“Traffic”

2005 Southeast Pavement Management and Design Conference

June 20, 2005

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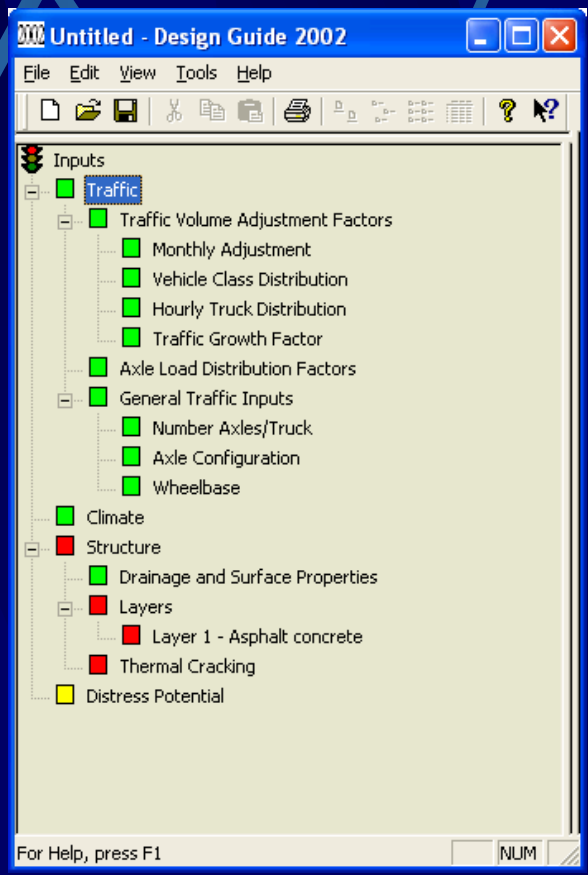
Austin, Texas

Content

- Traffic Data for the ME Pavement Design Guide
  - Input Requirements
  - Available Tools
  - Implementation
- Equipment
- LTPP Pooled Fund Study on Traffic Data Collection

Traffic in the ME Pavement Design Process

- Load Spectra
- Three Design Levels
- The more involved the design, the more traffic data required.



Traffic Load Spectra

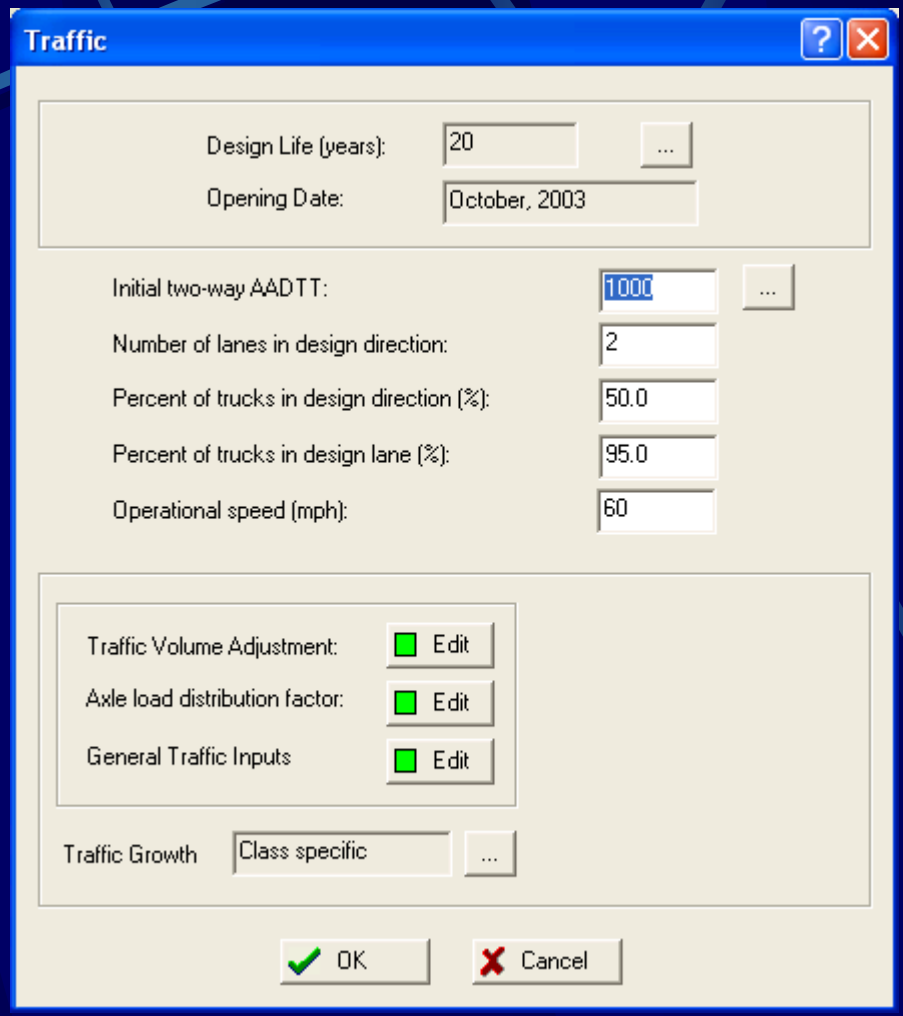
- **Load spectra is the distribution of the number of axles by load ranges for different axles (single, tandem, tridem, quad) for various vehicle classes.**
- **Distribution by time (e.g., concrete pavement distresses greatly influenced by hourly traffic distribution)**

