition of right of way by a public agency is the federal Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970, commonly referred to as the Uniform Act. The Uniform Act details virtually every aspect of agency and landowner relations, including policies and requirements for appraisals and relocations and for payment of moving costs and replacement housing. All federal, state, and local public agencies must comply with its provisions and its 1987 amendments. The Uniform Act sets specific standards for government's power of eminent domain and ensures compliance with the U.S. Constitution's 5th and 14th Amendments, which guarantee that private property shall not be taken for public use without just compensation.

Further complicating NCDOT's right of way efforts is the fact that one in five acquisitions is contested by the property owner and has to be resolved through the state's right of eminent domain. Cases involving unwilling property owners can be unpredictable in terms of their schedule. Only when all issues associated with property acquisitions (including condemnations) have been resolved can right of way be declared as cleared and the project ready for construction. Among the factors that affect the lead time for right of way clearance are the following:

- Number of parcels and types of acquisitions.
- Number of parcels requiring relocation assistance (residential and/or commercial).
- Number of improvements to be removed (e.g., buildings).
- Presence of hazardous materials.
- Time needed for condemnation proceedings.

b. Background – Utilities Clearance

Highway projects whether the building of new facilities or the rehabilitation or expansion of existing facilities, frequently need to shift the location of underground and above ground utilities, which include conveyances for electricity, natural gas, phone lines, water, and sanitary sewer. Utilities such as water authorities and sanitary sewer systems are typically publicly owned, while telecommunications companies are generally privately owned.

Utilities are often located in the right of way and need to be moved prior to or during the proposed construction. Construction provides convenient opportunities to place new utilities or upgrade existing ones, as well as opportunities to mitigate unsafe conditions. In cases where the utilities are no longer used, they may simply need to be removed to allow construction to proceed.

While federal regulations govern virtually all aspects of right of way transactions (hence the term "Uniform" Act), regulations governing the construction, access to, and relocation of utilities are determined by state law in terms of which entity is responsible for costs, what schedule requirements are needed, and what specifications are needed for the utility related work.

The North Carolina General Statutes identifies the circumstances and responsible parties for the payment of utility costs on state highway right of ways. Section 136-18(2) entitled "Powers of the Department of Transportation," states that the North Carolina Department of Transportation has the authority to locate and acquire highway right of ways for the location or relocation of above or below ground lines and pipelines that are operated by public utilities and other organizations regulated under Chapter 62 of the General Statues. However, to prevent delays in State highway construction or rehabilitation projects due to utility conflicts, Section 136-19(e) entitled "Acquisition of Land and Deposits of Materials; Condemnation Proceedings; Federal Parkways," further gives the Department of Transportation the authority to condemn or purchase the appropriate right of way(s) for the relocation of utilities.

In terms of payment, the utility owner pays for the moving of the utility in a right of way or during construction. This requirement is noted in article ten of Section 136-18, which states "…the (utility) owners therefore shall at their own expense, except as provided in G.S. 136.19.5(c), move or change the same to conform to the order of said Department of Transportation. Any violation of such rules and regulations shall constitute a Class 1 misdemeanor."

However, there are two instances where the Department of Transportation pays for the relocation of utilities. The first scenario is where the utility owner acquired the right of way and the Department reimburses the utility owner for moving the utilities. This instance is addressed G.S. 136.19.5(c) entitled "Utility Right of way Agreements," which states "whenever the Department of Transportation requires

the relocation of utilities located in a right of way for which the utility owner contributed to the cost of the acquisition, the Department of Transportation shall reimburse the utility owner for the cost of moving those utilities. The second scenario is where the Department of Transportation pays a nonbetterment cost for relocating water and sewage lines located within existing state highway right of way for a highway improvement project is outlined in Section 136.27.1 entitled "Relocation of Water and Sewer Lines of Municipalities and Nonprofit Water or Sewer Corporations of Association.," The type of locality, organization, and corporation eligible to receive a nonbetterment payment are:

(1)	"A municipality with a population of 5,500 or less according to the latest decennial census.
(2)	A nonprofit water or sewer association or corporation.
(3)	Any water or sewer system organized pursuant to Chapter 162A of the General Statutes.
(4)	A rural water system operated by a county as an enterprise system.
(5)	Any sanitary district organized pursuant to Part 2 of Article 2 of Chapter 130A of the General Statutes.
(6)	Or, constructed by a water or sewer system then sold or transferred to a municipality with a population of greater than 5,500 according to the latest decennial census."

V. Project Management

This section discusses current NCDOT project management and control practices, reviews best practice in these areas, assesses NCDOT against best practices, and makes appropriate recommendations. Specifically, this section will:

- Identify NCDOT's approach to the role of project manager and describe NCDOT's level of accountability, ownership, and control and compare this to best practices.
- Describe NCDOT current organization and culture and assess this against best practices.
- Identify existing NCDOT project management processes and methods and compare these to best practices.
- Inventory and analyze existing NCDOT project management tools and compare these tools against best practices.

A. Analysis Approach

The analysis approach involved:

- Reviewing the current role of project managers within NCDOT.
- Conducting detailed interviews with NCDOT staff and others to confirm the role of the new TIP Program Managers and other staff within NCDOT who perform project management functions as part of their current job assignment.
- Conducting detailed interviews with Board of Transportation members, NCDOT staff, resource agency staff, and private sector representatives who work with NCDOT to gain insights as to how the project management function is performed on a day-to-day basis at NCDOT.
- Conducting detailed interviews with Board of Transportation members, and NCDOT staff and others to understand the various responsibilities of different organizational components for project delivery and to assess the overall project management culture within NCDOT.
- Reviewing current NCDOT project management processes.
- Reviewing best practices in terms of the project manager function and project management processes through:
  - Comparison with the Project Management Institute's Project Management Body of Knowledge (PMBOK™)

  - Comparison with the Project Management Institute's Organizational Project Management Maturity Model (OPM3™).
  - Comparison of project management functions in other state departments of transportation through the Florida Department of Transportation and FHWA's recently completed National Project Management study.
  - Leveraging a number of industry leading state departments of transportation project management best practices studies recently completed by Dye Management Group, Inc. for other transportation agencies.
  - Specific detailed follow-up with other transportation agencies as appropriate.
- Reviewing current NCDOT project management tools and the capabilities and functionality available in these tools.
- Conducting detailed interviews with NCDOT staff and others to validate capabilities of current NCDOT project management tools and to better understand the planned use of and roll out strategy for NCDOT's Project Management Improvement Initiative (PMii) application.
- Reviewing in detail the Florida Department of Transportation's Environmental Screening Tool (EST).

B. Role of Project Manager

1. Issues

Concerns have been consistently raised by members of the General Assembly, Board of Transportation members, General Assembly staff, NCDOT staff, resource agency staff, consultant engineers, and others interviewed for this study about the lack of a clearly defined Project Manager role within NCDOT.

2. Findings

NCDOT traditionally has not had a defined project manager role or a specific project manager job description. Instead, NCDOT has relied on technical staff to perform project management responsibilities, in addition to other technical work assignments. Thus, there is no specific project manager career path, project manager training, or staff requirement to attain specific project management certifications.

NCDOT recently implemented a TIP Program Manager function, with two full-time staff and two part-time staff assuming this role. While a positive step, this role is currently that of an information collector and expediter for a predefined list of high priority projects. These TIP Program Managers do not appear to have true accountability in any sense for project scope, schedule, and budget for any of their assigned projects, and they do not have either project specific or line management

responsibility for any of the resources assigned to perform tasks on the projects for which the TIP Program Managers have been assigned oversight responsibility.

Specific findings in this area are described in further detail below. These findings include:

- **NCDOT does not have a specific Project Manager job function.**

  NCDOT traditionally has not had a Project Manager position with a specific job description centered on project management responsibilities. Instead, the project manager "role" has typically been performed by technical staff in addition to other project responsibilities. A Roadway Designer, for example, may have responsibility for performing the Roadway Design, as well as coordinating the efforts of other functional units such as Hydraulics or Bridge. Another example would be PDEA staff who might be responsible for assisting in development of the project scope and definition and conducting public involvement sessions, as well as coordinating and tracking the work of other units such as Natural Environment and Human Environment in support of the project. In addition, the individuals performing the project manager function are rarely focused on project management for one or more projects. Instead, they are assigned to several projects at once, with a combination of specific technical assignments and project management responsibilities across each of these projects.

