DYE MANAGEMENT GROUP, INC.

UDOT
Utah Department of Transportation
Design Process Performance Audit

FINAL REPORT

December 19, 1997
Executive Summary

This executive summary presents the results and recommendations of a performance audit of the Utah Department of Transportation’s (UDOT) design process.

A. Purpose

The purpose of the performance audit is to evaluate UDOT’s design process and develop recommendations to improve the efficiency, effectiveness, and quality of the process. The intent is to develop implementable recommendations for which the audit has identified a business case.

B. Approach

The performance audit methodology involved interviewing approximately 24 UDOT employees to identify issues and perceptions about the performance of the process. The audit then evaluated these issues to base findings and recommendations to the extent possible on data and analysis.

The following data sources and analytical techniques were used to get beyond individual perceptions:

- Detailed analysis of Preconstruction Program Management System (PPMS) data and other databases.
- Assembly and analysis of data sets.
- Structured work sessions with UDOT employees.
- Analysis of procedures and management controls.
- Flow charting assessments.

A two-step analysis approach was used. First, an assessment of the performance of the entire design process was conducted. Second, a detailed assessment of focus areas for improving the design process identified by UDOT’s Performance Management Team.

The findings and summary of the recommendations are presented for the entire process and the focus areas in the following sections.
C. Assessment of Entire Design Process

1. Observations and Findings

- UDOT employees have a common and clear understanding of the success factors and objectives of the design process.

- The 08-1 process is a good well documented process, however, the procedures are not being followed for a number of key activities.

- Most projects meet their schedule and budget targets, there is room for improvement.

- Design process employees perceive that they are accountable primarily for delivering projects on time.

- Estimated project costs and project scope increase considerably during design.

- The management and control of design consultant work is a potential risk area for further evaluation.

- UDOT does not have a current roadway design manual and other important documentation of standards.

- A large number of UDOT design engineers and consultant managers are new to their responsibilities and the agency.

- Design process employees are not fully utilized.

- UDOT’s career path and compensation structure provide a barrier to the success of the design process.

2. Recommendations Summary

- Establish and communicate clear management performance objectives and control procedures for schedule, scope, budget, and quality.

- Evaluate UDOT’s management and control of design consultant work.

- Update 08-1 documentation, UDOT’s roadway design manual, and other technical manuals.

- Establish utilization targets for design squads and preconstruction staff.

- Establish budget targets for training and improve the effectiveness of the preconstruction training program.
D. Review Related Activities

1. Observations and Findings

- The review procedures built into 08-1 are not being followed. The purpose and role of review and its relationship to building quality into the design process has not been established.

- The optional field review in activity 55D “Review Roadway Plans” rarely occurs.

- There are no documented review criteria, the regions and the review unit have different expectations regarding review activities.

- 08-1 does not have procedures in place to make the results of reviews and approvals binding. Designers can choose to ignore most input given to them by reviewers, even if it is valuable.

2. Recommendations Summary

- Prepare review criteria and related information for each review step.

- Establish a checklist and reporting mechanism to monitor and record disposition of design process review activities.

- Ensure that information essential to the completion of activity 10D (Conduct Scoping Meeting and Develop Report (DSR)) is available at the beginning of the activity.

- Eliminate activity 88D (Finalize Design Study Report).

- Conduct a binding review of design scope as part of the 94D activity.

- Define measures for quality, and quality-related review objectives, at each major review activity.

- Require field review participation for each project.

- Include customers of the design process at key points in the form of constructability and maintainability reviews.

- Continue to require consultants to certify their own design work, and provide them with clearer directions for navigating the preconstruction process.
E. Environmental Process

1. Observations and Findings

   • Much of the environmental process is driven by regulatory requirements and policies from agencies external to UDOT.

   • The environmental process is often viewed as a problem beyond UDOT’s control that impedes the design process.

   • The environmental process is not well understood by project managers. This impedes proactive management.

   • There is a need for more structured coordination through programmatic agreements with external agencies to help expedite the process.

   • The review of environmental documents by the Environmental Unit adds little value. It focuses more on details than larger issues.

   • Consultants have a large role in the process. They have a lead role in 49 percent of all environmental activities.

   • When environmental impact statements and environmental assessments are required there is a significant impact on project schedules.

2. Recommendations Summary

   • Clearly define the role of the Environmental Unit. It should provide technical assistance, training, issue resolution, and coaching on how to perform the environmental activities.

   • Establish programmatic agreements with resource agencies to increase predictability and expedite the environmental process.

   • Regions should assume more responsibility for reviewing environmental documents.
F. Right-of-Way Related Activities

1. Observations and Findings

- Incomplete ROW acquisition is the most frequent reason for projects to be advertised with limitations on operations. Relocation and condemnation are the areas with the biggest problems.

- The majority of projects advertised with limitations of operations are large projects in urban areas requiring 50 or more parcels. ROW plans for these projects are submitted to the ROW division in partial and/or supplemental packages. Sets are generally completed after the critical path due date.

- Both project managers in the regions and PPMS standards underestimate the effort required to complete ROW plans and provide for adequate quality control.

2. Recommendations Summary

- Provide a single point of contact at the ROW division for each project.

- Make sure that there are no relocations or condemnations that could have been avoided. Require the ROW division to involve the project manager/design engineer in the discussion to initiate relocation or condemnation proceedings.

- Evaluate the opportunities to focus ROW division staffing on relocation and condemnation or use outside contractors.

- Require that all parcels for large projects that are submitted to the ROW division over a period of time meet critical path requirements. Critical parcels should be submitted early on so that the ROW division can begin work.

G. Utilities and Railroad Related Activities

1. Observations

- There is no single point of contact for all stages of developing a utility agreement in the utilities section.

- Utilities and railroads often do not provide UDOT with current location plans. This is contrary to existing agreements.
• Utilities often do not return utility plans provided by the utilities section within the required 90-day period.

• The project design engineers do not appear to actively manage utility requirements.

• Master agreements can help customize the approach to dealing with utilities based on the complexity of the required agreement. Currently, UDOT uses the same approach for all agreements.

• The data that UDOT project managers and consultant project design engineers need on the status of utility and railroad agreements is not being entered in PPMS by the utilities section.

2. Recommendations Summary

• Assign individual utility section staff to specific projects. (The utility section is proposing this approach.)

• Provide utility companies with the option to hand the responsibility for maintaining information on the location of facilities within UDOT ROW over to the department for a fee.

• Strengthen the sanctions available to UDOT to ensure that utilities return utility plans and cost estimates in a timely manner. Request legislation if necessary.

• Place additional controls in 08-1 to ensure that utility work is initiated sooner.

• Ensure that existing plans are used to conduct a preliminary review of utility and railroad location information as part of concept plan development. As constructed, plans should be used to identify major utilities.

• Hold UDOT and consultant project design managers accountable for the accuracy of the scope and cost of utility and railroad clearance.

• Provide senior management support for the utilities section’s effort to develop master agreements with utility and railroad companies.

• Ensure that the required utility status is entered into PPMS.
H. Geometric Design Criteria Evaluation

1. Observations and Findings
   • A number of UDOT design criteria do not meet AASHTO criteria.
   • UDOT currently has several geometric values that exceed those in the Green Book.

2. Highlights of Recommendations
   • Adopt minimum AASHTO criteria for UDOT criteria that do not currently meet minimums.
   • For facilities off the state highway system, reduce minimum UDOT criteria to meet minimum AASHTO criteria.

I. Electronic Bid Proposal Package

1. Recommendations Summary
   • Delay implementation of an electronic bid proposal/package until it can be part of a comprehensive electronic bidding program.
   • Electronic versions of the specifications book and project manual should be produced for very large projects with high printing costs.
I. Introduction

The Utah Department of Transportation (UDOT) is managing the development of a series of performance audits of its key business processes. The performance audits are developing recommendations for improving UDOT’s management and financial controls. The focus of the audits is on evaluating UDOT’s processes to identify where UDOT has opportunities for improving efficiency, effectiveness, and the quality of the service provided to the citizens of Utah. This report presents the results of the performance audit of UDOT’s design process.

A. Background and Purpose

The Utah Department of Transportation’s business involves the operation, preservation, and improvement of the state’s transportation system. Its core business activities include the design and construction of highway projects in the Statewide Transportation Improvement Program (STIP). This performance audit addresses Utah’s design process, a core business process through which the UDOT delivers an annual construction program that is currently $160 million and in the fiscal year 1998 increasing to $360 million.

The design process includes all the work activities required to develop a project specified in the STIP into the detailed plan specifications and estimates that are used by contractors as their construction plan. This is a very complex process that is performed by UDOT’s Preconstruction Division, involving just over 100 employees in headquarters and the regions. The UDOT model for the design process indicates that for certain types of projects it can involve over 80 activities performed in three distinct phases. For large projects, the process from start to finish can take a number of years. The process involves many different engineering disciplines and functional areas of expertise that include: project management, highway design, structural engineering, hydraulics, environmental engineering, traffic engineering, right-of-way, utilities, environmental analysis and others.

The purpose of the performance audit is to evaluate UDOT’s design process and develop recommendations to improve the efficiency, effectiveness, and quality of the process. The intent is to develop implementable recommendations for which the audit has identified a business case. These are recommendations where we anticipate that the potential benefits in terms of efficiency, effectiveness, or quality to UDOT will exceed the costs for implementation.
B. Approach

Given the breadth of the design process, to manage the scope of the performance audit, a two-step analysis approach was used. The first step was an overview assessment of the performance of the entire design process. The second step was a detailed assessment of key focus areas identified by the UDOT’s Performance Management Team.

The overview assessment and the focus area assessments evaluated the following broad areas:

- **Management.** This includes the management objectives, procedures, and controls used in the design process.

- **Schedule.** This addresses the length of time, or duration, of the design process.

- **Budget.** This considers the cost, in terms of employee time, of performing the design process activities.

- **Project Scope.** This considers the scope of the project that is advertised for construction. The advertised cost of the project is used as an indicator of project scope.

- **Quality.** This addresses the quality of the intermediate and final work products from the design process.

1. Assessment of Entire Design Process

The assessment of the entire design process involved the following analysis steps:

- Fact finding interviews with UDOT and Federal Highway Administration employees to identify perceptions and issues regarding the overall management and performance of the design process.

- Collection and analysis of documented procedures, policies, and management plans.

- Assembly and analysis of data and factual information. The analysis period included all projects advertised between 10/1/96 and 6/2/97.

The data sources used for the overview analysis include:

- Preconstruction program management system (PPMS) data.

- Human resource data.
• Bid packages.
• Construction division change order sample evaluation.
• UDOT quality improvement survey results.

2. Focus Area Assessments

To provide direction for the audit and manage scope, a scoping meeting was held with UDOT’s Performance Management Team to identify priorities for the audit’s focus and key issues to consider in the audit. This resulted in the identification of the following audit focus areas:

• Design review process.
• Environmental review and permitting.
• Utility and railroad agreement process.
• Right-of-way clearance process.
• Evaluation of UDOT geometric design criteria.
• Bid proposal/package process.

The overview assessment was used to validate the selection of these focus areas, identify issues for evaluation, and to determine whether there are any high risk or high benefit areas for additional focus area assessment.

The approach taken in the different focus areas involved a combination of the following:

• Flow charting assessments.
• Workshop validation of issues and potential improvements with UDOT employees.
• Detailed analysis of PPMS and other databases.
• Assembly and analysis of data sets.
• Structured work sessions with UDOT employees.
C. **Report Structure**

The main body of this report is organized into the following sections:

- **Section II** Assessment of Entire Design Process.
- **Section III** Design Review Focus Area.
- **Section IV** Environmental Review and Permitting Process Focus Area.
- **Section V** Right of Way Related Activities Focus Area.
- **Section VI** Utility and Railroad Agreement Processes Focus Area.
- **Section VII** Roadway Design Standards Assessment Focus Area.
- **Section VIII** Electronic Bid Proposal/Package Automation.
- **Appendices.**

Each of these sections presents the key issues identified through the audit analysis and where required, recommendations that address these issues.

The appendices to the report document the information sources that the recommendations are based upon. They include:

- A list interviewees.
- Tabulation of analysis results.
- A list of references and source documents used in the analysis.
- Listing of working papers.
II-I. Introduction

This section presents the results of the overview assessment conducted as part of a performance audit of Utah Department of Transportation’s (UDOT) design process. The section is organized as follows:

**Approach.** This subsection describes the scope of the overview assessment, the methodology, and the data sources used.

**Design Process Background.** This subsection provides background on the design process that was subject to the performance audit.

**Issues and Recommendations.** This subsection reports the analysis issues identified by the audit in a series of interviews with UDOT employees and the results of the audit evaluation of the issues. The analysis of recommendations provides observations, findings, and recommendations regarding the design process issues.

**Appendix A.** This appendix to the audit report lists the interviewees, data sources, reports, and working papers that are the basis for the audit results.
II-II. Approach and Background

The overview assessment involved the following analysis steps.

A. Approach

1. Fact finding interviews to identify perceptions and issues

A series of 24 interviews were undertaken with UDOT managers and preconstruction division employees. The interviews provided employees’ perspective on strengths, weaknesses, and opportunities for improving the design process. The results were used to identify and validate the key design process issues that were subject to analysis.

2. Assembly, analysis of data/factual information for evaluation of overview issues

The interview results provide individual perceptions and judgements. This is valuable information; however, the audit approach complemented the subjective information by assembling, to the extent possible, factual information to evaluate the issues.

The data sources used for the overview evaluation include:

- Preconstruction program management system (PPMS) data

  PPMS provides data for project design engineers to develop a staff hour budget and work plan for all required activities to develop a set of plans and specifications ready for advertisement. Project design engineers and UDOT managers can use PPMS to check project status, schedule, and budget.

  Data from standard PPMS screens and special reports requested from UDOT staff were used. These data provide a valuable information source for the audit’s observations, findings, and recommendations. Therefore, our analysis strategy aimed to maximize the validity and reliability of the data used from this source. To accomplish this we:

  - Targeted analysis on projects advertised in the 1997 federal fiscal year. These are the most recently advertised projects and have the best project level PPMS data to date.
Avoided relying on individual data items with validity concerns.

Avoided data items over which employees expressed concerns about accuracy.

These analysis decisions ensured that we evaluated the projects with the most recent and most accurate data. These data are considered more reliable because since PPMS was implemented UDOT has taken steps to strengthen the management and control of data quality.

- **Human resource data**

  To evaluate issues relating to staffing levels and experience we developed a data set by region, unit, and length of time in current position for all preconstruction positions. This was built from data provided by UDOT human resource personnel and UDOT managers.

- **Bid packages**

  Bid packages for all projects advertised in the 1997 federal fiscal year between 10/1/96 and 6/2/97 were reviewed. These correspond to the data set of PPMS projects analyzed.

- **Construction division change order sample evaluation**

  Data from an evaluation of reasons for construction change orders compiled for 15 construction projects by the Construction Division.

- **UDOT quality improvement survey results**

  In 1996 UDOT completed a customer survey of contractors, subcontractors, and suppliers. The survey included 262 UDOT employees and consultants and 223 contractors and suppliers, with a return rate of 66 percent and 22 percent, respectively.

  The analysis evaluated projects advertised between 10/1/96 and 6/2/97. This analysis period was used consistently throughout the audit.

**B. Design Process Background**

The performance audit is of the design process as documented in 08-1, Design Process Procedures, and subsequent updates. These procedures represent a model that describes UDOT’s process for designing and advertising a traditional project included in the Statewide Transportation Improvement Program (STIP).
While the audit focuses on how UDOT conducts business today, it is important to consider the audit’s findings and recommendations in the context of UDOT’s change environment. In recent years there have been a number of policy, management, organizational, and procedural changes affecting the design process. Some of these changes have been fully implemented, for others implementation is underway. These include:

- Developing and updating 08-1 procedures.
- Implementation of PPMS.
- Developing and implementing a “cradle to grave” project manager function.

Overall, the change environment for the design process is one in which UDOT management is actively instituting management improvement initiatives aimed at improving the efficiency, effectiveness, and quality of the highway program. In developing the recommendations, we have highlighted those cases where we expect that UDOT’s existing changes will address the issues.

C. Analysis Period

The analysis evaluated projects advertised between 10/1/96 and 6/2/97. This analysis period was used consistently throughout the audit. This ensured that the audit focused on projects designed and advertised under policy, procedures, and management controls.
II-III. Issues and Recommendations

This section lists the issues, observations, findings and recommendations about the overall design process. They are grouped into the following areas:

- Management, oversight, and control of the design process.
- Providing tools to support the process.
- Employee experience and training to perform the process.
- Project production: Schedule, scope and budget.
- Efficient utilization of employees.
- Quality of design work.

A. Management, Oversight, and Control of the Design Process

Interviews with UDOT employees, evaluation of available data, and review of UDOT procedures identified a number of issues related to the overall management of the design process.

1. Issue: UDOT employees have a common and clear understanding of the success factors and objective of the design process.

   a. Observations and Findings

   The design process is well defined and understood by UDOT employees. There is common agreement that a successful design process delivers “biddable” projects on time, within budget, and within scope with minimum change orders during construction due to design omissions and errors.

   The documentation of 08-1 procedures is a strength of the process. It is considered a good, clear model to follow. PPMS is a key tool used by most project design engineers and UDOT managers for the management and oversight of their design projects. There are, however, a number of activities, noted in the focus area assessment, for which PPMS’s role as a project management tool should be strengthened.
UDOT has a number of changes underway that will strengthen the design process. (UDOT will need to monitor impacts of the improvements.)

UDOT appears to have a cadre of energetic, task-oriented design project managers.

2. Issue: It appears that 08-1 procedures are not being followed for a number of key activities.

a. Observations and Findings

The interview results indicate that, in general, with significant exceptions in the areas of right-of-way, utilities, and review, the documented procedures appear to be followed. This is substantiated by the focus area assessment evaluation of PPMS and other data.

Evaluation of PPMS data for the entire design process indicates that little time is being spent on many of the 08-1 procedures specifically designed to build quality, early-on, into the design process. While 08-1 activities are taking place, project scoping and the early identification of right-of-way, utility, environmental, and other conditions that need to be factored into design are not taking place. In addition, it appears that little time is being spent on field reviews and consideration of construction issues.

b. Recommendation: Clarify expectations, provide training, and peer-to-peer communication on how to be successful.

There is general consensus among project design engineers and headquarters staff interviewed that the 08-1 process provides a good model. To be successful project design engineers need to follow the model. The process is new and many project design engineers are new to their role. This recommendation would provide for targeted training on performing the 08-1 procedures and management’s expectations. The training should focus on peer-to-peer discussion of examples, good practice, and how to build in quality.
3. **Issue: Project design engineers and other preconstruction employees perceive that the design process is managed and that they are held accountable primarily for delivering projects on time.**

   a. **Observations and Findings**

      The process at present appears to be managed to ensure that projects are advertised on schedule. Project design engineers perceive that they are primarily managed and held accountable for delivering projects on time. Central design staff have a similar perception. Interviewees stated that, where necessary, they will not follow procedures and make quality a secondary consideration in order to deliver projects on schedule. Project design engineers believe these project management decisions are supported by UDOT’s accountability structure, management reporting, and management emphasis.

      Project design engineers recognize that they develop and agree to the project design schedules established in PPMS. Their concern is that, for policy reasons, commitments are made to schedules for high profile projects that are difficult to realize. Further, in order to meet these commitments, the schedules for projects are adversely impacted.

   b. **Recommendation: Establish and communicate clear management performance objectives and control procedures for schedule, scope, budget, and quality.**

      This recommendation will build upon UDOT’s current work to strengthen the management and control of design projects. This work began with the development of the 08-1 procedures that established the project design engineer and consultant managers as the project manager function for design. It is recognized that UDOT has made significant steps in meeting schedule commitments for advertising projects.

      Project design engineers are held accountable for schedule. The UDOT recently established the objective of limiting preliminary engineering (most design process activities) to 8 percent of project production costs. This addresses the “budget” area to implement the recommendation. To implement the recommendation, retain the original project schedule and cost estimate established in PPMS. This can be compared with actual costs as the project is completed.
c. **Recommendation: Establish measurable quality targets and quality controls in management oversight of the design process.**

As analyzed in the quality section, interviewees expressed concern, supported by our audit analysis, regarding the quality of design work. Project design engineers do not perceive themselves to be accountable for quality. Therefore, UDOT needs to establish measurable quality targets and management controls for quality. This should include explicit quality related criteria that, when applied, would delay subsequent activities and ultimately result in a project schedule not being met.

4. **Issue: Estimated Project costs and project scope increase considerably during design.**

a. **Observations and Findings**

There is considerable escalation in project costs from the initial project cost estimate to the engineer’s estimated project cost at the time of advertisement. Our analysis found that almost one third of projects advertised between 10/1/96 and 6/2/97 doubled in cost from the concept report to the engineer’s estimate at the time of advertising.

Project design engineers and UDOT managers are not held accountable for increases in project cost during design. The cost can increase for any of the following reasons:

- The original estimate was developed too early in the project development phase to be precise.
- The methods used to develop the original estimate were poor.
- Employees do not know how to develop good estimates.
- The original estimate was accurate but the scope of the project has changed.

The escalation of project costs is a cause for concern. It impacts the UDOT’s capacity to effectively manage the entire program, the productivity of the program, and limits management’s ability to use construction dollars effectively.

b. **Recommendation: Establish management and control procedures to address project cost escalation and scope creep.**

This recommendation requires establishing a better relationship between the project cost estimate in the Statewide Transportation Improvement Program...
(STIP), the concept report, and the engineer’s estimate in the P.S.&E. package. The design project managers should be held accountable for an engineer’s estimate within an acceptable variance of an estimate based on the project scoping.

Implementing the recommendation to address management and control of “scope creep” will require establishing an agreed set of goals and objectives for each project based on the project scoping meeting. Project managers need to be accountable for the impact of incremental decisions that will result in a variance from this. Any major variance based on engineering merits and considerations would require management authorization and explicit identification of how construction would be funded.

5. **Issue: A number of interviewees expressed strong concern regarding UDOT’s management and control of design consultant work.**

a. **Observations and Findings**

In recent years the proportion of UDOT’s design work that is undertaken by design consultants has increased substantially. Estimates provided by the consultant services manager put the figure for Fiscal Year 1996 at approximately 37%, compared to just 12% in the prior year. There are some difficulties in using this information as the basis from which to compare the overall cost of consultant work with that undertaken by in-house staff; however, we can conclude that a large and increased proportion of design work that is performed following 08-1 procedures is undertaken by design consultants.

The design consultants are either assigned responsibility for the entire project or retained to perform specific activities such as preparing the environmental documents. UDOT’s overall management approach is that design consultants may be used interchangeably with UDOT design squads to prepare and develop project specifications and estimates ready for advertising. Where this is the case, UDOT uses consultant managers whose position is dedicated to contract management.

UDOT has inexperienced consultant managers. Over three-quarters have been in their position less than 2 years. Each consultant manager is responsible for more projects than their counterparts managing UDOT design squads. Interviewees expressed concern that UDOT does not hold design consultants accountable for delivering on-budget, high quality products. In addition, there is concern that UDOT needs to more effectively manage the total cost of design consultant work.
b. **Recommendation: Evaluate UDOT’s management and control of consultant design work.**

Consultant design work accounts for a materially large portion of UDOT’s design work. This was identified by the interviewees as a “high risk” area.

6. **Issue: The construction perspective needs to be more consistently factored into design.**

a. **Observations and Findings**

A number of interviewees, especially those with construction responsibilities, believe that there needs to be better communication with construction during design. In addition, there needs to be more consistent consideration of constructability issues in design.

While UDOT does not currently perform formal constructability reviews for its projects, the 08-1 Design Review Process does require the identification and incorporation of construction issues into project designs. All regions are required to apply this process to all projects. Construction issues are identified during the initial phases of projects when scoping and site visits are conducted. Scoping and site visits identify environmental constraints, the presence and location of utilities, geotechnical issues, and other factors that could potentially affect the project. One intention of the 08-1 Design Review Process is to involve construction engineers and project engineers during scoping and site visits to enhance the quality of designs. However, in practice these engineers are not consistently involved.

There are no formal procedures for providing UDOT or consultant designers with feedback from construction personnel regarding the quality and scope of their work, although some of the interviewees indicated that they solicit and receive feedback. This reflects the lack of coordination between preconstruction and construction at UDOT. In addition, there is no formal constructability review process in place. This review process is typically organized so that construction and preconstruction personnel are coordinated to minimize the impact of construction obstacles and to identify potential efficiencies. At UDOT, preconstruction and construction work largely independently of one another. There is a perception that improved coordination between these functional areas would improve the project development process.
b. **Recommendation:** UDOT should address this issue through constructability reviews and the implementation of the project manager function.

One of UDOT’s priority strategic initiatives is the implementation of a project manager function. This will bring together responsibility for design and construction under a single project manager or project management team. We understand that UDOT is already addressing this issue through the commitment to develop the project manager function.

**B. Providing Tools to Support the Process**

1. **Issue:** The UDOT is realizing the benefits from a documented design process, however, the documentation needs updating periodically to include improvements.

a. **Observations and Findings**

The documentation of UDOT’s design process in 08-1 provides considerable value. Throughout the Preconstruction Division in headquarters and the regions there is a common understanding by employees of what constitutes a successful design process and UDOT’s model of that process. This is a valuable asset for helping new employees and design consultants to understand UDOT’s business rules.

