2002 Guide for the Design of New and Rehabilitated Pavements

Traffic Input Requirements

2002
Design Guide
NCHRP 1-37A

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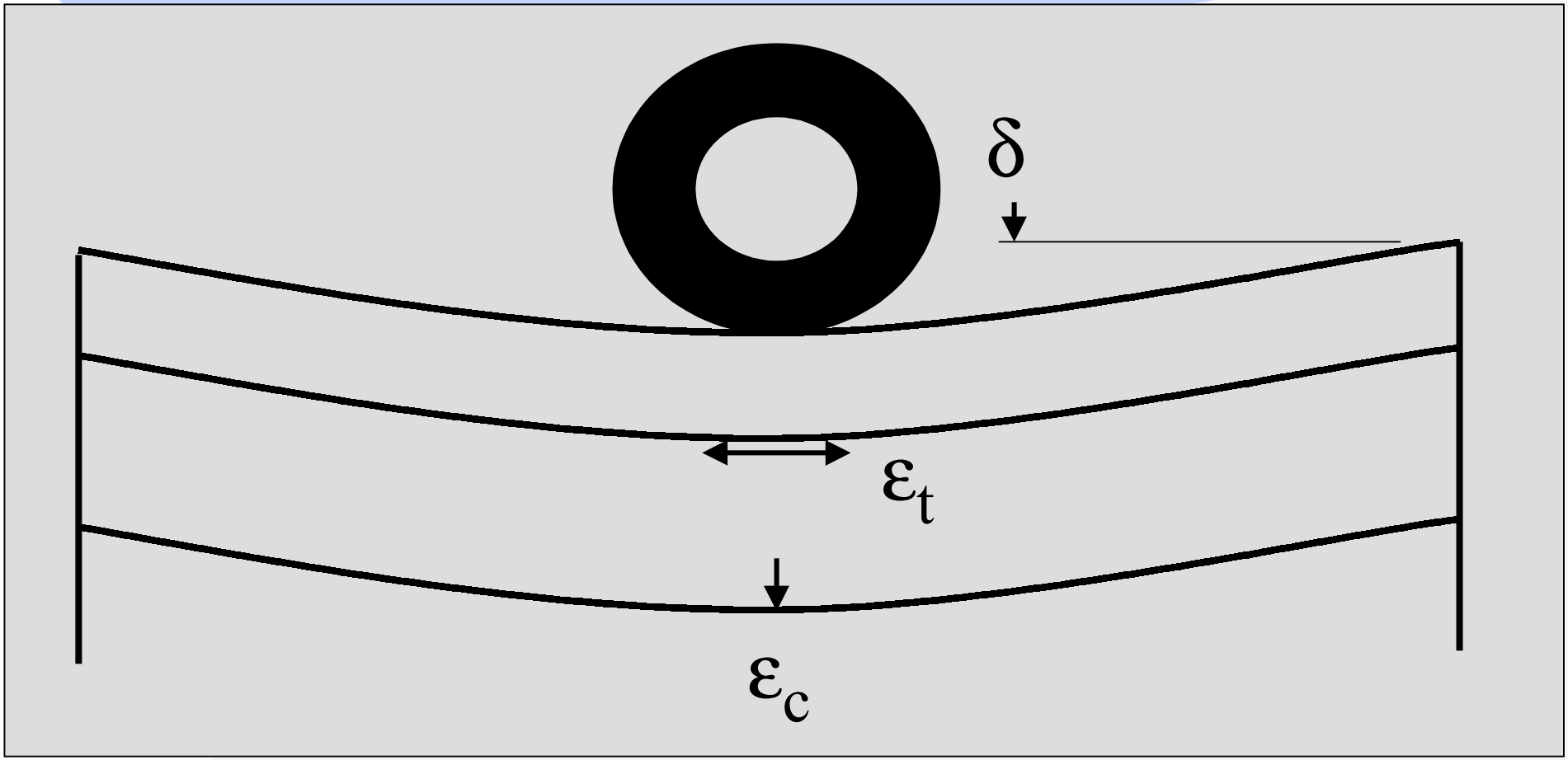
Objective

Develop and deliver the 2002 guide for design of new and rehabilitated pavement structures

- Based on mechanistic-empirical principals

Mechanistic Principals



Based on the assumption that pavement can be modeled as a multi-layered elastic structure.

