Dynamic Wireless Power Transfer (DWPT) In-Pavement EV Charging Pilot Projects

Greg Reilly – Associate Vice President - AECOM

ITS Wisconsin – October 17, 2024

Agenda

What we'll cover

1. What is DWPT?
2. DWPT pilot project overview
3. Pilot project design
4. Future of wirelessly charged vehicles
5. Other AECOM DWPT projects

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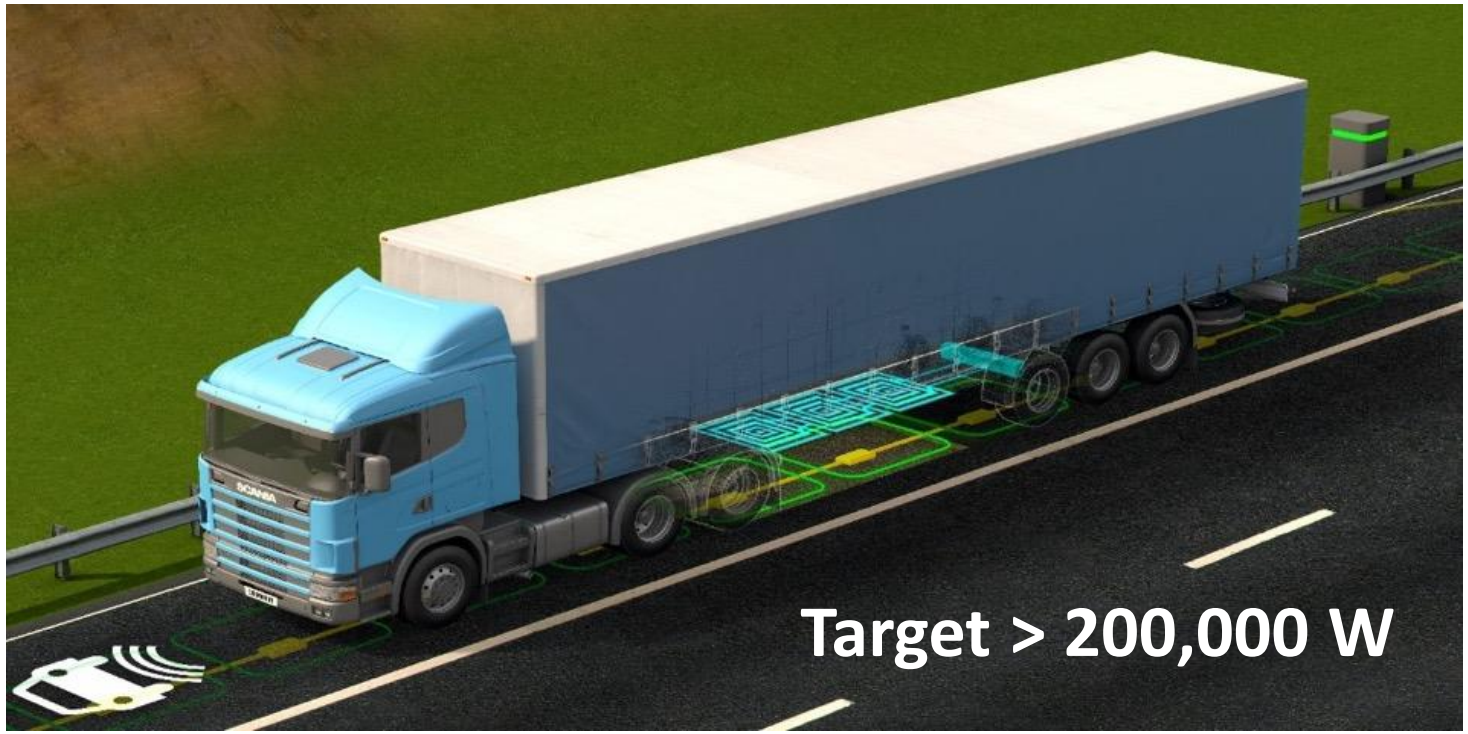
What is Dynamic Wireless Charging or DWPT?

- Energy transferred from transmitter to receiver through time-varying magnetic fields
  - Same fundamental idea as wireless cellphone charging
- High frequency electron movement (electric current, amps) in transmitter
- Similar technology used for static vehicle wireless charging



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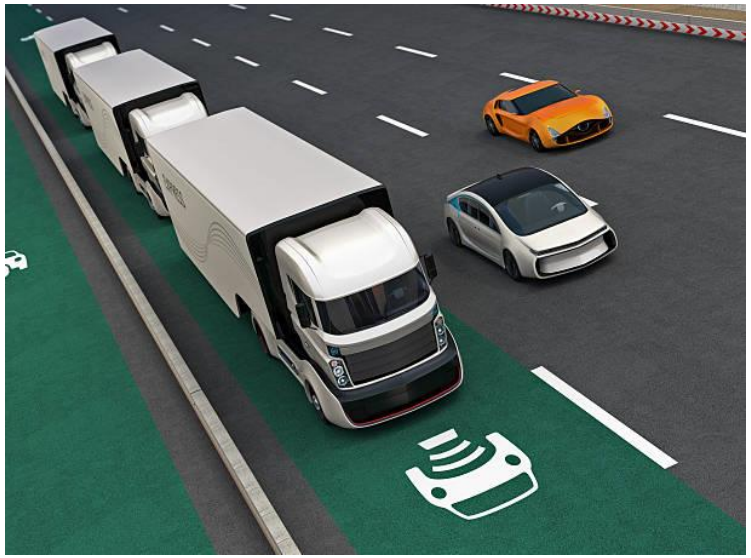
Dynamic & Static Wireless Charging Use Cases

