9 FREIGHT RAIL BENEFITS

Introduction: Ohio's goal is to improve the capacity and fluidity of its transportation corridors for movement of both people and freight. Implementation of the Ohio Hub would offer freight railroads added capacity and improved tracks, grade crossing and signal systems. A key question is how freight can best take advantage of the added rail capacity that the Ohio Hub passenger rail system would provide.

For passenger services at a top speed of 110-mph, a typical schedule is 8-12 trains each way. However, the proposed capacity enhancement in Ohio would include considerable track additions, which support significant added freight activity, up to 12 freight trains in each direction, particularly at night. Intermodal traffic in particular would be in a good position to benefit from Ohio's investment in high-quality rail infrastructure.

The Freight Rail Capacity Opportunity: Much of the current Engineering costing of the Ohio Hub is based on the proposition for adding dedicated passenger tracks at 28' centers from existing tracks. These have been called dedicated passenger tracks, but in fact it has always been envisioned that any spare capacity could be made available for freight use.[64]

Ohio Hub's current proposed capacity investment would add a track to most of the length of each corridor. The proposed capacity would be sufficient to support the proposed passenger schedules, usually 8-trains per day in each direction *on a stand-alone basis*. From Buffalo to Greenwich via Cleveland and from Ravenna to Toledo via Cleveland, the existing routes are double tracked so Ohio Hub would add a third track. Much of the 3-C corridor and to Toledo-Detroit line are single-tracked today, so a double track would be added there. Segments of the Youngstown line that are currently abandoned would be restored as a single-tracked line under the current Ohio Hub proposal.

Exhibit 9.1 gives practical capacity values for typical line configurations in terms of total freight trains per day. The greatest gain of 50 trains occurs when moving from a single to a double tracked configuration, which would occur on the 3-C corridor and Toledo-Detroit segment. After this, each track adds about 40 trains per day to the practical capacity of a rail line, as would occur on the Buffalo and Cleveland-Toledo lines. These capacities assume bi-directional signaling with universal crossovers on multiple tracked rail lines, or freight passing sidings on single tracked lines spaced at average 10-15 mile intervals.

Exhibit 9.1: Practical Freight Train Capacity of Rail Line Configurations

Number of Tracks	Trains per Day
1	30
2	80
3	120

For assessing the capacity increase, a single-tracked 110-mph passenger line with a 10-mile double tracked section every 50-miles can support passenger service on scheduled hourly headways. The theoretical capacity of this configuration is 24 daily passenger trains in each direction, a total of 48 trains. In the Ohio Hub analysis, only 8 passenger trains are usually scheduled each way so only one-third of the theoretical line capacity is used. Applying a

[64] See Appendix D, which recaps the MWRRS Toledo to Cleveland capacity analysis, for a more detailed discussion of these issues. Ideally the new track layout would be configured in such a way that makes it easy for freight trains, as well as passenger trains, to access and use the tracks when needed.

further 33% allowance to reduce from theoretical to practical capacity implies that passenger service would use no more than half the available capacity of the added track. For assessing the unused capacity that could be made available for freight in Exhibit 9.2 –

- For an abandoned corridor to which a single track is added, 50% of the line capacity is made available to freight.

- For a single track line converted to double track, 50% of the time the line operates in double track mode; 50% of the time it operates as single track (passenger service consumes one of the available tracks during the day).

- For a double track line converted to triple track, 50% of the time the line operates in triple track mode; 50% of the time it operates as double track.

Exhibit 9.2: Increase in Freight Train Capacity for Final Rail Line Configuration

Number of Tracks Before	Number of Tracks After	Calculation	Old Freight Capacity	New Freight Capacity	Freight Capacity Increase
0	1	50% * 30	0	15	15
1	2	50% * 30 + 50% * 80	30	55	25
2	3	50% * 80 + 50% * 120	80	100	20

Exhibit 9.2 shows that if an abandoned or lightly-used corridor were upgraded as a single-tracked line for passenger service, making 50% of the capacity of that line available to freight, the line could also handle 15 freight trains, 7 or 8 freight trains in each direction, mostly at night[65]. The most common case for the Ohio Hub is where an existing single-tracked line is double-tracked. Doing this results in a near-doubling of the effective capacity for freight trains, in spite of addition of passenger trains, allowing 25 additional freight trains. Tripling a double-tracked line would allow 20 additional freight trains. However, the economic analysis very conservatively assumes only a minimum capacity increase of 15 trains per day.

Alternative Uses for Added Freight Rail Capacity: The impact of Ohio's investment in rail capacity is a complicated question, since rail capacity is a network issue. In addition, the value of this capacity to a freight railroad will depend on whether the freight railroad can use, from a scheduling viewpoint, additional schedule slots at night. The ability to grow long haul freight may be limited by bottlenecks that lie beyond Ohio's borders. Thus, railroads' ability to use Ohio's investment to grow long haul freight must rely either on a Federal funding program[66], other states' passenger rail investments, or the railroads' own ability to internally finance investments for expanding capacity outside Ohio. To the extent that the freight railroads are able and willing to make such investments, they could leverage Ohio's investment could help them expand their long-haul traffic bases.

Railroads could choose to expand freight traffic in bulk, carload or intermodal. However, there is a major and immediate opportunity for railroads to shift some freight currently handled by trucks back to rail. This has been difficult for rail to do on its own, because of

[65] This calculation implies a displacement of one freight train for each passenger train; which at first glace appears to be too low; after all, shouldn't a passenger train consume more capacity than does a freight train? However, this doesn't account for the fact that the typical freight passing siding spacing is only 10-miles, while for passenger trains the interval between sidings is 50-miles. For this reason, the practical capacity for the two kinds of trains is roughly equivalent.