PPMS is UDOT’s “corporate database” for managing the design process. The system was implemented in 1995. It is the key tool used by project managers to track project budget and schedule for the activities detailed in 08-1. There have been a number of changes to 08-1 since it was produced.

b. **Recommendation:** Update 08-1 to account for recent and planned changes to the procedures and strengthen and enhance the use of PPMS as UDOT’s “corporate database” for managing the design process. (Focus area observations and recommendations will provide direction).

The procedures need to be updated to reflect improvements. UDOT should establish a mechanism for making improvements and communicating changes to employees and consultants. The published procedures need to be periodically updated to reflect these changes. One approach would be to publish an updated printed copy every two years at the same time. The document could be prepared for a three-ring binder and updates and modifications made on a periodic basis and then inserted.
2. Issue: The UDOT does not have current design and other manuals that document Utah design standards and criteria.

a. Observations and Findings

As noted earlier, UDOT does not have a current manual and sources of information about design standards, criteria, and procedures. In addition, in our focus area work we could not identify manuals that address environmental and right-of-ways. Our audit did not assess UDOT’s documentation in other key areas such as: hydraulics, bridge design, traffic engineering, pavement design/rehabilitation, plan preparation (computer aided design and drafting) among others.

The interviewees and our analysis indicates that there is not a systematic body of current information that new employees and consultant design engineers can refer to for guidance or to use in their training. The UDOT has increased the amount of work performed by design consultants. UDOT’s consultant managers are very new to their responsibilities. The absence of well-documented technical and procedural criteria increases the time for contract administration. Further, it makes it more difficult for consultants to perform their own quality control against UDOT standards and criteria.


Although the audit did not involve a benefit-cost analysis, we believe that there is a clear business case for updating Utah’s design manuals. The manuals can provide the tools to help build in quality by providing points of reference from which to specify scope and hold managers and design consultants accountable for the quality of their work.

C. Employee Experience and Training to Perform the Design Process

1. Issue: A large proportion of UDOT’s designers and consultant project managers are new to their responsibilities and to the agency.

a. Observations and Findings

Historically, UDOT has been a career organization. Employees, especially in the engineering disciplines, spent their entire career with the organization. The
human resource management, career development, and training structures are designed to support this. Typically, promotion and career progression was a function of experience and demonstrated performance within UDOT. In addition, UDOT provided the support that allowed employees to develop professionally and acquire new skills. Project managers understood how UDOT does business and the intricacies of different functional areas because they had been exposed to them. UDOT is currently in a new position with a large proportion of new employees.

There has been an exceedingly high turnover of employees in UDOT’s Preconstruction Division within the last three years. We estimate that 31 percent of preconstruction employees have been in their current position less than two years. Further, 38 percent of region design crew members and 86 percent of consultant managers have been in their positions less than two years.

b. **Recommendation:** The UDOT should evaluate whether existing human resource management and professional development programs meet the current employee requirements for a successful design process.

The UDOT’s strategic direction is as an “employee centered” organization. The expertise of UDOT employees is a key element in the success of the design process. This recommendation involves ensuring that UDOT’s human resource management activities meet the requirements of the design process.

2. **Issue:** UDOT’s career path, employee performance evaluation, and compensation structure provide a barrier to the success of the design process.

a. **Observations and Findings**

Preconstruction staff believe that UDOT’s career path and incentive structure results in movement out of design, especially out of design project management. Design engineers and UDOT Personnel staff believe that the current structure does not provide many promotion opportunities in the regions, especially for the Project Design Engineer. The only higher preconstruction design management positions in the region are the Roadway Design Engineer and the Preconstruction Design Engineer - both of which have low turnover rates. The introduction of the project manager function could provide another career path.

There is concern among preconstruction project managers that UDOT’s incentive structure does not reward high performers. They believe that they have no mechanisms to reward design squad members that are high performers and that this creates equity issues and limits the incentive for individual squad members.
b. **Recommendation:** The UDOT needs to establish a human resource management approach that will lead to a higher level of stability among design engineers.

The costs to UDOT from high labor turnover are great. These arise from added training burdens and the lack of continuity and experience in working with customers. In addition, there are adverse impacts on morale and culture. In addressing this recommendation, UDOT should evaluate whether there are changes to the current incentive structure that would provide a career path to ensure greater stability of preconstruction design engineers.

3. **Issue:** There appears to be a need for more effective training to improve the effectiveness of the design process.

a. **Observation and Findings**

As detailed earlier, in UDOT’s Preconstruction Division almost one third of employees have been in their current position less than two years. With the exception of Structures, this lack of experience extends across the different functional areas within preconstruction. In the areas of consultant management and environmental/hydraulic review, almost the entire work force has been in their current position less than two years.

Our analysis found that large amounts of time are being charged to training, yet interviewees believe that they need additional training. This suggests that the existing training programs and activities are not meeting the requirements for a successful design process.

Given the large number of new and less experienced project design engineers and design process managers, many are not familiar with the procedures. In addition, it is difficult to learn a process from a procedures manual. There will be benefits from additional training for design project managers and broader communication of the procedures.

b. **Recommendation:** Improve the effectiveness of the preconstruction training program.

This recommendation needs to be considered in conjunction with recommendation F.2.b on page II-24.
D. Project Production: Schedule, Scope and Budget

1. Schedule Issue: While most projects reach their target completion dates, there is room for improvement.

   a. Observations and Findings

      UDOT’s planning work establishes, by year, a financially constrained STIP that specifies which projects will be let. The project design process develops the plans and specifications for the construction projects that will be let to implement the STIP. This requires a project design process that produces plans ready for advertising in the specified fiscal year. In addition, there are specific periods during the year when construction should occur due to weather and other factors. UDOT’s preconstruction staff are involved in a multiple number of projects. To use labor resources most efficiently it is important to manage workflow throughout the year. For these reasons, it is critical that the design process deliver projects on an agreed schedule that utilizes staff resources efficiently and allows for cost effective construction. This is accomplished through setting an advertising schedule for projects.

      • It appears that UDOT has made a marked improvement in meeting the advertising schedule for projects.

         Two-thirds of the projects advertised that we analyzed in the 1997 fiscal year were advertised within 90 days of the target completion date. The audit team did not conduct its own similar independent trend analysis; however, reports prepared by UDOT staff for their management, indicate that this represents a substantial improvement over prior years.

   b. Recommendation: Use UDOT’s performance management plan to set and monitor project schedule benchmarks.

      There remains room for improvement, a third of federal and state projects are advertised 91 or more days after the baseline target completion date. UDOT should establish benchmark indicators and continue to work to improve the number of projects advertised within an acceptable period of the target completion date.
2. **Schedule Issue: The largest factors affecting the ability to deliver projects on schedule are right-of-way clearance and environmental documentation.**

   a. **Observations and Findings**

   The right-of-way clearance and environmental approval are the two design process activities that have the greatest critical path impact on meeting project schedule targets. The impacts are greatest where environmental impact statements and assessments are required and when right-of-way condemnation is involved.

   This raises two separate management issues. First, UDOT should determine whether it is possible to be more accurate in setting schedules for projects requiring environmental assessments or environmental impact statements. Similarly, for projects that are likely to require right-of-way condemnation or relocation, determining whether it is possible to anticipate this in advance and build this into the project schedule. Second, UDOT should evaluate whether the length of time it takes to clear right-of-way and prepare environmental documents can be reduced. These issues are considered in the focus area assessments as part of the audit.

   b. **Recommendation: This issue is addressed in detailed recommendations in Sections IV and V.**

3. **Schedule Issue: Large projects are being delivered on time but there is room for improvement.**

   a. **Observations and Findings**

   UDOT’s performance in delivering large projects (measured by dollar value of construction) on schedule is appreciably better than for smaller projects. UDOT’s performance with large projects (greater than $4 million) is notably better. Of the 67 projects measured, six were ahead of schedule and two were between 46 and 90 days behind schedule. This is a positive finding because the large projects account for a significant proportion of the program. Although we do not have systematic data to support any findings, we suspect that the improved performance with the larger projects reflects their importance and high profile. Further, UDOT’s performance in delivering smaller, less complex projects should be at least as good as for the larger projects.
b. **Recommendation:** Benchmark current performance and monitor overtime to continue to hold project managers accountable for delivering projects on schedule.

The 08-1 design process was only recently implemented; other change initiatives are underway, and UDOT has a new cadre of design project managers whose performance is explicitly measured on schedule. In addition, UDOT has an expanded accelerated program of projects underway in preparation for the 2002 Winter Olympic Games. Our audit recommends that UDOT stabilize this change environment in order to enable the new procedures, management objectives, and schedule oriented culture to stabilize. This can then provide the basis for internally benchmarking design process performance in meeting schedule objectives and building in continuous quality improvement in this area.

4. **Scope Issue:** The escalation of project costs and “scope creep” affects the overall efficiency and effectiveness of UDOT’s program.

a. **Observations and Findings**

Analysis of 67 projects advertised in Fiscal Year 97 finds that just over half had an engineer’s estimate that was 150 percent or more of the initial project cost estimate. (That is the cost estimate arising from the project concept meeting and specified in the concept report, Activity 35C.) Almost a third of projects doubled in cost. Overall, the variance between the first estimate and the advertised estimate for all 67 projects was $106,068,600. This represents an increase of 106%. These data need to be interpreted with caution. In particular, UDOT needs to determine what is reasonable performance is and at what point in the process it is possible to develop an accurate estimate.

Our analysis found that very little time is being spent on activities in the concept phase. In particular, there is limited participation in Activity 1OC (Develop Concept Plans). Many of the other activities (15C, 20C, 25C, 30C) have no, or little, time charged to them. This suggests that little attention is paid to developing accurate original estimates.

Project delays cause costs to escalate beyond those specified in the concept report. This occurs due to inflation and other factors. In addition, the advertised project may differ significantly in scope and hence cost, from the original project approved for inclusion in the STIP, and from the project scoping. This is known as “scope creep” and it is a widespread management problem in state departments of transportation. It arises because during design, usually for very good engineering reasons, the scope of a project changes to address deficiencies and improve the project. For example, at the individual project level this can be
characterized by a pavement preservation project whose scope increases as safety issues associated with vertical alignment are addressed, or driveway consolidation is added, turning lanes added, and so on. At the project level these are all “good” design decisions. The consequence of these project level decisions is that a different project with larger costs is built.

The cumulative impact of these project level decisions is that the overall program of improvements cannot be fully funded and implemented as planned. This makes it difficult to manage the overall program. Further, if the ultimate scope of the project had been considered at project selection, then a different project might have been selected. Scope creep has the effect overall of reducing the size of the program. In short, it prevents the efficient management of the highway program.

- **Meeting UDOT’s STIP commitments requires managing scope.**

The audit did not evaluate the STIP planning and management process; however, the design process is the mechanism through which UDOT’s published project commitments are met. These commitments cannot be met unless project scope is effectively managed and controlled. Cost escalation means that not all projects specified in the STIP can be funded.

b. **Recommendation:** Ensure that the concept phase and scoping establish cost estimates and scope parameters from which to effectively manage scope.

These estimates and scope parameters can be used as controls and a mechanism for approving variance beyond an acceptable level established. This will increase the productivity of UDOT’s program.

5. **Budget Issue: Projects are meeting their overall planned budget hours although there is room for improvement.**

a. **Observations and Findings**

Labor cost, measured by the number of hours worked, is used to manage the preconstruction budget. PPMS contains a set of work standards that provide the basis for establishing a project budget for each activity. Depending upon a project’s complexity and special circumstances, the project design engineer may override the standards in PPMS when establishing the project budget.

Overall, projects are being delivered within planned budget hours. For the 67 projects reviewed, 49 of which were federal and state projects, 72 percent were
delivered within their PPMS budget, and 15 percent exceeded their PPMS budget by more than 25 percent. Analysis of large budget overruns found that they are almost exclusively restricted to projects with construction budgets over $1 million.

b. **Recommendation:** Use UDOT’s performance management plan to set and monitor project budgets and preliminary engineering costs.

As part of its performance management initiative, the UDOT management is establishing overall benchmark targets for preliminary engineering. This establishes the objective of limiting preliminary engineering costs to 8% of the project construction cost. A significant proportion of these costs will be the labor costs of performing 08-1 activities. The UDOT is in the process of determining what to include and how to measure the preliminary engineering costs. When established, this can be used to provide a benchmark for tracking preliminary engineering cost reductions.

### E. Quality of Design Work

1. **Issue:** There is widespread concern that the quality of UDOT’s overall design work has fallen.

   a. **Observations and Findings**

   Interviewees in headquarters preconstruction functions involved with review, right-of-way, and environmental review expressed concerns about the quality of current work products that they were receiving. This issue has been evaluated in more detail in the audit’s individual focus areas.

   Our analysis indicates that the quality of work has decreased and “corners are being cut” to meet project schedule targets. Project design engineers responsible for delivering quality acknowledge this and UDOT’s headquarters review staff concur.

   The UDOT, in addressing quality concerns, is seeking to create the expectations and management controls to build quality into the design process. The philosophy is to get the work right the first time, rather than relying on a review and approval process to identify deficiencies. This philosophy was reflected in the original development of the 08-1 process. Our focus area assessment finds that a number of those activities and procedures designed to build in quality are not being followed. This may well be a project management problem.
There is common understanding among UDOT staff regarding what quality means in the design process and how to measure and monitor quality. The following measures used in the audit analysis reflect this:

1. Addenda changes to the bid package after advertising and before awarding.

2. Dollar value of change orders after contract awarded during construction due to design errors or omissions.

3. Customer or end user satisfaction.

4. Changes required in P.S.&E. and time between P.S.&E. review and final advertising. (Fewer changes and faster time indicate quality is being built into the design work).

Overall, interviewees’ concerns about quality are substantiated by the audit analysis. Using the measures listed above to evaluate projects advertised between 10/1/96 and 6/2/97, the audit found that:

- 40 percent of projects have addenda after advertising.
- 15 percent of projects have more than one addendum.
- 24 percent of projects were advertised with limitations of operations. These were mainly right-of-way related.
- A UDOT 1996 quality survey of 262 employees (66 percent responded) and 223 contractors (22 percent responded) revealed customer quality concerns regarding user input, inadequate review, and inexperienced UDOT staff.
- The Construction Division evaluated 15 construction projects with five or more change orders, selected by regions, to determine the causes of change orders. Analysis concluded that 68 percent of change orders could have been addressed in design. (However, they may have been considered during design, but not included for scope and other reasons.)

The audit analysis did not attempt to establish multi-year trend information; however, interviewees were asked to provide perspective on this issue. The interviews suggest that the decrease in quality is a recent concern and that UDOT has historically provided high quality work.
The reasons cited for recent quality concerns is the pressure and perceived management priority to deliver projects on schedule. This is perceived to be reinforced by the strategic priorities established in UDOT’s “Strategic Direction” documents that prioritize getting ready for the 2002 Winter Olympics.

In assessing the implications of these findings regarding quality, it is important to recognize that the performance audit addresses a process that has been subject to change and new management priorities. The management of the process has changed from one oriented primarily to delivering quality design with less regard for scope, schedule, and budget to one in which project design engineers are provided with budget and schedule targets that they are expected to achieve. Therefore, the focus of our recommendations is on creating the management expectations and controls for quality and the management information with which to monitor and improve quality.

b. **Recommendation: Establish and track agreed quality-related performance measures for the design process. Use the measures for accountability, management, and identifying quality improvement opportunities.**

This can be accomplished through the UDOT performance management initiative. The quality-related performance measures should be used to monitor quality. In addition, the Construction Division is developing a change order database to monitor and track change orders by cause. This can be used to provide information and support feedback to designers to continuously improve the quality of the design process.

Quality issues can also be addressed through developing a culture in which contractors and UDOT construction project managers are viewed as design process customers.

2. **Issue: There is concern about the quality of some design consultant work.**

a. **Observations and Findings**

Interviewees, including consultant managers, believe that there is a wide range in the quality of the design consultants’ work. Interviewees are concerned that through a combination of factors that include: the workload of consultant managers, inexperience of consultant managers, and UDOT’s historic reluctance to apply strong management and control, a minority of consultant design engineers are not being held accountable for producing poor quality products. In consequence, they are either paid to redo work or a UDOT employee identifies
the work that is required and effectively completes the project. In either case, this
drives up preliminary engineering costs.

b. **Recommendation:** As part of the recommended evaluation of UDOT’s
management and control of design consultant work, evaluate the controls
used to ensure that UDOT does not bear the costs of poor quality consultant
work.

One approach considered by UDOT is having design consultants stamp and
certify their work. This would fundamentally change the UDOT’s review and
approval procedures for design consultant work. Review and approval is
considered in detail in Section III.

### F. Efficient Utilization of Employees

The prior issue areas consider the effectiveness with which the UDOT is accomplishing
objectives for the design process and the quality of the process. One of the largest cost areas
over which UDOT has control is the labor input required to complete design projects.
Therefore, to evaluate the efficiency of the overall design process, the performance audit
targeted the utilization of design process staff because this accounts for a large portion of
project design costs that UDOT can influence.

1. **Issue:** Design process employees are not being fully utilized.
   Considerable time is spent on training and non-project activities.

   a. **Observations and Findings**

   The performance audit assembled data from which to evaluate the utilization of
   Preconstruction Division time in fiscal year 97, between 7/4/96 and 5/30/97. The
data analyzed were standardized to exclude overtime, vacation, and sick leave.
   These data indicate that the UDOT can realize large efficiencies and that there are
   potential cost savings in increasing the utilization of preconstruction staff, and
   especially design squads, on project design. Further, there are opportunities to
   increase productivity by balancing the workload between the regions. It appears
   that region 4 designers are highly under utilized.

   The analysis found that:

   - Overall, 27 percent of design function staff time has been charged to non-
     project activities (excluding training).
• Overall, 9 percent of design squad time and 31 percent of headquarters preconstruction staff time was charged to non-project activities (excluding training).

• There is considerable variation between regions. The data indicate that in Region 4, 32 percent of preconstruction staff and 16 percent of design squad hours are allocated to non-project related activities.

b. Recommendation: Establish utilization targets for design squads and preconstruction staff. Hold region preconstruction engineers accountable for achieving the targets.

UDOT can reduce costs and increase efficiency by setting targets for the utilization of design squads. The region preconstruction engineer should be responsible for achieving the targets. To achieve the targets it may be necessary to reduce the staffing levels assigned to design squads in regions that do not anticipate enough design work to keep staff fully utilized, alternatively the design squad members could work on projects in other regions.

2. Issue: There are large amounts of time charged to training, yet project design engineers report the need for more training.

a. Observations and Findings

Ten percent of design squad time is reported as training. Further, in regions 1 and 3, preconstruction staff report that 18 percent and 17 percent of their time, respectively, is spent in training. The data indicate that large amounts of time are charged to training, however, interviewees cite the need for more training to improve the design process. This suggests that design staff are receiving inadequate training and/or incorrectly allocating time to training. It should be noted that our data did not enable us to determine how much of the training could be attributed to the introduction of MicroStation.

We understand that UDOT has many new employees and that they require training. Despite this, based on the analysis of time charged to training, there are large efficiencies that can be realized by using preconstruction staff time charged to training to undertake design process work.
b. **Recommendation: Establish budget targets for training and improve the effectiveness of the preconstruction training program.**

The UDOT can reduce costs and increase efficiency by reducing training time. Further, it appears that the productivity and quality of the entire design process could be enhanced through more effective training. Although not directly evaluated by the audit, it appears through our interviews and analysis that current training programs are not meeting the training needs for the design process. To implement this recommendation will involve establishing training budgets, in terms of design squad and preconstruction division employees’ time.
III-I. Focus Area Overview

A. Description

The design review process specified in 08-1 includes a series of structured activities intended to provide quality control of work by a second set of eyes for clarity, completeness, and accuracy, among other measures. Its major areas of focus are the review of the Design Study Report and P.S.&E.. These activities take place in the regions and at UDOT headquarters. They include field reviews, scoping sessions, formal and informal review meetings, and involve both regional and UDOT headquarters personnel in reviewer roles. The most frequent participants are project design engineers and UDOT review unit staff.

Most major functions of the design process (i.e., structures, landscaping, hydraulics, right-of-way) have a review function particular to the issues in its area. This audit focus area evaluates the issues surrounding the major review activities that affect all projects. Exhibit III-I outlines the major activities that were evaluated and the secondary review activities that contribute to them.

B. Approach

The analysis of UDOT’s review process is based on the following analysis approach:

- **Interviews**
  Several series of interviews were held with UDOT managers, region preconstruction engineers, project design engineers and UDOT review unit staff.

- **Structured workgroup evaluation of the process**
  A workgroup session was held with project design engineers and review unit staff. The review process was flowcharted and validated with regional and headquarters staff involved in review. Specific issues and potential improvements were analyzed by the participants.

- **Evaluation of Preconstruction Program Management System (PPMS) data**
  In order to study the quantifiable scope, schedule, and budget issues surrounding the review process, an evaluation of PPMS data for projects advertised between October 1, 1996 and June 2, 1997 was conducted.
• Analysis of human resources data

To analyze the experience level of UDOT employees involved in the review process, position classification information generated by the UDOT personnel division was used.

C. Summary of Observations and Findings

• The review procedures built into 08-1 are not being followed. The purpose and role of the review steps and its relationship to building quality into the design process are not clear.

• Many Engineers believe that they “don’t have time” for review activities and are not following 08-1 as written. They indicate that management expectations for project schedule necessitates moving on to other activities without significant consideration of review activities.

• The “Plan-in-Hand” review has not been successfully replaced with the optional field review under Activity 55D (Review Roadway Plans). Project design engineers and consultant project managers indicate that the field review rarely occurs.

• The criteria used by review unit reviewers are not clear to staff in other units or divisions. The largest gap of understanding appears to be between the regions and headquarters when headquarters staff are reviewing materials prepared by the regions.

• 08-1 does not have procedures in place to make the results of reviews and approvals binding. Designers can choose to ignore most input from reviewers, even if it is valuable.

• PPMS estimates for the duration and budget hours for review activities are almost always exceeded.

D. Summary of Recommendations

1. Management

• Clearly define the purpose, scope, roles, and responsibilities for review.

• Specify individual expectations, business rules, and performance criteria for each review step.

• Establish a checklist and reporting mechanism to monitor and record disposition of design process review activities.
• Establish procedures in 08-1 and the business rules for each review activity to ensure that project materials address the critical issues identified by earlier review steps.

2. Schedule

• Make project managers responsible for ensuring that information essential to the completion of the Draft Design Study Report is available at the design scoping meeting.

• Eliminate Activity 88D (Finalize Design Study Report).

3. Scope

• Establish a binding review for scope at a midpoint in the design process.

4. Quality

• Define measures for quality and quality-related review objectives for each major review activity.

• Make at least one field review mandatory for each project.

• Refocus headquarters review activities to include coaching, “over-the-shoulder” advice, and technical assistance.

• Customers of the design process should be included at key points in the design process. This can be in the form of constructability and maintainability reviews at appropriate points.

• Require designers to review any post-design changes that result from their projects.

• Continue to develop an approach to require consultants to certify their own design work. Provide them with clearer directions for navigating the preconstruction process.
III-II. Issues and Recommendations

The following lists issues, observations, findings, and recommendations concerning review-related activities of the design process. They are grouped in five topical areas:

- Management
- Schedule
- Scope
- Budget
- Quality

A. Management

There are a number of issues related to the overall management of review related activities during the design process. The following lists these issues and provides recommendations for addressing them.

1. Issue: The review process, as outlined in 08-1, is not being followed.

   a. Observations and Findings

   Project design engineers and review unit staff alike indicate that the model for review activities in 08-1 is not being followed.

   Regional personnel preparing documents for review, and review unit staff confirm, that important tasks within review activities are often skipped. An example is Activity 55D (Review Roadway Plans). Project design engineers report that they are spending most of their time assuring that their packages are complete and “buildable,” and less on whether their plans conform to AASHTO and state standards. This is especially prevalent in Activity 55D (Review Roadway Plans) – where review for conformity with AASHTO and state standards is required.

   Region and headquarters staff also point out that 08-1 is used as a general framework for developing and reviewing plans and specifications, but is rarely followed in a step-by-step manner. In fact, many times important activities or subprocesses are bypassed. Project design engineers indicated that field reviews, including 55D (Review Roadway Plans), and scoping activities, such as 94D (Conduct Design Study Report Review), are many times entered as completed in
PPMS, although very little work was done. According to some project design engineers, review for the Design Study Report (DSR) is often skipped entirely. In practice, project design engineers provide a copy of their materials for review to the Review Section and then do not wait for a response before proceeding. Their main purpose in taking these actions is to prepare for, and get to, P.S.&E. review as soon as possible to meet advertising deadlines. The review unit confirms these occurrences and, as a result, actually questions the purpose of and need for the DSR.

An underlying reason for lack of compliance with 08-1 appears to be the absence of binding approval steps. All of the activities in the review process review documents for clarity, etc., or recommend them for approval, but do not actually require approval before moving on in the process. Without required approval, project design engineers and others with materials to be reviewed have no structured motivation to take review activities seriously.

b. **Recommendation: Clearly define the purpose, scope, roles, and responsibilities for review.**

Review activities are not taking place according to 08-1 procedures. The procedures either require modifying or project managers should be held accountable for following them.

