Abstract

Freight transportation is extremely important in Washington as it underpins the national and state economies, supports national defense and facilitates the distribution of goods and services to nearly all state residents on a daily basis. Because of this, the freight transportation system in Washington must function at all levels of government from international, national, to state and local. 

*Internationally*, Washington is a “gateway” state connecting Asian & Canadian trade flows to the U.S. economy. *Nationally*, Washington's freight system facilitates trade from Alaska and along the west coast. Additionally, the state’s firms and farmers use the freight transportation system to ship Washington made goods locally, across the country and around the world. And lastly, Washington's freight transportation system serves as a local utility, vital to citizens throughout the state to meet their consumption needs. As a result, the planning of freight improvement projects should be seamless across various government jurisdictions and county/state boundaries.

To understand the need for the coordinated collection and presentation of data, one needs only consider the various types of roads that contribute to the freight transportation system in Washington. Not only does the state host international border crossings and interstate highways, it is comprised of a myriad of county and city roads. As a result, there are several key agencies that have a stake in freight transportation planning in Washington: Washington State Department of Transportation (WSDOT), County Road Administration Board (CRAB), Strategic Freight Transportation Analysis (SFTA) as well as the county and municipal governments. In the process of completing this study, it was necessary to contact each of these agencies for assistance in the collection of data and maps.

To assist planners and policymakers at all levels of government, this paper describes the statistical and geospatial data collected from each county in Washington State and the analytical application of a complete GIS mapping of all-weather roads throughout the state, along with future county freight improvement projects. This information is then evaluated and analyzed on a regional/statewide basis to identify gaps or system inefficiencies resulting from local/county improvement projects that don’t extend across county borders. Specific county and regional case studies/examples of how this centralized GIS may aid policy decision-maker are also presented.
INTRODUCTION

Freight transportation is an important component of the larger transportation system, as it underpins the national and state economies, supports national defense and facilitates the distribution of goods and services to all residents on a daily basis (WTP 2005). Because of this, the freight transportation system in Washington must function at all levels of government from international, national, to state and local. Internationally, Washington is a “gateway” state connecting Asian and Canadian trade flows to the U.S. economy. Nationally, in 2002, 19 billion tons of freight was transported with a value of $13 billion. Of this amount, the truck share was $9 billion. The projected increase by 2020 is 70 percent, with most of this freight moved on roads because shipping by truck is faster and more reliable than other modes. As a component of the national freight system, Washington's freight system facilitates trade from Asia, Canada, Mexico, Alaska and other states.

By 2025 there will be twice as many cars and trucks on the road as there are now, states Douglas G. Duncan, President and CEO of Fed Ex Freight Corporation. This could have the potential of grid locking freight movements and negatively impacting our economy. Major manufacturers and large retailers like Wal Mart depend on an efficient transportation system to keep their shelves stocked without resorting to an inventory of a significant amount of commodities, e.g. just in time delivery. It is believed that congestion combined with rising fuel prices have caused transportation costs to increase by a record 14 percent in 2005. At the same time, trucking companies are having trouble keeping up with the increased demand, especially long haul truck routes, stated Christopher Lofgren, President and CEO of Schneider National, Inc., a Green Bay, Wisconsin trucking company.

Additionally, the state’s producers (firms and/or farmers) rely upon the freight transportation system to access distant markets across the country and around the world for Washington made products. And lastly, Washington's freight transportation system serves as a local utility, vital for access and mobility for citizens throughout the state as they meet their consumption needs (WTP 2005). As a result, the
planning of transportation and freight improvement projects should be multi-faceted so as to include all government jurisdictions.

According to the WSDOT’s *Washington Transportation Plan*, “Globalization, competitive industry trends, and new technologies are pushing freight volumes up twice as fast as Washington’s overall population and passenger traffic growth.” Whereas the state population is projected to grow 34 percent by 2030, growth in the freight system, in part as measured by truck trips and freight volumes, is expected to increase by nearly 80 percent (WSOFM 2004). In order to meet this growing demand on the freight transportation system, it will become imperative to employ coordinated decision-making and coordinated collection and integration of transportation projects, priorities and information.

