

# PAVEMENT DESIGN AND SELECTION UPDATES



VS



# Pavement Design & Selection

- ▣ Often blurred as one
- ▣ Each stands alone
- ▣ Could update each alone or together
  - Updates = pain
  - Tend to want to do any updates together
  - Need to update either one as warranted

# Design

- ▣ Material selection
- ▣ Guidance to the Designer
- ▣ Design details
- ▣ Minimums
- ▣ How thick

# Selection

- ▣ Economics of the alternatives - which is lower cost to owner?
- ▣ Present worth (PW) is a function of:
  - Construction cost
  - Out year cost (repairs and rehabs)
    - ▣ Period of time
    - ▣ Discount rate
    - ▣ Needs to be representative of what actually doing
- ▣  $PW = \text{Con } \$ + PW \text{ Rehab } 1 \$ + PW \text{ Rehab } 2 \$ \dots$
- ▣ Select lowest cost PW    HMA Vs. PCC

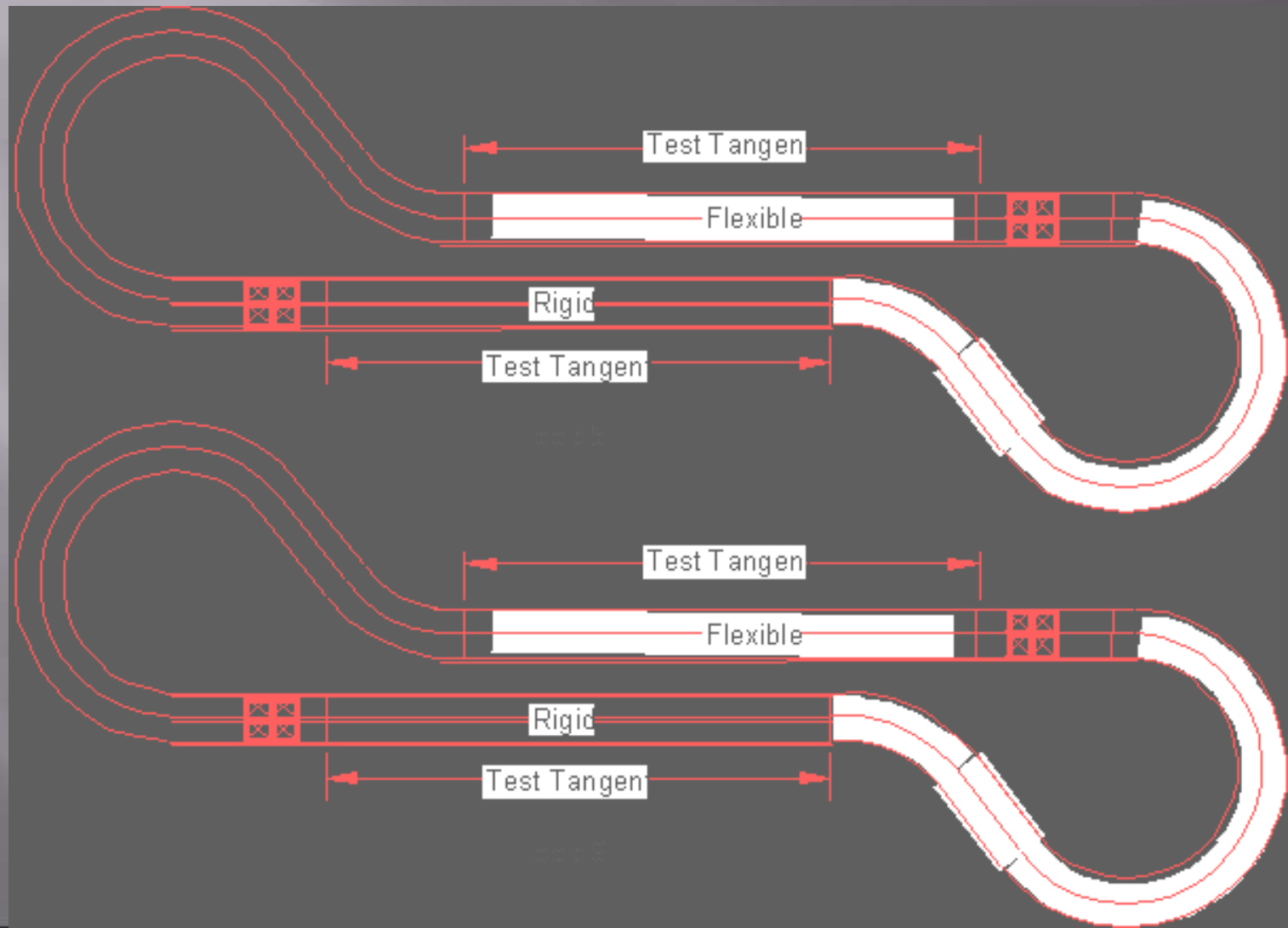
# PAVEMENT DESIGN HISTORY

# IDOT Design History

- ▣ 1950's - empirical design
  - AASHO Road Test

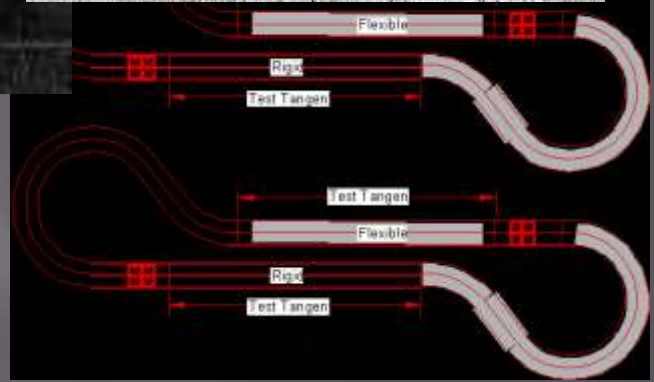


# AASHO Road Test



# AASHO Road Test

Loop	Lane	Weight in Kips		
		Front Axle	Load Axle	Gross Weight
②	①	2	2	4
	②	2	6	8
③	①	4	12	28
	②	6	24	54
④	①	6	18	42
	②	9	32	73
⑤	①	6	22.4	50.8
	②	9	40	89
⑥	①	9	30	69
	②	12	48	108



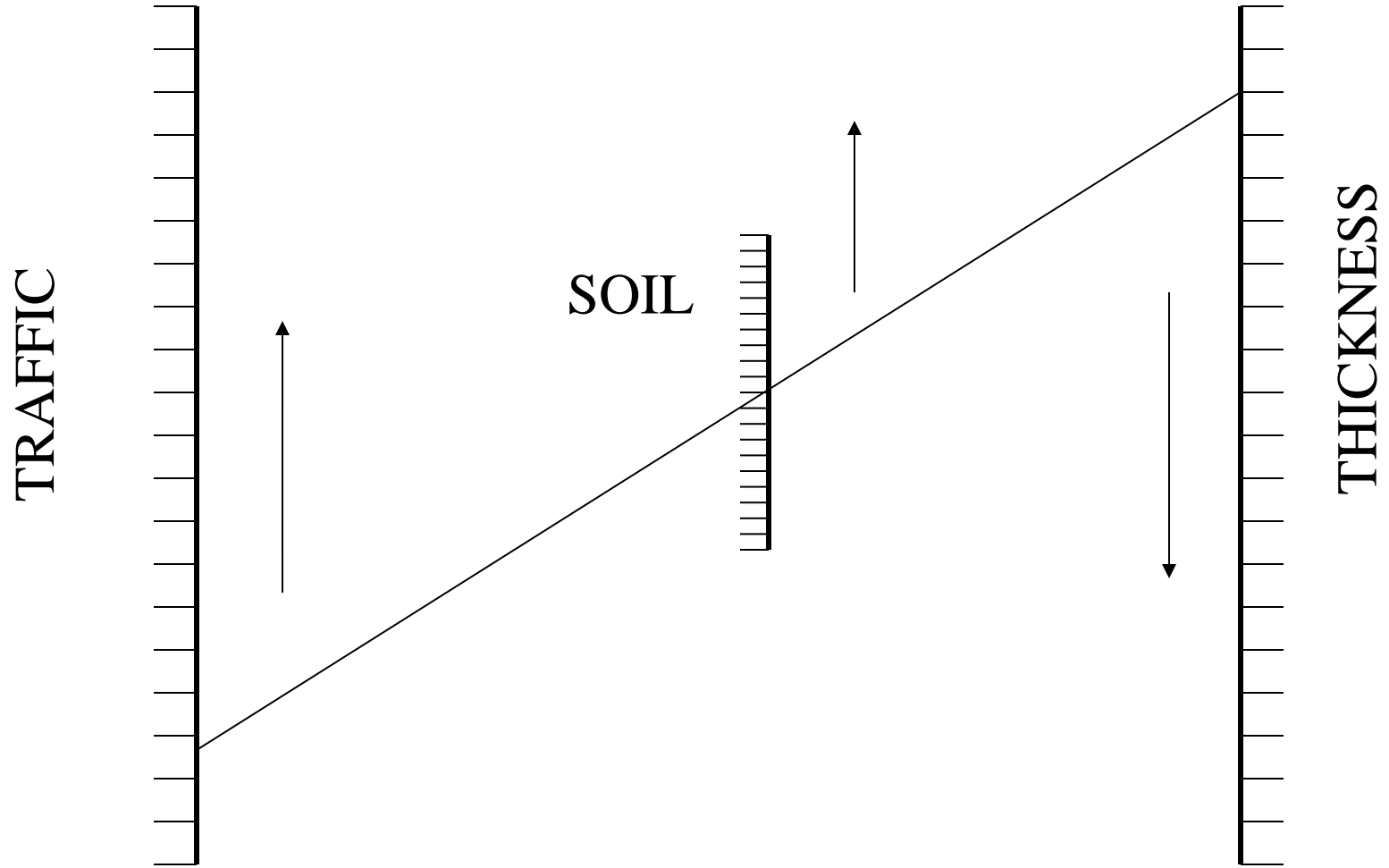
Mixed Axles Converted to:

18,000 lb Equivalent Single Axle Load

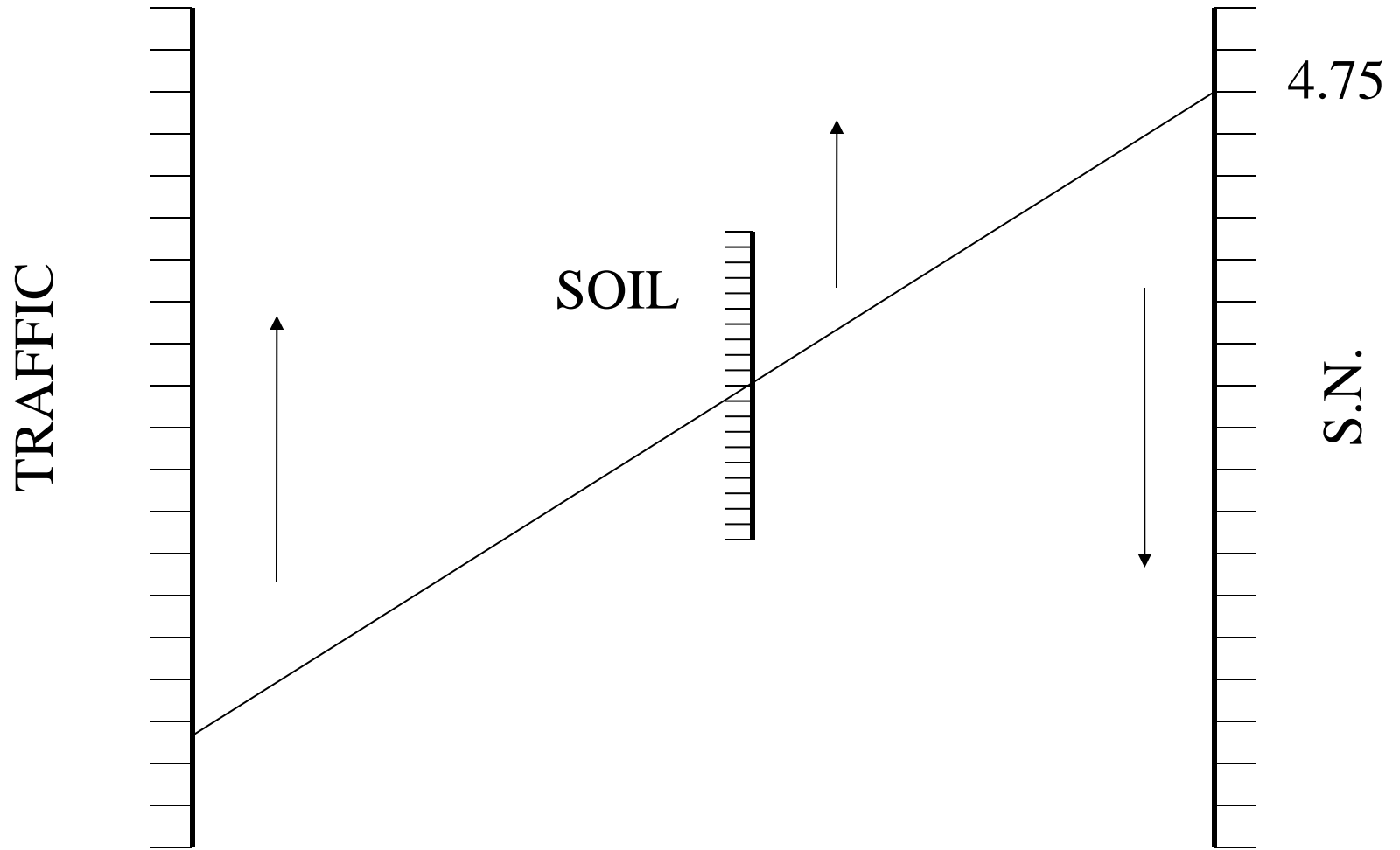
1 axle at 18,000 lbs = 1 ESAL



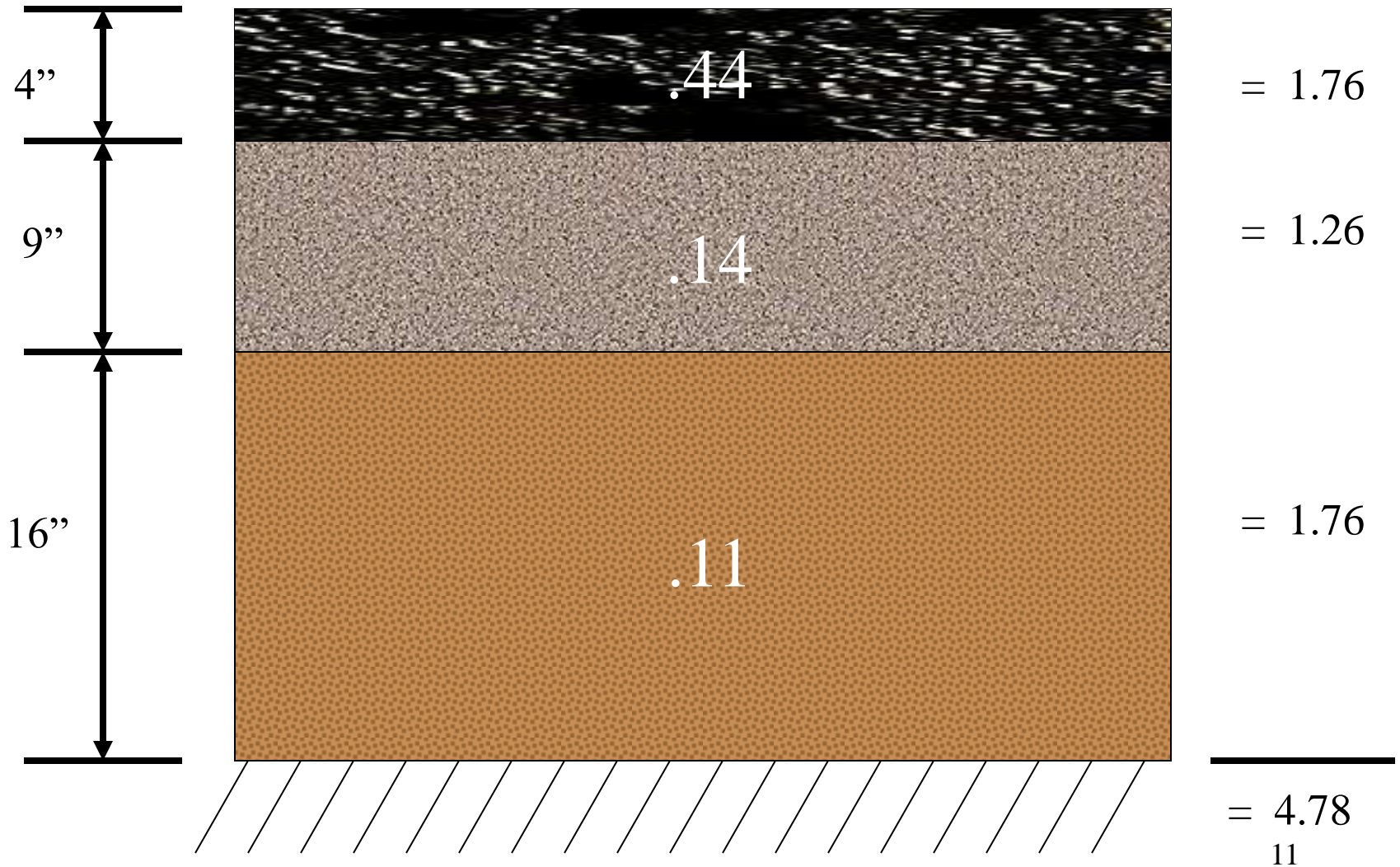
# Rigid Nomograph



# Flexible Nomograph



# Structural Number Concept



# IDOT Design History

- 1950's – empirical design
  - AASHO Road Test
- 1980's - 90's – mechanistic-empirical design
  - UIUC research