- We recommend starting with the 08-1 model and determining what types of review are required at different stages of project design. Among the issues to resolve are whether there is a distinction between review and approval authority. UDOT should consider what will be required to ensure that the Design Study Report (DSR) adds quality to the design process. If there is no value in carrying out the activity, discontinue it.

1) **Advantages**

- Will ensure review builds in quality.
- Increases effectiveness of current process.

2) **Disadvantages**

- None identified.
2. **Issue: Management expectations and review criteria are not clear to participants in the review process.**

b. **Observations and Findings**

Participants in the review process, whether in regions or headquarters, overwhelmingly indicated that they understood UDOT management expected them to “get projects to advertisement on time.” However, they indicated that they were confused about their individual roles within the process, especially as they apply to management’s expectations of them and the criteria used during review tasks.

- **Competing and unknown management expectations.**

  Project design engineers indicated that to meet the advertising schedule they are primarily focused on P.S.&E. review. They said they have difficulty providing quality products for review when they have such competing factors.

  Review unit staff indicated that they did not know what management really expected from them in the process. They believe that the design process, and especially the review functions, were not being followed by designers because management’s mandate for projects to be advertised on time pushed the process beyond the point where designers could complete their work in a timely or high quality manner. As a result, the review unit sees itself as either being relied on too much to address design flaws that should have caught by designers or not consulted enough by regions.

- **Unclear review criteria.**

  Project design engineers said they attempted to follow the various criteria found in technical advisories and business rules for each activity in 08-1. However, they also indicated that much of the criteria used by the UDOT review unit during 94D (Conduct Design Study Report Review) remains unclear to them. Review unit coordinators indicated that in addition to accuracy, appropriate formatting, and completeness (which are criteria appearing in the 08-1 manual), one of the largest criteria they measure for is consistency.

  In fact, review unit coordinators indicated that approximately 90% of all projects were returned to the regions because they lacked consistency between bid items, units, and quantities in the specifications, estimates, and special provisions. Other criteria were based on common sense and their experience at UDOT.
Region project design engineer and review unit staff also indicated that few formal checklists are used when reviewing projects. While they are aware of the business rules and technical requirement associated with each activity, they have to hunt for them because a central, mutually understood source that consolidates them does not exist.

c. **Recommendation: Specify individual expectations, business rules, and performance criteria for each review step.**

Participants in review activities need to understand their roles in the process. Each review activity should be assessed to see if a checklist can be developed. Reviewers and designers should work together to document explicit criteria for review activities.

Review criteria and related information for each review step should be prepared to include:

- A simple process flowchart and explanations of review and approval steps.
- Review criteria for each activity to be reviewed (both technical and otherwise), with examples.
- Checklists for each activity.
- The document should be developed by a team comprised of headquarters and region design staff.
- It can be introduced at and serve as the focus for regional “all-hands” meetings, with on-site participation by headquarters staff, as applicable.
- The criteria and procedure document can be an attachment to the 08-1 procedure manual.

(1) **Advantages**

- This effort will build consistency and predictability.
- The information should act as a valuable guide to all staff, including those new to preconstruction or to their review functions.
- Consultants should also find the document helpful. When combined with the 08-1 procedure manual, it will provide a more complete picture of the design process and its review steps.
(2) Disadvantages

- Costs will be associated with developing the information; however, the return in higher quality communication should offset costs incurred through misunderstanding.

- Staff time will have to be spent developing checklists that currently don’t exist.

3. Issue: Review activities cannot be easily tracked.

a. Observations and Findings

There is no formal procedure that systematically monitors review activities and provides meaningful data that can be used for quality control purposes. Many reviewers keep files for each project or a group of similar projects they have been involved with. However, there is no procedure for recording the types of review issues encountered or the number of times work was sent back for revision.

This information would allow a quality control/quality assurance function to easily analyze the results of revision, looking for trends relating to why projects are returned, where projects frequently exceed budget estimates, etc. This information could be used to support quality control and promote identification of issues.

b. Recommendation: Establish a checklist and reporting mechanism to monitor and record disposition of design process review activities.

A simple mechanism to record disposition of review activities could be developed. PPMS already provides the mechanism for status reporting. Recording disposition can provide information to support quality improvement. For example, if there is a pattern of computational errors, the data collected would identify it and it could get addressed in advance.

(1) Advantages

- The data could be used to build in quality by pinpointing problems so they can be acted upon.

- It would provide a structured avenue for management feedback on project progress.
(2) Disadvantages

- Initial commitment of staff time to develop the tracking checklist and reporting mechanism will be required.

4. Issue: There is no continuity of review to ensure that critical issues identified by earlier steps are addressed throughout the design process.

a. Observations and Findings

When projects arrive for headquarters review, the Chief Review Engineer assigns a project to one of his staff to track through the process. They are then responsible for reviewing it during Activities 94D (Conduct Design Study Report Review), 75P (Prepare for and Hold P.S.&E. Review), and 85P (Assemble Final Plan Set).

However, the review unit is not responsible for review of scoping activities, including 35C (Conduct Project Concept Meeting and Develop Report), 10D (Conduct Scoping Meeting and Develop Report (Draft DSR)), and in the final review of design products in Activity 75P (Prepare for and Hold P.S.&E. Review). This lack of continuity allows reinterpretation of project parameters by different scope setters and reviewers. This can lead to changes in the scope of projects. Neither 08-1 nor business rules for each activity require such consistency.

b. Recommendation: Establish procedures in 08-1 and the business rules for each review activity to ensure that project materials address the critical issues identified by earlier review steps.

Project managers should carefully monitor this involvement to ensure that it is contributing to quality control and quality assurance for the design process.

(1) Advantages

- Continuity of review should ensure review consistency.

B. Schedule

1. Issue: Review activities are delaying the design process.

This section identifies and evaluates the impact of review activities on the schedule of the overall design process.
a. Observations and Findings

Schedule delays due to review-related activities comprised 15% of all delays throughout the design process. A summary of the delays, developed from PPMS data, appears in Exhibit III-2, below:

**Exhibit III-2:**
**Number Duration Days over Original Workplan**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Planned Duration Days Exceeded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 10D (Conduct Scoping Meeting and Develop Report (DSR))</td>
<td>2862 (31%)</td>
</tr>
<tr>
<td>Activity 88D (Finalize Design Study Report)</td>
<td>3957 (43%)</td>
</tr>
</tbody>
</table>

Source: Data from PPMS for projects advertised 10/1/96-6/2/97.

Both activities are creating delays because they should be completed before moving on to other activities. Because of their potential to impact the overall schedule, the reasons for duration overages in Activities 10D (Conduct Scoping Meeting and Develop Report (DSR)) and 88D (Finalize Design Study Report) were analyzed in detail.

- **Activity 10D (Conduct Scoping Meeting and Develop Report (DSR))**

  Procedure 08-1 indicates that the purpose of Activity 10D (Conduct Scoping Meeting and Develop Report (DSR)) is to scope design issues for projects, including determination of whether or not the programmed budget estimate has increased 25% or more.

  Project design engineers cited several potential reasons for the overages in duration days. First, the activity is really the first one that designers become actively involved in – and are, therefore, “getting up to speed.” Second, time is often spent seeking out information needed for the draft DSR that was required to be included in earlier PPMS steps, such as the Concept Report, but was left out. According to project design engineers some of this information includes, but is not limited to, existing plans and pavement management data. This suggests that 10D would be more effective through better concept phase work.

- **Activity 88D (Finalize Design Study Report)**
According to Procedure 08-1, the purpose of Activity 88D (Finalize Design Study Report) is to provide the project design engineer time to collect and review materials for the Design Study Report, including the Draft Design Study Report and environmental document, before it is submitted to the region preconstruction engineer or to the review unit for review.

Project design engineers suggest several reasons for the duration overages. First, consultant design work and the environmental document are often late. Second, they indicate that 88D “gets lost” in the process, as it often takes place simultaneously with a host of other activities that prepare more specific information for use in the final DSR, such as 56D (Review and Approve Major Structure Situation Layout), 58D (Review Major Structure Hydraulic Plans), 70D (Review Landscape Plans), 73D (Review Signal and Lighting Plans), and 76D (Conduct Utility and Railroad Field Review).

b. **Recommendation:** Make project managers responsible for ensuring that information essential to the completion of the Draft Design Study Report is available at the design scoping meeting.

Information that 08-1 requires to be included as part of the Project Concept Report and other related reports should be completed prior to Activity 10D (Conduct Scoping Meeting and Develop Report (DSR)).

c. **Recommendation:** Eliminate Activity 88D (Finalize Design Study Report).  
Project design engineers should not have to rely on the formal step 88D (Finalize Design Study Report) to coordinate materials for the DSR. Such coordination should be an on-going activity.

(1) **Advantages**

- Removes an activity that appears to add little value.

C. **Scope**

This section describes the review related issues that affect the overall project scope. Recommendations that address the issues are provided.

1. **Issue: The project scope does not appear to be reviewed consistently.**

a. **Observations and Findings**

Specific components of a project, such as hydraulic and structures review, have requirements that must be met before the project can proceed. However, the
project scope is currently only reviewed on a critical path basis once: between P.S.&E. review and advertisement. PPMS data indicate that large increases in scope can occur during the time period leading to advertisement.

Review points that could identify scope changes are often ignored, such as Activity 94D (Conduct Design Study Report Review). Its requirements are often “met” by project design engineers when they submit their Design Study Report to design review unit staff (as complex projects require them to do) and enter a completion date for Activity 94D in PPMS. Project design engineers, region project design engineers, and design review staff confirm this pattern.

Activity 94D provides a good opportunity to identify scope increases, as the Design Study Report is, at that point, being carefully reviewed by a second set of eyes. As well, at the point where 94D occurs, enough work has been completed in the design phase that it can be measured before the continuation of such detailed work in the P.S.&E. phase.

b. Recommendation: Establish a binding review for scope at a midpoint in the design process.

This recommendation could be implemented by establishing a review and approval of scope as part of 94D (Conduct Design Study Report Review). At this point project design engineers should estimate project cost and determine whether there is significant variance from the original project scope. This task could be added to Activity 94D (Conduct Design Study Report Review). It should:

- Include the comparison of initial budget, schedule, and scope estimates with current estimates by the same staff who prepare project packages for final approval by the Deputy Director.
- Require regions to develop a course of corrective action, if the review unit identifies serious flaws or changes in scope, and file it with the Region Roadway Design Engineer, who must approve it.
- Require Region Roadway Design Engineer to enter this step as “completed” before any other PPMS activities can be initiated.

(1) Advantages
- Scope creep would be caught earlier and reduce project cost.

(2) Disadvantages
- Increases project management administration.
D. Budget

This section identifies review related issues affecting the cost of the design process and presents recommendations that address them.

1. Issue: Budget hour overages in review activities have a minimal impact on the overall design process.

The design process is not greatly affected by the size of budget overages caused by review process activities. According to the PPMS data, only 6% of all exceeded budget hours were associated with review activities. The activities with the largest overages are listed in Exhibit III-3.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Budget Overage</th>
<th>Hours</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>10D Conduct Scoping Meeting and Develop Report (DSR)</td>
<td></td>
<td>1001</td>
<td>19 %</td>
</tr>
<tr>
<td>85P Assemble Final Plan Set</td>
<td></td>
<td>2645</td>
<td>50 %</td>
</tr>
</tbody>
</table>

Source: Data from PPMS for projects advertised 10/1/96-6/2/97.

E. Quality

This section identifies the issues related to the role of review in building quality into the design process. Recommendations that address these issues are present.

1. Issue: Review activities, as undertaken in practice, are not building quality into the process.

a. Observations and Findings

Most region and headquarters staff involved in review activities indicated that quality in the review process, and by extension quality in the preconstruction design process, is defined as a “buildable set of plans.” Section II of the audit report identified agreed measures of quality.

However, agreement was not present on how quality was measured at individual points and activities within the process. For example, for Activity 94D (Conduct Design Study Report Review), Headquarters review unit staff said they primarily
measured quality as “consistency among documents within the design plan package.” However, many project design engineers indicated that they primarily measured quality at 94D by evaluating accuracy and completeness. Other review activities with similar differences in interpretation of quality include Activity 75P (Prepare for and Hold P.S.&E. Review) and Activity 85P (Assemble Final Plan Set).

b. **Recommendation: Define measures for quality and quality-related review objectives for each major review activity.**

For all review and approval points in the design process, especially at 75P (Prepare for and Hold P.S.&E. Review), 85P (Assemble Final Plan Set), and 94D (Conduct Design Study Report Review), consistent review criteria that address quality are required.

(1) **Advantages**

- Will help build quality into the process.
- Provides a clear standard for designers to reach.

(2) **Disadvantages**

- None identified.

2. **Issue: Field reviews are not occurring frequently enough before final P.S.&E. approval.**

a. **Observations and Findings**

Activity 55D, (Review Roadway Plans), was developed to replace the mandatory “Plan-in-Hand” review by providing the project manager with the authority to judge what review is necessary. In practice, the optional field review now rarely takes place at that point. A review may occur during earlier steps, such as the scoping meeting, Activity 34D (Develop Initial Roadway Plans), or in later steps, such as 75P (Prepare for and Hold P.S.&E. Review).

Most preconstruction staff interviewed indicated that thorough field reviews are very valuable in assuring project completeness and in providing a unique opportunity to build quality into the design.
b. **Recommendations:** Make at least one field review mandatory for each project.

A new floating activity should be added to 08-1 entitled “Field Review” and should:

- Take place on or before 55D.
- Become critical path for 55D.
- Involve, as applicable, reviewers identified in 08-1.

(1) **Advantages**

- Field reviews would be assured.
- As a floating activity, the review could be completed at a time most appropriate for the needs of a particular project.
- A mandatory field review would be consistent with requests in Kim Schvaneveldt’s December 27, 1995 review memo regarding changes in the review process. It said, under point 5, that “most projects should have at least one field review.”

(2) **Disadvantages**

- Additional time may have to be added to estimated project budget hours to accommodate this activity.

3. **Issue:** Headquarters review can help to resolve issues, clarify standards/criteria, and provide insight from other projects.

a. **Observations and Findings**

Region and headquarters staff concur that “over the shoulder” advice from headquarters staff is helpful in limiting the number and scope of later revisions. This type of informal review also offers a learning opportunity for new preconstruction staff.

b. **Recommendation:** Refocus headquarters review activities to include coaching, “over the shoulder advice”, and technical assistance.

Informal reviews should be continued and a role in which the experience and perspective of review staff is built into the design process.
4. **Issue: Customer needs are not sufficiently addressed during the review process.**

   a. **Observations and Findings**

      The needs of the short- and long-term users of the process, including the construction division, maintenance division, and contractors are often considered only after the design process is completed and the project has gone to bid. It then appears in the form of change orders and addenda. Providing this perspective before the design process is completed would allow for communication of changes that should be integrated into the design.

      (1) **Advantages**

          - Changes the nature of review to be proactive.
          - Would facilitate transfer of experience and UDOT practice.
          - Clarifies technical issues and questions.

      (2) **Disadvantages**

          - This is a new role for the review process.

   b. **Recommendation: Customers of the design process should be included at key points in the design process. This can be in the form of constructability and maintainability reviews at appropriate points.**

      In order to provide the missing “user” input into the preconstruction review process, UDOT’s construction and maintenance division, as well as affected contractors, should be involved in constructability and maintainability review. Potential points of involvement are:

          - Participation in the scoping team during Activity 10D (Conduct Scoping Meeting and Develop Report (Draft DSR)).
          - Continued participation on the scoping team during Activity 75P (Prepare for and Hold P.S.&E. Review).
5. **Issue: Many reviewers lack full confidence in the ability of the project design engineers.**

   a. **Observations and Findings**

      Region staff indicated, and headquarters review personnel concurred, that reviewers often lack confidence in the materials presented to them for review.

      - **UDOT personnel.**

         Reviewers identified experience as a major confidence factor regarding UDOT personnel. Records from the UDOT personnel division indicate some inexperience on the part of regional design staff. As of May 17, 1997, 12 of 39, or 31% of all members of regional design squads had been in their positions less than two years. 6 of 7, or 86% of all regional consultant managers had been in their positions less than two years.

      - **Consultants.**

         Region consultant managers and review unit staff also indicated that they lack confidence in the ability of certain new or inexperienced consultants to prepare documents, even though they are required to have the Professional Engineer certification as UDOT designers. Of particular concern to them is the impact of the high turnover rate of consultants. They indicated that consultants, who often have independent approaches, were challenged in their ability to adapt to the UDOT design process which caused work to be redone. Also of concern was the consultants’ apparent reliance on UDOT for reviewing their work, expecting that the UDOT design review activities will catch their errors.

   b. **Recommendation: Continue to develop an approach to require consultants to certify their own design work. Provide them with clearer directions for navigating the preconstruction process.**

      UDOT’s recent efforts to have consultants guarantee their own work should be further developed to include clear instructions for each step of the process consultants are involved in.

      The instructions should:

      - Include simple process flowcharts and explanations of review and approval steps.
• Include all applicable criteria for each activity to be reviewed (both technical and otherwise), with examples.

• Include checklists for each activity.

• Be reviewed and revised annually.

• Be signed by consultants, indicating they have read and understand it.

(1) **Advantages**

• Less UDOT time and budget would be spent contending with oversights that the consultants should have discovered.

(2) **Disadvantages**

• Errors not caught early enough by consultants could contribute to large increases in scope once they are caught later in the process.
IV-I. Focus Area Overview

A. Description

The environmental process is comprised of a series of activities centered on the development of documents for inclusion in the Concept Report, and ultimately, in the Design Study Report (DSR). Each UDOT project is classified as one of three environmental classifications. Each classification then follows different steps in the environmental process, including possible public hearings and clearances from external resource agencies, and has a detailed environmental document as its final product.

The most frequent participants in the process are environmental coordinators, who review documents prepared in the regions and interact with external agencies involved in the process, Region environmental engineers, who act as the regional “expert” on environmental matters and prepare many environmental documents, and consultants who supplement UDOT staff. Project design engineers are also involved in the process because of their project management responsibilities.

A significant part of the process is the acquisition of environmental permits from regulatory agencies, such as the U.S. Fish and Wildlife Service (USFWS). Three basic types of permits can be obtained.

An overview of all environmental activities can be found in Exhibit IV-1 on the next page.

B. Approach

The analysis of UDOT’s environmental review process is based on the following analysis approach:

- Interviews

Interviews were held with UDOT managers, Region environmental engineers, Preconstruction Engineers, Project design engineers and UDOT Environmental Unit staff.
• **Structured workgroup evaluation of the process**

  A workgroup session was held with Regional Environmental Engineers and UDOT Environmental Unit staff. The environmental process was flowcharted and used to evaluate process issues and potential improvements.

• **Evaluation of Preconstruction Program Management System (PPMS) data**

  In order to study the quantifiable scope, schedule, and budget issues surrounding the review process, an evaluation of PPMS data for projects advertised between October 1, 1996 and June 2, 1997 was conducted.

• **Analysis of human resources data**

  To analyze the experience level of UDOT employees involved in the environmental process, position classification data was generated by the UDOT Personnel Division.

• **Collection and analysis of other data**

  Notes from UDOT Environmental Division files for projects advertised between October 1, 1996 and June 2, 1997 was obtained.

**C. Summary of Observations and Findings**

• The environmental process is essentially driven by regulatory requirements and policies from agencies external to UDOT. As a result, it is often seen as beyond UDOT’s control and separate from the rest of the design process.

• The focus of review of environmental documents seems to be more on details than larger environmental concepts. This is indicated by our evaluation of notes from UDOT Environmental Unit reviews of regional documents.

• Throughout the process, there is a need for structured coordination through programmatic agreements with external resource agencies.

• Consultants have a large role in the process, as they are involved in 49% of all environmental activities.

• PPMS estimates for the duration and budget hours for environmental activities are almost always exceeded.
D. Summary of Recommendations

The following lists recommended changes to the environmental review process. The next subsection provides the context rationale, and advantages and disadvantages for each recommendation.

1. Management

- Conduct an annual training session covering all aspects of the environmental process.
- Clearly define objectives, responsibilities, and roles for headquarters and region employees in the environmental review process.
- Develop technical assistance that explains UDOT’s business rules and practices for meeting environmental requirements.
- Ensure that there is record keeping and status reporting to proactively manage environmental activities.
- Environmental Impact Statement and Environmental Assessment documents should have PPMS standards adjusted to match their complexity.
- Use headquarters staff to provide technical advice and coaching to resolve issues and build in quality.

2. Schedule

- Develop programmatic agreements with external resource agencies to simplify the process, increase predictability, and provide region environmental engineers a framework within which to assume risk.
- Identify potential activities associated with section 4f considerations as part of the preliminary environmental review.

3. Scope

- Project design engineers and consultant managers should ensure that activity 05C guidelines are followed.
4. Quality

- Define quality for the environmental process.

- Make the region environmental engineer responsible for reviewing environmental documents.

- Refocus design team efforts to solely prepare for the final environmental document approval.

- Clearly define the role and responsibilities of the region environmental engineer and the project design engineer in the environmental process.
IV-II. Issues and Recommendations

A. Management

1. Issue: The environmental process is not well understood.

There are a number of issues related to the management of the environmental review and approval process that affect the efficiency with which activities are performed. The following outlines the management issues and presents recommendations that address them.

a. Observations and Findings

Many region and headquarters staff, whether closely involved in the environmental process or not, indicated that part or all of the environmental process was unclear to them. A leading reason why was its complexity, as there are three types of environmental documents that can be developed and separately evaluated in the process, numerous environmental permitting options, public involvement requirements, and varying business rules. This is reinforced because the environmental process is separate from the rest of the design process. Contributing to this are the uniqueness of the issues in the environmental process and its extensive regulation by external resource agencies.

A key tool to understanding and effectively managing the environmental process is thorough and regular training. Such training is especially critical to UDOT’s environmental process because of the large number of its staff who are new to and unfamiliar with the environmental process. In fact, 80% of all personnel directly performing in the environmental activities have less than two years experience in their current positions,. 83% of them are in the regions and 17% are in the Environmental Division at headquarters.

However, Environmental Division coordinators indicate that short, non-mandatory training in the environmental process occurs annually at the Engineer’s conference and then through various other activities, such as National Highway Institute (NHI) and FHWA training sessions every several years. The Engineer’s Conference mainly addresses updates of engineering standards while the NHI and FHWA events cover specific topics on the environmental process. We have reviewed several NHI and FHWA engineering standards-related documents and find them difficult to interpret.
b. **Recommendation:** Conduct an annual training session covering all aspects of the environmental process.

The session should:

- Involve all staff who have a role in the environmental process and others with project management responsibilities for parts of the design process.
- Feature resource agencies who regulate the process.
- Include topics identified by Environmental Division staff as critical to the overall coordination and smooth operation of the process.
- Cover the latest trends/changes in state/federal environmental policy.
- Include topics identified by regional staff as critical essential needs.
- Be regularly evaluated as to its effectiveness.
- Provide the opportunity for all personnel to share their “best practices” and learn from other’s experiences and perspectives.

2. **Issue:** **Staff in the regions and headquarters have different perspectives on the purpose and objectives for the environmental process.**

Environmental Unit coordinators and Region environmental engineers do not entirely agree on what the environmental process is intended to achieve. Environmental Division staff indicated that the purpose of the environmental process is to:

- Approve environmental documents.
- Train individuals involved in environmental issues.
- Manage relationships with external agencies.
- Develop environmental policies.

Region staff, however, indicated that the purpose of review is to meet the minimum requirements of external agencies such as the FHWA and U.S. Army Corps of Engineers.

UDOT’s objectives for the design process are not clear to employees. Region and Environmental Unit employees did not indicate a shared understanding of what they
thought UDOT management expected from the environmental process and from their involvement in the process. Environmental unit staff thought that management expected them to provide environmental documents in an acceptable manner that meet legal requirements. Regions, however, were not sure what was expected.

b. Recommendation: Clarify objectives, responsibilities, and roles for headquarters and region employees in the environmental process.

This recommendation will ensure that the role that Environmental Unit and Region employees play in achieving UDOT’s objectives in the environmental process are defined and coordinated. This will clarify expectations and responsibilities.

3. Issue: Review criteria and expectations for environmental process documents are not clearly defined.

a. Observations and Findings

Review criteria are based on a wide variety of high technical advisories, statutes, and procedures. Checklists (such as those listed below and which also appear on pages A3-A15 in the 1995 edition of the Procedure 08-1 manual) are available to Region environmental engineers and Design Engineers in developing documents and are used by Environmental Division coordinators in reviewing them. However, more detailed criteria that support the checklists, while available, are not readily summarized in easy-to-read format. Some of the major documents referenced in this way are:

- FHWA technical advisory TA6640.8A and “Legal Sufficiency Criteria.”
- Lengthy NEPA statutes, including 23 CFR 771 and 400 CFR 1500.
- UDOT policies, such as Public Involvement / Public Hearing Procedures.
- “Draft Environmental Checklist.”
- “Substitute Environmental Demonstration Draft within Existing Roadway Prism.”
- “Environmental Study.”
- “Final Environmental Checklist.”
According to Regional Environmental Engineers, Project Engineers, and Environmental Division staff, these criteria are used frequently.

