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Workshop Proceedings

Federal Truck Size and Weight Policy: Looking Beyond the Comprehensive Truck Size and Weight Study

Irvine, California
May 10-11, 2000

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Workshop Proceedings

**Federal Truck Size and Weight Policy:
Looking Beyond the Comprehensive
Truck Size and Weight Study**

Irvine, California
May 10-11, 2000

Sponsored by:
U.S. Department of Transportation

Compiled by

Edward Fekpe
Phil Blow



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Name	Organization / Affiliation
1. Paul Adams	– Oklahoma State Department of Transportation
2. Sherri Alston	– Federal Highway Administration
3. David Barnes	– Transport Topics
4. Dan Beal	– American Automobile Association, Southern California
5. Mark Berndt	– Minnesota State Department of Transportation
6. Phil Blow	– Battelle
7. Ken Boyer	– Michigan State University
8. Joe Bryan	– Reebe Associates
9. Roger Cameron	– Railway Association of Canada
10. Rick Craig	– Owner-Operators and Independent Drivers Association
11. Jim Currie	– Montana State Department of Transportation
12. Jerry Donaldson	– Advocates for Highway and Auto Safety
13. Bob Dulla	– Sierra Research
14. Lily Elefteriadou	– Pennsylvania State University
15. Edward Fekpe	– Battelle
16. Bill Felts	– California State Department of Transportation
17. Joseph Foster	– Maryland State Department of Transportation
18. Francis Francois	– Independent Consultant
19. Glenda Fuller	– Idaho State Department of Transportation
20. Nicholas Garber	– University of Virginia
21. Gregory Gilks	– Saskatchewan Highways and Transportation
22. Ken Gudenkauf	– Kansas State Department of Transportation
23. Dale E. Hanington	– Maine Motor Transportation Association
24. Jim Hazeldine	– Oklahoma State Department of Transportation
25. Norman Hill	– Oklahoma State Department of Transportation
26. Mary Hrabowska	– New York Metropolitan Transportation Council
27. John Legler	– Waste Equipment Technology Association
28. Bill Linde	– Federal Highway Administration
29. Drew Livesay	– Montana State Department of Transportation
30. Tim Lynch	– Motor Freight Carriers Association
31. Chuck Mack	– International Brotherhood of Teamsters
32. Jim March	– Federal Highway Administration
33. Jim McDonnell	– AASHTO
34. Joe Morris	– Transportation Research Board
35. Sharon Nichols	– Western Highway Institute
36. Jim Norman	– Louisiana State Department of Transportation
37. Thomas Osborn	– International Truck and Engine Corporation
38. Wayne Parrish	– Maryland State Department of Transportation
39. Stan Paulis	– Illinois Department of Transportation
40. John Pearson	– Canadian Council of Deputy Ministers of Transport
41. Don Pickrell	– Volpe Transportation Center

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| 42. Jim Poirot | – CH2M Hill |
| 43. Andrew Reardon | – TTX Company |
| 44. Mike Rice | – Transystems |
| 45. Ben Ritchey | – Battelle |
| 46. Jim Roberts | – California State Department of Transportation |
| 47. Craig Rockey | – Association of American Railroads (AAR) |
| 48. Jim Saklas | – Federal Highway Administration |
| 49. Michael Scippa | – CRASH |
| 50. Ted Scott | – American Trucking Association |
| 51. Ann Skinner | – Colorado State Department of Transportation |
| 52. Daniel Smyser | – Pennsylvania State Department of Transportation |
| 53. Steven Sowers | – California State Department of Transportation |
| 54. Jerry Stephens | – Montana State University |
| 55. James Snyder | – New Jersey State Department of Transportation |
| 56. Peter Sweatman | – Roaduser Research |
| 57. Carl Swerdloff | – U.S. Department of Transportation |
| 58. Russ Vachon | – New York State Department of Transportation |
| 59. Steve Vaughn | – California Highway Patrol |
| 60. Michael Walton | – University of Texas |
| 61. Don Ward | – Iowa State Department of Transportation |
| 62. Robert Watson | – West Virginia State Department of Transportation |
| 63. Karen White | – Federal Highway Administration |
| 64. Parker Williams | – Maryland State Highway Administration |
| 65. Bill Wolford | – West Virginia State Department of Transportation |
| 66. John Woodrooffe | – Woodrooffe and Associates |
| 67. Doug Wylie | – California State Department of Transportation |
| 68. Firooz Zandi | – Indiana State Department of Transportation |

INTRODUCTION

This is a summary of a workshop that examined the issues raised in connection with the U.S. Department of Transportation's Federal Comprehensive Truck Size and Weight (TS&W) Study. The workshop was held on May 10-11, 2000 at the Beckman Center in Irvine, California. The purpose of the workshop was to discuss the key issues arising from the study in terms of their effects on future research and potential policy issues relating to truck size and weight regulation. The workshop provided the forum and opportunity to explore and examine the future directions of TS&W issues.

Sherri Alston of the Office of Transportation Policy Studies of the Federal Highway Administration (FHWA) opened the workshop by welcoming the participants and outlining the objectives of the workshop. Jim March, also of the Office of Transportation Policy Studies of FHWA, gave an opening presentation on the background of the U.S. Department of Transportation's Comprehensive Truck Size and Weight Study. Joe Morris of the Transportation Research Board presented an "Overview and Status of TRB Truck Size and Weight Policy Study." Joe Morris of the Transportation Research Board presented an "Overview and Status of TRB Truck Size and Weight Policy Study."

There were two panel discussion sessions, four breakout groups, and invited presentations on selected topics. The panel discussions provided significant opportunities for all participants to discuss current and future TS&W issues. The first panel discussion examined the evolution of Federal TS&W policy and the second panel discussion addressed arguments for and against changing Federal TS&W policy.

There were four invited presentations:

- Joe Bryan of Reebie Associates presented a paper titled "Trends in Freight Transportation and Their Implication for Truck Size and Weight Policy."
- Don Pickrell of Volpe Transportation Center presented a paper titled "Potential Impacts of Truck Size and Weight Limit Changes on Total Truck Travel."
- John Pearson of the Canadian Council of Deputy Transport Ministers presented an "Overview of the Highway Safety Performance Criteria in Support of Vehicle Weight and Dimension Regulations."
- Peter Sweatman of Roaduser commented briefly on "Australia's Experience with Performance-Based Systems for TS&W Regulation."

The four breakout groups were infrastructure; safety; shipper/carrier decisions; and policy options.

For the closing session, Ben Ritchey of Battelle presented an "Overview of Department of Transportation's Freight Analysis Activities." The workshop was concluded with a presentation by Jim March on future truck size and weight research plans.

Opening Session

Welcome and Overview of Workshop Objectives – *Sherri Alston, FHWA*

Overview of Recent Departmental Comprehensive Truck Size and Weight Study – *Jim March, FHWA*

Overview and Status of TRB of TRB Truck Size and Weight Policy Study – *Joe Morris, TRB*

WELCOME AND OVERVIEW OF WORKSHOP OBJECTIVES

Sherri Alston, FHWA

Sherri Alston, Director of the Office of Transportation Policy Studies of FHWA, opened the workshop by welcoming the participants and then summarizing the workshop objectives. She noted that the workshop is designed as a dialogue with partners on data and analytical tools used in the Department's Comprehensive Truck Size and Weight Study, and on truck size and weight (TS&W) issues that may arise in reauthorization. She noted that this is part of a continuous process to review the basic elements and products of FHWA's TS&W research program.

Ms. Alston noted that the Office of Transportation Policy Studies is working with FHWA Core Business Units on various freight issues. Of particular note is the coordination with FHWA's new Office of Freight Management and Operations on its Multimodal Freight Analysis Framework that will become a comprehensive set of data and tools for assessing a broad range of freight operations and policy issues. This close coordination will produce economies in data collection and facilitate consideration of TS&W issues within the broader context of multimodal freight transportation trends. Also, some of the data and analytical tools developed for TS&W analyses can be directly used for other types of freight analysis.

A key consideration in near-term TS&W research will be preparing to address TS&W issues that may arise during debates on the next surface transportation reauthorization legislation, as TEA-21 expires in 2003. This workshop is intended to provide inputs to that process in terms of research needs and the types of potential policy options that should be considered.

OVERVIEW OF RECENT DEPARTMENTAL COMPREHENSIVE TRUCK SIZE AND WEIGHT (TS&W) STUDY

Jim March, FHWA

Background

Jim March, FHWA Office of Transportation Policy Studies, presented an overview of the Department of Transportation's recent comprehensive TS&W study and public comments on that study. In testimony to Congress in 1994 when he committed to conduct the study, then FHWA Administrator Rodney Slater noted that it had been 30 years since the Federal Highway Administration had comprehensively assessed truck size and weight policy issues. The primary purpose of the study was to provide an analytical foundation for assessing a variety of TS&W policy options rather than to recommend specific policy changes.

While the comprehensive TS&W study was still in the review process at the time of the workshop, Mr. March noted that work to improve TS&W data and analytical methods was continuing. An important goal of the workshop was to discuss concerns that had been expressed in docket comments about data and methods used in the study. A second objective of the workshop was to discuss in greater detail perspectives of various organizations with an interest in TS&W policy as the basis for assessing options that might come up in reauthorization.

TS&W is a complex topic that has many dimensions. Considerable effort has been expended on Federal TS&W policy studies over the past 20 years including five studies by the Transportation Research Board (TRB), four by the Department of Transportation (DOT), and three by the General Accounting Office (GAO).

Issues that affect future TS&W policy directions include: increasingly diverse Federal and state TS&W limits; difficulties in quantifying the safety or crash experiences of certain types of vehicles; inequities and distortions caused by state grandfather rights; the future of the long combination vehicle (LCV) freeze; balancing Federal versus state interests in TS&W regulations; and North American Free Trade Agreement (NAFTA) harmonization.

Comments to the docket on the comprehensive TS&W study identified a number of areas where further research is needed including:

- Better truck flow data upon which to analyze potential modal and vehicle shifts resulting from TS&W policy changes
- Revisions of vehicle weights and dimensions assumed to be allowed under alternative TS&W options
- Revisions of the highway networks assumed to be available to alternative vehicle configurations under alternative TS&W options
- Review of current freight transportation characteristics including commodity density and how various types of commodities are being moved today

Mr. March reviewed the framework for the comprehensive TS&W study highlighting the importance of the diversion analysis. Assumptions for key illustrative scenarios analyzed in the study were then described. The base case scenario retains all features of current law with respect to axle and gross vehicle weight limits, grandfather rights, and LCV freeze. The base year for the analysis is 1994 and the analysis year is 2000. The Uniformity Scenario assumes a rollback of limits in some states, elimination of the current state grandfather provisions, and extension of Federal weight limits to the National Network for large trucks.

The North American Trade Scenario focuses on potential types of TS&W changes that might improve harmonization with TS&W limits in Canada and Mexico. The primary policy variable for this scenario is the establishment of specific weight limits for tridem axles (groups of three closely spaced axles). Two alternative tridem axle weight limits were analyzed – 44,000 pounds and 51,000 pounds. The latter limit would allow transportation of international containers loaded to the maximum ISO weight of 97,000 pounds on a six-axle tractor-semitrailer combination.

The LCV Nationwide Scenario assumes elimination of the 1991 LCV freeze and LCV (Rocky Mountain doubles, turnpike doubles, and triples) operations on limited networks nationwide. Maximum gross vehicle weights for each vehicle configuration are assumed to be equal to the sum of the axle weight limits for the axle/groups on each configuration. Triples were evaluated on their own as well as with the other LCVs.

Findings

Table 1 summarizes illustrative scenario impacts, expressed as percentage changes in costs relative to the Base Case. The impact analyses assume that the freight volume being moved remains unchanged from the volume moved in the Base Case. Results of the impact analyses indicate that no significant pavement damage would be expected from any of the illustrative scenarios. Significant bridge impacts were estimated for both the North American Trade and LCV Nationwide scenarios. The bridge impact analysis assumed that all bridges subject to stresses above a threshold derived from the federal bridge formula would have to be replaced. In comments to the comprehensive TS&W study docket, several states had noted that some bridges could be strengthened rather than having to be replaced, at a significant reduction in cost. Mr. March noted that further analysis of assumptions used in estimating bridge impacts was planned.