- Wireless highway charging for light & heavy-duty vehicles
- Wireless in-route opportunity charging
- Wireless fleet charging (static/overnight)
- Wireless autonomous vehicle charging
- Bidirectional grid power sharing (V2G)



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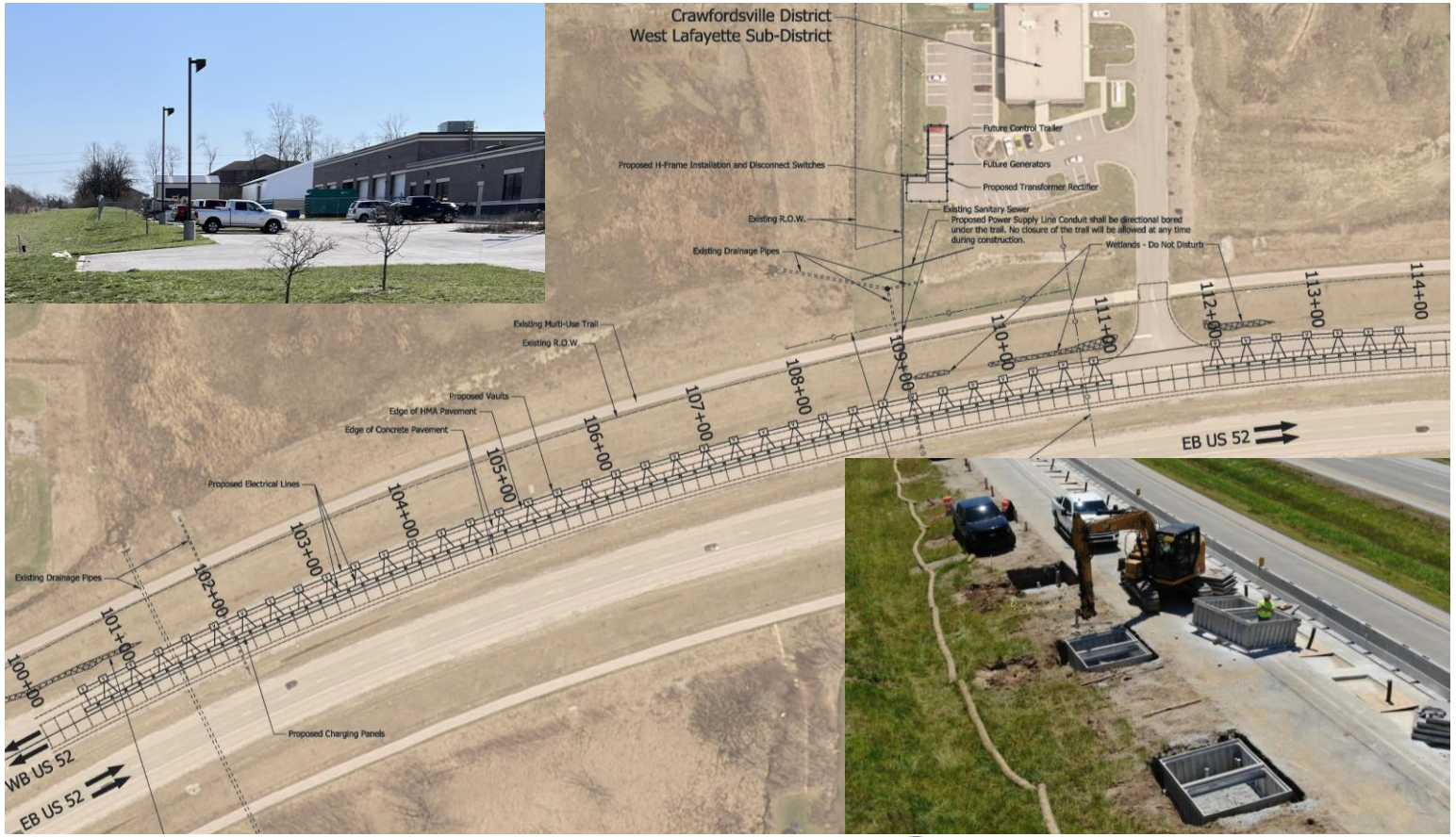
Wireless Charging Standards

- SAE Standards
  - J2954 – Light Duty Vehicles
  - J2954/2 – Heavy-Duty Vehicles
  - J2954/3 – DWPT
    - Light & Heavy-Duty Vehicles
    - Scheduled to be released 2024

INDOT DWPT Pilot Project Overview

- Project Purpose: Test the constructability, functionality, and capabilities of the DWPT system and specially equipped EVs designed to receive its power
- Charge vehicle moving along roadway
- On 1/4 mile of WB/NB US 52 in West Lafayette
- Adjacent to INDOT sub-district office