- **Staff performing the project manager role do not appear to focus on managing scope, schedule, or budget.**

  Based on interviews conducted for this study with staff from PDEA and Preconstruction who serve in the project manager role, it appears that this staff's focus is not primarily on management of project scope, schedule, or budget. As reflected in these interviews, staff felt they had little control of project schedule since they have little direct impact on ensuring that individual tasks are actually performed by functional unit staff or consultants in a timely manner. Likewise, they felt that pre-construction budgets were not particularly a concern since pre-construction cost is a relatively small percentage of the total cost of construction.

- **Staff performing the project manager role have little management authority over resources assigned to their projects.**

  The individuals performing the project management role on NCDOT projects typically do not have line responsibility or real authority over other staff working on the project. Staff report through their various functional units and simply work on, or support, a project as one of their many assignments. Thus, the staff person performing the project management role will typically need to address any issues of work quality or resource availability to the manager of a particular functional unit. In addition, responsibility for performance evaluations for staff assigned to a project remains with the manager of the functional unit and the person in the project manager's role has little if any input into the review, even if that person being reviewed has been primarily assigned to their project.

- **The recently created TIP Program Managers are more information collectors and expediters with little, if any, accountability for project scope, schedule, and budget.**

  NCDOT has recently implemented a TIP Program Manager function. Two full-time positions have been assigned to this role, with one position reporting to the head of the PDEA Branch and one position reporting to the Director of Pre-Construction. In addition to the two full-time positions, a staff member in the Highway Administrator's Office and another staff member reporting to the Director of Preconstruction are also performing the TIP Program Manager role on a part-time basis.

  The TIP Program Managers are charged with coordinating and reporting on the status of the Department's highest priority projects. Projects in the early stages of the project delivery life cycle have been assigned to the two full-time staff members, with projects nearer letting assigned to the part-time resources. The projects have also been divided by Division to help provide Division Engineers and Board members with a single point of contact for obtaining project status and other project information.

  The TIP Program Manager role is an important step forward for NCDOT in its development of a more formalized Project Manager role. However, based on our interviews with all of the staff currently performing this role on both a full- and part-time basis, the TIP Program Managers are at this point more information collectors and expediters. There is no doubt that this role does help to fill critical gaps. For example, the TIP Program Manager now provides a single point of contact for Board members and others about project status. The absence of this single point of contact would be a concern with Board members and Division Engineers. Likewise, the creation of the TIP Program Manager role also introduces a senior level resource who has responsibility for being aware of project status.

  However, the TIP Program Managers do not have full accountability for project performance against scope, schedule, and budget. Likewise, they do not have any direct responsibility or authority for resources assigned to their project and must still rely on the managers of specific functional units for ensuring that appropriate resources are assigned to the project. In fact, the TIP Program Managers really do not manage any of the work on projects themselves, but instead monitor status and gather information from the individual in PDEA or Preconstruction who is actually the hands-on Project Manager.

- **There is no formalized project management career path or project management training program within NCDOT.**

  There is currently no project management career path. Staff typically advance within their functional areas based on their technical skills and expertise and not their ability to provide project leadership and to manage projects within scope, schedules, and budget. The career path is towards functional management of a

unit in an engineering or environmental discipline and not towards multidisciplinary, crossfunctional project management.

There is no predefined training curriculum for project management within NCDOT. Likewise, there is no requirement for staff performing project management activities to attend a certain amount of training or take certain types of courses. Typical course topics in a project management training program would include project control and scheduling, financial and budget management, risk assessment and mitigation, project communication, project team management, contract management, and management of multiple projects.

Some state transportation agencies have established project management academies, with project management courses geared towards the specific skills for successfully managing capital projects. The Kentucky Transportation Cabinet's Project Manager Academy, for example, is focused on the basic training needed for successful management of a transportation project through all its preconstruction stages, with special attention given to environmental stewardship, teamwork, management skills, and public involvement. The training program, which was developed jointly by KYTC and the University of Kentucky, is an eight-day workshop designed to enhance and accelerate decision-making in the project development process. Likewise, the Virginia Department of Transportation has contracted for the development of a series of project management courses to be provided to managers and staff across VDOT.

- **The industry trend is toward developing the project management function through employees working towards project management certification.**

  Project Management Professional (PMP) certification, offered by the Project Management Institute, is generally accepted worldwide as the major certification credential for project managers. To achieve PMP certification, an individual must have a certain amount of course work with hands-on project management experience and pass a comprehensive examination.

  NCDOT does not currently either require or actively encourage staff performing project management roles to be working towards PMP certification. In addition, PMP certification is neither a requirement nor a highly desirable skill in the recently developed job descriptions for the TIP Program Managers.

- **While state departments of transportation nationally have different organizational models the trend everywhere is toward a stronger project manager role.**

  No states are moving toward a weaker project manager role.[14] States are strengthening the management, control, and accountability for delivering projects

[14] Arizona Department of Transportation: Best Practices in Project Management and Implementation Plan, April 2003.

within the scopes, schedules, and budgets established through planning and multi-year programming documents. To accomplish this, they are establishing well defined project delivery processes that specify roles and responsibilities for different elements.

Industry standards and best practice is based on the Project Management Institute's Project Management Body of Knowledge (PMBOK™), as well as practices within other transportation agencies as documented by Dye Management Group, Inc. in their past best practices surveys and the Florida Department of Transportation in their recent FHWA National Project Management study.

According to the PMBOK™ Guide, project management provides organizations with the knowledge, skills, tools, and techniques to help plan and execute projects on time and on budget. As an internationally recognized standard (IEEE Std 1490-1998), PMBOK™ is a collection of processes and knowledge areas generally accepted as best practice within the project management discipline.

PMBOK™ recognizes five basic process groups and nine knowledge areas typical of almost all projects. The basic concepts are applicable to projects, programs and operations. The five basic process groups are:

- Initiating.
- Planning.
- Executing.
- Controlling.
- Closing.

The nine knowledge areas are:

- Integration Management.
- Scope Management.
- Time Management.
- Cost Management.
- Quality Management.
- Human Resource Management.
- Communications Management.
- Risk Management.
- Procurement Management.

PMBOK™ supports the utilization of project management processes throughout the project life cycle and is intended to drive a series of project management best practices including:

- Effectively prioritizing projects to maximize efficiency.
- Clarifying project goals, problem areas, and project risks to enhance success.
- Consistently tracking tasks and milestones to better monitor potential outcomes.
- Expanding communication among stakeholders.
- Decreasing resources required to perform project activities through better refinement of resource requirements.
- Providing realistic performance measures.
- Increasing overall project performance, efficiency, and effectiveness.

PMBOK™ suggests a number of characteristics of a strong project management function. These include:

- Defined project manager role with a detailed job description focused on project management and required skills based on experience as a project manager and not in a specific technical discipline.
- Clear accountability for project success.
- Clear accountability and responsibility for managing project scope, schedule, and budget.
- Authority to assign resources and make decisions required to meet approved project schedule.
- Performance objectives (promotions, salary increases, incentives, etc.) clearly tied to project performance.

In addition, other characteristics in support of this strong project manager function would include a defined career path for project managers, a structured project management training program, and the requirement for project managers to be PMP certified or working to achieve this certification.

With few exceptions, these characteristics are not currently in place within the NCDOT project delivery organization.

C. NCDOT's Current Organization and Culture

1. Issues

Concerns have been consistently raised by members of the General Assembly, Board of Transportation members, General Assembly staff, NCDOT staff, resource agency staff, consultant engineers, and others interviewed for this study about the lack of clear organizational responsibility for the project delivery function and about the lack of a project management culture within NCDOT.