No estimates were made in the comprehensive TS&W study of changes in the number of crashes that might be expected under any of the illustrative scenarios. A thorough review of previous safety studies was conducted, but the Department concluded that LCV crash rates reflecting limited operations in western states and a few eastern turnpikes could not be extrapolated to nationwide LCV operations under much different conditions than those for which available crash rates were estimated. Vehicle stability and control are important safety-related factors directly related to changes in TS&W limits. Extensive research was conducted to develop vehicle stability and control measures that could be used to compare stability and control properties of alternative truck configurations. While there is no research directly linking differences in stability and control measures to differences in crash rates, the stability and control measures

were believed to provide the most direct comparison of safety-related characteristics of different vehicle configurations.

The analysis of highway geometry impacts includes estimates of costs for improvements to accommodate LCV and construction of staging areas. The energy impacts are related to changes in travel and energy consumption.

Although the results indicate that air quality impacts are proportional to vehicle miles traveled (VMT), there could be some localized impacts. The congestion impacts were observed to be proportional to VMT. Rail impacts are fairly significant and this may be controversial.

Table 1. Scenario Analysis – Findings

Impacts	Scenario Impacts		
	Uniformity	North American Trade	LCVs Nationwide
VMT	3.2% higher	10.2% lower	23.4% lower
Pavement	No Significant Impact		
Bridge	13% lower	33 - 42% higher	34% higher
Safety	Truck Specific Impacts		
Geometric	No Major impact	13% higher	965% higher
Energy	2% higher	6% lower	14% lower
Noise	Proportional to VMT		
Air Quality	Roughly Proportional to VMT		
Congestion	0.5% higher	1% lower	3% lower
Rail Return on Investment	Not Applicable	43% lower	56% lower
Shipper Costs	3% higher	5 – 7% lower	11% lower

Public Comments

The following is a summary of the public comments on Volume III of the Comprehensive TS&W draft study report.

- Scenarios
 - Vehicle weights assumed in the study are higher than those allowed today, and the study evaluated configurations that are not in use.
 - Analytical networks for LCVs generally were too extensive in the East and too sparse in the West, especially for Rocky Mountain doubles.
 - Access assumptions for certain configurations need refining.
 - The study should have included a western region scenario. FHWA is now evaluating a regional scenario requested by the Western Governors Association.

- Interchange/Staging Areas
 - Too many interchanges were assumed to require improvements to accommodate turnpike doubles.
 - Too many staging areas were assumed to be required for LCVs to assemble and disassemble.
- Freight Diversion Analysis
 - A probabilistic rather than an all-or-nothing modeling approach should be used to reflect the many different responses that might be expected from a change in TS&W limits.
 - Some threshold cost differential should be established to prevent freight from shifting modes with just a minimal cost advantage over competing modes.
 - Estimated diversion to the heavier trucks was overstated.
- Safety
 - Safety costs should have been estimated so that the total costs and benefits could be compared for all scenarios.
- Other Comments
 - The recovery through increased user fees of additional infrastructure costs that may arise under each scenario should have been included with other operating costs for the freight diversion analysis.
 - Time should be allowed for the states to implement changes in federal TS&W limits.
 - The study did not reflect the costs or other effects of operating restrictions that could be imposed.

TRB Study and Other Related Studies

- Section 1213(i) of TEA-21 requested a TS&W policy study by the TRB. FHWA is providing technical assistance to the committee formed by TRB for this study.
- Section 1213 (f) of TEA-21 requested that FHWA do a study of TS&W limits for Specialized Hauling Vehicles (SHV). The study is to examine the economic, safety, and infrastructure impacts of various weight standards for SHVs.
- The report, due to Congress in June 2000, is in the final drafting stage.

Next Steps

The next steps in FHWA TS&W policy research are to:

- Continue providing technical assistance to the TRB policy study.
- Continue outreach to AASHTO and other interested groups.
- Respond to congressional and other requests for TS&W policy analysis.
- Continue to improve TS&W data and analytical capabilities.

OVERVIEW AND STATUS OF TRB TRUCK SIZE AND WEIGHT POLICY STUDY

Joe Morris, TRB

Background

Joe Morris presented an overview and status of the TRB Truck Size and Weight Policy Study. The Congressional Study charge follows from provisions in TEA-21, Section 1213(i) (June 1998):

- The National Academy of Sciences (NAS) to study regulation of weights, lengths, and widths of commercial motor vehicles on Federal assisted (FA) highways to which federal regulations apply.
- Review law, regulations, practices, past studies (including TRB SR225: *Truck Weight Limits: Issues and Options*).
- Develop recommendations regarding any revisions to law and regulations determined appropriate.
- Evaluate impact on the economy, environment, safety, and service to communities.
- Consult with government, industry, labor, safety groups, and environmental groups.
- Report to Congress and to Secretary of the Department of Transportation (DOT) two years from enactment.

Study Approach

This study is being conducted by a committee with support by TRB staff. The committee is made up of engineers, scientists, researchers, and state officials. The National Research Council approves the committee members, provides public information to the committee, reviews and publishes the study report. FHWA provides funding and background materials for the study. In conducting the study, the committee solicits comments from the public and interested parties. Informational meetings are open to the public.

The purpose of the TRB study is to review all past studies and make recommendations regarding the federal TS&W regulations. It will be completed next year rather than this year. The committee, in addition to looking at past studies and recommendations, will consider the practical environment of what legislation is possible, that is, what recommendations can be enacted.

The committee started by reviewing the TRB Special Report 225, "Truck Weight Limits: Issues and Options" and its recommendations. The recommendations include:

- Revise the bridge formula to be a combination of the Texas Transportation Institute research formula for trucks weighing less than 80,000 pounds and the current federal formula for trucks weighing more than 80,000 pounds.
- Replace the current grandfather right provisions in the federal law with a state voluntary permit program subject to Federal oversight. This would provide equity among the states, unlike the current grandfather provisions. The program would include vehicle and

driver requirements, operating restrictions, strengthened enforcement, and fees to recover infrastructure costs.

State DOTs expressed skepticism about these recommendations.

The Committee has also looked at other TRB studies including:

- The “Turner Truck” Study (SR 227, 1990) recommended that higher gross vehicle weights be allowed for lower axle weights. This would significantly decrease pavement wear, but it estimated that there would be increased bridge costs and raised bridge management issues. The recommendations were not considered by Congress.
- The Access Study (“Providing Access for Large Trucks” (SR 223, 1989)) recommended, subject to traffic and roadway geometric limitations, that access be provided for STAA vehicles to food, fuel, rest, and repair facilities and to terminals, which were defined. FHWA implemented these recommendations by regulation. The concept of restricted networks has serious implementation problems.

Key features of past TRB committee recommendations include: allowing increase in gross weight, state option, strong federal oversight, and not to involve LCVs (other than short heavy twin trailer configurations).

Framework for Congressional Charge

The committee will consider defining a framework for congressional charge by:

- Declaring the purpose of TS&W regulations and proposing proper goals for any change to the federal regulations.
- Designing and evaluating packages of regulatory change: Three possible kinds of recommended changes are: (1) weighted toward the existing regulatory approach, i.e., policies within existing structure and precedents of federal TS&W regulation, (2) approaches outside the existing structure (e.g., SR 225 permits, user fee reform, performance standards, devolution); including long-run proposals, and (3) policies to mitigate the costs of large trucks (e.g., enforcement, monitoring, infrastructure management and design).
- If change is recommended propose strategy for implementation recognizing financial, political, and administrative obstacles.

A preamble to the report could include the objective of TS&W regulation, the federal responsibility in such regulation, and motivation for changes to the federal regulations.

The committee may consider short-term and long-term recommendations for revised TS&W standards with accompanying mitigation measures for these standards. Short-term recommendations would be limited to those in which there is no need for additional information. Long-term recommendations would include those requiring additional information before the recommendations are implemented.

The committee has identified bridge costs as among the key uncertainties. In contrast, the committee believes that safety, pavement cost, and congestion consequences of changing limits probably can be predicted well enough to guide decisions. The committee has considered reissuing Special Report 225. Arguments supporting this approach are:

- Benefits exceed costs.
- Benefits especially attractive because of emergent freight capacity constraints.
- Planned change is preferable to haphazard erosion of existing standards.
- Solutions to problems are feasible (e.g., bridge costs, rollover).

The disadvantages to this approach are:

- The railroads, small carriers, and truck drivers are significantly opposed to the implementation of the recommendations in the original report.
- Public antipathy toward trucks.
- Sustainable environmental issues.
- Public officials' aversion to risk.
- Impacts on state transportation budgets.
- Mistrust of incremental liberalization of TS&W regulations.

Key Questions

The following are key questions facing the committee that will be considered at its fourth meeting:

- Should the committee recommend a short-term package as in past TRB studies?
- Does the committee endorse, revise, or refute SR 225 recommendations?
- Does the report have a recommendation regarding length, especially LCVs? Past TRB committees avoided LCVs.
- Does the report address long-run infrastructure issues, (e.g., capacity, truck-only lanes, LCV network)?
- Does the report have a recommendation on linking user fees to costs?
- How does the report deal with induced demand? (One proposal: recommendations should be valid regardless of magnitude of induced demand.)
- How does the report address enforcement realities?
- Does the report define the relationship of ITS to size and weight issues?
- Should there be a statement of values underlying the committee's recommendations?

The committee is in contact with the TRB committee study on the "Nation's Capacity to Move Freight." A fundamental question is how are we going to move the volume of freight expected in the near future?

Panel Discussions

Panel Discussion: Evolution and Future Directions for Truck Size and Weight Policy-I

Frank Francois, Moderator

- State Perspectives – *Parker Williams, Maryland State Highway Administration*
- Trucking Industry Perspectives – *Ted Scott, American Trucking Associations (ATA)*
- Railroad Perspective – *Craig Rockey, Association of American Railroads (AAR)*
- Owner-Operators' Perspective – *Rick Craig, Owner-Operators and Independent Drivers Association (OOIDA)*
- Motorists' Perspective – *Dan Beal, American Automobile Association (AAA), Southern California*

Panel Discussion: Evolution and Future Directions for Truck Size and Weight Policy-II

Frank Francois, Moderator

- Safety Perspective – *Jerry Donaldson, Advocates for Highway and Auto Safety*
- Less-Than-Truckload Carrier Perspective – *Tim Lynch, Motor Freight Carriers Association*
- Western Motor Carrier Perspective – *Mike Rice, Transsystems, West Motor Carrier*
- Environmental Perspective – *Bob Dulla, Sierra Research*
- Drivers' Perspective – *Chuck Mach, Teamsters*
- Trucking Industry's Perspective – *Dale Hanington, Maine Motor Transport Association*

PANEL DISCUSSION: EVOLUTION AND FUTURE DIRECTIONS FOR TRUCK SIZE AND WEIGHT POLICY– I

Frank Francois, Moderator

This panel gave the viewpoints or perspectives of the states, American Trucking Associations, American Association of Railroads, Owner-Operators, Independent Drivers Association, and American Automobile Association.

State Perspectives: Parker Williams, Maryland State Highway Administration

Parker Williams, as Chair of the AASHTO Highway Transport Subcommittee, gave the State perspective. The subcommittee

- covers the operation of commercial vehicles on state highways,
- acts as liaison with FHWA on matters involving commercial vehicles,
- seeks and proposes uniform state regulations to facilitate interstate commercial vehicle operations, and
- participates in national studies related to these vehicles.

He noted that TS&W issues have been around for 60 years and they are complex and controversial. About 30 to 40 percent of trucks currently operate under oversize or overweight permits but are legally permitted in various states. The western states are more liberal in their size and weight limits mainly because these states depend heavily on trucks for freight movements. The states are concerned about the “ratcheting” of TS&W limits that has occurred in the past. They seek a strong Federal role on TS&W as they have in the setting of standards for freeway interchanges as shippers seek more liberal TS&W standards to reduce their transportation cost. They are also concerned about safety, while recognizing that trucking is vital to the state and national economies.

The AASHTO subcommittee’s position on TS&W issues was published in June 1995, after a considerable review of the issues. The subcommittee’s position on the DOT’s Comprehensive TS&W study was expressed in its 1999 Montana resolution, which addressed certain inconsistencies and the study’s assessment of bridge deficiencies. It is concerned about the estimates of costs to maintain the states’ pavements and bridges and setting highway use fees to recover the costs.

Trucks are critical to the economy but safety is a growing concern. There is also general concern about TS&W increases. AASHTO identified some concerns relating to structural deficiencies of bridges and the costs associated with the impacts, e.g., safety. The subcommittee is prepared to work with FHWA on improving its analytical methodologies and on any recommendations it may consider on federal TS&W policy changes.

Trucking Industry Perspectives: Ted Scott, American Trucking Associations (ATA)

Ted Scott started by identifying elements that are increasing trucking costs. Factors that are contributing to increased trucking costs include the proposed hours of service rules, increased driver pay, increased congestion, increased fuel prices, new environmental control costs, new ergonomic regulations, and highway pavement and bridge deterioration. Trucking costs are increasing with no new productivity gains anticipated in the future.