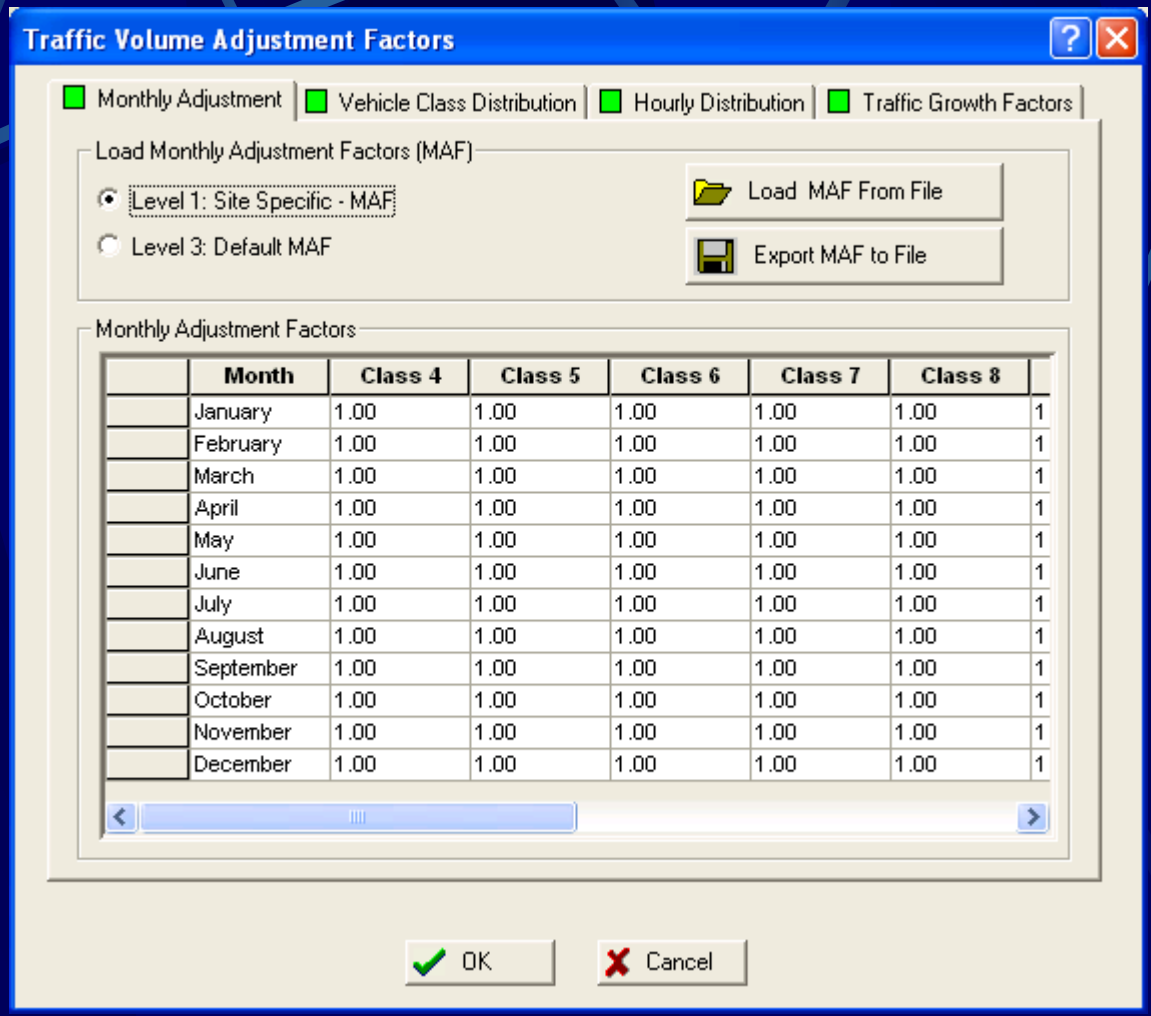
Traffic Hierarchical Input Levels:

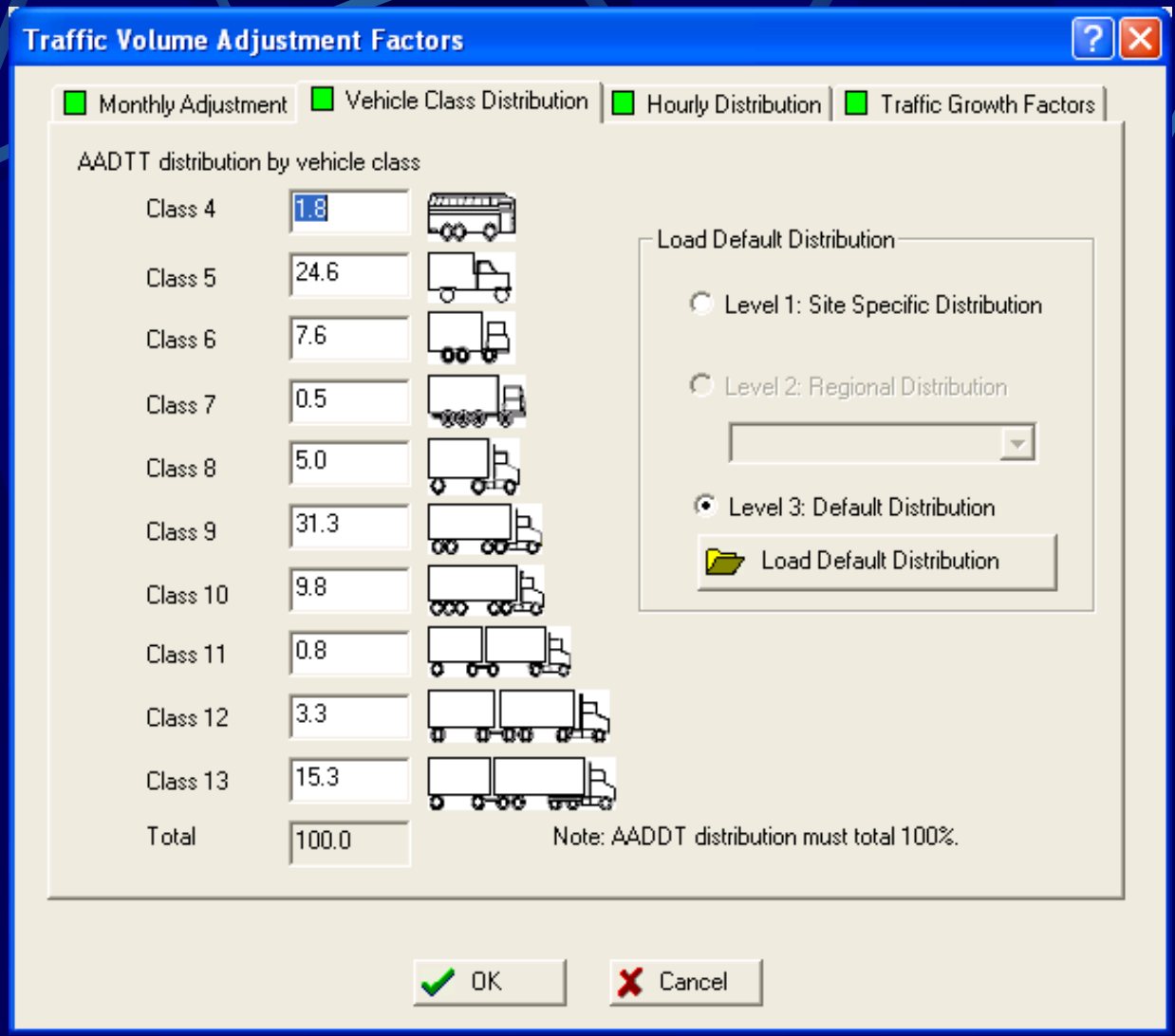
Input Level	Input Values	Knowledge of Parameters
1	Segment Specific AVC & WIM Measurements	Good
2a	Segment Specific AVC & Regional WIM Measurements	Fair
2b	Regional AVC & WIM Measurements	Fair
3	Site Specific Vehicle Count Data w/Defaults – Educated Guess	Poor

