COMPUTER MEDIATED DECISION MAKING PHASE II

FINAL REPORT
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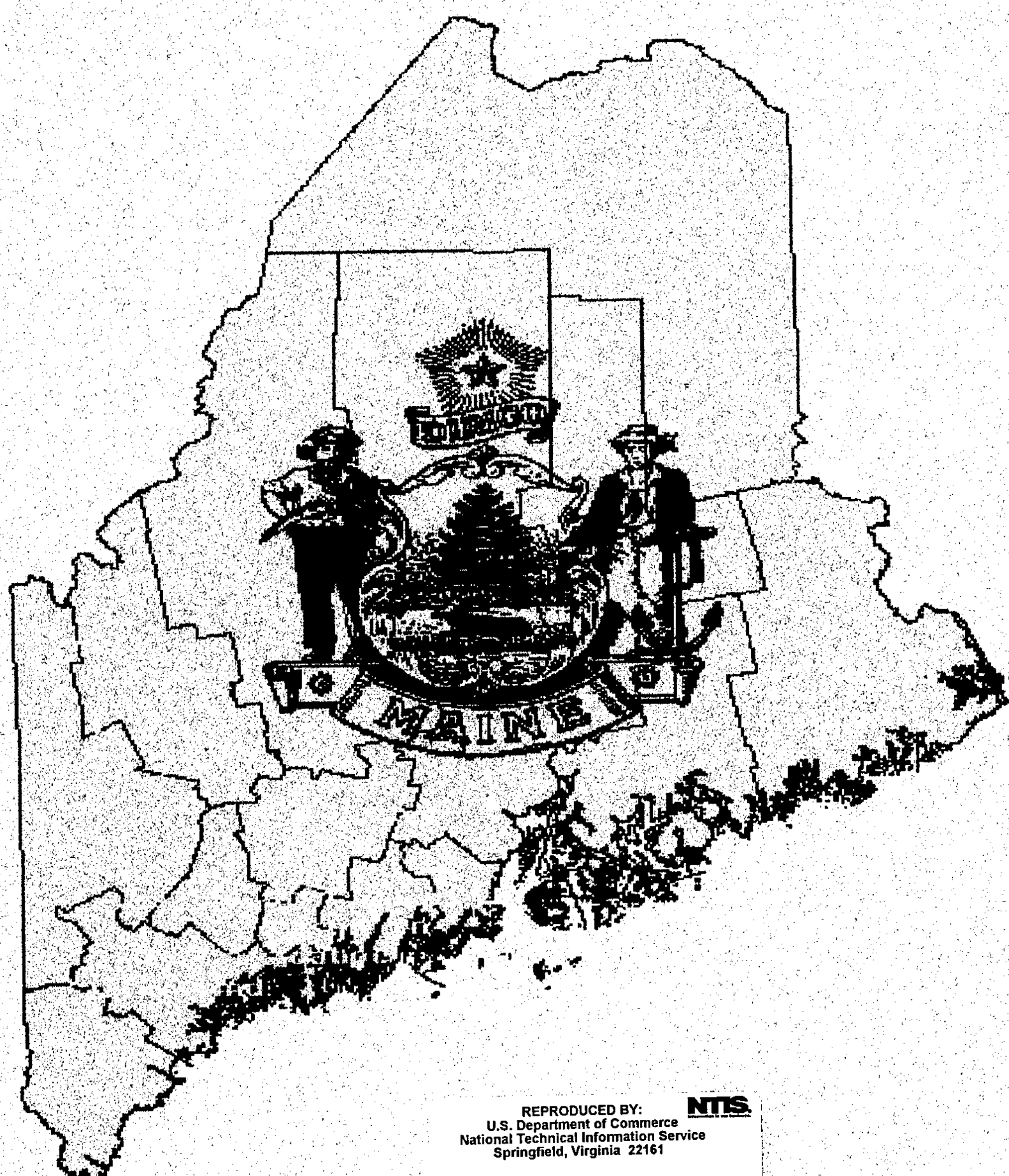
Research



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The presentation of highly technical information during the public phases of complex design projects is often complicated by the participants inability to understand the terminology and interpret the material provided.

The research was undertaken as a follow-up to a previous research study designed to review computer-based technologies that could be used to improve the public phases of design projects. A pilot project was developed to implement one or more of the technologies reviewed in the initial research effort and evaluate their effectiveness in presenting transportation design projects.

A project was selected in Camden, Maine and appropriate materials were prepared for use in a public meeting. An assessment was conducted with the participants during and after the public meeting to determine the effectiveness of the technologies. In addition, personnel from MDOT were interviewed to determine their perception regarding the use of the technologies.

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COMPUTER-MEDIATED DECISION MAKING
PHASE II

FINAL REPORT

February, 1999

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of Maine Department of Transportation. This report does not constitute a standard, a specification, or a regulation.

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EXECUTIVE SUMMARY

The presentation of highly technical information during the public phases of complex design projects is often complicated by the participants inability to understand the terminology and interpret the materials provided. The increasing demand to have public input as part of transportation projects makes it more important to find ways in which engineers and designers can effectively communicate with individuals that may not possess the technical knowledge to understand some of what is being presented. In presenting a proposed design in a public forum, it is hoped that individuals expressing concern about a design are basing that concern on a legitimate issue and not on a lack of understanding or an inaccurate interpretation of the information presented.

The research was undertaken as a follow-up to a previous research study designed to review computer-based technologies that could be used to improve the public phases of design projects. A pilot project was developed to implement one or more of the technologies reviewed in the initial research effort and evaluate their effectiveness in presenting transportation design projects.

The study was intended to look at using one or more computer-based technologies in an actual project being undertaken by the Maine Department of Transportation (MDOT). A project was selected in Camden, Maine and appropriate materials were prepared for use in a public meeting. An assessment was conducted with the participants during and after the public meeting to determine the effectiveness of the technologies. In addition, personnel from MDOT were interviewed to determine their perception regarding the use of the technologies.

The following conclusions were derived from the research study:

- The use of computer renderings showing existing and proposed views of design projects was rated positively by participants in a public meeting. The desirability of using the renderings was supported by both public participants and personnel from the MDOT.

- Computer renderings appear to enhance the public's understanding of the projects, but they need to be closely associated with other traditional presentation tools such as engineering drawings.

- Computer renderings appear to be effective in showing projects that do not possess significant changes in position, grade, or other extensive impacts. Participants may be equally interested in what is not being done as a result of a proposed design.

- The most appropriate photographs and computer renderings appear to depict views taken with a normal focal length lense at heights below 30 feet. The use of camera lenses other than normal (longer or shorter than normal) may result in distortions that result in a false impression of the actual distance and width being depicted. Photographs taken at heights of 30 feet may also result in a false sense of slope on those scenes that include significant change in slope. In addition, the distance between the camera and target points used to align the scene must be selected to allow the photographer to accurately locate on the target point.

- Ongoing changes in computer hardware and software are reducing the technological barriers to using computer-based tools as part of the execution of a transportation project in terms of internal and public participation activities. The use of such technology may become less dictated by the physical tools and increasingly influenced by process and public policy issues

- MDOT currently has many of the computer hardware and software components that could be used to prepare computer renderings for the public phases of projects.

- MDOT personnel appear to have a desire to find tools that can assist in the public participation phases of a project.

- MDOT needs to develop an implementation strategy to determine how the computer-based visualization tools can be integrated into the project workflow. Such an integration needs to determine how and to what extent the tools are used both internally and externally. Although there is evidence the tools are effective for even simple projects, MDOT must initially establish how such tools are used. Since the technology and the public's expectations are dynamic, the strategy needs to be frequently revisited.

The following are recommendations based on the research study process and outcome:

- Further experimentation is needed to determine the use of computer-enhanced tools in other settings and at other stages of design projects. The materials presented to the public in this study where used during later stages of the design phase of the project. Experimentation needs to assess the use and effectiveness of similar materials at early stages of the planning and design process. Experimentation should also be extended to other projects that incorporate more significant changes and alternative designs.

- The use of computer-enhanced visuals should be made available as a tool to use in the public participation phases of design projects. Such tools should be part of a "library" of tools available to MDOT personnel to use in public discussions, meetings, and hearings.

- The integration of improved visualization tools into the public participation process, and perhaps as importantly into the work flow of MDOT, needs to be explored in subsequent research efforts. Advances in computer technology, software, and communication services such as the Internet are impacting the quality, quantity, and timeliness of information available to the public. It is reasonable to assume that the public's demand for information delivered in a highly visual manner will continue to grow.

- Any MDOT implementation strategy for integrating computer-based visualization tools into the department's project workflow must consider using the technology early in the process. As the cost of using the technology continues to decline and the ease of use improves, use early in the process may prove to be highly effective in reducing public concerns and overall project cost .