Trucking productivity gains in the U.S. between 1980 and 1990 was about \$1.3 trillion (a savings of \$10,000 per household). Trucking productivity is now slowing to the point where it could become a drag on the nation's economic growth. Thus it is important to find new ways to increase productivity. Trucking productivity can be improved by allowing increases in equipment capacity without impacting highway safety. Without change, the trucking industry will put more trucks on the road to keep up with increased demand.

Federal TS&W regulations apply on the interstate system; however, 29 states allow gross vehicle weights greater than 80,000 pounds on the Interstate system through grandfather rights or other exemptions. And 47 states allow greater than 80,000 pounds on state roads. ATA recommends a new federal TS&W role, one that sets minimum standards to ensure the smooth flow of interstate commerce and allow States to set maximum limits in order to allow the use of more productive vehicles that meet the needs of states.

ATA wishes to work with FHWA to make needed improvements to its TS&W analytical toolbox. In particular, a more credible safety analysis capability and LCV crash rates are needed. The freight diversion model needs to be based on more reasonable assumptions on the truck configurations in use and how they are used.

Railroad Perspective: Craig Rockey, Association of American Railroads (AAR)

Railroads constantly evaluate their relationship to trucking since trucks are both the railroads' most effective competitors and partners in extensive joint ventures. From a peak during the 1920s, railroads have lost intercity freight market share to other modes of transportation, but have realized a limited recapture of lost share during recent years. Currently, railroads account for 40 percent of the intercity freight ton-mileage, 25 percent of intercity freight tonnage, and less than 10 percent of the revenues.

Under partial economic deregulation, freight railroads have reduced their rates, on average, by more than 50 percent in real terms since 1981. The rate decline along with improvements in the level of service has allowed modest increases in market share. In addition, these increases were made possible as a result of the unprecedented productivity gains generated by rail industry initiatives in the post-deregulatory period. Unlike trucks and barges, which operate over publicly owned and maintained rights-of-way, railroads own and operate their own infrastructure. Railroads are the most capital intensive of any major U.S. industry. Railroads require over 20 percent of their revenues to cover the capitalization of their infrastructure and equipment assets (and approximately 50 percent if roadway and equipment maintenance and improvement

expenses are included). The railroads are able to finance about two-thirds of their capital needs from internally generated funds. Despite the recent upturn in financial health the railroads have found it necessary to tap the financial markets in the past two decades to secure external investment funds for roughly one-third of their investment requirements.

The railroads are opposed to larger and heavier trucks for economic and equity reasons. The U.S. Department of Transportation's 1997 Highway Cost Allocation Study reveals that rail competitive trucks operating at the legal maximum weight of 80,000 pounds pay, on average, 60 percent of the cost of highway damage they cause. Heavier trucks (i.e., those with gross vehicle weights of 80,000 to 100,000 pounds) pay only about 40 percent of their damage cost through fuel and other taxes and fees. Thus, an inequitable relationship between the competing modes would be exacerbated with the advent of liberalized truck sizes and weights. In fact, DOT's TS&W study indicates that the rail industry would be adversely affected by the adoption of larger sizes and weights. For example, traffic diversion from rail to truck could reduce rail revenue by up to \$6.7 billion for a \$35 billion industry, reduce contribution to fixed rail costs by \$2 billion to \$3 billion, and reduce return on equity by one-third to one-half. Thus, increased truck sizes and weights would lower truck costs and cause diversion of traffic from railroads, thereby reducing the contribution to the railroads' large fixed costs. This inability to cover costs would staunch investment in railroads (causing railroads and others to disinvest in rail companies) and ultimately reduce the network coverage and efficiency of railroads, and their ability to handle intermodal and other freight.

Owner-Operators' Perspective: Rick Craig, Owner-Operators and Independent Drivers Association (OOIDA)

The Owner-Operator Independent Drivers Association (OOIDA) is opposed to TS&W increases and the expansion of routes that allow multiple trailer combinations. OOIDA seeks a rollback of TS&W limits that are uniform from state to state without exception. They are opposed to grandfather exemptions and the issuance of permits for divisible loads.

OOIDA opposes larger and heavier vehicles for safety reasons and because much of the nation's public and private infrastructure cannot accommodate vehicles larger than those currently in operation. OOIDA expressed concerns about hours of service regulation changes.

Motorists' Perspective: Dan Beal, American Automobile Association (AAA), Southern California

AAA has three concerns about heavier and larger trucks: (1) safety, (2) costs to maintain the nation's highways, and (3) public opinion on the use of larger and/or heavier trucks. AAA is concerned about lack of safety analysis and seeks improved LCV crash data to include a review of the existing state data. AAA understands the importance of trucks but does not know enough about TS&W changes. AAA does not accept the concept that economics drives TS&W regulations. The public is opposed to expanding LCV use and increasing TS&W limits, for example matching Canadian/Mexico TS&W limits.

PANEL DISCUSSION: EVOLUTION AND FUTURE DIRECTIONS FOR TRUCK SIZE AND WEIGHT POLICY – II

Frank Francois, Moderator

This panel gave the perspectives of a safety advocate, a less-than-truckload carrier, a western motor carrier, an environmental interest representative, and a state trucking industry.

Safety Perspective: Jerry Donaldson, Advocates for Highway and Auto Safety

Jerry Donaldson expressed concerns with the TS&W study, especially with regard to its sections based on specific size and weight scenarios which he believed prejudices the U.S. Department of Transportation in favor of larger, heavier trucks. Although he commended the safety chapter in the study, he also criticized the traffic engineering section as based on optimistic assumptions.

Mr. Donaldson also noted that TS&W study considerations about size and weight changes are made in a vacuum without evaluating the effects of changes in hours of service on freight delivery practices and schedules. These and other potential changes in motor carrier freight scheduling involving shipper-receiver practices directly affect productivity and alternative TS&W scenarios. The TS&W study also lacks any appreciation of the impact of TS&W changes on induced demand which has occurred over the last 18 years or more due to TS&W statutory and regulatory changes at both the state and federal levels. These changes include amendment of 23 U.S.C. Sec. 127 since the late 1970s, the advent of a National Network of routes for specific larger dimensioned combinations in 1982, and various state actions to increase TS&W on state routes, including attempts to increase or re-interpret TS&W grandfather rights.

Mr. Donaldson also expressed concerns about TS&W increases which, on balance, will be promoted by the trucking industry without equitable changes in user fee responsibility and highway cost recovery. Fundamentally, the industry wants to operate essentially through a subsidy supplied by other highway users and to foist the excessive cost impacts onto the shoulders of other users as economic externalities.

Furthermore, Mr. Donaldson noted that, in the last analysis TS&W changes are the product of political choices forged in the lobbying arena, not decisions premised directly on the merits. For example, grandfather rights have created a spoils system allowing the trucking industry to pursue a fragmented, divide-and-conquer approach to state and federal TS&W policies which is well-known and which inevitably results in a process called "ratcheting." Unless sweeping changes are made to the entire concept of how TS&W policies are made, grandfather rights will not be repealed. In fact, Congress has willingly amplified them in recent authorization bills. Similarly, high-minded exercises in indexing TS&W policies to purported "safety performance standards" is, again, simply fodder for the political process: safety performance standards will ultimately be negotiable values which unavoidably will grandfather almost all existing truck sizes and weights, and only banish extreme outlier configurations and safety performance from the highways. In any event, if realistic safety performance standards were actually to be instituted inducing genuine safety reform by controlling undesirable truck designs and road behavior, it would

propel widespread bans on the operation of commonly accepted truck configurations, sizes, and weights on a substantial portion of U.S. highways and streets, a process already initiated in part in at least one eastern state.

Less-Than-Truckload Carrier Perspective: Tim Lynch, Motor Freight Carriers Association (MFCA)

The major Motor Freight Carriers Association (MFCA) concern was the release of the study report with findings based on assumptions set to define the edges of the impact envelope rather than assumptions based on more reasonable expectations. These findings would likely be used by opponents to make changes in TS&W limits to represent what is likely to occur if any change were made.

The association would like to see an analysis based on reasonable assumptions before the study was released. Especially in question is the diversion of all freight from rail to truck if the annual costs to ship by truck dropped by \$0.01 per ton below the annual cost to ship by rail, when these costs are included with other logistics costs associated with each mode.

Another questioned assumption was the use of the 132,000-pound gross vehicle weight limit for the triple trailer combination. Less-than-truckload (LTL) carriers using triples operate around 100,000-pound gross vehicle weight on average, particularly since the weight and density of LTL freight are declining. In the East, triples, with other LCVs, are operated on turnpikes only under strict regulation by responsible carriers.

Educational outreach to the public regarding trucks and their benefits can be strengthened by MFCA. An Ohio Turnpike survey of triple trailers by MFCA between 1997 and 1999 shows benefits. For example, triples use resulted in 50 percent savings in miles traveled, more than 50 percent reduction in the number of trucks, and about 30 percent savings in fuel consumption.

Western Motor Carrier Perspective: Mike Rice, Transystems, West Motor Carrier

Mike Rice noted that reviewing Volume III of the draft study report was a surreal experience:

- Truck crashes are not a function of whether or not the truck is an LCV.
- There are many more LCV combinations in use than those analyzed in the study.
- Currently used LCVs are made up of existing equipment.

Mr. Rice focused his discussion on LCVs. He noted that LCVs are not new untested vehicles. They operate on all roads including two-lane roads and urban streets. They are not Surface Transportation Assistance Act (STAA) vehicles and that they are not a special make of vehicles. LCVs are used by carriers to haul many different commodities. Triple trailer combinations, for instance, are used to haul all kinds of commodities including bulk commodities, grocery, steel, and livestock. There is no difference in LCV accident rates compared to other trucks in identical circumstances.

Rail competition for freight transportation in the Western U.S. is rare. Shippers use trucks for several reasons including the following:

- Lack of rail cars
- Circuitous routing—frequently north-south
- Distance to/from rails is great
- Rail inventory cost
- Short notice for shipments
- Frequently trucks are loaded and unloaded without shipper/receiver assistance
- Need for special loading/unloading equipment
- Risk of rail service failure—cost of inventory to protect against rail failure
- Ability to redirect loads
- Need for split pickup/delivery.

He noted that there are major cost savings, about 30 percent, with LCVs. Mr. Rice questioned the use of truck/rail traffic statistics in developing the diversion model. A national diversion model is useless and too diverse. The model needs to be regional and based on a business-by-business approach. Analyses of impacts must also be measured regionally, by state and industry. Mr. Rice expressed disappointment with FHWA for not correlating its results with the extensive 30+ years of actual LCV experience in the west.

On safety, he noted that the TS&W analysis was speculative. The TS&W study did not verify study statistics with the western states that have 30-40 years of experience with LCVs. Mr. Rice concluded that based on over 30 years of experience, LCVs are safe vehicles.

Environmental Perspective: Bob Dulla, Sierra Research

Bob Dulla's perspective was that a national-level analysis of environmental impacts does not adequately capture the real effects. This is because key interactions occur in urban areas. Therefore, there is the real need to look at it from a regional level or representative urban areas. Items to be given more consideration for emissions are:

- Car and truck interactions
- Operating environment – time of day, congestion, grade, quality of vehicle

He stressed the need to examine specific areas to understand environmental issues. Air quality was not adequately addressed in the U.S. DOT Comprehensive TS&W study. Heavier trucks may have higher emissions. Induced truck growth can impact higher TS&W limits and negatively impact emissions. Limited emissions data makes analysis a challenge.

Drivers' Perspective: Chuck Mack, International Brotherhood of Teamsters

The Teamsters recognize the level of effort for the TS&W study. In terms of TS&W policy changes, they favor the status quo, i.e., they will not favor rollback or introduction of new LCV

regulations. They are especially concerned about the impacts of such changes on members. Safety is the number one concern regarding LCVs.

Trucking Industry Perspective: Dale Hanington, Maine Motor Transport Association

Maine has allowed heavier weights on six-axle semitrailer combinations largely in response to changes in the logging industry due to environmental concerns and rail line abandonments. In 1960, log drives on the rivers were stopped to protect these waters. Around 1966 many rail lines were abandoned. The result of these changes was that only trucks were left to haul timber to the sawmills. Allowing six-axle semitrailers operating up to 100,000 pounds gross vehicle weight on the Maine Turnpike and roads other than Interstate highways made the Maine timber industry more viable. On Interstate highways, Maine allows up to 80,000 pounds on six-axle semitrailers. The motor transport industry in Maine supports highway safety and intermodal facilities.

