

NDDOT Truck Harmonization Study

Upper Great Plains Transportation Institute
North Dakota State University

North Dakota Association of County Engineers

January 21, 2016

Bismarck ND – Ramkota Hotel

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Today's Presentation

- Give Background on Truck Size/Weight Harmonization Study
- Explain Who is involved
- Explain the Process
- Cover General Issue of Truck Weights and Axle Configurations
- Answer Questions

Background of Truck Harmonization Study

- Legislative Direction - HB 1012 (NDDOT's Budget Bill)
- SECTION 9. DEPARTMENT OF TRANSPORTATION - TRUCK SIZE AND WEIGHT HARMONIZATION:
- **Directs** for the department of transportation to collaborate with the upper great plains transportation institute to study the impacts in this state of harmonizing truck size and weight regulations with states in the western states transportation alliance regarding standard commercial truck envelope limits of **129,000** pounds gross vehicle combination weight or 100 foot cargo carrying length and potential implications, for the biennium beginning July 1, 2015, and ending June 30, 2017.

Background of Truck Harmonization Study

- South Dakota and Montana Currently Allow 129,000 lb. GVW
- Idaho performed study 2013
- FHWA/USDOT Released Study
 - June 2015

Volume 1: Technical Reports Summary

Comprehensive
Truck Size and
Weight Limits
Study

June 2015

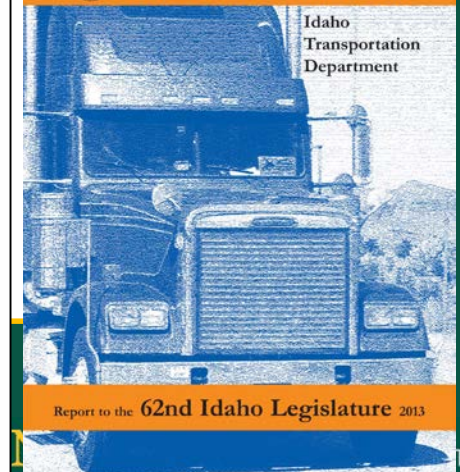


U.S. Department
of Transportation
**Federal Highway
Administration**

129,000 Pound Pilot Project


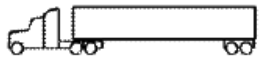
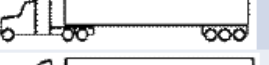


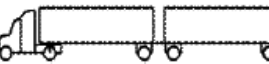
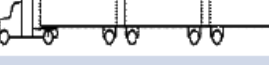
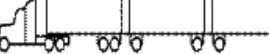
Idaho
Transportation
Department

Report to the 62nd Idaho Legislature 2013



USDOT/FHWA Study – Trucks Studied

Table ES-1: Truck Configurations and Weights Scenarios Analyzed in the 2014 CTSWL Study

Scenario	Configuration	Depiction of Vehicle	# Trailers or Semi-trailers	# Axles	Gross Vehicle Weight (pounds)	Roadway Networks
Control Single	5-axle vehicle tractor, 53 foot semitrailer (3-S2)		1	5	80,000	STAA ¹ vehicle; has broad mobility rights on entire Interstate System and National Network including a significant portion of the NHS
1	5-axle vehicle tractor, 53 foot semitrailer (3-S2)		1	5	88,000	Same as Above
2	6-axle vehicle tractor, 53 foot semitrailer (3-S3)		1	6	91,000	Same as Above
3	6-axle vehicle tractor, 53 foot semitrailer (3-S3)		1	6	97,000	Same as Above
Control Double	Tractor plus two 28 or 28 ½ foot trailers (2-S1-2)		2	5	80,000 maximum allowable weight 71,700 actual weight used for analysis ²	Same as Above
4	Tractor plus twin 33 foot trailers (2-S1-2)		2	5	80,000	Same as Above
5	Tractor plus three 28 or 28 ½ foot trailers (2-S1-2-2)		3	7	105,500	74,500 mile roadway system made up of the Interstate System, approved routes in 17 western states allowing triples under ISTEA Freeze and certain four-lane PAS roads on east coast ³
6	Tractor plus three 28 or 28 ½ foot trailers (3-S2-2-2)		3	9	129,000	Same as Scenario 5 ³

Truck Harmonization Steering Committee – formed by NDDOT

- ✓ ND Ag Coalition
- ✓ ND Motor Carriers
- ✓ ND Highway Patrol
- ✓ ND Township Officers Association
- ✓ ND Association of Counties
- ✓ ND League of Cities
- ✓ ND Grain Growers
- ✓ ND Petroleum Council
- ✓ ND Dept. of Commerce