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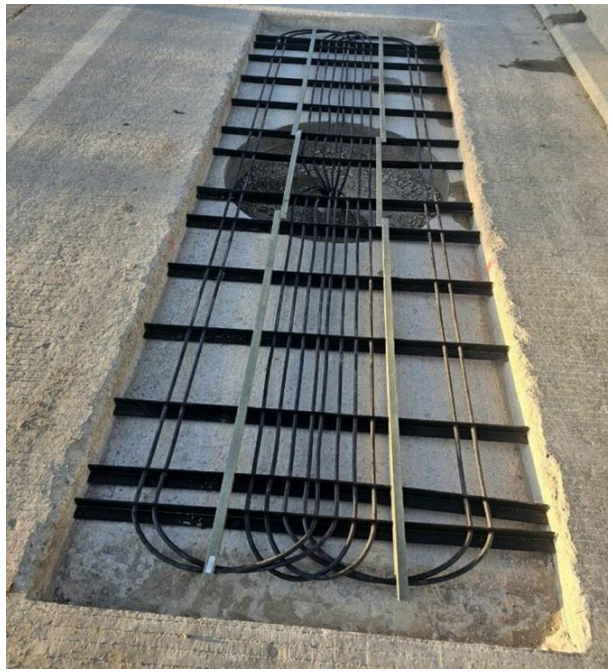
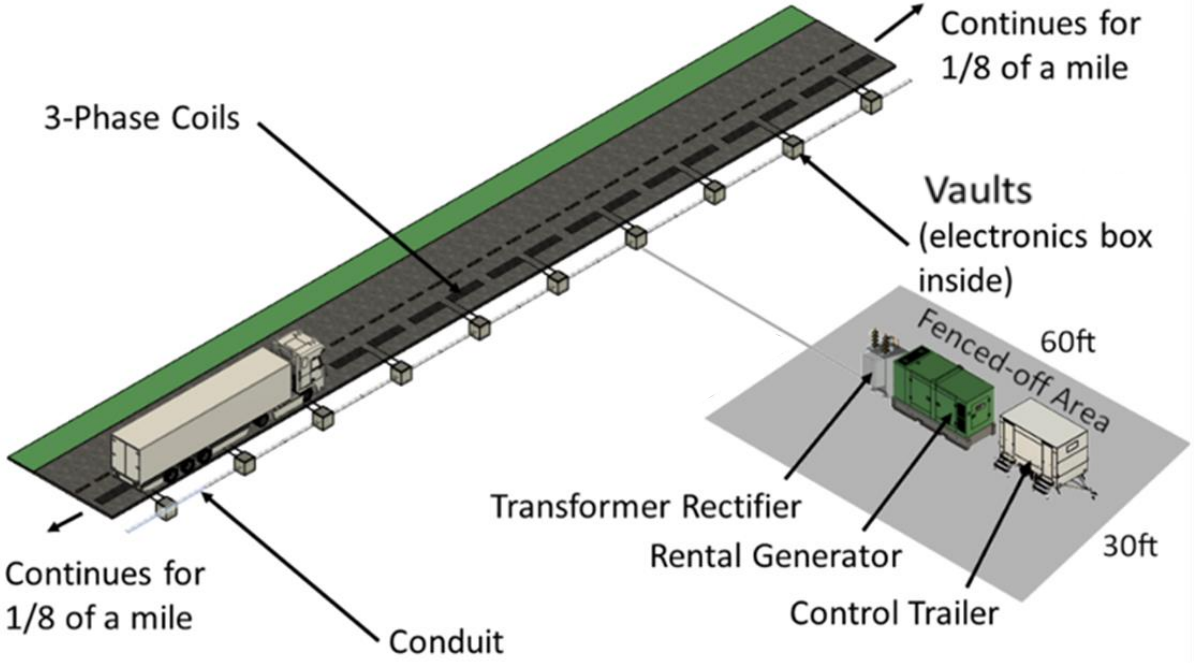
INDOT DWPT Pilot Project Overview

- Cummins Class-8 Truck for vehicle-centered evaluation
- Deliver up to 230 kW per pad
- Energy transferred from 3-phase transmitter to receiver
- DC & AC Power distribution
- CAT6 & MMF communications





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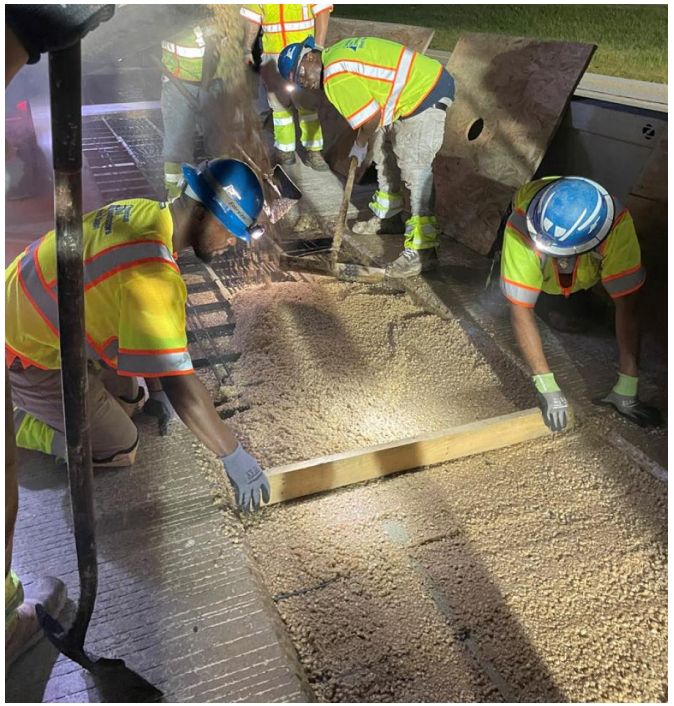
DWPT Pilot Project Overview