The need to examine TS&W issues at local, regional, or state levels was expressed. Diversion is not a zero-sum game situation. Diversion is very difficult to measure and results may be misleading. Safety or incidents are facts of life. It is important not to throw money at a problem without understanding it.

Invited Presentations

Trends in Freight Transportation and Their Implication for Truck Size and Weight Policy

Joe Bryan, Reebie Associates

Potential Impacts of Truck Size and Weight Limit Changes on Total Truck Travel

Don Pickrell, Volpe Center

Highway Safety Performance Criteria in Support of Vehicle Weight and Dimension Regulations:
Overview of Discussion Paper

John Pearson, Canadian Council of Deputy Ministers of Transport

Comment - Australia's Experience with Performance-Based Systems for TS&W Regulation

Peter Sweatman, Roaduser Research

TRENDS IN FREIGHT TRANSPORTATION AND THEIR IMPLICATIONS FOR TRUCK SIZE AND WEIGHT POLICY

Joe Bryan, Reebie Associates

The current trends in freight transportation suggest that productivity gains realized over the past 20 years may be tapped out and logistic systems with the developing E-commerce are being revolutionized. Such trends are likely to affect the desire for changes in TS&W regulation. The considerable reductions in transportation and inventory costs over the past two decades are not declining at nearly the earlier rates. These declines have come from:

- Deregulation
- Reduced labor costs
- Transportation network development
- Organizational structure
- Vehicle capacity
- Information technology
- Fuel efficiency.

Traditional logistics supply has been an integrated product manufacturer looking for customers with product flowing through wholesalers and retail outlets. Market feedback from the outlet to the manufacturer was through annual orders for each season. Relative proportions of supply chain costs in order were, material ownership (inventory costs), transportation costs, and information system.

The emerging neuro-logistics system is driven by a pull from the customer for consumer goods. Point-of-sale information on which goods are selling in which markets is rapidly transmitted back to the manufacturer and determines what is produced. These goods are then rushed to markets with the product being specific to each market. There is now generally more than one order cycle per season. The relative proportions of supply chain costs are then reversed to information systems, transportation, and material ownership.

These neuro-logistics systems:

- Are more dependent on transportation performance
- Favor higher cost transport due to need for service and reduced order size
- Still require reduced costs everywhere
- Still look for consolidation of carriers
- Apply pressure on all available carriers to improve service and reduce costs, that is, motor carriers are being pushed to provide more air mode type of service at a cost more like the rail mode.

Neuro-logistics, in summary, has two effects: (1) globalization and modal convergence drive intermodal integration and standardization, and (2) the supply chain integrator, with increased market power, demands better service quality at reduced rates.

E-commerce is a free radical in that it uses a new medium to generate new markets and distribution channels, which will likely result in untold changes in commercial structures and patterns. The effects of E-commerce are:

- Concentration of power
- Possibility of fragmented shipping
- Possible development of new urban vehicles to be more compatible with the available highways.

The TS&W implications of neuro-logistics and E-commerce are: (1) a more complex system of regulation, and (2) cost pressures resulting in the demand to liberalize existing TS&W limits, if the traditional sources of increased transportation productivity are exhausted.

POTENTIAL IMPACTS OF TRUCK SIZE AND WEIGHT LIMIT CHANGES ON TOTAL TRUCK TRAVEL

Don Pickrell, Volpe Center

This analysis covers the change in total travel, which is the diversion of freight traffic from other modes plus the change in the demand to move freight by truck that results from the reduced unit cost of freight transportation by truck. This latter demand is referred to as “induced demand.” Sources of induced demand include potential diversion from other modes with longer truck hauls in intermodal movements, and increased freight movements resulting from increased consumer demand and production process reorganization or relocation.

The freight diversion model used in the TS&W study takes explicit account of some but not all of these sources. The model does not include increases in total demand for trucking services and production process changes. The model considered only the truck and rail modes. Air, maritime, waterborne, and pipeline modes were not considered. The omitted modes represent about 28 percent of total ton-miles. The model captures the most significant sources of potential growth in truck ton-miles that are likely to occur in response to relaxed truck TS&W limits. It was estimated that the effect of the modes omitted from the diversion analysis on truck vehicle miles traveled (VMT) is typically small, less than 3 percent. This suggests that potential diversions of existing shipments to trucks that are not estimated within the model are likely to be unimportant for most commodity groups. Exceptions are low value bulk commodities with limited potential for diversion to trucks e.g., unprocessed “field crops” (primarily grains) and bulk industrial and agricultural chemicals. Even complete diversion would increase truck VMT only slightly. Most of the omitted sources would occur in the LCV scenario.

The second major source of potential increases in the number of ton-miles shipped by truck is an increase in total freight shipments that occurs in response to a reduction in truck shipping rates. This response would occur for two reasons. First, consumer demand would increase for goods whose production and distribution costs include a significant trucking cost component resulting from reduction in price. Second, production process organization—substitutability of trucking services for non-transportation inputs in the production and distribution processes would further increase the number of truck ton-miles. One example is the relocation of production and warehousing facilities to take advantage of lower shipping rates by truck.

The induced demand estimate for the LCVs Nationwide Scenario was estimated to range from 13.4 to 33.4 percent more than the actual diversion analysis estimate. For the North American Trade Scenario the estimated range was from 5.1 to 10.2 percent. For the Uniformity Scenario, the estimated change was about 1.2 percent.

HIGHWAY SAFETY PERFORMANCE CRITERIA IN SUPPORT OF VEHICLE WEIGHT AND DIMENSION REGULATIONS: OVERVIEW OF DISCUSSION PAPER

John Pearson, Canadian Council of Deputy Ministers of Transport

Introduction

This presentation covered work by the Vehicle Weights and Dimensions Working Group of the Land Transportation Standards Subcommittee formed under the terms of the North American Free Trade Agreement to propose for consideration certain truck performance standards for Canada, Mexico, and the United States. These include performance standards to preserve North American highway pavements and bridges and to improve vehicle stability and control. In North America, there are at least 95 government jurisdictions with authority to regulate the weights and dimensions of commercial vehicles. The Working Group is charged to define the regimes within the region, document the rules and regulations, and recognize the differences.

As a starting point, the Working Group exchanged information on the regulatory environment, highway networks, and engineering approaches found in each country. A comparison of size and weight regulations was assembled for 16 common configurations of heavy vehicles currently operating in North America. This material was synthesized and published in a discussion paper (issued in late 1997) entitled "Harmonization of Vehicle Weight and Dimension Regulation within the NAFTA Partnership."

In 1998 the Working Group examined the potential for applying safety performance criteria for considering this approach in its harmonizing efforts. As an initial step, a background paper was prepared with the objective of synthesizing available information and experience on the concept, both from within North America and abroad. The paper included:

- An overview of performance criteria concepts
- A review of work, discussions, and approaches used in North America and elsewhere
- Areas in addition to vehicle stability and control performance
- A basis for technical subgroup discussions.

This work considered how highway safety performance criteria might support the regulatory harmonization objectives under NAFTA, including recommendations on what criteria should be considered for adoption, along with recommended acceptability thresholds for each. In late 1999 a discussion paper on this work was issued for public comment by the Working Group entitled "Highway Safety Performance Criteria in Support of Vehicle Weight and Dimension Regulations: Candidate Criteria and Recommended Thresholds."

Historically, TS&W limits have been based on:

- Pavement structural capacity and life cycle
- Bridge structural capacity and life cycle
- Compatibility of vehicles with roadway geometry.

Performance Criteria and Public Policy Considerations

There is a growing recognition of the relationship between TS&W limits and the performance of the complete highway system including:

- Vehicle compatibility with roadway geometry
- Vehicle compatibility with other highway traffic
- Vehicle stability and control characteristics
- Other considerations.

Measures were selected that define vehicle characteristics as appropriate for considering TS&W policy to ensure safe and compatible truck operation on public highways. Initially, these measures have been applied to five- and six-axle single- and double-trailer combinations. Necessarily, following this is the determination of acceptable levels of performance for each measure. What performance targets are appropriate?

Appropriate dimension limits ensure that commercial vehicles can operate safely within the highway space made available for them. These would ensure that a truck:

- Fits within the traffic lane
- Can negotiate curves and corners within the available space
- Can pass under overhead structures.

Appropriate weight limits ensure that commercial vehicles can be safely carried by the highway infrastructure and not wear it out prematurely. These would ensure that:

- Axle and vehicle weights are within the structural capacity of bridges
- Axle weights are within the structural capacity of pavements.

Appropriate vehicle operating characteristics ensure that these vehicles are compatible with other vehicles in highway traffic. These would ensure that a truck:

- Can maintain highway speeds
- Can stop within limits comparable to those of other vehicles
- Is capable of clearing intersections safely
- Can be safely passed by other vehicles
- Can safely pass other vehicles.

Appropriate vehicle operating characteristics ensure that these vehicles are compatible with highway designs. These would ensure that a truck can safely:

- Negotiate curves and ramps at posted speeds
- Climb on upgrades and brake on downgrades.

Application of Performance Criteria

Performance criteria can be applied in three ways. As a (1) potential alternative to conventional “prescriptive” regulation, (2) foundation for revising public policy (an assessment framework for evaluating potential impacts of possible policy changes), and (3) quantitative basis for evaluating proposed program changes that depart from prescriptive regulations, such as pilot projects or special permits.

Safety performance criteria are determined by vehicle dimensions, vehicle axle and gross weight, or both dimensions and weights. Potential dimension- related performance criteria are:

- Overall height
- Overall width
- Overall length
- Box length
- Transient low-speed offtracking
- Front swingout
- Rear swingout

Table 2, Dimension-Related Performance Criteria, gives recommended standards for five-and six-axle semitrailer and double-trailer combinations to be applied on an International Access Network (IAN) of highways. The IAN is to be designated by the governmental jurisdiction responsible for constructing and maintaining highways. In the United States, this would closely correspond to the National Network for large trucks designated under the Surface Transportation Assistance Act of 1982.

Potential weight-related performance criteria are:

- Acceleration performance
- Dynamic axle loading suspension characteristics
- Bridge overstress
- Productivity: Impact on pavements relative to the weight of the freight to be transported

Table 3, Weight-Related Performance Criteria, gives recommended standards for five-and six-axle semitrailer and double-trailer combinations to be applied on the IAN.

Potential performance criteria related to both dimension and weight are:

- Load transfer ratio
- Transient high-speed offtracking
- Friction demand in tight turns

Table 4, Weight-and Dimension Related-Performance Criteria, gives recommended standards for five-and six-axle semitrailer and double-trailer combinations to be applied on the IAN.

Application and Implementation Concept

The proposed performance criteria and limits represent “minimum” standards that would be compatible with highways designated for the IAN and selected major highways in Canada, Mexico, and the United States. These standards apply to five- and six-axle semitrailer and double-trailer combinations in use on the IAN.

Foundation for More Compatible Regulations

The following actions provide a foundation for more compatible TS&W regulations: (1) A consensus on appropriate safety performance criteria and accompanying thresholds would provide a technically sound basis for identifying an International Access Network for efficient operation of highway transport vehicles among the NAFTA trading partners, and (2) an agreement on common definitions for dimension limit controls would address many of the “administrative” barriers faced by carriers that operate in more than one jurisdiction. Such actions must necessarily consider: (1) the large number of governmental jurisdictions within North America that have TS&W regulatory authority for vehicles operating on their highways, and (2) that proposals for any legislative or regulatory changes must follow prescribed democratic processes in each of the local, state/provincial, and federal governments.