[66] For example, an expanded availability of RIFF financing so railroad could accelerate the pace of their capacity investments.

truck traffic's high service requirements. Since all the excess capacity has been squeezed out of today's rail networks, the high level of traffic congestion makes it difficult for railroads to compete for such traffic. Additionally, railroads have typically not been able to generate the levels of capital funding that would be needed to enable them to build enough capacity to penetrate this market.

However, as truck VMT's on the highways continue to grow, there is an emerging public consensus on the need for public investment that could allow railroads to contribute more effectively to solving the emerging mobility crisis.[67] Even though adding rail capacity can be expensive, highway capacity can be even more expensive and problematical, especially in congested urban areas.

Both intermodal and carload are capable of drawing market share from trucks, but the assessment here of the value of the freight rail capacity enhancement is based on intermodal economics. Especially the addition of single-stack intermodal trains for domestic trailer freight, because of their relatively light axle loads,[68] would be a *compatible* freight use that could take full advantage of high quality infrastructure without damaging the tracks.

Long Haul versus Short Haul Traffic: Given the expected continued growth in long-haul freight, as a practical matter some portion of Ohio's added rail capacity can be used to accommodate this growth. With regard to assessment of national benefit, the longer the haul, the greater the economic advantage of rail shipping. It is therefore clear that both the public and private benefits of long-haul rail freight are very great. It is the efficiency that railroads provide to long-haul freight that allows railroads, for the most part, to privately finance their infrastructure.[69]

However, for estimation of economic benefits of long-haul freight, the indivisibility of costs, competitive assumptions and distribution of economic benefits between states or regions are all complicating factors. These are all technical issues that would need to be addressed in the context of a national rather than regionally-scoped study. For example, it would be inappropriate to estimate freight benefit nationally and then attribute only Ohio's share of the cost. A national assessment of long-haul freight benefit would have to be matched by a national assessment of cost, in order to properly estimate the Cost Benefit ratio.

Additionally, competitive factors for long-haul freight are very complicated since they include the effect of direct rail-to-rail competition as well as modal alternatives. For example, the competition for a Los Angeles to New York transcontinental double-stack train is not truck, but rather could be an all-water vessel service via the Panama Canal, as well as rail services competing with one another. Double stack containers are therefore priced on a water and rail rather than truck-competitive basis. These factors make it more difficult to assess the economic benefits associated with the rail haulage of such traffic.

[67] AASHTO freight Bottom-Line report, see: http://freight.transportation.org/doc/FreightRailReport.pdf

[68] Single stack intermodal trains typically have axle loadings in the vicinity of 20-25 tons. Double stack trains load as heavy as 30-35 tons per axle.

[69] Although, given the capital investment constraints faced by railroads, part of the growth in long-haul freight has been accomplished at the expense of short-haul traffic. Although short-haul freight may not produce the highest financial returns for railroads, its movement is still important to the economy and the investments needed for rail to continue to handle this traffic may stll satisfy public, if not private investment criteria. In other words, it could be shown that it would be better for the economy for traffic to continue moving by rail rather than shifting to truck or not moving at all. The contribution that short-haul freight makes to the Ohio and national economies is still strongly positive and would produce positive cost benefit ratios, especially if undertaken as a synergy with the proposed Ohio Hub passenger rail investment.

For this study, it was decided to base the assessment on the economics of a self-contained short-haul intermodal service such *CP Expressway* in comparison to truck, rather than on rail long-haul economics. While the development of a short haul intermodal system in Ohio may be somewhat visionary, it is useful as an analysis framework since it provides a *conservative* assessment of the economic value of rail freight capacity enhancement.

However, for Ohio there would be an added benefit to actually building this system: because of a short haul system's natural focus on developing local traffic, this approach would also ensure that the *local* economy benefits directly from Ohio's rail investments. The remainder of this chapter will describe the development of the suggested short-haul intermodal system and project its economic performance.

A Short-Haul Intermodal Concept for Ohio: The Ohio Hub investment would provide sufficient capacity for daytime as well as nighttime freight operations, although clearly much more line capacity would be available at night. This may or may not coincide with the timing of when capacity is needed for long haul freight, but overnight delivery is well suited to the service requirements for short haul traffic. In the past, developing short-haul intermodal traffic to and from Ohio ramps has not been a high priority for the freight railroads, but it is a natural fit with the proposed passenger system, since this traffic could utilize the spare capacity that Ohio Hub passenger lines could provide at night.

A suggested *Expressway* style-service that is the basis for this evaluation would operate single-stack intermodal trains on improved passenger infrastructure at up to 70-mph. Expanding rail's role in short-haul distribution is a strategy that can maximize the benefit of Ohio's investment to Ohio's *own* residents and shippers -- since they themselves would be the main users and beneficiaries of such a system[70].

With respect to the traffic it can handle, the suggested Ohio service would have some features in common with *CP Expressway,* but there would also be one important difference -

- Like *CP Expressway,* the proposed service would be trucker-friendly for attracting short haul, high value domestic freight from the Ohio interstate highway system.