Close examination of these documents indicates that they have not been, or cannot be, translated into easily understandable terms for staff, especially those new to the process. Rather, they are written for broad application to many design processes, are complex, and include many highly specialized terms and concepts that must be applied to, or interpreted for, the UDOT design process. Environmental Unit reviewers and Regional Environmental Engineers indicated that much of their interpretation of these rules was based on opinions developed from their own professional experiences.

b. **Recommendation: Develop technical assistance that explains UDOT’s objectives, business rules, and practices for meeting environmental requirements.**

Training assistance should be developed that:

- Draws together 08-1 procedures and flow charts (as revised through discussions with a regional and headquarters involved in the process), checklists, and nuances as described by Region and Headquarters staff who have used the process extensively.

- Compiles, summarizes, and translates detailed review criteria into understandable, digestible descriptions.

- Leads the user through the process via a series of questions.

- Plans for and accommodates the variety of activities and tasks that may need to be initiated as well as various contingencies that may occur.

- Is available in an electronic format and include templates for environmental documents, letters, etc.

- Incorporates the efforts already begun by the Environmental Unit to distill complex checklists.

(1) **Advantages**

- The guides and training will build in some consistency.
• The guides will serve as a resource that can be easily accessible and referenced regularly. They should be especially helpful to consultants and new employees.

(2) Disadvantages

• None identified.

4. Issue: The status of environmental documents is not easily tracked.

a. Observations and Findings

Procedure 08-1 includes basic environmental activities and PPMS outlines the project management steps. However, it is difficult to check the status of environmental documents. No formal record keeping systems are used by environmental unit staff to monitor their review tasks and subsequently use such information to measure progress made. The process is also difficult to track because, according to Environmental Unit coordinators and region environmental engineers, PPMS data has too many contingencies associated with it to be an accurate measure of many environmental review activities.

b. Recommendation: Ensure that there is record keeping and status reporting to proactively manage the environmental activities.

The information required by project design engineers and Regional Environmental Engineers to be proactive in managing the environmental activities needs defining and a reporting mechanism established.

(1) Advantages

• Staff can identify problems in the process and subsequently be able to act upon them before they become larger issues.

5. Issue: The document-driven environmental process is comprised by three very different tracks, but they all share scope, schedule, and budget issues.

a. Observations and Findings

The environmental process is centered on the development and approval of detailed documents. Each project is designated as one of three document classifications, based on a recommendation from the Regional Environmental
Engineer and confirmation by the Chief Environmental Engineer. This occurs at activity 04D “Initiate Environmental Process,” at the start of the design phase. The classifications are listed in Exhibit IV-1:

**Exhibit IV-I Environmental Document**

**Classification Descriptions**

<table>
<thead>
<tr>
<th>Class</th>
<th>Title</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Environmental Impact Statement (EIS)</td>
<td>UDOT actions which may significantly impact environment</td>
</tr>
<tr>
<td>II</td>
<td>Categorical Exclusion (CAT X)</td>
<td>UDOT actions which have no significant environmental effects</td>
</tr>
<tr>
<td>III</td>
<td>Environmental Assessment (EA)</td>
<td>UDOT actions in which the environmental significance is not clearly established</td>
</tr>
</tbody>
</table>

The class II classification, or the Categorical Exclusion, occurs the most often. As the chart below highlights, 92%, or 61 of 67 projects, advertised between October 1, 1996 to June 2, 1997, were classified as Categorical Exclusions. However, each of the classifications represented similar percentages of the estimated cost of all projects.

**Exhibit IV-2 Type of Environmental Documents Required in FY97**

<table>
<thead>
<tr>
<th>Document</th>
<th>Frequency</th>
<th>Value of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>EIS</td>
<td>3</td>
<td>4%</td>
</tr>
<tr>
<td>CAT X</td>
<td>61</td>
<td>92%</td>
</tr>
<tr>
<td>EA</td>
<td>3</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td></td>
</tr>
</tbody>
</table>

Source: PPMS data and UDOT Environmental Division Personnel for projects advertised 10/1/96-6/2/97.

The Environmental Impact Statements and Environmental Assessments were only associated with new/reconstruction projects.

- **Consultant involvement.** Consultants are hired to help develop environmental documents and manage activities affiliated with them. Data from 67 projects
advertised between October 1, 1996 to June 2, 1997 indicate that 49% of all environmental documents have consultant participation during their preparation. Exhibit IV-3 shows the extent of consultant involvement as primary participants in the environmental process. This understates overall consultant involvement because consultants are involved in preparing parts of environmental documents for which UDOT is the primary participant.

Exhibit IV-3 Consultant Involvement in the Environmental Process

<table>
<thead>
<tr>
<th>Document</th>
<th>Primary Participants</th>
<th>UDOT</th>
<th>Consultants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td>EIS</td>
<td>2</td>
<td>67%</td>
<td>1</td>
</tr>
<tr>
<td>CAT X</td>
<td>30</td>
<td>45%</td>
<td>31</td>
</tr>
<tr>
<td>EA</td>
<td>2</td>
<td>67%</td>
<td>1</td>
</tr>
<tr>
<td>Overall</td>
<td>34</td>
<td>51%</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: PPMS data for projects advertised 10/1/96 - 6/2/97.

- **Revisions.** Documents submitted for review at such activities as 25D “Prepare Draft Environmental Document” are subject to being returned to the writer by the reviewer for changes and corrections. According to data obtained from Environmental Division files, on 47 advertised projects from October 1, 1996 to June 2, 1997, all Environmental Impact Statement and Environmental Assessment documents were returned for revision 100% of the time. As shown in Exhibit IV-4 below, they were returned as many as 2 times at least 67% of the time and as much as 100% of the time.
Exhibit IV-4 Disposition by Environmental Division
of Draft Environmental Documents by Project

<table>
<thead>
<tr>
<th>Document</th>
<th>Projects</th>
<th>Number</th>
<th>Percent</th>
<th>Number</th>
<th>Percent</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIS</td>
<td>3</td>
<td>3</td>
<td>100%</td>
<td>2</td>
<td>67%</td>
<td>2</td>
<td>67%</td>
</tr>
<tr>
<td>CAT X</td>
<td>42</td>
<td>32</td>
<td>76%</td>
<td>15</td>
<td>47%</td>
<td>2</td>
<td>16%</td>
</tr>
<tr>
<td>EA</td>
<td>2</td>
<td>2</td>
<td>100%</td>
<td>2</td>
<td>100%</td>
<td>2</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Data from Environmental Division for projects advertised 10/1/96 - 6/2/97.

- **Schedule Delays.** The amount of time estimated to complete each environmental activity, measured by duration days and determined by a combination of PPMS standards and PPMS user judgment, is often exceeded. In fact, 96%, or 64 of 67, of projects analyzed exceeded their duration day estimates for environmental activities. As Exhibit IV-5 indicates, during that same time period, the Environmental Assessment had the highest average number of exceeded days for the three classifications.

Exhibit IV-5 Schedule Delays

<table>
<thead>
<tr>
<th>Document</th>
<th>Total Duration Days</th>
<th>Number of Projects</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIS</td>
<td>603</td>
<td>3</td>
<td>201</td>
</tr>
<tr>
<td>CAT X</td>
<td>8831</td>
<td>61</td>
<td>145</td>
</tr>
<tr>
<td>EA</td>
<td>2361</td>
<td>3</td>
<td>787</td>
</tr>
</tbody>
</table>

Source: Data from PPMS for projects advertised 10/1/96-6/2/97.

While Environmental Assessments had the highest average schedule delays, the largest single overage occurred on an Environmental Impact Statement project, as it exceeded its planned duration days by as much as 1,200%. This finding is consistent with observations from Environmental Division Coordinators and Regional Environmental Engineers, who indicate that Environmental Impact Statement projects are often complex and take significant amounts of time to complete.
Budget Overages. The budget estimated to complete each environmental activity, measured by budget hours and determined by a combination of PPMS standards and PPMS user judgment, is often exceeded. As shown in Exhibit IV-6 all of the 67 projects analyzed exceeded their budget hour estimates for environmental activities, causing overages. The Environmental Impact Statement had the highest average number of exceeded hours for the three classifications. In terms of UDOT resources, the overage in the preparation of categorical exclusion documents had the largest budgetary impact.

Exhibit IV-6 Budget Overages

<table>
<thead>
<tr>
<th>Document</th>
<th>Total Budget Hour Overage</th>
<th>Number of Projects</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIS</td>
<td>877</td>
<td>3</td>
<td>292</td>
</tr>
<tr>
<td>CAT X</td>
<td>2499</td>
<td>61</td>
<td>40</td>
</tr>
<tr>
<td>EA</td>
<td>156</td>
<td>3</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: Data from PPMS for projects advertised 10/1/96-6/2/97.

The Environmental Impact Statement and Environmental Assessment documents, by their nature, tend to be the most complex because of the high levels of technical development and public involvement required to complete them. Most of the time, they have to complete the steps shown in Exhibit IV-1 (with the exception of Environmental Assessments, which are not required to complete activity 79D “Public Comments on Final Environmental Impact Statement). However, the Categorical Exclusion has various ranges of complexity, as 08-1 procedures allow its development to be limited if a case for public involvement is not required at activity 25D “Prepare Draft Environmental Document.” In addition, its lesser degree of detail and technical difficulty provides an opportunity for easier UDOT coordination with external, regulatory agencies involved in the environmental process.

b. Recommendation: Environmental Impact Statement and Environmental Assessment documents should have PPMS standards adjusted to match their complexity.

This involves building into project management the recognition that the EIS and EA requirements can take significant amounts of time.
6. **Issue: The Environmental Division’s role needs refocusing to provide technical support and other resources that facilitate the design process.**

a. **Observations and Findings**

Environmental Division staff described their major role in the environmental process to be controlling the quality of individual environmental documents and expediting them through the FHWA review process. To the extent possible, they also see themselves mentoring regional staff, such as Regional Environmental Engineers, on the environmental process. Review of their actual written and e-mail comments made to regions and FHWA regarding environmental documents confirms that this perception matches their actions.

However, this role is only monitoring the preparation of documents on a case-by-case approach. A broader view is also needed to monitor, on an ongoing basis, the environmental process as a whole, to assure that all of its participants are apprised of key knowledge and lessons from the process, and to coordinate with the overall design process.

While the Environmental Division staff may make attempts to act in some of these capacities, their current orientation in the process and their depth of involvement in the daily reviews hinders staff from fully adopting them. Because of its unique position to view all environmental documents within UDOT, though, the Environmental Division is the ideal unit to take on such a role.

b. **Recommendation: Use headquarters staff to provide technical advice and coaching to resolve issues and build in quality.**

According to Region environmental engineers and Environmental Unit Coordinators, regional staff are increasingly submitting certain sections of their documents to Environmental Unit staff for review and technical opinions. These reviews are taking place outside of review activities and steps prescribed by Procedure 08-1. The regions are drawing on headquarters specialized knowledge and experience, this coaching and proactive assistance should be developed.

The Environmental Unit should focus less on detailed reviews of individual environmental documents and more on providing broad, statewide coordinating services.

In addition to mentoring and expediting, their functions should include:

- Regular review of all projects for statewide consistency.
- Developing interagency agreements.
- Recognizing and explaining changes in laws and regulations.
- Providing staff expertise on, and coordinating on-going training of Region environmental engineers on, key environmental issues.
- Distributing comments and information applicable to Region environmental engineers.
- Tracking all projects through the FHWA review process.
- Identifying trouble spots in the environmental process and proposing solutions for them.
- Setting project priorities for FHWA review of environmental documents.

B. Schedule

1. Issue: Environmental-related activities are adding to overall delays in the design process.

The following outlines issues related to the impact that environmental approval-related activities have on the schedule for the design process. It presents recommendations for addressing them.

a. Observations and Findings

Environmental–related activities are slowing down the overall design process. Evaluation of PPMS data for 67 projects advertised between October 1, 1996 and June 2, 1997 indicate that 15% of all duration, days exceeding workplan estimates could be attributed to environmental activities.

Exhibit IV-7 shows that the activity with the greatest schedule overrun is 25D (Prepare Draft Environmental Document). This activity, where most of the document is developed, exceeded projected durations by 3,453 days, representing 29% of the 11,795 over duration days incurred by environmental activities.
Exhibit IV-7: Duration Day Overtages By Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Overage</th>
<th>Hours</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>03D “Initiate NEPA Scoping/Public Involvement/Agency Coordination Process”</td>
<td></td>
<td>1798</td>
<td>15%</td>
</tr>
<tr>
<td>04D “Initiate Environmental Process”</td>
<td></td>
<td>1192</td>
<td>10%</td>
</tr>
<tr>
<td>10D “Conduct Scoping Meeting and Develop Report (Draft DSR)”*</td>
<td></td>
<td>2862</td>
<td>24%</td>
</tr>
<tr>
<td>25D “Prepare Draft Environmental Document”</td>
<td></td>
<td>3453</td>
<td>29%</td>
</tr>
</tbody>
</table>

Source: Data from PPMS for projects advertised 10/1/96-6/2/97.

* Indicates an activity that is also involved with other processes within preconstruction design.

UDOT staff has no direct control over many elements of the environmental process and therefore cannot control external agency impacts on the project schedule. Once the documents are in external agency control, it is often difficult to predict how long the process will take, as the external agencies have internal schedules that are different from UDOT and can change without UDOT’s knowledge. Simplifying the portions of the process that involve these resource agencies would allow UDOT to finish the environmental process faster and also speed up the entire design process.

The Environmental Unit is addressing this. It has a performance plan objective to work with the FHWA to change the emphasis of the environmental process from “documentation” to “process.” The Unit plans to implement a new and simpler environmental documentation and approval process for Federal Aid projects. A draft checklist to be used in the new process has already been started by Environmental Unit Coordinators.

- Some of the largest savings in time can occur when entire activities requiring regulatory sign-off can be shortened or skipped altogether. The tradeoff for the simplicity UDOT is seeking through such effort, though, is risk. By shortening the process, UDOT is taking the chance that a detail or details may be missed which could potentially cause unanticipated delays, costs, and increases in the overall project scope. As well, the risk could be in the form of fines imposed by an external agency or a tarnished UDOT reputation in the eyes of the public and the external agencies it is regulated by.

- UDOT has begun to bridge the difference between simplifying the process and taking risk, as it has entered into “educated risk” in the form of
programmatic agreements with external agencies that grant the Environmental Unit the authority to perform reviews on their behalf. The most extensive agreement is with the U.S. Fish and Wildlife Service (USFWS): an Environmental Unit staff member who has been formally trained and has extensive experience in applying her knowledge to environmental matters has been verbally granted authority to review certain biological opinions on their behalf. Environmental Unit coordinators indicate that without the agreement, UDOT could expect to wait at least 30 days while USFWS reviewed the environmental documents and issued an opinion. Whereas UDOT can now issue an opinion in minutes, or at the most, days. This service provides UDOT staff with immediate opinions on biological issues that otherwise they would have to navigate the structures of the external agencies to find. The Environmental Unit is currently working to establish similar agreements with the State Historic Preservation Office, the Army Corps of Engineers, and other similar agencies.

- Programmatic agreements could provide guidance to Regional Environmental Engineers in regard to:
  - The need for regulatory agency sign-off for a project located in an area that has recently already had a full environmental evaluation.
  - Whether or not endangered species clearance letters are needed by regulatory agencies in areas that clearly have no signs of endangered species.
  - Whether small projects, such as intersection and road widening projects in fully developed urban areas, still need to have clearances even though none of the issues qualifying the projects for a clearance are present.

However, current regulations by external agencies generally require various reviews and clearances to take place, regardless of the disposition of the project.

b. Recommendation: Develop programmatic agreements with external resource agencies to simplify the process, increase predictability, and provide region environmental engineers a framework within which to assume risk.

Existing programmatic agreements, which are currently oral agreements, should be developed as memoranda of understanding between UDOT and the appropriate agency. The programmatic agreements should be developed with resource agencies as possible and include the role of the Region Environmental Engineer. The focus will be on expediting categorical exclusion documents.
(1) Advantages

- Will reduce the time required to service environmental clearance.

- More predictability in terms of time spent waiting for clearances will be gained.

(2) Disadvantages

- Even though limited, risk will be increased.

2. Issue: Projects affected by public land ownership issues are causing delays.

a. Observations and Findings

When transportation projects are on publicly owned lands and historic sites there are additional regulatory requirements that cause delays 20% of the time. Confirming this, 11, or 23%, of 47 projects reviewed by the Environmental Division had public lands or historic site issues associated with them. 10, or 21%, were linked with projects that had exceeded duration hours by at least 85%.

These findings are consistent with the nature of publicly owned land and its specific requirements. Title 23 of the Code of Federal Regulations 771.135, Section 4(f) of the Department of Transportation Act, applicable to transportation-public land conversion proposals, states that “The (Federal Highway Administration) may not approve the use of land from a significantly owned public park, recreation area, or wildlife and waterfowl refuge or any significant historic site unless a determination is made that:

- There is no feasible and prudent alternative to the use of the land from the property.

- The action includes all possible planning to minimize harm to the property resulting from such use.

- This act ensures that the conversion of these categories of public lands for transportation purposes are adequately analyzed and that transportation is indeed the highest and best use of the land.”
b. **Recommendation:** Potential activities associated with section 4f considerations should be identified as part of the preliminary environmental review.

To accomplish this, UDOT should:

- Place additional priority and effort on identifying land ownership issues during the concept phase of design, especially in scoping activities such as 05C “Conduct Preliminary Environmental Review” and 35C “Conduct Project Concept Meeting and Develop Report.”

- Consult the State Historical Society, the U.S. Department of Interior, and Indian Tribes, as they many times have historic maps or other relevant information that can help predict the types of issues that may arise in a certain land area.

(1) **Advantages:**

- This will improve project management.

- Designers will have a better understanding of the potential issues involved and can expedite resolution.

- Designers will also be able to coordinate with Indian Nations and other external groups early on, which may impact quicker approval of the 4f.

(2) **Disadvantages:**

- Budget hours and duration days during the concept phase may increase to accommodate the additional coordination.

3. **Issue:** Environmental permit applications are not started soon enough.

a. **Observations and Findings**

Regional Environmental Engineers and Environmental Unit staff identified the environmental permitting subprocess to be a major cause of delays. It involves three types of permits as shown in Exhibit IV-8.
Exhibit IV-8 Types of Environmental Permit

<table>
<thead>
<tr>
<th>Permit</th>
<th>Issuing Authority</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 404</td>
<td>U.S. Army Corps of Engineers</td>
<td>wetland impacts</td>
</tr>
<tr>
<td>Stream Alteration</td>
<td>Utah Division of Water Rights</td>
<td>stream impacts</td>
</tr>
<tr>
<td>UPDES</td>
<td>Utah Division of Water Quality</td>
<td>point source/large acreage impact</td>
</tr>
</tbody>
</table>


The permitting is primarily performed through activities 61D “Prepare and Submit 404, Discharge, and Stream Alteration Permits” and 82D “Obtain Final 404 and/or Discharge Permit,” both of which are floating activities not required to be started at a particular point in the design process - although the design diagram of the overall process indicates 61D is to begin at just prior to environmental document approval and 82D is to be completed just prior to the completion of P.S. & E. revisions.

According to Region environmental engineers, the need for environmental permits is usually clear during the initial scoping meetings, 05C “Conduct Preliminary Environmental Review” and 35C “Conduct Project Concept Meeting and Develop Report.” They also indicated that miscommunication of the project parameters and unique characteristics often occurred between them and permitting agency officials during their infrequent interactions.

However, one Region Environmental Engineer has met regularly with all relevant external agencies, such as the U.S. Army Corps of Engineers, in order to keep them apprised of current permitting needs and future needs. These meetings helped develop relationships, project ownership, and common understanding early on that helped move applications through the process quickly.

b. **Recommendation: Region environmental engineers should initiate permitting activities earlier.**

This will help address the critical impacts of permitting requirements. In addition, meeting as needed with external permitting agency personnel to keep them apprised of their projects schedules and permitting needs can help expedite permitting.
C. Budget

This section presents issues related to the budget for the design process and recommendations that address them.

1. Observation: Environmental-related activities are not significantly adding to overall project budget excesses.

Evaluation of PPMS data for 67 projects advertised between October 1, 1996 and June 2, 1997 indicate that only 3.5% of all budget overages could be attributed to environmental activities (Labor input measured as time charged to the activity is used to establish and monitor design process budgets). The largest overage was activity 25D “Prepare Draft Environmental Document. It was over budget by 1096 hours, representing 31% of the 3,481 over budget hours. The other activities with significant percentages of total budget hours are shown in Exhibit IV-9.

Exhibit IV-9 Environment Process Budget Overruns By Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Overage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>04D “Initiate Environmental Process”</td>
<td>419</td>
<td>12%</td>
</tr>
<tr>
<td>10D “Conduct Scoping Meeting and Develop Report (Draft DSR)”</td>
<td>1001</td>
<td>29%</td>
</tr>
<tr>
<td>25D “Prepare Draft Environmental Document”</td>
<td>1096</td>
<td>31%</td>
</tr>
<tr>
<td>35C “Conduct Project Concept Meeting and Develop Report”*</td>
<td>345</td>
<td>10%</td>
</tr>
</tbody>
</table>

Source: Data from PPMS for projects advertised 10/1/96-6/2/97.

* Indicates activities that are also involved with other processes within preconstruction design.

- As noted earlier 50% of environmental documents are prepared by consultants. The audit did not evaluate the financial management and management control of their work.

D. Scope

The following outlines issues that relate to the impact of environmental process activities on project scope. Project scope is used as an indicator of the full cost to construct the project.
1. Issue: Earlier involvement of resource agencies as recommended in 08-1 could help manage scope.

a. Observations and Findings

Procedure 08-1 prescribes in activity 05C that the Region Environmental Engineer should ensure that affected agencies, such as the U.S. Army Corps of Engineers, State Division of Wildlife Resources, and the State Environmental and Engineering Divisions, should be brought into the process at that point. This does not appear to be consistently occurring.

Region environmental engineers indicate that affected federal and state resource agencies, when consulted, most often are brought into the process at activity 03D “Initiate NEPA Scoping/Public Involvement/Agency Coordination Process” or later—rather than at activity 05C “Conduct Preliminary Environmental Review” or 35C “Conduct Project Concept Meeting and Develop Report” (earlier activities). They believe that the external agency’s lack of involvement in the earlier step may cause changes and expansion in project scope because oversights, based on unique information from the agencies, could have been avoided had the resource agencies been brought in sooner. Other regional staff confirm this.

b. Recommendation: Project design engineers and consultant managers should ensure activity 05C guidelines are followed.

The Region Environmental Engineer should be held responsible for ensuring that the affected external agencies are involved in the review at 05C.

E. Quality

1. Issue: Quality is not defined in the same way by regions and headquarters staff.

a. Observations and Findings

Interviews with regional and headquarters staff indicated different definitions of quality for the environmental process. Several region staff defined quality as a clear set of environmental documents or as documents that were not returned for revisions. Several headquarters staff, however, defined quality as documents that were clear, met legal sufficiency, and were acceptable to FHWA.
This lack of agreement causes those involved in the process to potentially work toward different goals when preparing documents, often resulting in multiple revisions.

b. **Recommendation: Quality for the environmental process should be defined.**

Region environmental engineers and Environmental Unit staff should:

- Meet to define quality for the environmental process and to identify objectives they can meet at each activity to achieve it.
- Submit their definitions to UDOT management for review.

2. **Issue: Performance audit testing identified little value being added through the formal review of environmental documents.**

a. **Observations and Findings**

According to Procedure 08-1, the scheduled review of environmental documents occurs at Activities 25D (Prepare Draft Environmental Document) and 67D (Prepare Final Environmental Document). At these points, the Environmental Division, and to a limited extent, FHWA (for federal aid projects), reviews the work of the Design Engineers, checking for any issues that may affect the document’s potential success for final approval by FHWA.

The performance audit testing of these reviews found that they are focused on catching details that should have been identified before the documents ever left the regions. Of 7 randomly selected projects advertised between October 1, 1996 and June 2, 1997:

- All (7) had comments from reviewers concerning basic phraseology.
- More than half (4) had comments related to grammar and spelling.
- Slightly less than half (3) had comments related to consistency of thought.

Largely as a result, 79% of all projects reviewed were returned to the regions for additional work, with 40% returned more than one time, and 19% more than two times (based on a sampling of 47 advertised projects reviewed by the Environmental Division). However, most documents seemed to reflect that the proper processes and methodologies for environmental issues were being followed.
Knowing that the work they are submitting in 25D is considered to be a draft and that they will have another opportunity in 67D to shore up whatever the Environmental Division and FHWA indicates is lacking in their documents, regional design teams lack incentive to ensure that all details are covered the first time.

b. **Recommendation: Make the region environmental engineer responsible for reviewing and approval of environmental documents.**

An informal team of reviewers should be assembled by the Region Environmental Engineer to regularly review documents. The team should be comprised of many of the same individuals involved in scoping meetings at the concept phase, including FHWA representatives. Consider combining activities 25D and 67D so the intermediate “draft” step is eliminated and design teams see their work as final.