- **Project Schedule**
  - Bidding phase – July-Sept 27, 2023
  - Material fabrication / procurement – October 2023-April 2024
  - Construction – April 2024-Spring 2025
  - Pilot Testing – Spring-August 2025



Concept Lab Testing Phase → Design Phase → Bidding Phase → Material Fabrication / Procurement → Construction → Pilot Testing

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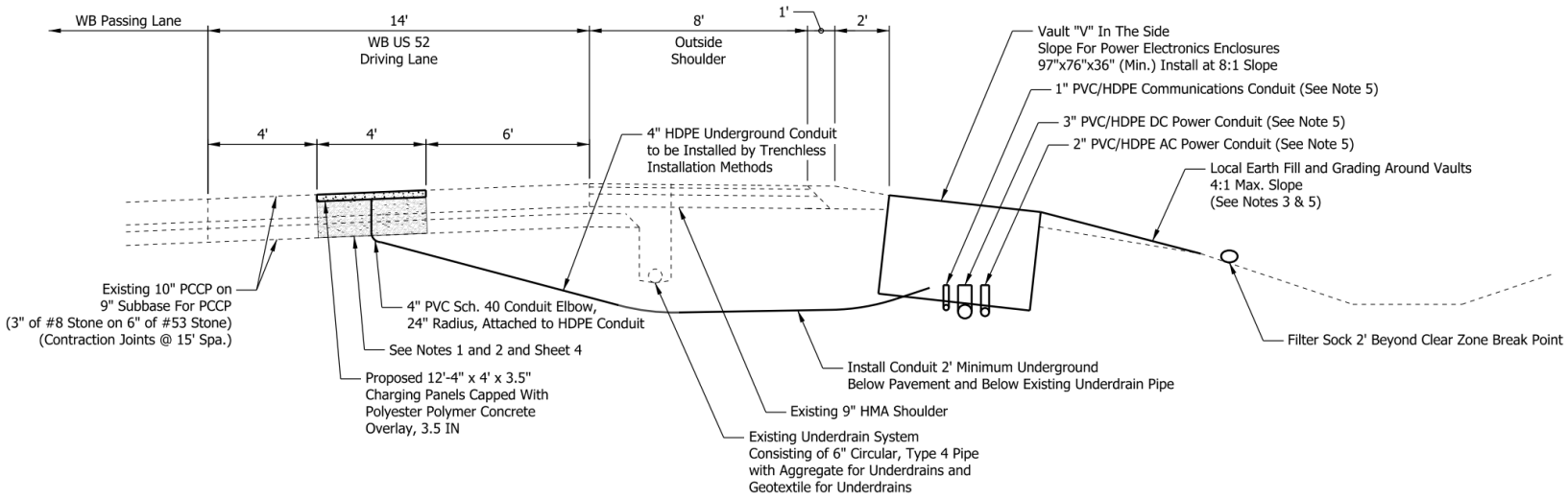
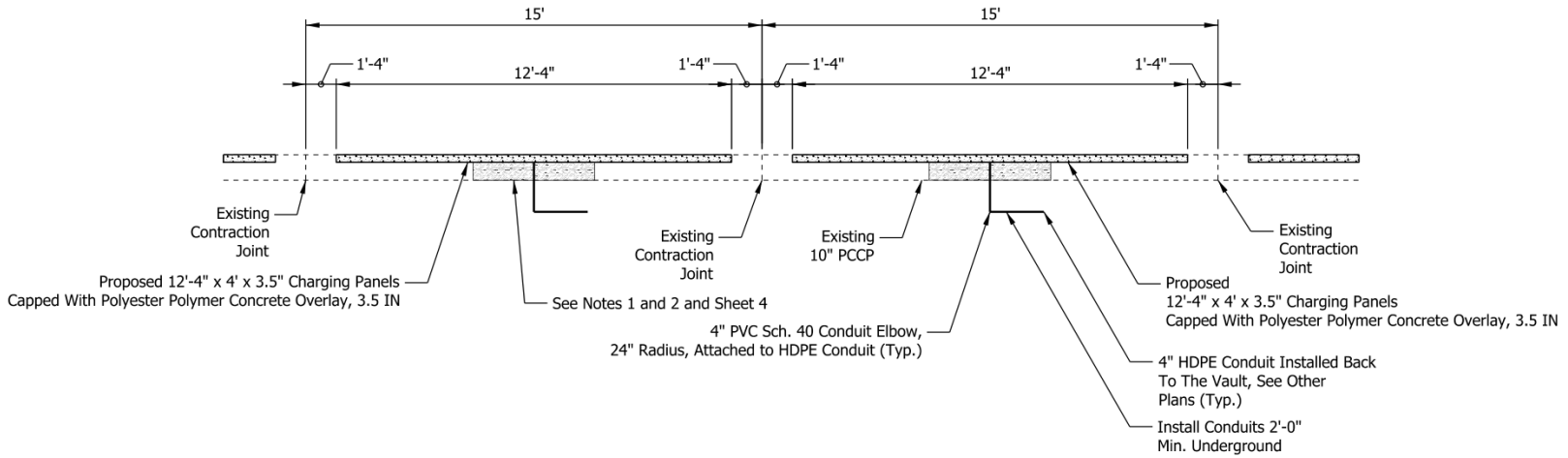
DWPT Pilot Project Design

