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Fremont Bridge Wearing Surface

Studies for Selecting a Wearing Surface for Re-Surfacing the Orthotropic Steel Deck of the Fremont Bridge in Portland, Oregon

Fremont Bridge

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- 2,159 foot Orthotropic Steel Deck
- Opened in 1973
- 68 feet wide
- Bolted Splices

Fremont Bridge

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- Crest vertical curve with 5% grade at each end
- Route splits at west end of bridge

Fremont Bridge

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Lane Split

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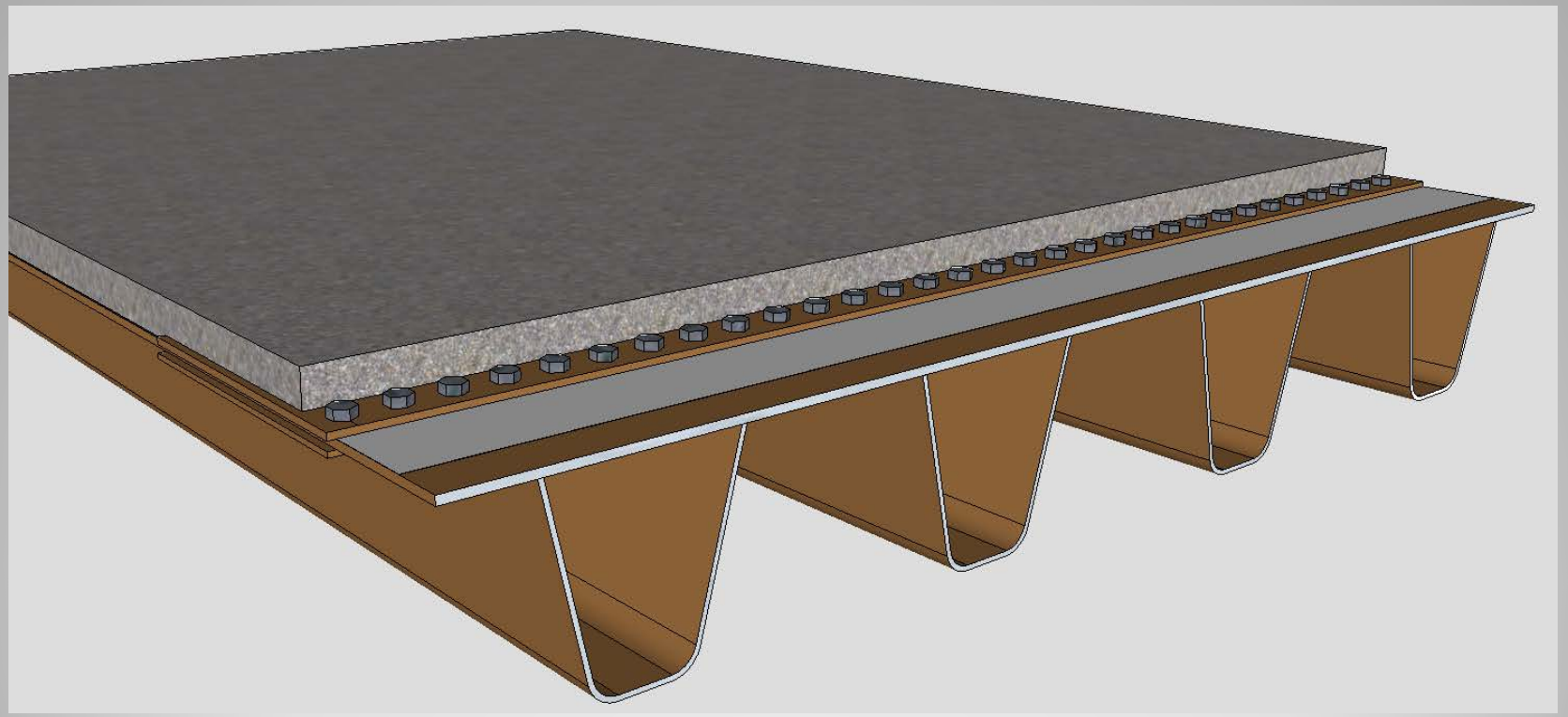
- **Original wearing surface - Epoxy Asphalt**