3. **Issue: As Project Manager, the Project Design Engineer should be more actively involved in management control of the region environmental engineer’s project work.**

a. **Observations and Findings**

The roles of regional environmental engineer and project design engineers are not clearly defined for the purposes of the environmental process. Regional environmental engineers indicate that they provide information to the project design engineer to use in completing the environmental document; they also indicate that sometimes they complete the document. Project design engineers, as managers of the projects, generally see themselves as minimally involved in the process and see the region environmental engineer as the manager of the environmental process in the region. As well, regional environmental engineers see themselves as the principal contact with environmental regulatory agencies; Project design engineers indicated no clear role for themselves with the agencies.

b. **Recommendation. Clearly define the responsibilities of the region environmental engineer and the project design engineer in the environmental process.**

This clarification should address the roles of each in:

- Preparing the documents.
- Developing on-going relationships with regulatory agencies.
V-I. Focus Area Overview

A. Description

The right-of-way process is comprised of all activities required for the purchase or the use of eminent domain to acquire right-of-way (ROW) for transportation facilities. It includes the identification of owners of parcels that are needed, appraisal, negotiation, and acquisition of parcels. In instances where the needed land is occupied, relocation assistance is required. Should UDOT not come to an agreement with the owner of a needed parcel, condemnation must occur. Exhibit V-1, on the following page, illustrates the major steps of the process.

B. Approach

The following analysis of UDOT’s ROW acquisition process is based on:

- A series of interviews with both managers of UDOT’s ROW division at the Rampton Complex and project managers in the regions.

- A workshop with UDOT ROW division managers and right-of-way engineers and project managers from the regions.

- A series of follow-up interviews.

- An evaluation of all ROW related data in PPMS on projects that were let during the 1997 fiscal year.

- An evaluation of data on active projects contained in the database maintained by the ROW division.

- A comparison of the data contained in the two databases.

C. Summary of Observations and Findings

- UDOT staff and consultants in the regions now generally do not hand the entire ROW package for a large project over at the scheduled date. Rather, the ROW division often receives sets of parcels at intervals. With one exception, all projects in the PPMS data set that were let with limitations on operations were submitted to the ROW division in partial and/or supplemental packages.
• Projects in developed urban areas for which ROW acquisition takes place require UDOT to initiate condemnation procedures more frequently than in the past. Large, complex projects are more likely to require condemnation of parcels than other projects.

• Incomplete relocation and/or condemnation efforts are the most frequent reasons for letting of projects with limitations of operations.

• PPMS data and our interviews indicate that many project managers do not follow 08-1 closely for ROW.

• For the majority of projects analyzed, project managers underestimated the amount of time (hours) required for all but one ROW related activity. This would indicate that the standards for most ROW related activities contained in PPMS are unrealistic if they used the standard.

D. Summary of Recommendations

The following lists the recommended changes to the ROW process. The next subsection of this document provides the context, rationale, and advantages and disadvantages for each recommendation.

1. Management

• Provide the project manager with a single point of contact at the ROW division for each project.

• Evaluate opportunities to focus ROW division staffing on relocation and condemnation.

2. Schedule

• Require that all parcels for large projects that are submitted to the ROW division over a period of time meet critical path requirements. Critical parcels should be submitted early on so that the ROW division can begin work.

• Work with the FHWA regional office to change the FHWA ROW approval process to allow for advance purchase of critical parcels.

• Ensure that the project manager/design engineer is responsible for authorizing ROW to initiate relocation or condemnation proceedings.
3. **Scope**

- Ensure that a preliminary review of land ownership and utilization information to identify any ownership or relocation issues which may impact the project scope is available at project scoping.

- Ensure ROW division staff participate during the scoping phase of project design on any project requiring ROW.

- Involve the ROW division in the developing the initial cost estimates.

- In addition to current cost information, develop inflation adjusted cost information as part of the ROW acquisition estimates that are approved by the Transportation Commission.

4. **Budget**

- Revise current PPMS duration standards for ROW activities upwards based on empirical information.

- Seek opportunities for using a simplified process for the acquisition of low value parcels, especially involving regions, if possible.

5. **Quality**

- Develop and require a certification sheet for Activity 40P (Final ROW plan review) to make accountability visible.

- Require consultants to provide an approach to ROW quality control, review previous performance as part of the selection process.

- Hold consultants to the agreed upon budget for ROW related tasks.

- Review and clearly define the department’s information and record keeping requirements for ROW activities. Revise the existing information systems to meet these needs. We suggest the following steps:
  
  1. Define the record keeping requirements of the ROW division (this should include the ROW reconciliation required by law currently carried out by Project Development Support Section staff).

  2. Define the information requirements of project managers.
3. Determine whether the data currently provided by PPMS and the ROW
database meet these needs.

4. Identify any administrative, system, or other changes that will be required
to provide the needed information.

5. Address and implement these changes as part of the broader modifications
that will be made to PPMS as part of project manager function
implementation.
V-II. Focus Area Issues and Recommendations

The following lists issues, observations, findings, and recommendations related to the ROW acquisition process. They are grouped in five topical areas:

- Management
- Schedule
- Budget
- Quality
- Scope

A. Management Issues and Recommendations

There are a number of issues related to the management of the overall ROW process impacting the efficiency with which tasks are carried out. The following outlines management issues related to ROW acquisition. It also presents recommendations for addressing these issues and lists advantages and disadvantages of different approaches.

1. Issue: Project managers feel that they do not have control once ROW materials have been handed to the ROW division.

   a. Observations and Findings

   Project managers have three major concerns:

   1. They need to know where their project stands.
   2. If they are held responsible for completing the project on time they need authority over the entire process, including the work of the ROW division.
   3. They need to be able to access information on the status quo.

   Currently, there is no single point of contact for information regarding the status of ROW activities for a project at the ROW division. The ROW division currently divides responsibility for the different components of the ROW process among its supervisors. This means that different sets of ROW materials can be at different steps of the ROW process. Since each step has a separate manager, this makes it difficult to determine where the project stands overall.
Supervisors also indicated during our interviews that they are not familiar enough with other components of the ROW process to comment on them. Since the ROW information for some, and in particular large, projects is now submitted in packets of 1-50 parcels, it becomes very difficult for the UDOT project manager and consultant design engineer to assess the status of a given project if the information contained in PPMS is not updated on a biweekly basis.

b. **Recommendation: Provide a single point of contact at the ROW division for each project.**

This recommendation would help UDOT project managers and consultant project design engineers to determine the status of a project much more easily. It would change the responsibilities of ROW division supervisors substantially and make them more accountable to their “customers”. Each would be assigned projects for which they are responsible while they are processed by the ROW division. Projects should be distributed so that there is a balance with regard to the number of parcels, complexity, and the geographic location of projects. Both supervisors and staff in the ROW division may retain an area of special knowledge but cross-training and knowledge of the whole process should increase over time. The goal should be that all supervisors have a working knowledge of all process components and can balance workloads.

1. **Advantages**
   - This would make it easier for UDOT project managers/project design engineers to determine project status.
   - ROW division supervisors and staff could be held accountable for providing services in a timely fashion if each project is coordinated at a single point in the division.

2. **Disadvantages**
   - ROW division supervisors and staff are specialized in the components of the ROW processes carried out by the division. The suggested change will require supervisors to coordinate with other supervisors and manage staff working on areas outside their own expertise.
2. **Issue:** The number of parcels requiring relocation or condemnation has increased in recent years and now exceeds the capacity of ROW division staff.

   a. **Observations and Findings**

      Large projects in urban areas like the Bangerter Highway projects are more contentious than projects completed in the past. For example, PIN #1280 required 8 relocations and 79 condemnations, PIN #1281 required 20 relocations and 45 condemnations. The scope of these efforts exceeds the capacity of UDOT ROW division staff. This causes project delays.

   b. **Recommendation:** Evaluate opportunities to focus ROW division staffing on relocation and condemnation or use outside contractors.

      Currently, UDOT ROW division staff are solely responsible for all relocation and condemnation efforts. Division staff indicated during our interviews that their capacity to carry out these activities does not meet current needs. Appraisal and acquisition work are currently contracted out.

      (1) **Advantages**

         - This allows the ROW division to target those activities that have the largest impact on overall project schedule.

      (2) **Disadvantages**

         - None identified.

B. **Schedule**

   The following outlines issues related to the scheduling and sequencing of activities and tasks with respect to ROW acquisition efforts. It also presents recommendations for addressing these issues and lists advantages and disadvantages of different approaches.
1. Issue: On many large projects the ROW division does not receive complete ROW packages on schedule.

a. Observations and Findings

Large urban corridor projects carried out by UDOT often require purchase of many parcels. UDOT region staff and consultants find it difficult to prepare complete ROW packages for such projects. Project design and region ROW engineers are now sometimes turning in more manageable sets of parcels of 10 or more at a time. (Our limited PPMS data indicate that projects requiring more than 50 parcels are likely to be submitted in batches.)

UDOT ROW division staff report that, in general, they receive the first of such sets of parcels at the due date for the entire package, and the rest in installments that come in after the due date. This makes it impossible to complete acquisition in a timely fashion. According to ROW division managers, this in turn leads to the need to acquire a larger percentage of projects through condemnation because the time available to conduct negotiations is reduced.

The analysis of PPMS data indicates that of the eight projects that were advertised with limitations of operations due to incomplete ROW acquisition, six were large projects for which there were multiple ROW packages or a substantial number of supplemental submittals.

In addition, current submittal requirements for approval of ROW purchases by FHWA make it difficult for the ROW division to begin work on initial submittals while the region is working on the next set. However, recent federal legislation making advance purchases eligible for federal reimbursement provides an opportunity for implementing the needed changes.

b. Recommendation: Require that all parcels for large projects that are submitted to the ROW division over a period of time meet critical path requirements. Critical parcels should be submitted early on so that the ROW division can begin work.

The practice of submitting parcels in smaller sets makes it easier for ROW division staff to carry out acquisition efforts because the volume is more manageable. UDOT should review current procedures and integrate this currently informal practice into standard practice for projects requiring a large number of parcels. However, since currently the timing of such submittals appears to create problems, the region must begin submittal early enough to
ensure that all parcels are submitted before the due date to meet critical path requirements.

We recommend that the UDOT project manager/project design engineer work with the ROW division to identify parcels that are critical to the project and may require condemnation. These parcels should be submitted early on to allow ROW division staff the time needed to go through the acquisition process.

(1) Advantages

- This approach allows both the project staff in the region and the ROW division to balance workloads.

- It will identify potential problem parcels early on and allow the ROW division to begin acquisition of these parcels and keep the project on schedule.

(2) Disadvantages

- This will require changes to the current FHWA ROW approval process to allow for advance purchases.

c. Recommendation: Work with the FHWA regional office to change the FHWA ROW approval process to allow for advance purchase of critical parcels.

Recent federal legislation has made it easier for states to receive federal reimbursements for advance purchase of parcels. We understand that the ROW division has already begun work to explore this opportunity. This effort should be continued.

(1) Advantages

- Achieving an agreement with FHWA would allow UDOT to begin the ROW acquisition process for projects with large numbers of parcels early on and accelerate project completion.

(2) Disadvantages

- None identified.
2. **Issue:** Anecdotal evidence indicates that some parcels go into relocation and/or condemnation unnecessarily.

   a. **Observations and Findings**

   Evidence from PPMS data indicates that relocation and condemnation procedures are the two most frequent causes of project delays. In addition, they are costly to administer. There may be opportunities to minimize their occurrence. Interview results provided us with examples:

   - Parcels are entering relocation although a relatively small change in alignment could avoid it. (The project in Roy.)

   - Condemnations could have been avoided by clarifying and minimizing the impact of the project on the property owner. Examples included a parcel that went into condemnation because the property owner was concerned about potential changes in access to his property. On another occasion, the property owner wanted to be ensured that the project would not require removal of a tree. These condemnation proceedings could have been avoided through better communication with the project manager, to determine whether the concerns of the property owner can be addressed within the existing scope of the project or, are possibly entirely unfounded.

   b. **Recommendation:** The design engineer/project manager and the ROW division should determine the need to initiate relocation or condemnation proceedings.

   The project manager/project design engineer should be informed about the potential need for relocation or condemnation and the reasons why property owners refuse to sell. If the project manager understands the concerns of property owners, he may be able to alleviate unwarranted fears or adjust the scope of the project to avoid costly relocation or condemnation proceedings.

   (1) **Advantages**

   - Current data indicate that UDOT will be able to bring a larger proportion of projects to letting without limitations of operations if relocation and condemnation needs are minimized.

   - The recommendation increases the project manager’s control and helps reduce risk.
(2) **Disadvantages**

- Implementation of this recommendation will increase the complexity of the process because it creates an additional hand-off.

**C. Project Scope Findings and Recommendations**

The following outlines issues related to the impact of ROW acquisition efforts on the overall project scope and cost. It also presents recommendations for addressing these issues and lists advantages and disadvantages of different approaches.

1. **Issue: Right-of-way acquisition efforts are not initiated early enough in the design process to minimize project scope and cost.**

   a. **Observations and Findings**

   During the workshop meeting with ROW division and region staff, participants indicated that the efforts for ROW acquisition are often not carried out early on in the process, causing problems later on. Our analysis of available PPMS data supports this view. Of the 30 projects analyzed for which UDOT acquired ROW, only three projects had any hours budgeted and four had actual charges for the first ROW activity, “Identify land ownership”. It therefore appears that 08-1 is not followed at this point. This is also supported by the data for charges to activities 19D (Develop ROW plans): For 13 of 27 projects charges exceeded budgeted hours and 5 projects incurred charges that were not budgeted for at all. (See Exhibit V-2.) It should be noted, however, that some of the projects contained in the sample have only incomplete data in PPMS because some activities were already completed when the project was entered into PPMS.

   The current approach concentrates on providing the best possible design. It does not provide a means to find a cost effective compromise between the best design solution and minimizing the impact of ROW acquisition on project scope and budget.

   b. **Recommendation: Ensure that a preliminary review of land ownership and utilization information to identify any ownership or relocation issues which may impact the project scope is available at project scoping.**

   The goal should be to obtain enough information to determine whether ROW acquisition and relocation requirements have the potential to significantly
affect the project scope. Based on the information in PPMS and our interviews with UDOT staff and managers, this could be a critical factor in avoiding project delays and cost overruns due to incomplete ROW acquisition.

(1) Advantages

- This approach will enable UDOT project managers to make an informed decision in balancing the best design solution with the impact of ROW acquisition on project scope, budget, and schedule.

- Project managers will have order of magnitude information about the number of parcels and relocations that will be required. They will also gain a sense of the level of contention surrounding the project and the need to go into condemnation for some parcels.

- This approach will help project managers to reduce the risk of project scope, budget, and schedule changes due to unanticipated problems with ROW acquisition.

- Project managers will be able to adjust PPMS scheduled manpower budgets to reflect reality.

(2) Disadvantages

- Project managers may feel that the project is not well enough defined to consider ROW acquisition.

2. Issue: Right-of-way appraisal staff are not involved early enough in the design process.

a. Observations and Findings

Usually, ROW division staff are not involved in the early design stages of project development. Both ROW division staff and ROW and design staff in the regions acknowledge that it only occurs as an exception but is more likely on large, complex projects. ROW division staff may receive a package of materials prior to the scoping meeting but are often not invited. On the other hand, ROW division staff has not actively requested to be included in the process during the earlier project development phases.

ROW division staff cited a facility in Roy as an example. The original design of the facility would have required the removal of a number of low income
housing units. Relocation of current residents to housing in the same price range proved more or less impossible. The ROW division staff suggested a different alignment for the facility that allowed the low income housing units to stay. Had the ROW division been involved earlier in the process, it would not have been necessary to redesign the facility and delays in project development caused by the relocation efforts and related costs could have been avoided.

b. **Recommendation: Ensure participation of ROW division staff during scoping.**

Under this approach, UDOT project managers (or the consultant project design engineer) would determine whether ROW acquisition is needed. For projects requiring ROW purchase, he would discuss the ownership information developed under activity 15C: “Identify land ownership”, including plot maps and other materials with ROW division staff. If the project is large, complex, and potentially contentious, project and ROW division staff may elect to make a field visit as part of scoping. Development of ROW plans could begin at that stage. ROW division staff involvement in scoping could help determine:

1. The most cost-effective alignment options for the project.
2. The likelihood that relocation and/or condemnation will be required, and the time frame needed to complete these tasks.
3. A realistic cost estimate for the acquisition of needed ROW.
4. A strategy/approach to manage ROW costs.

1) **Advantages**

- The project manager has an understanding of the potential ROW acquisition costs at the early stages of project design, minimizing the potential need for contentious, time consuming, and costly condemnation, redesign, or changes to the parcels to be purchased at a late stage in the design process.

- The ROW division has a good understanding of the level of effort that will be required once it receives the ROW materials.

- The ROW division is given an early warning about potentially problematic parcels and can begin work on these parcels up front.
• The costs of ROW acquisition can be minimized if they are taken into consideration when the alignment is determined.

(2) Disadvantages

• The ROW division must have the staff to be able to fulfill this support function.

• It is not clear whether ROW division staff who are physically removed from the regions will be able to provide the required service and be on-site if needed.

3. Issue: ROW cost estimates developed in the regions without the assistance of ROW division appraisal staff are often too low.

a. Observations and Findings

During our interviews, both managers from the regions and the ROW division indicated that the initial cost estimates for ROW acquisition are often too low because they are developed by region design or ROW staff or design consultants. Since these groups do not carry out estimates on a continuous basis, they do not know the market as well as ROW division staff or their contract appraisers. Staff indicated that this leads to budget overruns when the parcels are purchased at a higher price. (We were not able to establish the magnitude of this problem based on the data available to us.)

b. Recommendation: Involve the ROW division in developing the initial cost estimates.

PPMS already provides some information on the difference between the initial estimate and actual cost. We suggest that UDOT begin tracking the accuracy of the initial cost estimates to determine the magnitude of this perceived problem. Should it in fact be significant, ROW division staff should be involved in the development of the initial cost estimates. Another approach would be to have a consultant appraiser provide input to the initial cost estimate.

(1) Advantages

• Large differences in projected and actual project costs have in recent years raised concerns with the Transportation Commission. This
recommendation can help avoid or at least reduce this problem in the future.

- This approach provides the UDOT project manager/project design engineer with the ability to more accurately determine the scope of the project.
- This approach reduces the risk of unexpected increases in project scope and cost.

(2) Disadvantages

- This recommendation will further increase the work load of ROW division staff. Using a consultant appraiser would resolve this issue.

4. Issue: The requirement to develop cost estimates at current value leads to cost overruns.

a. Observations and Findings

During our interviews, both staff from the regions and ROW division staff indicated that the initial cost estimates for ROW acquisition are often too low because UDOT is currently required to develop cost estimates for real estate on the basis of current value. The longer the time between the initial estimate and the letting date is, the more likely it is that the UDOT project manager will have to go back to the Commission to ask for additional funds for the project. This is in particular true with large, complex projects. (We were not able to establish the magnitude of this problem based on the data available to us.)

b. Recommendation: In addition to current, develop inflation adjusted cost information as part of the ROW acquisition estimates that are approved by the Transportation Commission.

PPMS already provides some information on the difference between estimate and actual cost. We suggest that UDOT begin tracking the accuracy of the initial cost estimates to determine the magnitude of this perceived problem. Should it in fact be significant, the ROW division could develop cost estimates for future years for projects that will take more than one year before they are let. They could present both current and projected future values to the Commission.
(1) Advantages

- If the Commission has information on the future cost of ROW acquisitions, it can avoid having projects with long lead times return with requests for additional funding.

(2) Disadvantages

- Higher project budgets may lead to inflated prices on parcels that are acquired early in the acquisition process for large projects.

D. Budget Issues and Recommendations

The following outlines issues related to the scope and budget of ROW related activities during the design process. It also presents recommendations addressing these issues and lists the advantages and disadvantages of different approaches.

1. Issue: Current PPMS standards for ROW related activities underestimate the effort and time frame required for completion.

   a. Observations and Findings

   The data on the actual hours that were required to complete ROW acquisition indicate that the standards now used in PPMS are too low. This is in particular true for projects with a large number of parcels, specifically for those projects where ROW packages are submitted over time rather than in a single complete set. With the exception of Activity 15C (Identify land ownership), the number of projects for which charges exceeded budgeted hours was larger than that of projects where actual charges were lower than the budgeted amount. (See Exhibit V-2.)

   The analysis of projects advertised between 10/1/96 and 6/2/97 indicates that relocation and condemnation activities are the most frequent reason for projects being advertised with limitations of operations. In the sample, seven projects (10%) had limitations due to relocation and eight (12%) had limitations due to condemnation. ROW division staff indicate that this is in part because their ability to complete work on schedule depends on outside parties. For example, courts often take more than the six weeks currently used as standard to return condemnation materials.
b. **Recommendation: Revise current PPMS duration standards upwards based on empirical information.**

We suggest that UDOT review PPMS ROW data for all projects to evaluate the time it took to complete these tasks. Determine the major factors that influence the time it takes to complete these tasks and adjust current standards based on this analysis. This should include a more realistic standard for the time it takes to develop ROW plans for projects that require a large number of parcels, sufficient time for adequate final and conformity review, and a more realistic time frame for relocation and condemnation.

(1) **Advantages**

- Projects are more likely to stay on schedule because the estimates are more realistic.
- This approach can take into consideration that there are now a significantly larger portion of parcels going through relocation and/or condemnation than in the past.

(2) **Disadvantages**

- It may prove difficult for UDOT to expand the time schedule for project design to accommodate the changes in the time required to purchase a larger number of problem parcels.

2. **Issue: The same acquisition process is used for purchasing large, valuable or small, inexpensive parcels.**

a. **Observations and Findings**

UDOT buys many parcels with a low value. The data set from the ROW division indicates that five percent (82) of acquired parcels had a value of less than $1,000. For many of these small parcels, the cost of the acquisition process may exceed the value of the parcel.

b. **Recommendation: Seek opportunities for using a simplified process for the acquisition of low value parcels.**

We suggest that UDOT determine the cost of going through the full acquisition process for these parcels to determine the appropriate threshold under which a
simplified process should be used. Evaluate the current interpretation of legal requirements for the purchase of small parcels and make adjustments to the process to the extent possible. If existing legislation prevents simplification of the process, UDOT may decide to seek legislation.

(1) Advantages

- Administrative efforts for the purchase of small parcels could be minimized.

(2) Disadvantages

- The benefits for 5 percent of parcels may not exceed the costs of implementing a simplified process.

- Relaxed standards for small parcels may cause inconsistencies in their treatment across the state. This increases the potential for conflict and litigation.

E. Quality

There are a number of issues related to the quality of the ROW process. The following lists these issues, provides recommendations for addressing them, and outlines the advantages and disadvantages of different approaches.

1. Issue: Quality control for the preparation of ROW packages in the regions appears inconsistent.

a. Observations and Findings

UDOT ROW division staff indicate that many ROW materials received from the regions contain flaws that could have been detected if the final review required under Activity 40P (Conduct final ROW review) had been carried out properly. They also attested that the materials are rarely certified although 08-1 calls for it.

The PPMS data in our sample appear to support this position. We found that in one region, the ROW unit carried out Activity 19D (Develop ROW plans) but did not review its own work on three projects. There were three projects on which the consultant project design engineer developed the ROW plans and reviewed his own work. On three projects the ROW plans were developed by
the consultant project design engineer and submitted to the ROW division without any review by the region ROW unit or the consultant project design engineer. The ROW division charged in excess of budgeted hours for 16 of 29 projects for Activity 45P (Conformity review), on three projects ROW division staff charged hours where none were budgeted. ROW division staff indicated during our interviews that the review takes longer on problem packages, thus the data support the ROW division’s concern about quality control.

b. **Recommendation: Develop and require a certification sheet for activity 40P: “Final ROW plan review” to make accountability visible.**

ROW division staff indicated that there are fewer problems with materials from engineers who actually sign off on their work. This could be used to document that the materials are certified and thus help ensure that 08-1 is followed.

(1) **Advantages**

- This recommendation would support a performance evaluation approach that is based on clear roles and responsibilities.

(2) **Disadvantages**

- Activity 40P (Conduct final ROW review) already contains a certification step that is generally ignored. It is not clear whether a different type of approach would be more successful.

2. **Issue: Consultant project design engineers do not exercise sufficient quality control for the ROW materials.**

a. **Observations and Findings**

ROW division staff indicated during our interviews that materials submitted by consultants are more likely to be incomplete or contain errors than those submitted by UDOT region staff. These errors are identified late in the process when the materials are submitted to the ROW division staff for conformity review (Activity 45P). This can lead to costly modifications to project plans or ROW acquisition needs.

The PPMS data appear to support this position. There were 16 projects for which consultant project engineers had developed the ROW plans. Of these
projects, only five stayed within the budget established for the conformity review. The overcharges for these projects were on average larger than those for projects for which the region ROW unit developed the plans.

b. **Recommendation: Require region ROW units to carry out Activity 40P (Conduct final ROW review) for all ROW plans developed by consultant project design engineers.**

This recommendation will avoid a situation were flaws in the ROW plans are detected late in the design process.

(1) **Advantages**

- This approach will allow UDOT project managers to increase management controls over consultant project design engineer ROW plans.

- This recommendation will make it more visible that UDOT is holding the consultant project design engineer accountable for his work.

