

**Columbia Snake River System  
and Oregon Coastal Cargo Ports  
Marine Transportation System Study**

**Appendix C**

**Short Sea Shipping in the Columbia/Snake River System**

Prepared for  
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# **Short Sea Shipping in the Columbia Snake River System**

Short sea shipping is an innovative intermodal concept that substitutes water transportation for the more traditional surface modes of truck and rail. It can be used as a link in delivering cargo to and from international trade ports or it can be an all-water alternative for domestic movements. The purpose of this report is to identify public policy issues and market factors that affect the potential for successful short sea shipping within and to and from the Columbia Snake River System.

Cargo transported over water typically moves at lower cost while consuming less fuel and emitting fewer airborne pollutants than rail or truck. The U.S. Maritime Administration reported the relative energy efficiencies of the three modes of transportation. In their study, one gallon of fuel could move one ton of cargo 59 miles by truck, 202 miles by rail or 514 miles by barge (Environmental Advantages of Inland Barge Transportation, Maritime Administration, U.S. Department of Transportation, August 1994). In Oregon, where triple trailers are permitted on selected roadways, the Oregon Department of Environmental Quality estimates that trucks can move one ton 163 miles using one gallon of fuel (Utilizing Inland Waterway, Coastal and Open Ocean Barging of Containerized Agricultural Products to Overcome Existing Service Deficiencies and Increased Transportation Costs, Draft Report, August, 2004) Similar relative fuel efficiencies have been reported in Europe. Air pollutants from tow boats on a ton-mile basis were shown to be 20-30 percent of the emissions from rail and five-to-fifteen percent of the emissions from trucks (Maritime Administration, August 1994). The opportunity to relieve congestion and reduce maintenance costs on highways and railways has focused even greater attention on waterborne alternatives.

## **Columbia Snake River Container Barging as a Model for Short Sea Shipping**

After experiments began in 1972, the first regular container on barge service began in 1975, with a total of 125 containers. Growth was rapid, hitting more than 6,000 loaded containers in 1979 and surpassing 15,000 loaded twenty-foot-equivalents (TEU, a measure of containerized cargo equal to one standard container of 20 ft length, 8 ft width and 8.5 ft height) in 1988. Growth continued, peaking at more than 45,000 loaded TEU in 2000. These are all containers destined for the Port of Portland's Terminal 6 for export on direct service ocean-going ships.

The domestic movement of solid waste from the Vancouver, Washington area to Boardman, Oregon began in 1991. Tidewater Barge Lines moves, on average, 14,000-16,000 TEU of containerized solid waste each year.

A typical container barge carries 80-100 TEU. The largest on the river carries 160 TEU. The longest move is 365 miles from Lewiston, Idaho to Portland, Oregon. Container barge ports at Umatilla and Boardman, Oregon and Pasco, Washington are 170 to 225 river miles and 27 to 35 hours from Portland's container terminal.

According to the Oregon Department of Agriculture (August, 2004), rail rates for grain are nearly double barge rates and truck rates are about 3.5 times higher. The relationship between rates is similar for containerized cargo, though the differential is somewhat less.

Three major factors contributed to the start-up and continued success of container barging on the Columbia Snake River System: cooperation, commodity mix and geography.

### **Cooperation**

The ports, barge lines, shippers and steamship lines were all committed to making container barging successful. The ports developed facilities, fostered early technological experiments in loading containers on barges, and marketed the river system for containers on barge.

The barge lines quickly entered the market. Over time, they encouraged additional market growth by operating upriver terminal facilities and developing specialized equipment, such as powering barges to handle refrigerated containers.

Shippers took some risk in experimenting to establish the service. The first move was just three containers. Shippers were soon encouraged by barge rates that allowed them to save \$200-300 per container.

Steamship lines agreed to quote through rates to and from the inland ports and they were willing to position containers at those inland ports.