Truck Harmonization Timeline

- December 2015 to Late May 2016
 - Conduct Study, meet with steering committee and produce draft Report
- May 2016 – January 2017
 - Participate in Quarterly Reports to Interim Transportation Committee
- January 2017 – April 30, 2017
 - Participate in Legislative Actions/Hearings regarding any changes to current law

Truck Harmonization Study – Major Steps

- Research Existing State and Federal Laws
- Identify Truck Configurations that Merit Study
- Forecast commodity flow changes
- Model economic impacts to pavement, bridges, local roadways & rail movements
- Consult Shippers & Associations
- Assess Local Road Access Issues & Impacts
- Write Draft Report

UGPTI Team

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- Kim Vachal
- Dale Heglund
- Andrew Wrucke
- Leanna Emmer
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- Mark Berwick

Truck Harmonization Study – Important Concepts

- Allowing 129,000 GVW won't mean 80,000 pound trucks can carry 129,000 pounds
- In Montana and South Dakota it takes 9 to 10 axles to allow 129,000 pounds



Truck Harmonization Study – Important Concepts

- But a Rocky Mile Double (semi with pup) could carry 120,000 pounds under harmonization



Truck Harmonization Study – Major Concepts

- Montana and South Dakota check both interior and exterior bridge formula when setting GVW for an individual truck
- North Dakota only uses exterior check on state system and both interior/exterior on Interstate

A Few Concepts on Larger Trucks

- Heavier GVW Doesn't Always Mean More Pavement Damage
- Axle loads and axle clusters are more important than GVW for Pavement damage
- Bridges are more sensitive to higher GVW
- Unpaved roads are difficult to model impacts from higher GVW

**Table VI-1
Highway Infrastructure Elements Affected by TS&W Limits**

Highway Infrastructure Element		Axle Weight	GVW	Axle Spacing	Truck Length	Truck Width	Truck Height
Pavement	Flexible	E		E			
	Rigid	E		e			
Bridge Features	Short-Span	E		E	E		
	Long-Span		E	e	E		
	Clearance					e	E
Roadway Geometric Features	Interchange Ramps		e		E	e	
	Intersections				E	e	
	Climbing Lanes		E				
	Horizontal Curvature		e		e		
	Vertical Curve Length		E				
	Intersection Clearance Time		E		E		
	Passing Sight Distance				e		

Key: E = Significant Effect
e = Some Effect

Table VI-1
Highway Infrastructure Elements Affected by TS&W Limits
Issues Important to Local Jurisdictions

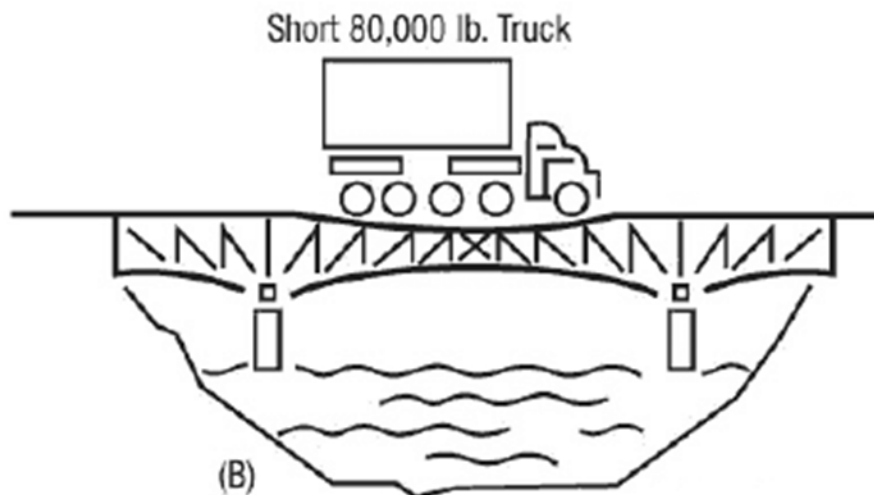
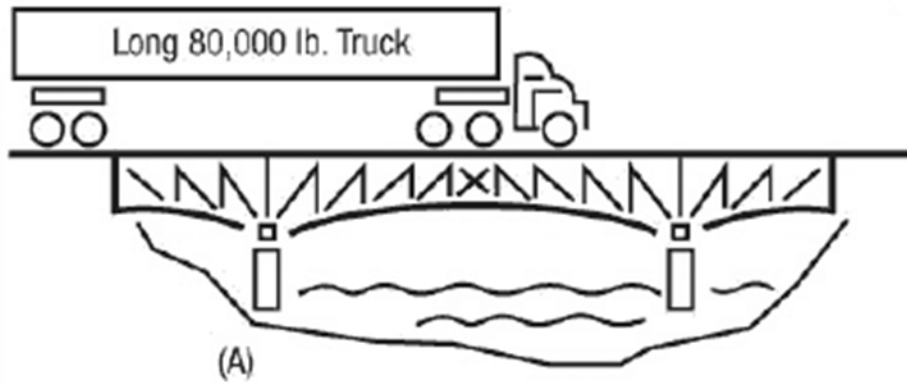
Highway Infrastructure Element		Axle Weight	GVW	Axle Spacing	Truck Length	Truck Width	Truck Height
Pavement	Flexible	E		E			
	Rigid	E		e			
Bridge Features	Short-Span	E		E	E		
	Long-Span		E	e	E		
	Clearance					e	E
Roadway Geometric Features	Interchange Ramps		e		E	e	
	Intersections				E	e	
	Climbing Lanes		E				
	Horizontal Curvature		e		e		
	Vertical Curve Length		E				
	Intersection Clearance Time		E		E		
	Passing Sight Distance				e		