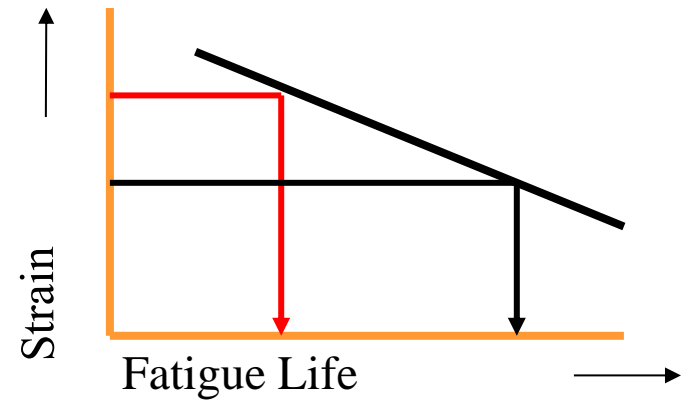
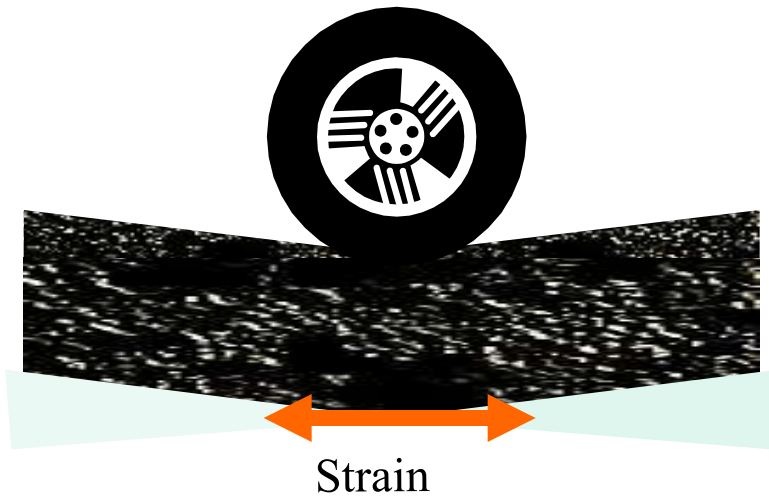
# How thick for HMA

- Early 1980's
  - UIUC research looked at update of AASHTO design
  - Many problems
  - Embarked on development of Mechanistic Design

