NCHRP 1-39
Traffic Data For Mechanistic Pavement Design
Required traffic loads are defined by the NCHRP 1-37A project software.

NCHRP 1-39 supplies a more robust mechanism to enter that data.

1-39 software converts traffic monitoring data into pavement design inputs.
Axle Load Spectra are the primary NCHRP 1-37A traffic load input
- Axle Load Spectra are basically W-4 tables
- Requires lane specific volumes / weights
Axle Load Spectra

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

- But load estimates are needed by
  - Environmental condition
  - Day / night condition
Extra Information Needed

- Monthly truck volumes (or seasonal adjustment factors)
  - Allow computation of unbiased annual average
  - Size the load spectra by month (season / environmental condition)

- Hourly truck volume distribution
  - Provides day versus night load distribution
Extra Information Needed

- Forecasts of truck volume growth
  - Shape of curve (linear? exponential?)
  - Size of growth

- Are you currently monitoring truck volume growth?
Data Program - Introduction

- Site specific data are better than “average” data for a state or group of roads

- Averages are used when necessary
Short count data are used to provide:

- Site specific vehicle volumes
- Lane distribution information
- Time of day distributions
Continuous count data are used to create:

- Seasonal adjustment factors for truck volumes
- Day-of-week adjustment factors
- Tracking trends
NCHRP 1-39 Design

- 1-39 software is intended to allow state highway agencies to
  - maximize the use of the data they already have
  - encourage the collection of better data
    - by showing better pavement design reliability when the data used are more reliable
Takes the diverse input data
Is designed to work with files produced by existing state traffic software
Will read existing data formats:
  – C-cards
  – W-cards
  – Plan is for version 2.0 to read other formats (directly read VTRIS DBF files)
NCHRP 1-39 Software

- Creates required NCHRP 1-37A data sets, for example
  - the number of axles per truck (by type of axle) for each class of trucks
  - seasonal factors (from continuous classifier data)
  - TWRG load distributions (from load spectra)
Different “Levels” of design.
- “Levels” relate to reliability of the load estimate
- A different “Level” can be used for vehicle class data than is used for weight data
- “Reliability” is reflected in statistical confidence associated with each load estimate
NCHRP 1-39 Software

- Will compute required NCHRP 1-39 error statistics for traffic 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>
Data Collection Levels

- Each “Level” can be further sub-divided
- For example, Level 2 Class can be
  - 7-day counts, 3 or 4 times per year
  - 48-hour counts, 3 or 4 times per year
  - One, 7-day count
  - One, 48-hour count
  - Short duration 6-hour) manual count
- Each subdivision has its own reliability
Data Collection Levels

- **Class**
  - 3A: Volume only, but where a classification count has been made somewhere on that road
  - 3B: Where no measured classification data exists to make an estimate
Weight Levels

1: Site specific
   - 1A: Continuous
   - 1M7: Seasonal samples taken
   - 1S7: One week long count
   - 1SD: One short duration count

2: Truck Weight Road Group (TWRG)

3: Statewide average
Level 2: Truck Weight Road Group (TWRG)

- Groups of roads that have similar load characteristics.
  - (Shape of W-4 curves, not number of actual loads)
Tandem Axle Load Distribution

Fraction of Tandem Axles in Weight Group

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

<table>
<thead>
<tr>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate and arterial major through-truck routes</td>
<td>Interstate and other through routes</td>
</tr>
<tr>
<td>Other roads – eastern part of state</td>
<td>Roads serving heavy industry, ports, and inter-modal terminals</td>
</tr>
<tr>
<td>Other roads – western part of state</td>
<td>Other roads</td>
</tr>
</tbody>
</table>
NCHRP 1-39 Software

- Allows use of
  - 13 FHWA vehicle categories, or
  - Up to 20 state defined vehicle categories, or
  - 3 or 4 length categories

- State must provide correlation between classifier data and WIM data
Outputs of 1-39 Software

- Load spectra (by VC and axle-group type)
- Error statistic for load spectra
- AADT(VC)
- Coefficients of variation (CVs) for the AADT(VC)
- Monthly distribution of AADT
- Directional distribution factor
- Time-of-day (hourly) distribution of AADT (by VC)
- Average number of axle groups (by type) for each VC
- Growth rates for the AADT(VC)
What Does 2001 TMG + AASHTO 2002 Guide Mean To Data Collection Programs?
What’s it mean?

- Truck volume counts mean more, so do more
- Understand seasonal, day-of-week movements of trucks
What’s It Mean?

- Plan ahead, where pavement design will occur – count early, efficiently

- Learn more about truck weight patterns:
  - Where are trucks heavy?
  - Where are trucks light?
What’s it Mean?

- Analyze the data you already have
- Learn how truck patterns (volumes / weights) change across your state
- Use that knowledge in the pavement design process