Key: E = Significant Effect
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Axle groups, such as tandems or tridem, distribute the load along the pavement, allowing greater weights to be carried and resulting in the same or less pavement distress than that occasioned by a single axle at a lower weight.

GVW is a factor for the life of long-span bridges – that is, bridge spans longer than the wheelbase of the truck.

Bridge bending stress is more sensitive to the spread of axles than to the number of axles.



Axle spacing is as important as axle weight in designing bridges. In Figure A, the stress on bridge members as a longer truck rolls across is much less than that caused by a short vehicle as shown in Figure B, even though both trucks have the same total weight and individual axle weights. The weight of the longer vehicle is spread out, while the shorter vehicle is concentrated on a smaller area.

Pavements are designed to accommodate projected heavy vehicle axle loads.

Design is based on axle weights, not GVW.

Equivalent Single Axle Load (ESAL) concept – measures effect of heavy vehicles on pavements.

Conventional five-axle tractor-semitrailer operating at 80,000 pounds gross vehicle weight (GVW) is equivalent to about 2.4 ESALs.

If the weight of this vehicle was increased to 90,000 pounds (a 12.5 percent increase), its ESAL value goes up to 4.1 (a 70.8 percent increase), because pavement damage increases at a geometric rate with weight increases.

However, a six-axle tractor-semitrailer at 90,000 pounds has an ESAL value of only 2.0, because its weight is distributed over six axles instead of five.

An added pavement benefit of the 90,000-pound six-axle truck is that fewer trips are required to carry the same amount of payload, resulting in significantly less pavement damage.

<u>Configuration</u>	<u>Total ESALs</u>
Current 5-axle tractor-semitrailer at 80,000 lbs.	2.4
6-axle tractor-semitrailer at 90,000 lbs.	2.0
7-axle tractor-semitrailer at 97,000 lbs.	1.5
8-axle double at 108,000 lbs.	1.8
Single unit 6- and 7-axle respectively	0.7 and 0.9

Approach to Studying Impacts to Local Roads*

- Identify Movements that would use longer Combination Trucks
- Field to Farm – unlikely
 - Difficult to get semi plus pup from field
- Farm to Elevator – Likely
- Elevator to Elevator – Likely
- Oil Development – Likely
- *Subject to steering committee approval

Approach to Studying Impacts to Local Roads

Bridges

- Look for Bridges with ton based restrictions and assess needing replacement
- These would need to be identified as a barrier or cost for moving to higher GVW
- Will not include bridges currently on minimum maintenance roads

Approach to Studying Impacts to Local Roads

Intersections-Geometrics

- Study if longer trucks can make turns at typical township and county road intersections
- Identify typical intersections through survey of an eastern, central and western county.
- Review if longer trucks will damage intersections and then calculate a cost to repair or improve

