

Working Paper

**Proposed Intermodal Freight and General Freight
Research Ideas**

Prepared by the

**Intermodal Freight Transport Committee*
Transportation Research Board**

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*This *Working Paper* is not an official publication of the Transportation Research Board. The opinions expressed are those of the working paper's authors and not those of the TRB.

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Proposed Intermodal Freight and General Freight Research Ideas

Introduction

During the summer of 2003, the Intermodal Freight Transport Committee of the Transportation Research Board (TRB) began revisiting its mission and strategic plan. At TRB's 2003 summer meeting in Portland, Oregon, the committee discussed the need for more focused attention and a more thorough definition of research needs on freight intermodalism. Meeting attendees supported continued preparation of a *Working Paper* for review and markup by Committee members prior and subsequent to the TRB Annual Meeting in January 2004. The expectation was that a broad roster of research ideas related to freight in general and to intermodal freight in particular would result. A revised *Working Paper* was presented at TRB's 2004 summer meeting in Park City, Utah. The January 2005 version of the *Working Paper* reflects comments received at the Park City meeting, at previous meetings, as well as during the interim between meetings.

The paper presents two complementary lists of unranked research ideas. List One suggests ideas for intermodal freight research topics; these ideas have been developed primarily for consideration by the Intermodal Freight Transport Committee while recognizing that other TRB freight and modal committees also may have an interest in them. List Two suggests ideas for general freight research topics; these ideas have been developed for consideration by the several TRB Groups and modal committees involved in freight mobility. To avoid repetition, the ideas on List One are not shown on List Two. Appendices 1 and 2 provide an expanded discussion for each of the candidate topics in List One and List Two. Appendix 3 provides ideas for components of a National Freight Cooperative Research Program, an initiative that has been proposed by the National Freight Stakeholders Coalition and other groups.

The Intermodal Freight Transport Committee foresees the opportunity for shared improvement to both lists, greater communication among TRB Freight Systems and modal committees, and joint committee sponsorship of research on some topics. To those ends, the committee requests that readers send their additional ideas and suggested changes to principal author Pete Beaulieu at pbeaulieu@psrc.org or to committee chair Steve Kale at steveonjory@aol.com.

Background

This *Working Paper* is intended to supplement ideas in *Freight Transportation Research Needs Statements*, TRB Circular E-C048 (<http://trb.org/publications/circulars/ec048.pdf>). The TRB circular, developed by committees comprising the former Multimodal Freight Transportation Section, identifies critical issues in freight transportation as a resource for researchers in the freight area and is intended to serve as a seedbed for further discussion and analysis from a wide cross-section of freight practitioners.

The Intermodal Freight Transport Committee provided seven research needs statements for the TRB circular; one of the needs statements was further developed into a National Cooperative Highway Research Program project (see idea 2.02 in List One). An asterisk included with ideas in List One and List Two of the *Working Paper* denotes the committee's needs statements that were included in the TRB circular. During 2005, the committee intends to review and update existing needs statements in the circular, as well as develop additional needs statements for consideration in future circulars or other compendiums of needs statements.

In general, the presentation of ideas in Lists One and Two is based on guidance in TRB's *Strategic Plan* (http://gulliver.trb.org/publications/admin/2002_strategic_plan.pdf). The *Strategic Plan* identifies four goals as shown below.

- To maintain and enhance TRB's role in fostering and contributing significantly to the research, development, and implementation of new transportation technologies and innovative practices in the United States,
- To strengthen TRB's activities in the non-highway modes and promote greater participation by private-sector transportation organizations, while maintaining its historic roles in contributing to improved highway transportation and supporting public-sector transportation agencies,
- To increase TRB's contribution to decision making on national transportation policy issues, with special emphasis on cross-cutting issues, modal/multimodal/intermodal areas beyond its more traditional scope, and the influence of transportation on other issues and aspects of society, and
- To contribute significantly to improved communication and public awareness of issues in transportation and more extensive dissemination of research findings, including the dissemination of foreign research results in this country and the dissemination of U.S. research findings both here and abroad.

For purposes of this *Working Paper*, the goals have been shortened as follows for usage in Lists One and Two and Appendices 1 and 2.

- Contribute to research on and development of new technology and innovative practices,
- Promote participation by the private and public sectors in research for highway and non-highway modes,
- Contribute to decision making on cross-cutting and other national transportation issues, and
- Help improve communication and public awareness nationally and internationally.

Other researchers might use the TRB *Strategic Plan* to categorize the ideas in Lists One and Two differently according to the four goals. The authors of this *Working Paper* encourage other researchers to revise and otherwise adjust the categorization of ideas in Lists One and Two where appropriate.

The development of ideas in List One was based in part on existing guidance for the Intermodal Freight Transport Committee, including the committee's statement of scope, its *Millennium Paper*, and its *Strategic Plan*. The statement of scope focuses on shipment of goods by two or more modes as follows (http://gulliver.trb.org/directory/comm_detail.asp?id=1099):

The scope of this committee includes all aspects of research pertaining to intermodal freight transport. Attention will be given initially to rail-water, rail-highway, highway-water, and highway-air modal combinations, but other combinations may be considered later. Intermodal freight transport includes all shipments that employ more than one mode in a single through movement from origin to destination; local pick-up and delivery by truck for other modes is not included. Consideration of rates, routes, services, transfer facilities, containers, and other items that impact the movement of freight in intermodal transport are included.

The *Millennium Paper* (<http://gulliver.trb.org/publications/millennium/00061.pdf>) goes beyond the committee scope to focus on the following major themes: supply chains, customer requirements, knowledge and skills, and coordination and integration, including through public/private partnerships.

The committee's recently updated *Strategic Plan* encourages committee members to focus on research through the identification of a research activity area and through the development of goals, strategies, and an action agenda for research. The *Strategic Plan* generally reflects the goals and activities of the TRB as a whole as well as the experiences, background, and activities of Intermodal Freight Transport Committee members.

Other sources consulted in the development of Lists One and Two include:

- American Association of State Highway and Transportation Officials, *Freight-Rail Bottom Line Report*, 2003 (<http://freight.transportation.org/doc/FreightRailReport.pdf>),
- Federal Highway Administration, *The Freight Story*, 2002, (www.ops.fhwa.dot.gov/freight/freight_analysis/freight_story/index.htm),
- Federal Highway Administration ITS Joint Program Office, *Challenges and Opportunities for an ITS Intermodal Freight Program*, Final Report, February 1999 (<http://www.its.dot.gov/intermodal.pdf>),
- Freight Stakeholders Coalition, "TEA-21 Reauthorization Agenda," no date (http://www.aapa-ports.org/govrelations/freight_stakeholders.pdf),
- Gerhardt Muller, *Intermodal Freight Transportation* (4th Edition), Eno Transportation Foundation and Intermodal Association of North America, 1999,
- U.S. Chamber of Commerce, *Trade and Transportation*, March 2003, (http://www.uschamber.com/NR/rdonlyres/eqqenmrtfifotl2m2ympwlb1g3pzlcz6jzunxoom3hoc5to5qn7jrf6hwolpkggnqjz6q2g3a6b4xm53x6je3hq2fg/portstudy_toc_0304.pdf), and
- U.S. Maritime Administration, *An Assessment of the Marine Transportation System: Report to Congress*, 1999 (<http://www.dot.gov/mts/report/>).

Future Action

Members of the Intermodal Freight Transport Committee are encouraged to refine and further develop ideas for intermodal freight research topics (List One) that best fit their understanding of the committee's strategic plan, scope and mission. Members of other TRB Freight System and modal committees are encouraged to refine and further develop ideas for freight research topics that best fit the scope and mission of their committees. Groups outside TRB may want to encourage or support further development of research ideas in Lists One or Two. Groups outside TRB could include the American Public Ports Association, American Transportation Research Institute, Association of American Railroads, Council of Logistics Management, Eno Foundation, Federal Highway Administration and other U.S. DOT modal administrations, Institute of Transportation Engineers, Intermodal Association of North America, National Industrial Transportation League, state transportation agencies, university transportation centers, U.S. Chamber of Commerce, U.S. DOT's Research and Innovation Technology Administration, and U.S. Transportation Security Administration.

Future actions could include but are not limited to (a) incorporating ideas for research topics into the TRB annual meeting Call for Papers, (b) co-sponsoring sessions at annual and summer TRB meetings, (c) developing research problem statements for possible submission to TRB by state transportation agencies, the Federal Highway Administration, or the American Association of State Highway and Transportation Officials, (d) developing research proposals for the FHWA, other US DOT modal and intermodal entities, and other organizations, (e) building selected issues into agendas for conferences sponsored by organizations other than TRB, and (f) publishing research in TRB publications and in publications of other organizations.

Future actions could include refining language in Appendix 3 regarding the establishment of a *National Freight Cooperative Research Program (NFCRP)* through reauthorization of the Transportation Equity Act for the 21st Century (TEA 21). For example, the *Working Paper* illustrates the importance of global supply chains along with public and private actions and partnerships, which could be an important component of an NFCRP mission statement.

Lastly, the recent administrative reorganization of TRB technical standing committees gives the various freight modes more direct access to the TRB Technical Activities Council. A coherent "freight story" and message among the TRB freight-related committees depend on a *comprehensive* presentation of freight research possibilities consistent with the four goals of the TRB *Strategic Plan*. This *Working Paper* is offered as a resource for broader and shared efforts to this end.