Table 2 – Dimension-Related Performance Criteria

Performance Criteria	Definition/Threshold Of Performance Criteria	Recommended IAN Standard	Related Factors
Overall Height	The vertical distance between the highest point on the vehicle or combination of vehicle, including cargo, and the surface of the road.	4.15 m (13.61 ft)	<u>Limiting factors</u> - Compatibility with available vertical clearances on the roadway. - Impact on the stability of commercial vehicles which are designed to fully exploit the “dimensional envelope” described by the regulations (that is, impact on the height of a vehicle’s center of gravity).
Overall Width	The greatest overall transverse dimension of a vehicle or combination of vehicles including load, but exclusive of devices or appurtenances at the sides of a truck, tractor, semitrailer, or trailer whose function is related to the safe operation of the vehicle.	2.60 m (102.36 in)	<u>Limiting factors</u> - Compatibility with available vertical clearances on the roadway, including factors such as lane width, shoulder width, horizontal clearances and horizontal curve radii. - Impact on the stability of commercial vehicles; wider track axles improve rollover stability.
Overall Length	The longitudinal measurement from the foremost part of a vehicle or combination of vehicles, including cargo, to the rearmost part of the vehicle or combination of vehicles, including cargo.	Tractor-Semitrailer 23.00 m (75.46 ft) Double-Trailer 25.00 m (82.0 ft)	<u>Limiting factors</u> - The maximum length of vehicle which can be safely passed within the passing sight distance and passing zone stripping practices. - Compatibility of the highway geometry with the turning and maneuvering characteristics of vehicles at the length limit selected.
Box Length	The longitudinal dimension from the forward most part of the cargo carrying unit(s) or load(s) to the rearmost part of the carrying unit(s) or load(s) exclusive of any extension(s) in the dimension caused by auxiliary equipment or machinery that is not designed for the transportation of goods.	Semitrailer 16.20 m (53.15 ft) Double trailer 20.00 m (65.62 ft)	<u>Constraining factors</u> - The space required within the constraint of the overall length limit to fit a tractor that can be operated safely and comfortably by the driver. - Standardization of equipment for fleet interchangeability and intermodal movement of trailers.
Transient Low-speed Offtracking	When a vehicle negotiates a 90° turn with an outside radius of 14.00 m, the maximum extent of lateral excursion of the last axle of the vehicle, relative to the path followed by the tractor steering axle, should not exceed 5.60 m.	5.60 m (18.3 ft)	<u>Limiting factors</u> - The available space within a traffic lane, shoulder, intersection or entrance or exist ramp. - Horizontal clearances to road furniture. <u>Influencing factors</u> - The radius of the turn. - The wheelbase of the truck or tractor. - The wheelbase of the trailer(s) or semitrailer(s) (the distance from the kingpin to the center of the axle group on the semitrailer). - The length of the drawbar on trailers or converter dollies. - The position of the fifth wheel. - The speed of the vehicle. Possible implementation approach: Place limits on the maximum acceptable wheelbase of tractors and trailers.
Front Swingout	When a vehicle negotiates a 90° turn with an outside radius of 14.00 m, the maximum extent of excursion of the outside front corner of the vehicle or cargo relative to the path followed by the outside tractor tires, should not exceed 0.45 m.	0.45 m (18 in)	<u>Limiting factor:</u> The available space within a traffic lane. <u>Influencing factors</u> - The radius of the turn. - The position of the kingpin relative to the front of the trailer or semitrailer the front overhang of the cargo. Possible Implementation Approach: Place limits on: - The position of the trailer kingpin relative to the front of the trailer (that is, kingpin setback) - The amount of front overhang that is permitted.
Rear Swingout	When a vehicle negotiates a 90° turn with an outside radius of 14.00 m, the maximum extent of excursion of the outside rear corner of the vehicle or cargo relative to the path followed by the outside trailer tires, should not exceed 0.20 m.	0.20 m (8 in)	<u>Limiting factor:</u> The available space within a traffic lane. <u>Influencing factors</u> - The radius of the turn. - The wheelbase of the trailer or semitrailer. - The effective rear-overhang of the trailer or semitrailer or the rear overhang of the cargo.

Table 3 – Weight-Related Performance Criteria

Performance Criteria	Recommendations	Related Factors
Acceleration Performance	None At this time	<u>Limiting factors</u> - Time available to clear intersections on green light cycle - Merging with high speed traffic on freeways and arterials - Maintaining speeds on grades - Distance available for passing maneuvers on two-lane roads <u>Influencing factors</u> - Engine horsepower - Gross vehicle weight
Dynamic Axle Loading Suspension Characteristics	None At this time	<u>Limiting factor:</u> Pavement and bridge life cycle management <u>Influencing factors</u> - Axle weight - Vehicle speed - Suspension damping characteristics
Bridge Overstress	Development of appropriate criteria and thresholds be accorded high priority in <u>future</u> discussions	<u>Limiting factors</u> - Bridge load bearing capacity - Acceptable levels of risk of failure <u>Influencing factors</u> - Axle weight - Gross vehicle weight - Interaxle spacing
Productivity: Impact on Pavements Relative to Weight Transported	Consideration of performance criteria for pavement related impacts of heavy axle loads be accorded high priority in <u>future</u> discussions	<u>Limiting factors</u> - Pavement structural capacity - Pavement life cycle management - Vehicle payload capacity <u>Influencing factors</u> - Number of axles - Axle group types and spacing - Axle and axle groups

Table 4 – Weight-and Dimension-Related Performance Criteria

Performance Criteria	Recommendations	Related Factors
Load Transfer Ratio	It is proposed that a load transfer ratio performance criterion be adopted as a regulatory principle with an acceptability ratio of 0.6 maximum.	<u>Limiting factors</u> - Safe speeds on curves - Speeds in lane change maneuvers <u>Influencing factors</u> - Payload center of gravity - Number of trailers - Trailer connecting mechanisms - Axle weights - Trailer wheelbase(s) - Suspension characteristics - Track width - Tire characteristics
Transient High-Speed Offtracking	It is proposed that a transient high-speed offtracking performance criterion be adopted as a regulatory principle with an acceptability threshold of a maximum of 0.8 m (32 in).	<u>Limiting factor:</u> Lane width <u>Influencing factors</u> - Payload center of gravity - Number of trailers - Trailer connecting mechanism - Axle weights - Trailer wheelbase(s) - Suspension characteristics - Track width - Tire characteristics
Friction Demand in Tight Turns	None at this time.	<u>Limiting factor:</u> Tire and road surface friction <u>Influencing factors</u> - Number of axles and spacing - Axle weights

COMMENT - AUSTRALIA'S EXPERIENCE WITH PERFORMANCE BASED SYSTEMS FOR TS&W REGULATION

Peter Sweatman, Roaduser Research

Peter Sweatman commented on Australia's experience with performance-based standards in TS&W regulation. Australia has spent considerable effort to reach a uniform set of TS&W regulations across all of its states. For example, the six-axle semitrailer combination is limited to either 42.5 or 45 tonnes.

Currently underway is a national-level project that is considering greater use of performance-based standards in lieu of the present prescriptive approach. This effort is considering approximately 100 such measures.

Breakout Sessions

OVERVIEW OF BREAKOUT SESSIONS

Jim March, FHWA

The breakout groups provided FHWA with feedback and other information related to two areas of concern:

- Improvements for the analytical tools:
 - Guidance on changes that should be made
 - Assumptions underlying the models
 - Need for sensitivity analysis
 - Priorities for making these improvements
- Information on the following policy considerations:
 - Enforcement needs
 - Regional approach
 - Availability of ITS technologies
 - Differences among vehicle configurations
 - Institutional issues.

Breakout Groups

Infrastructure – *Jerry Stephens, Montana State University, Facilitator*

Safety – *John Woodrooffe, Woodrooffe and Associates, Facilitator*

Shipper/Carrier Freight Transportation Decisions – *Joe Bryan, Reebie Associates, Facilitator*

Policy Options – *Mike Walton, University of Texas, Facilitator*

INFRASTRUCTURE BREAKOUT GROUP

List of Participants

Name	Organization / Affiliation
1. Paul Adams	– Oklahoma State Department of Transportation
2. Jim Currie	– Montana State Department of Transportation
3. Edward Fekpe	– Battelle
4. Francis Francois	– Independent Consultant
5. Bill Linde	– Federal Highway Administration
6. Jim McDonnell	– AASHTO
7. Joe Morris	– Transportation Research Board
8. Wayne Parrish	– Maryland State Department of Transportation
9. Jim Roberts	– California State Department of Transportation
10. Jim Saklas	– Federal Highway Administration
11. Ann Skinner	– Colorado State Department of Transportation
12. Jerry Stephens	– Montana State University (Session Facilitator)
13. Bill Wolford	– West Virginia State Department of Transportation
14. Russ Vachon	– New York State Department of Transportation
15. Firooz Zandi	– Indiana State Department of Transportation

Objectives of Breakout Group

The objectives of the infrastructure breakout session were to (1) summarize what is known about impacts of truck size and weight policy options on pavement, bridge, and other infrastructure costs and uncertainties about those costs, and (2) assess potential infrastructure-related initiatives that might be implemented in connection with truck size and weight policy changes to mitigate adverse infrastructure impacts.

Overview of Impact Analysis Approach

At the beginning of the breakout session, Jim Saklas, of the Office of Policy of FHWA, gave a presentation on methods used to estimate pavement, bridge, and other infrastructure impacts and costs associated with truck size and weight study scenarios. First, Mr. Saklas discussed the models and impacts on bridges followed by impacts on highway pavements

Bridges

The objectives of the bridge impact analyses are to (1) estimate the number of bridges that might require replacement if truck size and weight limits were changed; (2) estimate the agency costs to replace those bridges, (3) estimate user delay and air pollution costs associated with replacement bridge construction, and (4) develop a set of tools that permits the rapid analysis of the impacts of proposed truck configurations on highway structures.

The primary source of data for the bridge impact analyses was the National Bridge Inventory (NBI). This is state-provided database maintained by FHWA, that contains information on all

the bridges in the U.S. The “*Impacts of Heavy Trucks on Bridge Investment*” model developed by Transtec, Inc. and funded by FHWA specifically for the TSW study, was used. The model was developed to calculate live load/dead load ratios for numerous bridge types and compute bending moments on simple and continuous span bridges for any vehicle configuration. The model does not include timber, stayed, suspension, or movable bridges. The following steps were followed in applying the bridge impact analysis model:

- Compute total (dead load + live load) moments on each bridge generated by vehicles in the existing fleet (i.e., base case).
- Compute total (dead load + live load) moments on each bridge generated by the candidate vehicles (i.e., vehicles in the scenario under consideration).
- Compute total moments of the bridge rating vehicle. The actual bridge rating is used and not the design rating.
- Flag” the bridge for replacement under the Base Case if the moment generated by any of the existing vehicles exceeds the rating moment by more than some pre-established criterion.
- Compute the cost of the replacement bridges; sum the costs of all the replacement bridges to get the total agency cost attributable to vehicles in the existing fleet operating under current TS&W limits.
- Estimate the non-agency costs (delay and air pollution) during construction; sum nationally as was done for agency costs.
- Perform a similar analysis for the candidate vehicles assumed to operate under alternative truck size and weight limits.
- Compute the difference between the costs of the candidate vehicles for each TS&W scenario and the vehicles in the existing fleet. This is the cost attributable to that scenario.
- Expand to estimate national costs versus sample cost.

In estimating the costs, Jim Saklas noted that the unit cost data were provided by the states as the square footage costs. This was augmented by a factor of 0.25 (i.e., the unit costs were multiplied by a factor of 1.25). It was also noted that cost data from only 13 states were available and expanded to all 50 states.

Mr. Saklas then discussed the assumptions underlying the bending moment analyses. It was assumed that (1) overstressed bridges will be replaced, not strengthened, (2) overstress is defined as a level of stress exceeding the stress endured by the bridge due to the design vehicle representing the bridge's inventory rating, (3) replacement bridges are 25 percent larger (wider/longer) than those that they replace, (4) for multi-span bridges, the length of the secondary spans are equal to bridge total length less the primary span divided by the number of secondary spans; and (5) overstress criteria are mostly based on criteria used to develop the Bridge Formula B, i.e.,

- For all HS bridges: 1.05% of rating
- For all H bridges rated less than or equal to H17.5: 1.30% of rating
- For all H bridges rated greater than H17.5: 1.15% of rating.

Mr. Saklas concluded the discussion on bridge impact analyses by explaining the reasons for expansions used. “Internal” samples were expanded for two possible reasons: (1) data flaws identified in pre-processing of the NBI data, non-bridges, e.g. culverts, etc., and (2) the moment analysis subroutine identified other data flaws, non-analyzable structures, etc. In each case, an “improper” record is flagged and discarded. The final state samples were then expanded to the nation.

Pavements

The objectives of pavement impact analyses for the truck size and weight study are to (1) determine the cost of repairing pavement damage caused by the scenario trucks, and (2) develop a set of tools that analyzes the impacts of proposed truck configurations on highway pavements.

The Highway Performance Monitoring System (HPMS) was the primary source of data used in the pavement impact analyses. The HPMS data set is maintained by FHWA and contains data that document the conditions of over 100,000 pavement sections. Other site-and-state specific data on soil types, environment, vehicle miles traveled (VMT) by state, functional class, vehicle class, and weight group were used in the analyses. Twelve functional highway classes, 20 vehicle classes, and 30 weight groups were considered.

