Traffic Load Data And Pavement Design Engineers

Traffic Load Inputs
and
the NCHRP 1-37A Software

What it means to you
Required Traffic Data for NCHRP 1-37A

- Project Specific Axle Load Spectra for the Design Lane (actual conditions)
  - By time of day
  - Adjusted for volume differences by season
How We Get Load Spectra

- Vehicle classification counts
- Weigh-in-motion measurements
Loading Data Into NCHRP 1-37A Software

- Electronic files from traffic monitoring equipment
- Summary files and statistics from analysis of the collected data
Although most state highway agencies do collect the data needed

Many state highway agencies do not:
  – Compute the necessary summary statistics
  – Have their data readily accessible
Why Not?

- Many pavement designers don’t use new load data
- Many pavement designers have never looked at differences in loading rates from road to road or region to region
If designers don’t ask for specific summaries, those summaries will not be developed.
Limited resources for data collection and analysis + Limited use of the current data = No impetus or ability to create the necessary summaries
Why are actual loading rates important?

- Loading rates vary dramatically from road to road
- Weights per truck (and axle) change
- Truck volumes and patterns change
Tandem Axle Load Distribution
Lightly Loaded Trucks

Maximum Weight in a Given Axle Weight Group (x 1,000 lbs)

Fraction of Tandem Axles in Weight Group

0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16

6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
Tandem Axle Load Distribution
Heavily Loaded Trucks

Maximum Weight in a Given Axle Weight Group (x 1,000 lbs)
Tandem Axle Load Distribution – Mixed Truck Loads

Fraction of Tandem Axles in Weight Group

Maximum Weight in a Given Axle Weight Group (x 1,000 lbs)
ESAL Comparison

Lightly Loaded Tandems = 0.186 (flexible)
Moderately Loaded Tandems = 0.355
Heavily Loaded Tandems = 0.666

Simple conclusion:

Not knowing the loaded/unloaded condition can equal a 3X error in life expectancy
And those errors assume perfect truck volume estimates.

Yet truck volumes change even more dramatically.
Time of Day Truck Volume Variation

- Rural Cars
- Business Day Trucks
- Through Trucks
- Urban Cars
Seasonal Truck Volume Variation

Month of the Year

- Urban Cars
- Rural Cars
- Rural Combination Trucks
- Rural Single Unit Trucks
So?

- If Pavement Design doesn’t ask for it
- Traffic analysis won’t compute it
Which Means?

If You Want Good Load Data To Use In NCHRP 1-37A

- Pavement Designers need to ask for load spectra data
- Pavement Designers need to work with traffic data collection and analysis offices to ensure the summaries are done correctly
Pavement Designers may need to help supply the resources needed to develop these statistics.
What’s Needed?

● Resources
  – To collect data
  – To quality assure data
  – To analyze data
  – To summarize data
  – To report and make data available
The End
Required Traffic Data for NCHRP 1-37A

- Project Specific Axle Load Spectra for the Design Lane (actual conditions)
  - By time of day
  - Adjusted for volume differences by season
How do we compute load spectra?

- Load spectra are computed using:
  - Truck weight data (to shape the W-4 table)
  - Truck volume data (to size the W-4 table)

- But load estimates are needed by:
  - By environmental condition
  - By day / night condition
  - For specific roadways
Good News / Bad News

- The Good News: Your state probably already collects most of the data you need

- The Bad News: It may not analyze / summarize it in the format you need
The Data Collection Program

- Is defined in and supported by the FHWA Traffic Monitoring Guide

- Consists of
  - Short duration classification counts
  - Continuous Classifiers
  - WIM
Short Duration Classifiers

Provide:

- Site specific truck volumes (by class)
- Lane and direction specific volumes
- Time of day distributions
Continuous Classifiers

- Seasonal adjustment factors
- Day-of-week adjustment factors
- Trend information
Weigh-in-Motion
Provides

- Truck weights
  - Axle weights by type of axle
The amount of traffic data available changes the quality of the load estimate.
For Example?

- A VERY GOOD Estimate:
  - WIM data collected on the road being re-paved

- A DECENT Estimate
  - A lane specific, hourly truck volume count
  - A W-4 table of regional axle loads per truck from the state database
  - Some adjustment factors estimated by your central office
For Example?

- A POOR Estimate
  - AADT
  - Percent Trucks
  - Statewide W-4 table
  - Other factors from state data
### NCHRP 1-39 Design “Levels”

<table>
<thead>
<tr>
<th>Level</th>
<th>Understanding of Traffic</th>
<th>Class</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Good</td>
<td>Continuous at Site</td>
<td>Site Specific</td>
</tr>
<tr>
<td>Level 2</td>
<td>Modest</td>
<td>Site Specific, but short</td>
<td>Regional (TWRG) Average</td>
</tr>
<tr>
<td>Level 3</td>
<td>Poor</td>
<td>No Actual Class Data</td>
<td>Statewide Average</td>
</tr>
</tbody>
</table>
State Needs

- Refining the current data collection program
- Analyzing / summarizing the data into the statistics / formats needed
- The NCHRP 1-39 software will help with this (but will not do it all)
What’s Different? - Classification

- Need hourly volume data by class for design
  - greater detail than before
  - For design lane is preferable (better accuracy)
- Need site specific counts
  - better accuracy
- Need adjustments
  - Day-of-week, seasonal volume differences
  - Better accuracy
What’s Different? - Classification

- Continuous Counters
  - Need data to be analyzed and used
  - Need to compute traffic patterns
  - Need to determine how traffic patterns change across the state
What’s Different?
Weigh-in-Motion

- Need to use the data we collect
- Need to determine traffic patterns
  - Where are heavy trucks moving?
  - How much do they weigh?
- Need to make sure the data we collect are accurate
NCHRP 1-39 Software Will

- Take the data already collected
- Help organize it
- Input it into the NCHRP 1-37A software