SFTA Research Report No. 20, Freight Movements on Washington State Highways: Comparison of Results 1993 to 2003 notes that in 1993 to 1994 the annual economic value of cargo carried by freight truck was $163 billion (in 1997 dollars) which increased to $421 billion (in 1997 dollars), in 2003 to 2004, an increase of 158 percent. Of this increased cargo value, the greatest increase was experienced in eastern Washington, where cargo values increased over 180 percent to $47.6 billion annually. During the same period, truck trips nearly doubled, from 8 million to just over 14 million annually, while cargo weight increased 96 percent from 90 million tons to 176 million tons annually. These projections for freight movement increases underscore the need to have good, all weather roads to accommodate this demand.

The projected increased demand for freight transportation for commerce all across the state is increasing the need for the state and local governments to appropriately anticipate and provide for current and future freight transportation infrastructure, especially as it relates to improved freight mobility. To assist planners and policymakers at all levels of government, this paper coordinates the collected statistical and geospatial data of specific improvements from all counties in Washington into one GIS dataset addressing examples of all weather roads relative to county freight movements.
BACKGROUND AND MOTIVATION

A presentation to the National Service Transportation Policy and Revenue Study Commission by Jack Wells, Chief Economist, U.S. Department of Transportation on June 26, 2006, noted that transportation is particularly important to certain industries, e.g. it accounts for 12 percent of the total value for agriculture, fertilizers and chemicals, 10 percent for steel and other metals, and 8 percent for food. These examples reflect the importance of transportation to keep our economy moving forward. Moreover, the same presentation notes the average length of haul for trucks in 1960 was 280 miles which increased to 450 miles in 1999. Congestion is also growing on our roadways and is growing most rapidly in rural areas, which can particularly impact freight movements.

The need for a coordinated collection, presentation, and integration of data is evident when considering the various types of roads that contribute to the freight transportation system in Washington and the different governmental jurisdictions under which the operational management of these roads fall. Not only does the state host international border crossings and interstate highways, it is comprised of a myriad of county and city roads. As a result, these different key agencies may have different priorities and goals when it comes to freight transportation planning in Washington: Washington State Department of Transportation (WSDOT), Freight Mobility Strategic Investment Board (FMSIB), Washington State Association of Counties (WSAC), County Road Administration Board (CRAB), Metropolitan Planning Organizations (MPO), Regional Planning Transportation Organizations (RPTO), Association of Washington Cities (AWC) as well as the county and municipal governments. In the process of completing this report, several of these agencies were contacted to assist in the collection of data and maps.

It is also important, from a policy/planning context, to have a standardized statewide GIS map of county level transportation projects relative to the existing all weather road system. This Geographic Information System provides an important analytical tool that can facilitate decision-making by
presenting both quantitative (tabular) data as well as geospatial data (maps) and allows analysts to perform multiple queries across various attributes on a wide (statewide, regional) or narrow (county, municipality) scale. The importance of a uniform GIS across multiple organizations with differing needs as to level and types of analysis were suggested by Brian Mayfield: “The concept of the enterprise GIS is to provide uniformity and accessibility to geographic information across an entire organization. End users have differing levels of geographic data needs as they relate to accuracy, precision and overall cartographic appearance”. Having such an “enterprise” GIS with uniformity and accessibility assured across jurisdictions will facilitate the coordination of decision-making with respect to freight transportation needs throughout the state.

PROJECT SCOPE AND OBJECTIVES

The primary objective of this paper is to present a process for collecting and organizing information from individual counties throughout Washington State such that system-wide freight mobility issues or transportation system inefficiencies from county to county may be better identified and addressed. By assessing specific transportation infrastructure priorities on a county basis and placing that information in the context of the entire statewide system (using GIS), possible regional freight chokepoints or inefficiencies can be identified and ultimately addressed.

The specific project objectives:

1) Survey individual county officials regarding a maximum of three top priority all weather road freight transportation improvement projects with locations and estimated cost to upgrade to all weather road status

2) Consolidate information and data from County Road engineers into a Geographic Information System (GIS) to show proposed freight projects on a county, regional and statewide basis, relative to the all weather road network

3) Create a uniform statewide GIS coverage of all weather roads from state and county data

4) Identify possible adjoining projects across counties and reconcile priorities

The scope of the project itself was limited to a maximum of the top three priority freight projects per county as reported by individual county engineers and representatives. These representatives
(planners, engineers, commissioners) varied across the counties and may in fact reflect the different organizational structures. Data was also collected informally via phone solicitation and e-mail requests between December, 2004 and December 2006. This project provides an important output in the form of a standardized GIS presentation of state and county roads and all weather status including estimates to address infrastructure deficiencies that can aid future planning for freight transportation.