Original Construction

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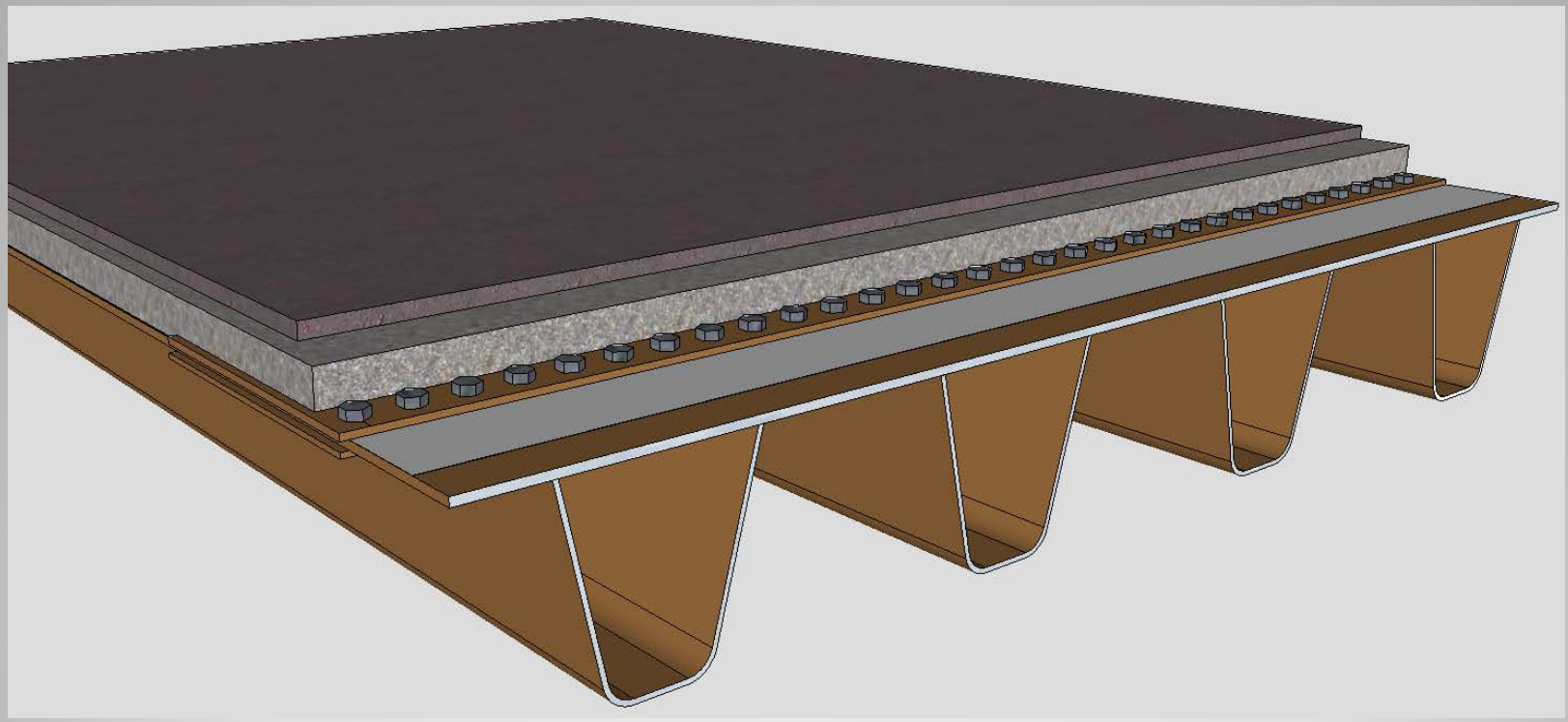
Issues with Original Surface

- **Original wearing surface - Epoxy Asphalt**

- Completed in cold weather
- Poor compaction
- Delayed cure of epoxy
- Rutting and Shoving

- 1” Asphalt Overlay in 1978
- 1 ½” Asphalt Inlay in 1997



Issues with Surface

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- Lane C at west end failed in 2002
- ODOT wanted a more durable solution

Issues with Original Surface

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Selection of New Wearing Surface

- CH2M HILL studied options for repair of wearing surface in 2006
- Assisted by Charles Seim
- New surface installed in 2011

