Wisconsin Implements of Husbandry (IoH) Study Group
Recent court cases have highlighted the growing problem of Implements of Husbandry (IoH) definitions and the increasing size and weight of agricultural vehicles running on public roadways.

Study Group Charge:
How can we create a balance that supports Wisconsin’s vital and diverse agricultural industry, while at the same time preserving the public’s investment in state and local roads and bridges and provide for safe travel for all users?
IoH Study Group Membership
Group convened Fall 2012

Wisconsin Department of Transportation - *In partnership with* Wisconsin Department of Agriculture, Trade, and Consumer Protection

- UW Center for Agricultural Safety and Health
- UW-Madison Department of Biological Systems Engineering
- UW-Extension Environmental Resource Center
- Wisconsin Traffic Operations and Safety Laboratory
- Professional Nutrient Applicators Association of Wisconsin
- Wisconsin Farm Bureau Federation
- Professional Dairy Producers of Wisconsin
- Wisconsin Towns Association
- Wisconsin County Highway Association
- Maxville Truck and Repair
- League of Wisconsin Municipalities
- Wisconsin Agri-Business Association
- Husky Farm Equipment (Ontario, Canada)
- Association of Equipment Manufacturers (Milwaukee, Wisconsin)
- Dairy Business Association
- Wisconsin Independent Businesses – Agri-Business Coalition
- RCI Engineering LLC
- *With additional support from*
  - John Deere
  - Kubota Tractor Corporation
  - Case New Holland (CNH)
  - AGCO

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Types of IoH Considered

Category I: Prime

Category II: Self-Propelled

Category III: IoH-CMV

Category IV: IoH Vehicle Trains
Evaluation Process - Pavements:

- **Structural Analysis** – Based on layered elastic (mechanistic) methodology
- **Damage Analysis** – Based on Miner’s rule of accumulated damage
- **Weather** – Based on average statewide condition and varied throughout the year.
- **Subgrade** – Average subgrade properties were used and structural capacity varied by time of year.
- **Pavement Structure** – Four different representative pavement structures were evaluated
Evaluation Process - Bridges:

- Only bridges with span lengths over 20 feet were evaluated.
- Evaluation of the vehicle based on the Federal Bridge Formula (FBF).
  It must be noted that though a useful tool, the FBF was intended for vehicles with standard tire widths and gauges; these IoH vehicles fall outside those parameters.

- Analysis of the moment (bending) and shear demands of these vehicles on approximately 12,000 structures with various span configurations.
  These demands were then compared to the demands of various design and posting vehicles to determine their relative impact.

- Analysis of approximately 9000 State and Local bridges to determine their safe load-carrying capacity with respect to these particular vehicle configurations.
  This was information used to support High, Medium, and Low impacts to bridge infrastructure. A number of assumptions on load distribution needed to be used as a result of lack of established factors.
Developing Recommendations

- Bridge and Pavement experts reviewed results of analysis and reached joint conclusion on what would be a manageable impact to the road and other structures.

- Pavement and Structures collaborated to create the IOH Engineering Matrix
# Equipment Analysis – Empty and Loaded Configurations

<table>
<thead>
<tr>
<th>IoH Category</th>
<th>Photo</th>
<th>Vehicle ID</th>
<th>Vehicle Make</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>![Tractor Image]</td>
<td>TR</td>
<td>John Deere 8430</td>
</tr>
</tbody>
</table>

## Empty Configuration

<table>
<thead>
<tr>
<th>Gross Weight</th>
<th>Meets FBF?</th>
<th>Controlling Element for FBF</th>
<th>BRIDGE Impact</th>
<th>PAVEMENT Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total = 30,240 lbs</td>
<td>YES</td>
<td>Axle 2 = 17,300 lbs</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Axle 1 = 12,900</td>
<td></td>
<td>87% of FBF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axle 2 = 17,300 lbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Fully-Loaded Configuration

<table>
<thead>
<tr>
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</table>
IoH Initial Recommendations

- Phase II Report sent to WisDOT Secretary on July 31st
- Stakeholder outreach included 6 Town Hall Meetings around Wisconsin in August and September and extensive media coverage
  - Over 1,200 attendees
  - Over 530 surveys collected
  - Over 150 written comments received (letters & emails)
- Town Halls and Surveys provide information on equipment in use that had been difficult to obtain through other channels.
Town Hall Findings:

- 22% to 36% of attendees did not know there was an IoH weight limit
- More than half did not know the gross vehicle weight of their largest piece of equipment
- 75% of participants had equipment that exceeded preliminary study groups recommendations for envelope size and weight limits:
  - 13’6” Height
  - 17” width
  - 60/100/70 length for 1/2/3 vehicles
  - 23,000 lbs. per axle/
  - 92,000 lbs. gross vehicle weight
Survey Results:

- Almost 70% of respondents exceeded the proposed width limit -- with over 40% operating equipment over 19 feet wide.
- Almost half did not know the individual axle weight and gross vehicle weight of their largest piece.
- 33% operate unloaded IoH that exceed the 23K/92K.
- 46% operate loaded IoH that exceed the 23K/92K.
**Clarify the IoH Definition:** Create a clearer, simpler definition of IoH to reflect today’s agricultural equipment. Noting:

- All IoH will be exempt from registration.
- There is a need for an IoH-CMV definition for commercial motor vehicles used exclusively for agricultural operations.
Final Recommendations

- Create size limits or an “envelope” for IoH:
  - **Width envelope**: No width limit for IoH, however lighting and marking is required if IoH is wide enough that it crosses over the centerline of the roadway during operation. Requirement applies the lighting standards of American Society of Agricultural Engineers (ASAE) S279 to **all IoH** (new and those in currently in service). Lighting must be visible to traffic bidirectionally.
  - Width of IoH CMV – 10’ (feet).
Final Recommendations

- **Height envelope:** No height limit, however the IoH operator is responsible for ensuring safe clearance of any overhead obstructions.

- **Length envelope:** Create 60’ limit for a single IoH and 100’ for combinations of two IoH. For combinations of three IoH the limit is 70’, but a three IoH combination may operate at lengths exceeding 70’ to a limit of 100’ at a speed no greater than 20 miles per hour.*

*WisDOT has concerns about this recommendation and would like to research.
Create a new IoH Weight limit:

- IoH is given an expanded 15% weight allowance over the limits as established by the Federal Bridge Formula, except where posted and during periods of spring thaw.

- This equates to a maximum single axle weight of 23,000 pounds and a maximum gross vehicle weight of 92,000 pounds.
Final Recommendations

- Require Written Authorization to exceed weight limit:
  - On an annual basis IoH operators may submit a travel or route plan and request written authorization from the maintaining authority to exceed the weight limit.
  - A nominal fee may be charged and additional conditions may be set by each maintaining authority.
  - Intent is to generate conversations between IoH operators and local officials.
  - IoH vehicles operating in excess of the 15% allowance will be fined for the amount in excess of standard gross motor vehicle weight or individual axle weight.
Final Recommendations

- Support Best Practices
- Develop youth further training requirements for large IoH equipment operations
- Establish a standing forum to continue to address issues regarding the use of agricultural equipment on roadways
- Advance the issues of size, weight, and more to groups such as FHWA and AASHTO to encourage the development of national standards.
Final Recommendations

- Partner with DATCP and others to do outreach in agricultural community
- Create Rural Safety Awareness campaign for planting and harvest seasons
- Review Driver’s Education materials for rural road content
- Develop education materials for local officials and law enforcement
Research Needs:

- Distribution Factors related to IOH type equipment to be used in the analysis of bridges
- Impact Factors related to IOH type equipment to be used in the analysis of bridges
- Impact of tire configurations and design on bridges and structures
- Design Code Provisions for the inclusion of the effects of IOH on the design of new structures
- Methods to retrofit existing structures that were designed with lower load configurations or that have experienced deterioration that has reduced the load capacity of the structure below the needs of IOH equipment.
Contacts/Resources:

- Dan Grasser – DTSD Administrator daniel.grasser@dot.wi.gov
- Rory Rhinesmith – IoH Study Chair/DTSD Deputy Administrator rory.rhinesmith@dot.wi.gov
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- Steve Krebs – WisDOT Chief Materials Engineer steven.krebs@dot.wi.gov
- WisDOT Website: http://www.dot.wisconsin.gov/business/ag/index.htm