(2) **Disadvantages**

- This recommendation may increase the work load of region ROW units.

c. **Recommendation: Require consultant project design engineers to provide an approach to ROW quality control, review previous performance as part of the selection process.**

If prospective consultant project design engineers are required to explain how they are planning to ensure the quality and accuracy of ROW materials, the department is sending a clear message that it considers this issue important. In addition, UDOT project managers could fill out a score card for each project that could be shared with the consultant and used during the next selection process. This issue should be addressed in the broader context of improving overall management controls.
(1) Advantages

- Quality control is clearly the responsibility of the consultant project design engineer and not exclusively that of the UDOT project manager or region ROW unit.

(2) Disadvantages

- This approach may not result in cost or time savings if consultants are permitted to charge for the time spent on cleaning up mistakes.

d. Recommendation: Hold consultant project design engineers to the agreed upon budget for ROW related tasks.

Make it clear to consultant project design engineers that UDOT will not allow expenditures that exceed the agreed amount to correct mistakes. In cases where UDOT sends materials back to the consultant project design engineer for corrections, the UDOT project manager must then carefully review invoices to ensure that the department is not billed for these corrections. While these efforts cannot entirely prevent charging for mistakes, they will send a clear message to the consultant project design engineer.

(1) Advantages

- If consultant project design engineers realize that they will be held accountable there is a bigger incentive to get it right the first time.

(2) Disadvantages

- It may be difficult to prevent consultant project design engineers from charging the clean up efforts to other tasks.

3. Issue: PPMS and ROW database data on ROW activities are not always consistent or correct.

a. Observations and Findings

Our comparison between the information on projects contained both in the ROW database and the PPMS data set shows that the information is generally inconsistent. PPMS information tends to be incomplete and out of date. Of the
42 projects contained in the PPMS data set, 19 projects were active in the ROW database. Of these 19 projects, the data matched only for one project. This is despite the fact that the ROW database reflected the status of these projects as of 6/23/97 and PPMS as of 6/24/97.

The most dramatic and frequent inconsistencies were with regard to information on condemnation proceedings (15 out of 17 projects for which condemnation occurred), followed by negotiation (6 projects), and relocation (6 projects). In addition, the relocation data contained in the ROW database appeared inconsistent in themselves for all but one of the six projects. This indicates that these activities are not only problematic with regard to schedule but also with regard to the accuracy and timeliness of data that are available to UDOT project managers and consultant project design engineers.

b. **Recommendation: Review and clearly define the department’s information and record keeping requirements for ROW activities.**

Revise the existing information systems to meet these needs. We suggest the following steps:

1. Define the record keeping requirements of the ROW division (this should include the ROW reconciliation required by law currently carried out by Project Development Support Section staff).
2. Define the information requirements of UDOT project managers and consultant project design engineers.
3. Determine whether the data currently provided by PPMS and the ROW database meet these needs.
4. Identify any administrative, system, or other changes that will be required to provide the needed information.
5. Address and implement these changes as part of the broader modifications that will be made to PPMS as part of project manager function implementation.

The ROW division has only fairly recently implemented its own database to manage ROW acquisition and clearance. Problems with the relocation data seem to indicate that not all ROW division staff is using it correctly. Staff indicated that the separate database for the ROW information is necessary because the record keeping requirements are very large. However, the dual system requires ROW division staff to enter the same data into two different databases. (PPMS data are a smaller subset of the ROW database data.) UDOT should determine whether there is in fact a need for two separate databases. It may also be possible to link them so that data entered into the ROW database can be automatically copied to PPMS.
(1) **Advantages**

- This approach will help UDOT to provide accurate and timely ROW data to those who need them.

(2) **Disadvantages**

- None identified.
Utah Department of Transportation

Design Process Performance Audit

Recommendations—Implementation Priorities

A. Background

The performance audit provides a detailed set of recommendations. Many of the recommendations are related and have dependencies. They cannot all be addressed immediately. UDOT has to balance priorities for implementing the recommendations with business continuity, other change initiatives, and the organization’s ability to absorb change. Dye Management Group, Inc.’s recommended implementation priorities are based on the following criteria:

- Benefit in terms of productivity and cost savings.
- Importance to the success of the design process.

B. Priorities

1. Establish management and control procedures to address project cost escalation and scope creep.

2. Establish and communicate performance objectives for schedule, scope, budget, and quality. Establish and exercise procedures for management oversight and control.

3. Address review area recommendations through establishing new review procedures, management controls, roles, and responsibilities.

4. Redefine the role of the environmental unit to provide technical assistance, training, issue resolution, and coaching on how to perform environmental activities.

5. Provide support and training to enable project design engineers to better manage the design process. Explain expectations and provide training on 08-1 procedures, project management, and, as possible, established performance related incentives.
VI-I. Focus Area Overview

A. Description

The design process must address utilities as described in Utah code. These include: sewer, water, power, telephone lines, cable television, and natural gas, as well as railroad tracks that may be located in the right-of-way (ROW) of a planned facility. The project design engineer provides utilities and/or railroads with preliminary plans of the project and requests plans of utilities/railroads in the ROW of the new facility. After the information has been obtained, the project design engineer enters it on the roadway plans. The project design engineer then schedules and conducts a field review with the utilities engineering coordinator, prepares a report, and makes any necessary corrections to the project plans. The project plans are then submitted to the utilities engineering coordinator who sends the plans to the utility companies, receives their plans and cost estimates, and prepares the necessary agreements. The agreements are sent to the accounting division and, after that, the project design engineer for approval and then forwarded to the utilities for signature. Exhibit VI-1 illustrates this process.

B. Approach

The following analysis of UDOT’s utilities and railroad related process is based on:

- A series of interviews with both managers of UDOT’s utilities section at the Rampton Complex and project managers in the regions.
- A workshop with UDOT utilities section managers and project managers from the regions.
- A series of follow-up interviews.
- An evaluation of all utilities and railroad related data in PPMS on projects that were advertised between 10/1/96 and 6/2/97 during the 1997 fiscal year.
- An evaluation of data on active projects contained in the database maintained by the utilities section.
- A comparison of the data contained in the two databases.
C. Summary of Observations and Findings

1. Management
   - There is no single point of contact for all stages of developing a utility agreement in the utilities section.
   - Utilities and railroads often do not provide UDOT with current location plans. This is contrary to existing agreements.
   - Consultant project design engineers are brought on board after the concept phase.

2. Schedule
   - Utilities often do not return utility plans provided by the utilities section within the required 90-day period.
   - Utility and railroad related activities are not initiated early enough in the design process.

3. Budget
   - The project design engineers do not appear to actively manage utility requirements.
   - Master agreements can help customize the approach to dealing with utilities based on the complexity of the required agreement. Currently, UDOT uses the same approach for all agreements.

4. Quality
   - The data that UDOT project managers and consultant project design engineers need on the status of utility and railroad agreements is not being entered in PPMS by the utilities section.
   - The utility and railroad plan format used by UDOT is different from that of at least one major railroad. This increases the time required for review.
D. Summary of Recommendations

The following lists recommended changes to the utility and railroad related process. The next subsection provides the context, rationale, and advantages and disadvantages for each recommendation.

1. Management

   • Assign individual utility section staff to specific projects. (The utility section is proposing this approach.)

   • Provide utility companies with the option to hand the responsibility for maintaining information on the location of facilities within UDOT ROW over to the department for a fee.

2. Schedule

   • Strengthen the sanctions available to UDOT to ensure that utilities return utility plans and cost estimates in a timely manner. Request legislation if necessary.

   • Place additional controls in 08-1 to ensure that utility work is initiated sooner.

3. Project Scope

   • Ensure that existing plans are used to conduct a preliminary review of utility and railroad location information as part of concept plan development. As constructed, plans should be used to identify major utilities.

4. Budget

   • Hold UDOT and consultant project design managers accountable for the accuracy of the scope and cost of utility and railroad clearance.

   • Provide senior management support for the utilities section’s effort to develop master agreements with utility and railroad companies.

5. Quality

   • Ensure that the required utility status is entered into PPMS.
VI-I. Focus Area Issues

The following lists issues, observations, findings, and recommendations concerning railroad and utility related activities of the project design process. They are grouped in four topical areas:

• Management
• Schedule
• Budget
• Quality

A. Management Issues and Recommendations

There are a number of issues related to the overall management of utility and railroad related activities during the design process. The following lists these issues and provides recommendations for addressing them.

1. Issue: There is no single point of contact for all stages of developing a utility agreement in the utilities section.

   a. Observations and Findings

      Under the current process, a number of different employees in the utilities section are responsible for components of each project. Agreements with affected utilities can be at different stages. This is more likely on larger, complex projects with 10 or more affected utilities. This fragmentation of responsibilities makes it difficult for the (consultant) project design engineer to determine the status of his project.

   b. Recommendation: Support the utility section’s current effort to assign individual staff to specific projects.

      The manager of the utilities section has recognized this issue and has begun to address it. The goal of this effort is to provide a single point of contact within the utilities section for each project for the project design engineer. Current practice providing utilities and railroads with a single point of contact at the utility section should be retained.
(1) **Advantages**

- This would make it easier for the project design engineer to determine project status and discuss any utilities or railroad related issues that may arise.

- Utilities section staff could be held accountable for providing service in a timely fashion if each project is coordinated at a single point in the section.

- This approach will allow the utilities section manager to better manage the work flow of staff.

(2) **Disadvantages**

- Utilities section employees are specialized in carrying out a specific, discrete step in establishing utility agreements. This change will require staff to cross train so that all staff are capable of carrying out all work necessary to establish an agreement.

- The utility section employee who is in charge of a project must coordinate efforts with the contact person for utilities or railroads, respectively.

2. **Issue: Utilities and railroads often do not provide UDOT with current location plans.**

   a. **Observations and Findings**

   UDOT region and utilities section employees indicated that there are utilities that rarely provide plans. Some utilities do not have the capacity to maintain accurate location information. Others indicate that they cannot provide accurate vertical location information because of UDOT resurfacing or other work.

   b. **Recommendation: Provide utility companies with the option to hand the responsibility for maintaining information on the location of facilities within UDOT ROW over to the department for a fee.**

   Small utilities may not have the staff to provide for updates to location plans. Utility section staff indicated that UDOT now de facto pays for most subsurface utility engineering required to locate utilities. It may be easier for UDOT to take over this responsibility for these utilities for a fee that reflects the costs to the department. The utilities section would maintain a library of
these plans for both UDOT project design engineer and utility company use. Plans would be updated as the location (e.g. vertical depth change due to resurfacing) is changed.

(1) Advantages

- As the library grows, UDOT project design engineers would have immediate access to existing location information.

- This approach would formalize current informal arrangements and realistically reflect the inability of some utilities to maintain accurate location information.

(2) Disadvantages

- This approach would result in an increase in the work load of utilities section staff of at least one to two FTE’s.

c. Recommendation: Conduct a meeting with affected utility companies and railroads during the scoping stage on all projects with significant impact on utilities.

For projects which are likely to affect a large number of utilities we recommend that the project design engineer work with the utilities section to conduct a scoping meeting with affected utilities. The meeting should be used to ensure that the utilities are aware of the project and to solicit input on the potential impact of preliminary alignment alternatives on utilities and thus project cost and schedule. It should also be used to determine whether there is any planned utility work that could or should be coordinated with the project.

(1) Advantages

- Utility and railroad companies have lobbied the utilities section to be included earlier in the process. This recommendation provides them with the requested opportunity for receiving information and providing input at an early stage of project development.

- UDOT can facilitate a more cooperative approach that makes the utilities partners in the design process and provides critical information early in the process.
(2) Disadvantages

- The logistics of carrying out such a meeting for projects that affect large numbers of utilities can be significant.
- Since there are no firm plans for the alignment of the planned highway, it may be difficult to assess its potential impact.

B. Scheduling Issues and Recommendations

The following outlines issues related to the scheduling and sequencing of activities and tasks that address utilities and railroads within the ROW of a project going through the design process.

1. Issue: Utilities often do not return utility plans provided by the utilities section within the required 90-day period.

   a. Observations and Findings

   Both UDOT region design engineers and utilities section employees indicated that location plans and the estimate for needed utility work are often late or not provided at all. This is despite the requirement for utilities to respond within 90 days.

   A review of the information in the database maintained by the utilities section strongly supports this view. At the time of the analysis, there was information on 84 projects for which a total of 552 plan packages had been sent out more than three months before. For 389 plans, 72 percent of packages sent out, the data indicated that no response from the utility had been received. According to utilities section employees, some utilities explain that they do not know the exact (vertical) location of utilities because of resurfacing and other activities carried out by UDOT.

   For 158 utility agreements, or 28 percent of the total, the date on which they were returned to the utilities section was available. Of these, 67 or 44 percent were returned within the three month period or less, 87 or 56 percent were returned after more than three months. This covers 64 projects. Thus the data indicate that the location plans are often not made available, and if they are provided, they arrive late. Since the information is required, UDOT is currently initiating and paying for the majority of subsurface utility engineering to locate these facilities. It also means that utility information is often not available when a project is designed. This can cause significant costs if there needs to be a design change to accommodate unknown utilities.
b. **Recommendation:** Strengthen the sanctions available to UDOT to ensure that utilities return utility plans and cost estimates in a timely manner. Request legislation if required to provide UDOT authority to accomplish this.

UDOT’s ROW is an asset that can be used by utilities to locate their own facilities under certain conditions to which the utilities agreed. This approach would reflect the agreed responsibilities of utilities in providing location information within a 90-day response period. UDOT would initiate location efforts if the utility has not responded to the request for information within the specified time frame. Should a utility’s claim that its information is inaccurate because of UDOT activities be correct, UDOT could pay for the location or agree to share the cost.

(1) **Advantages**

- UDOT would not have to pay for work that the utilities are required to provide.
- This approach would be consistent with the agreements between UDOT and the utilities.
- It would allow UDOT to progress on schedule even if the utilities do not provide the required information.
- The current approach rewards utilities that do not update their location information because UDOT pays a third party for subsurface utility engineering. The recommended approach can be designed to avoid rewards for bad management or non-responsiveness in the future.

(2) **Disadvantages**

- Utility companies are used to the status quo and are likely to resist a UDOT effort to require them to comply with the agreement.
- The recommendation will need to be carefully designed to avoid giving utilities a reward for bad management.
2. **Issue:** Utility and railroad related activities are not initiated early enough in the design process to keep projects on schedule.

a. **Observation and Findings**

PPMS data indicate that utility related activities do not receive significant attention (measured by hours expended) until activity 35P (Prepare utility/railroad agreements), which is the responsibility of the utilities section. It appears that few hours are being charged to those activities for which the project design engineer is responsible (16D, 46D, 52D, and 76D). These data, supported by our interview results, indicate that utility and railroad activities are not started early enough. This has an impact on overall project schedule.

b. **Recommendation:** Place additional controls in 08-1 to ensure that utility work is initiated sooner.

This should include ensuring that the results of Activity 16D (Obtain preliminary utility and railroad information) are in-hand for project scoping and that the products of Activity 52D (Develop utility and railroad plans) are complete before Activity 55D is considered complete. This will ensure that the project manager/project design engineers initiate utility work in time to enable the utilities section to complete Activity 35P (Prepare utility and railroad agreements) on schedule.

1. **Advantages**
   - Provides controls to ensure that project managers and project design engineers address utilities in accordance with 08-1.

2. **Disadvantages**
   - When delays arise because information is not provided by utilities, the project could be unnecessarily delayed by the proposed new 08-1 business rule.
C. Budget Findings and Recommendations

The following outlines issues related to the scope and budget of utility and railroad related activities during the design process. It also presents recommendations for addressing these issues and lists the advantages and disadvantages of different approaches.

1. Issue: The project design engineers do not appear to actively manage utility requirements.

   a. Observations and Findings

   PPMS data indicate that utility related activities that are the responsibility of the project design engineer are not consistently occurring during the process. This is illustrated by Exhibit VI-2.

   Thirty three projects in our sample had hours charged to Activity 35P (Prepare utility/railroad agreements), which is the responsibility of the utilities section. However, for the preceding utility related activities that are the responsibility of the project design engineer; activities 16D, 46D, 52D, 76D, PPMS lists expended hours only for 18, 17, 19, and 26 projects, respectively.

   There are nine projects (27 percent) for which the only utility related activity that incurred charges was Activity 35P (Prepare utility/railroad agreements). Six of these projects (18 percent) did not have any hours budgeted for Activity 35P (Prepare utility/railroad agreements) or any other utility related activity. Two additional projects had budgeted hours for Activity 35P that were exceeded by the hours charged to the activity. Only one of the nine projects showed less hours charged than budgeted for the activity.

   b. Recommendation: Hold UDOT and consultant project design managers accountable for the accuracy of the scope and cost of utility and railroad clearance.

   If the UDOT or consultant project design manager has been involved in the development of the scope for utility and railroad related efforts, the accuracy of the scope and cost estimates can be a part of the performance evaluation for the project manager. This could be integrated in the effort to develop and implement a project manager function within the department.
(1) Advantages

- This recommendation supports the development and implementation of a project manager function within the department.

- The approach will encourage project managers to more carefully evaluate the potential impact of utility and railroad facilities.

(2) Disadvantages

- Since the current standards for utility and railroad related activities are based on the current approach, the effort required during the concept phase is likely underestimated whereas the effort required during the design phase may be overestimated. UDOT will need to carefully monitor the impact of changes on the accuracy of existing standards and make adjustments as necessary.

2. **Issue:** Master agreements can help customize the approach to dealing with utilities based on the complexity of the required agreement. Currently, UDOT uses the same approach for all agreements.

   a. **Observations and Findings**

   UDOT utilities section employees indicated that there are large differences in the complexity of different projects. The scope of the effort could be reduced if UDOT entered master agreements with the utilities and modified these as needed for less complex projects. We understand that the utilities section is currently developing draft master agreements. In developing a department wide policy for the use of master agreements, the potential for decentralizing authority on decisions related to utilities to the regions should be considered.

   b. **Recommendation:** Provide senior management support for the utilities section’s effort to develop master agreements with utility and railroad companies.

   Provide the utilities section manager and staff with the authority to work with representatives from Utah’s utility companies to develop a master agreement that can be used for less complex projects. Employees working on this effort could be asked to provide status reports to and solicit guidance from the Performance Management Team.
(1) Advantages

- The workload of the utilities section could be focused on those projects where utilities can have a significant impact on project scope.

(2) Disadvantages

- If utilities are not treated consistently there may be legal challenges.

D. Quality

There are a number of issues related to the quality of efforts to address utility and railroad facilities within the ROW of UDOT projects. The following lists these issues, provides recommendations for addressing them, and outlines the advantages and disadvantages of different approaches.

1. Issue: The data that UDOT project managers and consultant project design engineers need on the status of utility and railroad agreements is not being entered in the PPMS by the utilities section.

a. Observations and Findings

Utility information provided through the 760S screen is not entered consistently by utilities section employees. The utilities section employees explained that this is occurring because they are still learning to use PPMS. However, the utilities section is maintaining a duplicate database that contains the information used by utility section staff to monitor status. Consequently, the UDOT or consultant project design engineer cannot monitor utility status.

Our analysis of utilities information in PPMS (the 760S screen) supports this assessment. Data are now entered only sporadically; we have not found a single complete set of data for a utility agreement. The only information that is available for some utilities includes the date on which the utilities section received the utility and railroad plans from the project design engineer, when they were sent out to the utility, when the utility’s cost estimate was received by the utilities section, and what the agreed amount was. However, this information is not consistently available for all utilities affected by a project.

We reviewed projects #1280 and #1281 (Bangerter Highway) which were advertised with limitations on operations due to incomplete utilities work. Our review indicates that the information in PPMS is very limited. For both projects, PPMS does not reference all utilities referenced in the utilities database. There is only partial information on each utility listed in PPMS. For
project #1280, PPMS contains partial information on the dates when cost estimates were received by the utilities section and the agreed amount. For project #1281, PPMS contains partial information on the dates plans were sent to the utility companies. There is no other information.

We have also found that there are discrepancies between the data provided by the utilities section database and PPMS. This is for example the case for project #225 (5600 South Street), where PPMS indicates that utility plans were sent to the utilities on 6/11/96. The utilities section database records 8/19/96. These types of discrepancies will continue to occur while there are duplicate databases.

b. **Recommendation: Ensure that utility staff is accountable for entering required utility status information into PPMS.**

UDOT has defined the information requirements of UDOT project managers and consultant project design engineers for utility status information in screen 760S. The utilities and railroads section believes that the database they use better meets their requirements.

Utility section employees perceive the data entry process for PPMS as cumbersome and are not entering data consistently on regular basis. There are fields for every step in the process. However, data for most fields are not entered. This can make it impossible for the project design engineer to evaluate the status of all utility agreements.

Despite these issues, 08-1 requires enterprise-wide status information on utilities. Therefore, the utilities section should enter data in PPMS and discontinue the use of a duplicate database for managing status. However, it is important that any utilities section data requirements not met through PPMS are defined and addressed through a separate database or modifications to PPMS. These changes should be implemented as part of any broader modifications to PPMS as part of the implementation of a project manager function. This should include development of a PPMS screen that provides utility information in a more concise format.

(1) **Advantages**

- This approach will help UDOT provide accurate and up-to-date utilities information for those who need them.
- The recommendation supports development and implementation of a project manager function within the department.
(2) Disadvantages

- This is a major effort. UDOT may not have the staff resources to carry it out.

2. Issue: The utility and railroad plan format used by UDOT is different from that of at least one major railroad. This increases the time required for review.

   a. Observations and Findings

   At least one railroad (Union Pacific) has a specific location plan format that is not compatible with a UDOT design plan. In this case, a practice used by one design consultant firm to shorten design review by the railroad is to provide a separate plan sheet that is not part of the standard project design package.

   b. Recommendation: Identify and address opportunities for speeding up the review of project plans by the utility and railroad companies.

   The department may be able to reduce the review period of some railroads and utilities by providing plans in a format that is easier to review. We recommend that the department carry out a survey of utilities and railroads to determine the potential for such improvements. This could occur as part of the process to develop and implement a project manager function.

(1) Advantages

- A shortened review period will provide utilities information early on. This improves the overall quality of the design work and the accuracy of the cost estimate for the construction phase.

(2) Disadvantages

- This approach will increase the work load of the design crews.
VII-I. Roadway Design Standards

A. Focus Area Overview

This focus area identifies documents and evaluates any variances between the UDOT geometric design criteria and the AASHTO *A Policy on Geometric Design of Highways and Streets (Green Book).* The focus area presents recommendations that address the documented variances between UDOT and AASHTO criteria.

B. Scope of Review

Our comparison of UDOT geometric design criteria to AASHTO includes the FHWA controlling design criteria and other selected major design elements. In summary, the evaluation addressed the following roadway design elements:

- Design speed
- Lane and shoulder widths
- Bridge widths
- Structural capacity
- Minimum radii
- K-values for crest and sag vertical curves
- Maximum grades
- Stopping sight distance
- Cross slopes
- Super-elevation rates
- Vertical clearances
- Intersection sight distance
- Roadside clear zones
- Criteria from the *Americans with Disabilities Act*
- Definition of low speed versus high speed
- Level-of-service criteria
- Horizontal alignment criteria for low-speed urban streets
- Use of turning roadway criteria for horizontal alignment on interchange ramps
- Acceleration/deceleration distances at interchange entrances and exits.
From a geometric design and roadside safety perspective, these elements are judged to be the most critical indicators of the highway facility’s performance. Collectively, these elements also represent a significant majority of the construction costs dedicated to the roadway design portion of the facility. Therefore, the evaluation of these design elements will provide UDOT with a significant review of its road design practices without attempting to address every design detail.

C. Context of AASHTO Publications

AASHTO develops all of its publications to achieve specific objectives, including:

- Achieving a certain measure of nationwide uniformity.
- Providing a single source of information to all 50 State DOT’s to avoid unnecessary duplicative efforts at the State level.
- Allowing each State DOT to gain from the experiences of other State DOT’s.
- Reflecting general cost-effective considerations based on the broad, nationwide experience.

By necessity, then, each AASHTO publication must be developed to be acceptable to 50 State DOT’s. This often requires AASHTO to seek the “lowest common denominator” when adopting specific numerical values for application. Therefore, a minimum value which is cost-effective in one State may be too restrictive in another; i.e., another State may justify on a cost-effective basis selectively adopting criteria which exceed AASHTO.

This general discussion is applicable to the AASHTO A Policy on Geometric Design of Highways and Streets (Green Book). The following excerpt from the Green Book Foreword provides some context:

*The intent of this policy is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations. Minimum values are either given or implied by the lower value in a given range of values. The larger values within the ranges will normally be used where the social, economic and environmental (S.E.E.) impacts are not critical.*

Our review and evaluation of UDOT’s geometric design criteria has been conducted from this perspective. In summary, our recommendations to UDOT in Section III have been based on:

- The theoretical basis for the geometric design criteria in the Green Book.
- The minimum recommendations in the Green Book.
• The conditions which are likely to prevail throughout Utah.
• General cost-effective considerations.
• Our engineering experience and expertise in addressing similar issues with many other State DOT’s.

