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
• 2,159 foot Orthotropic Steel Deck
• Opened in 1973
• 68 feet wide
• Bolted Splices
• Crest vertical curve with 5% grade at each end

• Route splits at west end of bridge
Lane Split
- Original wearing surface - Epoxy Asphalt

Original Construction
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
Issues with Original Surface

- Lane C at west end failed in 2002
- ODOT wanted a more durable solution
● CH2M HILL studied options for repair of wearing surface in 2006

● Assisted by Charles Seim

● New surface installed in 2011
- Waterproofing Membrane
- Bond Course
- Isolation Course
- Wearing Course

Wearing Surface Requirements
• Steel deck plate is integral part of structure

• Corrosion affects strength and stiffness

• Corrosion affects bond of wearing surface

Waterproofing Membrane
- Deck plate provides in-plane strength

- Bond layer stressed by
  - Temperature change
  - Flexure
  - Braking forces
- Distributes wheel loads to deck
- Contributes to stiffness of deck
Wearing Course

- Resists tire wear
  - Studded tires in Oregon
  - Heavy truck traffic

- Provides traction
  - Braking at split in route
  - Braking on downgrade
Options Considered

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

- Well-known system
- History on this bridge
- Current specs
- Consistent with existing surface thickness
• Disadvantages
  ◦ Sole source supplier
  ◦ No local batch plants
  ◦ Sensitive to weather and compaction
  ◦ Time to cure
  ◦ Painting of deck

Epoxy Asphalt
Polymer-Modified Asphalt

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

- Advantages
  - Consistent with existing overlay
  - Conventional equipment for mixing and placing
  - Some experience on bridge decks
**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
• Advantages
  ◦ Consistent with existing surface thickness
  ◦ Current specifications available for roads
  ◦ Contractors are familiar with material
  ◦ Quiet pavement
• **Disadvantages**
  ◦ Requires zinc-rich paint
  ◦ Stiffness not known
  ◦ Compaction requires care
  ◦ Some poor experience with material
Gussasphalt

- Stiff bitumen with sand and stone chips
- No voids
- Pourable and floatable without compaction
- Placed hot
- Aggregate rolled into surface
• Advantages
  ◦ Good performance record in Europe
  ◦ Limited set-up costs
  ◦ Easy installation
• Disadvantages
  ◦ Applied hot
  ◦ Limited experience and specs in USA
  ◦ Poor traction surface
• Thin (1”) modified portland cement

• Very thin (1/4”) epoxy
Advantages
- Very light weight
- Rapid installation
- Acceptable performance

Disadvantages
- Not as effective in distributing loads
- Too thin to cover bolt heads
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
• 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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