RESEARCH PROPOSAL

Problem Statement

The public's participation in public works projects is becoming more complicated due to involvement of more people often possessing less of the technical knowledge needed to understand complex construction projects. The greater demand for public participation is a result of increased demands on the part of the public for information and legislative actions at various levels of government that mandate increased participation. Local citizens participating in the public phases of a project are often confused by the presentation of projects using highly technical drawings and plans. The lack of understanding raises a question about public participation: can one's opposition to a proposal be the result of not understanding the nature and extent of what is being proposed?

A more visually accessible presentation of a construction project needs to be made available to the public so informed decisions can be made.

An initial study, Computer-Mediated Decision Making, Phase I (1994) reviewed visualization and related tools available to assist in the public phases of design projects. The study revealed that a number of techniques were available from the simple extension of two-dimensional computer-aided drawings to the use of more complicated three-dimensional models overlaid with digital images. The study identified an approach consistent with MDOT capabilities that could be used to improve the public phases of a project.

Objective of the Study

The objective of the study was to select and study an approach to using computer visualization tools that could demonstrate the use of such technology in the public participation phases of a selected MDOT design project.

Of particular interest with regard to this project is the use of computer-based visualization tools to enhance the design and mediation processes that are part of any major highway or bridge project. Generally, the visualization tools are applied to models that are created as part of a design process. Realistic visualization relies on accurate information and representations of a design. The representations can then be enhanced to provide meaningful depictions of how the design may appear in its final form.

Background

The genesis of the study was the result of legislation such as the Sensible Transportation Act and Intermodal Surface Transportation Efficiency Act (1991). Such legislative action changed the way local and national transportation infrastructure is planned and funded. Of particular significance to this study was the mandate that called for informed public participation.

In December of 1994, the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) released an interim policy (FHWA,1994) on public transportation regarding transportation projects. The following are among the stated objectives that these two organizations committed to:

- Promoting an active role for the public in the development of transportation plans, programs and projects from the early stages of the planning process through detailed project development.

- Strongly encouraging planning and implementation agencies use of combinations of different public involvement techniques designed to meet the diverse needs of the general public.

- Carefully evaluating public involvement processes and procedures to assess their success at meeting the performance requirements specified in the appropriate regulations during joint certification reviews, metropolitan planning and conformity findings, State Transportation Improvement Program (STIP) approvals and project oversight.

While the use of computers was not specified as a means to reach the objectives, a study was undertaken in 1994 (Computer-Mediated Decision Making Final Report, 1994) to determine the feasibility of using computer-based technologies to assist in the public participation phase of design projects. The study investigated the extent to which computer-based technologies were being used in presenting proposed designs during public phases of transportation projects.

In addition to a review of technologies, the 1994 research effort set up an experimental study to assess the effectiveness of using selected technologies. A recent construction project of the MDOT was used as part the experimental study. The experimental group was comprised of graduate students enrolled in a University of Southern Maine Masters in Public Administration class. The class was divided in to two groups. One group was presented the proposed highway project in a manner similar to that used by MDOT in regular public hearings. Participants were presented the same materials as those used in an actual public meeting. The second group saw the same materials with the addition of several computer-aided presentation materials, including a series of computer renderings and computer displayed maps.

Although limited in scope, the results of the study showed the value of using the computer enhanced presentation methods in presenting construction projects. Site details, such as a change in height, were more clearly identified by the group that had the benefit of the computer images.

The findings of the 1994 study were:

- The technology existed at the time of the study supporting the use of computers as part of the public participation phases of projects to improve overall visualization of proposed designs.

- There was clear[illegible]han one strategy for using computers as part of the public participation aspects that could prove beneficial to both the MDOT and the public.

- MDOT currently had many computer hardware and software components that could be used as part of the public participation phase. Although some components existed at the time of the study, additional resources were needed to implement several of the scenarios presented.

- It was concluded that the effective use of visualization tools required an expanded use of three-dimensional modeling as part of the department's design process.

- There appeared to be a strong commitment to improving the public participation aspects of the design process.

Several recommendations resulted from the phase one study.

- A pilot project should be selected that would allow the careful analysis of appropriate technologies and their resulting cost and benefit.

- A technology should be matched with the selected project that will enhance the public interface part of the project. The technology chosen should be currently available in the marketplace.

- Both the project selected and the technology chosen should result in a pilot program that can be implemented within existing project budgets.

Computer-Mediated Decision Making Phase II was designed to study the effectiveness of using reviewed technologies as part of a selected MDOT design project.

Benefits

The benefits for phase two remain consistent with those of phase one. A more effective method for transmitting technical information on projects to the public result in an improved decision making process. The improvements should be beneficial to both the public and the MDOT in providing for the exchange of more meaningful information that should reduce costs associated with less effective communication.

Work Plan
The Phase II proposal's work plan specified four major tasks for the study. The tasks included:

Task 1: A matrix of technologies was presented as a result of research undertaking as part of phase one efforts. The matrix displayed choices from simple to complex and from inexpensive to expensive. The technology most consistent with current and future MDOT plans will be chosen for evaluation in this phase. The technologies that look the most promising from a cost benefit standpoint will be presented to a group of MDOT public meeting experts for review. The methods which remain viable after review by the group will be developed and utilized in a demonstration project.

Task 2· Current MODT projects will be reviewed as possible candidates for a demonstration of the chosen technology. It will be important to select a project that both demonstrates the usefulness of the technique as well as the public participation The project should show enough change at the site to demonstrate the technology. It may be a small highway or bridge project.

Task 3: A presentation will be developed using the new technology, incorporating models created by MDOT, as well as current approaches. A survey will be conducted that assesses the effectiveness of the change in presentation.

Task 4: A parallel activity will be an assessment of advanced computer graphic technology for implementation by MDOT. The time frame for this implementation is two to five years. The final report from this phase will include a plan for the implementation of a pilot project that features advanced technology and a more complicated MDOT project as well as the results of efforts using current technology.

Definition of Terms
The following terms were defined to clarify their use in the context of this study:

Animation: Animation is the ability to display images in rapid succession to create the illusion of motion. This technique allows the viewer to not only see how the design appears, but to also experience how it may appear if one was traveling on a highway or crossing a bridge.

ARAN: A video system used by the MDOT to video tape roadways. The system uses a series of video cameras mounted on a van that records views of the roadway while the van is traveling.

Computer-Aided Design: This term emphasizes the use of computer hardware and software as part of the entire design process including design, development, and evaluation. Computer-aided design is used to either supplement or replace traditional drawing, drafting and design tools. The technology provides two-dimensional drafting and three-dimensional modeling capabilities that permit it to be used at all stages of the design process.

Coordinate Position: A coordinate position represents a particular location in three-dimensional space. Although the position can be defined in a number of ways, it is often specified in terms of three points (x, y, and z). The three points can represent an absolute distance along three mutually perpendicular planes from a specified origin (0,0,0).

Design Process: In terms of this study, the activity undertaken to develop plans outlining the main features of a proposed project. In its totality, it would include all design activities from initial idea to completed project.

MOSS: A civil engineering software package designed for use in 3-D modeling of land surfaces, both existing and new. MOSS® is one of the software packages currently being used by the MDOT.

Raster Images: Computer images can be categorized as either vector or raster images. Items that are displayed as vector images, such as MOSS® models, are stored as mathematical representation of the image (lines, circles, curves, polygons, etc.). Raster images are stored as individual picture elements (pixels) such as those displayed on the computer's monitor or raster. Digital photographs are typically raster images.

Rendering: Rendering refers to display techniques applied to computer models that control how the models appear to the viewer.

Virtual Reality: The most advanced form of computer interaction proposes that the actual way in which the viewer "journeys" through a design would be primarily controlled by the viewer.

Visualization: In terms of this study, visualization refers to the variety of techniques used to display proposed plans in a manner that assists in interpreting how a design should appear in its completed state. Computer hardware and software may assist in that visualization by creating "lifelike" models of plans that have varying degrees of realism.

RESEARCH

Introduction

The primary emphasis of this research effort was to select and implement a demonstration site that could be used to test the use and effectiveness of one or more of the technologies assessed as part of the phase one research. Although the use of the technology was demonstrated in phase one with an experimental group, the task of this phase was to study the preparation, implementation, and impact the technology as it applies to the public phase of an actual MDOT project.

Technology Review

The first major task of the study was to assess those technologies presented as part of the phase one research for the purpose of determining those most appropriate to MDOT projects. The technology can be applied at various levels of sophistication. Generally, more sophisticated approaches result in an increasing demand on the physical (i.e. computer) and personnel (i.e. time) resources. The selection of an approach is a judgement based on the perceived benefits obtained at the various resource costs. A major objective of this study is to determine some of the benefits of using the technology in the public phases of a design project.