List One

Ideas for Intermodal Freight Research Topics

Appendix 1 expands the description of the List One research ideas. Asterisks identify ideas that the Intermodal Freight Transport Committee submitted for inclusion in TRB Electronic Circular E-C048, *Freight Transportation Research Needs Statements* (<http://trb.org/publications/circulars/ec048.pdf>).

TRB Goal #1: Contribute to research on and development of new technology and innovative practices

*1.01 Analyze how physical freight carrier networks (evolving under federal deregulation of modal carriers) relate to shipper and carrier *new* concerns. Study intermodal linkages, based in part on selected cross modal demonstrations.

1.02 Select and research aspects of the National Academies of Sciences security recommendations (2002) reported by Mort Downey at the TRB summer conference in Portland.

TRB Goal #2: Promote participation by the private and public sectors in research for highway and non-highway modes

2.01 Explore intermodal aspects of the stated maritime research agenda.

*2.02 Conduct a national intermodal connectors conference. Note: this project was undertaken as “Workshop in Issues in Intermodal Connectors,” Task 30 for NCHRP Project 8-36, “Research for the AASHTO Standing Committee on Planning.” The final report for this task is available at: [http://freight.transportation.org/doc/8-36\(30\)connectors.pdf](http://freight.transportation.org/doc/8-36(30)connectors.pdf).

2.03 Identify the strategic actions needed to fit growing intermodal site operations within fixed footprints in dense urban areas (e.g., corridor or industrial sanctuary preservation).

2.04 Identify corridors with parallel rail and highway facilities, and investigate the operational and capital improvements that might offer better rail connectivity and competition. Encourage railroads to consider fundamental operational improvements, e.g., scheduled rail service as is now in place with Canadian Pacific Railway.

TRB Goal #3: Contribute to decision making on cross-cutting and other national transportation issues

*3.01 Research and quantify the potential benefits to regional and national economies of representative intermodal investments.

3.02 Include an intermodal component as part of the possible formation of a National Freight Cooperative Research Program (NFCRP) recommended by the National Freight Stakeholders Coalition and other groups (see Appendix 3.)

3.03 Conduct financing research focusing on three related topics: possible unevenness in public support for freight modes, criteria for identifying intermodal needs that may merit a public investment share, and approaches and methods of public finance.

3.04 Explore the extent to which congestion in freight mobility is due to underpricing of services rather than the undersupply of facilities.

TRB Goal #4: Help improve communication and public awareness nationally and internationally

4.01 Research and publicize the indirect “public benefits of intermodal freight transportation improvements,” in terms of such metrics as pollution, safety and tax generation.

List Two

Ideas for General Freight Research Topics

Appendix 2 expands the description of the research ideas. Asterisks identify ideas that the Intermodal Freight Transport Committee submitted for inclusion in TRB Electronic Circular E-C048, *Freight Transportation Research Needs Statements* (<http://trb.org/publications/circulars/ec048.pdf>).

TRB Goal #1: Contribute to research on and development of new technology and innovative practices

1.01 Identify what other carriers can learn from the integrated and time-sensitive methods of UPS and FedEx and apply to their own systems.

1.02 Advance security and cross-modal redundancy through research on possible Certified Loading Centers (CLCs).

1.03 Develop methods or contexts for identifying public sector benefits and costs of intermodal and other projects located in and benefiting overall supply chains.

1.04 Advance preliminary work on pricing of services as this might affect freight mobility modes and intermodal connectivity.

1.05 Identify performance measures to guide capital investments and operational solutions for intermodal connections.

1.06 Post an overview web-site (or index) that displays links to research related to freight intermodal connectivity and freight mobility.

1.07 Address how to factor non-recurring delay into modeling of system capacity and into expansion/operational decisions.

1.08 Coordinate ITS and other operational databases with freight flow data, and incorporate small area estimation techniques – or other small area techniques – into complex freight transportation databases.

1.09 At the sketch-planning level (the opposite end from small area estimation), research scenarios of shifting origins and destinations and how these relate to the more fixed continental and multimodal transportation system.

- 1.10 Identify and rank the intermodal “events” or performance chokepoints in the supply chain that are of common research interest to private sector shippers and carriers.
- 1.11 Scope, assess and develop a conceptual design for a “national freight reservation system.”
- 1.12 Continually scan the institutional horizon for disconnected decision processes.
- 1.13 Jointly address the three priorities—technology, landside systems, and clearinghouse functions--decided by the Cargo Handler’s Working Group in the work session for the 2003 TRB Summer Meeting in Portland.

TRB Goal #2: Promote participation by the private and public sectors in research for highway and non-highway modes

- *2.01 Research “cross border rail freight transportation.”
- 2.02 For different economic activities, identify the factors actually used by businesses to make modal (and intermodal) shipping decisions.
- 2.03 Determine the extent to which the lack of intermodal connectivity is a decisive obstacle to otherwise beneficial intermodal supply chains.
- *2.04 Scope and research “increasing capacity in rail corridors,” including the merits/ demerits and implications of an open access rail system, which could treat rail rights-of-way like public highway rights-of-way.
- 2.05 Identify and research key questions related to modal shift to barges and to rail. Where appropriate, investigate how to renew focus on short sea shipping or coastal shipping.
- 2.06 Compare candidate project investments to system (supply chain) benefits. Look first at operational improvements, as is being done in the Chicago area, as a context for then deciding supportive capital investments.
- 2.07 Research key needs for inland waterways, namely aging infrastructure and the Endangered Species Act (ESA).
- 2.08 Conduct a joint panel research to understand the *system* benefits compared to capital investments in marine terminals, rail terminals and the mainline.
- 2.09 Conduct a panel discussion among shippers on how their respective logistics managers actually decide among modal alternatives.
- *2.10 Research the pertinent issues that might be encountered in the future planning and design of pneumatic capsule pipelines for intercity and interstate freight transport.

TRB Goal #3: Contribute to decision making on cross-cutting and other national transportation issues

- 3.01 Report the unfolding intermodal impacts of security on each transferring carrier mode – air, marine, rail, and truck, and on intermodal trade as a whole.

- 3.02 Report how connectivity between modes is affected by new security issues.
- 3.03 Report on public agency (regulatory) and corporate (smart business) methods to ensure secure loading of containers at the point of origin.
- 3.04 Report on market opportunities for end-of-line rail intermodal facilities, combined with railroad business practices that might reclaim market share lost by railroads.
- 3.05 Critique the AASHTO *Bottom Line Report* and the Maritime Transportation System (MTS) and how these might fit together.
- 3.06 Conduct research on the impacts and implications of the paradox of just-in-time (JIT) – that lowered inventories also involve greater risks of possible supply chain disruption.
- 3.07 Investigate the benefits and costs of the recommendation to develop a practical, nationally uniform, state-based system for responsibly permitting the controlled use of larger and heavier trucks.
- 3.08 Structure a dialogue to help understand what is meant by practical performance measures, considering the complementary roles of productivity/efficiency and sustainability/energy and conservation/community impacts.
- 3.09 Research new financing approaches to freight transportation.
- 3.10 Bracket a tighter and reasonable forecast for long-term container traffic, possibly to narrow the range between national forecasts and the sum of local forecasts.
- 3.11 Document how intermodalism in general – especially connectivity between modes – relates to different local, state and national economies in a global setting.
- 3.12 Identify the final customers – the market niches – for rail improvements.
- 3.13 Research large-scale case studies on decision processes that foster parallel looks at (a) site development needs and (b) contextual environmental factors on the ground.
- 3.14 Develop guidelines or case information for cross-modal analysis of alternative shipping options, particularly involving intermodal connectors.
- 3.15 Research the implications of life-cycle container use.
- 3.16 Report to all of the mode-related committees on electronic-seal container tracking.
- 3.17 Screen the surveys of cases (best management practices) underway and, from these examples, develop an independent perspective on ground-level needs.

TRB Goal #4: Help improve communication and public awareness nationally and internationally

- 4.01 Research the *net effect* of trade liberalization and increased security on corporate supply chains.

- *4.02 Scope additional research on “gateways” and “multi-state corridors.”
- 4.03 Critique ideas from the FHWA scanning tours to the European Commission, and from the Commission’s *Communication on Intermodality* and other recent endeavors.
- 4.04 Research the strategic, legal and political limits to public agency involvement in intermodal connections – serving federally deregulated and global supply chains.
- 4.05 Research the need to protect future highway and goods movement corridors, and the utility of protecting sites for intermodal terminals.
- 4.06 Document experiences in the area of “city logistics” so that regional planning organizations have an additional toolbox of options with which to try to reduce the number of trucks in urban areas.
- 4.07 Evaluate the effectiveness of multi-state and multi-regional freight planning.
- 4.08 Review already completed research on intermodal connections to see what might be pushed to the next level for multi-state corridors and for transport nodes, e.g., gateways.
- 4.09 Research how information technology is radically altering the decision-making structure in the freight world.
- 4.10 Assess the extent of human error as a causal factor in hazardous materials spills.
- 4.11 Improve freight transportation modeling.
- 4.12 Develop the architecture for a visual global/regional flow model to illustrate, dynamically, where goods, materials and people are traveling within and across modes.
- 4.13 Conduct comprehensive research on the availability, accuracy, and uniformity of HAZMAT transportation incident and accident data across all modes of transportation.
- 4.14 Increase education of those directly and indirectly involved with intermodal systems.
- 4.15 Research changes to municipal planning and zoning and enforcement practices resulting in greater consideration for goods movement activities, a lower cost of doing business in urban areas, less congestion, and less pollution.
- 4.16 Jointly research the relationship between seamless international supply chains and the impacts/benefits on affected publics here and abroad.