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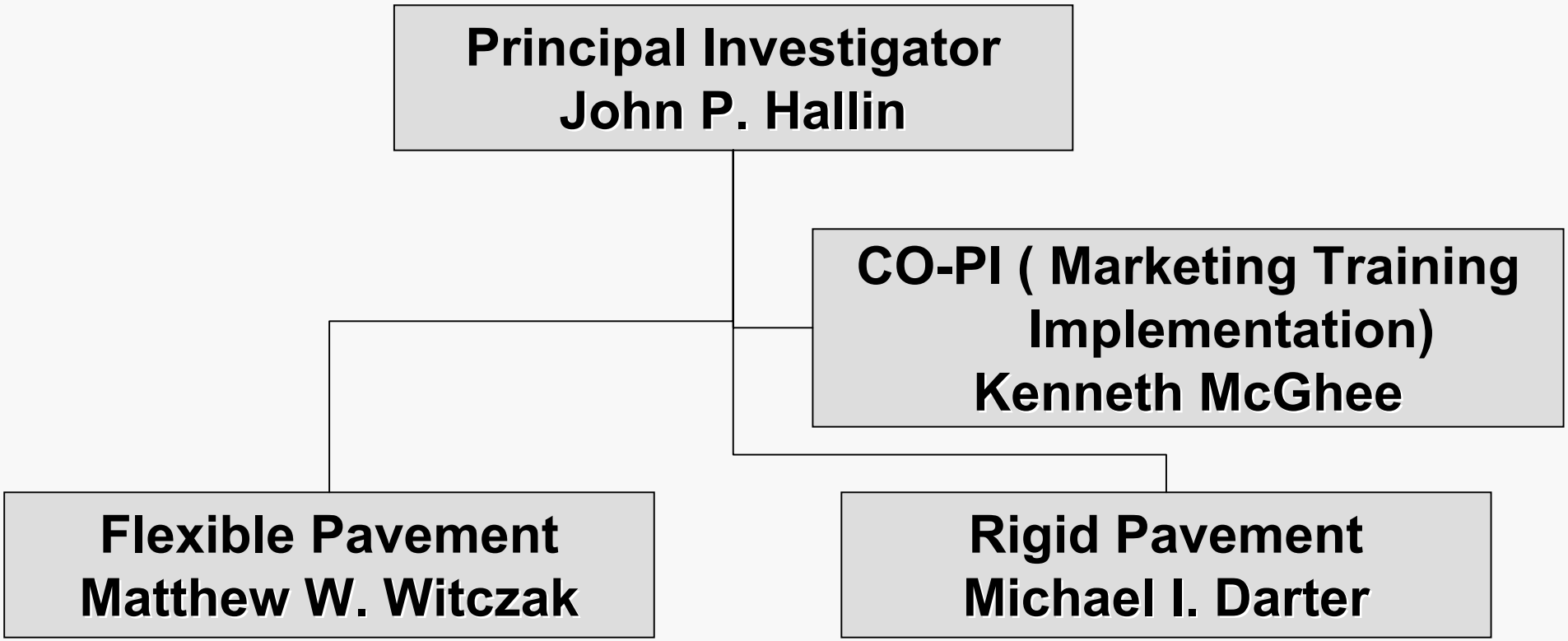
Key Staff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Design Inputs

- The 2002 guide will use a hierarchical approach for determining design inputs.
  - ➔Level of effort consistent with the importance of the project.
  - ➔Allows use of current procedures and provides for inclusion of improved procedures in the future.

Hierarchical Input Levels

- Level 1

  Site specific

  Advanced materials testing (e*,Mr)

- Level 2

  Region factors

  Available test procedures with correlation equations

- Level 3 & 4

  Default values

Hierarchical Input Levels

- Analysis procedure will be independent of input level
  - ➔Lower levels of inputs will have higher variability which will be considered in the reliability analysis
- Level 2 inputs reflect current practice and currently available data

Hierarchical Input Levels

- Level 1 inputs are what agencies should be striving for during the period following implementation of the 2002 procedure.