The National Pavement Cost Model (NAPCOM) was used for the pavement impact analyses. NAPCOM was developed for the Federal Highway Cost Allocation Study. One output is the number of failed lane-miles of highway attributable to travel by 20 different vehicle classes at various operating weights over a 20-year analysis period. NAPCOM is based on mechanistic relationships between axle loads/spacings and several flexible pavement distresses, such as: loss of serviceability, load-related fatigue cracking, rutting, loss of skid resistance, and thermal cracking. The model also develops mechanistic relationships between axle loads/spacings and several rigid pavement distresses, such as: loss of serviceability, load-related fatigue cracking, faulting of joints, and pumping. The following steps were followed in estimating the pavement impacts of TS&W scenarios:

- Run NAPCOM for the Base Case to estimate the number of lane miles requiring “repair” over a 20-year analysis period assuming that current truck size and weight limits remain unchanged
- Compute the “repair” cost using mean costs per lane mile
- Run NAPCOM for the Scenario Case with the new VMT to estimate the number of lane miles requiring “repair”
- Compute the “repair” cost using mean costs per lane.

The difference between the two costs is attributable to the changes in traffic composition and VMT between the Base Case and the Scenario Case.

Summary of Breakout Group Discussions

Jerry Stephens facilitated the breakout session and presented a summary of the discussions. A broad range of issues was discussed during the infrastructure breakout session, ranging from the

specific manner in which infrastructure impacts are calculated for different truck size and weight scenarios, to the desirability of making fundamental changes in truck size and weight limits based on optimizing infrastructure efficiency and performance. The background presentation by Jim Saklas initiated a general discussion of the manner in which infrastructure impacts were calculated. This discussion took much of the time allotted for the breakout session, and it produced many specific suggestions for FHWA with respect to the manner in which infrastructure impacts are assessed. Toward the end of the session, the participants considered the broad issue of what fundamental changes in truck size and weight limits would possibly result in more efficient use of the highway infrastructure. The conclusion was reached that, from a practical perspective, changes in many aspects of truck size and weight limits are unlikely to occur if the only motivation is maximizing the utility of the highway infrastructure.

Beginning with this last discussion question first, the breakout session participants briefly discussed a few changes that might be made in traditional truck size and weight limits, such as shifting from 34,000 to 37,000 pounds on tandem axles. While such changes might improve the utility of the existing infrastructure, environmental and financial constraints make it very difficult to move toward any such revised limits. The comment was made that if the highway system could be redesigned right now, it might not look anything like the system that currently has evolved. The engineering approach to providing a freight transportation system would be to ask representatives of the transport industry what they need, and to design a safe, economical system accordingly. While such an approach is attractive in the ideal sense, it does not reflect the situation with which we are faced. We have an existing highway system that generally evolved primarily to allow passenger cars to carry people from home to work. For a variety of reasons, ranging from environmental concerns to financial constraints, it will be difficult to radically alter this infrastructure. Therefore, while fundamental changes in axle weight limits or allowable bridge demands may be attractive from an infrastructure optimization perspective, they probably will be impractical to implement.

If dedicated truck lanes become a reality, one opportunity may emerge to redesign at least part of the highway infrastructure. These lanes could be redesigned to better suit new vehicle configurations. Many problems were seen with such lanes, however, ranging from possible difficulties in obtaining right of way, to resolving how trucks would access these lanes, and more generally, how their operation would integrate with general traffic flow. The session participants did briefly discuss the practice of establishing restricted route systems to accommodate special permitted vehicles. The universal comment from the states represented in the breakout session was that such systems have been, and can be, practically implemented and effectively used.

Presuming that highway infrastructure cannot be radically and/or immediately changed, the problem becomes one of trying to improve the efficiency of the existing system (with the possibility of gradually modifying the system through changes in future designs). It may be possible to improve the utility of the existing infrastructure by encouraging the development and use of road friendly vehicles. Such vehicles can carry more freight than existing vehicles without placing increased demands on the infrastructure. Ultimately, it may be possible to implement infrastructure-based performance specifications for vehicles, rather than specifying prescriptive weight limits. These specifications could be based on the inherent capacity of the infrastructure, and could be expressed, for example, in terms of such quantities as the maximum

contact pressure that can be placed on a pavement, and/or the maximum bending moment that can be created in a bridge.

Use of the existing highway infrastructure can only be maximized if its capacity and deterioration through time under various levels of use can be accurately determined. In this regard, the participants in the breakout session considered the manner in which vehicle impacts are assessed on three elements of the existing infrastructure: bridges, pavements, and geometrics. Much of the discussion during the session centered on our ability to reasonably assess the impact of various truck size and weight scenarios on the bridge system.

The session participants were concerned that the FHWA bridge analyses do not accurately portray bridge impacts, with several participants indicating that the federal methodology overstates these impacts. In many of the illustrative scenarios in the federal study, bridge costs were a significant part of the infrastructure impacts; thus, it is critical that such impacts be accurately assessed. Questions were raised regarding how information on issues such as bridge impacts should be presented in truck size and weight studies. If policy decisions are to be made based on such information, it is important that they be neither overstated nor understated. It is also important, however, that some indication be made on the range of uncertainty in the results.

Specific comments on the current methodology used by FHWA to assess bridge impacts included:

1. The data readily available and used by FHWA in performing its bridge analyses was from the National Bridge Inventory (NBI). This database has errors in it. Furthermore, only the design capacity, rather than as-built capacity, of bridges is reported in the NBI. In general, analyses are only as reliable as the data used in their inputs. If the results of the bridge analyses are important and sensitive to the input data, it is important to use better information in their implementation than is available from the NBI.
2. FHWA assumed that any bridge found to be deficient in its analyses needed to be replaced. It may be possible to simply strengthen some of these bridges. Many states have active bridge strengthening programs. While the FHWA "total replacement" approach is easy to implement, it may substantially overstate impact costs.
3. The approach to bridge capacity assessment and overstress being used by FHWA may not be the best approach available. While FHWA is using a traditional working stress approach to capacity rating, states are being required to begin reporting bridge load ratings in the NBI using the more contemporary load factor approach.
4. FHWA's current analyses of bridge impacts do not address accelerated deterioration of existing bridges under increased truck demands.
5. FHWA's current analyses assign substantial costs in some of the illustrative scenarios against delays experienced by highway users while bridges are being replaced. States have become innovative in minimizing user delays during construction, and it may be possible that the federal approach overstates delay costs.

Specific suggestions for FHWA for addressing the concerns identified above include:

1. While it is impractical for FHWA to do detailed analyses of all the bridges in the country, a small but representative sample of bridges should be evaluated. These analyses should:
 - a) determine accurate load ratings for the bridges
 - b) establish the specific actions necessary to correct any deficiencies in these ratings with respect to meeting the demands of specific size and weight scenarios (from strengthening to total replacement)
 - c) quantify any accelerated deterioration the bridges might experience under the demands of specific size and weight scenarios.

The results of these analyses should be compared with those obtained for these same bridges using less refined network-wide analysis algorithms. The outcome of such comparisons would indicate if the network-wide analyses were biased toward overstating or understating bridge impacts, and they could possibly be further used to adjust the network-wide results.

2. In performing their analyses, FHWA should take advantage of information available from the states on various bridge impact issues. Notably, FHWA might find useful information on bridge strengthening, bridge deterioration through time and use, and user delay time during bridge construction activities.
3. FHWA should consider using a bridge impact methodology that uses the new information that is becoming available in the NBI on the load factor based capacities of bridges.

With respect to assessing pavement impacts, the breakout session participants initially expressed several concerns about the NAPCOM pavement model that was used in the comprehensive truck size and weight study. It was discovered, however, that providing better information on how the NAPCOM model functions might alleviate many of these concerns. While Jim Saklas was able to provide some information on NAPCOM to the session participants, they were interested in obtaining written documentation on the model so that they could reasonably judge the validity of its performance. The specific recommendation was made that the model's performance continue to be evaluated against current and future data that are being collected and made available from the LTPP and other pavement evaluation programs.

A final infrastructure issue that was briefly discussed by the session participants was highway geometry. When the participants were queried regarding important infrastructure issues affected by truck size and weight limits, the only issue mentioned besides bridges and pavements was highway geometry. The observation was made that the costs associated with making intersection and access ramp geometries compatible with the operations of larger trucks in urban environments would be very high.

SAFETY BREAKOUT GROUP

List of Participants

Name	Organization / Affiliation
1. Mark Berndt	– Minnesota State Department of Transportation
2. Phil Blow	– Battelle
3. Roger Cameron	– Railway Association of Canada
4. Rick Craig	– Owner-Operators and Independent Drivers Association (OOIDA)
5. Lily Elefteriadou	– Pennsylvania State University
6. Nicholas Garber	– University of Virginia
7. Dale E. Hanington	– Maine Motor Transportation Association
8. John Pearson	– Canadian Council of Deputy Ministers of Transport
9. Michael Scippa	– CRASH
10. Daniel Smyser	– Pennsylvania State Department of Transportation
11. Peter Sweatman	– Roaduser Research
12. Parker Williams	– Maryland State Highway Administration
13. John Woodrooffe	– Woodrooffe and Associates (Session Facilitator)
14. Doug Wylie	– California State Department of Transportation

Objectives of Breakout Group

The objectives of the safety breakout session were to review the most important safety issues concerning potential truck size and weight policy changes, to summarize what currently is known about relationships between truck size and weight and highway safety, and to identify truck size and weight policy changes and supporting actions that might improve highway safety.

Overview of Analysis Approach

Phil Blow of Battelle gave an opening presentation that summarized the safety and traffic operations impact analyses of the comprehensive TS&W study, and public comments on these analyses.

Safety Analysis

The safety analysis has two components, (1) crash data analysis, and (2) vehicle stability and control analysis. Three types of trucks were considered in the crash data analysis: single-unit trucks, single-trailer combinations, and multi-trailer combinations (i.e., STAA doubles not LCVs). In calculating the crash rates, VMT data were normalized by functional class or highway type and area class i.e., urban and rural. Results of the crash rate analysis indicate that multi-trailer combinations have an 11 percent higher crash rate than single-trailer combinations. Also, crash rates are higher on lower class highways and they are higher when there is more traffic congestion.

The vehicle stability and control analysis considered three performance measures, including static roll stability, rearward amplification (RA), and load transfer ratio (LTR). These performance

measures were estimated using vehicle dynamics simulation models. The test matrix used 14 vehicle configurations at selected weights and dimensions appropriate for the vehicle configuration. Results of the vehicle stability and control analysis indicate that (1) distributing cargo over a larger deck area increases roll stability, (2) stacking cargo higher decreases roll stability, (3) increasing trailer length increases lateral (yaw) stability, (4) increasing the number of vehicle articulation points decreases lateral stability, and (5) adding axles increases roll and lateral (yaw) stability.

Public comments were positive regarding the general approach of the safety analysis. Other positive comments included the fact that the analysis results recognize the inherent stability issues of triples and that current LCV crash experience would likely change with their expanded use. The American Trucking Association, however, does not consider the safety analysis to be credible. STAA doubles are not viewed as representative of all multi-trailer combinations, and good LCV crash rates are needed for the analysis. It was noted that past crash experience does not necessarily represent present or future crash rates. It was also noted that the safety analysis failed to estimate crash costs and did not consider cargo instability in the analysis.

Traffic Operations Analysis

Traffic operations impact analysis of TS&W scenarios also has two components. The first component evaluates traffic congestion and associated costs. Second, the operational impacts of TS&W scenarios were estimated in terms of maneuvers such as low-speed offtracking with regard to lane encroachment, passing and being passed, acceleration (i.e., merging, hill climbing), lane changing, and intersection requirements.

Traffic delay and congestion costs were based on estimated passenger car equivalents (PCEs) using traffic simulation models and speed-flow curves to estimate changes in speed and hence travel time. Changes in speed resulting from the introduction of new trucks into the vehicle fleet are used to calculate the changes in total delay to traffic. Unit road user costs are then applied to estimate the costs of changes in traffic delay. Other traffic operation effects, such as acceleration capability and change in truck length, were assessed qualitatively.

Results of the traffic operations impact analysis indicate that acceleration capability is more important than vehicle length and that VMT reduction from longer trucks reduces PCEs and traffic congestion, *provided* weight to horsepower ratios are maintained. Furthermore, increased vehicle length cannot always be mitigated by acceleration capability, for example, being passed and changing lanes.

The public considers the traffic operations methodology to be reasonable. However, it was noted that PCEs were understated for urban areas. Also, some suggested that the analysis of grade effects should have been done on a state basis instead of at the national level. The public comments also pointed out that the traffic operations analysis did not include incident related congestion and driver "disamenity." The traffic operations analysis was limited to recurring delay only.