Perhaps the most important factor was that the container barges could be easily added to existing tows of grain or petroleum barges without adding significantly to the cost of the move. By itself, the container on barge system would not have been economically feasible.

### **Commodity Mix**

The Columbia Snake River System had the right commodity mix to make container barging successful. Shippers of low value, non-time sensitive cargo could afford the extra couple days of transit time in exchange for the lower transportation cost. Further, the cargo was concentrated in very close proximity to the river system. Forest products in Lewiston, Idaho, potato products in Boardman, Oregon and hay cubes in Pasco were all produced less than a mile from the barge docks.

### **Geography**

Five major geographic factors contributed to the success of container barging:

- The Columbia Snake River System feeds cargo west, in the direction of the ultimate destination of much of the cargo, the Far East. Barged containers are also exported to Europe in significant volumes.
- The cargo is concentrated, moving from a few inland locations to one major hub for steamship service in Portland and on to the Far East and Europe. Having one common-user ocean terminal in Portland is a great advantage. If the container on barge cargo needed to be split among two or more terminals, it would be much more difficult to aggregate the volumes needed to make economical use of ocean container terminal labor and equipment.

- The inland move is of intermediate distance (200-400 miles), which balances the cost and time factors to the shippers' advantage.
- The inland container ports created a new "alternative" or "off-line" hub, where the price advantages of barging were not competing directly with the major surface transportation hubs which could offer lower prices due to high volumes in certain corridors.
- The transpacific trade was large enough to offer a sufficient mix of ocean carriers that some steamship lines chose to cater to markets such as the agricultural and forest products that make up the majority of the container barge movements.

These elements combine to create a specialty market, where the container barge option best meets customer needs. And, as a specialty market, by definition, volumes are relatively low. Barged containers have made up about 25 percent of the Port of Portland's container volume over the last ten years, and less than one percent of the west coast container volume. In 2004, barged containers accounted for 22 percent of full containers exported from Portland's Terminal 6.

## **Other Regions as Models**

### **Western Europe**

Short sea shipping has been successful in Europe, where more than 40 percent of all freight is transported coastwise by water. This compares with seven percent in the U.S and 15 percent when coastwise and inland waterways are combined. High volumes of freight are transported between densely populated urban areas. For example, 160 million people reside within a 300 mile radius of Rotterdam in the Netherlands.

The National Ports and Waterways Institute credits European Union (EU) policy as a major factor in the success of short sea shipping. They say that accounting for external benefits or costs is a leading factor in formulation of EU transportation policies. External costs for trucking include increased costs of highway maintenance, increased air pollution, increased congestion, increased noise in urban and protected areas, and increased accidents and loss of life.

The European governments increased highway user charges to reflect these external costs and provided direct financial support to water transportation projects. The Institute cites an EU White Paper from 2001 which states, "These short sea lines will not develop spontaneously. They advocate national funding supporting operations and infrastructure to "encourage start-ups and give them an attractive commercial dimension."

### **The U.S. East Coast**

Key factors of success in studies of east coast short sea shipping identified by the National Ports and Waterways Institute include use of roll on/roll off (Ro/Ro) vessels, what they called "exclusively freight ferries", hauling only truck trailers and containers mounted on chassis, between dedicated domestic cargo terminals (The Public Benefits of the Short-Sea Intermodal System, National Ports and Waterways Institute, University of New Orleans, November 2004).

They analyzed of two routes, a 200 mile short route between New York City and Boston and a 1,000 mile long route between New York City and Miami, with stops at Charleston and Norfolk.

They concluded that, based on financial and operational criteria only, it would be difficult to establish new and commercially viable coastal services on either the short or long routes.

When external costs were added to the analysis, short sea shipping appeared much more attractive. Water transportation reduced infrastructure maintenance and repair costs, air pollution, congestion, noise, accidents and dependency on foreign oil.

