Prospective Estimates for Road Impacts in Eastern Washington from a Drawdown of the Lower Snake River

EWITS Working Paper Number 2

by

Jerry C. Lenzi
WSDOT East Region Administrator

and

Eric L. Jessup
WSU Department of Agricultural Economics

and

Ken Casavant, EWITS Project Director
Washington State University
Department of Agricultural Economics
103 Hulbert Hall
Pullman, WA 99164
EWITS Research Report:  
Background and Purpose

This report is the second in a series of Working Papers (current topics related to the mission of the Eastern Washington Intermodal Transportation Study (EWITS) to accompany EWITS reports providing information on the multimodal network necessary for the efficient movement of both freight and people into the next century.

EWITS is a six-year study funded jointly by the Federal government and the Washington State Department of Transportation as a part of the Intermodal Surface Transportation Efficiency Act of 1991. Dr. Ken Casavant of Washington State University is Director of the study. A state-level Steering Committee provides overall direction pertaining to the design and implementation of the project. The Steering Committee includes Jerry Lenzi, Chair and Regional Administrator (WSDOT, Eastern Region); Richard Larson, Regional Administrator (WSDOT, South Central Region); Don Senn, Regional Administrator (WSDOT, North Central Region); Charles Howard (WSDOT, Planning Manager), and Eric Berger, Executive Director, County Road Administration Board. Pat Patterson represents the Washington State Transportation Commission on the Steering Committee. An Advisory Committee with representation from a broad range of transportation interest groups also provides guidance to the study. The following are key goals and objectives for the Eastern Washington Intermodal Transportation Study:

- Facilitate existing regional and state-wide transportation planning efforts.
- Forecast future freight and passenger transportation service needs for eastern Washington.
- Identify gaps in eastern Washington’s current transportation infrastructure.
- Pinpoint transportation system improvement options critical to economic competitiveness and mobility within eastern Washington.

For additional information about the Eastern Washington Intermodal Transportation Study or this report, please contact Ken Casavant at the following address:

Ken Casavant, Project Director  
Department of Agricultural Economics  
Washington State University  
Pullman, WA 99164-6210  
(509) 335-1608
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The contents of this report reflect the views of the author, who is responsible for the facts and accuracy the data presented herein. The contents do not necessarily reflect the official views or policies of the Washington State Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification or regulation.

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Introduction

There is considerable concern by members of the agricultural community, river port owners and operators, transportation professionals, shipping representatives, etc. about the potential impacts of a Lower Snake River drawdown, the transportation infrastructure, and the movement of agricultural commodities. This paper offers some prospective estimates of accelerated wear on the county roadway and state highway infrastructure.

The geographical area that is now utilizing the Lower Snake River for transportation of grain includes all of Eastern Washington, parts of Idaho and Western Montana, as well as Northeast Oregon. Even with this broad geographic span, we have only utilized the grain produced in Eastern Washington for these estimates. Using this constrained approach yields estimates that are conservative.

The following information offers statistics that are used in the development of these estimates:

- 113,000,000 bushels of wheat and barley moved per year.
- 64% of this grain moves by truck-barge during the year.
- 9% of the grain movement occurs from April 15 to June 15.
- 24% of the grain movement occurs from April 15 to August 15.
- 24,000 pounds tare (empty) weight of truck
- 1 bushel = 60 pounds

Source: Eastern Washington Grain Movement Project Elevator Questionnaire Summary, May 1, 1994

Truck-barge average haul distance is 45 miles on road. This is the average distance from the center of production areas to a river port. Figure 1 visually depicts the current flow of grain in Eastern Washington moving to the river transportation system.

Average distance from elevator without rail to nearest elevator facility with rail is 15 miles. With a drawdown of the river that affects navigation from Lewiston to Pasco, the theoretical shift to rail usage is visually depicted in Figure 2.


Damage to state highways = $0.071 per ton-mile
Damage to county roads = $0.1065 per ton-mile

**Characteristics**

Farmers utilize the cheapest mode of transporting grain to market (truck-barge, in 64% of the volume).

Some wheat movements to and from elevators around the outer peripheral as indicated by the smaller arrows.

The largest volume of grain moves toward the river as indicated by the larger arrows.

Significant amount of road damage since there are large volumes being transported long distances.
Characteristics

Farmers do not have truck – barge capability and theoretically use the next cheapest alternative, rail, probably at multiple car rates.

Grain movement consists of farm to elevator, and from elevators without rail loading facilities to those elevators, which have rail facilities or those with, lower multiple car rate.