Summary of Breakout Group Discussions

John Woodrooffe, the session facilitator, led the discussions and presented a summary of the breakout session. The participants first discussed the key safety concerns associated with changes to TS&W. While discussing the safety concerns related to changes in vehicle weight, the participants noted that changes in vehicle weight may affect certain safety factors, including stability and stopping, the force of impact (this may not be relevant at weight ranges examined in the TS&W study), acceleration and speed (especially on a hill), truck-car conflicts (exposure, e.g., the time required by a truck to clear an intersection), and driver demands (e.g., center of gravity height, stopping distance, ride quality). In extreme cases, increased vehicle weight may result in bridge collapse, i.e., catastrophic failure and possible loss of life. On the other hand, decreased weight may result in increased safety risk due to increased exposure. This is based on the assumption of a constant volume of freight where decreased weight limits will require more truck trips to transport the same amount of freight.

With regard to vehicle dimensions, the participants identified some key safety concerns. It is believed that the effect of vehicle dimension on safety is a perception problem attributed to passenger car driver fears. Splash and spray from long vehicles is considered a safety risk because passing times are longer for passenger cars. Vehicle maneuverability is a function of the dimensions and is directly related to road geometry. For example, low-speed offtracking, the way a truck merges into traffic streams, and lane-change maneuvers are functions of vehicle length. The participants discussed the safety implications of vehicle width and focused on 102-inch versus 96-inch width tractors. It was recommended that tractor width should be increased to 102 inches.

Next, the session participants discussed the contribution of vehicle and load characteristics to safety concerns. Among the characteristics identified are cargo shift (load securement), flammable liquids (hazardous materials), load dynamics, and specialized loads (i.e., hydraulics – loading and unloading equipment).

The discussion then shifted to vehicle design options capable of offsetting safety concerns that have been identified. Vehicle design options identified include: lowering a vehicle's center of gravity height to improve vehicle stability and control properties, brake improvements, deployment of ITS technologies (e.g., proximity, run off road, rollover warning systems), the use of steerable axles, and vehicle width of 102 inches. One of the reasons that tractors currently are not 102 inches wide is the fact that 102-inch wide vehicles are not allowed on all highways, especially those with narrow lanes. The participants also believed that providing incentives such as tax breaks to carriers for using safety features will help improve truck safety.

Safety performance measures were then examined at length. The discussion centered on the potential contributions to improving safety. It was agreed that the advantages of safety performance measures clearly outweigh the disadvantages. These measures can effectively balance the economic factors motivations in vehicle design. The performance measures are both vehicle-and system-related (i.e., crash rates). It was felt that there is the need for information and understanding of causal relationships between performance measures and safety.

Performance standards affect vehicle design and can also be used to evaluate safety performance. The standards are related to the quality movement and carrier performance. However, it is important that the performance standards must be easily measured. They should be crisp with sufficient explanation.

The workshop participants strongly supported the idea of a special permit program for longer combination vehicles (LCVs). The special permit program is seen as a method of engendering an improved safety mindset and ensuring that users pay for LCV use. It was recommended that such permit programs incorporate Intelligent Transportation System (ITS) technologies. The participants recommended linking special permit systems to availability of railroad service. The rationale behind the recommendation is that if adequate rail service is available and if the special permit applicant can efficiently use the rail service, then the special permit would not be granted for highway transport. It was further recommended that products transported under state special permits should not be forced off the Interstate onto lower class roads having higher safety risk.

The question of the TRB 225 study and the recommendation for federal TS&W limit exemption for special permit programs was discussed. It was noted that this recommendation would impose safety restrictions on vehicles over 80,000 pounds. The important safety restrictions include power requirements, driver qualifications, collision reporting and insurance, braking systems, connecting equipment, axle width, tires, and rims.

Finally, the various means of truck-car separation to help prevent degradation in highway safety and ways to promote safety improvements were discussed. First, the use of climbing lanes was noted as a safety element in highway design that has been used for years. The participants agreed that it is critical to understand the problem in order to identify possible solutions. For example, it is important to make a distinction between congestion and fear. Second, the use of special lanes in accident black spots was seen as a logical solution. Thirdly, double decking roads was identified as one possible approach to improving safety. It was agreed that highway safety would become a public health issue. It was concluded that no “quick and dirty” approach would help address the safety issue. In other words, there are no silver bullets to improve safety.

SHIPPER/CARRIER FREIGHT TRANSPORTATION DECISIONS BREAKOUT GROUP

List of Participants

Name	Organization / Affiliation
1. Ken Boyer	– Michigan State University
2. Joe Bryan	– Reebe Associates (Session Facilitator)
3. Bill Felts	– California State Department of Transportation
4. Ken Gudenkauf	– Kansas State Department of Transportation
5. Jim Hazeldine	– Oklahoma State Department of Transportation
6. Don Pickrell	– Volpe Transportation Center
7. Mike Rice	– Transystems
8. Craig Rockey	– American Association of Railroads (AAR)
9. Ted Scott	– American Trucking Association
10. James Snyder	– New Jersey State Department of Transportation
11. Don Ward	– Iowa State Department of Transportation
12. Karen White	– Federal Highway Administration

Objective of Breakout Group

The objective of the breakout session on shipper/carrier freight transportation decisions was to summarize what is known about the impacts of truck size and weight policy options on modal and truck configuration choices. This included a discussion of the best practices for modeling and forecasting freight shipments, including limitations of analysis.

Overview of Modeling Approach

The diversion model estimates shipper/carrier freight transportation decisions by computing the total transportation and inventory costs for a total logistics approach. The Intermodal Transportation and Inventory Costing (ITIC) model uses a deterministic approach to assign a shipper's annual shipments to a mode (rail, rail-truck intermodal, or truck) and truck configuration with the lowest annual logistics cost.

The model analyzes rail and rail-truck intermodal shipments from the 1993 Carload Waybill Sample. The truck shipments analyzed are from the North American Transportation Survey (NATS) collected by the American Association of Railroads (AAR) between 1992 and 1993. The NATS data focused on rail competitive truck shipments, and while it is a large data set, it is not comprehensive. Research is underway to create a more extensive truck shipment database and also update to the 1998 Carload Waybill Sample.

The basis of the proposed truck shipment database is a county-to-county freight shipment database created by Reebe Associates utilizing the Commodity Flow Survey, Survey of Manufacturing, County Business Patterns, and Reebe's Transearch database. Currently the

database contains the tons of a commodity [at the 4-digit Standard Transportation Commodity Code (STCC) level of detail] shipped by truckload, less-than-truckload and private carriers. Work has begun at FHWA to create a database of truck shipments specified by truck configuration and weight distribution.

Summary of Breakout Group Discussions

Joe Bryan facilitated the shipper/carrier freight transportation decisions breakout session. The breakout session focused on both the broad topics of the modeling approach and specific topics examining the building blocks of the model. The model attempts to quantify and capture all the relevant cost elements, in their substantial diversity. Doubts about the thoroughness and accuracy of the deterministic inputs raised questions of utilization of a probabilistic approach. For example, if shippers behave differently day-to-day, presumably conditions and immediate cost profiles will change. The bottom line is that there is a choice between changing the approach, and improving the deterministic inputs.

The key deterministic inputs are:

- **Average Pounds Per Cubic Foot for Various Commodity Groups** – This translates into payload. The main question raised was whether the ITIC model fully reflected payload variability across and within commodity groups. Field research could help better define this issue.
- **Cost Per Mile to Ship Various Commodities by Mode and Vehicle Type** – Apart from questions regarding cost components, some participants were optimistic about procuring rate information. This could be attempted; however, 1) market rates are not list prices; 2) a large body of rates would need to be assembled covering commodity, equipment, regional, and length of haul differences; and 3) it is not clear that rates are helpful in the *prospective* analysis that truck size and weight scenarios require.
- **Inventory Cost for Different Commodities** – This variable was not a key driver but perhaps should be. Service distinctions are captured here and a “total logistics” cost model that is affected only by transport cost and payloads seems incomplete. It was suggested that the model could use an unexplained variable cost in the calibration. The model could be calibrated using an LCV region composed of Montana, Oregon, Utah, Washington, Wyoming, Nevada, and North and South Dakota.

Currently, the model’s inventory costs are holding cost (including the costs of safety stock, cycle stock, and in-transit stock) and ordering cost. The safety stock is held to protect against stock-outs. The door-to-door reliability of transportation directly impact this variable. Cycle stock is the average balance on-hand during an inventory cycle and is strongly affected by the payload of a particular mode. The in-transit stock is the fraction of the year that the commodity spends in transit. The average transit time of a mode will directly affect in-transit stock.

Even though the model accounts for all the important types of inventory costs, the final summation of those costs is less than expected given general estimates of inventory cost represent 4-5 percent of GDP. There was a strong concern among the participants that the inventory costs are often the most important part of a shipper's modal choice and the ITIC model needs to show that.

- **Loading/Unloading Costs** – It was suggested that the loading and unloading costs should be specified by commodity and truck equipment type. For some commodities the additional time to load or unload a longer combination vehicle (LCV) would overcome any potential over-the-road savings. Field research with carriers and shippers could yield better specifications in the model.
- **Road Networks** – The size of the road network where LCVs may operate has a material impact on the cost of operation and diversion. The assumed size of the network used in the study was viewed as too large. Technically, this is a policy point and not a modeling issue, but the model should show sensitivity to the size of the networks.
- **Equipment Utilization** – Currently the model does not account for the economies of scale necessary for operating alternative vehicles. LCVs have been successful in parts of the Western States for carriage of natural resources that offer high volume origin to destination, and relatively short road lengths of haul. This would not be true for a national truckload carrier who needs to manage a large fleet of vehicles. For example the North American Trade Scenarios in the study would require mixed fleets, which become more expensive to operate as the geographic scope of the fleet expands. Thus, the cost of equipment conversion probably is lower over shorter lengths of haul, and fleet uniformity has a stronger influence over longer hauls. Field research with carriers and shippers may help determine methods to integrate this into the model.

The participants believed that the ITIC model as utilized in the Comprehensive Truck Size and Weight Study was a good beginning at building a tool for the estimation of shipper/carrier mode and configuration choices. Improvements to the truck input data set was seen as the number one priority to strengthen the model.

POLICY OPTIONS BREAKOUT GROUP

List of Participants

Name	Organization / Affiliation
1. David Barnes	– Transport Topics
2. Dan Beal	– American Automobile Association (AAA), Southern California
3. Jerry Donaldson	– Advocates for Highway and Auto Safety
4. Joseph Foster	– Maryland State Department of Transportation
5. Glenda Fuller	– Idaho State Department of Transportation
6. Gregory Gilks	– Saskatchewan Highways and Transportation
7. Norman Hill	– Oklahoma State Department of Transportation
8. Mary Hrabowska	– New York Metropolitan Transportation Council
9. John Legler	– Waste Equipment Technology Association
10. Drew Livesay	– Montana State Department of Transportation
11. Tim Lynch	– Motor Freight Carriers Association
12. Jim March	– Federal Highway Administration
13. Sharon Nichols	– Western Highway Institute
14. Jim Norman	– Louisiana State Department of Transportation
15. Thomas Osborn	– International Truck and Engine Corporation
16. Stan Paulis	– Illinois Department of Transportation
17. Jim Poirot	– CH2M Hill
18. Ben Ritchey	– Battelle
19. Carl Swerdloff	– U.S. Department of Transportation
20. Michael Walton	– University of Texas (Session Facilitator)
21. Robert Watson	– West Virginia State Department of Transportation

Objectives of Breakout Group

The objectives of the policy options breakout group were to (1) summarize reasons that have been suggested for changing Federal truck size and weight limits and reasons put forth for not changing existing limits; (2) identify the full range of TS&W changes that might be considered, including the criteria that should be used to evaluate potential policy changes; uncertainties about potential impacts of Federal truck size and weight policy changes; potential ways to deal with those uncertainties; and institutional and other impediments to changing Federal truck size and weight limits. The objective is not necessarily to rank options or reach consensus on a set of potentially acceptable options. Rather, the objective is to set forth a framework for evaluating options that goes beyond the analytical framework and toolbox developed for the Comprehensive Truck Size and Weight Study and addresses some of the more fundamental policy considerations underlying the truck size and weight debate.

Overview of Options and Public Comments

Jim March gave an opening presentation that summarized the types of options that have been examined in previous DOT and TRB studies; recommendations, if any, in those studies; comments received on policy options evaluated for the DOT's recent Comprehensive Truck Size and Weight Study; and some of the types of options that have not been explicitly analyzed in previous studies.