There are two aspects to visually presenting a computer-based model of a design. The first are the processes used to create design alternatives from available data. The second is how the designs are presented. Often, the two aspects are integrally linked. The available output options are often dictated by the process used to create the design. For example, two-dimensional information cannot be output as a three-dimensional representation without adding additional information.

The research team, MDOT design engineers, and members of the project panel reviewed several of the techniques presented in the phase one research and discussed those techniques most appropriate for use by MDOT in the public phases of design projects. The technologies can be categorized in three broadly defined categories:

- Drawing or overlaying two-dimensional images upon digitized maps, digitized photographs, or other digital images. Since the display and manipulation of two-dimensional images over raster "background" images tends to be less computationally intensive, it lends itself to the potential for "real-time" on-site manipulation of the images. Scenes may be output in the form of printed materials or slides (photographic or electronic).

- Creating and rendering three-dimensional models that are overlaid on digitized scenes of the actual construction site. This technique, often called photo matching, can be output as a series of still images either in the form of printed materials, slides, or videotape. The still images are often depicted in a "before and after" format showing the extent of change resulting from the proposed design.

- Creating, rendering, and animating three-dimensional models. The primary thrust of this approach is to provide the viewer with the sensation they are actually part of the design site. This format is generally displayed directly on the computer or output to video tape. The preparation of such realistic imagery is by current standards both highly computationally intensive and time consuming.

In all the above cases, there are several techniques for presentation of the visual images. The use of additional materials, such as maps, engineering drawings, video, and photographs can support the overall presentation. In addition, text and sound can be added to several of the approaches. The above described approaches and the supporting presentation techniques can be combined to create a multimedia presentation.

After a careful review of the approaches described, it was determined that still image renderings showing existing sites and proposed design would be the most appropriate for study. Extensive work had been done in transferring, manipulating, and rendering three-dimensional models created as part of the phase one study. MOSS® models created at the MDOT had successfully been integrated with digitized images of proposed construction sites in previous experiments. Those "composite" images proved to be successful in research conducted as part of 1994 phase one study. In addition, research had indicated that the use of still images by other state departments of transportation had proven to be successful. A list of observations and comments resulting from the review meeting are included in Appendix A.

Demonstration Site

This research project called for the use of the visualization tools in a pilot project that would include a public meeting. The research team and the review panel selected a site based on the following criteria:

- an active project with a scheduled public meeting.
- a project that could be photographed prior to winter.
- a location in the southern part of the state (travel distance issues).
- evidence of significant physical change in the proposed changes to the site.
- a project that is either a small highway or small bridge.
- a design that was being completed within MDOT (in-house).
- a design process that had available three-dimensional MOSS® files.

The group reviewed four potential projects:

- a downtown beautification and pedestrian safety project in Cape Elizabeth.
- an intersection improvement and widening in Westbrook.
- an intersection improvement and widening in Lewiston.
- a widening and addition of a sidewalk in Auburn.

The original site selected for the pilot project was Cape Elizabeth. Preliminary work for the pilot project was undertaken including several meetings with Bob Skehan, design engineer from MDOT, an historical review of project hearings and supporting data, a review of the ARAN video of the site, and photographing significant locations in the proposed design corridor. The photographs were digitized in preparation for overlaying the MOSS® models provided by MDOT.

In May of 1996, MDOT project advisory panel coordinator, Steve Abbott, halted work on the Cape Elizabeth pilot when decisions relating to project scope and funding delayed work on the Cape Elizabeth design. It was decided to locate possible candidates for a new pilot and make a selection during the summer of 1996. In August of 1996 a panel reviewed possible candidates to replace the Cape Elizabeth pilot project. Candidates reviewed included a section of Route 1 in Camden, Route 1 work proposed for the Lincolnville Beach area, and a roundabout project design for Gorham. Based on the nature of the project, proposed changes, and the work schedule, the review group selected the Lincolnville Beach Route 1 project for the demonstration project.

In September of 1996, the principle investigator coordinated with Roy Lord, from the highway design division of MDOT; Bob Skehan, MOSS® coordinator for MDOT; and Paul Guguere, photographer from the department, on acquiring photographs of the Lincolnville site to begin preparation of visuals depicting the proposed changes in the highway. As with previous efforts, the visualization tools, and thus the pilot project, relied on the availability of three-dimensional MOSS® models.

The on-site photographic sessions for the newly selected Lincolnville Beach Route 1 project took place on October of 1996. In preparation for the photographic session, camera and target points were selected and coordinate positions located for each position. Plan view drawings of the existing site, including the camera and target positions for the photographic session, were produced by Roy Lord. Photographs were taken by Paul Giguere at each of the six different camera locations. Each position was photographed at heights of 5, 10, 20, and 30 feet. In November, the photographs were scanned and electronically retouched to remove unwanted items (primarily vehicles and traffic control personnel) from the various scenes. In addition, Bob Skehan provided a MOSS® triangulation model of the existing road to use for alignment. The existing MOSS® model was aligned to several of the scenes to determine best process and most ideal elevations for viewing.

In February of 1997, Roy Lord indicated the completion of the Lincolnville Beach Route 1 project was in doubt. Several issues had arisen that put the project in jeopardy. In early March, Steve Abbott confirmed that the Lincolnville Beach project would likely be placed on hold. Steve consulted with others on the highway project and the research project panel members to determine how to proceed. Based on that consultation, it was decided that another pilot would be selected.

In March of 1997, a review panel met and selected an alternate design project for the proposed pilot project. The team selected the Route 1 Camden project as the new pilot project for use with the visualization tools. After meeting with MDOT personnel to determine appropriate camera and target points, photographs of the site were completed in May of 1997.

In January of 1998, Robert Skehan sent the MOSS® DXF (data exchange files) files for the design and the respective 3-D coordinates that were required to begin preparing renderings for the Camden project. The models were overlaid on the digitized photographic images that had been made of Camden. The completed renderings were then enhanced and mounted for presentation at a public meeting.

Photographing the Site

The composite images used in the study required photographs to be prepared for use as backgrounds for the proposed design changes. MOSS® models representing the design changes are electronically matched to the digitized background images. The models are then rendered over the background images providing a rough view of the modified site. The renderings are then "cleaned up" in an image editing software package prior to output for the public hearings.

Photographs represented significant areas of the project. Roy Lord was asked to identify sites he determined may be significant in terms of design or controversial in terms of public response. The selected sites were then photographed with a variety of camera lenses (24 mm, 50 mm, and 70 mm). Each location to be photographed was indicated by a camera point (where the camera was to be positioned) and a target point (where the camera was pointing). MDOT maintains all survey and design data points as an absolute coordinate position relative to a fixed point. The coordinate positions of the camera, target, and other reference points were used to calculate angle and distance allowing the resulting photographs to be accurately matched to the MOSS® model. With the assistance of an MDOT truck equipped with a lift bucket, the photographer photographed each target with each camera lense at approximately 5.5 feet (1.676 meters), 10 feet (3.048 meters), 20 feet (6.096 meters) and 30 feet (9.144 meters). The varying lens sizes and heights were to assist in determining those most appropriate to future use of the technology. The varying camera lenses and positions are depicted in Appendix B. The scenes in Appendix B represent those taken in Camden, Maine.

The principal investigator and design engineer reviewed the photographs and selected eleven views for inclusion in the study. The photographs selected were made with a variety of different camera lenses and at differing heights. Since two of the projects were delayed or canceled, three separate sites were photographed. Photographing three separate sites did yield some evidence with regard to the location of camera and target points. There were some increased difficulties in aligning the MOSS® models to the backgrounds for the Camden project over the other two sites photographed. In analyzing the sites, it appeared that the camera and target points used for Camden were generally at a greater distance apart. The greater distance may have increased the margin of error by making it more difficult for the photographer to precisely locate the camera center on the target.

As the study progressed, several conclusions were reached with respect to selecting appropriate views.

- It is important to try to have photographs that depict any view showing a significant change or that may be an issue during the public meetings.

- Views taken with other than a standard focal length lense may distort images that give a false impression of the actual change. This was evident at the public meeting when at least one individual thought one section of highway in one of the wide angle photographs (24 mm lens) was wider than another. The view is depicted in Figures 3 through 5 in Appendix C. Appendix C shows the actual images used in a public meeting. This was also evident when selecting the photographs for use in the public hearing. The photographs taken with the 70 mm lense tended to compress distance. Figures 5 through 8 in Appendix C illustrate the compression. It was concluded that the use of camera lenses with focal lengths that are longer or shorter than the normal focal length should be used with caution. Focal lengths that compress (longer than normal focal lengths) or distort (shorter than normal focal lengths) photographs may result in renderings that give a false impression of the actual distance and width of a particular site.