- Unlike *CP Expressway*, an Ohio service should also integrate with, and provide an effective feeder to the national long-haul network, with which it could connect at main double stack hubs[71]. This way, if a shipment for Cleveland arrives in Columbus, instead of having to truck from there, a short-haul intermodal service could forward that container closer to its ultimate destination. Bringing long-haul containers as close as possible to their destination reduces origin and destination drayage charges. It will be shown that doing this in fact produces very strong financial margins, since the drayage savings exceed the terminal handling costs. If a trailer or container is already at a rail terminal, it can be

[70] Both the track infrastructure and terminal capacity for the proposed short-haul service would be provided by public investment; the line capacity as by-product of the proposed passenger rail investment, terminal capacity as an adjunct to the development of major double-stack hubs in Cincinnati, Columbus, Cleveland and Toledo. The short-haul freight service would not be expected to recover its full capital cost that was paid for by state and federal grants, but only its direct operating cost and make a contribution towards capital. Access fees would be negotiated between the freight railroad operator and the public entity. Shipping rates could be competitively priced at a level sufficient to cover the railroad's direct operating costs, but still retaining a cost advantage to shippers who use the service.

[71] To facilitate efficient transshipment, the proposed short-haul intermodal service should be operated from the main intermodal hubs rather than provided out of separate facilities. However, it might make sense to dedicate a specific area for use by the short-haul service. In this way the costs and equipment utilization related to the short-haul service can be specifically tracked and managed, to ensure that the short-haul service operates profitably and uses terminal resources in an efficient manner, as intended.

economical to transship a long-haul container onto a short-distance feeder service, even for short hauls that may not be economical if the shipment had to bear the added burden of drayage cost at each end.

The proposed rail service would be suitable for handling both domestic trucks and international containers as an alternative to highway movement. In fact, international container traffic from connecting double-stack trains could provide a "base volume" while domestic traffic may support incremental train frequencies. When an international container arrives at one of the main double-stack terminals, instead of automatically being sent out the gate over the highway, it could be forwarded closer to destination by rail. As will be shown, the economics for transshipping containers can be very attractive since they don't have to bear the burden of drayage to be brought into an intermodal ramp.

Economic Viability of Short-Haul Intermodal Service: The viability of intermodal service depends on the assumed distribution of line haul, drayage and terminal operating costs. Most studies of intermodal economics assume that double-stack equipment, with its high terminal costs, will be used even in short-haul applications,[72] and they also ignore transshipping economics. This may not be the most appropriate assumption. While large double-stack trains do have the best line-haul economics, they can be enormously expensive in terms of terminal costs. These costs can be justified only for extremely long-distance, high-volume lanes. Specialized short-haul intermodal technologies are less efficient in line-haul, but they have lower terminal costs, leading to overall lower cost. The real problem for rail intermodal competitiveness is not in line-haul efficiency but rather lies in terminal and drayage costs. Double stack, which focuses on improving line-haul efficiency at the expense of higher terminal cost, is most effective in extremely long haul lanes. It is not the most cost effective rail technology for a short haul service.

For example, Exhibit 9.3 shows the operating cost structure comparison between a double-stack versus single-stack *Expressway*-style intermodal service for a typical 350-mile intermodal lane. $0.36 per mile was used as the rail line-haul cost for single-stack technology or $0.24 per mile for double stack.[73] Either line-haul cost compares very favorably to a trucking cost of about $1.75 per mile. Overall, it can be seen that the single-stack option, costing $480, is much cheaper than double-stack, which costs $623. It can also be seen that the drayage cost for trucking at each end of the intermodal movement comprises a significant share of the total cost – for the single stack service truck drayage would comprise $300 or 63% of the overall cost of the move.

For the example 350-mile lane, terminal and drayage costs comprise 88% of the total cost of the double stack move, and 78% of the total cost of the single stack move. Single stack technology with circus loading[74] is much more cost effective for short haul applications

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[72] See, for example: http://www.fra.dot.gov//downloads/policy/Rail Intermodal Short Haul Corridor Case Studies.pdf

[73] Consistent with the rest of the report, all costs and revenues in this chapter are in $2005 unless otherwise noted.

[74] *CP Expressway* uses end-ramps to roll trailers on and off the flatcars. Trailers are backed up and loaded on their wheels. This loading system was once the predominate method for loading and unloading flatcars, but with the advent of container double stacking, it has been largely replaced by the use of gantry or side-loading equipment to lift trailers or containers on or off the train. However, *CP Expressway* still uses it because this method avoids the cost associated with the heavy lift equipment, which is too expensive to be used for a short-haul move. The end loading method results in much smaller, lower cost and compact intermodal terminals. The cost of these terminals has not been included in the Ohio Hub capital cost estimate, but because of their very small footprint, would not really add significantly to the cost. These terminals may handle several trains a day and only have room for storing trailers for a few hours. *CP Expressway* relies on very tightly coordinated trucking operations to minimize trailer detention and the cost of terminals.

because it focuses on reducing the terminal cost. In fact, by comparison to a trucking cost of $525, it can be seen that the double-stack service would cost more than truck because of high terminal costs. *However, single-stack service can be competitive over this distance and would generate about a $45 cost savings for each trailer shipped*.[75]

The economic advantage of short-haul rail intermodal is even stronger for international containers that would be brought by double stack trains into major intermodal hubs, as shown in Exhibit 9.4. For example, consider an import container arriving at Sharonville, north of Cincinnati, to illustrate the tradeoff. If this container were actually destined for Cleveland, the only question would be whether to forward the container on by rail to Cleveland or to truck it directly to its destination. (The assumed highway distance from Sharonville to Cleveland is 245 miles.)