Less total damage since grain is transported shorter distances. However, impact to selected roadways is more severe.
Drawdown Scenarios

There are many different possibilities on the timing and level of a potential Lower Snake River drawdown or drawdowns. There will be studies that will determine if the river should be taken to the spillway level or drawn down to the natural river elevation (the latter could mean the river would be non-navigable all year). The National Marine Fisheries Service will make a decision in 1998 to determine which dams will be affected and the level of the drawdown of the operating pool depth that may impact barge transportation. The Northwest Power Planning Council recommended a drawdown to spillway level at Lower Granite Dam in 1996. Currently it has been suggested that the year 2000 is when an actual drawdown could occur. However, we need to be cognitive that the federal courts are also reviewing this issue and will most likely continue to do so. Decisions forthcoming from the courts could impact the drawdown levels, the duration and actual occurrence at any time.

The analyses will deal with two drawdown scenarios. One scenario is for two months in duration, from approximately April 15 through June 15, and the other scenario is a four-month drawdown from April 15 to August 15. We should note at the onset that for a two month drawdown there might be a possibility that producers will pre-sell or store the grain on-farm or in elevators and not move it. However, the movement of grain is based upon the market price and the associated transportation and handling costs. This is to say that if the market price is at a sufficient level, it will induce the movement of wheat during that time frame.

To establish baseline data in the existing situation, we know the amount of grain in Eastern Washington that moves by truck-barge is 64 percent and that during the two month drawdown, approximately nine percent of the grain moves (therefore about 5.5% by barge). With a four-month drawdown period, approximately 24 percent (or 15% by barge) of the grain normally moves. Moreover, the distance from the center of the production area to the ports via truck barge is approximately an average of 45 miles. In the drawdown situation, it is assumed that grain will be transported from elevators and on-farm storage to the nearest elevator with rail loading facilities or elevators with lower multiple car rates. This distance averages about 15 miles. This general model allows a comparison of the before and after county roadway and state highway impacts due to grain movements. As the damage component of both the county and state system is directly dependent upon miles traveled, one can assume that the damage estimates in aggregate should go down with a shorter truck haul distance. This does occur, as will be seen by our analyses.
Analyses

April 15 to June 15 (two months)

\[
\left(113,000,000 \text{ bu.} \times 60 \text{ lbs/bu.}\right) + (48,000 \text{ lbs/trip} \times 121,071 \text{ trips}) \times 64\% \times 9\% = 2000 \text{ lbs/ton}
\]

362,630 tons moved by truck-barge

April 15 to August 15 (two months)

\[
\left(113,000,000 \text{ bu.} \times 60 \text{ lbs/bu.}\right) + (48,000 \text{ lbs/trip} \times 121,071 \text{ trips}) \times 64\% \times 24\% = 2000 \text{ lbs/ton}
\]

967,020 tons moved by truck-barge

Two Month Drawdown Damage

Before (Truck -Barge)

362,630 tons x 45 miles = 16,318,350 ton-miles

16,318,350 ton-miles x 17\% county roads = 2,774,120 ton-miles
16,318,350 ton-miles x 83\% state highways = 13,544,230 ton-miles

2,774,120 ton-miles x $0.1065 = $295,440 county
13,544,230 ton- miles x $0.071 = $961,640 state

After (Elevator with Rail)

362,630 tons x 15 miles = 5,439,450 ton-miles

5,439,450 ton-miles x 38\% county roads = 2,066,990 ton-miles
5,439,450 ton-miles x 62\% state highways = 3,372,450 ton-miles

2,066,990 ton-miles x $0.1065 = $220,130 county
3,372,450 ton-miles x $0.071 = $239,440 state

Roadway Wear Summary for Two Month Drawdown

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<td>$1,257,080</td>
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Four Month Drawdown Damage

Before (Truck - Barge)

967,020 tons x 45 miles = 43,515,900 ton-miles
43,515,900 ton-miles x 17% county roads = 7,397,700 ton-miles
43,515,900 ton-miles x 83% state highways = 36,118,190 ton-miles

7,397,700 ton-miles x $0.1065 = $787,850 county
36,118,190 ton-miles x $0.071 = $2,564,390 state

After (Elevator with Rail)

967,020 tons x 15 miles = 14,505,300 ton-miles

14,505,300 ton-miles x 38% county roads = 5,512,010 ton-miles
14,505,300 ton-miles x 62% state highways = 8,993,280 ton-miles

5,512,010 ton-miles x $0.1065 = $587,020 county
8,993,280 ton-miles x $0.071 = $638,520 state

Source: Percent of road use is from Eastern Washington Road Damage Estimates from Wheat and Barley Movement “Draft Copy” Eastern Washington Intermodal Transportation Study, Jessup and Casavant, 1995