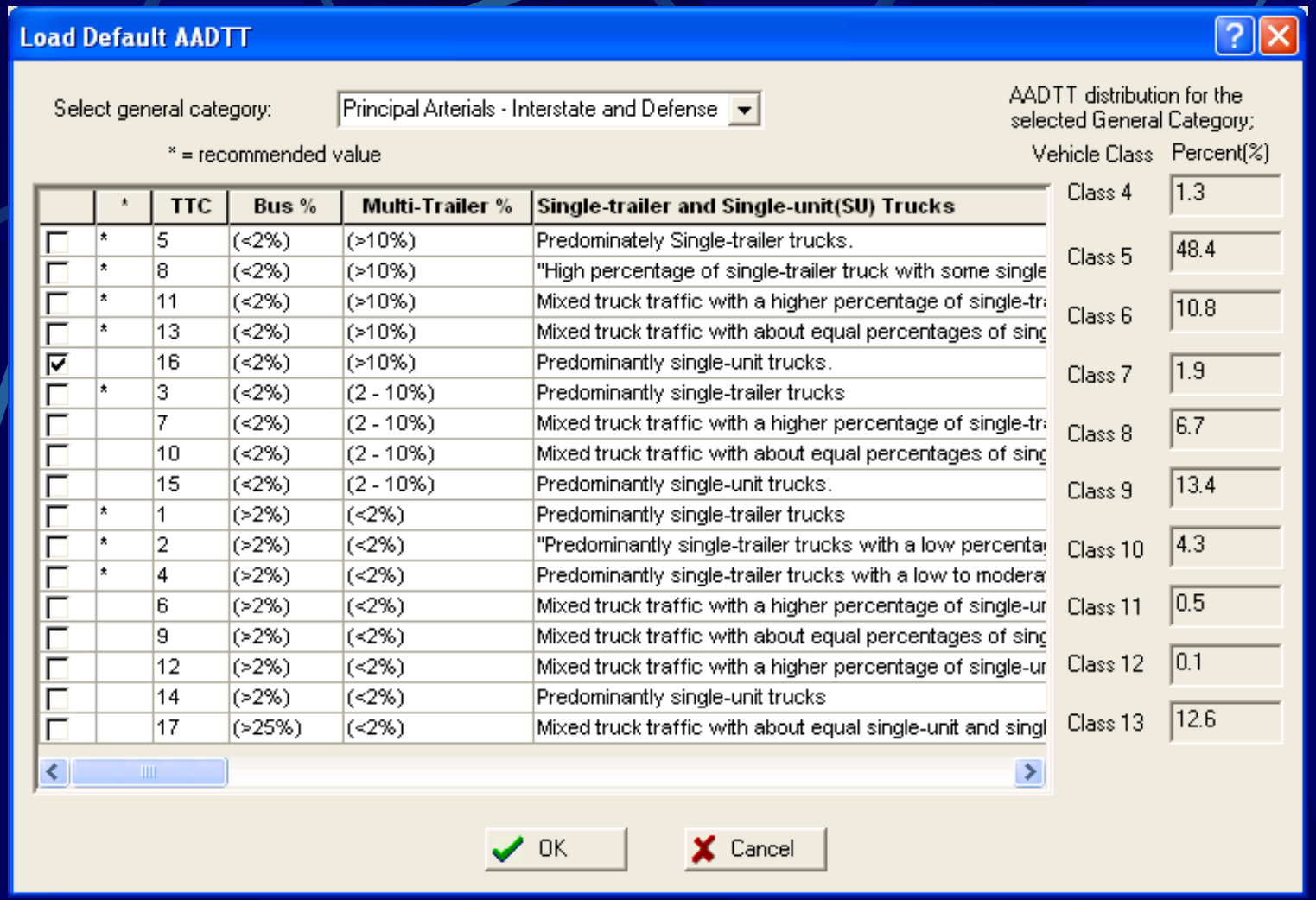
ACCURACY

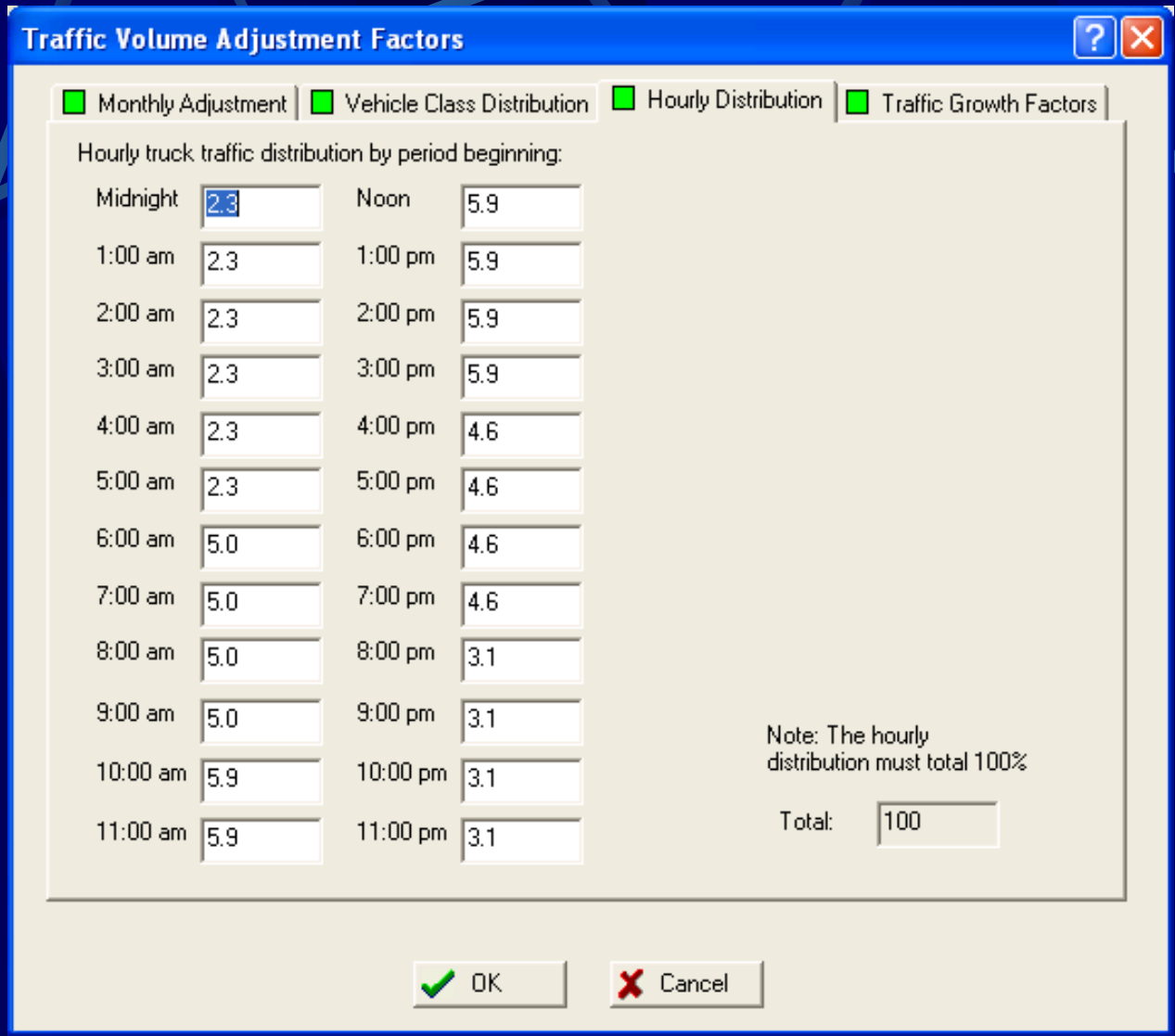
Kathy Petros, FHWA 2003

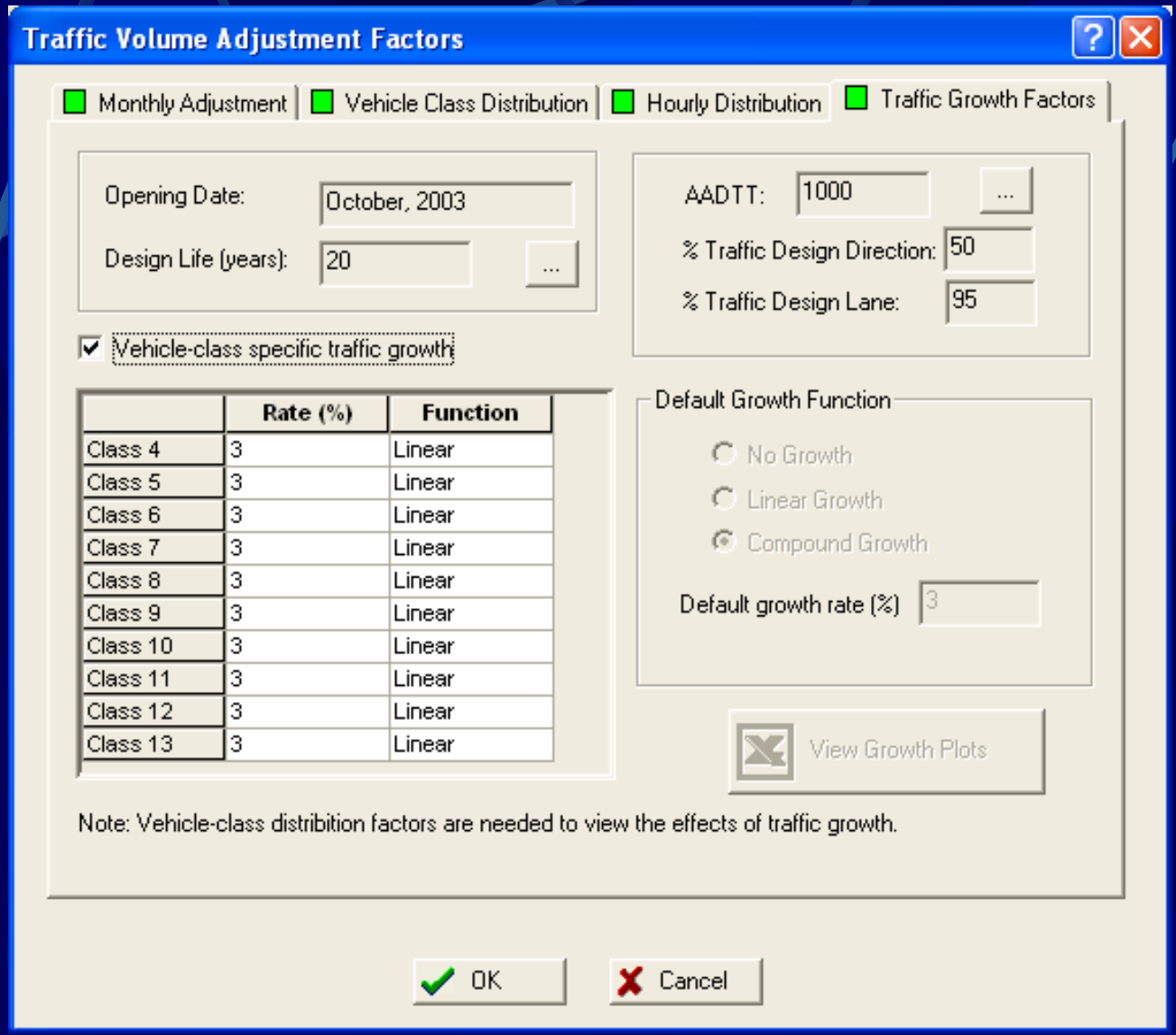

Traffic
Design Life (years):
20
...
Opening Date:
October, 2003
Initial two-way AADTT:
1000
...
Number of lanes in design direction:
2
Percent of trucks in design direction (%):
50.0
Percent of trucks in design lane (%):
95.0
Operational speed (mph):
60
Traffic Volume Adjustment:
Edit
Axle load distribution factor:
Edit
General Traffic Inputs
Edit
Traffic Growth
Class specific
...
OK
Cancel