2. Findings

- **Responsibility for project delivery at NCDOT is fragmented across multiple organizational units.**

  Responsibility for management of project delivery at the enterprise level at NCDOT is fragmented across organizational units. Currently, NCDOT project delivery activities fall into two major organizational units as follows:

  – Planning, Programming, and Project Development and Environmental Analysis (PDEA) report to the Deputy Secretary for Environment, Planning and Local Government Affairs.

  – Preconstruction, the Construction headquarters functions and the Resident Engineers within Divisions who manage construction projects report through the State Highway Administrator.

  However, the nature of the project delivery process requires close coordination between a number of these functions throughout the project delivery life cycle. There is especially a need for coordination between Planning and Project Development early in the project delivery life cycle and PDEA and Preconstruction from project definition through letting.

  The development of a project to the point of letting, or the development of a set of biddable and buildable plans, is essentially one of NCDOT's key "products" as an organization. However, as the organization is currently aligned, accountability and responsibility for ensuring the timely and quality completion of this core or strategic product is diffuse. At the individual level or as a management team, there is limited systematic overall management, control, and accountability.

  There are a range of organizational models that states use to provide organizational accountability. A key to their success is recognizing the differences between technical or functional management and project management. The inherent key in any of these organizational constructs is a common strategy and vision across each of the units, with all organizational units working from a common plan and executing to, and being measured by, common performance metrics.

Given the current NCDOT organization structure, we believe that this can be best accomplished at NCDOT by:

- Instituting a Program Delivery Management committee at the senior executive level to provide oversight, management control, and strategic direction for program management.
- Establishing through this Program Delivery Management committee measurable department-wide strategic objectives for program delivery and an annual business plan for potential business improvements.
- Establishing a Program Office for project delivery to own the overall policy, procedures, standards, and other support mechanisms.

- **NCDOT has very informal project team structures.**

  For the most part, NCDOT has very informal and ad hoc project team structures. Project team members clearly report to and through their functional units and then are assigned to support a project based on skill sets and availability. This method of assignment leads to staff members working on a number of different projects in different regions of the state concurrently. In this scenario, a staff member could be assigned to three different project teams in three different Divisions and all three projects could be in effect a "number one priority" for one or more Board members or senior management team members. Likewise, given that there is no clear rationale for assigning project team members, it is difficult for a Board member or Division Engineer or a senior staff member to know who is working on which project in order to determine project status or discuss resolution of a particular issue.

  PDEA is currently taking steps to address this issue by moving towards a regionally focused organization in which, while the Project Development resources will remain centrally based in Raleigh, they will be divided into teams by region. The goal of this regional model is to have resources work within a single region in order to allow for better focus, facilitate prioritization at least at the region level, and provide better communication flow among team members and to other interested parties.

  The Roadway Design function within Preconstruction has also explored this regionalization approach. However, it is unclear as of May 2004 if Roadway Design will adopt a similar regional model. It would appear that there are several benefits of Roadway Design and Project Development utilizing the same organizational model, including increased synergy between members of both units who would then likely work together more often on the same project teams.

  There are a number of different organizational approaches for team-based project delivery employed by states. In general, the approach is to make the team responsible for delivering the project to letting against an agreed scope, schedule,

and budget. States have found that team-based approaches require a team leader with a certain level of project management authority and skills and team members who are able to resolve issues within the team.

- **Communication within project teams is difficult and very siloed within functional organizations.**

  Based on the interviews conducted for the study, it appears that communication tends to be primarily vertical within a staff member's functional organization unit versus horizontal across the project delivery process. For example, if staff members in Bridge or Natural Environment assigned to a particular project encounter an issue, they are more likely to raise this issue for resolution with their supervisor within the functional unit than to apprise the person performing the project manager role.

  The difficulty in ensuring communication flow across the project delivery process horizontally would appear to be primarily a result of the strength of each functional unit and the role of the functional unit as the primary management vehicle for all staff members in terms of career growth and performance management.

- **NCDOT does not have a "can-do" culture in terms of project management.**

  Based on our interviews, NCDOT, in general, does not currently demonstrate a "can-do" culture in terms of managing projects. Based on discussions with a number of NCDOT project managers and other staff directly involved in the project delivery process, we do not believe that these staff are necessarily driven to do what it takes to make schedule dates. They seem inclined to accept that dates can and will be missed rather than trying to think creatively or outside the box about ways to get projects back on schedule. Team members seem to feel that projects take "as long as they take" and these team members seem to have little motivation or incentive to try and find ways to perform tasks more efficiently or to shorten the length of project activities. As we heard expressed by several team members, "It is an eight year process, if we do something one or two weeks faster, does it really make all that much difference?"

  This pessimistic attitude about project delivery and the lack of a real commitment to schedule dates is definitely in contrast to experiences the Dye Management Group, Inc. team has had in several other departments of transportation nationally, where staff at the project level seem to be singularly focused on making the schedule dates for their project activities. These staff in other states view schedule changes to be a last resort since they are not received well by senior management and could be potentially career limiting if they occur very often. In North Carolina, however, it seems to be accepted, almost expected, that the schedule will change at least once, if not multiple times, within the life of a project and that such changes are not a major issue.

- **NCDOT's project management organization and culture is in its infancy as compared to accepted best practice.**

  Based on the Project Management Institute's Organizational Project Management Maturity Model (OPM3™), NCDOT's current project management organization and maturity level is extremely low as compared to best practice.

  Organizational project management is the systematic management of projects, programs, and portfolios to achieve an organization's strategic goals. Organizational project management focuses on the clear correlation between an organization's capabilities in the management of projects and programs and its ability to achieve desired business results. The degree to which an organization practices this type of project management is referred to as its organizational project management maturity.

  The Project Management Institute's OPM3™ model was developed based on collaboration by more than 800 project management professionals from 35 countries and a variety of different industries over 6 years beginning in 1998. It measures an organization's project management maturity on a number of factors, including among others:

  – Extent of integration of project activities.

  – Effectiveness of scope management.

  – Effectiveness of time management.

  – Extent of cost management.

  – Implementation of Quality and Risk Management programs.

  – Utilization of a structured project communications program.

  – Extent of integration of vendors or suppliers into an organization's project management processes.

  Exhibit V-1 below presents an assessment of NCDOT's project management maturity based on a scale known as the Project Management Maturity Model or PMMM™ developed by Project Management Solutions, Inc. This scale is based on an adaptation of the Project Management Institute's OPM3™ maturity model and also uses components of the Project Management Institute's PMBOK™ model of project management knowledge.

Exhibit V-1: Assessment of NCDOT Project Management Maturity

Level of Project Management Maturity	Level 1: Initial Process	Level 2: Structured Process and Standards	Level 3: Organization of Standards and Institutionalized Process	Level 4: Managed Process	Level 5: Optimized Process	Current NCDOT Maturity Level
Integration Management	No established practices, standards, or Project Office. Work performed in ad hoc fashion.	Basic documented processes. Management only involved on high visibility projects.	Project integration efforts institutionalized with procedures and standards. Program Office established.	Processes/standards utilized by all projects and integrated with Department systems. Decisions based on performance metrics.	Project integration improvement procedures utilized. Lessons learned regularly examined and used to improve documented processes.	**Level 1.** Since no documented Project Development Manual, no Program Office driving coordination of initiatives, etc.
Scope Management	General statement of requirements. Little/no scope management or documentation. Management aware of key milestones only.	Basic scope management process in place. Scope management techniques regularly applied on larger, more visible projects.	Full project management process documented and utilized by most projects. Stakeholder actively participating in scope decisions.	Project management processes used on all projects. Projects managed and evaluated in light of other projects.	Effectiveness and efficiency metrics drive project scope decisions by appropriate levels of management. Focus on high utilization of value.	**Level 1 or 2.** There is no documented scope management process and little scope management except potentially on some higher visibility projects.