Appendix I

List One: Detailed Intermodal Freight Research Ideas

TRB Goal #1: Contribute to research on and development of new technology and innovative practices

1.01 Analyze how physical freight carrier networks (evolving under federal deregulation of modal carriers since 1980) relate to new shipper and carrier concerns in the current economy. Study intermodal linkages, based in part on selected cross-modal demonstrations:

- (1) The pattern of intermodal nodes within the United States is *a system of transfer points among rail, highway and marine corridors*. How does this pattern enable route redundancy across modes in the event that any major modal corridor is disrupted, e.g., destruction of a rail bridge or tunnel requiring rerouting by truck, or rerouting from one marine port to another to offset surge overload? This analysis can be related to *Simulating Disruptions in Critical Infrastructure* well underway for the Northwestern States by Sandia National Laboratories and Los Alamos National Laboratories. (We understand that this research might be replicated for all regions of the United States.)
- (2) What are the benefits of “shared intermodal terminals” (*E-C048*) such as the Detroit example, e.g., improved backhaul asset utilization, and transfer of steamship line best management practices to inland rail terminals.
- (3) What are the possibly broad applications of “regional mixing centers” pioneered by the automobile industry?

Regional Mixing Centers: Autos from several Ford assembly plants are rail-carried to shared inventory sites (Chicago; Shelbyville, Kentucky; Kansas City Missouri; Fostoria, Ohio) that function as logistics distribution centers by creating an assortment of vehicles that can be shipped more readily to dealers in full rail cars or trucks to destination markets. (See “Economic Effects of Transportation: The Freight Story,” ICF Consulting, for FHWA, draft, January 2002; and “Freight Benefit-Cost Study,” May 11, 2001) Mixing Centers create poised inventories from different assembly plants within their respective and partly shared supply chain. Cross-docking terminals serving trucks might also be surveyed for their similar practices and lessons at the warehouse level – possibly applicable to another proposal for shared Certified Loading Centers (CLC) capable of meeting new security inspection requirements at the point of container stuffing (See List Two, item 1.02).

1.02 Select and research aspects of the National Academies of Sciences special report on Security recommendations (2002) presented by Mortimer Downey at the TRB summer conference in Portland.

The Academies’ recommendations deal with: (1) technology and operations, (2) a layered defense (e.g., e-seals combined with selective use of scanners at the ports), and (3) the economic consequences of both terrorist actions and of countermeasures.

Common security issues for the separate modal carriers are the extensiveness of the transportation system, interconnectivity of the system, funding, and the number of

stakeholders involved. With regard to interconnectivity, what are the emerging and specific implications for intermodal transfers (rail/marine, truck/air, and truck/rail) within the supply chains, and for consistency across supply chains? For example, what is the possible need for ITS interoperability up and down the entire West Coast? A possible West Coast Corridor Coalition might be formed around the benefits of consistent ITS along I-5. With this in place, east-west ITS through the port regions might also move a step closer toward consistency and interoperability.

As part of the layered defense approach, directly address the initial step of container stuffing, upon which the success of all subsequent container security measures is dependent. To what extent can and should corporations assure secure container loading? The World Bank estimates that one-third of merchandise trade is *internal* to the three hundred or so largest world corporations. And, that an additional one-third is between corporations in this group. *Most of world trade in merchandise is between parent corporations and dependent subsidiaries.* How does this pattern factor into national and international security concerns, and solutions, for international container traffic?

TRB Goal #2: Promote participation by the private and public sectors in research for highway and non-highway modes

2.01 Explore intermodal aspects of the stated maritime research agenda. Likely candidates would include: (a) operational scenarios and case studies to relieve port congestion (e.g., agile ports as explored in the Port of Tacoma, in California Interregional Intermodal System, and at the Port of New York/New Jersey), and (b) site development issues related to species listings under the Endangered Species Act (ESA).

Regarding the ESA, work in the Bay Area identifies a calendar of seasonal “windows” for site-specific dredging. This illustrates a method of context-integrated transportation thinking and actions, which might be applied to other “footprint-challenged” port regions. The Bay Area method seeks to align parallel decision domains (transportation/ natural resources) for coherent geographic areas, rather than separately considering actions at the project level, and in sequence as we often see with the late preparation of project-level environmental impact statements.

Working broadly together at the front end is part of the answer to the universal call for permit “streamlining.” Other promising models are provided by some corridor-level planning work and “major investment studies.” The systems question might be whether the current species protection approach under ESA statutes always fosters needed species protection/eco-system management or is shaped too much by our case-by-case (literally) litigious institutional setting.

2.02 Conduct a “national intermodal connectors conference.” TRB funded this project as Task 30 for NCHRP Project 8-36, “Research for the AASHTO Standing Committee on Planning.” The final report for this task is available at: [http://freight.transportation.org/doc/8-36\(30\)connectors.pdf](http://freight.transportation.org/doc/8-36(30)connectors.pdf).

Additional research on NHS connectors might include:

(1) Ways to supplement the proposed two-percent set-aside of NHS funds (per TEA 21 reauthorization legislation) at the state level for intermodal connectors,

(2) The degree to which improved intermodal connectors reduce drayage costs to rail yards and, thereby, improve rail competitiveness overall, and

(3) The degree to which intermodal yards are managed and priced as profit centers, thereby *offsetting* the possible benefits of investments in “intermodal connectors” for rail competitiveness and intended net benefits for the multimodal transportation system. (For related research, see “Short Haul Rail Intermodal: Can it Compete with Truck?” Resor and Blaze, Zeta Tech, paper prepared for the 2004 TRB Annual Meeting).

Limited case information also suggests that private intermodal yards can compete in niche markets if they own their own railroad equipment. This scenario deserves a close look as we consider the recommendations of the AASHTO *Bottom Line Report*. The case in point is Northwest Container Services operating at least four intermodal yards in Washington and Oregon (as reported to the Regional Freight Mobility Roundtable located in Seattle).

(5) Proposals to improve intermodalism through the ports range from “intermodal connectors” to broad operational (and capital) solutions: the “efficient marine terminal” or “agile ports.” We also hear, however, that some shippers are content to use the ports as cost-free storage areas for their containers. A survey of ports should be conducted to gather estimates on the prevalence of this practice. For example, are stored full containers obstructing repositioning of empty containers?

2.03 Identify the strategic actions needed to fit growing intermodal site operations within fixed footprints in dense urban areas (e.g., corridor preservation or industrial sanctuary).

How do interregional goods movements fit within the goal of regional smart growth? A mission focus for the Intermodal Committee is facility needs at modal transfer points, e.g., rail yards and terminals at marine ports. System design can include as a sub-element “goods movement: supportive land use planning guidelines” (*TRB, E-C048*), which is currently focused more on making urban streets more user friendly for trucking and delivery activities. Also to be considered is connectors within regions and between business clusters, terminals, and intermodal facilities.

2.04 Identify corridors with parallel rail and highway facilities, and investigate the operational and capital improvements that might offer better rail connectivity and competition.

The interstate-5 Corridor (Washington, Oregon, California) is a possibility. Another is the forecasted future growth in truck volume *and* market share through the Alameda Corridor after 2007, if mainline rail capacity needs are neglected in the eastern sector (aka Alameda East). And a third is the hub-and-spoke Port Intermodal Distribution Network (PIDN) being developed by the Ports of New York and New Jersey.

The public sector interest is in at least retaining current rail market share at its current level. The public benefit includes consideration of avoided (life-cycle) highway improvement costs, and the strategic location of possible new rail intermodal yards (to reduce, rather than increase, truck traffic on congested roadways). Routes with significant bridge structures especially fall into this category of concern.

On the west coast, the BNSF currently offers a Carload Service Assurance Program with 5-7 day guaranteed service between Vancouver, BC, and destinations in the Bay Area, Los

Angeles and Phoenix. Does this marketing program sufficiently develop the potential market for rail carload service? What are the other examples, and is marketing enough? What strategic actions by the railroads (in cases like this) could reduce the time schedule and better serve the needs of candidate shipments or commodities?

Now Union Pacific is spinning off its trucking subsidiary, as have CSX and the other railroads. How can a rail link be promoted *within* particular corporate supply chains? Or, are rail/trucking synergies a completely unrealistic expectation? Are railroads destined to become ever more a trainload niche player in a trucking world? Again, what is the cross-modal action strategy if roads cannot handle forecasted demand?