Because the example in Exhibit 9.4 would be for the continuation of a long-haul intermodal movement, there are no added drayage costs to be borne at the origin since the container has already been brought into the rail terminal by double-stack train. As well, destination drayage cost is fixed and unavoidable since the container must ultimately be delivered by truck, although a longer dray will cost more than a shorter dray. At $1.75 per mile, the trucking cost from Cincinnati to Cleveland would be $429.

• A $150 fixed fee would be incurred in any case so the total trucking cost from Cincinnati to Cleveland would be estimated as $429 + $150 = $579.

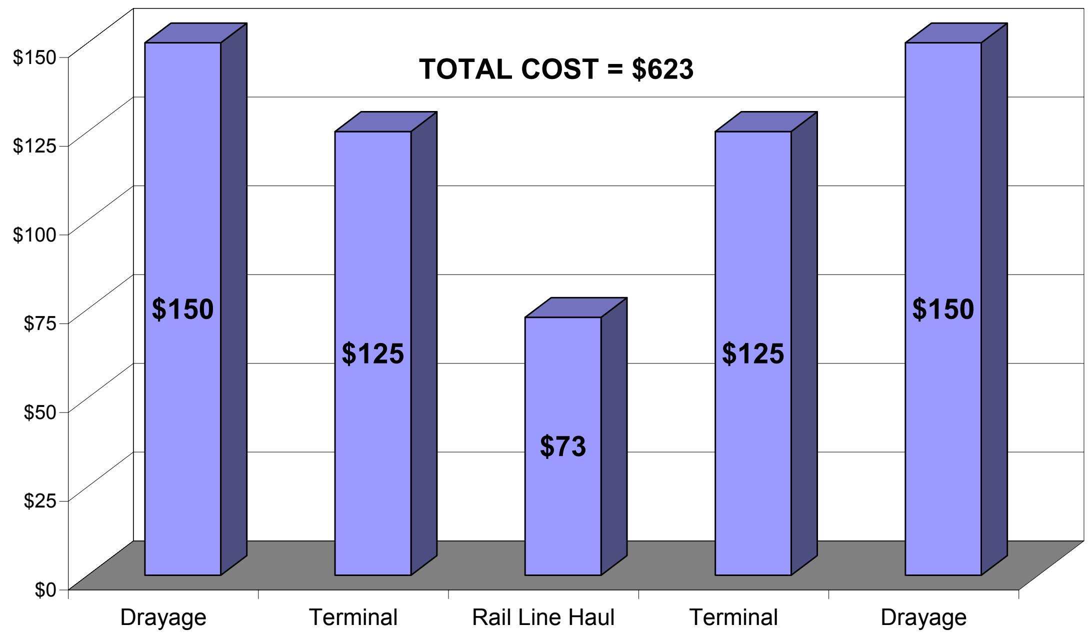
• The cost for trucking from the Cleveland ramp to the destination would just be the basic drayage charge of $150.

Drayage costs are essentially fixed by virtue of the container already being "in the intermodal system." The only added cost for forwarding the container would be an added terminal handling at the destination, along with the rail line haul cost. We assume there would be no difference in the cost for sending the container out either by rail or by truck, since Sharonville would have to handle the container anyway.

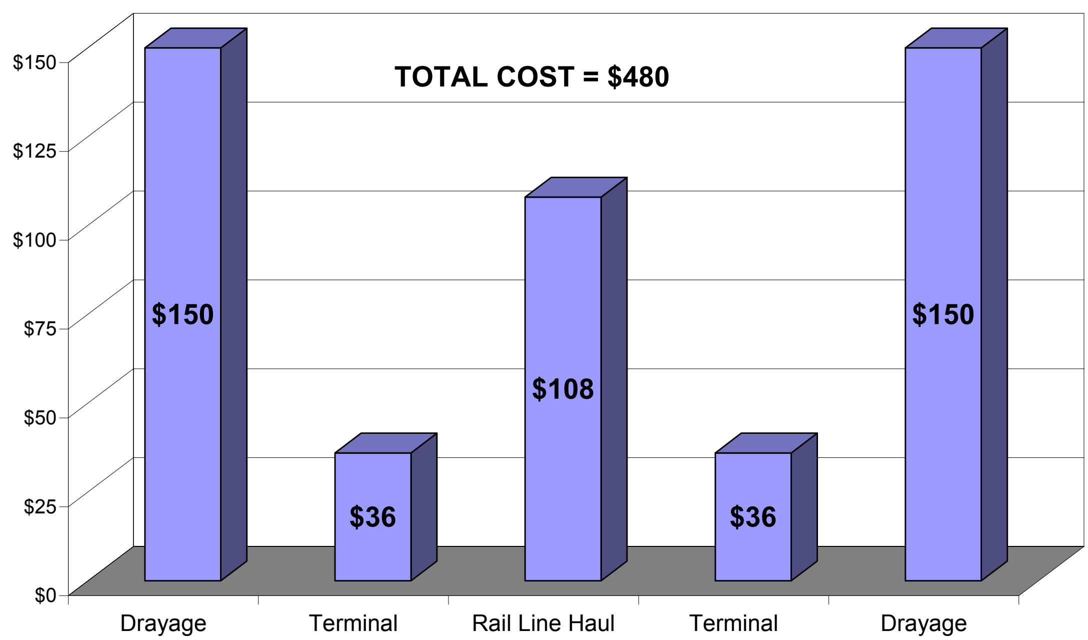
As shown in Exhibit 9.4, for a container arriving at Cincinnati, a forwarding rail move to Cleveland by either double or single stack train would be *much* less expensive than trucking the container, with a cost of $184 or $124 compared to a trucking cost of $429. The single-stack option would be the most effective for forwarding the container because it would result in a lower terminal handling cost at the destination ramp. *Transshipping the container to a connecting rail service rather than trucking to the destination would result in a* ***very substantial*** *cost savings of $579 - $124 - $150 or $305 per container.*

[75] The savings would be more for customers who are located close to the ramps and whose actual drayage costs may be less than the assumed $150 at each end of the move. Maximizing these savings is why the "Logistics Park" or "Freight Village" concept seeks to cluster intermodal-dependent industries in close proximity to the rail intermodal facility.