Level of Project Management Maturity	Level 1: Initial Process	Level 2: Structured Process and Standards	Level 3: Organization of Standards and Institutionalized Process	Level 4: Managed Process	Level 5: Optimized Process	Current NCDOT Maturity Level
Time Management	No established planning or scheduling standards. Lack of documentation makes it difficult to achieve repeatable project success.	Basic processes exist but not required for planning and scheduling. Standard scheduling approaches utilized for large, visible projects.	Time management processes documented and utilized by most projects. Organization wide integration includes inter-project dependencies.	Time management utilizes historical data to forecast future performance. Management decisions based on efficiency and effectiveness metrics.	Improvement procedures utilized for all time management processes. Lessons learned are examined and used to improve documented processes.	**Level 1 or 2**. NCDOT has developed time metrics for each project type as part of PMii implementation. No process yet for effectively managing against these metrics and for ongoing update and adjustment to metrics based on lessons learned.
Cost Management	No established cost practices or standards. Cost process documentation is ad hoc and individual project teams follow informal practices.	Processes exist for cost estimating, reporting and performance. Cost management processes are used for large, visible projects.	Cost processes are organizational standard and are utilized by most projects. Costs are fully integrated into Program Office function.	Cost planning and tracking integrated into Program Office and tied to financial and HR systems.	Lessons learned improve documented processes. Management actively uses efficiency and effectiveness metrics for decision-making.	**Level 1.** Limited cost practices or standards. Projects are not managed to budget, especially during Project Development and Preconstruction phases

Level of Project Management Maturity	Level 1: Initial Process	Level 2: Structured Process and Standards	Level 3: Organization of Standards and Institutionalized Process	Level 4: Managed Process	Level 5: Optimized Process	Current NCDOT Maturity Level
Quality Management	No established project quality practices or standards. Management is considering how they should define "quality."	Basic organizational project quality policy has been adopted. Management encourages quality policy application on large, visible projects.	Quality process is well documented and an organizational standard. Senior management involved in quality oversight for most projects.	All projects required to use quality planning standard processes. The Program Office coordinates quality standards and assurance.	The quality process includes guidelines for feeding improvements back into the process. Metrics are key to product quality decisions.	**Level 1.** NCDOT has no defined quality standards or formalized project level quality assurance process.
Human Resource Management	No repeatable process applied to planning and staffing projects. Project teams are ad hoc. Human resource time and cost is not measured.	Repeatable process in place that defines how to plan and manage human resources. Resource tracking for highly visible projects only.	Most projects follow established resource management process. Professional development program establishes project management career path.	Resource forecasts used for project planning and prioritization. Project team performance measured and integrated with career development.	Process engages teams to document project lessons learned. Improvements are incorporated into human resources management process.	**Level 1.** Project staffing is currently ad hoc.
Communications Management	Ad hoc communication process in place whereby projects are expected to provide informal status to management.	Basic process is established. Large, highly visible projects follow the process and provide progress reporting.	Active involvement by management for project performance reviews. Most projects are executing a formal project communications plan.	Communications management plan is required for all projects. Communications plans are integrated into corporate communications structure.	An improvement process is in place to continuously improve project communications management. Lessons learned are captured and incorporated.	**Level 1 primarily, with some characteristics of Level 2.**

Level of Project Management Maturity	Level 1: Initial Process	Level 2: Structured Process and Standards	Level 3: Organization of Standards and Institutionalized Process	Level 4: Managed Process	Level 5: Optimized Process	Current NCDOT Maturity Level
Risk Management	No established practices or standards in place. Documentation is minimal and results are not shared. Risk response is reactive.	Processes are documented and utilized for large projects. Management consistently involved with risks on large, visible projects.	Risk management processes are utilized for most projects. Metrics are used to support risk decisions at the project and program levels.	Management is actively engaged in organization-wide risk management. Risk systems are fully integrated with time, cost and resource systems.	Improvement processes are utilized to ensure projects are continually measured and managed against value-based performance metrics.	**Level 1.** NCDOT has no documented risk management process and risk reviews are not regularly conducted, even on large, visible projects.
Project Procurement/Vendor Management	No project procurement process in place. Methods are ad hoc. Contracts managed at a final delivery level.	Basic processes documented for procurement of services. Procurement process mostly utilized by large or highly visible projects.	Process an organizational standard and used by most projects. Project team and Purchasing unit integrated in the procurement process.	Make/buy decisions are made with an organizational perspective. Vendor is integrated into the organization's project management mechanisms.	Procurement process reviewed periodically. On-going process improvements focus on procurement efficiency and effectiveness metrics.	**Level 2 to Level 3.** Standardized processes, with significant opportunity for improving effectiveness of these processes.

D. Project Management Processes and Methods

1. Issues

Concerns have been consistently raised by Board of Transportation members, NCDOT staff, resource agency staff, consultant engineers, and others interviewed for this study about the lack of clearly defined project management processes and methods at NCDOT.

2. Findings

- **NCDOT does not currently have an end-to-end project development manual.**

  NCDOT does not currently have a formalized end-to-end Project Development manual or set of uniform standards and procedures for the project delivery process from project inception through construction. Such a Project Development manual is critical to ensure that projects are carried out in a consistent manner, with consistent deliverables regardless of whether the work is done internally or by an outside consultant. In addition, given the degree of turnover within the PDEA and Preconstruction branches, a Project Development Manual is also critical to capturing the intellectual capital of experienced employees on best practices or the best ways to do certain tasks. Likewise, a Project Development manual can help new employees shorten their learning curve by giving them a defined, predictable set of processes and procedures to follow.

  NCDOT has recently documented their processes to some extent as part of a number of the improvement initiatives, such as the process flows developed as part of defining the Merger01 process, the diagrams of various activities developed as part of requirements definition for the PMii application, and the detailed work break down structures developed for PMii. However, these activities are not described in detail or codified in a manual. The closest thing NCDOT has to a manual is a series of informal notebooks by PDEA staff, which they put together on their own initiative a few years ago. However, these have not been kept consistently up-to-date.

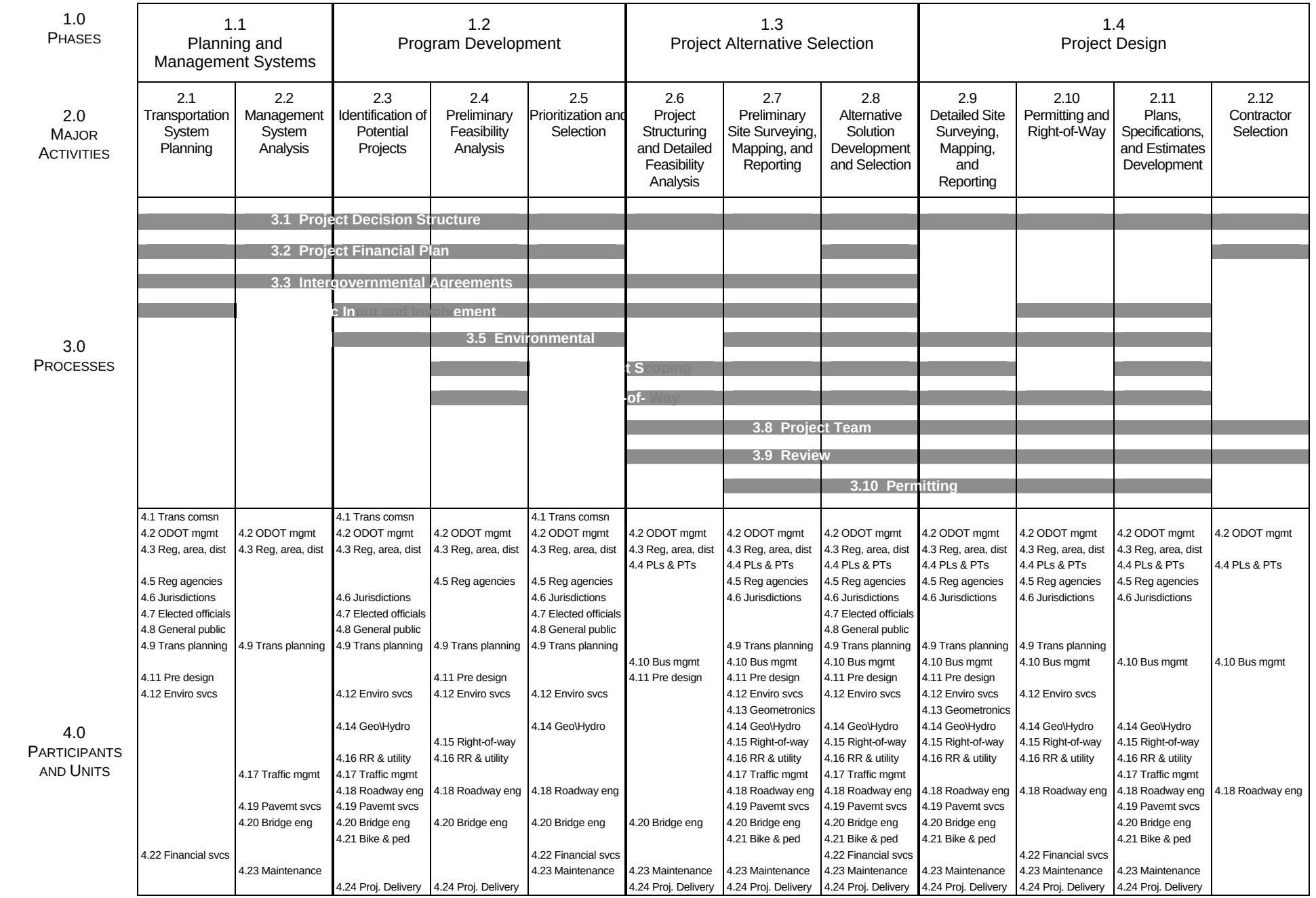
  NCDOT has recently begun the process of developing a Project Development manual as an adjunct to an improvement initiative to more closely integrate the Planning function with initial project development activities. However, what is required is a manual which covers the entire process end-to-end and is developed by staff from the various functional units involved in the project delivery process department-wide. The work done to date in preparation for the implementation of the Merger01 process and PMii can serve as crucial inputs to the development of a more comprehensive Project Development Manual.

