Roadway Infrastructure and WPT Integration

CERV

February 9, 2015

Rebecca S. McDaniel

North Central Superpave Center, Purdue University

Technical / Engineering Challenges

- More concern for dynamic and semi-dynamic charging
  - Mainline charging pad installation and performance
- Different types of pavements behave differently
  - Asphalt pavements deform under load, stiffness changes over time, properties vary with temperature
  - Concrete pavements expand and contract, curl and warp with variations in temperature and moisture
  - All types of pavements may crack

Pavement Surface Courses

- Safety
- Traffic Loads
- Environmental Factors
  - Temperature extremes
  - Moisture variations
- Other Considerations
  - Noise
  - Smoothness
  - *Economics – Initial and Life Cycle*
  - *Traffic Disruptions*

Steel in Concrete Pavement

- Depending on type of concrete pavement, there can be significant amounts of steel.

- Steel slag aggregates used extensively in some areas

Surface Types

Public Roads

- Unpaved 1,393,651 miles
- Asphalt 768,961 miles
- Concrete 50,369 miles
- Composite 98,758 miles

Urban Interstates

- Unpaved – none
- Asphalt – 6,912 miles
- Concrete – 4,534 miles
- Composite – 4,246

We will have to be able to install in asphalt, concrete and composite pavements.

Very little new roadway construction – will have to be able to "retrofit" installation.

Concerns about WPT Impacts on Pavement

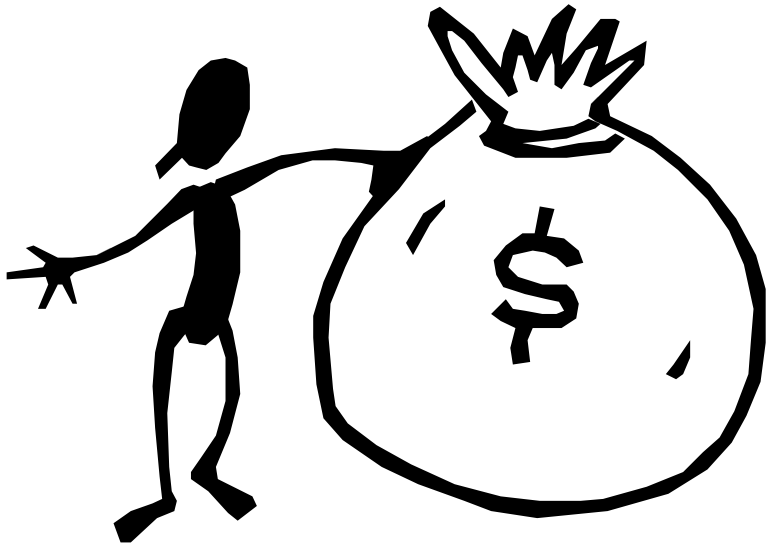
- Must maintain safe, durable roadways (adequate friction and smoothness) over pavement life
- WPT cell must function while pavement deforms and cracks
- Effects of WPT on steel reinforcing or steel slag aggregate (and vice versa)
- How long will cells perform?

Pavement Service Lives

- Asphalt pavements may last 8-20 years or more
  - Perpetual pavements designed to last 50 years with routine surface renewal
- Concrete pavements – 30-50 years
- Significant reductions in service life – anything more intrusive than routine maintenance – will not be acceptable.

WPT Network Needs

- WPT network must be large enough to justify costs of vehicles and infrastructure



Crumbling Infrastructure

- American Society of Civil Engineers 2013 Report Card rates:
- Roadway conditions – D
  - Congestion and condition problems
  - 42% of US major urban interstates are congested
  - Congestion costs $101 billion a year in lost productivity and wasted fuel
  - Federal, state and local budgets investing $91 billion per year
  - FHWA estimates funding needs at $170 billion annually
- Bridges – C+
  - One in nine bridges rated structurally deficient

Economic Climate

- Reduced mileage and more efficient vehicles reduce Highway Trust Fund income
  - Gas tax has not increased since 1993
- Electric vehicles further reduce income
- Under these conditions, hard to justify increased costs to build roads
- Must convince state agencies, FHWA of value of WPT infrastructure

Highway Agencies

- Conservative, risk averse
- Striving to increase pavement service lives, decrease costs
- Some are more environmentally conscious than others
- Generally reluctant to do anything that might reduce pavement life, increase maintenance costs and disruption

Realistically

- WPT is a great idea with many benefits
- But, it will be a hard cell in cash-strapped highway agencies
- How can we overcome the reluctance of agencies to implement the technology?

Rebecca S. McDaniel
Technical Director
North Central Superpave Center
765/463-2317 ext. 226
rsmcdani@purdue.edu
https://engineering.purdue.edu/NCSC/