Roadway Wear Summary for Four Month Drawdown

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<td>State</td>
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<td>Total</td>
<td>$3,352,240</td>
<td>$1,225,540</td>
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It is evident that a river drawdown could decrease the amount of road damage, particularly on state roads where a 63 percent decrease is possible. But another way to assess the impacts is to look at the dollar impact per mile for the accelerated wear. In aggregate, it is evident that the road damage decreases with the drawdown situation, but in fact the accelerated wear per mile on selected routes is much greater.
### Impacts Per Mile

#### Two Months

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<td>$14,670</td>
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#### Four Months

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<td>$42,560</td>
<td>$81,690</td>
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The impact per mile in the drawdown situation causes more concentrated stress to the roadway/highway infrastructure because of the high volume transported and the short distances that the grain is moved. This impact per mile for the short trips we term as “pockets of destruction”.

What is particularly noteworthy in the analyses is the fact that the impact cost per mile for the two-month scenario increases over two times for the county road system, but decreases 24 percent for the state system. However, in aggregate the impact per mile goes up approximately 11 percent.

For the four month drawdown scenario, again the county road system receives an increased impact per mile of over double from the before situation and the state system declines slightly. However, in aggregate the increased impact per mile is up to approximately 10 to 11 percent.
Additional Analysis

The above situation of trucking to an elevator with rail facilities can be further complicated due to car supply problems. As we are well aware through past experience, the major railroads, Burlington Northern and Union Pacific, deploy their fleet where they have the highest rate of return. This means that a majority of their cars are deployed for long haul movements, in the central part of the United States around Nebraska, Kansas, etc. We have in past years experienced periodic significant car supply shortages, forcing producers, elevators, and co-ops to ship their grain via truck.

Due to car supply problems, transportation rate increases, etc., it is very probable that not all the grain will be trucked from the nearest non-rail elevator to an elevator with rail. In fact, it is reasonable to investigate the situation where only one half of this grain will be trucked between elevators and the remainder will be loaded on trucks, hauled to Pasco, and transloaded to barges (because it will have a minimum operating pool that will allow barge transportation). This causes transportation dynamics to change considerably.

**Two Months**

362,630 tons x 0.5 x 15 miles = 2,719,720 ton-miles  
362,630 tons x 0.5 x 100 miles = 18,131,500 ton-miles  
2,719,720 ton-miles x 38% county roads = 1,033,490 ton-miles  
2,719,720 ton-miles x 62% state highways + 18,131,500 ton-miles = 19,817,720 ton-miles  
1,033,490 ton-miles x $0.1065 = $110,060 county  
19,817,720 ton-miles x $0.071 = $1,407,050 state

**Four Months**

967,020 tons x 0.5 x 15 miles = 7,252,650 ton-miles  
967,020 tons x 0.5 x 100 miles = 48,351,000 ton-miles  
7,252,650 ton-miles x 38% county roads = 2,756,000 ton-miles  
7,252,650 ton-miles x 62% state highways + 48,351,000 ton-miles = 52,847,640 ton-miles  
2,756,000 ton-miles x $0.1065 = $293,510 county  
52,847,640 ton-miles x $0.071 = $3,752,180 state
Roadway Wear Summary for Two Month Drawdown

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Roadway Wear Summary for Four Month Drawdown

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Impacts Per Mile

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<tr>
<td>Before</td>
<td>$17,500</td>
<td>$56,980</td>
<td>$74,480</td>
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<tr>
<td>After</td>
<td>$19,560</td>
<td>$55,610</td>
<td>$75,170</td>
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As you would expect in the two month drawdown, the county road system experiences a reduction in the impacts after a drawdown, whereas the state system experiences a fifty percent increase in impacts. The aggregate impact reflects a net increase of twenty five percent for the entire highway/roadway transportation system in the situation where rail car supply is inadequate.

In the four-month scenario, again the county road system reflects decreased impact from the drawdown, and the state system reflects a fifty percent increase in impacts from the existing to the drawdown situation, resulting in a net roadway/highway system fiscal impact increasing approximately twenty five percent. Also, remember that the 100 miles was assumed to be on the state highway system, which has a much lower impact per ton-mile than would be the case if more county roads were traversed.

This scenario is visually displayed in Figure 3.
**Figure 3: Grain Flows in Eastern Washington with a River Drawdown and Rail Car Constraints**

**Characteristics**

Have considerable short distance hauls as rail is an important mode.

However, a large amount of grain may be trucked to the Tri-Cities due to rail car constraints.