- **Best practice in this area is to have an integrated end-to-end project manual, which is available on line, as well as supporting templates and practice aids.**

  As outlined above, NCDOT does not currently have an end-to-end Project Development Manual. Best practice for transportation agencies nationally is to have a comprehensive end-to-end Project Development manual. These manuals are typically being developed to be Web-based to allow ease of access by staff and consultants and to simplify updates when required. In addition, these manuals are often accompanied by supporting document templates, document samples, and other best practice aids to support development of various deliverables identified across the project delivery process.

  A number of state departments of transportation are currently developing, or have recently developed, Project Development Manuals, including Massachusetts, Florida, New Jersey, Oregon, and Utah.

  Exhibit V-2 below is an example of a diagram in the Oregon Department of Transportation Project Development Guidebook. This exhibit illustrates the comprehensive scope of the Oregon Department of Transportation Guidebook by documenting the main elements of the project development process and showing where each of the elements is discussed in the Guidebook. The exhibit shows how project development phases are composed of multiple activities. In turn, one or more ongoing processes impact the phases and activities. The lower part of the chart shows that participants and units are the foundation of the upper processes and activities.


1.0 PHASES
1.1 Planning and Management Systems
1.2 Program Development
1.3 Project Alternative Selection
1.4 Project Design
2.0 MAJOR ACTIVITIES
2.1 Transportation System Planning
2.2 Management System Analysis
2.3 Identification of Potential Projects
2.4 Preliminary Feasibility Analysis
2.5 Prioritization and Selection
2.6 Project Structuring and Detailed Feasibility Analysis
2.7 Preliminary Site Surveying, Mapping, and Reporting
2.8 Alternative Solution Development and Selection
2.9 Detailed Site Surveying, Mapping, and Reporting
2.10 Permitting and Right-of-Way
2.11 Plans, Specifications, and Estimates Development
2.12 Contractor Selection
3.0 PROCESSES
3.1 Project Decision Structure
3.2 Project Financial Plan
3.3 Intergovernmental Agreements
3.5 Environmental
3.8 Project Team
3.9 Review
3.10 Permitting
4.0 PARTICIPANTS AND UNITS
4.1 Trans comsn
4.2 ODOT mgmt
4.3 Reg, area, dist
4.4 PLs & PTs
4.5 Reg agencies
4.6 Jurisdictions
4.7 Elected officials
4.8 General public
4.9 Trans planning
4.10 Bus mgmt
4.11 Pre design
4.12 Enviro svcs
4.13 Geometronics
4.14 Geo\Hydro
4.15 Right-of-way
4.16 RR & utility
4.17 Traffic mgmt
4.18 Roadway eng
4.19 Pavemt svcs
4.20 Bridge eng
4.21 Bike & ped
4.22 Financial svcs
4.23 Maintenance
4.24 Proj. Delivery

E. Project Management Tools

NCDOT is implementing the Project Management Improvement Initiative (PMii), a state-of-the-art critical-path, project scheduling tool based on SAP's project scheduling module. While PMii represents a significant step forward in terms of project scheduling capabilities, there is some concern about NCDOT's ability to successfully adopt and maximize the benefits of this tool given the organization's lack of an overall project management culture, including project management skills, standards, and processes.

In addition, even with the implementation of PMii, NCDOT still lacks a number of critical project management tools and capabilities. PMii, for example, does not provide needed summary-level project status reporting or the capability to monitor projects on an exception basis for progress against predefined criteria relative to the plan scope, schedule, and budget. NCDOT also does not have a number of other critical project management tools or practice aids including an online project development manual, pre-defined templates for project deliverables, and a project repository to allow easy access to documents and leveraging of past project deliverables on future projects.

1. Issues

Concerns were expressed by a number of NCDOT, resource agency and other interviewees about NCDOT's lack of project management tools as compared to best practices. In addition, concerns were also expressed by a number of NCDOT interviewees about NCDOT's efforts to implement PMii and the effort which will be required to fully integrate and institutionalize PMii within the Department.

2. Findings

There is very little consistent and reliable management information regarding project scope, schedule, and budget that NCDOT management can use to provide oversight and control of program delivery. In many cases, basic project management information relating to a project's estimated costs or delivery schedule and actual schedule is not available. Further, this lack of information impedes the systematic identification and removal of barriers to the timely delivery of projects.

Analysis finds:

- **That there is little management information available for program and project delivery management.**

  As illustration, it required a major research effort and much assistance from NCDOT staff to develop the information reported in this study. Even then, some basic project delivery questions about scope and cost management could not be answered.

- **NCDOT does not have a set of metrics for measuring, managing, and monitoring project delivery performance.**

  In the most basic terms, a purpose of this study has been to evaluate project delay; however, there is no basis for evaluating project delay because NCDOT has no organizational agreement as to how long a project should take, or standards for how long specific activities within the project delivery process should take. More broadly, NCDOT has not established a set of project management or overall program delivery metrics. The sole measure used and reported on the website is the dollar value of construction let.

a. With PMii, NCDOT is implementing a highly functional project scheduling application.

NCDOT has expended considerable time and resources to develop and implement PMii. PMii has been developed using SAP's project scheduling module and is intended to provide a highly functional, critical path project scheduling application for project development activities (from TIP approval through letting). PMii is envisioned as a multi-phase project with the May 2004 implementation providing a basic critical path scheduling tool for certain types of TIP projects: Interstate, Rural, Urban, Bridge and Special (A, X). Later phases are intended to include other types of TIP projects and provide additional system functionality.

With the implementation of PMii, NCDOT has a scheduling tool comparable in functionality with several other transportation agencies that have recently deployed scheduling functionality on a statewide basis. This includes, for example, the Tennessee and New Jersey Departments of Transportation both having recently completed deployments of Primavera as a project scheduling tool on a statewide basis.

- **There are significant concerns about NCDOT's ability to properly institutionalize and maximize the return on investment from PMii.**

  – **NCDOT senior management, technical managers, and project managers have differing understandings and expectations about the outcome from PMii implementation.**

    NCDOT managers and potential system users do not have a common understanding of the role of PMii, or near-term risks and benefits of its implementation. In short, PMii has been implemented as a scheduling system. It assumes that NCDOT projects will be delivered following a set of business rules and procedures that may not be understood well enough to be followed on all projects. Further, there is no procedures manual or requirements for following these rules. PMii will not provide the information required to support resource loading, budget, and cost management.