### **The Texas Gulf Coast**

Researchers from the University of Texas investigated the “Feasibility of a Container-on-Barge Network Along the Texas Gulf Coast” (Transportation Research Record 1782, 2002). Looking at market forces rather than government policies, they found a few opportunities but did not expect them to overcome what they called “daunting” hindrances to forming a container-on-barge network. They include the lack of container equipment and infrastructure, low population density with only one large population center, a supply chain developed around short transportation times, high port development costs, rail competition and high operating costs.

### **Cascade Gateway**

Cambridge Systematics prepared a “Cross Border Shortsea Shipping Study” for Transport Canada (May 2004). Two of their factors affecting short sea shipping were directly related to the international trade aspect of cross border shipping, trade and customs regulation and security issues. The others would be more generally applicable to the Columbia Snake region, port infrastructure, market and operational issues, institutional issues and cost.

They found that port and terminal operations at larger deepwater seaports are not amenable to short sea shipping operations for a variety of logistical, regulatory and financial reasons. Smaller ports are better suited to handle the equipment and volumes carried in short sea shipping.

The Canadian study found the biggest barrier to short sea shipping was the lack of a defined market. Existing short sea operators handle a limited commodity mix, typically high-weight, low-value cargo, such as wheat, grain or scrap metal. Cambridge Systematics found very few operators interested in investigating such markets.

Cost and reliability were identified as key market issues. Drayage to and from the ports plus the cost of labor for rehandling at each origin and destination port have the potential to offset any gains in per ton-mile cost savings of the waterborne option. The study reported that shippers are concerned that barge transit times will be less reliable than truck or rail because weather factors can affect ocean travel times, with, they say, speeds varying from two to eight knots per hour for a tug-barge combination.

Another key factor identified was trip frequency. Trucks can operate on demand. Rail carriers can offer daily or twice daily service. They found no short sea or coastal shippers in the U.S. offering daily service. Delivery schedules increasingly need to fit just-in-time delivery requirements.

The Harbor Maintenance Tax, which is applied to cargo moving in and out of federally maintained navigation channels in the U.S., was identified as a barrier, placing short sea and coastal shipping at a price disadvantage compared to other modes.

In analyzing the market case, the study demonstrated that bulk raw materials or semi-finished goods, such as raw logs, woodchips, paper, lumber, petroleum, bulk chemicals and sand and gravel currently move in short sea services. The shipments are generally large lots that do not need to be consolidated. They are not time sensitive. Shippers are typically located on the water, using their own private terminal, thus keeping labor costs down and eliminating the need for additional handling and inland distribution costs.

Successful general cargo short sea shipping tended to be short-haul feeders to smaller markets on islands (Vancouver, San Juan Islands) or longer hauls locations on the coast of Canada or to Alaska, where there is no other practical mode available.

### **Public Investment Issues**

When considering public support for short sea shipping, there are two major areas for consideration. One is the application of funds and the other is in setting public contracting policy.

Financial support could be offered to jump-start a new service or to cover operating expenses. Given the condition of the federal budget in recent years, the priority for public funding should be in helping get a service started if economic analysis demonstrates that it would be self sustaining over the long term. The benefit of providing a long-term operating subsidy to a service that would not otherwise be economically feasible would be harder to justify.

Revising government contracting policy to consider external costs of trucking and rail when evaluating public bids would encourage more short sea shipping. It would increase the government's direct financial outlay, but may reduce other government expenditures on the external costs. This may be a less costly and more sustainable mechanism for supporting short sea shipping than offering a direct operating subsidy.

### **Applying the Models to the Columbia Snake River System**

Three major classes of moves have been discussed as short sea shipping opportunities in the region:

- Feeder service for containerized cargo currently moving in domestic and international trade,
- Shifting current domestic cargo movements from road and rail to water, and
- Generating new domestic cargo movements utilizing the economic efficiencies of coastwise short sea shipping.