What would encourage Class I railroads to consider fundamental operational improvements, where this is an option? The Federal Railroad Administration (FRA) is researching the potential for scheduled rail service. This business plan focuses on schedule-based rather than tonnage-based train dispatching. Competitive shipping rates might be driven by comprehensive management of both non-transport logistics and transport costs. The business plan would be structured to reduce intermediate railcar handling, fuel consumption, railcar transit time, transit time variability, and total railcar-miles traversed. Canadian Pacific Railway (CPR) has instituted this model and is realizing financial rewards (see "Perfecting the Scheduled Railway: Model-driven Operating Plan Development," *Draft*, Phil Ireland, Rod Case and John Fallis with Multimodal Applied Systems, Inc., March 12, 2003). Private sector revenues from increased business might then be used to help finance capital improvements that otherwise are not possible.

TRB Goal #3: Contribute to decision making on cross-cutting and other national transportation issues

3.01 Research and quantify the potential benefits to regional and national economies of representative intermodal investments.

These benefits include reduced congestion and truck pollution, enhanced mobility and safety for people and goods, and increased attraction of business investment and tax revenue (*E-C048*). Are there cases where reinvestment in short-line rail service would result in a mode shift to rail, broadly beneficial to congested highway corridors? Or, is the chokepoint in the business model used by the railroads? Is there any merit in greater railroad attention to non-bulk business markets, similar to yield management strategies followed by the airlines? Rail container service is one example, but are there carload examples that merit more railroad attention?

Likewise, are there tributary barge routes which, if supported, should be evaluated (for cost effectiveness) in terms of mode shift to all-water routes feeding into and using larger river systems, e.g., the Mississippi and its tributaries?

3.02 Include an intermodal component as part of the possible formation of a National Freight Cooperative Research Program (NFCRP) recommended by the National Freight Stakeholder Coalitions and other groups (see Appendix 3).

The Coalition states that the research effort should be "led by an industry-based steering/oversight group such as (a national freight industry advisory group) to ensure useful research results to benefit the freight transportation system as a whole." It might be that the

reorganized TRB into its new Groups, and the elevation of the freight modes, can also help accomplish the needed consultation.

The *private sector* is interested in such factors as rates, routes and services, with varied sets of performance measures for shippers, investors and carriers. The *public sector* is interested in partnerships, information systems (ITS as part of services), community context and impact mitigation, and congestion-related performance measures (nodes more than corridors, and especially urban areas as nodes within global supply chains). Both sectors are interested in the relationship between global supply chains, outsourcing, and local and national economies.

3.03 Conduct financing research focusing on three related topics: possible unevenness in public support for freight modes, criteria for identifying intermodal needs that may merit a public investment share, and approaches and methods of public finance.

Past TRB research concludes that different carrier modes do have varied levels of government support, but that cost-recovery pricing probably would not alter mode selection by shippers (*Paying Our Way: Estimating Marginal Social Costs of Freight Transportation*, TRB #246, 1996). To help establish a context for public investment in intermodal projects, a panel should respond to these findings. This would help us outgrow the “gas-tax phase” of federal transportation policy.

On the second area of focus (intermodal investments), federal transportation policy is giving renewed attention to (multimodal) freight mobility as a third leg in the transportation stool, together with highways and public transit. The difficulty is in defining the responsive and responsible shape and size of public sector involvement. The carrier industries are federally deregulated and private, yet there are both public benefits and unmitigated impacts on the public.

To illustrate, the maritime carrier mode is inadequately supported by trust funds supported by the Harbor Maintenance Tax and by inland waterway fees. Other sources that have been mentioned are a share of customs fees or a national or continental container-handling fee. Other modal examples would address rail, air cargo, and trucking. In the meantime, successful project-level financing for intermodal solutions is typically a mosaic of sources assembled at the local or regional levels.

What is the proper size and shape of public financing for intermodal investments including, but not limited to, the gateway ports?

More broadly, there are those who think that railroad optimization toward scheduled service could improve the internal balance sheet (as it is for Canadian Pacific Railway, CPR), and who even suggest that this might attract some new business (mode shift). Depending on these hypothetical outcomes, part of the rail financing dilemma might actually lie in new railroad business plans to replace the dominance of tonnage-based models. Based on the recent CPR experience, the revenues to be realized vastly exceed the contest total \$170 million/year paid by all United States railroads into the general fund through the rail diesel fuel tax. How do things look from inside the railroad business, and where are the specific institutional and geographic opportunities to retain rail market share?

3.04 Explore the extent to which congestion in freight mobility is due to underpricing of service rather than the undersupply of facilities.

Across the modes, examine whether transportation prices are lower than costs (direct and indirect) and the extent to which supply shortages are the effect of underpricing. Following deregulation, (1980) the dollars per truck mile declined by 53 percent (to roughly \$1.25) and cents/rail ton-mile have dropped by 44 percent (to roughly \$0.02) (“Economic Effects of Transportation: The Freight Story,” ICF Consulting, January 2002, p. 10). In the first instance, congestion is leading for increased demands for transportation facilities. In the second instance, the railroad business model has yielded efficiencies and cost-cuts, but is incapable now of financing added capacity to handle ever-growing demand. Maritime transport also displays a surplus of deck capacity and bargain pricing to attract container traffic. Air transport for high value cargo continues to grow rapidly, and is split about half and half between passenger planes and cargo planes.

To what extent is the new economy – a shift from warehousing and bulk deliveries to an economy of order-response and batch deliveries – dependent upon non-sustainable pricing? How accurate is this picture, and what might be done about it? Or, what actuarial factors should play a role in major intermodal investment decisions?

TRB Goal #4: Help improve communication and public awareness nationally and internationally

4.01 Research and publicize the indirect public benefits of intermodal freight transportation improvements in terms of such metrics as pollution, safety and tax generation.

This focus sets aside the direct benefits (and costs) of greater market reach and of increased outsourcing to foreign economies. The proposed research focuses on indirect costs and benefits. It will better enable intermodal freight to compete with highway projects benefited by a less cross-modal approach to benefit-cost analysis, e.g., the focus on “congestion” begs the question whether the highway mode should be in the driver’s seat ahead of other modes.

Appendix 2

List Two: Detailed General Freight Research Ideas

TRB Goal #1: Contribute to research on and development of new technology and innovative practices

A. Supply chains.

1.01 Identify what other modal and intermodal carriers can learn from the integrated and time-sensitive methods of UPS and FedEx and apply to their own systems? How can regions learn from the same model?

The UPS and FedEx logistics/ transportation systems are possibly one of the best models for other just-in-time carriers to think about. One of the keys to their systems is their respective communication and information system(s). Both companies essentially use off-the-shelf handling and transportation equipment, but the way they are tied together for communication is outstanding.

Thinking also of regions, Rotterdam and perhaps Bremen begin to come close to these two models. On a larger scale, we could talk about The Netherlands as a prototypical model. If that is so, why and how did they accomplish those goals and what has been the result? Eventually, the two items (carriers and regions) need to blend and coordinate their systems if infrastructure funds and other resources are becoming scarce. Who will be the magician who will make this work and how?

We must keep in mind, however, that not all suppliers require the same degree of time control as do contracted deliverers of high value products. UPS and FedEx are not typical. Some are even asking whether just-in-time (JIT) is universally applicable. *JIT was invented at a time of high interest rates and the need for inventory cost control. We are now in a period of low interest rates, and rising transportation costs and fuel costs.*

1.02 Advance security and cross-modal redundancy through research on possible Certified Loading Centers (CLCs).

The CLCs are proposed consolidated locations where intermodal transfers take place and security is assured. CLCs are compatible with the agile ports proposals but would not be limited to these sites. This research has been proposed by students from the University of Washington (the Global Trade, Transportation and Logistics (GTTL) Program).

B. Integration and Public-Private.

1.03 Develop methods or contexts for identifying public sector benefits and costs of intermodal and other projects located in and benefiting overall supply chains.

For example, a multiplier of truck driver wages is an inadequate surrogate for trip time *and* the more important need for trip predictability. Broadly, what is the relationship between freight transportation and energy, environment and safety? And, what are the specific and sometimes countervailing relationships between freight transportation and economic development, international trade, productivity and land use? Domestic trade between California and the rest of the United States is three times as great as foreign trade. And we

know from the Commodity Flow Survey (CFS, 1997, 2000) that over eighty percent of freight truck shipments are less than two hundred miles in length.

C. Performance and Reliability

1.04 Advance preliminary work on pricing of services as this might affect freight mobility modes and intermodal connectivity.

This research would be follow-up to fundamental points made in the new Special Report #271: *Freight Capacity for the 21st Century* (2003). Illustrative and particular issues are (1) the degree to which pricing would relieve general traffic demand and give access to lane capacity on priced lanes for possible freight use, and (2) the dollar benefits for shippers/carriers who choose to participate.

For some shippers and carriers, the avoided cost for discretionary and paid access to managed (and reliable) lanes is *not* zero; the avoided cost is the greater cost they currently incur by deploying extra company trucks on bad days in order to make deliveries on contracted schedules. For others, the congested route segment is only a small and negligible part of the total trip. In these cases travel-time savings are not so important, but then trip predictability (measured in some other way) is often very important.

Uneven subsidies might affect freight mode choice (and intermodalism). In 1996 the TRB published Special Report #246 – *Paying Our Way: Estimating Marginal Social Costs of Freight Transportation*, chaired by Jose Gomez-Ibanez of Harvard University. The findings: greater “user-pays” might make sense for economic efficiency but might or might not affect mode shift. It is important not to assume that mode shift can be understood and predicted in terms of system-wide cost curves on a piece of graph paper.