- Existing PCCP roadway
- Micro-milling & 4’ round pavement removal for coils and conduit
- Polyester polymer concrete patch & overlay
- Directional bored conduit
- Vaults in side slope



Typical Section - US 52
Sta. 100+00 to Sta. 115+00 Line "A"



Side View - US 52

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DWPT Pilot Project Design

- AC to DC transformer rectifier unit
- Disconnect switches/junction box/H-frame rack
- Polymer concrete vaults

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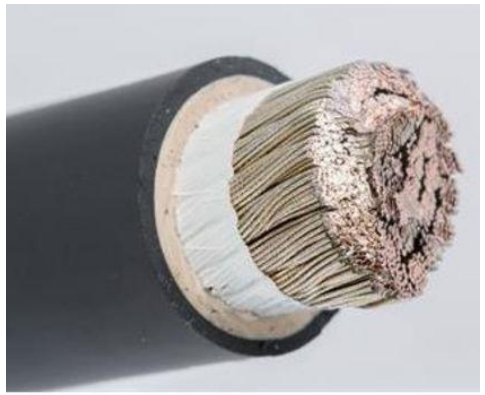
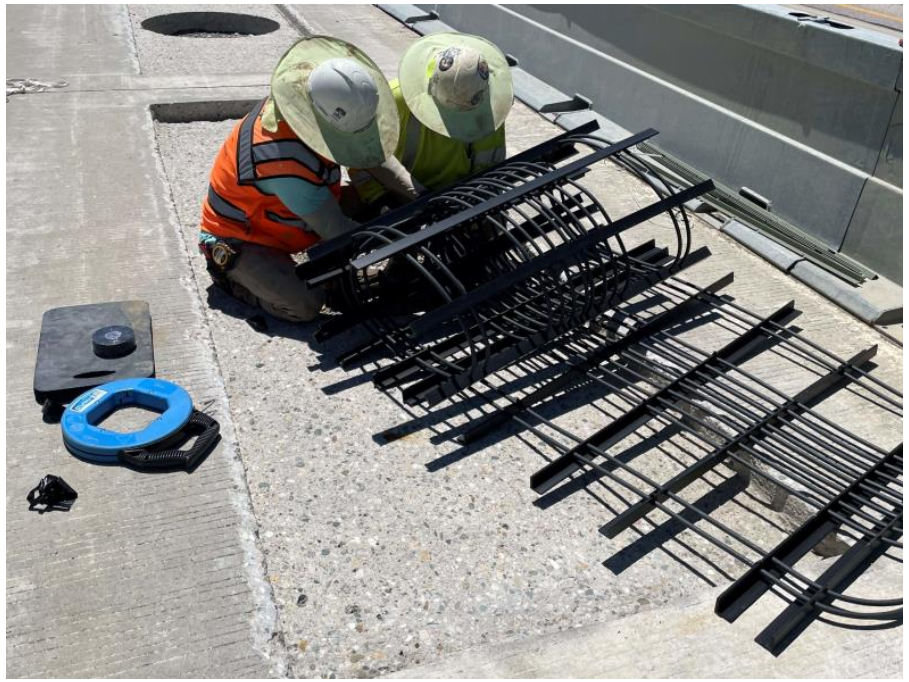
DWPT Pilot Project Design

- DC & AC feeder DLO cables
  - 750VDC & 120VAC operating Voltages
- CAT6 & MMF cables

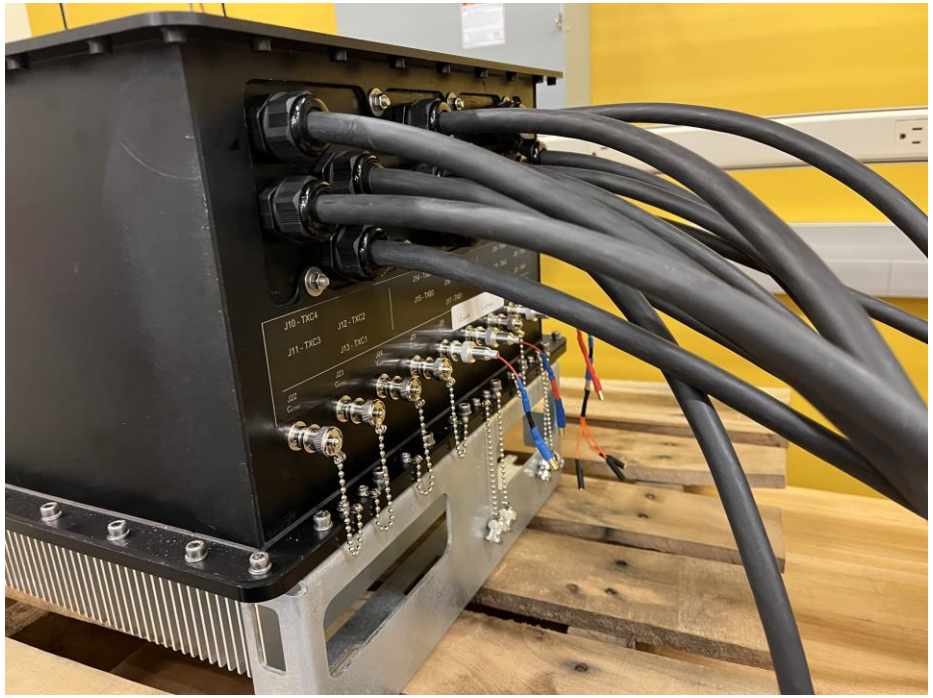


- Litz wire (for embedded coils)
  - Pattern & no splices are critical
  - Wire leads twisted back to vault