Traffic Data for Pavement Design

- No more ESAL's!!!
- Traffic input will be numbers of axles by type and weight
- Same type and quality of raw traffic data currently used to compute ESAL's

Traffic Hierarchical Input Levels:

1 – Site Specific AVC & WIM Data
2 – Site Specific AVC Data & Regional WIM Data
3 – Regional AVC & WIM Data
4 – Site Specific Vehicle Count Data

Default Values for Selected Variables

- No. Of axle types per vehicle for each vehicle class (FHWA classes 4 thru 13)

Class	Sgl	Tan	Tri
4	1.55	0.94	0.00
5	1.98	0.64	0.00
6	0.96	0.94	0.13
7	1.01	1.15	0.91
8	2.35	1.00	0.60

Class	Sgl	Tan	Tri
9	1.11	1.95	0.79
10	1.28	1.06	0.99
11	4.13	0.97	0.45
12	3.43	0.95	0.67
13	1.65	1.60	0.99

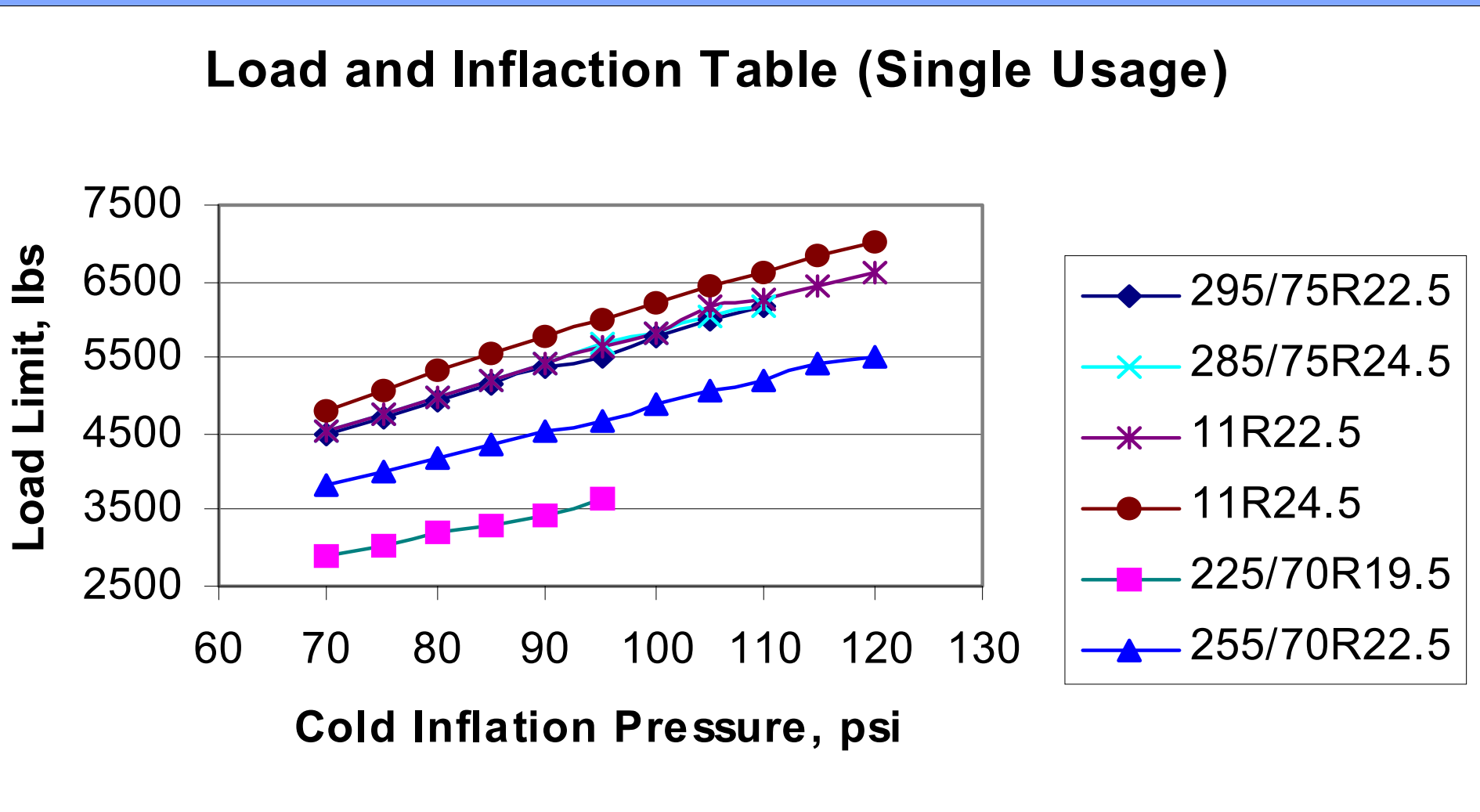
Default Values for Selected Variables

- Axle spacing
  - ➔Tandem, tridem = 1,310 mm (51 inches)
  - ➔Quad = ?
- Dual tire spacing
  - ➔287 mm (12 in.) Center to center
- Tire pressure
  - ➔827 kPa single (120 psi)
  - ➔758 kPa dual (110 psi)

Defaults can be changed by the user

Tire Spacing and Pressure Default Values

Based on Industry Information and State Highway Agency Studies



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Relationship between load limit and cold inflation pressure for single usage.

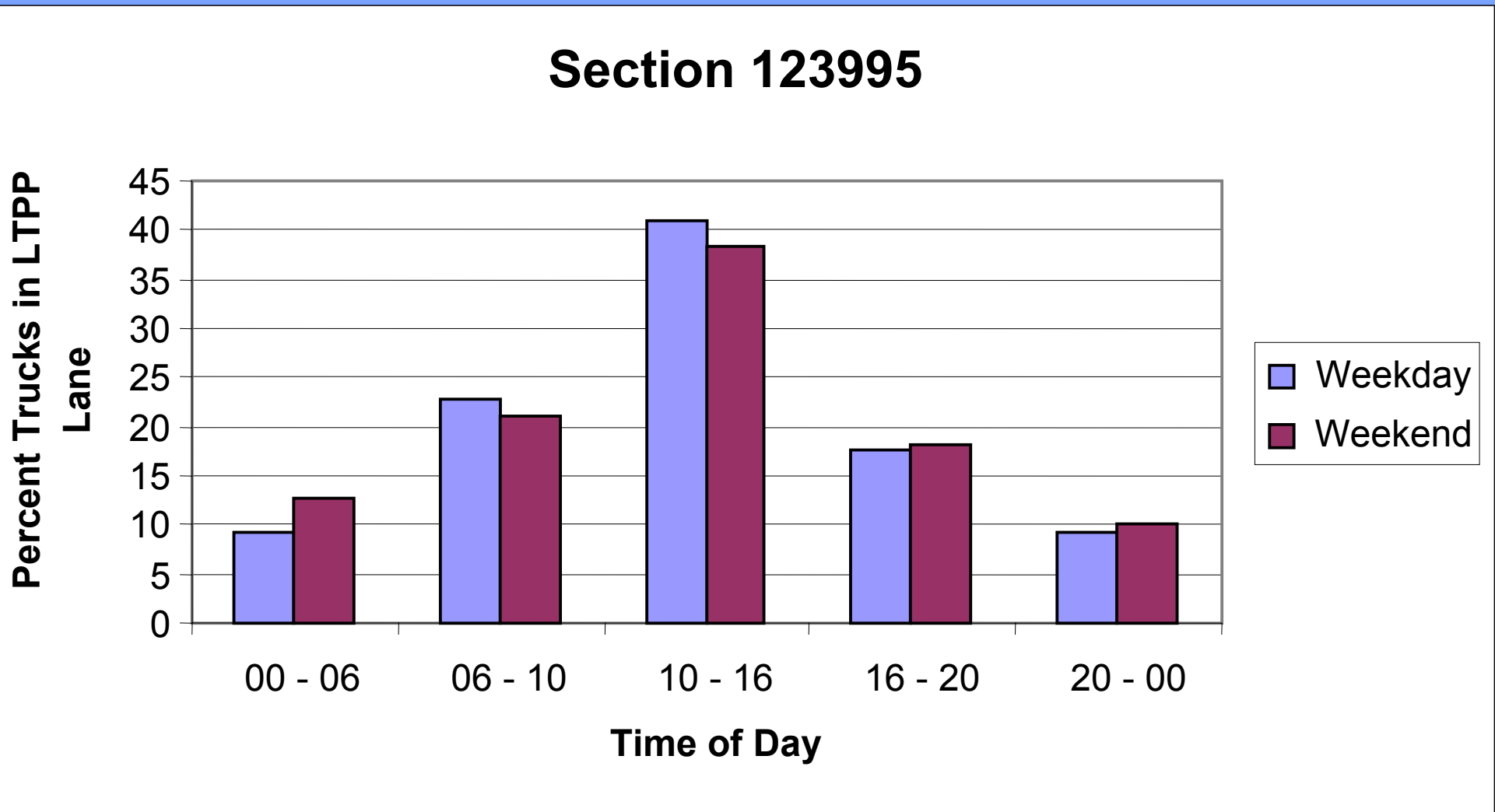
HOT INFLATION PRESSURES:

10 PERCENT ABOVE COLD INFLATION PRESSURE

TIRE COLD INFLATION PRESSURE SELECTED BASED ON MAXIMUM AXLE LOAD AND AXLE TYPE

Traffic Input for Levels 1, 2, & 3

- Base year average annual daily truck traffic (AADTT)
- Truck traffic distribution factor (TTDF)
  - ➔% Of AADTT in classes 4 - 13
- Truck hourly distribution factors
  - ➔Percent of AADTT by hour



Truck traffic distribution factors by time of day.

Time of Day Distribution Default Values

Time Period	Time of Day	Default Value % Truck Traffic
1	Midnight - 6 am	14.0
2	6 am - 10 am	19.8
3	10 am - 4 pm	35.1
4	4 pm - 8 pm	18.5
5	8 pm - Midnight	12.6

Traffic Input for Levels 1, 2, & 3

- Directional distribution factor for AADTT – default set @ 0.55
- Lane distribution factor (% directional AADTT in the design lane)
  - ➔1 lane = 1.0
  - ➔2 lanes = 0.9
  - ➔3 lanes = 0.6
  - ➔4 lanes or more = 0.4

Default values

Traffic Input for Levels 1, 2, & 3

- Monthly truck traffic adjustment factors by class

Month	Truck Class			
	4	5	6	etc
Jan	0.95			
Feb	1.06			
Etc	n			

0.95 in Jan means the Class 4 AMDTT equals 95 % of the Class 4 AADTT

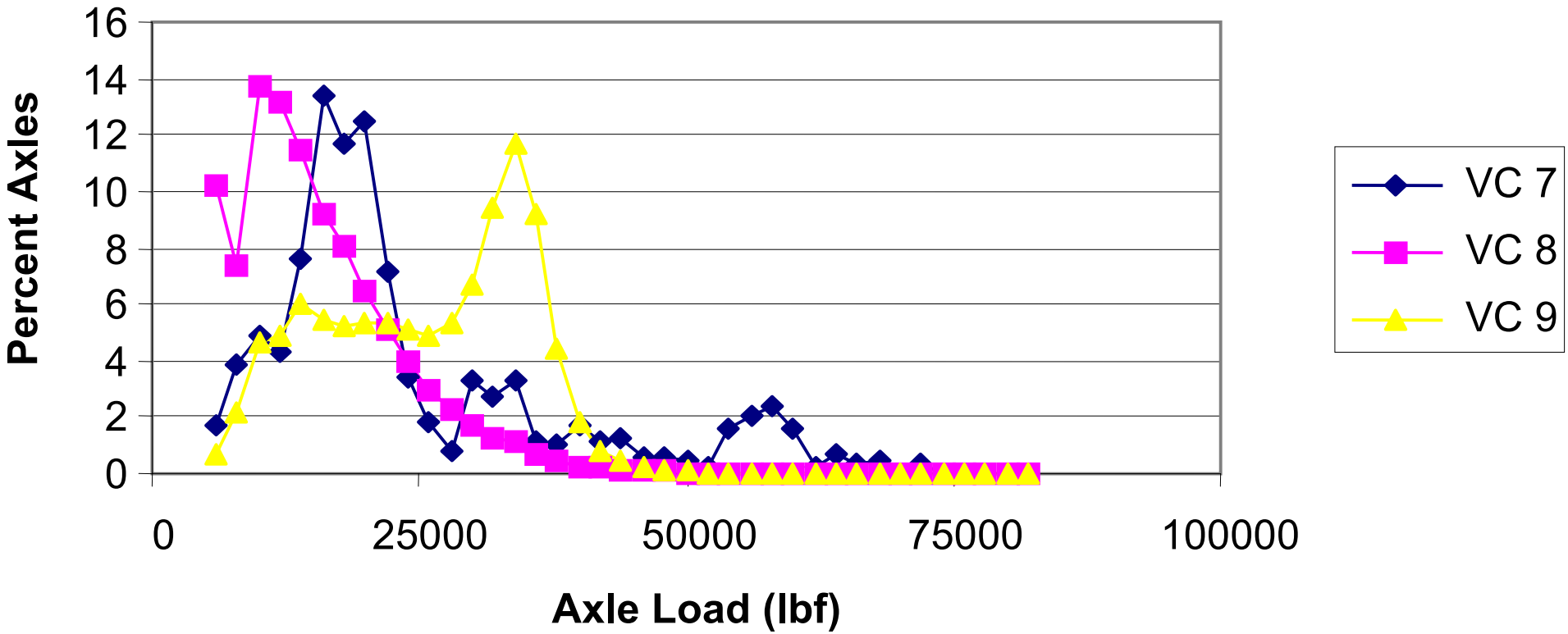
Traffic Input for Levels 1, 2, & 3

- Normalized axle load spectra for each axle type by truck class.

Truck Class	Axle Type	Load Group (kips)						
		8	9	10	11	12	13	
9	S	1.9	9.6	19.6	25.7	27.5	9.1	
9	T	.8		3.4		7.2		

% of axles

Section 421627 Tandem Axles



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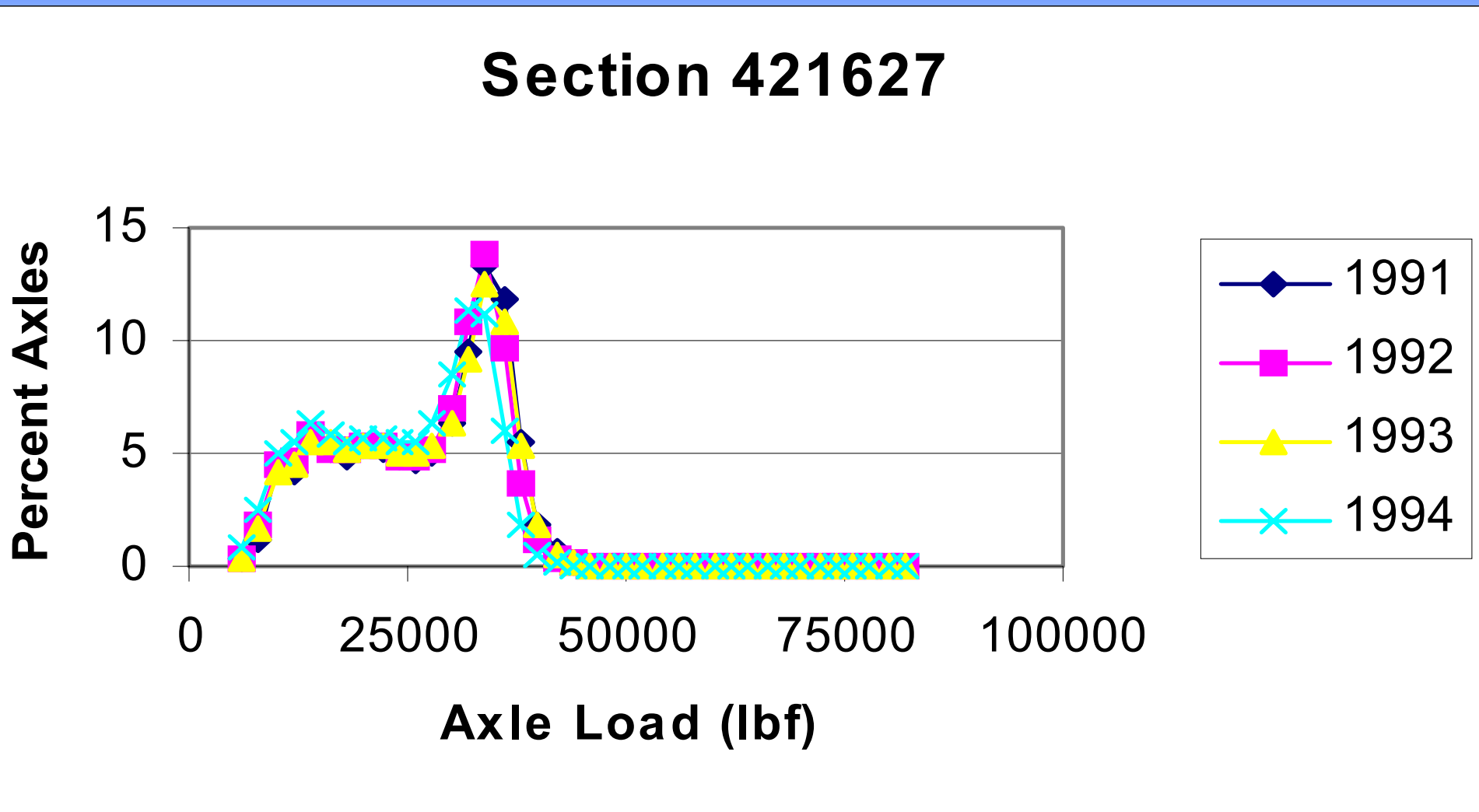
Average annual tandem axle load distribution for Section 421627 for years that good data are available.