Approach to Studying Impacts to Local Roads

Intersections-Geometrics

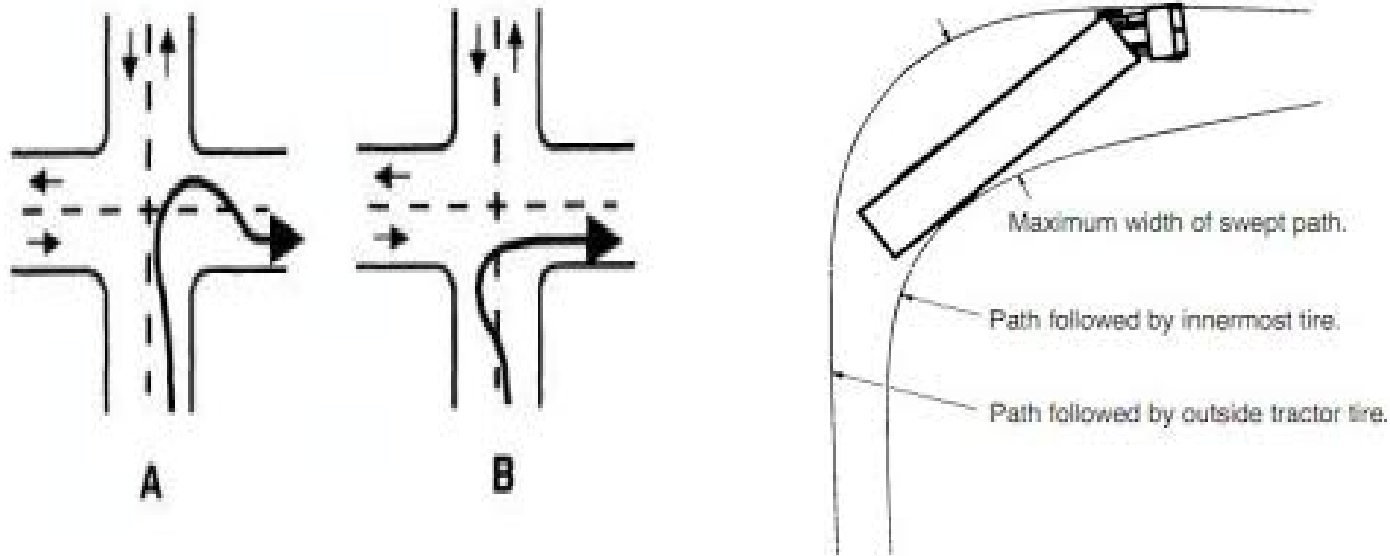
Example of Truck Tracking issue in an urban area

Damage from Wide Turns



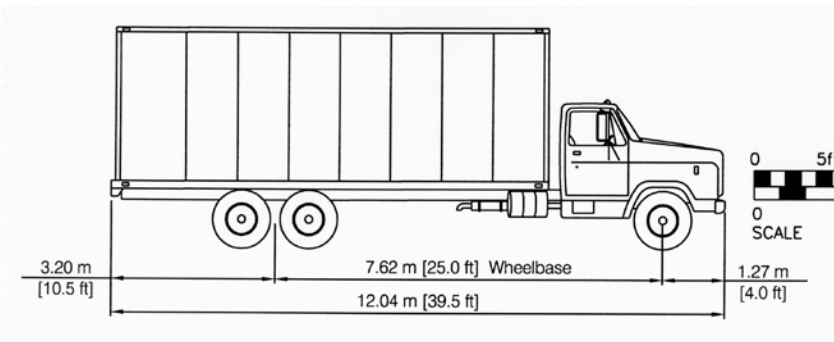
Approach to Studying Impacts to Local Roads