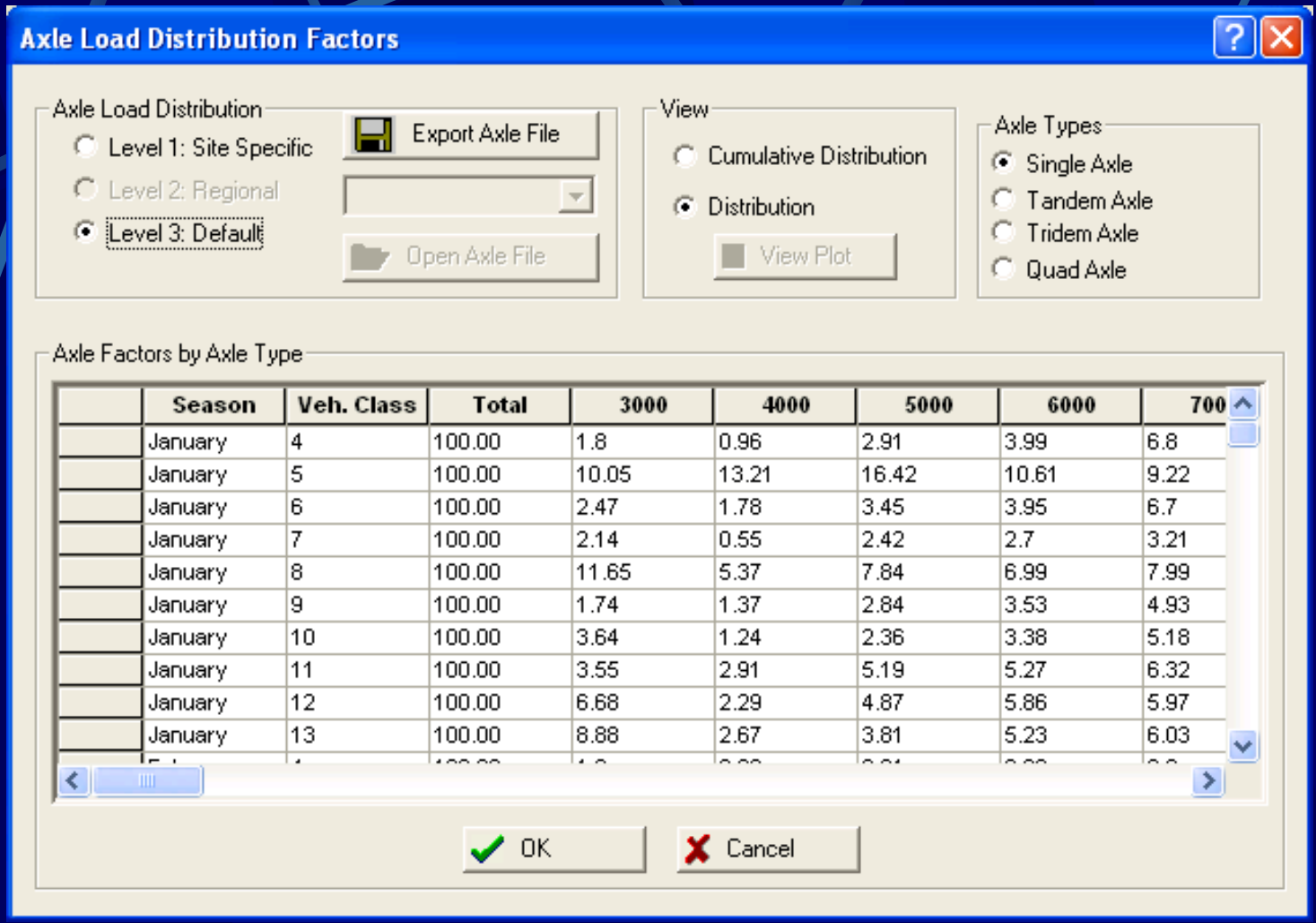

Traffic Volume Adjustment Factors
Monthly Adjustment
Vehicle Class Distribution
Hourly Distribution
Traffic Growth Factors
Load Monthly Adjustment Factors (MAF)
Level 1: Site Specific - MAF
Level 3: Default MAF
Load MAF From File
Export MAF to File
Monthly Adjustment Factors
Month
Class 4
Class 5
Class 6
Class 7
Class 8
January 1.00 1.00 1.00 1.00 1.00
February 1.00 1.00 1.00 1.00 1.00
March 1.00 1.00 1.00 1.00 1.00
April 1.00 1.00 1.00 1.00 1.00
May 1.00 1.00 1.00 1.00 1.00
June 1.00 1.00 1.00 1.00 1.00
July 1.00 1.00 1.00 1.00 1.00
August 1.00 1.00 1.00 1.00 1.00
September 1.00 1.00 1.00 1.00 1.00
October 1.00 1.00 1.00 1.00 1.00
November 1.00 1.00 1.00 1.00 1.00
December 1.00 1.00 1.00 1.00 1.00
OK
Cancel


Traffic Volume Adjustment Factors
Monthly Adjustment
Vehicle Class Distribution
Hourly Distribution
Traffic Growth Factors
AADTT distribution by vehicle class
Class 4
1.8
Class 5
24.6
Class 6
7.6
Class 7
0.5
Class 8
5.0
Class 9
31.3
Class 10
9.8
Class 11
0.8
Class 12
3.3
Class 13
15.3
Total
100.0
Load Default Distribution
Level 1: Site Specific Distribution
Level 2: Regional Distribution
Level 3: Default Distribution
Load Default Distribution
Note: AADDT distribution must total 100%.
OK
Cancel

