

Commission Briefing Paper 4B-05

Impacts of Just-in-Time Freight Logistics

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

This paper presents information on the compounding demands of business logistics on the freight transportation system.

Background and Key Findings

Just-in-time (JIT) logistics have become a key part of businesses throughout the economy, and are placing increasing demands on the transportation system for high reliability. For many businesses, JIT also places a premium on speed while contributing significantly to increased traffic and congestion.

- JIT and speed are essential to manufacturers, wholesalers, and retailers of perishable or high valued products, especially in volatile markets, to minimize inventory costs, reduce spoilage, and maximize revenues. Best in class companies for supply chain management have 25 percent higher sales growth than other companies and 40 percent higher profitability than median companies
- Aspects of JIT and low transport costs are essential to most other parts of the economy to reduce inventory costs.
- High valued goods moving at high velocity account for 30 percent of the weight and 85 percent of the value of freight moved in the United States, while bulk commodities account for 70 percent of the tons and 15 percent of the value.
- Extensive adoption of JIT by American manufacturers, wholesalers, and retailers indicates that the high velocity system has generally performed well; however, the system is showing signs of stress and vulnerability. JIT is fueling growth in freight traffic by encouraging greater frequency of service and smaller payloads, often in locations where vibrant economies and related population growth conspire to create congestion.
- The bulk system has performed relatively well since deregulation of railroads and motor carriers in 1980, but reliability may be threatened by aging facilities and potential conflicts with high velocity freight and passenger travel.

Staff Comments

Commission briefing papers 04 and 05 discuss changing logistical practices of American businesses and consequences for the transportation system. Paper 04 emphasizes consequences for freight carriers, and paper 05 emphasizes consequences for transportation infrastructure.

This paper represents draft briefing material; any views expressed are those of the authors and do not represent the position of either the Section 1909 Commission or the U.S. Department of Transportation.

Definition and Scope of JIT

According to the web site of the Council of Supply Chain Management Professionals (CSCMP), Just-in-Time (JIT) is "an inventory control system that controls material flow into assembly and manufacturing plants by coordinating demand and supply to the point where desired materials arrive just in time for use. An inventory reduction strategy that feeds production lines with products delivered 'just in time'. Developed by the auto industry, it refers to shipping goods in smaller, more frequent lots."¹

As described in Commission briefing paper 4B-04, supply chain management based on JIT is essential for businesses that sell high valued goods in relatively volatile markets. Manufacturers, wholesalers, and retailers minimize inventory costs by manufacturing or acquiring products as close as possible to the time when the product is ordered by the customer. These businesses also improve revenues when they can respond quickly to changes in demand, especially when the changes are driven by consumer tastes.

JIT is most closely associated with businesses produce and sell high value goods, These goods include machinery, electronics, mixed freight, motorized vehicles, and textiles and leather, representing only 30 percent of the tons but 85 percent of the value of freight moved within, to, and from the United States in 2002.²

JIT is also closely associated with businesses that depend on global supply chains. These businesses account for a large share of the dramatic growth in international merchandise trade, predicted in briefing papers 4B-01 and 4B-02 to grow at a much faster rate than domestic freight movement. Global supply chains are inherently intermodal, requiring the coordination of international and domestic transportation services through advanced management of information on customer demands, overseas manufacturing, and the performance of all links in the supply chain,

Aspects of JIT have been embraced well beyond the manufacturing, wholesale, and retail industries. Businesses in virtually every corner of the economy seek ways to improve bottom lines by reducing storage requirements and other costs. Purveyors of perishable goods are especially dependent on timely, reliable transport to reduce spoilage.

JIT is linked with speed or cost depending on the type of business. For businesses that respond to unpredictable, volatile demand or deal in perishable or very expensive goods, deliveries must be both just in time and fast. For businesses with very predictable demands for less expensive goods, speed is less important than transportation costs. In all cases, inventories can be reduced only if the transportation system delivers JIT reliably.