DWPT Pilot Project Design

- Inverters for DC to 3-phase AC conversion
  - 230kW, high frequency AC output
  - Controller w/4-port Ethernet switch
- Transmitter compensation units
  - Capacitors & inductors to tune coils
- One set per embedded coil



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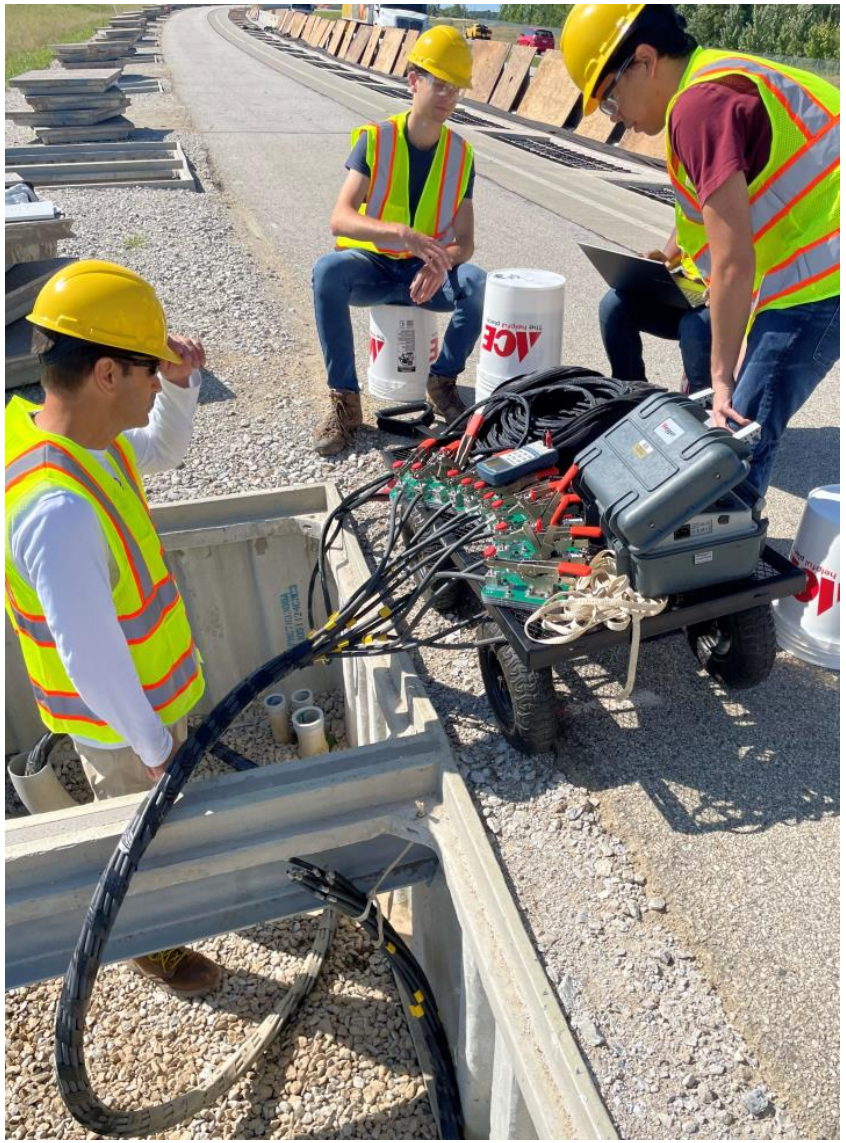
DWPT Pilot Project Design

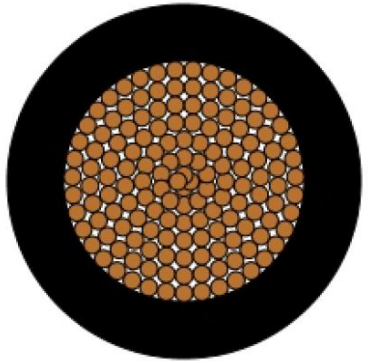
Components	By Contractor	By Others	Acceptance Testing
Portable generators (during acceptance testing)	X		
AC to DC transformer rectifier unit & concrete pad	X		X
Disconnect switches/junction box/H-frame rack	X		
DC & AC feeder cables	X		X
CAT6 & MMF cables	X		X
Litz wire (for embedded coils)	X		X
PVC/HDPE Conduits	X		
Polymer concrete vaults	X		
Inverters	X		X
Transmitter compensation units	X		X
Grounding	X		X
Control trailer		X	
Portable generators (long term for pilot)		X	
Mobile test apparatus/vehicle		X	
Wiring from trailer to H-frame/transformer rectifier unit		X	