This evaluation has, as documented in Section VII-III, resulted both in recommendations to retain existing UDOT criteria which exceed AASHTO and in recommendations to adopt minimum AASHTO criteria in lieu of more generous UDOT criteria.
VII-II. General Observations and Findings

A. Internal UDOT Activities

The Utah Department of Transportation has for some time recognized that several of its geometric design criteria exceed those of AASHTO, and the Department has initiated independent internal efforts to evaluate this issue. This observation is based on conversations with UDOT personnel and on a review of the Minutes from several meetings of the Standards Committee. We understand that, in the near future, UDOT will determine its own recommendations for what revisions may be appropriate in its existing design standards.

B. Information-Gathering Strategy

Before we could conduct an evaluation of any variances between UDOT and AASHTO criteria, it was necessary to develop a strategy to identify these discrepancies. Therefore, we prepared a Report/Questionnaire which, where practical, placed the AASHTO and UDOT criteria side-by-side in a set of tables based on functional class and rural/urban location. The UDOT criteria were extracted from the most recent version of the metric UDOT Standard Drawings. This Report/Questionnaire was submitted to UDOT to verify the information we compiled and to provide the missing information. The Department’s response provided us with the base information to formulate our recommendations in Section VII-III. The Appendix F provides the Department’s completed Report/Questionnaire.

C. Overall Perspective

Our comparison of UDOT criteria with the Green Book has revealed a high level of conformity with AASHTO. Obviously, in the development of the UDOT Standard Drawings, the Department closely scrutinized the Green Book for guidance. Presumably, then, any variances are attributable to the Department’s assessment that the Green Book criteria were not appropriate for Utah. However, the Department may determine that its existing design standards should be modified to be more consistent with AASHTO for a variety of potential reasons, including:

- The application of the more generous design has generated problems and/or resistance within the Department or with local governments.
- The Department unintentionally overlooked flexibility within the Green Book (e.g., horizontal alignment criteria for low-speed urban streets).
• The Department may be persuaded by a compelling argument that its criteria are too generous.

• The discrepancy may have been unintentional.

Therefore, the Department should seriously consider the recommendations in Section VII-III for potential changes to its road design criteria.

D. Other Issues

In addition to comparing UDOT geometric design criteria with the Green Book, Section VII-III presents several other recommendations. In summary, these include:

• A review of UDOT

• A recommendation to develop geometric design criteria for 3R non-freeway projects.

• A recommendation to develop a comprehensive road design manual.
VII-III. Issues and Recommendations

A. UDOT Criteria Which Do Not Meet AASHTO

1. Findings

Based on our comparison of AASHTO and UDOT criteria, UDOT currently has adopted several geometric design values which do not meet those in the *Green Book*. Tables 1 through 10 in the Appendix F document these UDOT geometric design values, which are identified in shaded boxes with UDOT criteria in block letters. The following summarizes the more significant discrepancies:

- **Design Speed (Rural Freeways).** For rural freeways, UDOT has adopted a minimum design speed of 80 km/h in level and rolling terrain. The AASHTO minimum is 110 km/h.

- **Left Shoulder Width (Freeways with 6 or More Lanes).** On these facilities, UDOT has adopted a minimum width of 1.8 m. The AASHTO minimum is 3.0 m.

- **Existing Bridges to Remain in Place (Structural Capacity).** For freeway and arterial facilities (urban and rural), AASHTO designates the MS-18 for structural capacity; UDOT designates MS-13.5.

- **Existing Bridges to Remain in Place (Width on Freeways).** The UDOT criteria is the approach traveled way width + 0.6 m on each side. The AASHTO criteria is the approach traveled way width + 3.0 m (right) + 1.1 m (left).

- **Design Speed (Rural Arterials).** In level terrain, UDOT allows a minimum design speed of 80 km/h. The AASHTO minimum is 100 km/h.

- **Shoulder Width (Rural Local Roads).** UDOT criteria for shoulder widths on these facilities uses a break of 100 DHV; AASHTO ranges are expressed in AADT. In highway capacity analyses, the “K” value is the ratio between DHV and AADT. This is approximately 15% - 20% on rural facilities. Using a K = 15%, the 100 DHV becomes an AADT of approximately 700. Based on this conversion, the UDOT criteria for shoulder widths on rural local roads do not meet AASHTO as follows:

<table>
<thead>
<tr>
<th>Traffic Volumes</th>
<th>UDOT</th>
<th>AASHTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 AADT-700 AADT</td>
<td>1.2 m</td>
<td>1.5 m</td>
</tr>
<tr>
<td>&gt;2000 AADT</td>
<td>1.8 m</td>
<td>2.4 m</td>
</tr>
</tbody>
</table>
Because the *Green Book* must be developed to apply to the entire nation, there may be site-specific factors within a State which justify adopting criteria which do not meet AASHTO. For example, a heavily urbanized State (e.g., Connecticut) may include many areas which are “rural” by definition but “urban” in character. The *Green Book* criteria for rural areas does not account for this and, therefore, it may be appropriate to adopt reduced geometric design criteria for these areas. However, there are disadvantages to a State DOT adopting geometric design values which do not meet AASHTO. These include:

- Increased exposure to tort liability.
- For the FHWA controlling design criteria, the need to seek a “blanket” design exception from FHWA.
- Providing reduced benefits to the traveling public.

2. **Recommendation: Adopt minimum AASHTO criteria for all geometric design elements.**

In general, there appears to be no compelling or overriding factors which justify the adoption of UDOT design criteria which do not meet the minimum criteria from the *Green Book* or the AASHTO *A Policy on Design Standards-Interstate System*. Although there may be some merit in a case-by-case analysis, we are recommending that UDOT upgrade its geometric design values, in all cases where applicable, to meet the minimum AASHTO criteria.

**B. UDOT Criteria Which Exceed AASHTO**

1. **Findings**

Based on our comparison of AASHTO and UDOT criteria, UDOT currently has adopted several geometric design values which exceed those in the Green Book. Tables 1 through 10 in the Appendix document these geometric design values, which are identified in shaded boxes, with UDOT criteria in italics, set off by asterisks. In many cases, exceeding minimum AASHTO criteria is a justifiable and cost-effective expenditure of highway construction funds. Because the *Green Book* must gain general acceptance from 50 States, it must therefore seek the lowest common denominator for the adoption of specific geometric design values in many applications. An individual State may legitimately elect to adopt a design value higher than AASHTO for selected elements to better reflect the prevailing conditions within that State, including:

- Topography.
- Climate.
• Traffic volumes.
• Extent of urbanization.
• Experience.
• Engineering judgment.

Because of these factors, it is appropriate to examine each significant discrepancy between UDOT and AASHTO and to present a case-by-case recommendation.

2. Recommendation: For facilities off the State highway system, reduce minimum UDOT criteria to meet minimum AASHTO criteria.

Table 7 presents UDOT criteria for local rural roads and Table 10 applies to local urban streets. In addition, some rural and urban collectors are likely not on the State highway system. Based on our experience with many State DOT’s, the universal position of the State is that it should not impose State criteria on non-State facilities which exceed AASHTO. Therefore, we are recommending that UDOT adopt design criteria on these facilities which meet, but do not exceed, minimum AASHTO criteria. If UDOT criteria exceed AASHTO for State highways on collectors, this will require UDOT to adopt two sets of geometric design criteria—one for State highway collectors and one for non-State highway collectors.

Note: All remaining recommendations in VII-III.B. apply to the State highway system.

3. Recommendation: For widths of new and reconstructed bridges, retain the existing UDOT criteria.

UDOT criteria for new and reconstructed bridge widths is the full approach roadway width plus 0.6 m on each side. In general, AASHTO criteria are the full approach roadway width although, for low-volume rural collectors, lower widths are acceptable. The advantages of wider bridges include:

• Additional space for snow storage.
• Increased safety because of the additional lateral offset to bridge rails.
• Where intersections are located near bridges, improved sight distance for vehicles turning onto the main roadway.
• Improved bridge deck drainage (i.e., more ponding of water can be accepted without interfering with traffic flow).
• Additional available width for traffic operations during bridge maintenance and future bridge rehabilitation projects.
• Increased sense of driver comfort.
The only significant disadvantage to increased bridge widths is increased construction costs. However, it is judged that this is a cost-effective expenditure of UDOT highway construction funds.

4. **Recommendation: Reduce the minimum UDOT stopping sight distance (SSD) criteria to minimum AASHTO criteria.**

Currently, the UDOT minimum SSD criteria meet the AASHTO desirable SSD criteria. For a design speed of 110 km/h, this yields lengths of crest vertical curves which are almost 50% longer with a resultant increase in construction costs, right-of-way impacts, environmental impacts, etc. In general, proper highway design dictates the provision of the best sight distance which can be attained practically. This directly improves the safety and comfort of the traveling public and often produces ancillary benefits (e.g., less erosion potential, better drainage characteristics). However, to the best of our knowledge, no other State DOT in the nation has adopted minimum SSD criteria which exceed the minimum AASHTO criteria. There are at least two major observations which demonstrate that this is a prudent highway engineering position:

- The AASHTO SSD model is based on a conservative set of assumptions which assume a worst-case scenario which rarely occurs in actual highway operations.
- Accident studies have never successfully concluded that sites which meet minimum AASHTO SSD criteria are demonstrably less safe than sites where minimum AASHTO SSD criteria are exceeded.
- There will inevitably be sites on UDOT facilities where it is impractical or cost-prohibitive to attain the desirable SSD, and the UDOT position should be that it is acceptable to meet the minimum SSD criteria without the need to attain a design exception.

5. **Recommendation: Adopt the AASHTO criteria for horizontal curvature on low-speed ($V \geq 70$ km/h) urban streets.**

Attaining super-elevation on low-speed urban streets can create many complications, including:

- Roadside Development/Intersections/Driveways. Built-up roadside development is common adjacent to low-speed urban streets. Matching super-elevated curves with many driveways, intersections, sidewalks, etc., creates considerable complications. This may also require re-grading parking lots, lawns, etc., to compensate for the higher elevation of the high side of the super-elevated curve.
- Non-Uniform Travel Speeds. On low-speed urban streets, travel speeds are often non-uniform because of frequent signalization, stop signs, vehicular conflicts, etc. It is undesirable for traffic to stop on a super-elevated curve, especially when snow or ice is present.
• Limited Right-of-Way. Super-elevating curves often result in more right-of-way impacts than would otherwise be necessary. Right-of-way is often restricted along low-speed urban streets.

• Wide Pavement Areas. Many low-speed urban streets have wide pavement areas because of high traffic volumes in built-up areas, the absence of a median and the presence of parking lanes. In general, the wider the pavement area, the more complicated will be the development of super-elevation.

• Surface Drainage. Proper pavement drainage on low-speed urban streets can be difficult even on sections with a normal crown. Super-elevation introduces another complicating factor.

In recognition of these problems, the 1984 Green Book introduced horizontal alignment criteria for low-speed urban streets which differ significantly from those for open roadways. The differences include:

• Higher maximum side friction factors,
• The use of Method 2 to distribute super-elevation and side friction (instead of Method 5 used for open roadways), and
• Shorter super-elevation runoff distances.

The practical benefit is that super-elevation is rarely warranted on low-speed urban streets when compared to the criteria for open roadways presently used by UDOT. Every State DOT for whom we have worked has adopted these criteria. It is recommended that UDOT likewise use the Green Book criteria for horizontal alignment on low-speed urban streets as a cost-effective but sound engineering approach to an often difficult problem.

6. **Recommendation: Retain flatter UDOT side slopes.**

As indicated in Tables 1 through 6 in the Appendix, UDOT has adopted flatter side slope criteria for its rural State highway facilities than presented by AASHTO. In summary, these are as follows:

• Flatter back slopes in earth cut sections on all functional classes.
• Flatter fill slopes on rural collectors.

There are significant advantages to providing flatter side slopes, including:

• Increased roadside safety for run-off-the-road vehicles.
• Less susceptibility to erosion.
• Improved side slope stability.
• Fewer maintenance problems.
• An enhanced sense of openness to the driver.

The disadvantages include increased construction costs and a wider required right-of-way. However, it is judged that, considering prevailing conditions within the rural areas of Utah (e.g., the general availability of right-of-way), the additional construction costs and impacts for flatter side slopes are a cost-effective expenditure of UDOT’s highway construction funds.

7. **Recommendation:** Retain UDOT’s vertical clearance criteria for freeways and arterials; further evaluate UDOT’s vertical clearance criteria for collectors.

As indicated in the Tables in the Appendix, UDOT has adopted vertical clearance criteria which exceed the minimum AASHTO requirements. In summary, these are as follows:

- For freeways and arterials in urban and rural areas, UDOT vertical clearance criteria are 5.05 m + 150 mm = 5.2 m. AASHTO requires 4.9 m + 150 mm = 5.05 m.
- For rural and urban collectors, UDOT vertical clearance criteria are 5.05 m + 150 mm = 5.2 m. AASHTO requires 4.3 m + 150 mm = 4.45 m.

The benefits to UDOT’s higher vertical clearances include greater allowances for future pavement overlays and greater protection against bridge overpass impacts from oversized trucks. The disadvantages include increased construction costs and, in some cases, increasing the complexity of the bridge design (e.g., higher vertical clearances may limit the selection of a superstructure type).

For freeways and arterials, UDOT’s criteria only exceed the minimum AASHTO criteria by 150 mm. It is judged that this is a cost-effective expenditure of UDOT’s highway construction funds especially considering the benefit related to future overlays. For collectors, UDOT’s criteria exceed the minimum AASHTO criteria by 0.75 m. However, Utah may have a State law which dictates the minimum vertical clearances on the State highway system. Therefore, no definitive recommendation is made at this time on the cost-effectiveness of the higher clearances. If State law does allow the lower vertical clearances on rural and urban collectors, UDOT should further evaluate this issue.
8. **Recommendation:** Increase the maximum grade on rural multi-lane arterials in mountainous terrain (80 km/h).

In our comparison between UDOT and AASHTO criteria, this is the only discrepancy for maximum grade criteria, and it may have been unintentional. Regardless, providing flatter grades in mountainous terrain is often one of the most cost-prohibitive elements in highway design. There are definite operational benefits to flatter grades, especially where truck volumes are appreciable. However, it is recommended that UDOT revise its maximum grade criteria to meet the maximum AASHTO criteria.

9. **Recommendation:** Retain UDOT lane and shoulder width criteria which exceed AASHTO.

As illustrated in the Tables in the Appendix in a few selected applications, UDOT lane and shoulder width criteria exceed the minimums recommended by AASHTO. These discrepancies may have been unintentional, and UDOT should consider reducing these widths. However, these are design elements where AASHTO has arguably made a concerted effort to find the “lowest common denominator” for nationwide application. This includes, for example, the use of 2.7-m lane widths on urban and rural collectors in some cases. There are significant benefits to wider roadway widths including:

- Improved traffic operations.
- Improved highway safety.
- Improved pavement structural performance.
- Fewer maintenance problems.
- Additional space for snow storage.
- Increased lateral clearances to roadside safety appurtenances (e.g., guardrail).
- Enhanced hydraulic performance of the roadway.
- More space for emergency stops.
- Improved sense of openness to the driver.

It is judged that UDOT’s selected applications of wider lane and shoulder widths than AASHTO minimums is a cost-effective expenditure of UDOT’s highway construction funds.
C. Other Design Issues

1. Findings

Based on UDOT’s response to the Report/Questionnaire, we have determined that UDOT should address several other design issues. Although these design elements are not addressed directly in the Green Book and/or are not FHWA controlling design criteria, they are nonetheless issues which:

- Are controversial,
- Have significant cost implications,
- Are currently in a transitional phase and/or
- Have generated confusion in their application.

2. Recommendation: Develop criteria for roadside clear zones across roadside ditches.

Table 3.1 in the Roadside Design Guide presents clear zone values for cut sections. However, the application is to the schematic in Figure 3.1 where the cut slope begins at the edge of the roadway; i.e., Table 3.1 does not apply to cut sections with a traditional roadside ditch section. In addition, note that Figures 3.5 and 3.6 address the issue of roadside ditch traversability; they do not address the issue of clear zones across ditch sections. Therefore, the Roadside Design Guide does not provide explicit criteria for this element.

In its response to the Report/Questionnaire, UDOT indicated that it currently uses Table 3.1 in the Roadside Design Guide to determine clear zones across roadside ditches. Because of the incorrect application of Table 3.1, it is recommended that UDOT develop criteria for roadside ditches which is consistent with this application.

3. Recommendation: For roadside clear zones, make the horizontal curvature adjustment optional.

Currently, UDOT requires the horizontal curvature adjustment when calculating the design value for roadside clear zones. The AASHTO Roadside Design Guide clearly places this adjustment within the context of discretionary (i.e., it is not required). Therefore, it is recommended that UDOT modify its practices to make the horizontal curvature adjustment optional.
4. **Recommendation:** Adopt criteria for the accessibility of disabled individuals on public rights-of-way where not addressed by the *ADA Accessibility Guidelines for Buildings and Facilities*.

In July 1991, the Architectural and Transportation Barriers Compliance Board (Access Board) published the *ADA Accessibility Guidelines for Buildings and Facilities*. The Guidelines provided criteria for buildings, off-street parking, accessible routes, etc. However, it is unclear how to treat sidewalks not on an accessible route and along public rights-of-way, how to treat on-street parking, etc. To clarify these issues, the Access Board in June 1994 published in the *Federal Register* an interim Final Rule which included Section 14 “Public Rights-of-Way.” Due to numerous comments and concerns, action on this Final Rule was suspended in March 1996. Based on our information, the Access Board intends to publish “Guidelines” for treatment of ADA criteria in public rights-of-way in the fall of 1997 which will not be a part of the *ADA Accessibility Guidelines*.

For rest areas, off-street parking, train stations, etc., the ADA Accessibility Guidelines are generally clear for what is required (e.g., sidewalk widths, longitudinal slopes, cross slopes, curb ramps). However, for application of ADA criteria along public rights-of-way, States have adopted various approaches. Most have assumed the approach that they will provide the best practical treatment (e.g., curb ramps, cross slopes, widths). However, longitudinal sidewalk gradients, warping around driveways, etc., still tend to be problems. Therefore, it is recommended that UDOT address this issue and develop criteria for its application.

5. **Recommendation:** Evaluate intersection sight distance criteria.

The *Green Book* presents the overtaking vehicle model for turning vehicles for application at all stop-controlled intersections. Because of many complaints from State DOT’s that the *Green Book* criteria are unrealistic, NCHRP 383 *Intersection Sight Distance* was initiated several years ago to evaluate the *Green Book* and, if appropriate, recommend changes to Chapter IX of the *Green Book*. The now-published NCHRP 383 recommends that AASHTO modify the *Green Book* to use gap acceptance at all stop-controlled intersections.

We believe that the conceptual approach based on driver gap acceptance is a far more realistic and practical basis for ISD criteria than that in the 1994 *Green Book*. Therefore, we anticipate that the gap-acceptance criteria will be incorporated into the next edition of the *Green Book*. Several State DOT’s for whom we have worked have already adopted gap acceptance, including Illinois, Mississippi, Vermont and Montana (rural intersections).

It is recommended that UDOT evaluate the ISD criteria in NCHRP 383 and consider its adoption in advance of its incorporation into the *Green Book*. This has the potential to be a cost-effective but sound engineering approach to an often difficult problem.
D. Use of SI Units of Measurement

1. Findings

The *Omnibus Trade and Competitiveness Act of 1988* required that all Federal agencies develop a Metric Conversion Plan by FY92. The Federal Highway Administration published its Plan in April 1991, which required that all Federal-aid construction contracts be in metric by October 1, 1996. The conversion date has been extended to October 1, 2000 by the National Highway System Designation Act of 1995.

Based on the information we have received, UDOT has converted its operations to the International System of Measurement (SI). However, in a few places, the UDOT conversion is inconsistent with AASHTO publications.


All AASHTO publications have adopted the V:H nomenclature to express side slopes, including:

- *Guide to Metric Conversion.*
- *Model Drainage Manual.*

3. Recommendation: Review all numerical conversions for consistency with AASHTO publications.

Our review of the UDOT *Standard Drawings* has revealed a few metric conversion discrepancies with the AASHTO *Green Book*. The following presents some examples:

- UDOT has converted 9 to 2.75 m; the *Green Book* conversion is 2.7 m.
- UDOT has rounded stopping sight distance values to the next highest 10-m increment; the *Green Book* has rounded SSD’s to the next highest 1-m increment.
- UDOT has rounded passing sight distance values to the next highest 5-m increment; the *Green Book* has rounded PSD’s to the next highest 1-m increment.

A thorough review of all UDOT design documents may reveal additional discrepancies in metric conversion when compared to the national publications.
E. Interpretation of FHWA Controlling Design Criteria

1. Findings

The FHWA controlling design criteria, as documented in its April 15, 1985 Memorandum, include:

- Design speed.
- Lane and shoulder widths.
- Bridge widths.
- Structural capacity.
- Horizontal alignment.
- Vertical alignment.
- Grades.
- Stopping sight distance.
- Cross slopes.
- Superelevation.
- Vertical clearances.

*Note: Originally, horizontal clearances (or clear zones) were among the controlling design criteria; however, in the June 25, 1990 Federal Register, FHWA rescinded clear zones from the list.*

The FHWA intent is that, if a proposed project (new construction/reconstruction) includes a design value which does not meet the AASHTO criteria for any of the above elements, a State DOT must request a written design exception from FHWA on applicable projects. However, the implementation of a design exception process requires the explicit identification of the design value that applies to a given site. The FHWA list of controlling design criteria are, in many cases, subject to interpretation.

2. Recommendation: Develop a written design exception policy which explicitly identifies the application of geometric design criteria.

Based on UDOT’s response to the Report/Questionnaire in the Appendix, the Department needs a written design exception policy which explicitly identifies the numerical value which applies in all cases. This will significantly reduce confusion for its designers.
3. **Recommendation:** For the design exception policy, adopt an approach which minimizes the need to seek a written design exception thereby minimizing paperwork.

Based on this philosophical approach, it is recommended that the design exception process only apply to the highway mainline and not to auxiliary lanes nor interchange ramps. This would be a modification to the current UDOT application. Further, it is recommended that the list of FHWA controlling design criteria be designated as follows:

- Design speed.
- Lane and shoulder widths.
- Bridge widths.
- Structural capacity.
- Minimum radii.
- K-values for minimum AASHTO SSD at vertical curves.*
- Maximum grades.
- Cross slopes on travel lanes and shoulders.
- Super-elevation rates.
- Vertical clearances (including the designated allowance for future resurfacing).

*This would be a change to the current UDOT application.

F. **3R Geometric Design Criteria for Non-Freeways**

1. **Findings**

The overall objective of this Focus Area is to compare UDOT geometric design criteria with AASHTO, to evaluate at a management level the cost-effectiveness of any variances, and to develop recommendations for UDOT’s consideration. Presumably, this Focus Area has been included in the Design Process Performance Audit because of concerns that UDOT may not be optimizing the benefits from its scarce highway construction funds; i.e., the Department in some cases may be spending too much money for too little benefit.

From an overall perspective, the Department’s highway program is intended to improve the greatest number of highway kilometers within the available funds for
highway projects. “Improve” is meant to apply to all aspects which determine a facility's serviceability, including:

- The structural integrity of the pavement, bridges and culverts.
- The drainage design of the facility to, among other objectives, minimize ponding on the highway, to protect the pavement structure from failure, and to prevent roadway flooding during the design-year storm.
- From a highway capacity perspective, the level of service provided for the traffic flow.
- The adequacy of access to abutting properties.
- The geometric design of the highway to safely accommodate expected vehicular speeds and traffic volumes.
- The roadside safety design to reduce, within some reasonable boundary, the adverse impacts of run-off-the-road vehicles.
- The traffic control devices to regulate the traffic, to provide the driver with critical information and to meet driver expectancies.

These objectives are competing for the limited funds available for highway construction in Utah. The Department's responsibility is to realize the greatest overall benefit from the available funds. Therefore, on individual projects, some compromises may be necessary to achieve the goals of the overall highway program. Specifically for geometric design and roadside safety, the compromise is between what is desirable (new construction criteria) and what is practical for the specific conditions of each highway project.

The Green Book presents criteria which are directly applicable to new construction and major reconstruction projects. For these projects, the designer often has the liberty of designing the highway to meet the most desirable and stringent criteria possible. Therefore, exceptions to these criteria should be relatively rare. However, the geometric design of projects on existing highways must be viewed from a different perspective. These projects are often initiated for reasons other than geometric design deficiencies (e.g., pavement deterioration), and they often must be designed within restrictive right-of-way, financial and environmental constraints. Therefore, the design criteria for new construction are often not attainable without major and, frequently, unacceptable adverse impacts. At the same time, however, the Department must take the opportunity to make cost-effective, practical improvements to the geometric design of existing highways and streets.

In recognition of these problems, FHWA published the June 10, 1982 Final Rule in the Federal Register which provided State DOT’s with the flexibility to adopt reduced geometric design criteria for 3R non-freeway projects when compared to the Green Book. TRB Special Report 214 Designing Safer Roads; Practices for
Resurfacing, Restoration and Rehabilitation provided reduced numerical values for the following geometric design elements:

- Lane and shoulder widths.
- Horizontal curvature and super-elevation.
- Vertical curvature.
- Bridge width.
- Side slopes.
- Pavement cross slopes.