- Views taken at a height of 30 feet tended to diminish changes in slope. Figures 13, 14, 17, and 18 in Appendix C illustrate photographs at 20 and 30 feet. Research undertaken in phase one (Maine Department of Transportation, 1994) of this project appeared to support a preference for views that were elevated. It was concluded that photographs taken at the greater heights may give a false impression of the actual slope of a roadway. When a significant slope is present, the height at which the photograph is taken needs to be assessed in terms of appearance to the viewer.

The resulting 4" x 6" photographs were digitized at resolution of 300 dpi (dot per inch). This allow the images to be significantly enlarged for display at the public hearings. For the demonstration project, items were printed at a 75 dpi. The scanning resolution relates to the output resolution. It is desirable to have images stored at a resolution close to that which is optimum for the output device. The color printer used on this project had an optimum color resolution of 75 dpi.

It was estimated by the MDOT that to create the on-site photographs for the project cost approximately $1200. This was based on doing the photographic session independent of any other activity. A review of costs associated with photographing a project site is included in Appendix D.

Creating Visuals
The pilot project used several visuals aids created using computer software tools. A detailed description of the procedure used to create the visualization tools used for the project is provided in Appendix E. Generally, the procedure included the following:

Photographs were prepared of the site based on predefined camera and target points. The camera and target points were used to define views that the design engineer determined were the most significant or potentially controversial for the project. Each camera and target position was represented by an absolute coordinate position (numeric x, y, and z value) that MDOT uses to identify a particular location in the state.

The printed photographs were then scanned and enlarged to be used as backgrounds for three-dimensional computer models representing the proposed designs for the project.

Three-dimensional MOSS® models representing the proposed design were created at MDOT and saved in the DXF file interchange format. The DXF files were then loaded in computer-aided design software at the University of Southern Maine. Location data in the form of coordinate positions was then used to position and orient the model relative to the absolute coordinate positions used by MDOT.

Colors and textures were then assigned to the surfaces of the MOSS® model to reflect the features represented by the surface. For example, surfaces that corresponded to the curbing along side the highway were appropriately colored and a "granite" texture was applied. When rendered, those surfaces would appear to be made of granite.

The digitized images from the photographs taken of the site were loaded as background images for the MOSS® model. Background images loaded were those that corresponded to the position and orientation of the MOSS® model. The view established in the computer-aided design software was adjusted to match the view used when making the original photograph.

The MOSS® model was then rendered over the background image. The resulting images were then exported and edited within image editing software. Inconsistencies in the rendered image were corrected within the image editing software. The inconsistencies included the addition of shadows, corrected items that were only partially covered by MOSS® model, and the cloning of background features onto the rendered MOSS® model. For example, copying grass from the background onto what would be grass on the surfaces represented by the MOSS® model.

The completed renderings were then printed on a color printer and mounted for use at the public meeting.

Public Meeting Phase
The completed renderings were designed to be used in a public meeting organized to present and discuss the proposed design for the highway. The visualization tools were used at a public meeting of members of a local committee and other interested parties.

The research project called for the visualization tools to be used in addition to any traditional visuals that were typically used by MDOT in public meetings. The most common visual tool used by MDOT in public hearings has been traditional "plan view" engineering drawings that were enhanced with the addition of colors that highlighted various features of the project (old location vs. new location, area of construction, highway shoulders, etc.).

The public meeting that used the visualization tools was held in the Camden town hall on November 2, 1998. The meeting was conducted by Dave Bernhardt from MDOT and included members of a local committee and other interested parties. During the meeting, the overall status of the project was reviewed by Dave with additional information about the scope of the project provided by John Devin from MDOT. Personnel from MDOT had met several times with the local committee prior to the meeting on November 2. The Camden town manager was present at the meeting along with 17 other people. Some people came late and left early with about 12 people participating in the entire meeting.

Participants at the meeting had an opportunity to view the engineering "plan view" drawing and the computer renderings on display prior to the meeting. The large engineering drawing depicted the full extent of the project corridor. Ten different sites were depicted using the computer renderings showing existing and proposed conditions. Appendix C contains a series of images similar to those used in the public meeting.

Survey and Assessment
Three assessments were conducted to gather information about the impact of using the computer renderings in the public phase of a project.

- The individuals that participated in the public meeting in Camden were asked to complete the survey form found in Appendix F.

- Two investigators observed participants at the meeting and recorded reactions to the materials presented before and during the meeting.

- Interviews were conducted with MDOT personnel directly following the public meeting.

Participants were not aware that any assessment was being planned or conducted during the November 2 meeting in Camden. The observers were introduced to the group as consultants working on the project. At the conclusion of the meeting, the survey instrument was administered with a brief explanation of the items included on the survey.

The survey instrument was developed to ascertain the public's reaction to the meeting. It included questions regarding their understanding of the project and comments they had regarding items used at the meeting. A copy of the survey instrument can be found in Appendix F and data regarding the survey results is provided in Appendix G.

The population surveyed at the Camden meeting was relatively small. It was also not the first time that those attending the meeting had discussed the project. The survey did not provide a sense of how people seeing the project for the first time would react to the addition of the computer renderings.

An analysis of the survey results did provide some indication of how people perceived the use of the visuals. The visual materials (engineering drawings and computer renderings) received the highest average ratings. Participants rated them higher than the verbal descriptions and other non-visual project data in terms of how satisfied they were in the methods used to communicate existing conditions, conceptual design (proposed changes), and in terms of gaining a better understanding of the project.

A significant indicator was the result of the question, "The materials presented at this meeting were an improvement over materials previously presented and they helped me form an opinion." The result was an average rating of 3.6 on a scale from strongly agree (4) to strongly disagree (1). Only ten people responded to this question, which may have been an indication that some of the participants had not seen other materials at previous meetings. Participants also gave a favorable rating (a rating of 3.64 on a scale from strongly agree (4) to strongly disagree (1)) when asked if the decision-making process was improved by the presentations made at the meeting. Again, the fewer individuals responding to this question could be an indication they had not attended prior sessions.

When asked how effective the engineering drawings and computer renderings were with regard to several items, the computer renderings were rated higher than the engineering drawings on a scale from 5(definitely helped) to 1 (definitely confused) in all but one area. The one area was "major areas impacted by project," which may have been a result of a project that did not have major changes in highway position or grade.

Issue	*Engineering Drawings*	*Computer Representations*
Extent of proposed change	4.53	4.85
Ability to orient your position	4.31	4.62
Scale of proposed project	4.38	4.46
Major areas impacted by project	4.38	4.38
Identification of familiar landmarks	4.31	4.38
Rise and fall of land forms (contour)	3.50	3.92

Table 1. Average ratings comparing the extent engineering drawings and computer representations helped participant's ability to form judgements about selected issues on a scale from 5 (definitely helped) to 1 (definitely confused).

When participants were asked to what extent they would you like to see items used in similar situations, the computer renderings of existing and proposed conditions received the highest average rating (5 = increase use; 1 = do not use).

Presentation Tool	*Average*
Engineering drawings	4.15
Photographs of existing conditions	4.77
Verbal descriptions	4.33
Computer renderings of and proposed changes	4.76

Table 2. Average ratings indicating the extent participants would like to see presentation tools used in similar situations on a scale from 5 (increase use) to 1 (do not use).

The survey results also appeared to indicate that the participants level of understanding of several project features was better after the meeting than before the meeting. Since most of the participants had previously been presented information about the project at other meetings, the improved level of understanding may indicate the new materials presented at this meeting may have a positive impact in improving participant's understanding. The following table shows the average rating for how participants level of understanding on project features at the end of the Camden meeting on November 2, 1998 compared to before the meetings on a scale from 5 (substantially better) to 1 (much worse).

Project Feature	*Average*
How the sidewalks affect the project?	4.15
How the curbs affect the project?	4.54
How the proposed design impacts cars?	4.15
How the proposed design impacts pedestrians?	4.17
How the proposed design impacts bicycles?	4.08

Table 3. Average ratings indicating the extent participants had an improved level of understanding regarding selected project features after the meeting on a scale from 5 (substantially better) to 1 (much worse).

Ivan Most and Andrew Anderson were present to observe participants at the meeting. Observations were done before the meeting and included comments made by participants with regard to the presentation materials. Participants sat at a large conference table with a single large engineering drawing and 20 computer renderings located around the table. The following summarizes some of the key observations:

- At the suggestion of one of the participants, the computer renderings were passed around the room for all to see. Participants tried to locate the views represented by the computer renderings on the engineering drawing.
- Participants appeared to like the computer renderings even though the project did not represent a major change in highway position or grade. The ability to see simple proposed features such as curbing and shoulders do appear to be valued by participants.
- Participants would like to have viewed one or more renderings of what appeared to be a significant feature proposed for the new design. This appears to support the need to identify significant or controversial views early in the process.