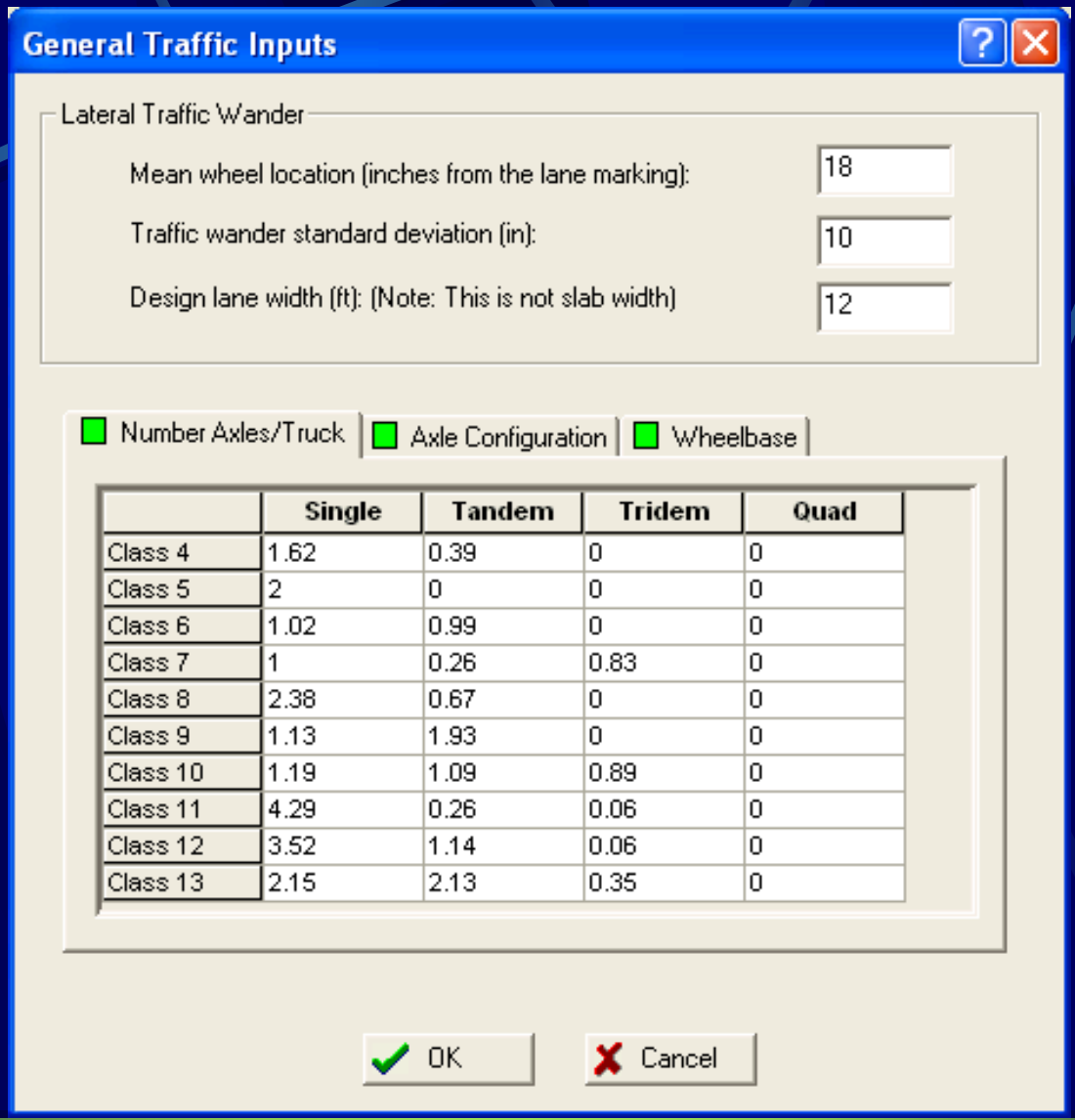

Load Default AADTT
Select general category:
Principal Arterials - Interstate and Defense
* = recommended value
AADTT distribution for the selected General Category;
Vehicle Class
Percent(%)
TTC
Bus %
Multi-Trailer %
Single-trailer and Single-unit(SU) Trucks
5 (<2%) (>10%) Predominately Single-trailer trucks.
8 (<2%) (>10%) "High percentage of single-trailer truck with some single
11 (<2%) (>10%) Mixed truck traffic with a higher percentage of single-tr
13 (<2%) (>10%) Mixed truck traffic with about equal percentages of sing
16 (<2%) (>10%) Predominantly single-unit trucks.
3 (<2%) (2 - 10%) Predominantly single-trailer trucks
7 (<2%) (2 - 10%) Mixed truck traffic with a higher percentage of single-tr
10 (<2%) (2 - 10%) Mixed truck traffic with about equal percentages of sing
15 (<2%) (2 - 10%) Predominantly single-unit trucks.
1 (>2%) (<2%) Predominantly single-trailer trucks
2 (>2%) (<2%) "Predominantly single-trailer trucks with a low percenta
4 (>2%) (<2%) Predominantly single-trailer trucks with a low to modera
6 (>2%) (<2%) Mixed truck traffic with a higher percentage of single-ur
9 (>2%) (<2%) Mixed truck traffic with about equal percentages of sing
12 (>2%) (<2%) Mixed truck traffic with a higher percentage of single-ur
14 (>2%) (<2%) Predominantly single-unit trucks
17 (>25%) (<2%) Mixed truck traffic with about equal single-unit and singl
Class 4 1.3
Class 5 48.4
Class 6 10.8
Class 7 1.9
Class 8 6.7
Class 9 13.4
Class 10 4.3
Class 11 0.5
Class 12 0.1
Class 13 12.6
OK
Cancel


Traffic Volume Adjustment Factors
Monthly Adjustment
Vehicle Class Distribution
Hourly Distribution
Traffic Growth Factors
Hourly truck traffic distribution by period beginning:
Midnight 2.3
1:00 am 2.3
2:00 am 2.3
3:00 am 2.3
4:00 am 2.3
5:00 am 2.3
6:00 am 5.0
7:00 am 5.0
8:00 am 5.0
9:00 am 5.0
10:00 am 5.9
11:00 am 5.9
Noon 5.9
1:00 pm 5.9
2:00 pm 5.9
3:00 pm 5.9
4:00 pm 4.6
5:00 pm 4.6
6:00 pm 4.6
7:00 pm 4.6
8:00 pm 3.1
9:00 pm 3.1
10:00 pm 3.1
11:00 pm 3.1
Note: The hourly distribution must total 100%
Total: 100
OK
Cancel