- **Study findings raise strong concerns about NCDOT's organizational readiness to use PMii.**

  In short, PMii is a technically sophisticated system and is being implemented to support the project scheduling system. It is not clear, however, that the change management has occurred that NCDOT project managers and technical managers need to be ready to use PMii to support project management. It is also not clear that NCDOT is ready to institute the business changes explicit within PMii across the organization. For example, PMii has established a number of scheduling paths for different types of projects based upon different networks.

- **Institutionalization of PMii will likely be difficult. PMii began implementation in production beginning in May 2004**.

  The dedicated PMii team has consisted primarily of retired NCDOT staff and outside consultants, with only one full-time NCDOT team member. As of mid-May, many of the NCDOT project managers who are the most likely candidates to use PMii are not familiar with the project delivery process, delivery network, and milestones upon which it is based. It appears that there are a number of the business improvement and organizational change issues affecting PMii that still need to be resolved. For example, who will use PMii and what are the expectations for how will they use it?

b. PMii only addresses project scheduling, and project and program management information is required on project budgets and scope.

To manage individual projects and overall program delivery, NCDOT managers, and especially the recommended Program Delivery Management team (see recommendation 5.1), require the following types of information:

- Estimated construction costs of projects at major milestones. This involves preparing a periodic update of the estimated construction costs because costs change during project delivery. Updated cost information across the program of projects will support financial planning, programming, federal funds management, and scope management.
- Labor resource budget to accompany project schedules for major project delivery work. To manage individual projects as well as the overall program, the recommended NCDOT program delivery management team needs to know in at least a broad sense the amount of labor required by discipline and when. This knowledge of labor needs would be used to establish and manage preconstruction budgets and ensure there are no bottlenecks.

- There is currently no mechanism or plan for developing this information even though it is an important requirement for strengthening program and project management.

c. NCDOT lacks a project status reporting functionality, including the capability to manage projects on an exception basis against pre-defined criteria.

NCDOT management (project managers, unit and branch managers, and senior management) does not have easy access to project status information or the ability to quickly compare project performance against agreed upon project metrics in order to focus on those projects potentially most at risk and requiring additional project management attention.

Best practice in this area is to establish a series of pre-defined project performance metrics and provide tools to assess and report project level performance against these criteria which highlight for management attention those projects (through exception reporting) not meeting the pre-defined criteria or are at risk of not meeting this criteria.

An example of best practice in this area is a Project Dashboard recently developed by the Virginia Department of Transportation (VDOT). The VDOT application, which has both an internal component and external component published to the Web, has extensive "stop light" based exception reporting and associated drill down capability. For example, the VDOT Project Dashboard provides an enterprise red, yellow, or green "stop light" level status of projects against various parameters and criteria set by the Department, as well as drill down capability to get details about any specific project. To date, VDOT has received extremely positive feedback from the Virginia General Assembly and the public at large for substantially improving access to its project financial and status information.

The components of the VDOT Project Dashboard designed for external users can be viewed on VDOT's website at <http://dashboard.virginiadot.org>.

- **NCDOT does not have a project repository or other electronic means for ensuring capture, easy access to, and reuse of project intellectual capital within a project or between one project and another.**

  NCDOT does not have a document management system or other project repository capability to allow for ease of access to project documents and other records by project team members or for the sharing of information from past projects.

  Project records are still typically either paper or kept in ad hoc project work spaces on the NCDOT network. This makes sharing of information across project team members in multiple functional areas more difficult. It also does not allow information captured on one project to easily be used on another

project. This information sharing across projects could include leveraging a similar deliverable required on both projects or it could include sharing of project attribute information such as information on high quality resources collected on one project for use on another project in the same area.

Best practice in this area is the development of enterprise level shared project repositories for use by all functional areas internally and by consultants working on projects. These repositories are designed to allow ease of sharing of information or collaboration among project team members during the project and to provide robust search capabilities to access project information for later use on other projects once a specific project is completed. These applications often include document management, Web collaboration and GIS capabilities. Examples of these types of applications being developed nationally include:

- **Florida Department of Transportation Environmental Screening Tool (EST).** The EST brings together information about a project and provides analytical and visualization tools that help synthesize and communicate that information. It is used throughout the planning and project development process to:
  - Integrate data from multiple sources into an easy to use, standard format.
  - Analyze the effects of proposed projects on the human and natural environment.
  - Communicate information effectively among Environmental Technical Advisory Team (ETAT) representatives and to the public.
  - Store and report results of the ETAT review effectively and efficiently.
  - Maintain project records, including commitments and responses, throughout the project life cycle.

  The EST integrates Internet mapping technology, relational database management systems, and geographic information systems (GIS). The EST application consists of five modules including a Project Input Utility, Project Management Tools, Environmental Process Review Tools, Sociocultural Effects Module entering and managing community characteristics, and a Public Information site.

- **Colorado Department of Transportation (CDOT) Corridor Web.** This application has been designed to capture and provide a repository of project-specific information for defined highway corridors. It is designed as a spatial data warehouse, containing survey data, environmental data, project data, and as-built data. The information is provided by CDOT staff in the CDOT regions or consultants during or after projects for approximately 10 defined corridors in specific formats defined by the GIS Unit.

- **New Jersey Department of Transportation Roadway Information System**. This application contains the typical roadway inventory information, but it is closely integrated with a commercially available document management system.
- **Dallas Fort Worth International Airport Capital Program Management System**. In this application, GIS is integrated with a document management system, the CAD platform and a Contracts Management system, to serve as a central project repository for management of all capital program activities at the airport.

Attachment A: NCDOT's Environmental Streamlining Initiatives

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Initiative Title	Brief Description	Status
Predictive Modeling for Archaeological Sites	The use of GIS to predict archaeological sites during the transportation planning process. The GIS approach will allow for ready adaptability to changes that occur throughout the life of a given project. Model of archaeological sensitivity for all alternatives contained within project corridor gives a better understanding of the scope, cost, and time frame associated with the field effort. This will allow a realistic project schedule to be generated and improve the coordination of state and federal agencies responsible for compliance with NEPA and section 106. It will foster better up front decision-making and lower cost	It is in the initial phases. Details are still being worked out between the DOT and the regulatory agencies.
Development of a Permit Review Process in Highway Design Branch	Development of a Permit Review Process in Highway Design Branch	Initiative is being carried out presently.
Immediate Corrective Action (ICA's) with Area Roadside Environmental Engineers (AREE)	The Department has its own sediment and erosion control program as delegated by the N.C. Sedimentation Control Committee and DENR. The Delegation Agreement has a self-monitoring component that requires the Department to inspect its projects for compliance with sediment pollution laws. Area Roadside Environmental Engineers (AREE) inspect for compliance.	This process is in place and working and usually prevents the issuance of Notices of Violation.

Initiative Title	Brief Description	Status
Walkable Communities – TND/Subdivision Manuals	Walkable Communities workshops and Traditional Neighborhood Development Street Design Guidelines	Walkable Communities: The workshop portion of this program has concluded and the road show audits are in progress. Planning assistance and training initiatives, for both local governments and for NCDOT staff are being developed at this time. TND Guidelines: The guidelines are in place as a voluntary alternative available to developers.
NCDOT funded positions program (development and annual reporting)	NCDOT currently funds 21+ positions in other state and federal environmental resource agencies.	The program is working well. In late 2003 there was approval for 20+ additional positions.
Memorandum of Agreement with DENR, DOT, and USACE (specific goals to improve relationships/ processes)	A memo of agreement was signed and executed by the authorizing sponsors of the three agencies on May 7, 2001 to proceed with a joint process improvement effort.	Several initiatives outlined in the agreement have been accomplished
Context Sensitive Design	Context Sensitive Design is fitting the project nicely into its natural surroundings while involving all necessary stakeholders. A workshop was held to discuss the main points and process of context sensitive design. An internal course, “Context Sensitive Solutions,“ is being taught departmentwide.	The Context Sensitive Solutions course began in February 2003 and is taught every two weeks. More than 700 DOT employees and partner agency staff (including consultants) have attended the three-day course. The course is scheduled to continue throughout 2004.
Formation of the Office of Human Environment		The office is an active unit within the Project Development and Environmental Analysis Branch. The unit has a community involvement section.
Monthly Meetings with Agencies to Discuss Issues and Project Specifics	Interagency meeting with NCDOT, US Army Corps of Engineers, and NCDENR to discuss project specifics and concurrence points. There are actually 2 meetings, one for projects and one for concurrence.	Active - currently an issue/initiative basis discussion (for the past 3 years)
DENR/DOT Senior Staff Meetings	A monthly meeting between senior management of both agencies to discuss important mutual issues often involving policy questions. The meetings rotate locations.	Meetings occur monthly. Senior leadership from USACE and FHWA now participate regularly too. The meetings have proven valuable in discussing critical high-level decisions.