Exhibit 9.3: Double Stack versus Single Stack Cost for 350-mile Truck Shipment

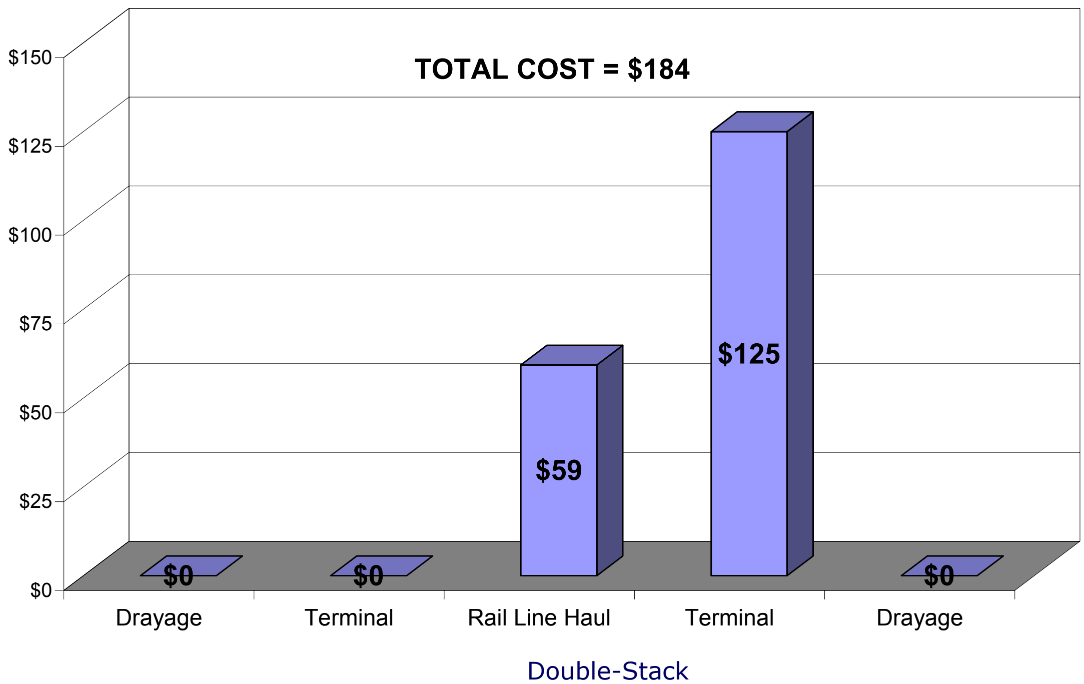


Double-Stack



Single-Stack

Exhibit 9.4: Double Stack versus Single Stack Cost for 245-mile Container Transshipment



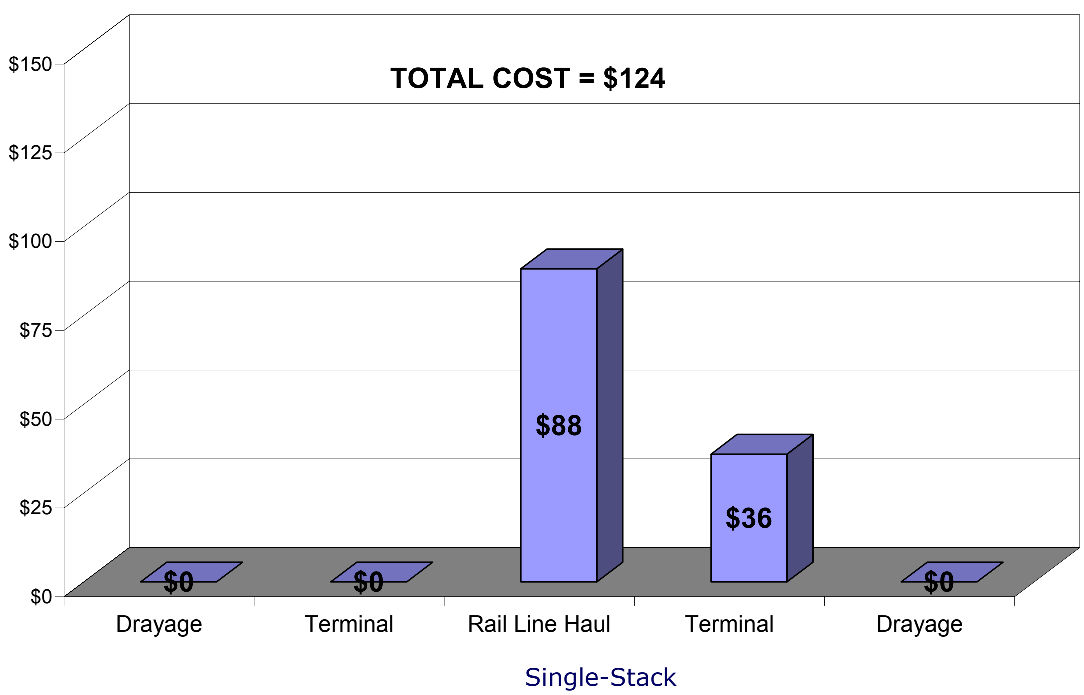


Exhibit 9.5 examines an extreme case of whether it would be worthwhile to transship an intermodal container for a very short haul of only 100 miles from Cincinnati to Columbus. For this example, the highway distance from Cincinnati to Cleveland is 100 miles. At $1.75 per mile, the savings in trucking cost would be $175.

