TRANSPORTATION INFRASTRUCTURE IN WISCONSIN:
MORE THAN JUST ROADS

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MORE THAN JUST ROADS

HOW DO WE DEFINE TRANSPORTATION INFRASTRUCTURE?

INFRASTRUCTURE : The underlying framework or features of a system.
INFRASTRUCTURE

- CAPITAL / PUBLIC TREASURY
  - THE MEANS BY WHICH ROADS AND BRIDGES ARE CONSTRUCTED AND MAINTAINED

- SYSTEM MANAGEMENT
  - SYSTEM OVERSIGHT
  - PLANNING AND BUDGETING

INFRASTRUCTURE

- ENGINEERING AND DESIGN
  - DEFINING EXISTING CONDITIONS
  - DESIGNING FACILITIES TO STANDARDS
  - PREPARATION OF PLANS AND CONTRACT DOCUMENTS

- CONSTRUCTION
  - CONSTRUCT FACILITY TO PLAN AND SPECIFICATIONS
INFRASTRUCTURE

- MAINTENANCE
  - THE EFFORT REQUIRED TO MAINTAIN A GIVEN ROADWAY AS CLOSE AS POSSIBLE TO ORIGINAL CONDITION
  - PRESERVATION OF PUBLIC SAFETY
  - PROTECTING ROADWAY FROM HARMFUL EFFECTS OF CLIMATE AND ENVIRONMENT
  - PRESERVING ROAD’S LONGEVITY

INFRASTRUCTURE

- LAW ENFORCEMENT
  - TRAFFIC LAW ENFORCEMENT / PUBLIC SAFETY
  - PROTECT ROADS AND BRIDGES FROM DAMAGE AND PREMATURE FAILURE DUE TO OVERWEIGHT LOADS – WEIGHT ENFORCEMENT
EFFECTS OF OVERWEIGHTS ON INFRASTRUCTURE

- LESS HIGHWAY LONGEVITY
- MORE DAMAGE TO HIGHWAYS
- MORE COST TO THE TAXPAYER
- WITHOUT INVESTMENT- LOWER QUALITY ROADS

HIGHWAY DESIGN 101

- You wouldn’t put frosting on a rock and call it a cake...
- Roads: from the bottom up and from the outside in
TYPICAL SECTION

- Elements
  - Cross-slopes
  - Materials
  - Dimensions
Reconstruction: How do you get to over $1 million per mile?

- Design
- Right of Way Acquisition
- Utility Relocation
- Project Management/Administration
- Construction
- Structures or other unique situations

**Pierce County**

- Life of Roadway: 50 years
- Miles: 248
- Life cycle requirement for reconstruction: 5 miles per year
- Cost: $5.79 million
- Likely appropriation: $2.5 million
SUBGRADE (IN SITU SOIL)

- Type of soil
- Grain size and ability to drain
- Freeze – Thaw: how does it react?

IMPROVING THE SUBGRADE

- Drainage! Drainage! Drainage!
- Remove areas of undesirable soil:
  - EBS (Excavation Below Subgrade)
- Shape and Compact
SUBGRADE TREATMENTS

- Moisture management
- Products
  - Geogrids
  - Fabrics
- Stabilizations
  - Flyash
  - Lime

SUBBASE

- Above the subgrade, below the base course
  - Breaker rock
  - Sand
BASE COURSE

- 1 ¼” crushed limestone
- Sand and gravel
- WATCH THE P200!

PAVEMENT

Types:

- Flexible
  - Hot Mix Asphalt
- Rigid
  - Concrete
PAVEMENT STRUCTURE

- Pavement does not carry the entire load, it also distributes it!

PAVEMENT DESIGN

- Factors
  - Traffic count
  - Truck percentage of the traffic count
  - Soils
  - Design Life
STANDARD DESIGN

- A Structure Number (SN) is established from the traffic and soil factors
- Layer coefficients for HMA, Base and Subbase are used to match or exceed the SN

PAVEMENT DETERIORATION

- 20-year life with proper maintenance
  - Crackfilling and sealcoat
- Fatigue from loading
- Fatigue from Freeze-Thaw and weather
WHAT IS AN ESAL?

- Equivalent Single Axle Load
  - A unit of damage – 18,000 lb single axle
  - A road is an ESAL bank
  - How many ESALs do you need for 20 years?