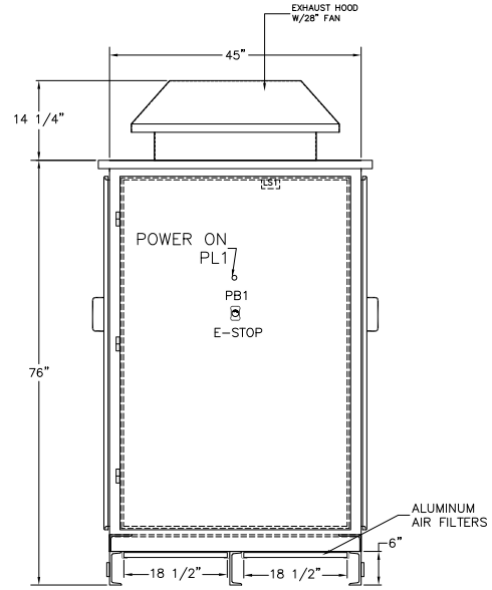


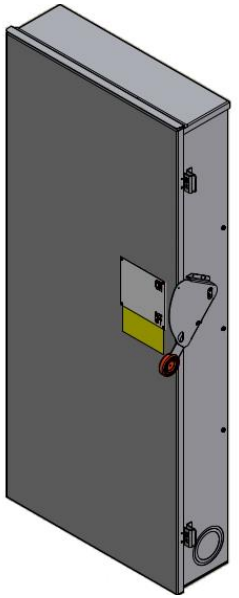
DWPT Pilot Project Shop Drawings & Field Inspection

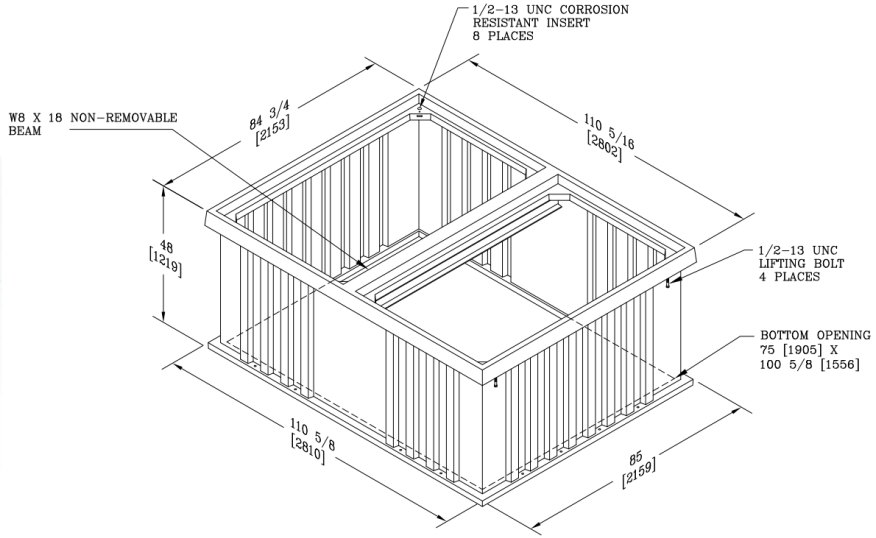
Field Inspection

- Wiring in vaults
- Vault electronics installation
- Vault electrical/comm cabling termination
- Transmitter coils
- Rectifier installation
- Electrical terminations at disconnect switches and rectifier
- Review cable test reports









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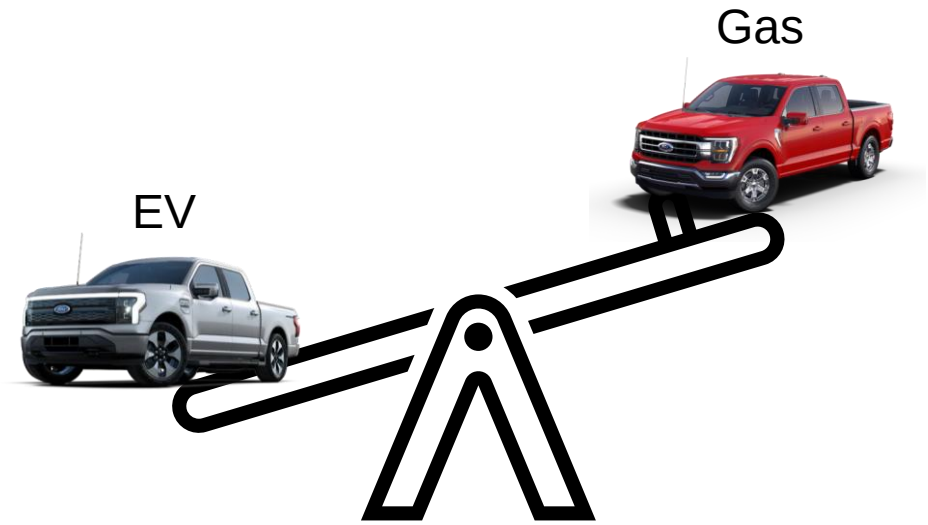
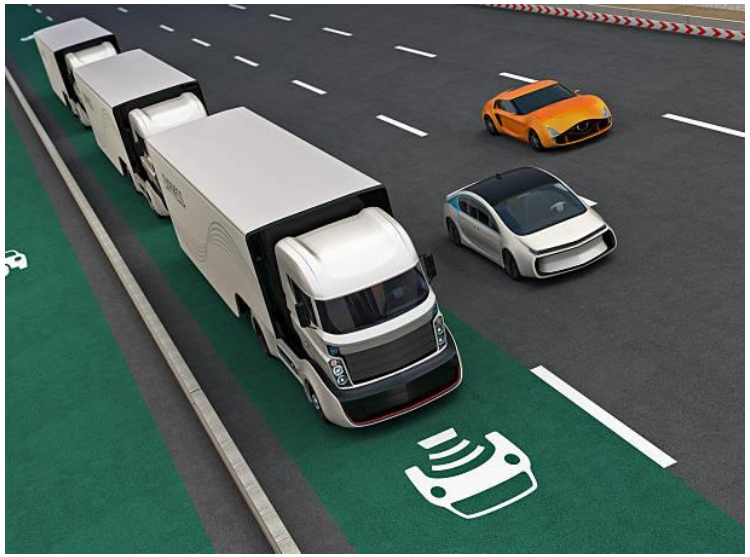
Future of Wirelessly Charged Vehicles