DATA COLLECTION AND METHODOLOGY

DATA AND INFORMATION SOURCES:

I. Data Collection
The collection of specific transportation project data and maps was coordinated by Walt Olsen of the County Road Administration Board (CRAB). The data included a prioritized list of the top three (maximum) transportation projects each county would like to see completed, accompanied by a physical map detailing the exact geographic location of each project. In most situations, the county engineer or planner responded to the request, although for some smaller (rural) counties, a county commissioner responded directly with the requested information. The counties also reported data about estimated costs for each of the three transportation projects. In some cases, follow-up contacts were made with specific questions to clarify details regarding projects and the cost details.

II. Geospatial Data
In order to identify and locate the individual transportation projects for each county, geographic data was first collected for the relevant transportation attributes for each county (all county and state highways, the geographic boundaries for each county and those highways which were designated all weather status). From this base level of information, the individual transportation projects identified by the counties were mapped and identified within the GIS (The proposed projects and their costs as reported by the 39 counties are presented in tabular form in Appendix I). The comprehensive road coverage (interstate & state highway systems, county & local roads) were obtained from the ESRI
Geography Network (www.esri.com). Other Washington transportation layers (road annotations, bridges, tunnels) were obtained from the WSDOT website (WSDOT GeoData Distribution Catalog) at www.wsdot.wa.gov. In the process of digitizing the data, some county specific data including geographic features such as rivers, lakes, parks were helpful with mapping. These GIS layers were found at the Washington Department of Natural Resources website and the WSDOT GeoData Distribution Catalog.

III. Geo-Coding the Individual Project Data

After the county level project data was collected and organized into a spreadsheet (Appendix I), the GIS layers (highways, county roads, and natural features) were compiled for all the counties to assist with the digitizing of the projects into separate (projects) layers. This involved taking the physical flat maps from each county and creating a digital map of the project region. Once in digital form, the project layers could be used by multiple jurisdictions for decision making.

The process of digitizing was time consuming as the various layers were from different sources (federal, state and local governments) and often had features identified differently. For example, a road might have one name designation from one data source (ex. TIGER files) and yet be referred to by a different name by another level of government (local municipality). It was common that the TIGER line files have one name for roads, but local roads have a different name designation and then the information provided by the county may have a third name designation. It is important to note that the name designations were not changed during this project but making associations between different names for the same road should be considered to facilitate the comprehensive GIS for freight planning.

Because of the challenges of identifying the correct location for the projects, follow-up was often important and involved contacting the counties directly for clarification. More than once it was
impossible to reach the person who first responded to the survey. The verification of the data was in some cases conducted by a different person altogether.

Lastly, after the projects were digitized into their own coverage, an all weather layer was created using information provided in a spreadsheet from the WSDOT. In many cases, especially the more rural counties of the state, the all weather roads within the counties consisted primarily of state and interstate highways including portions of some county roads with direct highway access. On the other hand, in the more populated areas of the state, such as King County, many of the roads were classified as “all weather.”

IV. Analysis of the Data

Across the 39 counties of Washington, data was reported for 107 proposed freight projects with a total estimated cost of $1.023 billion in 2004 dollars. A complete listing of the projects can be found in Appendix I. The transportation improvement projects ranged in expected costs from Pierce County’s 15 mile improvement of Canyon Rd. E ($162,700,000) to Skamania County’s 1.3 mile Smith Beckon Rd. improvement ($250,000). Since no stipulations were placed on the types of transportation improvement projects, the counties responded with a wide variety of needs. In fact, five counties (Asotin, King, Kittitas, Lewis and Yakima) reported only one major improvement project. Some examples of projects included improvements to interchanges (5 counties), under crosses (2 counties), bridge improvements (2 counties), a county-wide overlay and a ferry landing. The top three transportation projects reported by the counties varied widely in estimated cost as well. For example, Pierce County reported three projects that together were expected to cost a high of $249,700,000 while Lewis County’s three improvement projects had a reported cumulative cost of only $657,500.
PROJECT DESCRIPTION

COUNTY LEVEL ANALYSIS:

Since the original source of the data for each of the projects came from the counties, the following sample map are presented at the county level. Additionally, the counties are combined for each WSDOT region to evaluate regional efficiencies/inefficiencies associated with project prioritization. However, given the scale difficulties associated with presenting a region with the geographical extent of Washington on a 8 and ½ by 11 inch page, many of the county level projects become difficult to identify and distinguish.