- The $150 destination delivery fee would be incurred in any case so the total trucking cost from Cincinnati to Columbus would be $325.

- The cost for trucking from the Columbus ramp to the destination would just be the basic drayage charge of $150.

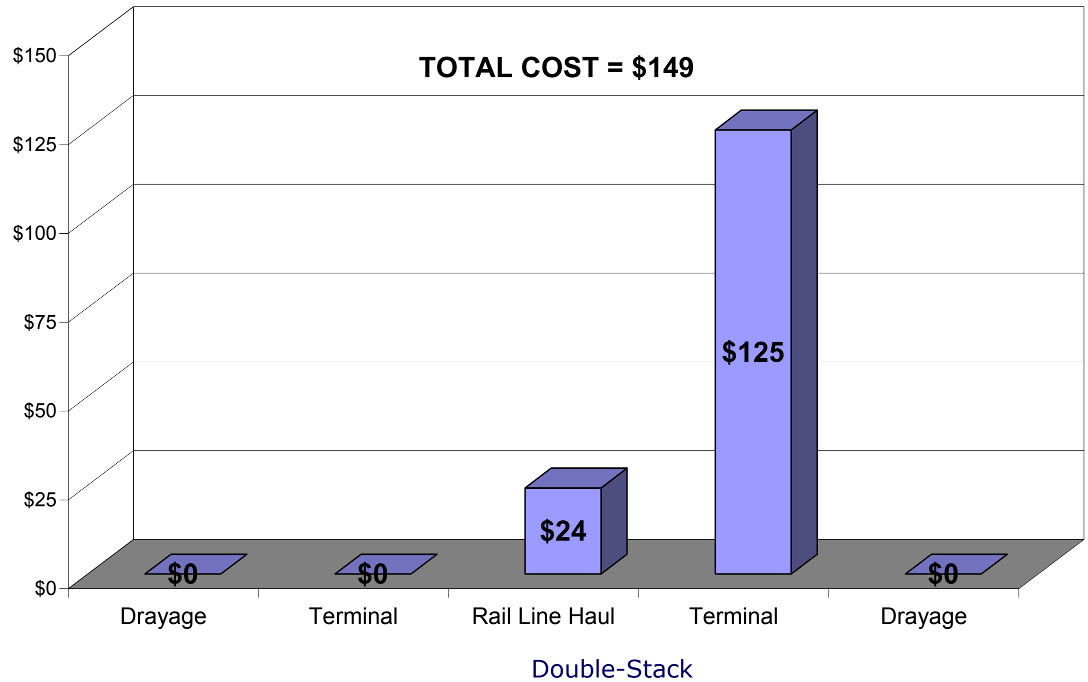
The finding from Exhibit 9.5 is that either option for transshipping the container by rail is cheaper than trucking direct although the single-stack option again, by virtue of its lower terminal costs, comes out ahead. *Forwarding the container by rail would result in a cost savings of $325 - $72 - $150 or $103 per container.* This shows that, once a trailer or container is in the intermodal network, because of the high cost of truck drayage, there is a compelling economic case for moving the shipment as close to its destination as possible.

Rail Pricing Assumptions: For estimation of rail revenue potential and consumer surplus, a detailed study would be needed to assess all the competitive factors that can determine rail pricing for an Ohio short haul intermodal service. Although railroads clearly would like to charge the highest price they can get for their services, as a practical matter they must leave at least some "consumer surplus" on the table as an inducement for customers to use their services. However, even if railroads do not maximize revenue yields, "consumer surplus" is still a public benefit that can be included in an FRA Cost Benefit analysis under the 1997 Commercial Feasibility criteria.

Pricing of domestic intermodal services between fixed origins and destinations can be a relatively straightforward exercise, if prevailing truck rates are used as the base. By subtracting the drayage costs at origin and destination, a railroad can estimate the highest price they can charge for the rail or line-haul portion of the move. Pricing of international container services is more complicated because of the many competitive options shippers have for moving this traffic, as well as the market leverage possessed by the large container shipping lines. Often the true competition is not truck, but may be a competing railroad or even vessel service. For this reason, rates for international container traffic are often set much lower than are sustained in domestic shipping lanes.

Generally, intermodal services are priced competitively to trucking cost. However, the Surface Transportation Board defines a 1.8 ratio of directly variable rail cost as "full cost" and very few rail shipments are competitively priced higher than this. This study assumes that intermodal shipments are priced based on the direct trucking cost minus drayage, but no higher than a 1.8 ratio of directly variable rail cost for each move. For shipments that are priced on a truck competitive basis, it is assumed that the railroad will divide the cost savings evenly with the shipper so that the railroad and consumer both benefit equally. The result is as shown in Exhibit 9.6.