An additional assessment was performed as an interview with MDOT personnel following the meeting. MDOT presenters Dave Bernhardt and John Devin were both experienced in presenting at public meetings. The interview was intended to ascertain their perception on the use of computer renderings. Questions and a summary of comments from the interview are provided in Appendix H. Generally the responses to the question indicate the use of the computer renderings did prove beneficial to the presenters, participants, and overall process.

SUMMARY

Computer hardware and software tools are constantly being improved. The MDOT has been using computer-aided design software as part of the design process for several years. The study indicated that the use of computer-enhanced still photographs depicting existing and proposed conditions, when linked to traditional engineering drawings, provide an effective presentation tool for use by MDOT in future projects, both simple and complex. It became further evident that decisions regarding the use of computer-based technologies in conjunction with public phases of a project are increasingly based less on the technology and more on issues of process, public policy, and overall effectiveness.

There are clearly issues relating to the extent to which the technology can be used effectively and efficiently. There is evidence in this study that the public and personnel from MDOT find the use of computer-enhanced visuals desirable. It also appears that projects using the technology do not necessarily need to have extensive changes in location, grade, or similar high design impacts. MDOT possesses much of the technical capacity needed to develop visuals similar to those used in this study.

One of the many benefits associated with computer-aided design is the ability to manipulate images. It is generally understood in almost every production or construction setting that changes made early in a design process are far easier and less costly to make than those that occur close to or during the actual production or construction phase. As computer-aided design hardware and software continues to advance, the ability to modify and present design changes should continue to become easier. The true benefit for both the public and MDOT may best be realized the earlier the technology can be integrated into the planning and design process.

CONCLUSIONS

The following conclusions were derived from the research study:

1. The use of computer renderings showing existing and proposed views of design projects was rated positively by participants in a public meeting. The desirability of using the renderings was supported by both public participants and personnel from the MDOT.

2. Computer renderings appear to enhance the public's understanding of the projects, but they need to be closely associated with other traditional presentation tools such as engineering drawings.

3. Computer renderings appear to be effective in showing projects that do not possess significant changes in position, grade, or other extensive impacts. Participants may be equally interested in what is not being done as the result of a proposed design.

4. The most appropriate photographs and computer renderings appear to depict views taken with a normal focal length lense at heights below 30 feet. The use of camera lenses other than normal (longer or shorter than normal) may result in distortions that result in a false impression of the actual distance and width being depicted. Photographs taken at heights of 30 feet may also result in a false sense of slope on those scenes that include significant change in slope. In addition, the distance between the camera and target points used to align the scene must be selected to allow the photographer to accurately locate on the target point.

5. Ongoing changes in computer hardware and software are reducing the technological barriers to using computer-based tools as part of the execution of a transportation project in terms of internal and public participation activities. Decisions regarding the use of the technology may be increasingly process and public policy issues.

6. MDOT currently has many of the computer hardware and software components that could be used to prepare computer renderings and be used in the public phases of a project.

7. MDOT personnel appear to have a desire to find tools that can assist in the public participation phases of a project.

8. MDOT needs to develop an implementation strategy to determine how the computer-based visualization tools can be integrated into the project workflow. Such an integration needs to determine how and to what extent the tools are used both internally and externally. Although there is evidence the tools are effective for even simple projects, MDOT must initially establish how such tools are used. Since the technology and the public's expectations are dynamic, the strategy needs to be frequently revisited.

9.

RECOMMENDATIONS

The following are recommendations based on the research study process and outcome:

1. Further experimentation is needed to determine the use of computer-enhanced tools in other settings and at other stages of planning and designing projects. The materials presented to the public in this study where used during later stages of the design phase of the project. Experimentation needs to be done to assess the use and effectiveness of similar materials at early stages of the planning and design process. It should also be extended to other projects that incorporate more significant changes and alternative designs.

2. The use of computer-enhanced visuals should be made available as a tool to use in the public participation phases of planning and designing projects. Such tools should be part of a "library" of tools available to MDOT personnel to use in public discussions, meetings, and hearings.

3. The integration of improved visualization tools into the public participation process, and perhaps as importantly into the work flow of MDOT, needs to be explored in subsequent research efforts. Advances in computer technology, software, and communication services such as the Internet are impacting the quality, quantity, and timeliness of information available to the public. It is reasonable to assume that the public's demand for information delivered in a highly visual manner will continue to grow.

4. Any MDOT implementation strategy for integrating computer-based visualization tools into the department's project workflow must consider using the technology early in the process. As the cost of using the technology continues to decline and the ease of use improves, use early in the process may prove to be highly effective in reducing public concerns and overall project cost .

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Appendix A

A meeting was held to show several visualization tools researched in the phase one study to personnel from the MDOT. The feedback obtained from the group would be used in determining those approaches most appropriate to an MDOT design project. Those in attendance included: Stephen Abbott, Mike Burns, Norm Baker, John Buxton, Russ Charette, Leanne Hinkley, and Rhonda Waterman. The following observations and comments summarized many of the comments made by the participants:

- The technologies presented would clearly help, but there was also concern expressed about the time frame and resources needed to prepare the materials.

- There was a concern about turning off lights for a portion of a hearing, especially if they are off for any length of time. It may be acceptable if they are off for only a short period of time. It was suggested we consider displaying only still images.

- It was noted that hearings tend to be only a small number of people. Different techniques may be appropriate for different projects.

- While one individual suggested that some of the more sophisticated techniques may only be done on "significant" projects, others thought the public may expect them on all projects. The Bangor/Brewer project was cited as an example of a significant project.

- It was noted that bringing computer equipment may add to complexity with added concerns for the operation of the equipment and the additional personnel required for preparation. There was also concern regarding the logistics of using the technology in locations with facilities not conducive to showing computer images.

- Concern was expressed for the need to carefully select the images to be displayed at a hearing. What scenes the public would like to see is somewhat unpredictable and may not always be an easy task.

- It was suggested that the use of these techniques may help with other government agencies (EPA, etc.). They often do not fully understand a project.

- There was concern expressed about the danger of being too interactive resulting in increased confusion.

- Several noted that the techniques used at the hearings need to be simple. The use of computer-generated still images displayed at a hearing in much the same manner as the plan view drawings seemed to be highly favored. The composite computer images showing the existing and proposed are very clear. It was suggested that the images be made at a large scale similar to the plan view drawings.

- It was suggested that personnel presenting at a public hearing should be able to select from a "menu" of options. For example, they could choose plan view drawing, computer generated renderings, an ARAN video, and/or a computer/video presentation. Match the techniques to the needs of the project, presenter, and public.

- The group noted that many MDOT projects include real photographs that may be useful in the hearings or enhanced with the computer.

Appendix B

Views were photographed using a 35 mm single-lens reflex camera with varying camera lense focal lengths and at varying vertical heights. The following examples illustrate the various focal lengths and heights used in the study (note that vehicles have been electronically removed in some views):

Lens Focal Length: 24 mm

Height: 5.5 feet

Height: 10 feet

Height: 20 feet

Height: 30 feet

Lens Focal Length: 50 mm

Height: 5.5 feet

Height: 10 feet

Height: 20 feet

Height: 30 feet

Lens Focal Length: 70 mm

Height: 5.5 feet

Height: 10 feet

Height: 20 feet

Height: 30 feet

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Appendix C

The actual computer renderings used at the public meeting were 17 x 22 full-color mounted prints. The visuals represented a series of views showing both the existing site and the site with the proposed changes. The following is an overview of the visual created for the public hearing:

View A

Figure 1. View of existing site.

Camera Lens:
50 mm

Camera Height:
10 feet

Figure 2. View of proposed changes.

Camera Lens:
50 mm

Camera Height:
10 feet

View B

Figure 3. View of existing site.

Camera Lens:
24 mm

Camera Height:
10 feet

Figure 4. View of proposed changes.

Camera Lens:
24 mm

Camera Height:
10 feet

View C

Figure 5. View of existing site.

Camera Lens:
50 mm

Camera Height:
5.5 feet

Figure 6. View of proposed changes.

Camera Lens:
50 mm

Camera Height:
5.5 feet

View D

Figure 7. View of existing site.

Camera Lens:
70 mm

Camera Height:
5.5 feet

Figure 8. View of proposed changes.

Camera Lens:
70 mm

Camera Height:
5.5 feet

View D

Figure 9. View of existing site.

Camera Lens:
24 mm

Camera Height:
20 feet

Figure 10. View of proposed changes.

Camera Lens:
24 mm

Camera Height:
20 feet

View E

Figure 11. View of existing site.