Initiative Title	Brief Description	Status
Waste and Borrow Pit Environmental Screening Process		The initiative is functioning and there have been no permit violations associated with borrow and waste sites
Division Environmental Officer Roles	The Department has recently established Division Environmental Officer positions (DEOs) in the Divisions to aid with environmental issues in the field. This initiative was implemented because the DEO responsibilities were not consistent statewide. In order to better define the DEO's job functions, guidance was provided to the Divisions that specifically detailed their roles.	The initiative is implemented and performing in the field. Every division has a DEO.
Delegated Erosion and Sedimentation Control Program (on behalf of DENR)	The Department has its own sediment and erosion control program as delegated by the North Carolina Sedimentation Control Committee and DENR. It delegates NCDOT the authority to self-regulate its own program including preparation, review, and approval of sediment and erosion control plans for land-disturbing activities associated with highway construction and maintenance. Also included within this delegation is a self-monitoring program to insure Department compliance with program requirements and to evaluate and rate levels of field implementation	Each year the Sediment Control Commission reviews the program. This year the program will be reviewed and if the Department is administering the process correctly, the Commission will continue the delegation another year. There is currently (2003-04) an internal review of the program
Establishment of State Operations Environmental Engineering Section	Establishment of a position to serve as the lead engineer for NCDOH Operations Environmental Programs. The position works closely with management and field personnel to develop environmental resolutions and to implement the Department's maintenance and construction environmental policies and procedures on a statewide basis.	The position and unit was established in 2001. The mission of the Environmental Operations Section is to address the environmental issues that affect the Operations Section of the Division of Highways.
Formation of the Office of Environmental Quality	The establishment of a new office dedicated to environmental streamlining and stewardship.	The office was established in 2003. The OEQ's mission is to coordinate, facilitate and promote environmental stewardship and streamlining throughout the North Carolina Department of Transportation.

Initiative Title	Brief Description	Status
Formal Elevation Process with DENR	An adopted formal elevation process to resolve conflict in a positive manner between the NC Department of Transportation and NC Department of Environment and Natural Resources.	Active. The process is used on average about once per month. The process itself began in 2001 and was revamped in 2003 to accommodate organizational changes.
SWAMP/SWIMS (strategic planning for mitigation needs)	Strategic Wetland Analysis and Mitigation Planning (SWAMP) and Stream and Wetland Inventory Management System (SWIMS) -- A database to manage wetland and stream mitigation programs.	This in an ongoing program. It is updated and modified as needed (may be transitioned into EEP).
Evaluation of Secondary and Cumulative Impacts		
Programmatic CE Forms and Checklists		Fully Implemented
Programmatic Section 4(f) Evaluation Forms		Fully Implemented
Interagency GIS Expansion/Fast Track (LRS Information)		Unknown
40% Reduction In Project Cycle Time	This initiative originated under former Transportation Secretary Norris Tolson. He asked his senior management staff to identify ways to shorten the project cycle time by 40 percent. A team from the Highway Design Branch and the Project Development & Environmental Analysis Branch examined the current process and recommended a project not be programmed in the Transportation Improvement Program (TIP) until there is concurrence with the environmental agencies on a Purpose and Need for the project and that Reasonable and Feasible Alternatives are identified. The proposal then started the TIP clock after the planning documents and functional designs.	The initiative has been combined with the 01 Merger process. Changes within the 01 Merger that will affect the project development flow process are being examined. There will be significant reduction in project cycle.

Initiative Title	Brief Description	Status
PMii – an integrated scheduling and project tracking system	The Project Management Improvement Initiative (PMii) was originally requested to establish an integrated scheduling system for the entire Department of Transportation. Each Branch/Unit within the Department either had no scheduling system or had an independent scheduling system. Scheduling was manual and rather laborious. Also, problems in meeting scheduled dates for planning document completion, right of way acquisition, construction lettings, and distribution of work within the groups were encountered by those not having a scheduling system. The BSIP (Business Systems Improvement Project) gave an opportunity to tie into a system to address scheduling needs and to integrate a scheduling system for the entire Department. Exploring the PMii has shown that the system can be used as a communication tool to alert internal and external customers of design changes.	The Discovery Phase is nearing completion (2002) with the development of a road map laying out the different parts of the overall effort over several phases. The Implementation Phase is to begin in October or November 2001 (was actually delayed and implemented much later). Current status: PMii will be operational in summer of 2004 and training will occur in spring.
Instituted Original NEPA/404 Merger Process (development of)	Instituted Original Merger Process: The Merger Process is a joint agreement between the US Army Corps of Engineers, the FHWA, and the Department of Transportation. The Merger process involves the formation of a project team that consists of all environmental regulatory agencies, department staff, and the FHWA. The team must have concurrence at four key points in the project development process. These four points are Purpose and Need, Identification of Reasonable and Feasible Alternatives, the Least Environmentally Damaging Practicable Alternative, and Minimization of Impacts.	Still underway and about to be modified or expanded to the 01 Merger
Merger 01 Development (analysis of original Merger process)	It's a streamlining initiative - a permit process improvement program to completely analyze and update the current permitting process. The intent is narrow and the conclusion is broad, to broaden the NEPA/404 process. It will be a better system for 2001.	In development and implementation stage. It will probably be two more years until implemented. Process improvement effort completed in 2001 and implementation phases began in 2002 through teams. In 2003 several aspects of the new Merger 01 process were implemented. Additional changes/ recommendations will be implemented in 2004.

Initiative Title	Brief Description	Status
Creation of the Board of Transportation's Environmental Planning and Policy Committee	The Board created a new committee for environmental issues during its reorganization in 2001. The committee is chaired by the first-ever member appointed to the Board by the Governor to represent environmental issues throughout the state.	The committee meets monthly (the Wednesday before the BOT meeting in the Boardroom at 8:30 AM). The committee has a website where meeting minutes and presentations are posted after monthly meetings.
Developing High Quality Resource Identification	The universe of wetlands and natural habitats can be subdivided qualitatively into those that are recognized for their high quality and those that are not valued so highly. For example, there is fairly good consensus on what is a high quality wetland. In general, wetlands that perform multiple functions (storage of flood waters, removal of pollutants, providing wildlife habitat, and recharging the ground water table) are viewed as very important wetlands. In contrast, certain kinds of wetlands may only perform one or two major functions (provide wildlife habitat and, perhaps, recharge ground water table). There are two separate initiatives that are taking place simultaneously. DOT staff have long discussed the need to establish special protocols for planning, designing, and constructing projects in high quality resources. State and federal environmental agency staff are also busy addressing the same issue.	Team was established among many agencies, including DOT, to review and recommend. Team meets regularly and intensively to develop. High Quality Resources Guidance Manual has been drafted and will be finalized and implemented in 2004.
Pre-TIP Planning Process (pilot and analysis)	Effort by Transportation Planning Branch to begin some project level studies before a project is actually funded in the TIP.	Pending the dedication of resources
Identification of Interagency Policy Issues Embedded in Project Planning Interagency Meetings	This concept is still in the planning and working stage. It currently part of the DOT/DENR one and three year work plans.	Its part of the one year and three year work plans established between DOT and DENR
USACE/DOT - Team Concept for Hurricane Repairs	The Department and the Corp of Engineers (COE) will work closely together to plan and coordinate roadway repairs caused by major storm events, natural disasters, etc. The COE will make additional personnel available to the Department during emergency situations to aid with environmental permitting issues at project sites.	The process will be used when necessary.