Impacts of JIT on Businesses

Aggressive supply chain management including JIT is central to improving productivity and competitiveness of American businesses. According to one estimate, best in class companies for

¹ Kate Vitasek, Supply Chain and Logistics Terms and Glossary (Updated October 2006), <http://www.cscmp.org/Downloads/Resources/glossary03.pdf>, p. 83

² All statistics are from the Freight Analysis Framework release 2.2 unless otherwise noted. See http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/index.htm.

supply chain management have 25 percent higher sales growth than other companies and 40 percent higher profitability than median companies.³

As businesses become more dependent on JIT, they become more sensitive to the costs of delay and congestion. When shipping delays require Nike to carry an extra 7-to-14 days of inventory, the company must spend an additional \$4 million per week.⁴ Delays also affect carriers who serve the JIT demands of shippers. Just one day of delay in American President Line's eastbound trans-Pacific service requires that intermodal carrier to increase its use of containers and chasis by 1,300, adding \$4 million in costs par year.⁵ A recent assessment for the Federal Highway Administration (FHWA) attributes more than 243 million hours of annual truck delay to highway bottlenecks throughout the United States.⁶ At a delay cost of \$32.15 per hour, the conservative value used by FHWA's Highway Economic Requirements System for estimating national highway costs and benefits, the direct user cost of these bottlenecks is about \$7.8 billion per year.

Impacts of JIT on the Transportation System

JIT demands speed for most goods and reliability for all, and makes achieving reliability by increasing traffic on already congested facilities. For many products, JIT requires greater numbers of vehicles hauling smaller payloads to meet market demands. An extreme case is pizza delivery: the marketplace will not wait for the accumulation of enough orders to fill a 40-foot trailer before the pizzas are dispatched to home-based consumers.⁷ This shift to more vehicles carrying less per vehicle has contributed to the 49 percent growth in trucks over 10,000 pounds and 62 percent growth in their vehicle miles of travel over the last 15 years.⁸

The growth of time-sensitive, high value freight tends to occur in locations with vibrant, growing economies. Growing economies correspond to growing populations, and congestion is the typical result. Freight contributes to congestion, and congestion impedes the ability of the freight to arrive quickly and reliably. The growth of trucking with the growth of JIT contributes significantly to congestion on both urban and intercity routes. By 2020, more than 25,000 miles of highway are likely to carry over 5,000 commodity-carrying trucks each day. Roughly one-fifth of that mileage will be significantly congested.⁹

³ Mark Hermans, Supply Chain Benchmarking, presentation to the TRB Freight Roundtable, October 23, 2006, <http://www.trb.org/conferences/FDM/Hermans.pdf>.

⁴ John Isbell, Maritime and Infrastructure Impact on Nike's Inbound Delivery Supply Chain, presentation to the TRB Freight Roundtable, October 23, 2006, <http://www.trb.org/conferences/FDM/Isbell.pdf>.

⁵ John Bowe, The High Cost of Congestion, presentation to the TRB Freight Roundtable, October 24, 2006, <http://www.trb.org/conferences/FDM/Bowe.pdf>.

⁶ U.S. Department of Transportation, Federal Highway Administration, *An Initial Assessment of Freight Bottlenecks on Highways*, prepared by Cambridge Systematics, October 2005, p. ES-2.

⁷ Alan Pisarski, testimony before the Subcommittee on Highways and Transit, Committee on Transportation and Infrastructure, U.S. house of Representatives, March 21, 2001, <http://www.house.gov/transportation/highway/03-21-01/pisarski.html>

⁸ Vehicle Inventory and Use Survey, in FHWA, *Freight Facts and Figures, 2006*, table 3-4,

http://www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/06factsfigures/table3_4.htm

⁹ U.S. Department of Transportation, *2004 Status of the Nation's highways, Bridges, and Transit: COnditions and Performance*. 2006. chapter 13.

High value goods moving at high velocity must overcome: delays from port, airport, rail, and highway congestion; capacity and safety conflicts with passenger travel on highways and railroads; shortages of drivers and other equipment operators; weather disruptions; and delays caused by measures to improve cargo security. Earlier problems with equipment standardization and regulatory impediments to service innovation are less severe today than in the past.

