The Inside Story of Pavement Deterioration

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Pavement Deterioration
We've Come a Long Way

Ford Model T traveling on a muddy road, ca. 1915.
Pavement (text book definition):

A pavement is a man-made structure whose primary function is to spread the load of a vehicle sufficiently that the underlying soil can support it without excessive deformation.

(This definition is from a text book of soil mechanics and foundations.)
Improve Your Odds for Success

Understanding the pavement deterioration process helps you evaluate your pavements and spend your agency's limited money most effectively.
Session Goal

Enable *you* to understand and accurately diagnose the root of Pavement Deterioration.
What Causes Deterioration?
• Obviously, wheel loads from traffic cause pavements to deteriorate.

• But that answer doesn't tell us what is going on within the pavement materials.

• Your odds of making the most effective decisions are improved with knowledge of what the problem is.

• "It's hard to hit a target you can't see."
Pavement Deterioration

I know it when I see it, but I can't explain it.
You *Can* Explain it !!!

Pavement deterioration is **permanent deformation** of any part of the pavement structure.

*Remember this!*
Presentation - Three Parts

• 1st - Definitions
• 2nd - Principle of Loading & Deformation
• 3rd - Pavement Deterioration
Part 1

Definitions

1. Pavement Structure
2. Pavement Structure Materials
3. Pavement Loading
Pavement Structure
Definitions

Pavement Structure Materials
Pavement

= Aggregate + Glue
Aggregates
Liquid Asphalt

Portland Cement
Aggregate Layer
Subgrade
Last but not Least!
Subgrade
Pavement Loading
Part 2

A Basic Engineering Principle

Loading Causes Deformation
You'll be astounded by this mattress the first two nights... and then...

you'll never want to sleep on anything but a Form-Fitted Mattress of Firestone FOAMEX*

Larger air-spaces! Feel your lighter-weight foot section in gentle comfort.

More Foamex (smaller air-spaces) feel your heavier mid-section in firm support.

Larger air-spaces feel your lighter head section in cradling comfort.

...Because Foamex floats your body (instead of sinking under you) — compels you to relax — and SLEEP!

It's the most unexpected sleep sensation in the world — unlike anything you've ever experienced before, you'll simply be astounded the first two nights! Because, for the first time in your life, you can actually lie — relax every tired nerve, every tense muscle and let this remarkable mattress take over!

Never again do you have to dig down and carve out a comfortable spot for yourself. Form-Fitted Foamex meets your curves all the way. The soft surface follows every contour and hollow of your body — while firm foam supports every part of you evenly. And once you've learned the secret of this magic, total abandonment to sleep — you'll never want any other mattress again.

Form-Fitted construction — found only in mattresses of Firestone Foamex — distributes curve-conforming Foamex in direct proportion to your body weight. Lighter head and ends rest on just enough Foamex to give perfect, secure support. Heavier mid-section has more Foamex for firm, luxurious support. The result is head-to-toe balanced comfort that sends you off to sleep.

Foamex "breathes" — cool, fresh air as you do. And easily clean, light-weight Foamex is a joy to care for. Never requires turning. Stays smooth, firm, shaped with no bulges, ruffles, or bulges to spoil the look of the made-up bed.

Your favorite department or furniture store has a wide selection of Form-Fitted Mattresses of Firestone Foamex starting as low as $8.95. Stop in today and take a FREE Ref Test.
An Engineering Principle
To **Understand** Pavement Deterioration

Loading **always** causes material deformation.
Pavement deformations of individual vehicles are usually too small to see with the naked eye.
Elastic vs. Non-elastic Deformation

Elastic Deformation returns to original shape.

Non-Elastic Deformation Doesn’t.
Part 3

Pavement Deterioration

• What happens within the Pavement Structure when it is loaded?
• What parts of the Pavement Structure are effected by loading?
• What is Pavement Deterioration?
• What parts of the Pavement Structure can Deteriorate?
What happens within the Pavement Structure when it is loaded?

Pavement Materials Deform.
What Materials of the Pavement Structure can Deform?

Deformation can and will be in all of the Pavement Structure materials; (the subgrade, the aggregate layer, and the pavement.)
What is Pavement Deterioration?

• Pavement Deterioration is non-elastic deformation of any part of the pavement structure.
What parts of the Pavement Structure can Deteriorate?

Deterioration can be in any or all of the Pavement Structure materials; (the subgrade, the aggregate layer, and or the pavement.)
Pavement Deterioration that is visible is usually the Sum of Non-Elastic Deformations Caused by Many Vehicle Loads.
The Cumulative Effect Example

• Assume a Non–Elastic Deformation of only 0.001-inch per vehicle. This is about ½ the diameter of an average human hair.

• 1,000 vehicle passes would have created 1-inch of deformation.
Non-Elastic Pavement Deformation Example

Photo courtesy of

The Transportation Engineering and Road Research Alliance
Now *you* know how this happens.
Bottom Line:

Limit the amount of Non-Elastic Deformation.

"That's all folks!"