1.05 Identify performance measures to guide capital investments and operational solutions for intermodal connections.

How can we evaluate project-level public investments as parts of optimized systems? More broadly than intermodal connections, the Urban Freight Committee should research the *varied* effect that congestion has on different kinds of businesses. Different products are more vulnerable to price increase from rising transportation costs than are others.

In the *1987 Metropolitan Toronto Goods Movement Study*, the conclusion was that a large increase in congestion (assumed to be 80 percent in ten years) would increase product costs by the following percentages: manufacturing (9.5 percent), retail (13.0 percent), services (0.5 percent) and all sectors combined (5.0 percent). Retail is twenty-five times as vulnerable as is services.

D. Information.

1.06 Post an overview web-site (or index) that displays links to research related to freight intermodal connectivity and freight mobility.

This should be a brief index and link to each of the listings, beginning with those submitted by TRB Freight Systems Group committees and by the freight-related committees under the air, marine (e.g., Marad.dot.gov/research/), and rail Groups.

1.07 Address how to factor non-recurring delay into modeling of system capacity and into expansion/operational decisions.

We might survey regions to see if and how non-recurring delay is being accounted for in actual decisions affecting freight movement. Infrequent research is now provided by Oak Ridge National Laboratory: *Temporary Losses of Highway Capacity and Impacts on Performance* (ORNL/TM-2002/3), May 2002.

Non-recurring delay is half of total delay, yet non-recurring delay is invisible to long-term policy decisions that are driven unilaterally by standard metropolitan transportation model simulations. Non-recurring delay includes weather, work zones, breakdowns (the smallest share), and crashes (the largest share). Spot improvements, operational solutions (accident clearance), weather-related actions, and attentive planning for construction all affect reliability and, especially, time-sensitive deliveries in the freight/supplier industry.

1.08 Coordinate ITS and other operational databases with freight flow data, and incorporate small area estimation techniques – or other small area techniques – into complex freight transportation databases.

As part of this broad and imprecise topic, TEA-21 funded two ITS freight pilot deployment projects. One of these (in Washington state) examines container e-seals, camera surveillance of truck access points to the Port of Tacoma (linked to the Internet), and some work to track trucks on intra-regional routes. How much of this is transferable and what are the next steps? (the second pilot project deals with biometric identification at O’Hare Airport in Chicago.)

With regard to “small area estimation techniques,” the alternative approach used in the Seattle-Tacoma region and in Portland is to relate truck trip modeling to employment categories, and to *complement* and adjust (not simply refine) the more generalized Commodity Flow Survey (CFS) data with independent and more reliable surveys and other information available locally. For example, the CFS is weak in reporting non-manufacturing sectors, and this information is provided below the national level from other sources.

1.09 At the sketch-planning level (the opposite end from small area estimation), research scenarios of shifting origins and destinations and how these relate to the more fixed continental and multimodal transportation system.

Thinking in terms of decades, some of the scenarios we see are as follows – In the 1980s the invention of double-stack container trains, and other influences, served to shift Panama Canal traffic to the continental land bridges leading inland from west coast ports. Trade agreements in north America, refined in the North American Free Trade Agreement (NAFTA) have led to the designation of forty-three trade corridors in federal legislation in 1998, most of them north-south. Corporate outsourcing to foreign labor pools has recently shifted manufacturing activities from Mexico to the Far East (stressing east-west corridors). And in Southeast Asia, following the economic meltdown of 1997, we find a rethinking of the siren call of globalization (human, capital, and financial), even as forecasters anticipate an eventual return of container handling trends to what they were in the mid 1990s. In 2002, the dockside labor slowdown on the West Coast contributed to a marked (but mostly temporary) shift of inbound marine cargo from west coast ports to ports on the east coast.

What is the range of uncertainty we should be thinking about, and what are its major drivers? What does “reliability” mean, above the myopic level of highway congestion? What is the

most resilient “system” for dealing with fluid conditions on the national and regional levels? Which bottlenecks in some regions (Alameda East, Chicago rail transfer capacity, etc.) should be cause for concern in other regions often far distant?

E. Customers.

1.10 Identify and rank the intermodal “events” or performance chokepoints in the supply chain that are of common research interest to private sector shippers and carriers.

Familiar events important to the public sector are security, connectivity with the National Highway System via “intermodal connectors”, and ITS. Additional possibilities are to define the appropriate public sector role, if any, in the following supply chain events:

- *Asset utilization*, e.g., surge management, and attention to efficient container repositioning, closed loop supply chains, chassis tracking, *Cost reduction*, e.g., ways to protect JIT from its fragile downside in a congested environment, and how to foster risk-adjusted supply chain management, and other improvements to operations,
- *Speed, and route and mode redundancy*, e.g., bottlenecks within corridors, or corridors around bottlenecks (what are the combined implications of a doubling of container trade on the West Coast and the possible enlargement of the Panama Canal to handle post-Panamax ships?
- *Environment*, e.g., the societal benefits of possible mode-shift to rail or to barge, in some corridors

The need for better *origin-and-destination* information for trucks, to clarify where truck congestion can be mitigated by investments in rail, air (better locations and cargo facilities), marine (barging) and intermodal facilities.

1.11 Scope, assess and develop a conceptual design for a “national freight reservation system.”

A reservation system could give shippers a level of information comparable to that which is available to today’s air travelers. Logistics managers are beginning to explore the notion of “transportation portfolio management,” and how to optimize their overall network rather than separately optimizing transactions one at a time. A reservation system can dovetail with this new corporate approach (This suggestion is included in Turnquist and List, “Charting a Course for Intermodal Policy and Research”, *Transportation Quarterly*, 47:2, April 1993, pp. 257-280.)

The utility of this product would be judged within the context of decentralized (within private corporations) mode choice decision-making, not a centralized system spanning corporations. In this decision structure, the United States differs from possibly more centralized network optimization as is discussed by others for the European Union.

F. Technology

1.12 Continually scan the industrial horizon for disconnected decision processes.

This is more a research attentiveness than it is another research report. The most urgent need is to ensure that standards and specifications being advanced by the Intermodal Maritime Organization (IMO) Maritime Security Working Group and separately in the United States

are mutually compatible. The net result of the two decision tracks must not risk disruption of the overall system and of supply chains. The need for timely attention applies to vessel security, port facility security standards in terms of vulnerability, intermodal system efficiency, cargo flow and cost.

1.13 Jointly address the three marine priorities—technology, landside systems, and clearinghouse functions--decided during the 2003 TRB summer session in Portland.

These priorities are: (1) technology (e-seals), (2) cargo handling and surface systems on the landside of marine ports, and (3) how to serve as a clearinghouse for new technologies and new systems. This list simply illustrates how clarifying insights on one research group match those from other (of the multiple) committees, and the need to get in step with each other, especially where urgent security needs are on the table.

We cannot afford to have our most imperative needs dissipated across an entire waterfront of separately talented Groups and committees working on separate research agendas. Joint meeting dates are a start, but even the minimum step of joint attendance at key committee meetings is in its infancy. The TRB must become a coordinator of the subject matter, not simply of the respective committee meetings. A great deal of work has already been done along these lines (joint conferences).

TRB Goal #2: Promote participation by the private and public sectors in research for highway and non-highway modes

A. Supply chains.

***2.01** Research “cross border rail freight transportation.”

The research focus should be on barriers, incentives and recommendations. Opportunities should not be limited to the Mexican border, and might draw from experience under TEA-21 Section 1119 (and its successor in SAFTEA as it may appear after final Congressional action). Related to this proposal is the interaction between railroad consolidations and ports of entry for maritime containers.

A case in point is that shipping lines that have integrated service with either the BNSF or the UP now have total discretion as to which west coast port to visit. Another case in point is the competition between Puget Sound ports and the Canadian port of Vancouver, which is linked by continuous rail service to the Chicago area and, by additional rail access agreements, south to the Gulf States. (Train scheduling by Canadian Pacific Railway, addressed in other research topics, is also relevant.)

B. Integration and Public-Private

2.02 For different economic activities, identify the factors actually used by businesses to make modal (and intermodal) shipping decisions.

Some research was done in England in 1990 – *Transportation*, 17:29-47, Kluwer Academic Press; we need more. Another source is TRB, *Paying Our Way: Estimating Marginal Social Costs of Freight Transportation*, 1996, Special Report #246).

The first study examines internal corporate considerations (only one of which is infrastructure) *and concludes that a statistical mode choice model is probably not likely*. The second source finds that correction of modal pricing inequities could improve cost-recovery, but by itself probably would *not* affect mode choice. What is the next step in this kind of important research?

2.03 Determine the extent to which the lack of intermodal connectivity is a decisive obstacle to otherwise beneficial intermodal supply chains.

From a *business perspective*, what are all of the logistics factors weighed by trucking firms in their bottom line? How do they decide for or against being a segment within a larger intermodal supply chain, especially for long-haul trips? And what actions, if any, should rail take to foster synergies between rail and highway transport modes? Any survey results should be stratified by broad employment categories and geographically, and should focus on new opportunities for truck on flatcar (TOFC) or container on flatcar (COFC).

In its transport decisions, one trucking firm (Kraft) lists these performance measures: cost per shipment, on-time delivery, empty mile reduction, idle time and driver turnover (*Transport Topics*, April 28, 2003).