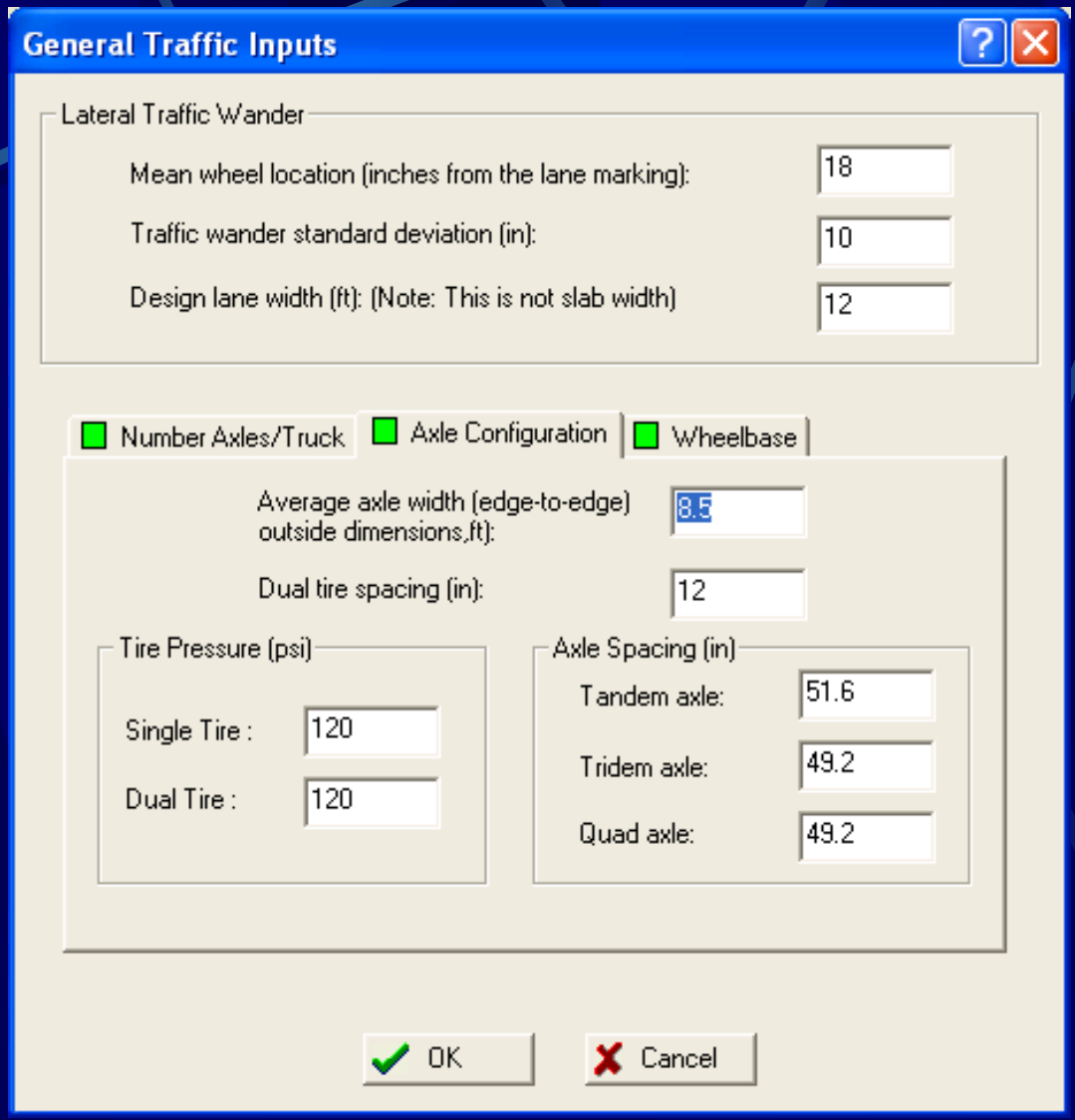

Traffic Volume Adjustment Factors
Monthly Adjustment
Vehicle Class Distribution
Hourly Distribution
Traffic Growth Factors
Opening Date:
October, 2003
Design Life (years):
20
...
AADTT:
1000
...
% Traffic Design Direction:
50
% Traffic Design Lane:
95
Vehicle-class specific traffic growth
Rate (%)
Function
Class 4 3 Linear
Class 5 3 Linear
Class 6 3 Linear
Class 7 3 Linear
Class 8 3 Linear
Class 9 3 Linear
Class 10 3 Linear
Class 11 3 Linear
Class 12 3 Linear
Class 13 3 Linear
Default Growth Function
No Growth
Linear Growth
Compound Growth
Default growth rate (%)
3
View Growth Plots
Note: Vehicle-class distribution factors are needed to view the effects of traffic growth.
OK
Cancel

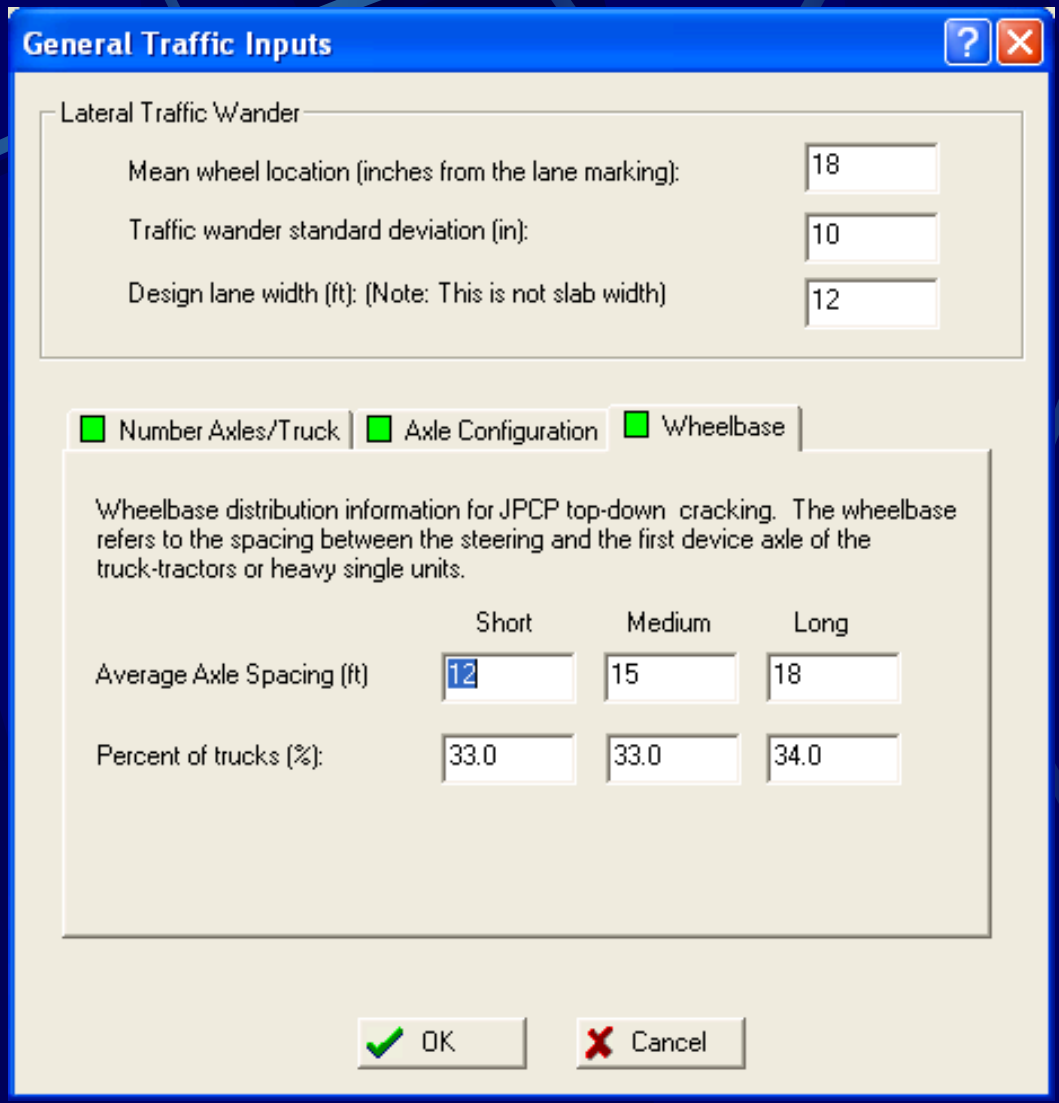


	Season	Veh. Class	Total	3000	4000	5000	6000	700
	January	4	100.00	1.8	0.96	2.91	3.99	6.8
	January	5	100.00	10.05	13.21	16.42	10.61	9.22
	January	6	100.00	2.47	1.78	3.45	3.95	6.7
	January	7	100.00	2.14	0.55	2.42	2.7	3.21
	January	8	100.00	11.65	5.37	7.84	6.99	7.99
	January	9	100.00	1.74	1.37	2.84	3.53	4.93
	January	10	100.00	3.64	1.24	2.36	3.38	5.18
	January	11	100.00	3.55	2.91	5.19	5.27	6.32
	January	12	100.00	6.68	2.29	4.87	5.86	5.97
	January	13	100.00	8.88	2.67	3.81	5.23	6.03