Axle Load Factors

![Axle Load Factors Image]
NATURE OF ESALS

- EXPONENTIAL INCREASE IN DAMAGE DUE TO INCREASED WEIGHT

\[
\left( \frac{\text{WEIGHT OF AXLE}}{18,000 \text{ LBS.}} \right)^4 = \text{ESALS}
\]

SINGLE AXLE: load factors

<table>
<thead>
<tr>
<th>Axle load</th>
<th>ESAL load factor</th>
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<tbody>
<tr>
<td>12 kips</td>
<td>0.23</td>
</tr>
<tr>
<td>14 kips</td>
<td>0.40</td>
</tr>
<tr>
<td>16 kips</td>
<td>0.65</td>
</tr>
<tr>
<td>18 kips</td>
<td>1.00</td>
</tr>
<tr>
<td>20 kips</td>
<td>1.49</td>
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</table>
EXPONENTIAL NOT LINEAR DAMAGE

- 18 KIPS = 1.00 ESALS
- 20 KIPS = 1.49 ESALS

11% INCREASE IN WEIGHT =
50 % INCREASE IN DAMAGE

DUAL AXLES: load factors

*Adjusted for a 4'-2" axle spacing

<table>
<thead>
<tr>
<th>Dual Axle load</th>
<th>ESAL load factor*</th>
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<tbody>
<tr>
<td>32 kips</td>
<td>0.90</td>
</tr>
<tr>
<td>33 kips</td>
<td>1.00</td>
</tr>
<tr>
<td>36 kips</td>
<td>1.40</td>
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<tr>
<td>38 kips</td>
<td>1.70</td>
</tr>
<tr>
<td>40 kips</td>
<td>2.09</td>
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</table>
EXPONENTIAL NOT LINEAR DAMAGE

- 36 KIPS = 1.40 ESALS
- 40 KIPS = 2.09 ESALS

11% INCREASE IN WEIGHT = 50% INCREASE IN DAMAGE

Raw Forest Truck Configurations

<table>
<thead>
<tr>
<th>Vehicles in Combination</th>
<th>Max. Gross Weight</th>
<th>Truck ESAL Factor</th>
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<tbody>
<tr>
<td>C</td>
<td>90K</td>
<td>3.76</td>
</tr>
<tr>
<td>D</td>
<td>98K</td>
<td>2.85</td>
</tr>
<tr>
<td>E</td>
<td>98K</td>
<td>3.11</td>
</tr>
<tr>
<td>F</td>
<td>90K</td>
<td>4.38</td>
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</tbody>
</table>
BRIDGES

BRIDGE LOADING

- AXLE LOAD AND SPACING MUST BE CONSIDERED
- LOW ESALS ON HIGHWAYS CAN EQUAL HIGH LOADINGS ON BRIDGES
ESAL BANK ROBBERS

- OVERWEIGHT VEHICLES AND EQUIPMENT
- UNANTICIPATED HAULING

HOW DO OVERWEIGHTS OCCUR?

- DELIBERATE OVERWEIGHTS
  - OVERWEIGHT HAULING IS PROFITABLE
  - OBEYING POSTINGS IS INCONVENIENT
  - NO FEAR OF ENFORCEMENT
HOW DO OVERWEIGHTS OCCUR?

INADVERTENT OVERWEIGHTS
- FAILURE TO SCALE LOAD
- ASSUME EXEMPT OR EXCEPTION
- DON'T UNDERSTAND POSTINGS APPLY TO THEM
- NO FEAR OF ENFORCEMENT

HOW DO OVERWEIGHTS OCCUR?

LEGAL OVERLOADS
- STATE EXEMPTIONS
- STATE EXCEPTIONS
- STATE SPECIAL PERMITS
- FAILURE OF LOCALS TO POST THEIR ROADS AND BRIDGES
WHAT IS UNANTICIPATED HAULING?

- FAILURE TO ESTIMATE LOADINGS IN DESIGN PROCESS
- UNEXPECTED SITING OF BUSINESS OR INDUSTRIES
- UNEXPECTED CHANGES TO TRAFFIC PATTERNS
- AVOIDANCE OF ENFORCEMENT

WHAT CAN BE DONE TO PREVENT ESAL BANK ROBBERIES?

- ENGAGE IN POLITICAL PROCESS
  - PROTECT LOCAL CONTROL OVER LOCAL ROADS
  - OPPOSE BLANKET EXEMPTIONS AND EXCEPTIONS
  - SHINE SPOTLIGHT ON DAMAGE CAUSED BY OVERLOADS
WHAT CAN BE DONE TO PREVENT ESAL BANK ROBBERIES?

- **ENGAGE IN POLITICAL PROCESS (CONT’D)**
  - DEMAND THAT CHANGES TO WEIGHT LAW BE DONE IN THE CONTEXT OF A “NO HARM” APPROACH
  - STRONGER ENFORCEMENT/ ZERO TOLERANCE FOR VIOLATORS
    - MORE ENFORCEMENT ON LOCAL SYSTEM
    - HIGHER FINES
    - LOSS OF PERMIT OR PRIVILEGES

WHAT CAN BE DONE TO PREVENT ESAL BANK ROBBERIES?