#### **Container Feeder Service**

Each year, more than 500,000 container TEUs, both full and empty, are transported to and from the Columbia Snake River region for shipment on ocean-going vessels. Thus region includes all of Oregon, Southwest Washington, and the areas in Eastern Washington and Idaho. Historically,

between 50 and 60 percent of this movement is shipped via Portland's Terminal 6. The remaining 40 to 50 percent is trucked or railed to and from Seattle and Tacoma for shipment on vessels calling those ports. These surface movements to and from Puget Sound occur for a variety of reasons, for example, to use specific steamship lines or to meet a specific schedule to the foreign destination.

The volume of regional cargo diverted to the Puget Sound expands and contracts with changes in the level of Portland direct container service. Nonetheless, even when the level of Portland direct container service has been high, significant volumes of regional cargo have continued to move overland through the Puget Sound. This indicates a market that may be large enough to support short sea feeder service, regardless of the status of Portland direct service. A short sea container feeder service that shifts these overland movements to water would likely complement rather than compete with direct container service in Portland.

There are obstacles, however, to the use of short sea container feeders to service the Columbia Snake River region cargo. Geography is one such obstacle. The Puget Sound ports of Tacoma and Seattle are only 140 to 170 miles from Portland, making surface transport by truck and rail highly competitive. By comparison, the all-water route is 300 miles or more in distance and includes crossing the Columbia River bar. This added distance negates some of the per-ton-mile cost advantages of barging.

Another obstacle to short sea container feeders is modal interchange costs, or handling costs. These handling costs are minimized when containers are shipped directly via ocean vessel at Portland. They are also much lower, when compared to water feeders, for containers drayed by truck or rail to/from Puget Sound ports. In the case of upriver barge cargo, the additional handling costs would be particularly onerous as containers would need to be transhipped from river barges to short sea feeder vessels and then to ocean vessels. Once in Puget Sound, in contrast to Portland, where container service is concentrated at one common-user terminal, containers might need to be drayed between the feeder terminal to multiple terminals at either Tacoma or Seattle, further increasing the handling costs associated with feeder operations.

Despite these current obstacles to short sea container feeder service, it is in the public interest to explore and promote solutions by which these obstacles can be overcome and short sea container feeder service implemented. Shifting freight from an increasingly overburdened and congested surface transport system to the water transport system, which has ample capacity and is environmentally cleaner, makes sense. The full consideration of the external costs of surface transportation and the application of broader public policy goals makes public support of a short sea alternative desirable.

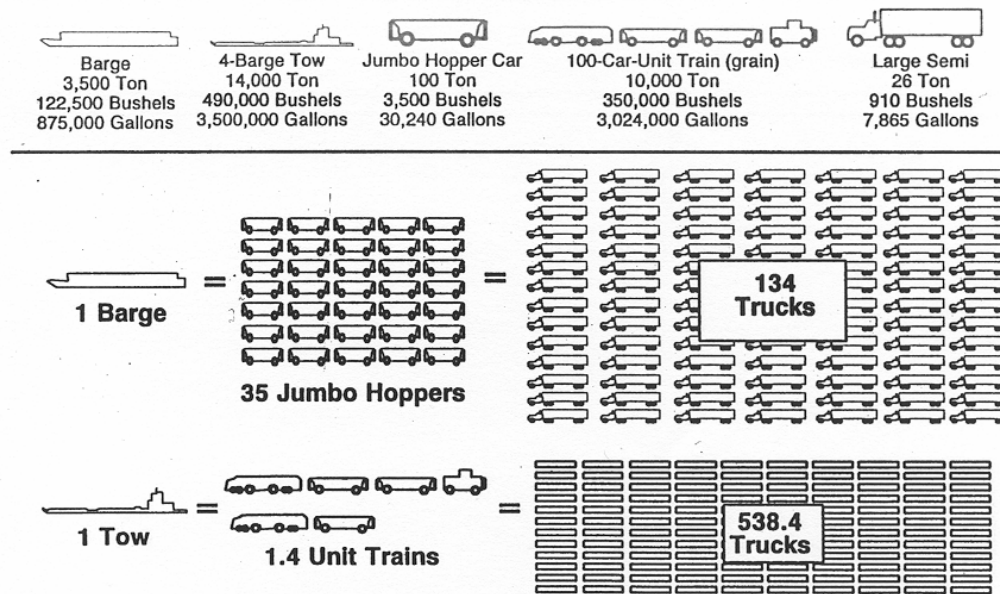
However, direct container service via Portland is the most beneficial alternative, both economically and environmentally. It would not be good public policy to support a feeder service that competes with, or potentially eliminates the more efficient direct ocean carrier service. Federal, state and local governments are already investing in maintaining and improving navigation channels, port facilities and surface transportation access for direct service to Columbia River ports.