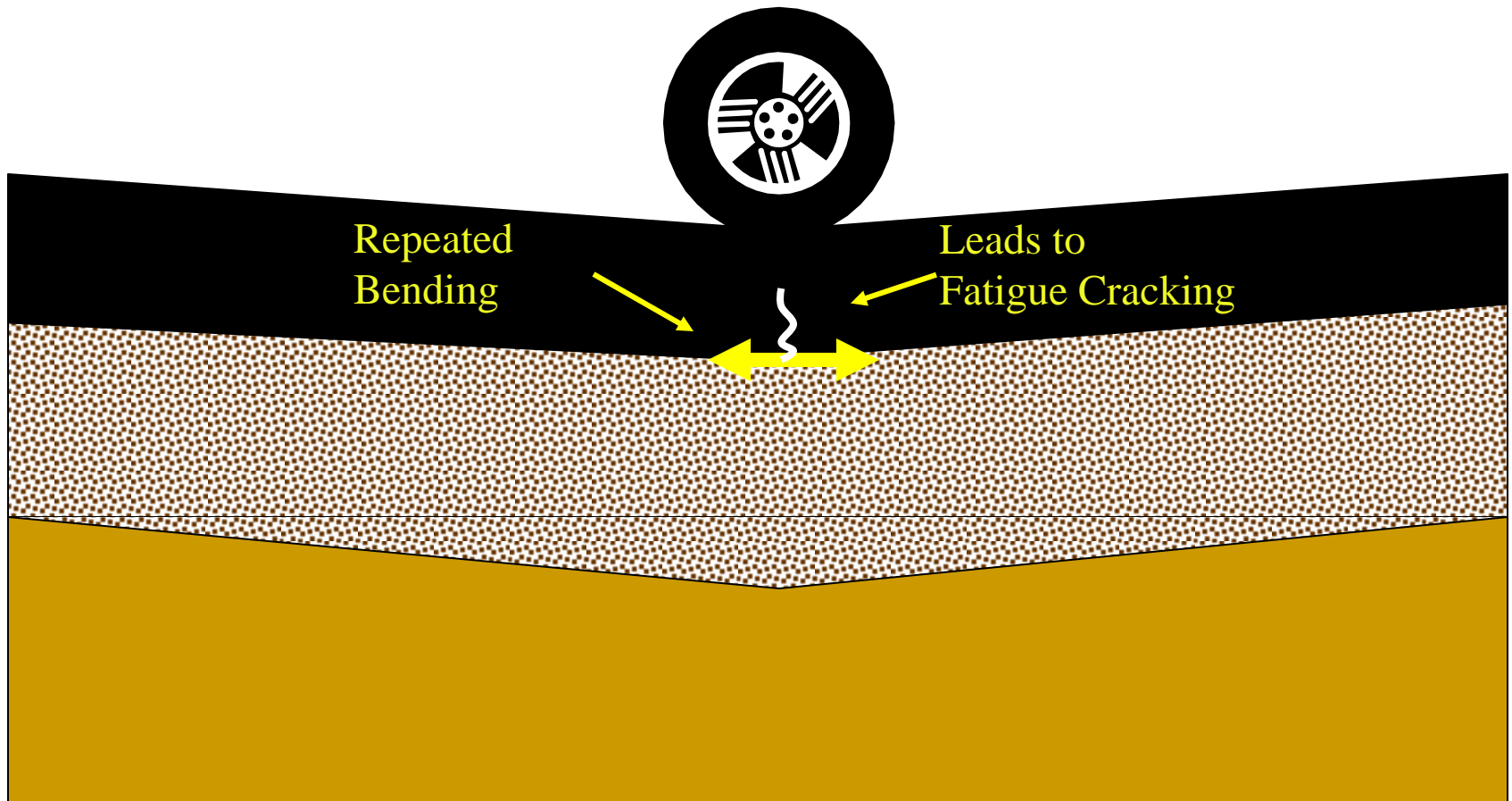
# Fatigue Theory

High Strain = Short Life

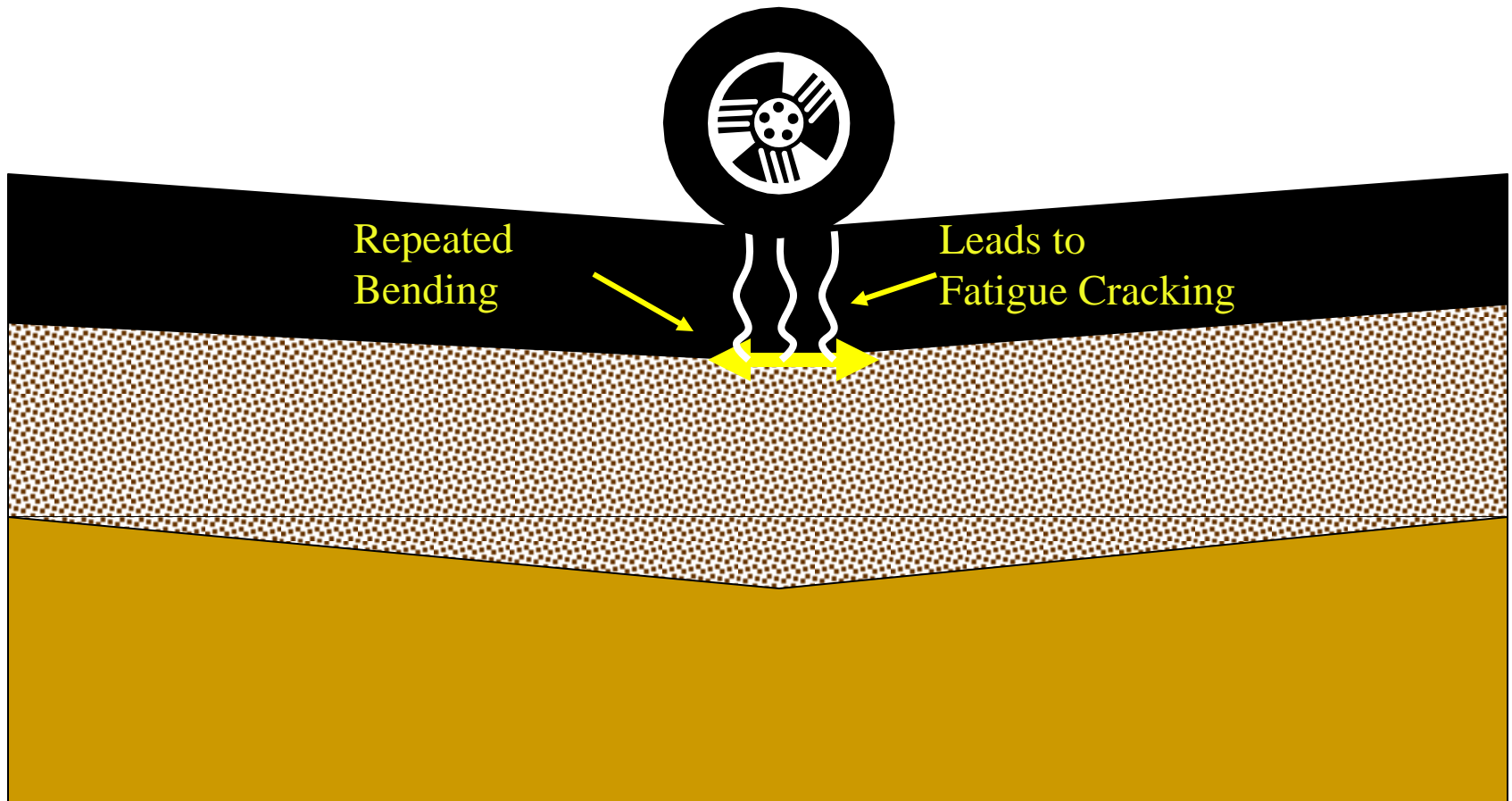
Low Strain = Long Life



# Fatigue Cracking



# Fatigue Cracking

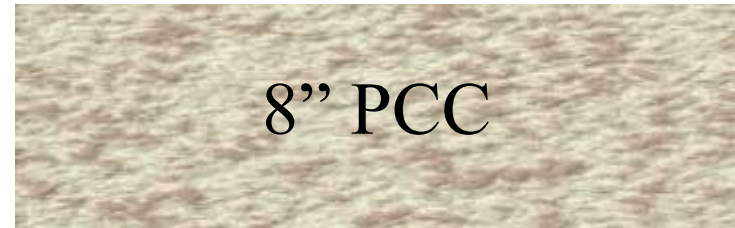




# PCC Design

- Late start
- Developed a Jointed Plain PCC design
  - Mechanistic based

# Alternate Pavements



# Selection

- ▣ 1980's – LCCA
  - Maintenance models developed by expert panel
  - Multiple HMA models to handle rutting
  - One PCC model for all traffic
- ▣ Implementation.....

# Mechanistic Wars!

- ▣ Design (HMA and PCC) attacked
- ▣ Claims of being flawed
- ▣ Selection process attacked
- ▣ Investigations
  - News
  - Private Investigators
  - FBI
  - FHWA
  - Legislative hearings



# 20 Years Later....

- Overdue for update of selection process

# To Revise or Not to Revise

That is the Question

- IDOT and Industry met in 2003 and 2005 to discuss revisions to the pavement performance models



# We took a right turn.....

- 2003 and 2005/2006 attempts ended in failure
  - Many reasons
  - Limited resources prevented detailed data collection after 2000
  - Reviewed rut depths, video images to determine maintenance and rehabilitation activities
  - Changes in upper management at IDOT



# 2009 – Third Time is a Charm

- **Series of IDOT/Industry meetings set for Fall 2009**
  - 2009 legislation passes LCCA for state projects where the pav't cost exceeds \$500,000
  - August 2009 – IDOT presented proposed design and selection changes
    - JPCP design
    - Full-Depth HMA design
    - Maintenance models

# 2009, cont'd.

- September 2009
  - Industry presented their concerns
- October 2009
  - IDOT responded to industry's concerns
  - IDOT suggested modifications based on industry's comments
- December 2009
  - Industry has unresolved concerns

# Proposed Changes to BDE Manual

- Change minimum TF (lower)
  - Actual traffic used more often
- Add PCC inlays/overlays
- Increase LCCA analysis period from 40 to 45 years
- Add alternate bids when LCCA cost comparison  $\leq 10$  percent
- Bring in unbonded concrete overlays and rubblizing as mainstream treatments