Camera Lens:
50 mm

Camera Height:
20 feet

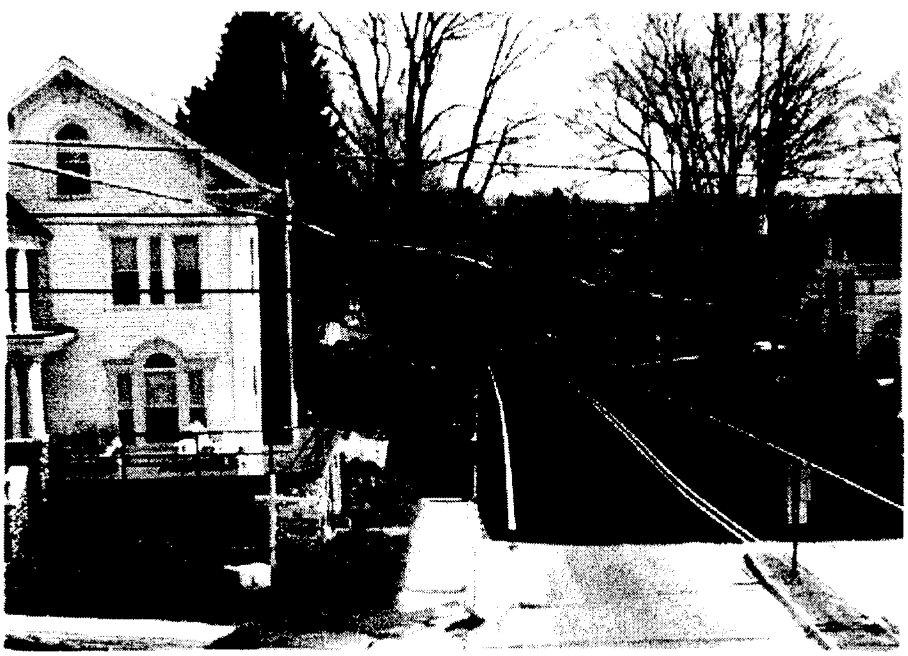

Figure 12. View of proposed changes.

Camera Lens:
50 mm

Camera Height:
20 feet

View F

Figure 13. View of existing site.

Camera Lens:
50 mm

Camera Height:
20 feet

Figure 14. View of proposed changes.

Camera Lens:
50 mm

Camera Height:
20 feet

View G

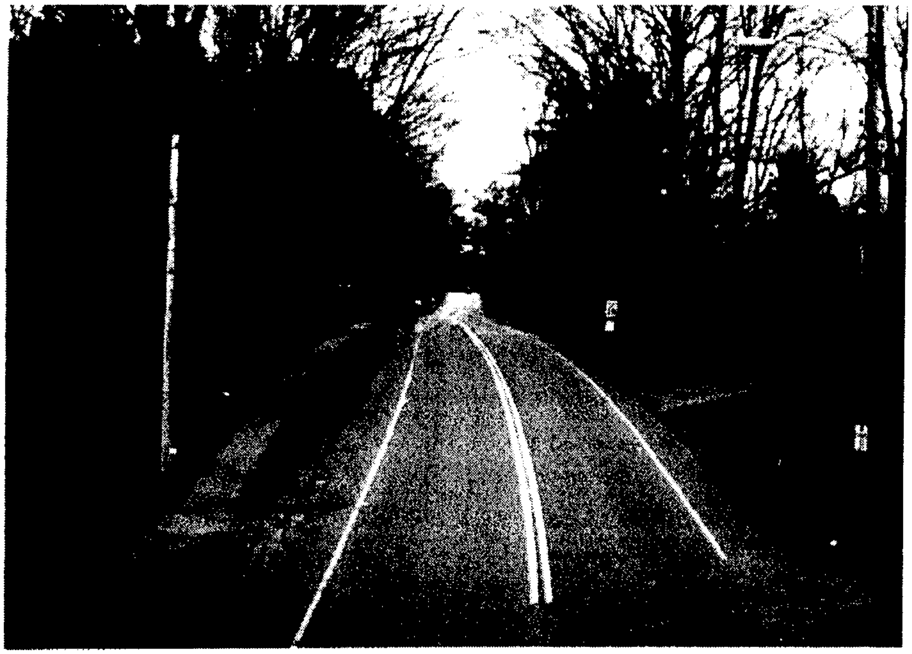

Figure 15. View of existing site.

Camera Lens:
70 mm

Camera Height:
20 feet

Figure 16. View of proposed changes.

Camera Lens:
70 mm

Camera Height:
20 feet

View H

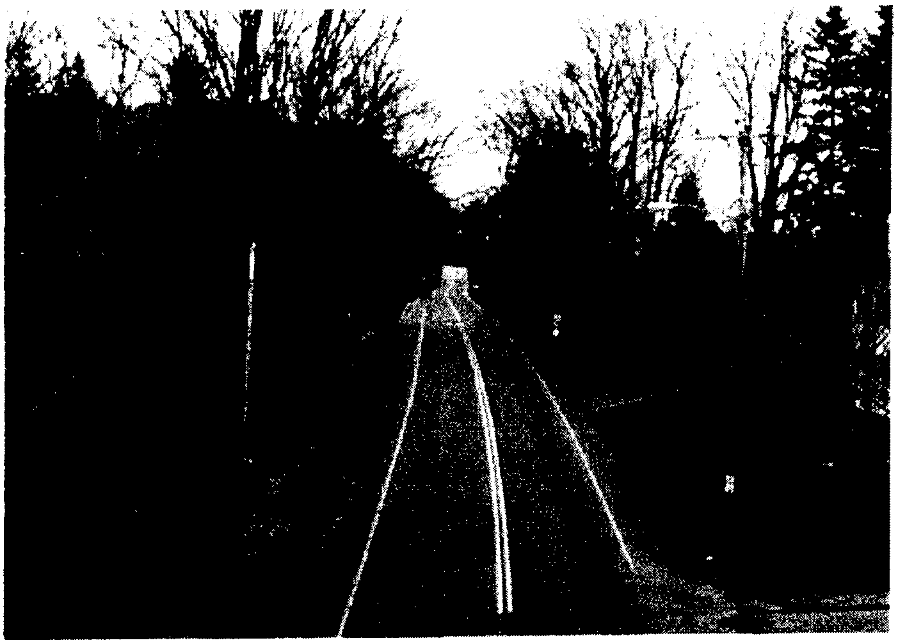

Figure 17. View of existing site.

Camera Lens:
50 mm

Camera Height:
30 feet

Figure 18. View of proposed changes.

Camera Lens:
50 mm

Camera Height:
30 feet

View I

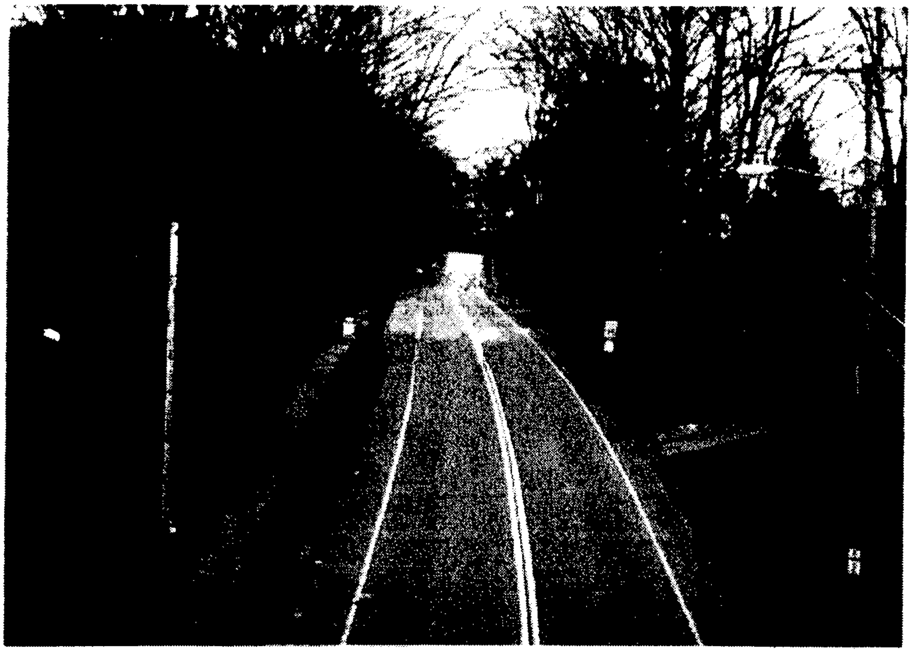

Figure 19. View of existing site.

Camera Lens:
70 mm

Camera Height:
30 feet

Figure 20. View of proposed changes.

Camera Lens:
70 mm

Camera Height:
30 feet

View J

Figure 21. View of existing site.

Camera Lens:
50 mm

Camera Height:
5.5 feet

Figure 22. View of proposed changes.