Exhibit 9.5: Double Stack versus Single Stack Cost for 100-mile Container Transshipment



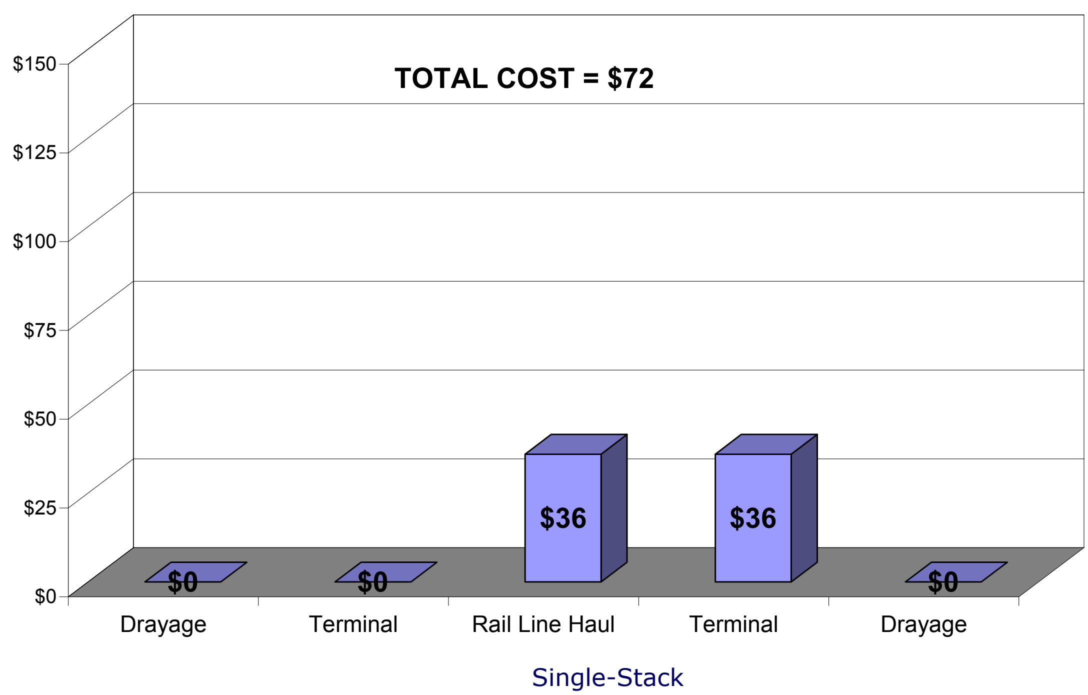


Exhibit 9.6: Estimation of Producer and Consumer Surplus

Shipment	Trucking Cost	Rail Cost	Rail Price Calculation	Producer Surplus (Rail Contribution)	Consumer Surplus
350-mile Truck Shipment 76	$525	$180 (customer incurs $300 in drayage)	$180 + $23 = $203	$203 - $180 = $23	$525-$300-$203= $22
245-mile Container Transshipment	$579	$124 (customer incurs $150 in drayage)	$124 * 1.80 = $223	$223 - $124 = $99	$579-$150-$223= $206
100-mile Container Transshipment	$325	$72 (customer incurs $150 in drayage)	$72 * 1.80 = $130	$130 - $72 = $58	$325 – $150 – $130 = $45

Public Costs and Benefits: With regard to public costs and revenues, the Short Haul Intermodal study by Casgar, DeBoer and Parkinson[77] assessed these costs and found that they can vary widely, depending on the circumstance –

- The study found that the public cost of trucks varied from 10.9¢ per mile for 30-ton trucks on rural interstates up to 71.9¢ per mile for 40-ton trucks on urban interstates.

- By comparison, Highway User Revenues per truck mile from all State and Federal taxes and fees ranged from 10.8¢ to 15.5¢ per mile.

In summary, the study found that 30-ton trucks operating on rural interstates barely cover their public costs; but 40-ton trucks operating on urban interstates cost the public up to 60¢ per mile more than the fees they pay. For this analysis, a blended net public cost of 14.6¢ per truck mile was estimated based on a combination of 66% rural and 34% urban miles that would characterize a typical Ohio corridor.

Results from the three example shipments are summarized in Exhibit 9.7. It can be seen that because of high drayage and terminal costs, short-haul trailer movements in the 300+ mile range with drayage at both ends generates razor thin, but still positive profit margins for railroads. These margins have not been sufficient to justify private investment in capacity for handling such traffic. However, adding the Public Benefits more than doubles the economic value of the modal shift and provides sufficient justification to support public funding of such investments – especially so as a by-product of a passenger rail investment.

As can be seen in Exhibit 9.7, transshipping long-haul containers offers better financial margins than hauling local short-haul traffic, since long-haul traffic doesn't incur any added drayage cost for collection and distribution. Since these trailers or containers are already at an intermodal hub and do not have to be drayed to get there, the economics for transshipping them to a connecting short-haul rail service are very strong and offer an

[76] This lane won't sustain a 1.80 Rev/VC ratio, so the Cost Savings are split evenly with the shipper

[77] See: http://www.fra.dot.gov/%5Cdownloads%5Cpolicy%5CRail Intermodal Short Haul Corridor Case Studies.pdf

attractive business opportunity to the railroads, provided the needed terminal and line haul infrastructure can be provided by public investment.

Exhibit 9.7: Shipment-Level Benefits for Ohio Hub Short-Haul Intermodal System

Description	Producer Surplus	Consumer Surplus	Public Cost Savings	Total Economic Benefit	Net Benefit per Mile
350-mile Truck Competitive Domestic Trailer	$23	$22	$51	$96	$0.274
245-mile Transshipped International Container	$99	$206	$36	$341	$1.392
100-mile Transshipped International Container	$58	$45	$15	$118	$1.180

Assessing the Overall Economic Value of Freight Capacity Improvement: The Ohio Hub is an 860-mile rail network that consists of four rail routes hubbing in Cleveland. It is *conservatively* assumed that a short-haul intermodal freight network can be developed to support up to 15 daily intermodal trains on each route. This assumption is *very conservative* based on freight use of a only *single-tracked* passenger line at night. The actual capacity increase for adding a second or third track to most Ohio Hub lines is actually between 20-25 freight trains, so the 15 train estimate is extremely conservative.