Mr. March first reviewed the current Federal TS&W limits and their historical development since 1975. It was noted that axle load, bridge formula, and gross vehicle weight (GVW) limits have not changed since 1975. The various grandfather rights included with the current Federal limits have been revised over the years. The 1982 Surface Transportation Assistance Act (STAA) established new Federal weight limits. The new limits were a significant departure from previous requirements in that they established mandatory rather than permissive maximum weight limits. The Act substantially expanded Federal regulation and authority over both vehicle size and weight, establishing minimum and maximum standards for weight, width, and minimum standards for length on the Interstate system and many Federal-aid highways (i.e., national network (NN)). Thus, minimum trailer length on NN and minimum GVW on Interstate were established. The LCV freeze came into effect with the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Other potential TSW policy components include: special permit requirements, vehicle equipment standards, route restrictions, driver qualifications, vehicle performance standards, and cost recovery requirements.

The federal TS&W study assessed the potential impacts of policy changes in terms of safety (i.e., stability and control, passing, traffic operations), motorist opposition, productivity in the freight transportation industry, and infrastructure (i.e., pavement, bridges, highway geometry features). Other impact areas include the effects on energy consumption, environmental quality, and modal competition, especially rail impacts.

The comprehensive TS&W study did not analyze the many implementation issues that would have to be considered before any new size and weight policy changes could be enacted. One issue is whether changes would be enacted incrementally versus comprehensive changes. A second issue is the question of enforcement of any new regulations developing from the policy analyses. Third, the issue of uneven distribution of benefits and costs arising from the policy will need to be considered. Fourth, consideration should be given to infrastructure improvement needs necessitated by any new policy, sources of finance to implement the policy, as well as the programming of the improvements.

"Ratcheting" of TS&W limits was also identified as one of the implementation issues that needs consideration. It is noted that recognition of the roles and responsibilities of Federal and state agencies in implementing TS&W limit changes is important. Policies on network designation and access, and overcoming motorist opposition, are also viewed as important implementation issues.

Mr. March discussed examples of the TS&W policy options that could be considered. One set of options would involve rolling back certain truck size and weight limits. These options include:

- Elimination of grandfather rights
- Uniform weight limits on NHS
- Establish maximum semitrailer lengths

Another set of options could involve increasing the gross vehicle weight allowable for certain vehicles without raising the current 80,000-pound Federal weight limit. These options involve alternative bridge formulas.

- Alternative bridge formulas to the Bridge Formula B
 - TTI/TTI-HS-20
 - NTWAC

These options primarily affect specialized hauling vehicles (SHVs) such as waste haulers, dump trucks, transit mixers, and similar short wheelbase vehicles whose gross vehicle weight is limited by the current bridge formula.

Another set of options involves elimination of the 80,000-pound cap on gross vehicle weights. These options include:

- Uncapping bridge formula B
- Alternative bridge formulas
- Establishing specific tridem axle load limits as was done in the North American Trade Scenario of the comprehensive TS&W study.

Under many of these options, some route restrictions might be necessary primarily for bridge protection.

A subset of the previous set of options involves allowing more widespread use of LCVs. This would require:

- Elimination of LCV freeze
- Uncapping Bridge Formula B or using some alternative bridge formula without gross vehicle weight limit
- Eliminating grandfather rights.

More widespread use of LCVs could require route restrictions or highway improvements not only for bridge protection, but also for inadequate highway geometry, and traffic operations considerations.

Mr. March concluded his presentation by identifying issues associated with the use of a premium highway system. These are: (1) high design standards, (2) separation of autos and trucks, and (3) public/private/quasi-public operation.

Summary of Breakout Group Discussions

Mike Walton facilitated the policy options breakout session. During the first part of the session the various elements of federal truck size and weight policy were discussed to determine which elements to change and some of the issues surrounding potential changes.

Vehicle Dimensions

Height – There was a consensus that no changes are needed in Federal limits on vehicle height.

Width – None of the participants expressed a desire to increase the general Federal width limit established in the STAA of 1982 of 102 inches on National Network routes. There are issues, however, with the definition of vehicle width. Certain specified safety devices are excluded in measuring vehicle width, but States receive many requests to exclude other vehicle appurtenances as well. The participants felt that there should be an improved definition of width and a policy on special exemptions. Some concern was expressed about ratcheting for specific vehicle types moving into other vehicles.

Length – It was observed that the most significant recent changes in overall vehicle weights and dimensions have been in the area of trailer lengths. There is no maximum trailer length specified in Federal law and over the years there has been a gradual increase in State trailer length limits. The increase from 48 to 53 feet was quickly approved by most states, and a number of States now allow trailers 57 feet or more in length. It was noted that shippers have been major drivers of the ratcheting in State trailer length limits.

There was discussion regarding vehicle length being very visible to other drivers and the fact that surveys have found that many drivers believe truck lengths should not be increased. There also was discussion regarding competing needs for flexibility and uniformity. Some industries benefit significantly from longer trailer lengths but it is more difficult for carriers to manage fleets, either large or small, with different trailer lengths. The use of performance-based systems was considered useful in limiting vehicle lengths, and in fact is an area where performance-based standards are most directly implemented. Regional variation and state issues were recognized in discussing the policy regarding vehicle length.

Vehicle Weight

Axle load limits – No strong sentiment was expressed to increase Federal axle load limits.

Gross vehicle weight – Vehicle configuration and Bridge Formula should be important considerations in determining GVW limits. It is further complicated by grandfather rights and special permit allowances.

Performance-Based Systems

The Performance-Based System (PBS) concept received considerable attention during the discussions. A narrow majority of participants favored the concept of PBS as a regulatory tool. Several concerns were raised including current pressure to maintain the status quo and that PBS only voids extreme trucks and misses marginal performing trucks. It was suggested that this approach should be used as an analytical tool only to provide data to legislators and state regulators. Concerns were also expressed regarding implementation and enforcement of a PBS approach. A certification system was suggested due to the poor enforcement in the field. Federal assistance in helping to develop standards and guidelines was recommended.

Regarding the question of FHWA examination of the PBS process, two issues were identified: (1) the legal truck size issue versus special permit operations, and (2) the need to clarify Federal versus state roles for PBS. It was noted that 30 to 40 percent of trucks are operating under special permits and 1 out of 3 are not in full compliance with the laws.

Enforcement

With regard to enforcement, it was recommended that Federal assistance be provided in developing enforcement guidelines and training packages. Fines and other sanctions under the current enforcement policy are often viewed by violators as simply part of the cost of doing business. To be effective in encouraging compliance, enforcement needs to have “teeth”; that is, the consequences for non-compliance should be painful to violators. It was also recommended that both shippers and carriers should be involved in the enforcement policy and practices.

Regionalism and Trade Corridors

Regarding the question of regionalism and trade corridors, the majority of the participants favored more state flexibility for regional policies. A special permit system with strong enforcement was generally viewed as a must for regional TS&W limits. Multi-state agreements are recognized as a means of promoting and implementing regional truck size and weight policies. It was recognized, however, that to avoid states having total control over TS&W limits, a Federal umbrella would be needed to impose some overall limits on flexibility. The ratchet effect was a particular concern with regards to regionalism of TS&W limits.

The issue of trade corridors was discussed at length. Under carefully controlled conditions, such corridors could be candidate sites for operations of vehicles with larger weights and dimensions. Concerns were expressed, however, about cost and the potential for off-corridor operations (i.e., trucks not staying in specified lanes or corridors). On high volume freight corridors there may be opportunities for separate truck lanes. Some workshop participants felt that consideration should be given to liberalizing Federal truck size and weight limits for some trade corridors. Due to uncertainties concerning potential impacts of liberalizing size and weight limits, there was a consensus that any initiative would probably have to be in the form of a demonstration project with a well defined termination date and strong controls so that the project can be ended. Concerns about ratchet possibilities were expressed by some participants.

Uniformity

With regard to the notion of nationwide uniformity, the majority of participants favored some state flexibility in maximum weights and dimensions. It was felt that a better inventory of current usage patterns for different vehicles in different regions is required for future TS&W studies. It was agreed that there are many dimensions to the safety problem beyond size and weight. The participants recommended a public education program on the importance of freight movement and the role of trucking in overall freight transportation.

Closing Session

Overview of Department of Transportation's Freight Analysis Activities – *Ben Ritchey, Battelle*

Plans for Future Truck Size and Weight Research – *Jim March, FHWA*

OVERVIEW OF THE DEPARTMENT OF TRANSPORTATION'S FREIGHT ANALYSIS AND ACTIVITIES

Ben Ritchey, Battelle

Ben Ritchey provided a brief overview of the Department of Transportation's current freight analysis and activities. The Multi-Modal Freight Analysis Framework (MMFAF) study for FHWA's Office of Freight Management and Operations is designed to develop a framework for strategic-level analysis across a multi-modal, regional/national/international network. Once developed, the analytical framework will support the evaluation of the impact of freight policy and/or strategic investment on freight productivity and mobility. Battelle is leading a team (including WSA, CS, VZM, HB, and Reebie) of contractors on this project. Two other related studies are as follows:

1. The National Transportation Network Analysis Capability (NTNAC) study for FHWA's Planning and Environment Core Business Unit is developing a national-level, agent-based, simulation tool that will simulate multi-modal freight movements. The tool, when developed, will allow the Department of Transportation to examine the critical interdependencies, dynamics, and uncertainties in the U.S. national transportation network. This project is being conducted by the Los Alamos National Laboratory Team.
2. The Strategic National Intermodal Freight Analysis Tool (SNIFAT) study for the Bureau of Transportation Statistics (BTS) and the Office of Intermodalism is developing a prototype for a strategic freight flow-based analysis tool. The tool will utilize multimodal CFS network database and freight traffic routing algorithms developed by Oak Ridge National Laboratory (ORNL). The network will use commodity-specific, mode-specific, and county-to-county freight movement data. Development of the tool will give the Department of Transportation the capability to display multi-modal flow patterns and distinguish domestic and foreign origins and destinations. The contractor on this project is the ORNL Team.

The MMFAF study adopts a trends and issues approach in which themes are developed from:

- National markets to global markets
- A manufacturing to a service-based U.S. economy
- "Push" to "pull" logistics systems
- Modal fragmentation to modal integration
- System construction to system optimization
- Regulation to deregulation and decentralization
- Low visibility to environmental accountability
- Department of Defense stovepipes to "Focused Logistics."

A freight flow database will be developed by synthesizing diverse data from other studies. Significant attempts are being made to understand U.S. transportation activities including international connections. MMFAF data components include:

- County level flows
- International and domestic flows
- STCC commodity groupings
- Modal splits (truck, rail, air, water).

The next steps in the freight framework analysis study are:

- Complete base case database
- Provide forecasts database
- Develop white papers on themes
- Generate specific freight strategies and develop freight policy options
- Coordinate with other Department of Transportation freight analytical research projects

PLANS FOR FUTURE TRUCK SIZE AND WEIGHT RESEARCH

Jim March, FHWA

The comprehensive TS&W study produced analytical tools, data, and policy architecture for analyzing potential TS&W related policies. FHWA's Office of Transportation Policy Studies plans to update the data and analytical tools to be prepared to analyze TS&W issues that may arise during congressional work on the next surface transportation reauthorization legislation as TEA-21 expires in 2003.

The update objectives are to:

- Validate and refine scenario assumptions through sensitivity analyses
- Improve the impact assessment methods and assumptions
- Provide a more detailed understanding of equipment choice and utilization decisions
- Use new data including truck flow data reflecting the 1997 commodity flow survey (CFS) data
- Prepare to respond to reauthorization proposals by others.

FHWA will build upon the existing toolbox of impact assessment methods, incorporating new data and methods as appropriate. Outreach efforts on key TS&W policy issues will be continued and recommendations from the TRB TS&W policy study will be reviewed. Extremely limited research funds will constrain the research activities.

Safety remains a key focus area. The Department of Transportation has aggressive goals to improve motor carrier safety. Any TS&W policy proposal will be expected to contribute to meeting the motor carrier safety goals. It is recognized that some safety impacts are difficult to estimate. However, one open question is whether there are win-win TS&W options that will improve productivity while convincingly improving safety.

In formulating future research, the following issues need to be addressed:

- TS&W laws across the country are becoming fragmented. There are continuing requests for exemptions to the Federal TS&W limits to meet "niche" economic/trucking needs.
- Are there comprehensive solutions that could improve productivity, assure increased safety, and mitigate adverse impacts?
- Are there incremental solutions that could accomplish most objectives?
- What are the benefits and costs of doing nothing?

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