***2.04** Scope and research “increasing capacity in rail corridors,” including the merits/demerits and implications of an open access rail system, which could treat rail rights-of-way like public highway rights-of-way.

Give attention to: the alternative of greater track sharing agreements, cost sharing, and public-private partnerships. Build on rail-supportive research published in *The Bottom Line Report* (AASHTO, January 2003). Take special note of proposed track sharing in the Chicago area as an agreed prerequisite for defining the (related) capital construction elements of a system-wide solution to transcontinental rail connections in the Chicago region.

2.05 Identify and research key questions related to modal shift to barges and to rail. Where appropriate, investigate how to focus on short sea shipping or coastal shipping.

Instead of looking at a map and seeing only landmasses, why not try to invert the focus to see the water highway systems that are not being used to relieve rail and highway congestion?

Two examples: (1) What are the commodities most amenable to a healthy barge system and how might other modes be engaged to support a mode shift for societal reasons, and (2) What are the specific impacts of the National Master Freight Agreement that currently limits the amount of freight that trucking companies can ship by rail (to no more than 28 percent of total miles, and modified to 26 percent beginning in 2004)?

2.06 Compare candidate project investments to system (supply chain) benefits. Look first at operational improvements, as is being done in the Chicago area, as a context for then deciding supportive capital investments.

This is a generalized placeholder topic looking for better definition. The point is that in complex systems, we often find ourselves making increasingly expensive capital investments at the margin when adjustments to total system operations would be the smarter and less expensive thing to do. In the intermodal system, where can we be smarter instead of bigger?

Reformed gate and terminal hours at the ports are a commonly cited example. In that instance, what are the conditions, beneficial to both labor and to shippers, that could make this possible? In the Seattle area, discussions at the Regional Freight Mobility Roundtable suggest that overtime wages could be justified and supported by shippers, but that a reliable threshold of need – a minimum of, say, fifty containers – would also be expected in order to open the terminals during agreed night hours. How, then, might shipper deliveries to the ports be coordinated in a maritime urban region?

2.07 Research key needs for inland waterways, namely aging infrastructure and the Endangered Species Act (ESA).

Capacity issues at waterways and harbors suggest to some the need for an equivalent to the Highway Capacity Manual. Issue areas are port congestion (and other aspects of a possible Maritime Transportation System initiative, MTS), the possible merit of a maritime cooperative research program, and the economic impacts of the MTS, and its modal environmental advantages.

D. Information and Data

2.08 Conduct a joint research panel to understand the *system* benefits compared to capital investments in marine terminals, rail terminals and the mainline.

From this analysis (probably anecdotal) discuss possible guidelines for determining when there is an important public interest in these improvements, and the appropriate share for public investment.

We should note that rail and marine transport are private and that neither benefits from a significant “trust fund” source as do highways and airports. The Harbor Maintenance Trust Fund earns about \$700 million annually but the use is limited to dredging, and the Inland Waterway Trust Fund earns about \$100 million annually. Following federal deregulation the railroads, although unable to compete well on the market for private capital, are very leery of any renewed involvement of the federal government in the railroad business.

E. Customers

2.09 Conduct a panel discussion among shippers on how their respective logistics managers actually decide among modal alternatives.

Factors from the inside can include group decisions, customer requirements, price, urgency, transport infrastructure, company policy and production levels. One researcher in this neglected field concludes, “it is unlikely that a universal mode-choice model can ever be developed” (“Determinants of modal choice in freight transport,” *Transportation*, 17:29-47, Kluwer Academic Publishers, 1990).

F. Technology

***2.10** Research the pertinent issues that might be encountered in the future planning and design of pneumatic capsule pipelines for intercity and interstate freight transport.

TRB Goal #3: Contribute to decision making on cross-cutting and other national transportation issues

A. Supply Chains

3.01 Report the unfolding intermodal impacts of security on each transferring carrier mode – air, marine, rail, and truck, and on intermodal trade as a whole.

For example, for insurance reasons do we see a shift of air cargo from passenger planes to integrated (land-air) carriers where there is no risk to air travelers?

3.02 Report how connectivity between modes is affected by new security issues.

Is intermodalism (and liberalized trade) jeopardized because it increases handoffs? Report on best practices related to the new ITS security technologies. Focus on tighter operations and procedures at all points in the supply chain, from stuffing to final delivery. What is the current thinking on the tradeoff between absolute security and something more “realistic”?

3.03 Report on public agency (regulatory) and corporate (smart business) methods to ensure secure loading of containers at the point of origin.

Container security initiatives under the Transportation Security Administration (TSA, part of Homeland Security) are focusing on secure methods of container tracking, e.g., container electronic seals (e-seals). At the front end of any tracking system there must be the assurance that the container is safe at the point of actual loading, before the e-seals are attached. As part of broader quality assurance, some corporations monitor container loading by their foreign subsidiaries. What can we know about this? And what else of a regulatory nature is needed for other cases?

B. Integration and Public-Private

3.04 Report on market opportunities for end-of-line rail intermodal facilities, combined with railroad business practices that might reclaim market share lost by railroads.

For example, are larger rail cars (286,000 pounds) a benefit to rail or not, considering likely additional loss in some corridors of existing short-line feeder service? The upgrade requirements can be prohibitive.

Observers say that since the Staggers Act (1980), railroads generally have engaged more in cost cutting than in system enhancements. What now is needed to change this, especially for boxcar loads where the reliability of service is reported to be 70 percent (compared to 99 percent for intermodal)? It would be interesting to know what each of the Class I railroads has to offer on their tracks in their respective corridors of control.

3.05 Critique the AASHTO *Bottom Line Report* and the Marine Transportation System (MTS) and how these might fit together.

At the July meeting of the Regional Freight Mobility Roundtable in Seattle, a Maritime Administration (Marad) member challenged AASHTO to sponsor research on the potential for selective mode shift to barge traffic and what it might take to protect natural markets (that also benefit the public good) from undue competition by trucks and rail. AASHTO does

have active state-level leadership in the Southeast dealing with maritime issues. The current focus at AASHTO is on the connection points between highway systems and maritime routes.

C. System Performance and Reliability

3.06 Conduct research on the impacts and implications of the paradox of just-in-time (JIT) – that lowered inventories also involve greater risks of possible supply chain disruption.

In addition to route or mode redundancy, when might corporate risk management require inventories to be re-established (as a supply chain cushion)? What is the dividing line between inventories maintained on the basis of reasonably assured aggregate demand, and product completion that is pulled by specific and changing market demands?

3.07 Investigate the benefits and costs of the recommendation to develop a practical, nationally uniform, state-based system for responsibly permitting the controlled use of larger and heavier trucks.

3.08 Structure a dialogue to help understand what is meant by practical performance measures, considering the complementary roles of productivity/efficiency and sustainability/energy and conservation/community impacts.

In the United States the embedded criteria for system performance are productivity and efficiency. One can ask the elephant-in-the-living-room question: Efficiency for what? In the European Union, the focus on efficiency is more embedded within broader concerns of sustainability, energy conservation and community impacts.

Points of discussion might include: the relationship between possible public investments in “agile ports” and the private construction of large container ships (with economies of scale and reduced unit costs), the likely need for strategic public investment in rail, the history of private cost-cutting by railroads since deregulation (including the shedding of feeder short lines), the increased need for public investment in new roads and roadway maintenance, and the private evolution of trucking supply chains with more small-load JIT deliveries as well as oversize loads.

From a public-private perspective, what is the fit between engineering criteria of efficiency and other possible decision criteria? In the long term, is it better to be approximately right instead of exactly wrong? On the *public side*, what does all of this mean to evolving federal transportation policy and efficiency-driven decision criteria? And on the *private side*, and thinking in terms of sustainability, is there another relevant logistics paradigm other than the “push” economy (consumers respond to producers) or the “pull” economy (producers respond to consumers)?

*Note: Evolution of transportation policy is marked by a sequence of three major themes. These are:

First, assistance toward market entry for each new technology, namely canals, then roads, then rail and then air.

Second, federal deregulation of these modes mostly in the 1977-84 period. In 1991, federal legislation toyed with the idea of a National Transportation System even as it devolved

authority to states and regions, and in later years has clung to this bi-focal picture, but with less grandiose intentions.

Third, with regard to freight mobility and within a new global setting, proposed legislation would retain the federal gas tax associated with the National Highway System, while also encouraging gateways (limited eligibility for existing programs), border crossings (a firewall and separate funded program), and planning for multi-state corridor coalitions. To what extent does each of these programs protect host communities from the impacts of other communities benefiting from far-flung supply chain freight transportation systems? Should federal construction funds be used attract freight partnerships throughout multi-state corridors, especially those crossing national borders? And, what features are needed to ensure that a merit-based and systems-conscious program is put in place and remains intact?

D. Information and Data

3.09 Research new financing approaches to freight transportation.

How to outgrow the funding silos and move beyond the gas tax, with a more systemic view that is also sufficiently segmented to avoid inappropriate cross subsidies? Without promoting policy positions, what are the implications of possible approaches?