	Single	Tandem	Tridem	Quad
Class 4	1.62	0.39	0	0
Class 5	2	0	0	0
Class 6	1.02	0.99	0	0
Class 7	1	0.26	0.83	0
Class 8	2.38	0.67	0	0
Class 9	1.13	1.93	0	0
Class 10	1.19	1.09	0.89	0
Class 11	4.29	0.26	0.06	0
Class 12	3.52	1.14	0.06	0
Class 13	2.15	2.13	0.35	0


General Traffic Inputs
Lateral Traffic Wander
Mean wheel location (inches from the lane marking):
18
Traffic wander standard deviation (in):
10
Design lane width (ft): (Note: This is not slab width)
12
Number Axles/Truck
Axle Configuration
Wheelbase
Average axle width (edge-to-edge) outside dimensions,ft):
8.5
Dual tire spacing (in):
12
Tire Pressure (psi)
Single Tire :
120
Dual Tire :
120
Axle Spacing (in)
Tandem axle:
51.6
Tridem axle:
49.2
Quad axle:
49.2
OK
Cancel


General Traffic Inputs
Lateral Traffic Wander
Mean wheel location (inches from the lane marking):
18
Traffic wander standard deviation (in):
10
Design lane width (ft): (Note: This is not slab width)
12
Number Axles/Truck
Axle Configuration
Wheelbase
Wheelbase distribution information for JPCP top-down cracking. The wheelbase refers to the spacing between the steering and the first device axle of the truck-tractors or heavy single units.
Short
Medium
Long
Average Axle Spacing (ft)
12
15
18
Percent of trucks (%):
33.0
33.0
34.0
OK
Cancel

That’s a LOT of data entry !!!

Fear not…there are tools to help you.

Tools

- TRAFLOAD – NCHRP 1-39
- WIMNet
- Atlas
- Others ??

Implementation

- Institutional Barriers – Materials, Traffic, Designers not talking to each other.
- Institutional Inertia
  - Getting things started.
  - Changing the way things have been done.
- Cost
- Time - one estimate is 5 yr effort
- Tools to go from raw data to input values.

“If you're riding ahead of the herd, take a look back every now and then to make sure it's still there.”

Will Rogers

An Implementation Plan

- Development of state-specific default values (TTC, Class and hourly distributions, load spectra, etc)
- Review availability of existing traffic data, and plan future monitoring efforts.
- Changes to data management.

So what does this mean for Data Collection ?

Traffic Hierarchical Input Levels:

Input Level	Input Values	Knowledge of Parameters
1	Segment Specific AVC & WIM Measurements	Good
2a	Segment Specific AVC & Regional WIM Measurements	Fair
2b	Regional AVC & WIM Measurements	Fair
3	Site Specific Vehicle Count Data w/Defaults – Educated Guess	Poor

Typical Design - Level 2

- You will need….
  - Section specific volume and classification data (hourly distribution), and default load spectra (by TWRG).
- Do you already have it?
  - Possibly…depending on the number and distribution of classification and WIM site locations

Typical Design - Level 2

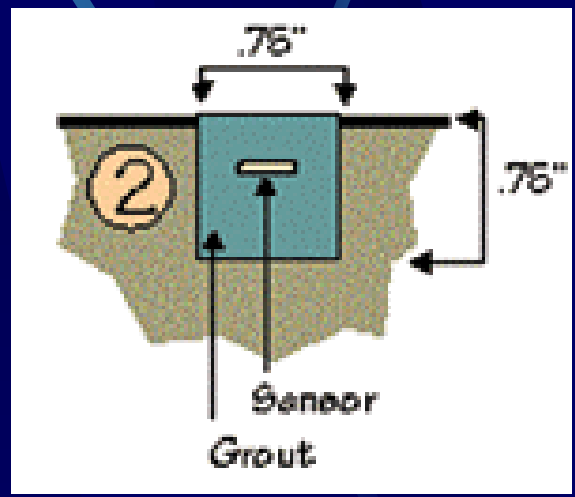
- How much effort will be required to get it??
  - Site specific data
    - Consistent traffic patterns - one week of classification data.
    - Variable traffic – Representative samples
  - TTC and TWRG for state.
  - Automation will significantly reduce LOE.

- *The ME pavement design process is going to require greater attention to traffic data than before.....*

- Equipment....

Piezo Ceramic

- Least Expensive
- Typically requires more calibration activity
- Non-linear load response
- Temperature sensitive response



Quartz Piezo

- Small and relatively easy to install
- Relatively inexpensive
- Linear load response
- Temp. stable

Bending Plate

- Relatively expensive
- Generally more reliable.

LTPP Pooled Fund Traffic Study

TPF-5(004)

What is TPF-5(004)?

- Partnership with the States to get a minimum 5 years of research quality data at SPS-1, -2, -5, -6 and - 8 sites
- Contracts managed by FHWA to provide a mechanism for states to fund traffic data acquisition activities at these SPS sites

Research Quality Definition

SPS-1, -2, -5, -6 & -8	95 Percent Confidence Limit of Error
Single Axles	± 20 percent
Axle Groups	± 15 percent
Gross Vehicle Weight	± 10 percent
Vehicle Speed	± 1 mph (2 kph)
Axle spacing	± 0.5 ft (150 mm)
Classification	<= 2% Unclassified <= 2% Heavy trucks misclassified

Assessments – What do they produce?

- Recommendation to validate or not to validate
- Work includes -
  - Pavement evaluation (distresses impacting trucks, profile via WIMIndex)
  - Checking equipment condition
  - Reviewing ability to correctly classify vehicles
  - Quantifying data needs
  - Suggestions for equipment and or pavement repair or replacement

Assessment Statistics

- 34 completed to date
- No sites completely ready for validation
  - 1 - SPS-8 requires classification validation only
  - 6 - Conditionally (equipment repair with pavement reasonable)

Assessment Recommendations

- Repair or replace sensors – 1/3
- Pavement improvements – 90%
  - For smoothness – 90%
  - For distress – 15%
- Improve classification algorithm – 40%
  - Class 3/5 problem – 40%
  - Excessive number unclassified – 10%
  - Overlapping class definitions – 5%

A note on quality….

- A little good data is better than a lot of poor quality data….
- In implementation of a data collection plan, include QC/QA in the planning.
- Typically you'll be working on an expansion of an expansion…try to make base data representative

“Never miss a good chance to shut up....”

Will Rogers