Camera Lens:
50 mm

Camera Height:
5.5 feet

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Appendix D

Costs Associated with Photographing Site

The example below details typical costs associated with photographing a project site in preparation for creating visuals. In the example below, the estimates were for photographing a site in Cape Elizabeth.

Item	*Time*	*Unit Cost*	*Total*
Photographer			
Travel time	3 hours		
Time on site	2 hours		
Total time	5 hours	$24 per hour	$120
Van	5 hours	$20 per hour	$100
Film (4 rolls)		$3.50 each	$14
Film processing		$9.00 each	$36
Miscellaneous laboratory			$18
Central Maine Power wrapping power lines			NC
Maintenance Crew			
Bucket truck	6 hours	$50 per hour	$300
Operator	6 hours	$18 per hour	$108
Impact attenuation truck	6 hours	$27 per hour	$162
Operator	6 hours	$18 per hour	$108
Pickup truck with signs	6 hours	$20 per hour	$120
Operator	6 hours	$18 per hour	$108
		TOTAL	$1194

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Appendix E

This appendix describes the procedure used to create the visualization tools used as part of the survey done in Camden. Although other software could be used, the procedures describes the specific packages used in completing this particular project.

1. Photographs were taken of the site and printed 3.5 x 4.75 inches in size.

2. The printed photographs were then scanned using an HP Scanjet II® scanner and enlarged to approximately 17 x 22 inches. This was an enlargement of approximately 470 percent. Scanning resolution selected was to match the optimum output for the printer used in producing the materials, which was 75 dpi (dots per inch). The enlargement size and the scanning resolution were set in the scanning software.

3. Since the photographs were to be significantly enlarged, scanning resolution was set to 300 dpi to allow for a final resolution of 75 dpi (enlarging a 300 dpi by 4.7 times results in a 75 dpi image).

4. The MOSS® models of the new design was provided by MDOT in the form of the DXF file interchange format. The DXF files were loaded into Microstation® '95 (command was FILE > IMPORT > DXF).

5. Three locations (x, y, and z points) were identified on the imported DXF file. The three points from the MOSS® model were used to properly orient the model and position the model at the proper absolute coordinates used by MDOT. All points on a MOSS® model accurately reflect an absolute coordinate position within the state. One of the x,y,z coordinate points was used in conjunction with Microstation's® "global origin" key in command to set the global origin to match the selected point.

6. The three points were also used to properly orient the model to a plan view (looking down on the model in the top view).

7. After the model was properly positioned and oriented, a color and level where assigned to each of models components (the polygons in the MOSS® model that represent curbing, pavement, etc.). The use of color provided a means of clearly distinquishing features. The use of levels allows rendering materials to be assigned to particular features (curbing, pavement, etc.). Microstation® assigns materials on a level-by-level basis.

8. After assigning levels to features, materials were assigned to the appropriate level. For example, the material granite was assigned to the level that represented curbing.

9. Once the appropriate colors and materials were assigned to the model, background images were loaded. The background images were the scanned photographs that corresponded to locations relative to the MOSS® model. An image was set up as a background in Microstation® by first setting the pixel (command was SETTINGS > DESIGN FILE > VIEWS) proportion equal to the proportion of background image. The pixel size of the background can be ascertained using an image editing software package such as Photoshop® (command was IMAGE > IMAGE SIZE). The images was then loaded in Microstation® as a background (command was SETTINGS > DESIGN FILE > VIEW). The same command was used to display the background.

10. The "camera" view in Microstation® was set equal to the camera settings used when making the original photographs (command was SETTINGS > CAMERA > SETUP). This included setting the focal length to match the photographer's focal length when scene was photographed.

11. The actual direction of the Microstation® camera view was set to define camera target point (command was SETTINGS > CAMERA > SETUP) and camera position point.

12. The MOSS® model was rendered over the background image (command was UTILITY > RENDER > PHONG). This provided a rendered image incorporating the previously assigned materials.

13. The rendered image was then saved (command was UTILITY > IMAGE > SAVE). The following were the settings:

File format	TIFF
Mode	24-bit color
Shading	Phong
Resolution width and height	Set to the resolution of background image (1700 x 1197)

14. The rendered image saved in Microstation® was then loaded into an image editing package (Adobe Photoshop® Ver. 4). Inconsistencies in the rendered image were corrected within the image editing software. The inconsistencies included the addition of shadows, items that were only partially covered by MOSS® model, and the cloning of background features onto the rendered MOSS® model. For example, copying grass from the background onto what would be grass on the surfaces represented by the MOSS® model.

15. The completed TIFF images were then saved and placed within Adobe Pagemaker® (command was FILE > PLACE). Pagemaker® was used only to aid in the printing of the image. Images were output on an HP DesignJet® 350C printer. The output options on the 350C were set to best (enhanced).

Appendix F

The following pages are copies of the survey instrument used during the public meeting in Camden on November 2, 1998.

CAMDEN SURVEY

Dear Participant:

We ask that you take a few minutes to complete a questionnaire that is assessing your reaction to various items used in presenting the highway project discussed at this meeting. Your confidential comments will be extremely helpful in helping the Maine Department of Transportation determine meaningful ways to present projects to the public.

DIRECTIONS: **Please rate questions 1 and 2 by circling the number which best represents your satisfaction using the following scale:**

Definitely Satisfied	Satisfied	Neutral	Not Satisfied	Definitely Not Satisfied
5	4	3	2	1

1. How satisfied were you with each of the following methods used to communicate EXISTING CONDITIONS for the project discussed at the meeting:

A.	Verbal description	5	4	3	2	1
B.	Visual materials	5	4	3	2	1
C.	Non-visual project data	5	4	3	2	1
D	Overall presentation	5	4	3	2	1
E.	Other ____________________	5	4	3	2	1

2. How satisfied were you with each of the following methods used to communicate the CONCEPTUAL DESIGNS for the project discussed at the meeting:

A.	Verbal description	5	4	3	2	1
B.	Visual materials	5	4	3	2	1
C.	Non-visual project data	5	4	3	2	1
D	Overall presentation	5	4	3	2	1

DIRECTIONS: **Please rate question 3 through 5 by circling the number which best represents your understanding of the issues using the following scale:**

Strongly Agree	Agree	Disagree	Strongly Disagree
1	2	3	4

3. The following presentation methods helped me gain an understanding of the project.

A.	Verbal description	4	3	2	1
B.	Visual materials	4	3	2	1
C.	Non-visual project data	4	3	2	1
D	Overall presentation	4	3	2	1
E.	Other ____________________	4	3	2	1

4.	The overall presentation helped me form an opinion.	4	3	2	1
5.	The decision making process was improved by presentations made during the meeting.	4	3	2	1

DIRECTIONS: **Please rate question 6 through 7 by circling the number which best represents your understanding of the issues using the following scale:**

Definitely Helped	Helped	Neutral	Confused Understanding	Definitely Confused Understanding
5	4	3	2	1

6. To what extent did the ENGINEERING DRAWINGS help your ability to form judgments on each of the following issues:

A.	Extent of proposed change	5	4	3	2	1
B.	Ability to orient your position	5	4	3	2	1
C.	Scale of proposed project	5	4	3	2	1
D.	Major areas impacted by project	5	4	3	2	1
E.	Identification of familiar landmarks	5	4	3	2	1
F.	Rise and fall of land forms (contour)	5	4	3	2	1
G.	Other ____________________	5	4	3	2	1

7. To what extent did the PHOTOGRAPHIC and COMPUTER REPRESENTATIONS OF EXISTING AND PROPOSED changes help your ability to form judgments on each of the following issues:

A.	Extent of proposed change	5	4	3	2	1
B.	Ability to orient your position	5	4	3	2	1
C.	Scale of proposed project	5	4	3	2	1
D.	Major areas impacted by project	5	4	3	2	1
E.	Identification of familiar landmarks	5	4	3	2	1
F.	Rise and fall of land forms (contour)	5	4	3	2	1
G.	Other ____________________	5	4	3	2	1

DIRECTIONS: **Please rate question 8 by circling the number which best represents your opinion using the following scale:**

Substantially Increase Use	Increase Use	Same Use	Decrease Use	Do Not Use
5	4	3	2	1

8. To what extent would you like to see the following presentation methods used in similar situations?

A.	Engineering drawings	5	4	3	2	1
B.	Photographs depicting existing	5	4	3	2	1
C.	Verbal descriptions	5	4	3	2	1
D.	Computer renderings of and proposed changes	5	4	3	2	1
E.	Other ____________________	5	4	3	2	1

DIRECTIONS:	**Please rate question 9 by circling the number which best represents your understanding using the following scale:**			
Substantially Better	Better	No Change	Worse	Much Worse
5	4	3	2	1

9. From the information presented, what is your level of understanding now compared to before this meeting regarding the following items?