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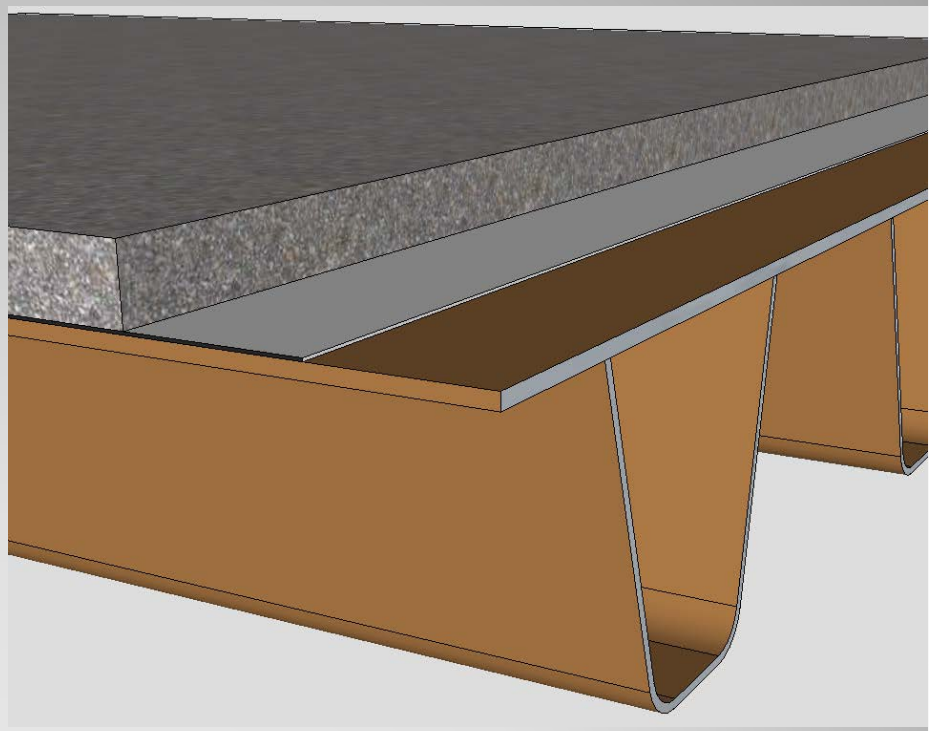
- Waterproofing Membrane
- Bond Course
- Isolation Course
- Wearing Course



Wearing Surface Requirements

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- Steel deck plate is integral part of structure
- Corrosion affects strength and stiffness
- Corrosion affects bond of wearing surface

Waterproofing Membrane

Bond Course

- Deck plate provides in-plane strength
- Bond layer stressed by
  - Temperature change
  - Flexure
  - Braking forces

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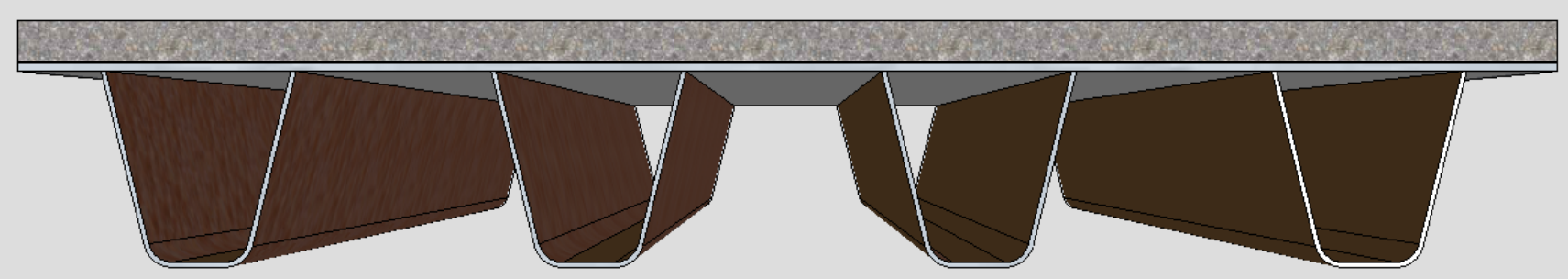
- Distributes wheel loads to deck
- Contributes to stiffness of deck