Controversial suggestions include: (1) a nationwide or NAFTA-wide container handling fee (probably charged against shippers) or (2) a share of Customs fees identified as a user-charge and diverted from the Congressional general fund (for example, a few percentage points of the twenty billion plus collected each year, to be placed in a modal trust fund). If (3) the diesel fuel tax charged against railroads (\$170 million/year) is not redirected out of the general fund (and presumably restored to the railroads), sources of this type might be cobbled together into a new trust fund for strategic and defensible public investments in maritime and rail infrastructure – parallel to what currently exists for public highways and public airports.

(A fourth possibility, theoretical, would be for railroads to provide successful (?) scheduled rail service (as is being tested by Canadian Pacific Railway) and with some of the revenues find ways to share in strategic system upgrade partnerships.)

3.10 Bracket a tighter and reasonable forecast for long-term container traffic, possibly to narrow the range between national forecasts and the sum of local forecasts.

At the national level we have a wide range from a doubling to a quadrupling in the next twenty years. TRB could help pioneer ways to factor in the uncertainties that surround all such globally-nested forecasts. This could include work toward a probabilistic forecasting strategy and modular ways to size or resize intermodal facilities for the future.

Second, shippers look at even the moderate level of international container growth (5-6 percent/year) and see a *range of future practices* including inland point intermodal terminals (agile ports) versus deconsolidation and transloading, and rail/bridge versus all water routes from Asia. This range influences many of the perspectives held to be certainties by advocates within the TRB. Can these broad issues of long-term needs and open-ended global dynamics be framed better for combined attention to operations research and capital investments?

E. Customers

3.11 Document how intermodalism in general – and especially connectivity between modes –relates to different local economies and to state and national economies in a global setting.

For example, from a national perspective, it is a matter of indifference whether a firm moves from one domestic location to another, but not if it moves overseas. States and locales have a more fine-grained perspective on corporate mobility. Businesses are courted by competing localities.

3.12 Identify the final customers – the market niches – for rail improvements.

Evaluate the different implications of: (a) the *AASHTO Bottom Line Report* which proposes federal grants, (b) a state-based loan program (RAIL-21), or (c) the fine-grained tax code recommendations proposed by the AAR.

3.13 Research large-scale case studies on decision processes that foster parallel looks at (a) site development needs and (b) contextual and environmental factors on the ground.

What to do about NIMBY (Not in My Back Yard), BANANA (Build Absolutely Nothing Anywhere Near Anyone) and NOPE (Note on Planet Earth)? Two integrative planning examples are the Port of Portland Master Plan, and the identification of dredging “windows” in the Bay Area, researched by the Bay Commission. The windows template is defined by the varied seasonal needs of biological systems in different parts of the Bay. In general, success depends now on working up from the community, not down from the ports (a finding of the Los Angeles Economic Development Corporation).

Other examples include some corridor studies (e.g., the 240 square mile I-405 Corridor in the Seattle area included as part of its Preferred Alternative a Corridor Environmental Program with crosswalks into region-wide basin management planning.) These planning models also offer lessons on how to go beyond “stove-pipe” planning (internally connected and externally disconnected) among modal administrations.

3.14 Develop guidelines or case information for cross-modal analysis of alternative shipping options, particularly involving intermodal connectors.

This might have application to possible multi-state corridors served by alternative modes – rail, water, rail, and air (in the west, the I-5 Corridor has none of the network route redundancy and benefits found in the eastern corridors). At the national level, research improved accessibility to markets provided by intermodalism. (Internationally, alliances between deregulated marine shipping and rail/truck carriers have helped create global intermodal supply chains.)

Confounding factors are the added cost of intermodal handoffs, and other restrictions, e.g., labor contract provisions limiting intermodal carriage to a percentage – 28 percent – of total freight haulage by each affected companies.)

3.15 Research the implications of life-cycle container use.

Foldable containers have been field tested to a limited degree (to deal with the costs of empty backhaul). With regard to container disposal, worn-out containers are marketed for private

storage in developed countries and are dispatched upstream to be used as housing in Southeast Asia. What is the full “container story” (as distinguished from the “full container” story), and what are the possibilities?

F. Technology

3.16 Report to all of the mode-related committees on electronic-seal container tracking.

For example, what is the fit between *domestic* advances in technology such as electronic seals (e-seals are one layer in a multi-layer security strategy) and the other possible specifications or standards at the *international* level, such as the International Standards Organization (ISO), and the International Maritime Administration (IMO)?

3.17 Screen the surveys of cases (best management practices) underway and, from these examples, develop an independent perspective on ground-level needs.

Specifically target gateway strategies, e.g., do we see a mode shift resulting from the three recent railroad mergers. Is there really a trend toward load centering? What does the new hub-and-spoke system at the Ports of New York/New Jersey teach us? And what do forecasted container trends mean if the Chicago nerve center cannot keep up?

TRB Goal #4: Help improve communication and public awareness nationally and internationally

A. Supply chains.

4.01 Research the *net effect* of trade liberalization and increased security on corporate supply chains.

Is it inadequate to maintain that we must have both, or that we must strike a balance? Does the new environment tilt favorably toward more domestic production (simplified and secure supply chains at higher prices for goods), while liberalization does not? Does heightened security tilt *toward* those countries most able to comply (China, India, Pakistan), but *not toward* those who are unable (Bangladesh)? An initial probe on these points was done by students at the University of Washington Global Trade Transportation and Logistics Program (GTTL), in a paper entitled “Economic Effects of a Heightened Security Since 9/11 on Selected U.S. Businesses.”

Regarding corporate *supply chain costs* and security, some corporations are actually looking closely at their total package of supply chains for the first time. They (for example, the Boeing Company) are finding that they have failed to offset their import products with exports of the same products, such that they might be eligible for significant exemption from or refunds of Customs fees – thereby offsetting increased security costs?

***4.02** Scope additional research aimed at audience “gateways” and “multi-state corridors.”

For example, the authors of *TRB Report #246* recommend measurement of air-quality effects from a change in the distribution of freight volumes on a road, waterway, or rail line. The authors recommend a benchmark analysis to find where economic benefits justify more internalized costs, and marginal cost analysis connected to possible user fee levels – not

simply cost-allocation analysis. This recommendation came prior to the 1997 FHWA *Cost Allocation Study*, and the more recent *AASHTO Bottom Line Report*.

4.03 Critique ideas from the FHWA scanning tours to the European Commission, and from the Commission's *Communications on Intermodality* and other recent endeavors.

Typical issue areas identified for special attention are: public/private financing options for intermodal improvements, trends and near-term chokepoints, shared passenger/freight use of infrastructure, best practices at hubs and transfer points.

The *COM 243* is included as Appendix B in A1B05-member Gerhardt Muller's *Intermodal Freight Transportation*, 4th Edition (Eno and IANA), 1999. Much is familiar and proposed actions come in four areas: integration, interoperability, mode-independent services, and horizontal activities such as research dealing with sustainability.

The FHWA report, *Freight Transportation: The European Market* (June 2002) identifies ten "Lessons for North America". These generally call for attention to bottlenecks, trip reliability over trip speed, public investment as a catalyst, the context for private decision-making (mode choice), efficiency of current investments, financing, cross-modal incentives, forums, interoperability, and training.

B. Integration and Public-Private.

4.04 Research the strategic, legal and political limits to public agency involvement in intermodal connections – serving federally deregulated and global supply chains.

Five questions are posed below:

- (1) What thresholds establish a *public interest* and defensible public intervention (productivity, efficiency, avoided public costs, security)? In varying degrees the railroads call for help where public costs are low and the public benefits are high. Where, exactly, would this be?
- (2) Determine how shippers and carriers would respond to potential changes to reduce *modal subsidies*, including changes in user charges, public investment, and regulation. (Build on *Paying Our Way: Estimating Marginal Social Costs of Freight Transportation*, TRB Report #246, 1996.)
- (3) What share of the supply chain transportation costs should be *internalized* rather than federally supported? Is it true that half the dollar value of container imports is internal to individual corporations, e.g., outsourcing/importing partly to capture low cost foreign labor markets?
- (4) Are costs too high, or are rates too low? Carriers in all modes – rail, truck, water, and airlines especially – are strapped. What are the broad consequences of past federal *deregulation* on each mode, and on the formation of supply chain systems as a whole? Is rail undervalued, and is trucking pressured to be too cutthroat? If so, how and why? Is there a case for tailored re-regulation to guard against disruptions on the downside?
- (5) Regarding increased *security* – should the costs be internalized and, if so, who pays, shippers or carriers? And where is system surveillance leading us in the long run?

4.05 Research the need to protect future highway and goods movement corridors, and the utility of protecting sites for intermodal terminals.

The benefit is more efficient land use, future savings in energy and environmental costs and a reduction in congestion.

4.06 Document experiences in the area of “city logistics” so that regional planning organizations have an additional toolbox of options with which to try to reduce the number of trucks in urban areas.

City logistics reduces the number of trips or else increases load factors. Examples are found in Japan and in Europe.

4.07 Evaluate the effectiveness of multi-state and multi-regional freight planning.

This effort can draw from the multi-state corridor planning pilot program intended under SAFETEA (replacing TEA-21 Corridor Planning and Development, Section 1118), but should also consider the “gateway” efforts (corridors *and* nodes), and other strategic planning initiatives that are above the project level – but that might not be multi-state or north-south in orientation as assumed in SAFETEA.