With Portland's loss of two transpacific container services in 2004, the region has increased its interest and exploration of all-water alternatives to surface transportation. Among the options being explored is to reduce the operational costs of the all-water service. Building new, larger capacity barges that could be used in both the river and the ocean is being investigated by the Oregon Department of Agriculture.

### Shifting from Roads to Water

The Columbia River is the number one wheat export gateway in the U.S. Nearly 50 percent of the wheat exported out of the river arrives at the export elevator by barge. The barging of wheat and other commodities on the Columbia and Snake Rivers is estimated to keep the equivalent of 700,000 trucks off the highways, primarily Interstate 84.

### Comparing Columbia/Snake River Barge, Truck and Rail



One panamax vessel = 60,000 tons of grain = 4-5 barge tows = 600 rail cars = 2,400 semi trucks  
 = 6 miles of trains = 95 miles of trucks on the highways (at 150 feet between trucks)

Shifting additional cargo off the highways onto barges can alleviate congestion, reduce highway maintenance costs and decrease air pollution. Highway congestion is a serious issue in the Portland-Vancouver Interstate 5 corridor. Hundreds of highway bridges throughout Oregon, including many in the Columbia River corridor, have been identified by the Oregon Department of Transportation as having structural problems in need of repair. Weight limits and other restrictions have been imposed. Air pollution and acid rain have been identified as problems in the Columbia Gorge National Scenic Area, along the river corridor east of Portland. Shifting cargo from highways to barges can contribute to solving all of these problems.

The Oregon Department of Agriculture is working with shippers, ports and tow boat companies to identify agricultural and forest products that may be shifted from road to water. They are

investigating both movements within the Columbia Snake River System and shipments from the Columbia River to Pacific Ocean destinations along the U.S. west coast.

Applying the European model of taking external costs into account in setting transportation policy may be necessary to gain more success in shifting cargo from road to water. For example, Metro, a regional government agency in the Portland metropolitan area, is responsible for land use and transportation planning and for solid waste and landfills. Metro has contracted to send Portland area waste to the Columbia Ridge Landfill near Arlington, Oregon, 140 miles east of Portland on the Columbia River. Each year since 1990, over 600,000 tons of material has been trucked through the Columbia Gorge on Interstate 84 to this land fill.

The contract to transport containers of solid waste was awarded by bid, with a trucking company providing the low bid. That contract is up for renewal in 2009. Tow boat companies in the region believe that had external costs been considered, 600,000 tons of solid waste would likely be moving by water rather than by truck. They are encouraging the Metro to consider the total cost of the movement, including external costs such as highway maintenance, air pollution and congestion impacts when evaluating the next round of bids. To accomplish this move, a barge dock would need to be built in Arlington. A site has been identified and plans are being developed, but funding sources have not yet been committed.

### **New Coastwise Movements**

For decades, there have been large domestic coastwise movements of petroleum products from northern California and Puget Sound to Portland by barge and ship. Three-to-four million tons per year of gasoline and other refined petroleum products move from Richmond in the San Francisco Bay area and Anacortes in northern Puget Sound to Portland. From tank farms on the Willamette River in Portland, roughly half of that volume is then distributed by special purpose petroleum barges to Pasco, Washington and Umatilla, Oregon on the Columbia River and to Wilma, Washington on the Snake River. The remainder is distributed by truck and pipeline within the Portland metropolitan area and surrounding region.

