Roll-Coupling Hitches for Heavy Trucks:
``improving safety & truck productivity``

Presentation to Forest Resources Association
May 2012
Trucking Industry Challenges

- **PRODUCTIVITY** – maximize payloads
- **SAFETY** – regulatory mandates & operational incentives
- **ENVIRONMENTAL** – reduce fuel consumption & GHGs

Roll–coupling hitch can help with each of these elements (given the right circumstance)
What is roll-coupling and why is it important?

Loaded trailer (34,000kgs / 75,000lbs.) during a dynamic roll-over event, generates a torsional force of ~103,000 ft-lbs. at the hitch.
Safety Concerns: UMTRI training video

Wolf Trailer "The Safer-Trailer Company"
Evaluating Truck Stability

Progression to rollover as predicted by Load Transfer Ratio

<table>
<thead>
<tr>
<th>LTR</th>
<th>0</th>
<th>0.3</th>
<th>0.6</th>
<th>0.8</th>
<th>0.94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel Loading (kg)</td>
<td>8,500</td>
<td>11,050</td>
<td>13,600</td>
<td>15,300</td>
<td>16,490</td>
</tr>
<tr>
<td>Bunk Angle</td>
<td>0°</td>
<td>8°</td>
<td>16°</td>
<td>21°</td>
<td>25°</td>
</tr>
</tbody>
</table>

Acceptable

Unacceptable

Wolf Trailer "The Safer-Trailer Company"
Stability-Challenged Configurations

Truck and Pony Trailer

A Train Double Trailer Combination  
(single drawbar dolly)

Truck and Full Trailer

Denotes location of pintle hitch coupling

Wolf Trailer "The Safer-Trailer Company"
Stability Comparisons

Resistance to Rollover

- Truck - Pony Trailer
- A Train Double
- Truck - Full Trailer
- B Train Double
- Straight Truck
- C Train Double
- Tractor Semitrailer

Load Transfer in Evasive Maneuver

Wolf Trailer "The Safer-Trailer Company"
General Approach to Regulatory Incentives

Improved dynamic performance / stability

Safer configuration

Opportunities to improve productivity
(...and reduce environmental impacts)
Our Solution = Improved Trailer Stability

Replace the traditional pintle hitch coupling…….

…..with roll-coupling hitch!

(Must transmit a torsional force upto 103,000 ft-lbs.)
Product development: field trials

Wolf Trailer "The Safer-Trailer Company"
Product development: field trials

Wolf Trailer "The Safer-Trailer Company"
Regulatory Acceptance (+ payload incentive)

**BC** - accepted for pony trailers + 3 tonne weight increase and approved for full-trailers at 34 tonnes.

**Saskatchewan** - hosting pilot study for both full and pony trailers

**Four western provinces** - in discussions to develop harmonized regulations for implementing roll-coupling.

**Abroad**

**New Zealand** – introduced concept in 2010 with NZTA (gov’t regulator); have preliminary partnership arrangements with manufacturer (Australian connection) and transportation division (400 trucks) of large dairy.

**USA** – supporting UMTRI research project that includes roll coupling as an option to mitigate issues with larger, more-productive, multi-trailer combinations.
Quick-Change Receiver Design for Truck

Hitch mounting apron at rear of truck frame

Roll-coupling insert

Standard pintle insert

Wolf Trailer "The Safer-Trailer Company"
Quick-Change Coupler for Trailer Drawbar

Traditional arrangement with lunette ring in place

Roll-coupling arrangement with lunette ring rotated out of way
Typical Pony Trailer Installation (BC)

Wolf Trailer "The Safer-Trailer Company"
Unlocking for Off-road Operation

Automatic – speed sensitive
Manually activated/de-activated
Roll-coupled A-train Converter Dolly

Wolf Trailer "The Safer-Trailer Company"
Thank You

Wolf Trailer Company, Inc.
PO Box 1117,
Vernon, BC, V1T 6N4

Toll Free: 1-877-258-9653   Fax: 250-550-7519
Email: Wolftrailer@shaw.ca   http://wolftrailer.com
Return On Investment with 3T Payload Increase

Wolf Trailer "The Safer-Trailer Company"

ROI Projection
(Convert Tridem Pony Trailer)

Cost

Time (Days)

0 50 100 150 200 250 300 350 400

$0 $10,000 $20,000 $30,000 $40,000 $50,000 $60,000 $70,000 $80,000 $90,000 $100,000

10 hr
day

20 hr
day

RC
Cost
Finite Element Analysis

Wolf Trailer "The Safer-Trailer Company"
Variations of Hitch Designs

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Hitch Offset Influence on Load Transfer Ratio

- Tridem Truck Quadaxle Full-trailer
  - Truck wheelbase 6.6 m
  - Trailer wheelbase 6.5 m

Maximum LTR Allowable = 0.6

Load Transfer Ratio vs Hitch Offset (m)

- Non Roll-coupled (GCW 60.5 tonnes; Trlr 31 tonnes)
- Roll-coupled (GCW 63.5 tonnes; Trlr 34 tonnes)
- Non Roll-coupled (GCW 63.5 tonnes; Trlr 34 tonnes)
- Roll-coupled (GCW 65.3 tonnes; Trlr 34 tonnes)

Wolf Trailer "The Safer-Trailer Company"
Establishing the Solution

Wolf Trailer "The Safer-Trailer Company"

- Computer modelling
- Lab testing
- FEA analysis
- Field testing and in-service evaluation
General Approach

Improved dynamic performance / stability

Safer configuration

Opportunities to improve productivity
(...and reduce environmental impacts)
Operational features:
• Simple conversion for towing conventional trailers is done in minutes.
• Self-aligning makes hooking-up easy.
• Roll-coupling mechanism has optional disengagement when off-road.
• Low maintenance