A.	How the sidewalks affect the project?	5	4	3	2	1
B.	How the curbs affect the project?	5	4	3	2	1
C.	How the proposed design impacts cars?	5	4	3	2	1
D.	How the proposed design impacts pedestrians?	5	4	3	2	1
E.	How the proposed design impacts bicycles?	5	4	3	2	1

10. Any additional comments you would like to add to help improve MDOT presentations.

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Appendix G

Surveys were received from 14 people at the November 2, 1998 meeting held in Camden, Maine. The following provides summary statistics for each of the questions.

1. How satisfied were you with each of the following methods used to communicate EXISTING CONDITIONS for the project discussed at the meeting. (5 = most satisfied; 1 = least satisfied).

	n	*average*	*std. deviation*
A. Verbal description	14	4.07	.73
B. Visual materials	14	4.64	.50
C. Non-visual project data	10	4.20	.79
D Overall presentation	14	4.50	.52
E. Other ____________________	0		

Comments on surveys:
- We had a number of previous mtgs where this was done well.
- now

2. How satisfied were you with each of the following methods used to communicate the CONCEPTUAL DESIGNS for the project discussed at the meeting (5 = most satisfied; 1 = least satisfied):

	n	*average*	*std. deviation*
A. Verbal description	13	4.07	.76
B. Visual materials	13	4.61	.51
C. Non-visual project data	11	4.00	.77
D Overall presentation	13	4.46	.66
E. Other ____________________	0		

Comments on surveys regarding 2A:
- If you were at this mtg for the first time it would be a 1- but I've been to them all and it was a refresh
- future

3. The following presentation methods helped me gain an understanding of the project (4 = strongly agree; 1 = strongly disagree).

	n	*average*	*std. deviation*
A. Verbal description	13	3.38	.65
B. Visual materials	13	3.84	.38
C. Non-visual project data	11	3.18	.60
D Overall presentation	12	3.58	.51
E. Other ____________________	1		

4. The materials presented at this meeting were an improvement over materials previously presented, and they helped me form an opinion (4 = strongly agree; 1 = strongly disagree).

n	*average*	*std. deviation*
10	3.6	.97

5. The decision making process was improved by presentations made during the meeting (4 = strongly agree; 1 = strongly disagree).

n	*average*	*std. deviation*
11	3.64	.67

6. To what extent did the ENGINEERING DRAWINGS help your ability to form judgments on <u>each</u> of the following issues (5 = definitely helped; 1 = definitely confused):

	n	*average*	*std. deviation*
A. Extent of proposed change	13	4.53	.88
B. Ability to orient your position	13	4.31	.85
C. Scale of proposed project	13	4.38	.77
D. Major areas impacted by project	13	4.38	.65
E. Identification of familiar landmarks	13	4.31	.75
F. Rise and fall of land forms (contour)	12	3.50	1.31
G. Other ____________________	2		

Comments on surveys regarding 6F:
- unchanged?? existing width needed to be easier to see

7. To what extent did the PHOTOGRAPHIC and COMPUTER REPRESENTATIONS OF EXISTING AND PROPOSED changes help your ability to form judgments on <u>each</u> of the following issues (5 = definitely helped; 1 = definitely confused):

	n	*average*	*std. deviation*
A. Extent of proposed change	13	4.85	.38
B. Ability to orient your position	13	4.62	.65
C. Scale of proposed project	13	4.46	.66
D. Major areas impacted by project	13	4.38	.65
E. Identification of familiar landmarks	13	4.38	77
F. Rise and fall of land forms (contour)	13	3.92	1.19
G. Other ____________________	1		

Comments on surveys regarding 7B:
- Needed a few landmarks

Comments on surveys regarding 7D:
- more examples maybe

Comments on surveys regarding 7F:
- unchanged

8. To what extent would you like to see the following presentation methods used in similar situations (5 = increase use; 1 = do not use):

	n	*average*	*std. deviation*
A. Engineering drawings	13	4.15	.80
B. Photographs of existing conditions	13	4.77	.44
C. Verbal descriptions	12	4.33	.78
D. Computer renderings of and proposed changes	13	4.76	.44
E. Other ____________________	2		

Comments on surveys regarding 8A:
- a little fine tuning on vegetation impact

Comments on surveys regarding 8C:
- however previous meeting the verbal descriptions were adequate

9. From the information presented, what is your level of understanding now compared to before this meeting regarding the following items (5 = substantially better; 1 = much worse):

	n	*average*	*std. deviation*
A. How the sidewalks affect the project?	13	4.15	.80
B. How the curbs affect the project?	13	4.54	.52
C. How the proposed design impacts cars?	13	4.15	.55
D. How the proposed design impacts pedestrians?	12	4.17	.58
E. How the proposed design impacts bicycles?	13	4.08	.76

10. Any additional comments you would like to add to help improve MDOT presentations.

- Since we have had many previous meetings a verbal presentation here was not as critical for those that have attended the prior meeting- but if this had been your first meeting it would not have been enough
- I have attended all the meetings and the information + personnel have been excellent + very accommodating. The computer photos were very helpful to others who may not have had as much background. For me they were fun but not critical.
- This survey does not appear to present questions whose answers will be of help to you.
- The photographs were very helpful

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- Thanks for the pictures
- Nice job!!!
- Well done
- Sidewalks should be paved in a different color as a visual aid + to help calm traffic

Appendix H

The following were questions and summaries of the responses by Dave Bernhardt and John Devon in an interview conducted after the public meeting in Camden on November 2, 1998:

1. **How do you feel the set of presentation techniques used in this meeting affected your working relationship with the committee?**

   It helped the working relationship with the committee.

2. **How did the presentation techniques affect you and your presentation?**

   It appeared to give them more confidence having the computer renderings available before and after the meeting. It may be valuable to have them on an overhead presentation so they could be pointed at to help make issues clear. There needs to be other approaches to link the computer renderings to the engineering drawings.

3. **Do you feel that the computer enhanced graphics increased the public's understanding of the design?**

   The computer renderings let the public understand exactly what it will look like. If we had to just explain it, would have taken three times as long and there is no guarantee that they would get the explanation. Nobody asked what kind of curb; the rendering showed it well. Less questions about where curb ended than expected. Increased level understanding.

4. **Did you feel the decision process (both public and MDOT) was improved?**

   Clearly felt the project was improved. In the past, the designer completed a design and it was presented to public - take it or leave it. Many times the public would "blown us right out of the water." Now they try to get early agreement. Process is improved.

5. **Did the computer enhancements make it easier to explain critical design issues?**

   Critical design issue was width. The computer renderings did add some confusion because the wide angle lens used in some views distorted the perspective. We should probably take picture from center of the road using a standard 50mm lens. This may be a subject for a standards group to develop. The images need to be up to accuracy of the drawing.

6. **Do you feel this meeting was a fair test of the technology?**

   Easier to test in a group the size of this meeting. They help a lot. Once again a good idea to have pictures available before meeting. It works well dealing with a vocal minority. Ones that are interested show up. Less questions in a public hearing because of rendering.

7. **Did the computer enhancements increase your confidence in conducting the meeting?**

   Yes, will help to have renderings at public hearing.

8. **Did the computer enhancements change the working dynamics with public? More adversarial? Less adversarial?**

   Get people early in meeting while they are looking at pictures. It becomes less adversarial. Some of the people at the meeting had not been at prior meeting.

9. **With respect to computer enhanced presentations, how do you feel MDOT compares to other state DOT's?**

   Maine is ahead of the other states. Maine is ahead in selling projects. Other states have maintenance and reconstruction, not new projects like Maine. Maine is at the top in technology compared to other New England states. Maine willing to make investments in technology.

10. **Did the computer enhancements alter the nature and/or extent of questions and comments regarding the project?**

    Same kind of questions. No one asked about right-of-way. We are not taking a lot. Rendering showed changes which resulted in less questions. Continuity of project engineer is important. Project engineer should pick the views to be photographed.

11. **Did the computer enhancements compromise your technical presentation?**

    No, definitely not.

12. **Should computer enhanced presentations only be used to "sell" the project after a design has been agreed upon at MDOT or should it be used at earlier stages in the process?**

    Would help to have rendering at the preliminary meeting. Typically, process has three meetings: preliminary public meeting, informational meeting, and public meeting. This was the informational meeting. Need rendering at informational meeting. Helpful to show how it looks. You would have to show many alternates at a preliminary meeting which would be difficult to use rendering at preliminary meeting. Incorporate ARAN information into process.

13. Knowing that this was an experimental use of the technology, to what extent would you like to see such enhanced presentation tools used in meetings of this nature or at other stages of the design process?

Barrier to getting it implemented is it will take time. There is a learning process. There may be concern about wasting time. Why design something that will never get built? Can the process be speeded up?