Isolation Course

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Wearing Course

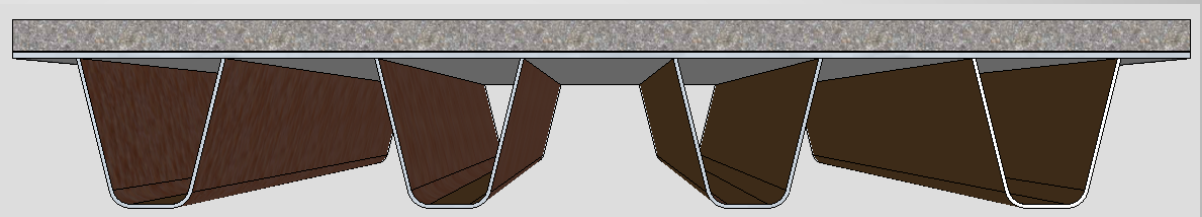
- Resists tire wear
  - Studded tires in Oregon
  - Heavy truck traffic
- Provides traction
  - Braking at split in route
  - Braking on downgrade

- Epoxy Asphalt
- Polymer-Modified Asphalt
- Stone-Matrix Asphalt
- Poured Asphalt (Gussasphalt)
- Trinidad Lake Asphalt
- Thin Epoxy or Epoxy- or Polymer-Modified Concrete

Options Considered

Epoxy Asphalt

- Original surface worked for 33 years
- Uses zinc-rich paint for corrosion protection
- Epoxy asphalt bond course
- Applied in two courses
- Requires careful control of temperature and compaction



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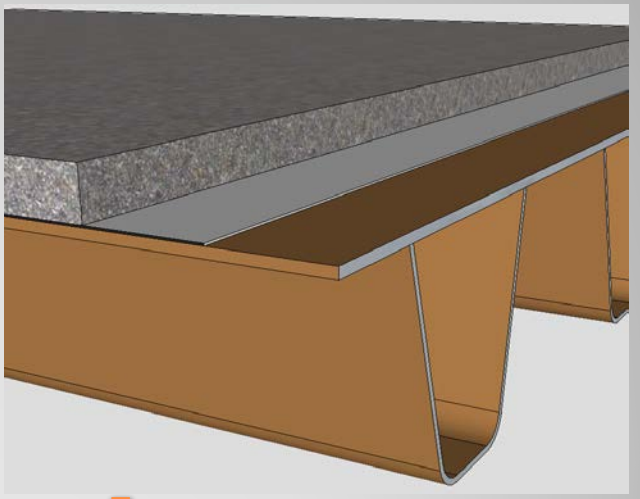
Epoxy Asphalt

- Advantages
  - Well-known system
  - History on this bridge
  - Current specs
  - Consistent with existing surface thickness

Epoxy Asphalt

- Disadvantages
  - Sole source supplier
  - No local batch plants
  - Sensitive to weather and compaction
  - Time to cure
  - Painting of deck

- Dense graded asphalt concrete
- Polymer modifiers provide strength
- Zinc-rich paint for corrosion protection
- Modified asphalt for bond course



Polymer-Modified Asphalt

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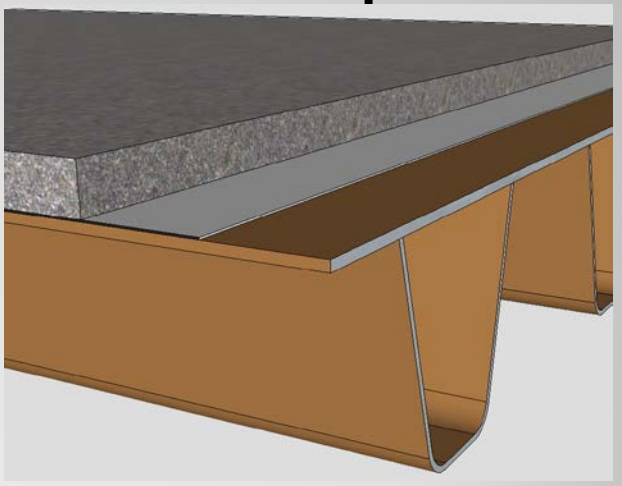
Polymer-Modified Asphalt

- Advantages
  - Consistent with existing overlay
  - Conventional equipment for mixing and placing
  - Some experience on bridge decks

Polymer-Modified Asphalt

- Disadvantages
  - Requires painting the deck
  - Stiffness not known
  - Design guidance not readily available
  - Some reports of short life

- Low-void asphalt pavement
- Strength from stone-on-stone contact
- Liquid asphalt bond course
- Can use polymer-modified asphalt



