PAPER #2016 DESIGN BUILD TRANSPORTATION AND WATERSHED PLANNING MEET IN GIS

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ABSTRACT

More infrastructure and facility projects are being programmed as design build projects in order to expedite the construction schedule and deliver infrastructure solutions more quickly. Washington State Department of Transportation (WSDOT) completed a Programmatic Final Environmental Impact Statement (FEIS) for a 30-mile urban corridor on I-405 in King and Snohomish Counties in June 2002. Currently, several Environmental Assessments, Biological Assessments, and other environmental documents are being prepared for several road sections undergoing design along the corridor by a General Engineering Contract (GEC) Team consisting of the client (WSDOT), three lead consultants, and more than ten subconsultants. This paper will use the I-405 Corridor Program as a case study to discuss using a GIS for a dynamic and large project with numerous engineering and environmental teams. The discussion will include planning the GIS for impacts and design analysis, environmental documentation, "early action" environmental mitigation, watershed characterization, and the lessons learned.

BACKGROUND

I-405, the interstate on the east side of Lake Washington in the Metropolitan Seattle area, is the second most traveled corridor in Washington State carrying over 800,000 people each day. It is an economic lifeline for the state carrying over twice the goods that are shipped through the Port of Seattle. WSDOT has developed an I-405 Master Plan including roadway and transit improvements. A Programmatic Final Environmental Impact Statement (FEIS) for 30 miles of the urban corridor was completed in June 2002.

Currently, project-level designs and project-level environmental assessments are being conducted concurrently. As more infrastructure and facility projects are being programmed as design build projects in order to expedite the construction schedule and deliver infrastructure solutions more quickly, environmental consultants need to find innovative ways to deliver the transportation projects. HDR is one of three lead consultants on a General Engineering Contract (GEC) team working with WSDOT to implement the I-405 Corridor vision.

INTRODUCTION

This paper will discuss several elements of the corridor project, and how GIS assisted in delivering the needed designs, environmental information, and innovations that are helping to do business differently. The following sections discuss the transportation design process, environmental assessments and the

GIS planning necessary to deliver this work. Environmental programs in transportation such as Watershed Characterization and Early Environmental Investments (EEI) will also be discussed.

TRANSPORTATION DESIGN

The FEIS was written to cover the "ultimate" I-405 vision. The ultimate vision includes transportation improvements in almost 10 jurisdictions and 30 basins in two Washington State Water Resource Inventory Areas (WRIAs). There are five transportation design teams for different road sections. There are also several environmental teams. All of these teams must share information and coordinate as one I-405 team. A key element to the screening effort was utilizing existing GIS data sets to answer "what if" questions as well as coordinate GIS data formats with AutoCAD and MicroStation data sets.

Early GIS spatial analysis and overlays have aided the program in designing transportation improvements on the fly rather than as a reactionary process. Using the environmental GIS data during early screening of options have helped the design teams to avoid and minimize more effectively as they narrow down the final designs. Rather than benchmarking various levels of design to run the impacts analysis and to determine mitigation, many of the potential impacts have been avoided at the beginning of the design effort. These avoidance and minimization measures were documented, and the agencies have a better understanding of the efforts put forth by WSDOT to be a good environmental neighbor.

GIS DATA FOR ENVIRONMENTAL DOCUMENTATION

The I-405 Team is charged with completing Environmental Assessments (EAs) and Biological Assessments (BAs) for each of the five road sections. In this design-build scenario, the writers must analyze road improvements and environmental impacts with less final design information than is normally available. The EAs and BAs are being written concurrently with design of road improvements. Because so much avoidance and minimization have occurred during this concurrent process, the mitigation is being written as part of the overall project description.

GIS is being used for spatial analyses including right-of-way, noise, and resource impacts. Report graphics are also being produced through the GIS. The Map Book extension has been especially helpful for such a long corridor project.

One of the challenges in delivering the documentation was to plan the GIS data structure and processes as a foundation that was efficient at the fast-paced project kick-off, and would continue to be useful throughout the duration of the I-405 Corridor Program. It was important to gain an understanding of the needs of over 30 authors and field personnel. Part of understanding their needs includes conveying what GIS can do for them and what things should be done another way in order to meet schedule.

The data was structured to track original data sets from state agencies, counties, and local municipalities. As the large data sets were further developed with attributes and clipped, the data was organized by road project and environmental discipline. The map documents were also organized by road project and discipline. Labels and other graphic features were stored separately in geodatabases and used as base mapping for all report graphics.