Multi-state corridors have gained attention, partly because of the way they fit into yet larger contexts: (1) Latin American Trade and Transportation Study (LATTs) within the context of a possible Free Trade Agreement of the Americas in 2005, and (2) the I-95 Corridor within the context of needed ITS integration across a dozen relatively small states. And (3) the Western Transportation Trade Network (WTTN, 1997) conforms to the area of the Western Association of State Highway and Transportation Officials and served as input leading to the Corridors Planning and Development Program (Section 1118) in TEA-21 (1998). Part of the WTTN falls within (4) the possible I-10 Corridor running east and west through eight states from California to Florida. SAFETEA defines most corridors as (5) north-south, within the context of NAFTA trade. Some observers point to location and relocation of outsourced jobs first to Mexico (north-south) and now to even lower-cost Asia (east-west). And (6) a West Coast Coalition is under review, in part to foster more export trade to offset the national trade deficit.

On a broader screen, perhaps the appropriate TRB committees should research the relationship between the overall trade deficit and transportation systems and investments. Within the NAFTA bloc, to what degree are north-south trade deficits with Canada (\$51 billion in 2002) and Mexico (\$38 billion), due more to currency exchange rates, offset (or not) by transportation investments? Or is there no relationship? How should transportation investments be related to strengthening this bloc and to competition from other blocs emerging in Asia and the European Union? And how might coastal “gateway” investments and operations foster cooperation in all directions?

4.08 Review already completed research on intermodal connections to see what might be pushed to the next level for multi-state corridors and for transport nodes, e.g., gateways.

The TRB website provides an overview of topics covered by the seventy TRB policy studies completed since 1982: counter-terrorism, speed limits, highway design, truck size-and-weight issues, airport capacity, transit use, high-speed rail, airline deregulation, dredging,

environmental policy, school transportation safety, and automotive safety. Should we lift from the total list those that affect intermodalism, e.g., high-speed rail on freight tracks?

4.09 Research how information technology is radically altering the decision-making structure in the freight world.

The public-private freight decision “system” involves a decentralized information system and decentralized and interactive decisions points (i.e., the market). This inverts the standard government or corporate management model.

The decision process is not completed in the “stovepipe” administrations or corporations, for example, but in peer-to-peer communication at the periphery, aided and abetted, for example, by the Internet. Research is needed on how this kind of institutional process can be sustained and how expertise on this frontier can become a reliable new kind of career track. As a technological example, the ports continue to find new ways to interconnect the separate needs of shipping lines, railroads, trucking firms, shippers, freight forwarders, terminal operators and others – all without violating privileged information within each sector. This interactive kind of career track contrasts a bit with moving up the ladder within a narrower service delivery context (the public transit business).

C. System Performance and Reliability

4.10 Assess the extent of human error as a causal factor in hazardous materials spills.

D. Information and Data

4.11 Improve freight transportation modeling.

Comprehensively review transportation modeling for service-related truck trips, gather a data set for model development, and develop methods for forecasting and depicting the flow of service-related truck trips.

4.12 Develop the architecture for a visual global/regional flow model to illustrate, dynamically, where goods, materials and people are traveling within and across modes.

This would be an enhanced GIS simulation/ decisions analysis model showing the geography and flows in a dynamic way with the ability to bring in data from both Data Resources (DRI) global projections and national/regional flows. It could focus on the “cross-roads” in the system and be used to screen investment needs for infrastructure both modal and intermodal, as well as efficiencies and equity within the system as a whole.

4.13 Conduct comprehensive research on the availability, accuracy, and uniformity of HAZMAT transportation incident and accident data across all modes of transportation.

E. Customers

4.14 Increase education of those directly and indirectly involved with intermodal systems.

Security issues have risen to the top of national interest because of direct consequences if nothing is done to deal with the threat of terrorist attacks. Apart from this urgent need, additional steps also should be designed to educate the public more generally about supply

chains, and how the “box of Cheerios” gets to the store shelf before the consumer does. The perception loop must be completed between consumer expectations and the presence of trucks, trains and planes in our urban setting.

4.15 Research changes to municipal planning and zoning and enforcement practices resulting in greater consideration for goods movement activities, a lower cost of doing business in urban areas, less congestion, and less pollution.

This is related to another recommendation to develop a sketch-planning guidebook for local governments dealing with freight access features and considerations. (Regarding the guidebook, see “Learning from Truckers: Moving Goods in Compact, Livable Urban Areas,” Washington State Transportation Center, University of Washington Research Project T9903, Task 69; 1997.)

4.16 Jointly research the relationship between seamless international supply chains and the impacts/benefits on affected publics here and abroad.

Just as a universal mode choice model might not be possible, it is also not likely that durable generalities can be made on the impact of trade liberalization (and the supporting transportation system) on affected and highly varied societies. Anecdotal information abounds. Outsourcing has shifted many jobs to Mexico, and from here to even less expensive overseas labor centers in Asia. On the reverse side of this coin (the container conveyor belt), foreign economies now provide export opportunities to their people otherwise not available, although sweatshop conditions are also part of this complex picture. Without standardized containerization, much of this might have not have happened.

The proposed joint research might explore the following illustrative questions:

- (1) Of total “foreign trade” by United States corporations, what share is *internal* to these outsourcing corporations (said to be fifty percent), and is this ratio changing over time.
- (2) Are global supply chains and international trade a growing or diminishing part of the transportation/economic picture? Ninety percent of freight transport in the United States is domestic. Who are the real *beneficiaries* of transportation infrastructure?
- (4) Globalization increases market reach and outsourcing while it also increases *vulnerabilities* to disruption (the most prominent example is the security threat). Can we give precision to the so-called Wolfen Paradox whereby the fragility of the just-in-time (JIT) systems increase as a consequence of steps to perfect JIT? How should “we” plan for, both, disruptions and redundancy and for speed and seamlessness? What does it mean, really, when we demand both security and functional and timely supply lines?
- (5) What should we know about frictionless global transportation as it relates to development policies that protect (in some way) the job-exporting economies as well as those developing economies where a comprehensive perspective on development is needed? Is the free-trade logic more constructive for integrated regions than it is for the world as a whole (critics say that in the latter case we find a “race for the bottom”). In the World Trade Organization, global access by agricultural economies is as large an issue as is either job export from developed countries (e.g., the United States trade deficit is approximately \$500 billion/year), or lagging job productivity (the European Union). In some United States ports, the value of maritime container imports (and value per ton) is four or five times as great as the value of

exports. For every 2.5 containers (TEUs, twenty-foot equivalent units) passing inland through the Port of Seattle in 2002, only one returned loaded westbound. Is this a typical picture? What are the broad implications of transportation for long-term economic development here and abroad? What additional units of measure should be used at the ports, besides TEUs?

The broad question is how to preserve the advantages of global markets and competition while also ensuring that this new dynamic works for people – human resources, communities and environmental resources?

How does freight transportation fit into a bigger picture? In the European Union the goals of efficiency and productivity fit within a broader business plan that also values sustainability, energy conservation and quality of living. (The *USDOT 2003-8 Strategic Plan* does address mobility, global connectivity, environmental stewardship and Security). The exploratory research question to be jointly addressed with TRB modal and intermodal committees is how, in specific cases, transportation fits into and might help solve this riddle of the 21st Century.

Appendix 3

National Freight Cooperative Research Program

The National Freight Stakeholders Coalition and AASHTO have proposed the formation of a National Freight Cooperative Research Program (or alternatively, a National Cooperative Freight Research Program). In its detailed proposal, the Coalition calls for a program to focus on collecting better data and enhancing planning, outreach, financing, and project management skills (<http://www.intermodal.org/Freight%20Stakeholders/Cooperative%20Research%20Program.pdf>).

Collecting better data would rely on funding and conducting an American Freight Survey to replace the current Commodity Flow Survey (CFS). The new survey would have a wider range of industry coverage than provided in the CFS and would provide input data for FHWA's Freight Analysis Framework, the Office of Intermodalism's Intermodal Bottleneck Evaluation Tool (IBET), and other US DOT freight program initiatives. The Coalition proposes that the data collection effort be funded from the Highway Trust Fund at \$15 million annually over a six-year reauthorization period. The Coalition further recommends that NFCRP-sponsored research for planning tools be funded from FHWA State Planning and Research dollars at \$5-7 million for the first year of reauthorization and at five percent of SPR dollars in future years.

If an NFCRP is authorized and funded, the Intermodal Freight Transport Committee recommends that in addition to what is proposed above, program administrators consider research problem statements that address operating problems, new technologies, and other freight industry innovations. Research might also address investment and regulatory responsibilities of different levels of government with respect to the largely private shipper and carrier industries. The NFCRP could serve as one of the principal means by which the very complex freight industry can be better understood in its systems and functioning, and in its relationships to the common good. Other research priorities might focus on developing innovative near-term and long-term solutions to meet demands on the industry and from the broader community(ies) this industry impacts and serves.

The Committee hopes that if the NFCRP becomes reality, program administrators and proposers of research problem statements will consider TRB Research *Circular E-C048*, Freight Transportation Research Needs Statements, (and any updates thereof) as a starting point for identifying worthwhile research. The Committee believes that the research ideas in this working paper also may be useful for thinking about how to implement an NFCRP. Lastly, the committee recommends that research ideas developed through a new NFCRP be coordinated and funded, where appropriate, through the NCHRP synthesis program.