Using the GIS, the county could show on a map the location of the project as well as the relationship to other features or freight routes. Although these maps identify only the county roads and the proposed transportation projects, decision-makers have the option of adding/including other relevant features such as rivers, bridges, or railroads simply by adding the appropriate GIS layer to the map.

Additionally, one of the benefits of using GIS is that tabular data can be presented along with the map. This allows decision-makers to see the cost or length of the proposed freight project in addition to the placement. Other data such as “purpose” (for example, access, safety, or mobility) of the project could also be included in the table.

The following pages include the county level maps for a select few (3) of the 39 counties in the state of Washington. Following each map is a brief description of the project as provided by the county officials. Some counties provided more detail than others. Each map shows the transportation system including the interstate and state highways and county roads. Those roads that were deemed to be “all weather” by the county have been identified as well. The projects are shown in varying shades of green to depict their priority.
The new unit train grain terminal facility located east of Ritzville has diverted traffic (truck traffic) away from the Snake River onto Danekas, Marcellus and Paha-Packard Roads to access the terminal. It is necessary for Adams County to improve these roads to handle the increased freight volume. The top priority transportation project identified by Adams County is 7.73 miles of Danekas Road up to I-90 for an estimated cost of $2.319 million. The second priority is the improvement of 9 miles of Marcellus Road for an estimated cost of $2.7 million. The third priority is the improvement of 9 miles of Paha-Packard Road for an estimated cost of $2.7 million.

In terms of all weather status, there are very few non-state routes that were classified as “all weather” roads. Most of these were within the city limits of Hatton, Othello and Ritzville. The Marcellus Road project would connect with an all weather road.
Walla Walla County

The highest priority freight improvement project for Walla Walla County is the widening and re-surfacing of 7.78 miles of Eureka North Road. The project is estimated to cost $7 million. Currently this freight route receives truck traffic hauling wheat to the Snake River. It would be widened to a 32 ft. paved width consisting of 12 ft. lanes and 4 ft. shoulders. Several large cuts and fills would be needed to improve this road to current standards. An additional right of way would be required to accommodate the wider road and to meet clear zone purposes.

The next highest priority freight improvement project for Walla Walla County is the widening and re-paving of eight miles of Sheffler Road. The project is estimated to cost $8 million. This freight route receives truck traffic hauling wheat to barges at the elevators. Poor horizontal and vertical realignments would likely require some large cuts to provide for drainage and to meet current standards. The proposed road would be widened to a 32 ft. paved width consisting of 12 ft. lanes and 4 ft. shoulders. An additional right of way would be required to accommodate the wider road and to meet clear zone purposes.

The third most important transportation improvement project for the county would be the widening and re-paving of 4.32 miles of Fishhook Road. This project is estimated to cost $3.7 million. Fishhook road connects to the Snake River and receives truck traffic all year long. The proposed road would be widened to a 32 ft. paved width consisting of 12 ft. lanes and 4 ft. shoulders. A portion of the road to the Snake River would require improvements to the horizontal and vertical alignments. An additional right of way would be required to accommodate the wider road and to meet clear zone purposes.
Thurston County

The highest priority improvement project submitted by Thurston County was the improvement of 1.7 miles of Nisqually Cut-Off / Kuhlman Road for an estimated cost of $2 million. This freight route accesses much of the Portland cement, concrete and aggregate sources for asphalt in the county as well as the agriculture of the Nisqually Valley. This road is presently a narrow two lane facility with many curves and no shoulders. The native material is silt river deposit with poor truck carrying capacity. Traffic volumes are around 5,000 ADT with approximately 10 percent trucks, depending on the construction season and the nature of the construction contracts using the gravel source. Estimated cost is $2.0 million.

The second most important transportation project identified by Thurston County was the improvement of 2.6 miles of Grand Mound Road for an estimated cost of $12 million. This project is an urban growth area of the county in the vicinity of the I-5 and SR 12 interchange where an improvement district recently completed water and sewer facilities. This area is scheduled for considerable growth with current projections calling for additional vehicle lanes of travel as well as non-motorized facilities. Currently the traffic volumes are approximately 7,000 ADT with more than 10 percent trucks.