A potential new coastwise market is solid waste container traffic. Local interests have identified potential markets in Seattle, Hawaii and California, where city and regional garbage handlers will soon overwhelm the capacity of local landfills. Specifically, the Columbia Ridge landfill at Arlington, Oregon has ample capacity to take a considerable portion of the available volume from these other states if a short-sea shipping option were available.

This market is particularly attractive because the commodity is readily available, the landfill is happy to handle the new business, and at least some of the containers could be moved on existing barges. There may also be ties between the ownership of the Arlington, Oregon landfill and operators of collection services for the municipalities under consideration. That could make the barge option to Arlington even more attractive. As with the movement of solid waste from Portland, a barge dock would need to be built in or near Arlington.

A long-range investigation is underway by interested parties within the region for a coastwise container service from the congested southern California ports to Portland. Those involved think that such a service could be established on a weekly basis using articulated tug-barge (ATB)

technology. The articulated tug-barge vessels being discussed are capable of delivering 700 forty-foot equivalent containers (FEUs) to Portland's Terminal 6.

These vessels have advantages over traditional tug & barge service in that they can carry more cargo, operate in much heavier seas and can navigate the Columbia River bar with fewer weather delays. Their fuel efficiency and speed are better. Compared with domestic movement by ship, they have favorable manning requirements and greater flexibility to operate in shallower drafts. Transloading containers to these ATB vessels could make a small contribution to relieving some of the rail and highway congestion problems at southern California ports and provide additional access for Northwest shippers to container carriers who do not serve Portland. This would be attractive if the new service adds capacity and cargo to the region and does not take cargo from carriers who now call or who have potential to call the Columbia River.

Other opportunities for coastwise short sea shipping include the movements of agricultural and forest products in bulk from the Columbia River to the southern Oregon coast and California markets. The geography of shipping coastwise to California is more favorable shipping containers over the ocean within the Pacific Northwest. One of the most important factors is that the cost advantages of shipping by water are preserved to a greater degree. The all-water distance is not considerably longer than the road distance. The longer north-south haul to California increases the likelihood that the cost per ton-mile benefits of water transit will overcome the higher handling costs associated with that mode. The most efficient operation would be for these bulk cargoes to be handled at just one destination facility located on the water to reduce the need for additional handling and an inland move from the destination port.

Development of specialized equipment for some of these moves, particularly handling waste from Seattle, would further increase efficiency. An ocean-going barge built to the constraining dimensions of the locks on the Columbia Snake River System would reduce handling as there would not be the need to transload cargo in the lower Columbia. The locks' limiting factor is their width of 86 feet. Most current ocean barges have a broader beam.

## **Conclusions**

Market forces have generated demand and the industry has responded with the development of successful short sea shipping services in the Pacific Northwest. Container-on-barge service and barging of solid waste are two prominent examples within the Columbia Snake River System. The shipment of petroleum products from California and Puget Sound to Portland is the most prominent coastwise example.

Barging containers improved the efficiency of the Columbia Snake River international trade corridor and contributed to regional goals of increasing trade and maintaining reliable and frequent steamship service to and from world markets.

Barging of solid waste within the river system is a market-driven domestic movement that offers cost advantages, but also solves local land use issues and keeps thousands of trucks off the highways.

New short sea shipping opportunities exist for container feeder service and for the coastwise movement of domestic cargo. Short sea shipping can also be a useful tool to assist local, state, regional and federal governments meet other policy objectives. Waterborne transportation can help alleviate congestion, reduce pollution, decrease highway maintenance costs, reduce the loss of life and property, and solve land use problems. Both practical and theoretical models exist in Europe and the U.S. that can inform policy decisions to support waterborne commerce.

Care must be taken in making policy decisions to promote short sea shipping opportunities. When establishing public policy, it is important that policy makers understand the full set of impacts of their policy decisions.