Stone-Matrix Asphalt

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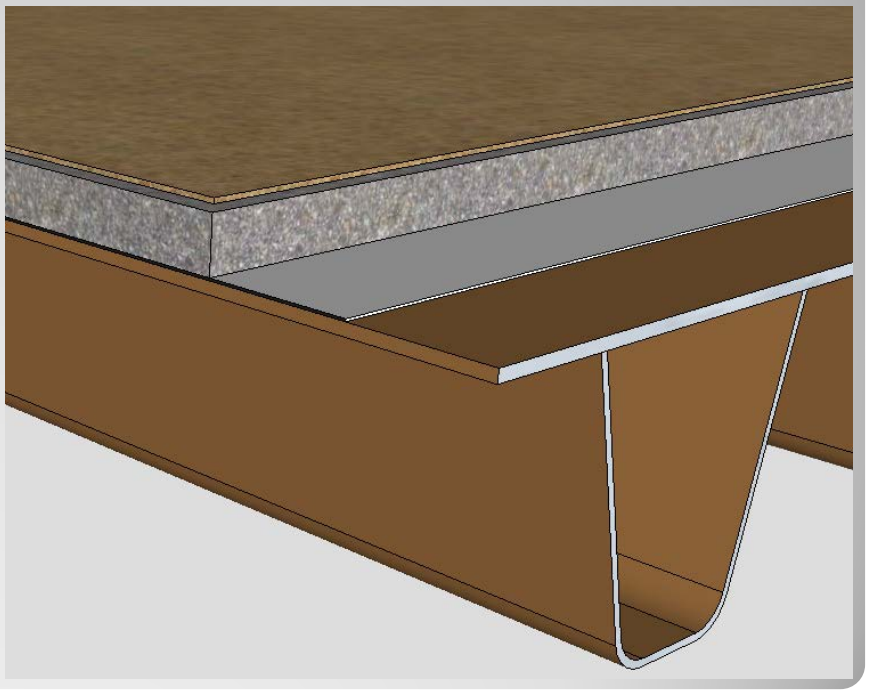
- Advantages
  - Consistent with existing surface thickness
  - Current specifications available for roads
  - Contractors are familiar with material
  - Quiet pavement

Stone-Matrix Asphalt

- Disadvantages
  - Requires zinc-rich paint
  - Stiffness not known
  - Compaction requires care
  - Some poor experience with material

Stone Matrix Asphalt

- Stiff bitumen with sand and stone chips
- No voids
- Pourable and floatable without compaction
- Placed hot
- Aggregate rolled into surface



Gussasphalt

Gussasphalt

- Advantages
  - Good performance record in Europe
  - Limited set-up costs
  - Easy installation

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Gussaphalt

- Disadvantages
  - Applied hot
  - Limited experience and specs in USA
  - Poor traction surface