Intersections-Geometrics



Approach to Studying Impacts to and Local Roads

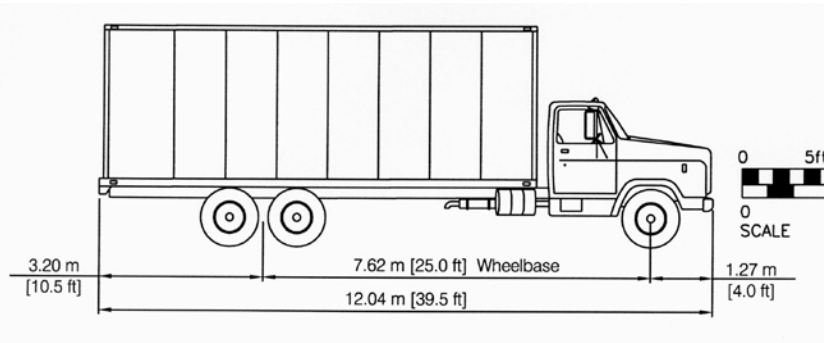
Intersections-Geometrics



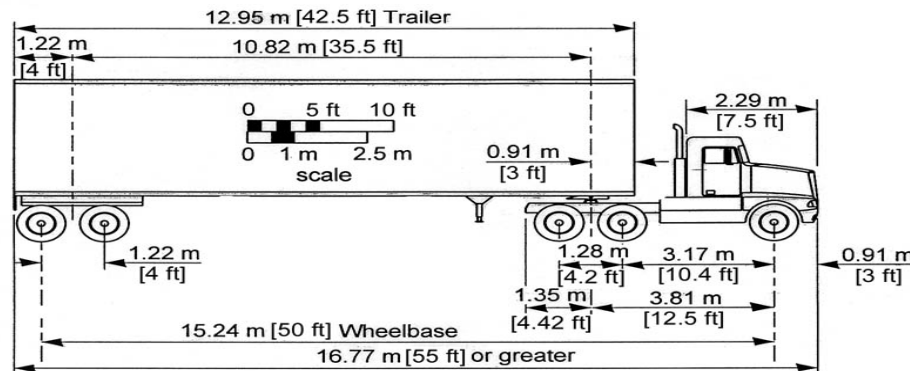
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Approach to Studying Impacts to Local Roads

Intersections-Geometrics



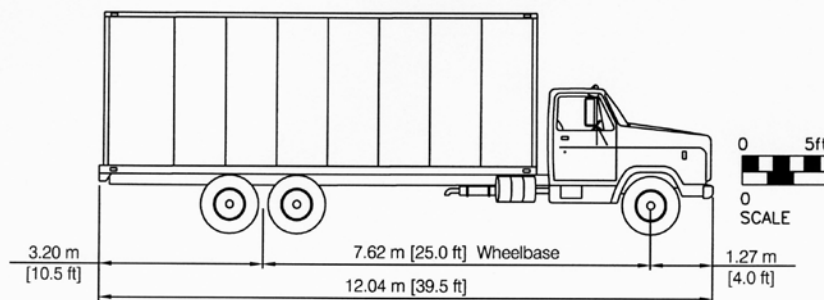
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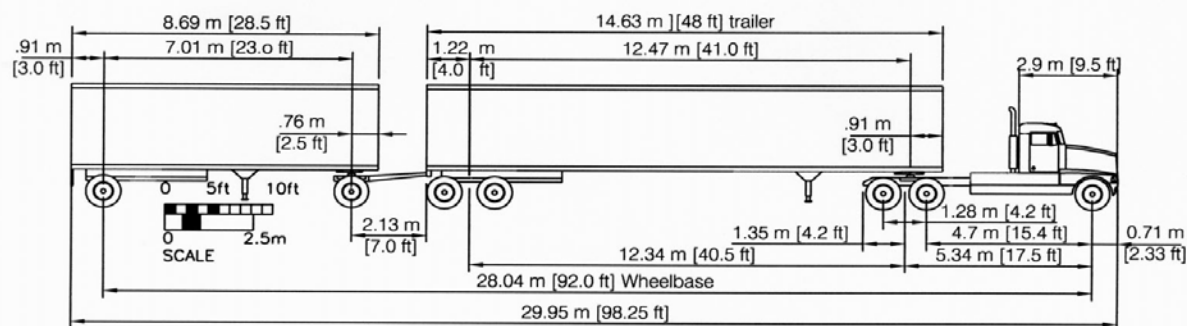
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Approach to Studying Impacts to Local Roads

Intersections-Geometrics



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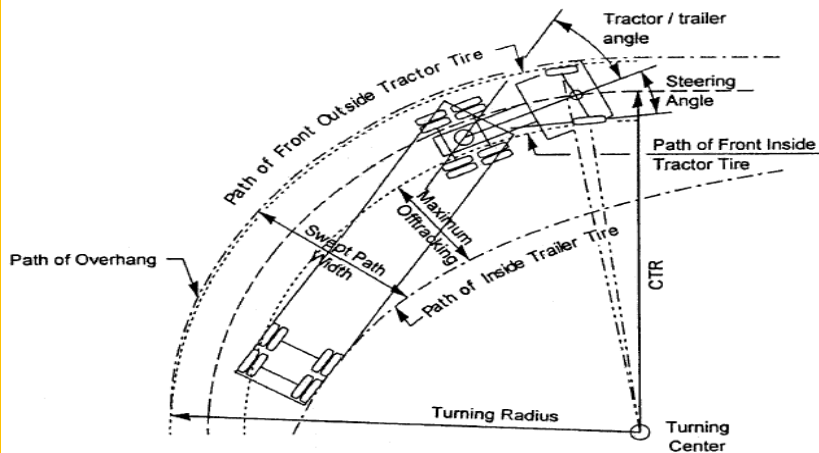


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Approach to Studying Impacts to Local Roads

Intersections-Geometrics

Analyze the truck types for the sampled intersections



Example TWP Intersections

State Hwy Intersection





Thank You!

Questions?