A financial business plan for the proposed short haul service would require development of a detailed origin-destination, year-by-year demand forecast for each proposed service. For this concept-level analysis, we simply assume that the available capacity can be sold, and that the traffic will consist of a mixture of international containers being redistributed between hub terminals, as well as some short-haul truck traffic. The exact traffic mix is not yet known, but we assume the proposed system would handle about 2/3 transshipped international containers and 1/3 domestic traffic that would be attracted from the highway system. Accordingly, the traffic for the system would be expected to consist mostly of connecting long-haul rail containers that would be augmented by local truck traffic.

As a short haul service, we have assumed that each train would average only about 70 trailers[78] (or FEU's, Forty-Foot Equivalent Units) assuming a 78% load factor. If containers remained in their double stack cars and only domestic trailers were circus ramp-loaded[79], train capacity would be much higher and many more containers could be handled. 15 trains with 70-trailers each, operating over an 860-mile rail network would generate a total of 903,000 trailer-miles each day. Again, the economic benefits derived here are very conservative. Because long-haul double stack trains can carry up to 250 containers and because of the higher revenue and consumer surpluses generally associated with long-haul traffic, the benefits would be much higher if assessed for long-haul rather than short-haul rail traffic.

[78] CP's *Expressway* trains have a capacity of no more than 90 trailers; the train is broken up into two or three sections for rapid loading and unloading. An average of 70 trailers used in the economic calculation implies a 78% load factor.

[79] The CP *Expressway* does not use lift equipment, rather trailers are simply rolled on and off the flatcars using ramps and tugs. This avoids the need for reinforced intermodal trailers and allows conventional trucker-owned equipment to use the service.

Exhibit 9.7 estimated that the level of net benefit ranges from $0.274 up to $1.392 per trailer-mile. Container transshipments show a higher level of benefit because these moves aren't burdened with the cost of drayage at both ends. A composite benefit rate of 94.9¢ per trailer mile has been developed based on an equal mix of the three different kinds of shipments evaluated. Assuming 312 operating days per year, and based on the assumed daily production of 903,000 trailer-miles the economic benefits of freight system can be summarized as follows –

• The annual rail revenue opportunity is between $163 and $356 million. Assuming an 1/3 split of the trailer-miles between each of the three kinds of traffic it would be $262 million.

• The annual rail contribution is between $19 and $163 million, with the low value related to domestic traffic diverted from the highway, and the high value based on a large number of transshipped containers. The transshipped containers are more profitable since they don't bear the drayage cost burden, which directly reduces the rail carriers' margins. With a 1/3 split of the trailer-miles between the three kinds of traffic, the annual rail contribution would be $99 million.

• The annual consumer surplus benefit ranges from $18 to $237 million depending on the traffic mix. A 1/3 split of the trailer-miles would give $127 million per year.

• Public benefits are in a narrow range since they are mostly trailer-mile driven, but would be in the annual range of $41 to $42 million.

• The overall annual benefit is between $78 million and $442 million. For domestic freight diverted from the highway, the consumer and producer surplus margins are very tight; the public is the main beneficiary of reduced emissions and highway maintenance cost. Transshipped containers offer better financial margins so that the traditional measures of consumer and producer surplus are the main contributors to the cost benefit ratio for this type of freight. A 1/3 split of the trailer-miles would give an annual benefit of $268 million. As these consumer surplus benefits propagate through the distribution channels, this benefit will translate into increased competitiveness for Ohio firms, more jobs for Ohio residents and lower consumer prices in Ohio stores.

• The Present Value of this Benefit stream, over 30 years at 3.9% with a 1/3 split of the trailer-miles would give a Present Value of $4.9 Billion. Since the extreme values of $1.4 to $8 Billion are based on highly unlikely short-haul scenarios, the most reasonable range for the economic value is +/- 30 per cent or $3.4 to 6.4 Billion.

Conclusion: The Economic Benefits of using the Ohio Hub system to provide Intermodal Freight Capacity is estimated at $4.8 Billion within a range of $3.4 Billion to $6.4 Billion depending on the mix between short haul international container and domestic trailer freight. If the capacity investment were used for developing long-haul freight, the total economic benefit would substantially exceed $8.0 Billion on a national basis, but it may be distributed to entities outside of the Ohio region.

- Freight railroads would enjoy revenues of $163-$356 million per year from operating the system with a net income of $99 million based on a 1/3 split of each type of traffic. This is equivalent to $1.79 billion over the life of the project.
- Ohio shippers would enjoy benefits equal to $127 million per year or an NPV of $750 million. This is equivalent to $2.27 billion over the life of the project.
- Highway maintenance savings are estimated at $41 million per year, as a result of the diversion of truck traffic to intermodal rail. This is equivalent to $0.74 billion over the life of the project.

The calculation shows that even for *short-haul* traffic running in *short* trains that *don't completely fill all the available line capacity*, the Ohio Hub investment still produces strongly positive public cost-benefit ratios for freight along with substantial environmental benefits. While the precise values of the public and private benefits depend on the exact mix of long haul vs. short haul, container and trailer traffic, train length and train frequency, this analysis has shown that the freight rail capacity investment provided by the Ohio Hub could offer significant benefits for Ohio, as well as for the freight railroads that serve the region.