Significant amount of road damage as a result of large grain volume being shipped long distances.
External Factors

To modify the prospective scenarios to encompass other real world possibilities, we need to understand that there are several forces impacting this transportation shift that are external. First, the county road construction cost of 10.7 cents per ton-mile is, more than likely, low. Many of these county roads are bituminous surface treatments, thin lift asphalt, or even gravel, that will not be able to withstand the impacts of repeated conservative loading of 80,000 pounds (gross vehicle weight) trucks. This accelerated wear estimate, for all practical purposes, should probably be in the order of 12 to 12.5 cents per mile. Thus, these estimates can be considered conservative.

Also, with the absence of the river barge traffic as a competitive transportation factor, there may, in fact, be rail rate increases due to the lack of competition and the potential of a monopolistic pricing structure. With a transportation cost increase of 10 cents per bushel, in a two-month scenario this could equate to an increased transportation cost to producers/shippers of over $650,000. In the four month drawdown scenario, this could amount to over $1,735,000 increased cost to the producer/shipper. And, important to this analysis, it could cause increases in the truck movement to Pasco.

We can also factor in additional externalities among the various modes. Figure 4 represents the various emissions produced by the different modes. Based on the choice or the availability of the mode, these emissions can have a negative impact on the environment. Correspondingly, Figure 5 reflects fuel efficiency, which notes the various efficiencies of each mode to move one ton of commodity per gallon. This clearly will have some influence on transportation rates and overall energy consumption.

A direct impact on the capability of moving a large volume of grain is also the size of the conveyance vehicle. Figure 6 reflects the associated relationships of barge, rail car and trucks and the equivalent number of each that would carry the same amount of grain. This leads directly to Figure 7, which is a significant factor in determining transportation rates relative to the efficiencies of the various modes.
Emissions Produced

Train
Truck
Tow Boat

Pollutants produced in pounds in moving one ton of commodity 1,000 miles
Fuel Efficiency

Miles one ton of commodity can move per gallon

Rail: 202.3
Highway: 59.2
Waterway: 514.0
Compare

- Barge
  3,500 Ton
  122,500 Bushels
  875,000 Gallons

- 4-Barge Tow
  14,000 Ton
  490,000 Bushels
  3,500,000 Gallons

- Jumbo Hopper Car
  100 Ton
  3,500 Bushels
  30,240 Gallons

- 100-Car-Unit Train (grain)
  10,000 Ton
  350,000 Bushels
  3,024,000 Gallons

- Large Semi
  26 Ton
  910 Bushels
  7,865 Gallons

1 Barge = 35 Jumbo Hoppers

1 Tow = 1.4 Unit Trains

134 Trucks

538.4 Trucks
1 Gallon Fuel Moves 1 Ton Cargo

Truck 50 miles

Rail 202 miles

Barge 514 miles
Conclusion

We believe the prospective estimates of this assessment reflect that there may be additional transportation infrastructure impacts. However, the following two opposing situations result from the analyses:

- If there is no rail car supply problem during the two month or four month drawdown periods and rail rates remain reasonably close to existing rates, roadway and highway wear decreases in the aggregate. However, some county roads may experience accelerated wear.

- If market conditions or an inadequate rail car supply occurs, at least one-half of the grain production may be trucked to Pasco. In this event, roadway and highway wear increases in the aggregate. County roads may experience reduced wear, while state highways experience accelerated wear.

The analyses also mention many of the externalities such as the car supply situation, potential transportation rate increases, the price of grain on the world market, safety concerns, rail line congestion, adequate car supply, and the associated economic implications of a drawdown that can significantly impact the decisions of shippers and producers to effectuate a modal shift.

Perhaps one of the most striking elements of these preliminary analyses is the potential to increase truck traffic from a 45-mile haul distance to approximately 100 miles. With this particular scenario there would be an additional 60,000+ one-way truck trips put on the system for 100 miles. Clearly, this increase in traffic in some areas could create additional transportation problems.

We believe that the results predicted in these analyses are very conservative. However, even with the conservative nature of the prediction, it reflects a potential for general increased impact and therefore stress upon the county road system and the state highway system. Therefore, the results of the analyses indicate a need to invest in the infrastructure to ensure preservation of surface transportation to move grain.

Hopefully, if we continue our efforts to interact with the National Marine Fisheries Service, Northwest Power Planning Council, Washington Public Ports Association and the other interested stakeholders in this effort to comply with the Endangered Species Act, we will be able to bring recognition of the needs of transportation, and the economic factors that surround these needs, into the policy equation.
Freight Cost

$25.00

$10.15

$5.55

Rail  Truck  Barge

Dollars per ton of grain, Lewiston to Portland
Capacity

Carrying capacity, tons of grain

Rail Car: 100
Truck: 25
Barge: 3,500