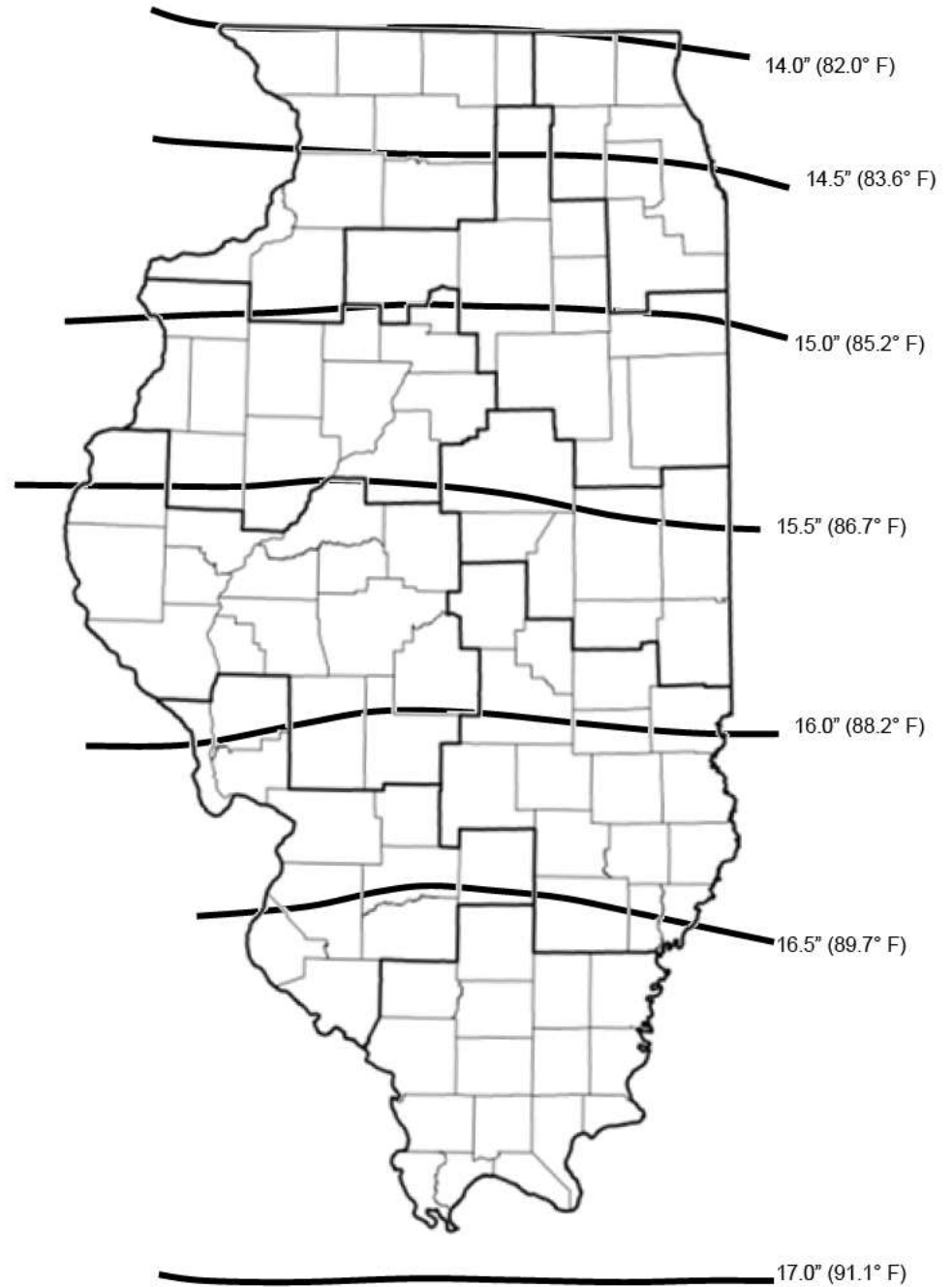
# Proposed PCC Changes

- Eliminated diamond grind – last grinding job done some 10 years ago +/-
- Overlaid with HMA at year 30
- Decrease patching in early years
- Update JPCP thickness design charts
- Revise requirement for stabilized subbase under PCC - raising TF from 0.7 to 1.0 (later modification)
- Allow use of CRC when  $TF \geq 60$  from 35
  - Increases JPCP and HMA selection process
- Work underway on maximum JPCP design
- Work underway on new M-E CRCP design

# Proposed HMA Changes

- New fatigue curve
- Update Full-Depth HMA thickness design charts
- IDOT binder PG grades from AC 10/20
- Introduce limiting strain design for Full-Depth HMA design for maximum thickness design
- Single Maintenance Model - HMA life 15 years
- Use Class III TF equations for Class IV routes

# Max Pavement Thickness



# Reviewed for Fatal Flaws

- HMA – Carl Monismith/Rita Leahy
- PCC - Lev Khazanovich
- LCCA – Carl Monismith/Rita Leahy
- No fatal flaws – suggestions for next round

# Current Status

- Looking at low volume PCC
  - Original PCC design started at 7.5 inches +/-
- Reviewing industry concerns
  - HMA
  - PCC



# THE END