The third priority freight improvement project selected by Thurston County is 1.7 miles of Rich Road for an estimated cost of $2 million. Rich Road is an important east-west connector south of the urban growth areas of Olympia, Tumwater and Lacey. Because of the Deschutes River and related wetlands there are few roads in this area. The road will be difficult to build due to creek/wetland crossing and existing sharp curves. The traffic volumes are around 3,000 ADT with truck traffic representing about nine percent of the total traffic.
WSDOT Regional Analysis

The above analysis and presentation of county level project information, relative to all weather roads and the transportation network provides very detailed county level information. However, the transportation and freight system does not stop at county (or state) borders and therefore requires a much broader perspective for effective/efficient policy planning. The following section evaluates all counties comprising the WSDOT Eastern Region in order to identify county projects that may be mutually beneficial to the region or likewise recognize regional gaps in project prioritization.

Eastern Region

The Eastern region is comprised of Ferry, Stevens, Pend Oreille, Lincoln, Spokane, Adams (most of Adams) and Whitman counties (see graphic on following page). Many of the individual county transportation projects have no connectivity with neighboring counties, as is evident from the regional map. Two counties that do share a border, Ferry and Okanogan have priority projects that would result in an all weather road between Curlew (Ferry county) and Wauconda (Okanogan county), thereby increasing all weather access between two counties and two different WSDOT regions (Eastern and North Central). Also, the second highest priority project in Spokane county would result in improved all weather access between Spokane county and Whitman county, going from Fairfield (Spokane county) to just north of Rosalia (Whitman county). Other county projects throughout the Eastern region appear to be interior to individual counties. The second and third priority project in Adams county would result in an all weather road that stops at the Adams-Lincoln county border.
SUMMARY AND CONCLUSIONS

The primary objective of this paper was to offer a process for collecting and organizing information from individual counties throughout Washington State such that system-wide freight mobility issues or transportation system inefficiencies from county to county may be better identified and addressed. By assessing specific transportation infrastructure priorities on a county basis (a maximum of three projects per county) and placing that information in the context of the entire statewide system (using GIS), possible regional freight chokepoints or inefficiencies can be identified and ultimately addressed. This initial analysis resulted in the identification of $1.024 billion (will have to be updated with new county estimates) in county financial requirements to achieve all weather road status.

Furthermore, this report supports and reinforces the FHWA Freight Management and Operations and BTS information of shipments by mode for 2002 which indicates nationally trucks carry 58.2 percent of all commercial freight tonnage with 63.7 percent of the total commodity value. In Washington, this results in trucks carrying 159.6 million tons of freight which accounted for 61 percent of all the freight moved valued at $89.6 billion. Moreover, incoming truck crossings at the Washington – Canadian border have increased by over 39 percent from 1995 to 2000.

These areas of emphasis are further supported by the recently adopted Washington Transportation Plan, which notes that growers cannot get produce off their farms for up to two months a year due to weight restrictions on County roads in eastern Washington. Agriculture employed more than 87,000 people in Washington in 2002, 80 percent of whom work in eastern Washington. Transportation infrastructure is critical to getting
agriculture products to market. Weather related constraints on freight routes argue strongly for developing a statewide core of all weather county road systems with an initial targeted investment of $200 million, which is suggested in the WTP. This proposed $200 million investment would establish a program, define criteria for selecting key routes and county roads, prioritize projects and make an investment in the design and construction of the highest priority projects. The inability of Washington State producers to meet buyers’ requirements because of weight limitations on roadways causes a loss of customers and ultimately a loss to the state’s competitive advantage and economy. This increase in the level of truck freight at the state and national level and the indications that it’s going to continue to increase significantly, provides a clear message that we must have our highway/road infrastructure in a condition that will allow these freight movements to continue all year without restriction, and thereby support our regional, state and national economy.

In addition to the projects provided by 39 Washington Counties and graphically presented on individual maps, the collection of counties comprising each WSDOT region is also presented to identify system-wide gaps or inefficiencies that may inadvertently occur.
REFERENCES


United States Department of Transportation (WSDOT) Bureau of Transportation Statistics (BTS)

USDOT: Federal Highway Administration (FHWA)