- **EXERCISE LOCAL AUTHORITY**
  - POSTING
    - SPECIAL OR SEASONAL (SS 349.16)
    - CLASS “B” (SS 349.15)
  - REQUIRE BONDING
  - LOCAL ENFORCEMENT
  - ZONING/ LAND USE CONTROL
  - PROMOTE FROZEN ROAD HAULING
ASHLAND COUNTY POLICY

- POOR SOILS - CLAY AND FROST SUSCEPTIBLE TYPES
- DO NOT HAVE SUFFICIENT PAVEMENT STRUCTURE FOR SPRING CONDITIONS
- POST NEARLY ALL COUNTY TRUNKS DURING SPRING THAW
- USE FROST TUBES TO MEASURE FROST AND THAW
ASHLAND COUNTY SPRING POSTING POLICY

- NO SET DATE, DETERMINED PURELY BY THAW INFORMATION COLLECTED FROM FROST TUBES
- ADVANCE NOTICE FOR IMPENDING POSTING (ONE OR TWO WEEKS)
- SHORT NOTICE FOR ACTUAL POSTING (OFTEN ONLY A DAY OR TWO)

ASHLAND COUNTY SPRING POSTING POLICY

- TRY FOR A WEEKDAY MORNING POSTING
- TRY TO MAKE SURE ACTIVE ENFORCEMENT IS TAKING PLACE JUST BEFORE AND JUST AFTER POSTING
- USE NEWSPAPER, E-MAIL, RADIO STATIONS TO ANNOUNCE POSTING
- TRY TO COORDINATE WITH OTHER COUNTIES
ASHLAND COUNTY SPRING POSTING POLICY

- 4 TON PER AXLE LOAD LIMIT (EMPTY TRUCK)
- NO BLANKET EXEMPTIONS OR EXCEPTIONS
- ALLOW SPECIAL HAULING THROUGH PERMITS ISSUED BY HIGHWAY DEPARTMENT OFFICE

ASHLAND COUNTY SPRING POSTING POLICY

- SPECIAL HAULING PERMITS MUST MEET A REASONABLENESS TEST
- THERE ARE NO ORAL PERMITS, MUST HAVE A WRITTEN PERMIT IN VEHICLE
- THERE ARE NO RETROACTIVE OR POST ENFORCEMENT PERMITS
- GRANTED ONLY WHERE NO ALTERNATIVE ROUTE EXISTS
ASHLAND COUNTY SPRING POSTING POLICY

- SPECIAL HAULING PERMITS CONTAIN:
  - VEHICLE LICENSE NUMBER
  - DATE AND TIME FOR TRIP
  - SPECIFIC ROUTE
  - TOTAL WEIGHT/ LOAD SIZE (%)
  - CARGO
  - VEHICLE CONFIGURATION (AXLES)

ASHLAND COUNTY PROBLEMS – PAST & PRESENT

- FIRST TIME POSTINGS – POLITICAL END RUNS
- COMPLAINTS ON LACK OF NOTICE
- ENFORCEMENT
  - LACK OF 24 HOUR/ DAY COVERAGE
  - LIMITED OR NO LOCAL ENFORCEMENT
  - CONFUSION ON HOW TO IDENTIFY OVERLOAD
ASHLAND COUNTY PROBLEMS – PAST & PRESENT

- HOME BASED BUSINESSES
- SMALL BUSINESSES (BARS & RESTAURANTS)
- AGRICULTURE – ASSUMED EXEMPTION
- ESSENTIAL SERVICES – FUEL HAULING
- COORDINATION WITH ZONING DEPARTMENT – ASSUMPTION COUNTY ZONING PERMIT ELIMINATES NEED TO OBEY POSTINGS
- TAKING TRUCKS HOME

ASHLAND COUNTY SUCCESSES

- GOOD COMPLIANCE
- ENFORCEMENT HAS IMPROVED, DUE TO A CLEARER UNDERSTANDING OF LIMITS
- COOPERATION FROM HAULERS IMPROVES EVERY YEAR
- BEHAVIOR HAS CHANGED – FEWER TRIPS, ALTERNATE APPROACHES AND BETTER PLANNING BY USERS
ASHLAND COUNTY SUCCESSES

- FROST TUBES HAVE ELIMINATED GUESS WORK
- SEEMS TO BE A BETTER UNDERSTANDING OF THE VULNERABILITY OF HIGHWAYS IN SPRING
- OVERALL PROTECTION OF THE HIGHWAY INFRASTRUCTURE HAS IMPROVED

THANK-YOU

QUESTIONS?