GIS AIDS INNOVATIONS TO DELIVERING TRANSPORTATION PROJECTS

Through the Programmatic FEIS process, WSDOT developed several programs and concepts to implement a better corridor project. The following sections highlight two of those programs, the Early Environmental Investments (EEI) program and the Watershed Characterization program. Both programs utilized GIS as the tool to get results, and were coordinated to maximize environmental benefits for the transportation dollar spent.

Early Environmental Investments

What are early environmental investments (EEI)?

One environmental component that the team is currently charged with implementing is the EEI program. EEI is mitigation developed in advance for the estimated effects of project construction on the environment. It is a corridor-wide process to identify, rank, select, design, and permit environmental investment opportunities in advance of transportation construction that would create any environmental impacts.

The EEI uses a watershed approach to identify opportunities for improving aquatic resources, fish, wetlands, water quantity, and floodplains. The process is summarized below:

- Compiled potential projects for a "long list" of over 425 sites.
    - Utilize previous basin planning efforts.
    - Utilize watershed characterization program results
    - Work with EEI Task Force of agencies and jurisdictions to identify sites.
- Conducted fatal flaw analysis resulting in a short list of 50 projects.
- Score and rank projects based ecological benefit and project feasibility.
- Finalize site selection
- Design, permit, and construct EEI project.

Potential EEI projects were compiled using basin planning efforts in two WRIAs. The goal was to quickly locate environmental mitigation in the watershed that would have the most bang for the buck. After final site selection, the site will be designed, permitted, and constructed before road construction begins.

Investing in the environment at a watershed level early helps the permitting agencies see WSDOT's commitment to the environment, and it is hoped that a clear environmental commitment will help to permit and implement the design-build transportation projects. WSDOT was charged by their steering committee and other public committees with finding larger sites in the watershed with added environmental benefit. In an urbanized area, this charge generally resulted in off-site mitigation options.

How did GIS assist EEI?

GIS assisted EEI throughout the process with analyses, community involvement, and site mapping. The following sections highlight two major GIS efforts in the EEI Program: impacts/effects analyses and watershed characterization.

Effects Analyses

In order to select potential EEI projects, GIS was utilized to estimate impacts based on the latest road design information. Spatial analyses were performed iteratively as more questions arose about impacts to water resources. Working with stream, wetland, fish barrier, drainage, and other resource planning data, GIS helped to guide design, quantify design impacts and mitigation areas. The political and funding climate made it necessary for the I-405 Team to position for a multitude of road design and mitigation options. Without GIS tools for spatial analyses, topographical analyses, and data coordination, the program would not have the flexibility to address options "on the fly".

Watershed Characterization

GIS was also utilized to characterize one of the large basins along the I-405 corridor. Watershed characterization is an emerging planning and technical tool. WSDOT has developed a program to characterize watersheds in Washington State to identify alternative mitigation opportunities to conventional stormwater Best Management Practices (BMPs) and on-site wetland and habitat mitigation options. Ideally, the available mitigation options would be clear ahead of the transportation construction schedule.

The goal of watershed characterization is to provide the project management team with viable mitigation options that have potential to increase environmental benefits and reduce project cost. Watershed characterization assesses condition of surrounding natural resources and seeks a more complete understanding of project effects. It also identifies potential mitigation options that have the greatest opportunity for maximizing environmental benefit, while reducing cost.

The watershed characterization beta test along the corridor resulted in "areas worthy of site specific work" for aquatic resources as well as more specific areas for stormwater facilities. The areas were added to the list of potential EEI

projects. The results were especially helpful in identifying project sites along streams where no projects were identified in previous efforts, but where environmental work could have a great deal of benefit.

Lessons Learned

The following list highlights some lessons learned with regard to GIS, watershed planning, and design-build transportation:

- Plan early with the team to set up data structure, naming conventions, and style guides.
- When you cannot plan early, take time as early as possible to reorganize as the project demands.
- When you do not have all of the resources you need, prioritize tasks and products, set real expectations, and exceed them.
- Using GIS for watershed characterization not only works technically, but demonstrates to agencies and local jurisdictions the commitment to using the best available tools, at a reasonable cost, to position for the best transportation and environmental decisions.
- GIS is the necessary tool for dynamic projects, but the GIS team must take a holistic and efficient approach to supporting transportation and environmental teams.

Summary

It is hoped that this paper is a testament to utilizing GIS to deliver large, dynamic projects. Engineering projects now go hand-in-hand with environmental, planning, and public relations teams. GIS is the necessary tool to share information among all of the teams to answer "what if" questions, keep a consistent message for environmental and engineering goals in an ever-changing political environment, and to utilize the best available data across agencies and jurisdictions.

Acknowledgements

A special thank you to the WSDOT watershed characterization group, namely Dick Gersib, Tim Hilliard, and Albert Perez for their hard work, coordination, and environmental solutions in the transportation sector.

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