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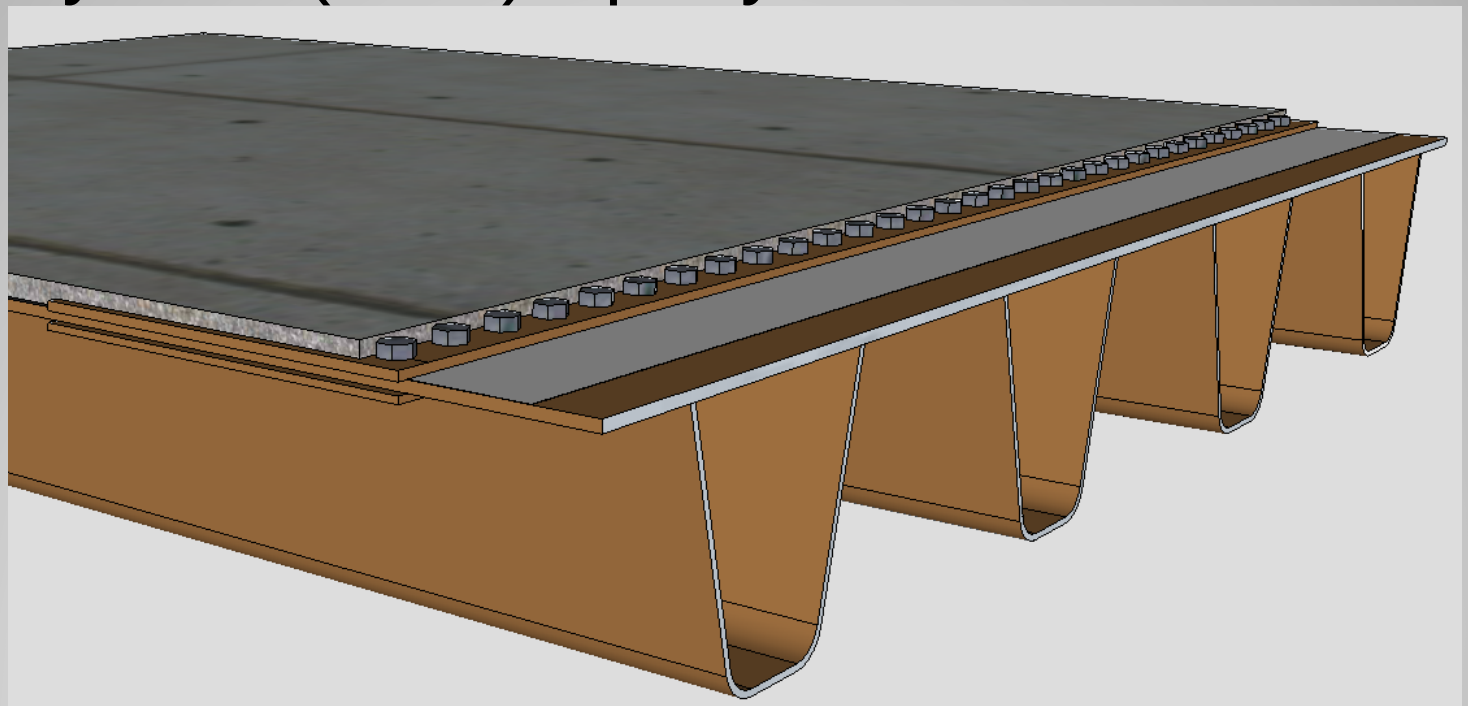
- Thin (1”) modified portland cement
- Very thin (1/4”) epoxy



Thin Modified Concrete

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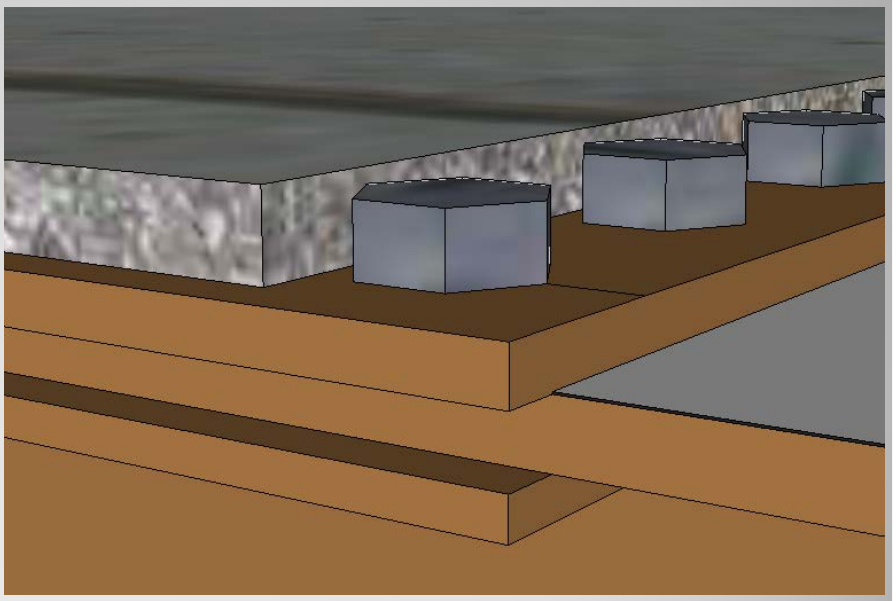
Thin Modified Concrete

- Advantages
  - Very light weight
  - Rapid installation
  - Acceptable performance
- Disadvantages
  - Not as effective in distributing loads
  - Too thin to cover bolt heads



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Short List

- Epoxy Asphalt
  - Excellent bond to steel deck
  - Good resistance to shoving
  - Well-developed specifications
- Polymer-Modified Asphalt
  - Lower cost vs lower service life
  - Conventional construction process

Recommendation

- Recommended Epoxy Asphalt
  - Installed cost within 5% of polymer-modified asphalt
  - Savings over life of wearing surface
  - Less traffic disruption for future wearing surface replacement
  - High level of confidence in performance
- Installed over entire deck in 2011
- Completed over three weekends

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