The growth of high value goods moving at high velocity has shifted policy concerns from an earlier focus on bulk transportation. The top five bulk commodities include natural gas, gravel, cereal grains, crude petroleum, and coal, representing 70 percent of the weight and 15 percent of the value of freight moved in 2002. Reliability is central to supply chains for bulk products as for high valued products, but lower value places a premium on shipping cost rather than speed for bulk products. Working against reliability for bulk products are: lock condition and performance on inland waterways; pipeline conditions; weather disruptions; and routing restrictions for hazardous cargo. Rail car availability and abandonment of low volume rail lines are also problems, though far less severe than in recent decades.

Transportation facilities and services that handle bulk products tend to be specialized and have relatively few overlaps with facilities and services for high valued products moving at high velocities. Conflicts between high velocity and bulk freight are less common than between freight and passenger travel, especially on congested urban freeways and on rail lines in major metropolitan areas.

Future Trends and Questions

Global competition and the continuing quest of American businesses for efficiencies and productivity will probably continue unabated through the decades ahead. As long as the transportation system can deliver the goods on time, businesses will continue to demand lean supply chains emphasizing JIT. JIT in turn will put greater demands on the transportation system, requiring on-time performance on both high velocity and bulk systems and adding greater numbers of vehicles making more trips on the high velocity system.

Extensive adoption of JIT by American manufacturers, wholesalers, and retailers indicates that high velocity freight services generally have performed well; however, the system is showing signs of stress and vulnerability, illustrated in recent years by supply chain disruptions from western railroad congestion, the West Coast dock strike, and the Howard Street tunnel fire in Baltimore. Can port, airport, rail, and highway capacity keep up with JIT demands? What should be done to resolve conflicts between the high velocity freight system and passenger travel, especially in major urban corridors? How can a balance be achieved between fast, reliable transportation of goods and homeland security?

Freight services for bulk commodities have performed relatively well since deregulation of railroads and motor carriers in 1980. Will it continue to perform reliably in the future? Are aging locks and pipelines deteriorating to the point that major service disruptions will occur?

Do conflicts between the high velocity and bulk freight movements warrant significant private or public investment to improve capacity or separate the systems? Will conflicts with the high

velocity system increase dramatically if hazardous materials are prohibited from routes through urban areas?

CONSOLIDATED COMMENTS FROM MEMBERS OF THE BLUE RIBBON PANEL OF TRANSPORTATION EXPERTS - PAPER 4B-05

One reviewer commented as follows:

The paper should make clear that most lines “abandoned” by large railroads are actually sold to short lines. In addition, it should note that rail car availability problems are rare for freight that has consistent and viable (*i.e.*, remunerative) demand. If demand is inconsistent or revenue noncompensatory, short-term rail car availability problems are virtually unavoidable unless enough rail car owners take the seemingly economically-irrational step of investing in rail cars that will sit idle for much of the time and not generate an appropriate return for the owners.

Another reviewer commented as follows:

On page 3 -- Very significant statement, “This shift to more vehicles carrying less per vehicle has contributed to the 49 percent growth in trucks over 10,000 pounds and 62 percent growth in their vehicles miles of travel over the last 15 years”¹

On page 3 -- This is also a noteworthy point, “The growth of time-sensitive, high value freight tends to occur in locations with vibrant, growing economies. Growing economies correspond to growing populations, and congestion is the typical result. Freight contributes to congestion, and congestion impedes the ability of the freight to arrive quickly and reliably.”

On page 4 -- Also significant, “Extensive adoption of JIT by American manufacturers, wholesalers and retailers indicates that high velocity freight systems generally have performed well, however the system is showing signs of stress and vulnerability.” (Emphasis mine)

General lacking in this discussion, which are significant factors in increasing service demands and costs, are two trends which are not mentioned:

- (1) Guaranteed delivery windows, some as short as 15 minutes
- (2) Home delivery, driven by catalogues and the Internet (resulting in very small delivered quantities)

Despite these omissions, this is a good, solid, useful paper