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Annual normalized tandem axle load distribution for Section 421627.

Traffic Module Output Files

Yr.	Mon.	Hr.	Axle Type	Load Group				
				0-2	2-4	4-6	...	x-y
k	j	l	Single 1					
			Single 2					
			Tandem					
			Tridem					
			Quad.					

Number of axles within each axle load group for each axle type.

Traffic Input for Level 4

- Site-specific vehicle count (AADT)
- Selection of a truck traffic classification
  - ➔17 groups with similar truck traffic characteristics
  - ➔Selection of the group determines default truck traffic distribution factors and normalized axle load distribution factors

Developed using LTPP Data

Truck Traffic Classification Groups

- Determined using a decision tree and estimating the following items
  - ➔Buses:

    < 2%, 2%-25%, >25%
  - ➔Multi-trailer

    <2%, 2%-10%, >10%
  - ➔Single trailers & single units

    Descriptive terms

Quality of Traffic Data

- Need to attach a measure of quality to the data
  - ➔What was the sample size (number of days/year and number of years of data) for the WIM and AVC data
  - ➔Expected error and level of confidence

Quality of Traffic Data

- WIM data (level 1 & 2)
  - ➔Normalized axle load distributions were found to be constant over time and season
  - ➔Data collected within a one year period is generally adequate

Days per year

% Error Expected	Level of Confidence %				
	80	90	95	97.5	99
20	1	1	1	1	1
10	1	1	2	2	3
5	2	3	5	7	10

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Quality of Traffic Data

- AVC data (level 1 and 2)
  - ➔Include data from a minimum of 3 years
  - ➔Sampled seasonally (one month unless historic data available to identify longer seasons)

Days per season

% Error Expected	Level of Confidence %				
	80	90	95	97.5	99
20	1	1	1	1	1
10	1	2	3	5	6
5	3	8	12	17	24

Traffic Forecasting

- Forecast options
  - ➔Assume normalized traffic distribution remains constant and project AADTT into the future
  - ➔Assume normalized traffic distribution changes and project volumes of individual truck classifications into the future

Traffic Forecasting

- Growth functions included
  - ➔Increasing at an increasing rate
  - ➔Linear increase
  - ➔No growth

Traffic Module Summary

- Extensive computations within traffic module for incremental damage accumulation.
- Module is flexible allowing user to use other default values.
- Default values based on LTPP data collected over time.
- Historical traffic data is required, but is consistent with requirements from LTPP and FHWA.

Traffic Data for Pavement Design

Questions?