Initiative Title	Brief Description	Status
Formal Elevation Process	The only formal process is with NCDENR. They have an Informal Elevation Process with the US Army Corp of Engineers. Currently, there is no need for a formal process because the communication is at a positive and open level. Adopting a formal process may hinder the current relationship, which works very well. Therefore, there is no need for a "formal" process. If there is an issue that needs to be addressed, it is addressed at the proper level.	Informally active
Best Management Practices (BMPs) for Maintenance, Emergencies and Construction (and design-future)	Preparation of a document or manual that details proper construction and maintenance procedures to be followed by Division Operations personnel. This manual will dictate how work should be performed in jurisdictional areas to ensure compliance with environmental permits and regulations.	The BMPs are currently being developed. – A BMP Manual was produced through an interagency team effort and published in November 2003. It's also available online. Additional BMP manuals are under development for design activities.
DOT / DENR MOU for Secondary and Cumulative Impacts	A Memorandum of Understanding that addresses indirect and cumulative impacts.	Training manual was created and course was developed to educate internal and external stakeholders. Course and manuals have received national recognition.
Needs Assessment - Multi Modal (development of State Long Range Transportation Plan)	This concept is a component of the NC Multimodal Long Range Transportation Plan [see State Long Range Plan (F58)]. In summary, it is the assessment of efficiency data through all modes of transportation throughout North Carolina. The assessment has been divided into three areas of concentration: statewide, regional, and local. The "needs assessment" is scheduled to be complete in April 2002 and the State Long Range Plan is scheduled to be complete by the end of 2002 following a summit conducted in May 2002.	Plan Executive Summary / Draft Report is underway, expected approval of Plan at August or Sept 2003 BOT meeting.

Initiative Title	Brief Description	Status
Project Selection Criteria	This is criteria that determines whether a project planning study should be placed in the Merger 01 process.	The Merger 01 process actually began on May 1, 2003. PDEA has just begun using screening criteria. PDEA has applied screening criteria to projects that are not following the Merger process. PDEA has developed a list of projects that will not follow the Merger. After applying the screening criteria, it appears that they should have followed the Merger process. PDEA will review their list of projects with necessary representatives from the environmental agencies to verify that the projects should be switched to the Merger 01 process.
Permitting Process Improvement Workshop	NCDOT, NCDENR, and the USACE jointly sponsored the permit improvement process initiative to analyze and redevelop the permitting process. The initiative was undertaken with the primary purpose of developing quality permit applications and issuing environmental permits that support the timely delivery of the transportation program while minimizing disruption to the natural and human environment.	This process improvement effort has been transitioned into its implementation stages. The team task and recommendations are being logically implemented through different aspects of the transportation decision-making. An Implementation Group has been formed with high-level interagency managers to oversee and coordinate the implementation efforts.
Environmental Green Sheets	Environmental green sheets are a final list of environmental commitments that summarize all commitments made throughout the project. These commitments are placed on green paper and are included as part of the contract package.	The initiative has been put in place and is functioning as was initially intended.
Centerline Environmental Newsletter (communication of ONE initiatives and highlights)	The Office of the Natural Environment (ONE) distributes a quarterly newsletter, Centerline, discussing NCDOT projects work as it pertains to wetland and stream mitigation, natural resource work, and permits for environmental impacts. This newsletter also discusses staff achievements.	The newsletter began in 2000 and has a distribution of over 700. Due to lack of resources, the publication has been tabled following the Fall 2003 distribution.
Mitigation Process Improvement Initiative and Workshop	In September 2001, NCDOT, NCDENR, and the USACE-Wilmington District undertook a joint process improvement initiative to review, analyze, and redesign the mitigation process. Following the workshops, thirteen recommendations were identified.	This process improvement transitioned into the Ecosystem Enhancement Program, which is an active organization following July 2003.

Initiative Title	Brief Description	Status
Environmental Stewardship and Streamlining Initiative Inventory	In 2001, NCDOT began inventorying departmentwide environmental initiatives. This process is ongoing and identifies key aspects of each initiative, so that there is a better understanding of its purpose, goal, and measures. In addition, a "best environmental practices database" was created identifying specific environmental projects in the field that could potentially be duplicated.	The inventory database was last updated thoroughly in the summer of 2003. The database will be completely updated in the summer of 2004. There are currently 150+ initiatives listed in the inventory.
Statewide River Basin Signage Program	A partnership between the North Carolina Department of Transportation and the North Carolina Department of Environment and Natural Resources, the River Basin Signage Program has posted "river basin signs" along highways throughout North Carolina. The program has also identified the river basin boundaries on the State Transportation Map.	The following river basins have been signed: Roanoke, Catawba, New River, French Broad, White Oak, and Tar-Pamlico. The following have signs pending: Savannah, Watauga, Little Tennessee, Hiwassee, Chowan, Pasquotank, Broad, Yadkin, and Lumber.
The development of the Ecosystem Enhancement Program (also see ID #89)	On July 22, 2003, NCDOT entered into a partnership with the N.C. Department of Environment and Natural Resources -- Ecosystem Enhancement Program (EEP) to provide wetland and stream mitigation needs. This partnership effort allows the agencies to implement wetland and stream mitigation for transportation projects years in advance of construction to fulfill its stream and wetland mitigation requirements.	The EEP is a developed organization within DENR and is actively transitioning into a full time staff of 50+ to be in place by 2005 (this will include the transfer of DOT staff).
GIS in Early Rail Planning and Identification of Problems.		Unknown
Providing Funds to Help De-List Several Plant and Animal Species.		Unknown
Office of Natural Environment Assistance with Agencies in Field Studies to Enhance Estuarine and Riverine Systems.		Staff assistance and funding has been provided.

Initiative Title	Brief Description	Status
Environmental Streamlining for Enhancement Projects: Categorical Exclusion Form		Unknown
NCDOT Enhancement Program Improvements Including the Enhancement Manager's Project Guide		Unknown
Archaeology Predictive Modeling (Project)	The predictive modeling project has concluded task 1 in September 2003. The goals of the project are: Digitize Environmental and Cultural Information for the 3 Physiographic Provinces of North Carolina; update and convert all existing OSA Site Files to MS Access database; Digitize all site and survey area data into GIS; Develop GIS Prehistoric and Historic Archaeological Predictive Models; Create WWW-compatible GIS Model, Graphical User Interface (GUI) for NCDOT and SHPO Staff Use; Apply GIS Archaeological Predictive Models to Multiple Corridor/Alternative TIP Projects (aid in preferred selection) and; Field Test and Refine Model (using GPS Survey Transects) in upcoming NCDOT Projects	Pilot project 70% complete. Pending funding initial model for pilot projects seven counties to be developed by 12/02/03. Next phases are currently being developed.
DOT Funded Positions Program evaluation/audit		
DNA Genetic Analysis (freshwater mussels)		Unknown
GIS for predicting archeology sites statewide	The use of GIS technology for predicting and quantifying potential archaeological impacts is viewed as a way to deal with archaeological resources early in the NEPA process – proactive use of GIS layering for potential archaeological sites.	
Context Sensitive Solutions Course		

Initiative Title	Brief Description	Status
Bridge relocation and Reuse Program	The North Carolina Department of Transportation established a program for the relocation and reuse of the state's metal truss bridges in 1978.	Program is running and positive
Development of Indirect and Cumulative Impacts Policy and Practitioners Handbook		
Joint DOT/FHWA workplans		Workplans have been identified with team leaders. Process was launched in March 2003 and will continue.
Integration of systems planning and project development		Process improvement workshop has been conducted to begin integration
Development of an Environmental Strategic/ Management Plan	To prepare an environmental management plan that sets specific environmental goals and objectives for the Department, as well as performance measures for environmental stewardship and streamlining.	Under development (just getting started)

* Data is missing or incomplete.