The development of 3R criteria for non-freeways provides a State with the opportunity to document a geometric design improvement level which is commensurate with the overall objectives of a State’s highway construction program and its financial resources. In addition to the design elements in SR 214, a State may develop revised 3R criteria for many other design elements, including:

- Sag vertical curves.
- Clear zones.
- Vertical clearances.
- Level of service.
- Maximum grades.
- Design forecast year.
- Design speed.
- Intersection sight distance.

2. **Recommendation: Develop and adopt separate geometric design criteria for 3R non-freeway projects.**

Based on the Department’s response to the Report/Questionnaire, UDOT has not yet exercised the opportunity to develop and adopt separate geometric design criteria for 3R non-freeway projects. This provides UDOT’s best opportunity to document and implement geometric design and roadside safety criteria based on the Project Scope of Work (i.e., new construction, reconstruction or 3R) to maximize the benefits to the traveling public from the State’s overall highway program. Therefore, it is recommended that UDOT exercise this opportunity and develop geometric design criteria for 3R non-freeway projects. The overall objective of the
Department’s criteria should be to fulfill the requirements of the FHWA regulation which governs the 3R program. These objectives may be summarized as follows:

- 3R projects are intended to extend the service life of the existing facility and to return its features to a condition of structural or functional adequacy.
- 3R projects are intended to enhance highway safety.
- 3R projects are intended to incorporate cost-effective, practical improvements to the geometric design of the existing facility.

G. Preparation of a Road Design Manual

1. Finding

Based on our discussions with the Department, UDOT does not have a current, comprehensive documentation of its road design practices and policies. Virtually all of the 50 State DOT’s have recognized the importance of developing a road design manual although, at any given moment, there is a wide disparity among the State DOT’s in their manual documentation considering:

- The comprehensiveness and quality of the manuals’ coverage.
- The currentness of the information within the manual.

The more important benefits of a road design manual include:

- State-Specific Criteria. A State DOT needs a document which tailors the engineering and administrative criteria specifically to the needs of the State. The literature on road design issues, of course, includes publications which have gained national prominence. These have been published by the American Association of Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), the Transportation Research Board (TRB) and the Institute of Transportation Engineers (ITE). Specifically, two national publications have special significance:
  - AASHTO A Policy on Geometric Design of Highways and Streets, and
  - AASHTO Roadside Design Guide.

Other relevant national publications may include the Highway Capacity Manual, the Model Drainage Manual, and the regulations promulgated to meet the transportation-related requirements of the Americans with Disabilities Act.

Any State DOT must be sensitive to and evaluate the criteria in the national publications. They typically represent the collective judgment and consensus
opinion on the "best" approach, and these publications may also be scrutinized during any litigation action. Therefore, the national publications provide a logical starting point from which a State may develop and adopt its own criteria. However, the criteria in the national publications are often intended to apply to a wide range of conditions. By necessity, then, a national policy cannot address all conditions and account for all factors. Therefore, most States desire to develop road design criteria which are tailored to the prevalent conditions, practices and policies within the State. In addition, the national publications may not clearly address some criteria or, in some cases, do not address some important elements at all. The preparation of a State road design manual can address these weaknesses.

• **Operational Procedures.** One major objective of a road design manual may be to document a State DOT’s in-house operational procedures. Quite naturally, these practices are unique to the State, and a State's own manual offers the best opportunity to document its internal operations. Therefore, the documentation in a road design manual may emphasize treatments such as organizational responsibilities, the road design process, preparation of plans, quantity estimates, cost estimates and, in general, the flow of paperwork through the Road Design Section.

• **Research.** The research literature in road design can advantageously supplement both the guidelines in the national publications and State-developed practices. However, the day-to-day designer often does not have convenient access to the information in the literature. Therefore, one of the objectives of a road design manual may be to extract valuable information from research and insert it into the manual, where practical. If this is not practical, the research may be referenced.

One applicable example is truck-climbing lanes. Two relevant research publications are:

- *Methods for Predicting Truck Speed Loss on Grades*, FHWA/RD-86/059;
  and


The two reports concluded that the existing AASHTO critical-length-of-grade (CLG) criteria are too conservative; i.e., the CLG is exceeded too frequently and, therefore, the threshold for conducting a detailed capacity analysis is not cost effective. A State DOT may ultimately reject the findings from the two reports but, during manual preparation, it will have had at least an opportunity to consider these criteria.

• **Metrication.** The Omnibus Trade and Competitiveness Act of 1988 required that all Federal agencies develop a Metric Conversion Plan by FY92. The FHWA published its Plan in April 1991, which required that all Federal-aid construction
contracts be in metric by October 1, 1996. This deadline has been extended to October 1, 2000 by the National Highway System Designation Act of 1995. The preparation of a road design manual provides an opportunity to clearly identify a State DOT’s metric conventions. This may be especially important in, for example, the preparation of plans (e.g., plan and profile scales).

- **3R Non-Freeway Projects.** As discussed in Section III.F. of this Focus Area, the development of geometric design criteria for 3R non-freeway projects would likely be a major objective in the preparation of a road design manual.

- **Training.** A road design manual can serve as an important training tool for new Department employees. Any Unit within a State DOT will experience a certain amount of personnel turnover and advancement. Personnel new to a given assignment need clear documentation to answer their questions and provide them with a head start towards understanding job activities and responsibilities. This objective could be met in a road design manual.

- **Consultants.** Many State DOT’s, including UDOT, use outside consultants for a significant percentage of their road design projects. UDOT has indicated that a lack of clear, comprehensive guidance to its consultants has created problems and inefficiencies. Well-documented technical and procedural criteria can assist project development and reduce the State’s time in contract administration. This will lead to a better quality of work and fewer requests for additional funds.

- **Flexibility.** A road design manual must find the proper balance between ensuring that acceptable practices are followed, but allowing for some degree of divergence when this is justified. Therefore, one objective of a road design manual would be to provide reasonable flexibility for the Department.

- **Interaction with Preconstruction Management.** Often, problems in preconstruction management may be traced to deficiencies in a State’s documentation of its technical and/or procedural criteria. This may also result in a significant number of change orders which are necessary during construction. Therefore, a well-defined road design process and road design manual should help increase the efficiency and productivity within preconstruction management.

2. **Recommendation: Develop a comprehensive Utah Road Design Manual.**

Based on our experience, UDOT will realize significant benefits from a Road Design Manual tailored to the prevalent practices within the State. This should be a cost-effective expenditure of the Department’s highway funds.
VIII. Electronic Bid Proposal/Package Automation

A. Focus Area Overview

The purpose of this focus area is to determine the feasibility of providing the bid proposal package to prospective bidders in an electronic format. The primary business problem perceived by UDOT is that the current manual process of assembling and printing the bid proposal/package is time-consuming and costly. This focus area analysis includes a description of the current process and the proposed change, an analysis of the feasibility of making that change, and summary recommendations. Information was gathered from interviews with department subject matter experts and UDOT contractors; an analysis of procedures manuals, bid packages, proposals, and designs; and a survey of other state departments of transportation.

B. Current Process

The current process adheres closely to the methodology outlined in the 08-1 procedure document. The bid package is assembled by the Plans and Contracts Specialist during the assemble final plan set process (Activity #85P). The components of the package include traffic and structure drawings, right-of-way and utility certificates, the R-709 (authorization to advertise the job), and the engineer’s assessment report. The Plans and Contracts Specialist organizes and formats this mixture of electronic files and paper documents to create the final bid package. He sends the paper-based bid package to the printers who create copies for advertising (Activity #90P) to distribute to bidders. The plans desk distributes subsequent addenda to prospective contractors.

In a parallel process, some of the bid package documents are published on the Internet as browsable or downloadable files. The specifications book is available in both metric and English versions as a downloadable file. The metric version can also be accessed online by web browser. The project manual and bid proposal booklets are distributed only in paper format. At this time, all contractual documents are transmitted by paper media.

C. Proposed Change Evaluated

The proposed change evaluated is to modify the current final plan assembly and advertising processes. The Plans and Contracts Specialist would compile an electronic version of the specifications book and project manual to submit to Advertising. Advertising would distribute these documents to prospective bidders via electronic mail, web page browsing, and/or file download. Any addenda to these documents would be distributed in a similar manner. This change would greatly reduce the amount of printing
and duplication required, and it would also reduce the time necessary for contractors to receive important bid documents.

In a separate but related effort, UDOT is considering the implementation of an electronic bidding process to replace the current paper-based system. This new system would provide the capability for bidders to submit electronic bids to UDOT. Since the bid proposal/package is one of the inputs to this bidding system, its format will need to be compliant with the requirements of the new system. Any proposed changes to that format will need to be examined within the context of the electronic bidding project.

D. Feasibility Study

The pros and cons of implementing an electronic bid package and project manual are listed in Exhibit VIII-1 (below).

Exhibit VIII-1

Advantages and Disadvantages of Electronic Bid Package and Project Manual

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.a Printing and distribution cost savings, especially on large packages</td>
<td>2.a Security issues—data could be altered</td>
</tr>
<tr>
<td>1.b Prospective bidders have faster access to bid packages and addenda</td>
<td>2.b Difficult to proof electronic version for errors, formatting problems</td>
</tr>
<tr>
<td>1.c Inexpensive to implement, minor impact on current procedures</td>
<td>2.c Signatures required on some documents</td>
</tr>
<tr>
<td>1.d UDOT has provided electronic bid packages in the past</td>
<td>2.d Printing costs are transferred to prospective bidders</td>
</tr>
</tbody>
</table>

1. Advantages

a. Printing and distribution cost savings—especially on large packages

Currently, UDOT incurs all of the costs associated with printing and distributing the many paper bid documents required for each project. These expenses can be substantial, especially on large projects which have volumes of design documentation and many bidders who want multiple copies. These print costs would be saved by distributing the bid packages on floppy diskettes
or by file download. The contractor would be responsible for the costs of any subsequent diskette duplication or printing of the electronic files.

b. **Prospective bidders have faster access to bid packages and addenda**

Distribution of an electronic bid package would skip the time-consuming printing and mailing processes. This change would greatly reduce the elapsed time between contract request of the document and receipt. Changes to the bid package would also be delivered to the prospective contractors much more quickly in electronic format. This would allow bidders more time to respond to the original bid package and any subsequent amendments.

c. **Inexpensive to implement, minor impact on current procedures**

Changing the bid package distribution procedure would be a minor change requiring no new equipment, personnel, or training. The cost to implement the change would be minimal.

This change would not significantly alter the effort or time required to assemble the final plan set and advertise the project. The change would be a small procedural one requiring no additional training.

d. **UDOT has provided electronic bid packages in the past**

The Department has provided bid packages on electronic media in the past—the I-15 project. This was done to save the substantial printing costs associated with a huge bid package. UDOT was successful in the one instance where it published the bid package on diskette, so it would presumably have little trouble adopting the procedure for all bid packages.

2. **Disadvantages**

a. **Security issues—data could be altered**

Data stored on diskette can be more easily altered without trace than printed media. This lack of security heightens the risk that the contracted work will not be the same as the original design created by the Department. Vendors could conceivably alter the contract documents and designs.
b. **Difficult to proof electronic version for errors, formatting problems**

Electronic files are more difficult to quality control than printed documents. Creation and approval of a single master document on paper with subsequent copying is a simple, straightforward process. The transmission of an electronic file by any media creates a risk that the wrong file will be sent, a file might be corrupted or incomplete, or a file may be imported with errors in formatting or content into the contractor’s software. The present lack of Internet standards makes it impossible for UDOT to ensure that the images viewed by bidders are identical to those published the Department.

c. **Signatures required on some documents**

The electronic transmission of documents that are legally binding raises the problem of affixing a legal signature to the contract. The electronic signature is one solution to this problem, but it greatly increases the level of complexity in the process. Implementing a system of secure electronic signatures is a costly endeavor, and electronic signatures are not considered legally binding on certain types of documents. The implementation of the electronic bid package would probably require a separate package of printed documents for required signatures.

d. **Printing costs are transferred to prospective bidders**

For many of the reasons above, prospective bidders need to have hard copies of the bid package for internal distribution. Even if the Department distributed electronic files, each bidder would still incur printing costs which they would pass right back to the Department in their bids. In addition, printing out the bid package from an electronic file adds one more step to the process where errors can arise.

E. **Practices in Other State Departments of Transportation**

A survey of 12 state departments of transportation (Connecticut, Florida, Illinois, Kentucky, Massachusetts, Michigan, Nevada, North Carolina, Tennessee, Vermont, Virginia, and Washington) has shown that the distribution of electronic bid packages to contractors is not a standard practice. Of these states, only Massachusetts provides the documents in electronic format, and that state gives them only to the successful bidder. In all cases, bidding documents are still distributed in hard copy. Although the practices in other states do not directly impact upon UDOT, it is important to know what they are doing to make their contracts more attractive to prospective bidders. At this time, little effort has been made in other states to automate the bidding process.
F. Recommendations

1. Delay implementation of an electronic bid proposal/package until it can be part of a comprehensive electronic bidding program.

The implementation of an electronic specifications book and project manual in the bid process would provide small but measurable benefits for little cost or risk. Typical projects would see only a minor costs savings to the Department, with these costs being transferred to prospective bidders. Contractors would gain some advantage from having an electronic copy of the documents but would still need to rely mainly on printed copy. The need for systems to handle electronic signatures and the Microstation file format would increase the complexity and cost associated with the bid process for the Department and for contractors.

2. Electronic versions of the specifications book and project manual should only be produced for very large projects that would otherwise incur high printing costs.

Automating this process should be part of any project to automate the entire bidding process. It is not justified on its own.
Utah Department of Transportation

Appendices to the Design Process Performance Audit

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- Appendix VI: Utility and Railroad Agreement Process
- Appendix VII: Roadway Design Standards
Appendices for the Design Process Performance Audit

Introduction

The following documents provide the background materials for the performance audit of Utah Department of Transportation’s design process. The performance audit report is under separate cover. The appendices contain the following:

Appendix I: Materials Used in All Focus Area Performance Audits

This appendix contains a listing of UDOT documents and data sources that were used in all focus areas. It also provides copies of all working papers that were developed to support the entire audit process rather than audits of individual focus areas.

Appendix II: Overview Assessment

This appendix contains:

- A listing of interviewees.
- A listing of reference and source documents.
- Copies of all working papers that were developed to support the audit of the overall design process.

Appendices III-VII follow the same structure as Appendix B. They address the following focus areas:

Appendix III: Design Review Process

Appendix IV: Environmental Review and Permitting Process

Appendix V: Right-of-way Clearance

Appendix VI: Utility and Railroad Agreement Processes

Appendix VII: Roadway Design Standards
Appendix I: Materials Used in All Focus Area Performance Audits

A. References and Source Documents

Sample data from PPMS for 67 projects advertised between October 1, 1996 and June 2, 1997.

“08-1 Procedures Document”, UDOT’s “white book” documenting design process activities and procedures, June 1, 1995.

B. Working Papers


- “General Questions on Design Process Activities,” interview guide used for all workgroup meetings to ensure consistency, July, 1997. (Copy provided.)
Appendix II: Assessment of Entire Design Process

A. Interviewees

Ken Adair, Region 4
Clark Mackay, Region 4
Robert Dowell, Region 4
Randy Lamoreaux, Project Management Director
Jim McConnell, Cedar District
Lynn Zollinger, Chief Environmental Engineer, UDOT Environmental Division
Denis Stuhff, Region 1
Bruce Swenson, Region 1
Phillip Huff, Region 3
Barry Axelrod, UDOT Engineering Services
Jack Storey, Advertising Review Engineer, UDOT Engineering Services
Blaine Bailey, Contracts/Estimates Manager, UDOT Construction Division
Randy Park, Region 2 Design Engineer
Andrew Gemperline, Region 2
Tom Smith, UDOT, Construction Engineer
Robert Fox, Right-of-Way
P.K. Mohanty, Preconstruction Engineer, UDOT
Ahmad Jaber, Region 3
Orlando Jerez, UDOT Utilities and Railroad Relocation Unit
Judy Jaramillo, UDOT, Consultant Services Manager
Boyd Wheeler, Engineer Manager, UDOT Structures Division
Roy Nelson, Federal Highway Administration, Field Operations Engineer
William Gedris, Structural/Environmental Engineer, Federal Highway Administration
Richard Laubsch, Construction Engineer, Federal Highway Administration

B. References and Source Documents

“UDOT Departmental Initiatives”, finalized May 5, 1997. This document provides a synopsis of UDOT’s current management improvement initiatives.

Memorandum from Kim Schvaneveldt to UDOT Management, December 27, 1995 on “Changes to the Project Review Process”.

Letter to Tom Warne, Director, Utah Department of Transportation, from Associated General Contractors, April 15, 1997, addressing goals and objectives for the coming year.

“UDOT Strategic Direction-Fiscal Year 1998”.


C. Working Papers

• Charts measuring schedule, scope, budget, quality, and other issues affecting the overall design process. (Copy provided.)

• Spreadsheet analysis of schedule and budget issues, by project. Included examination and comparison of engineer’s estimated project costs, target project completion dates, and estimated and actual project and duration and budget measurements for 67 projects advertised between October 1, 1996 and June 2, 1997. Information used was gathered from PPMS.

• Spreadsheet analysis of personnel and time utilization issues, by function, region, and position classification. Included examination and comparison of preconstruction staff time in current positions, vacancies, and hours dedicated to project/non-project and training for preconstruction personnel employed as of May 17, 1997 and hours logged between July 4, 1996 and May 30, 1996. Information used was gathered from PPMS and the UDOT Personnel Division.

• Spreadsheet analysis of addenda. Included comparison and examination of special provisions, such as limitations of operations, change in bidder schedules, etc. for 67 projects advertised between October 1, 1996 and June 2, 1997. Information used was gathered from PPMS and the UDOT Engineering Services Department.

• Spreadsheet analysis of individual 08-1 activities, by focus area. Included comparison and examination of occurrence of individual activity codes, consultant involvement, and projected and actual schedule and budget measurements for 67 projects advertised between October 1, 1996 and June 2, 1997. Information used was gathered from PPMS.
• “Performance Audit of the Design Process, Interview Guide” distributed to overview assessment interviewees prior to interview.

• “Summary of Design Issues from Interviews Conducted for the Project Manager Project” internal audit team working document.

• “Measures for Design Process Review” document includes internal working questions used in the overview assessment.

• Data analysis of consultant contract totals and survey of consultant managers provided by Judy Jaramillo, UDOT Consultant Services Manager, June 10, 1997.
Appendix III: Design Review Process

A. Interviewees

Verne Wilde, Project Management Administration
Andrew Gemperline, Region 2
Jack Storey, Advertising Review Engineer, UDOT Engineering Services
Farrell Wright, UDOT Engineering Services Division
Ron Rasmussen, UDOT Hydraulics Division
Jerry Stone, UDOT Personnel Division
Gordon Maestras, UDOT Program Development
Boyd Wheeler, Engineering Manager, UDOT Structures Division
Rodney Terry, Preconstruction Engineer, Region 1
Dan Knowlden, Region 3

B. References and Source Documents

“Changes to the Project Review Process,” a December 27, 1995 memorandum from Kim Schvaneveldt to UDOT management. (See Appendix II.)

C. Working Papers

- “Process Diagrams for Design Review Activities,” to facilitate the work group discussion on the current use of 08-1 and develop potential improvements, July, 1997. (Copy provided.)

- “Detailed Questions on Design Review Activities,” list of questions specific to the focus area, ensuring that all critical issues are identified and discussed, July, 1997. (Copy provided.)

- “Budget Hours and Duration Days Overage Total for Review Activities” chart. This chart details the number of budget hours exceeded and the number of duration days exceeded for review activities within 67 projects advertised between October 1, 1996, and June 2, 1997. (Copy provided.)
“Analysis of Review-related Activities” chart. This chart outlines the number of times review activities were triggered in PPMS and the level of consultant involvement for 67 projects advertised between October 1, 1996, and June 2, 1997. (Copy provided.)
Appendix IV: Environmental Review and Permitting Process

A. Interviewees

Verne Wilde, Project Management Administration
Lorraine Richards, UDOT Environmental Division
Jerry Chaney, UDOT Environmental Division
Robert Dowell, Region 4
Lynn Zollinger, Chief Environmental Engineer, UDOT Environmental Division
Jerry Stone, UDOT Personnel Division
Rodney Terry, Preconstruction Engineer, Region 1

B. References and Source Documents

Environmental classification of 67 projects by UDOT Environmental Division staff.
Sample data from UDOT Environmental Division files.
Sampling of (available) environmental document return rates and “4f” classification for 67 projects.
Notes on November, 1994 UDOT Engineering Conference entitled “Understanding the Environmental Process.”
“Environmental Process Flowcharts” created by the UDOT Environmental Division.
“1997 Performance Plan” for the Chief Review Engineer.
Selected NEPA, U.S. Fish and Wildlife Service, and FHWA guidelines and statutes.

C. Working Papers

• “Process Diagrams for Environmental Activities,” to facilitate the workgroup discussion on current use of 08-1 and develop potential improvements, July, 1997. (Copy provided.)

• “Detailed Questions on Environmental Activities,” list of questions specific to the focus area, ensuring that all critical issues are identified and discussed, July, 1997. (Copy provided.)

• “Budget Hours and Duration Days Overage Total for Environmental Activities” chart. This chart outlines the number of times environmental activities were triggered in PPMS and the level of consultant involvement for 67 projects advertised between October 1, 1996, and June 2, 1997. (Copy provided.)

• “Analysis of Environment-related Activities” chart. This chart outlines the number of times environmental articles were triggered in PPMS and the level of consultant involvement for 67 projects advertised between October 1, 1996, and June 2, 1997. (Copy provided.)
Appendix V: Right-of-Way Clearance

A. Interviewees

Bob Fox, Chief, UDOT Right-of-Way Division
Verne Wilde, Project Management Administration
Jim Baird, UDOT Right-of-Way Division
Craig Fox, Property Management, Relocation, UDOT Right-of-Way Division
Dan Knowlden, Region 3, Project Design Engineer
Jack Lyman, Region 3, Right-of-Way Engineer
LaMar Mabey, Appraisal, UDOT Right-of-Way Division
Dave West, Acquisition, UDOT Right-of-Way Division

B. References and Source Documents

Sample data for all current projects from the right-of-way database maintained by the ROW division.

“ROW Certification Time Frame”, a chart prepared by the ROW division to lay out the time requirements for each step of ROW acquisition carried out by the division.


C. Working Papers

- “Process Diagrams for Right-of-Way Related Activities,” to facilitate the workgroup discussion on current use of 08-1 and develop potential improvements, July, 1997. (Copy provided.)
• “Detailed Questions on Right-of-Way Related Activities,” list of questions specific to
the focus area, ensuring that all critical issues are identified and discussed, July, 1997.
(Copy provided.)

• “Percent of Projects with Hours for Concept Stage Activities”, chart. It should be
noted that some of the projects contained in the sample have only incomplete data
because some activities were already completed when the project was entered into
PPMS. (Copy provided.)

• “Comparison of ROW Database and PPMS Information for Sample Projects”, chart.
The chart illustrates the differences in the data available to ROW division staff and
region project design and ROW engineers, respectively. It also shows that the projects
with more that 50 parcels and submittal of multiple packages were those that caused
scheduling problems. (Copy provided.)

• “Responsibilities for Development and Review of ROW Materials Submitted to the
ROW Division: Impact on Conformity Review”, chart. This chart shows charges to
projects for which the ROW division carried out a conformity review. The amount of
time charged for conformity review and, in particular, time spent in excess of
budgeted hours can serve as a measure of quality for the ROW materials submitted
for conformity review. On that basis, the data substantiate the ROW division’s
concern about the quality of ROW work prepared by consultant design engineers.
They also support ROW division comments about a lack of quality control with
regard to ROW materials in the regions. (Copy provided.)
Appendix VI: Utility and Railroad Agreement Processes

A. Interviewees

Orlando Jerez, UDOT Utilities and Railroad Relocation Unit
Verne Wilde, Project Management Administration
Randy Park, Region 2, Project Design Engineer
P.K. Mohanty, Preconstruction Engineer, UDOT
Cliff Larsen, UDOT Utilities and Railroad Relocation Unit
Mike Arambula, UDOT Utilities and Railroad Relocation Unit

B. References and Source Documents

Sample data from the utilities and railroad database.


Draft of “Project Certification Check List for Utilities and Railroads”, proposed by the Utilities and Railroad Relocation Unit, March 17, 1997.

C. Working Papers

- “Process Diagrams for Utilities and Railroad Related Activities,” to facilitate the workgroup discussion on current use of 08-1 and develop potential improvements, July, 1997. (Copy provided.)

- “Detailed Questions on Utilities and Railroad Related Activities,” list of questions specific to the focus area, ensuring that all critical issues are identified and discussed, July, 1997. (Copy provided.)
Appendix VII: Roadway Design Standards

In June 1997, a Report/Questionnaire was submitted to the Utah Department of Transportation to identify any variances between UDOT geometric design criteria and the AASHTO *A Policy on Geometric Design of Highways and Streets*. The Report/Questionnaire also addressed several other relevant issues. In July 1997, UDOT submitted its completed Questionnaire, which has been used to develop recommendations for the Department's evaluation. This Appendix reproduces the Report/Questionnaire with the UDOT responses.