- In-route recharging & lighter vehicles
- Safety considerations
- Autonomous EV’s

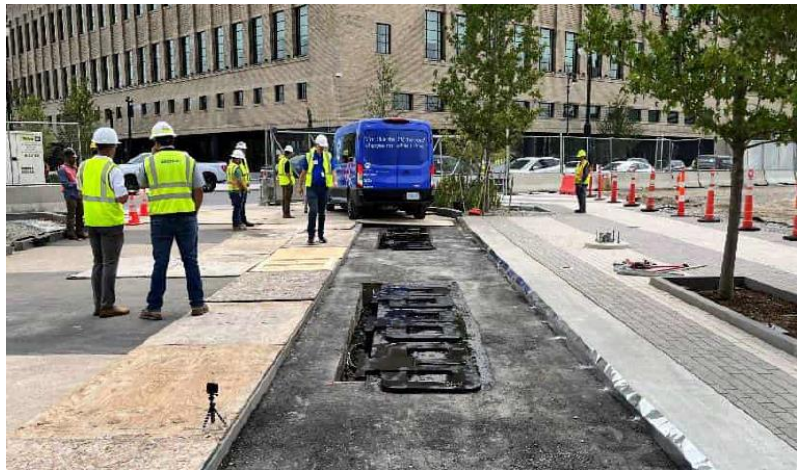




Other AECOM DWPT Projects

MDOT - Dynamic Wireless Inductive Charging Road Systems Project

14th St. Dynamic Charging Installation



15th St. Static Charging Installation

Limits of Deployment for the US-12 (Michigan Avenue) Dynamic Inductive Wireless Charging Deployment

Other AECOM DWPT Projects

FDOT - SunTrax

- Dynamic Wireless Inductive Charging Pilot

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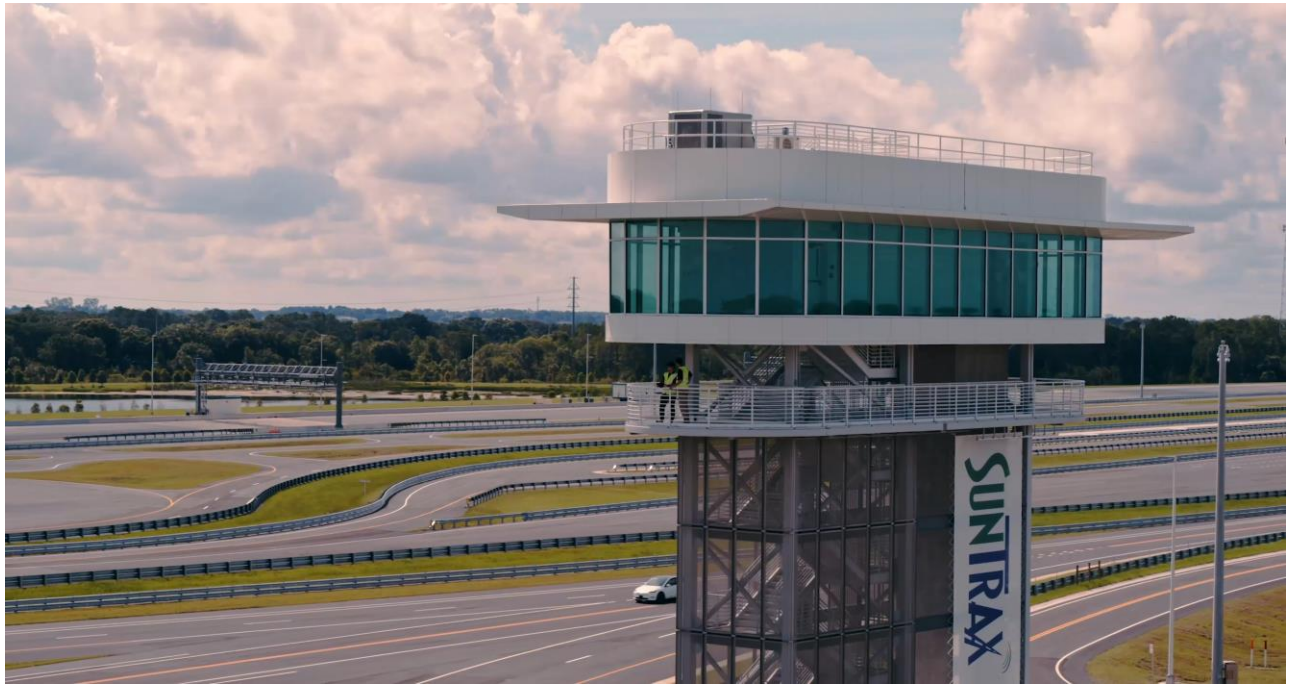

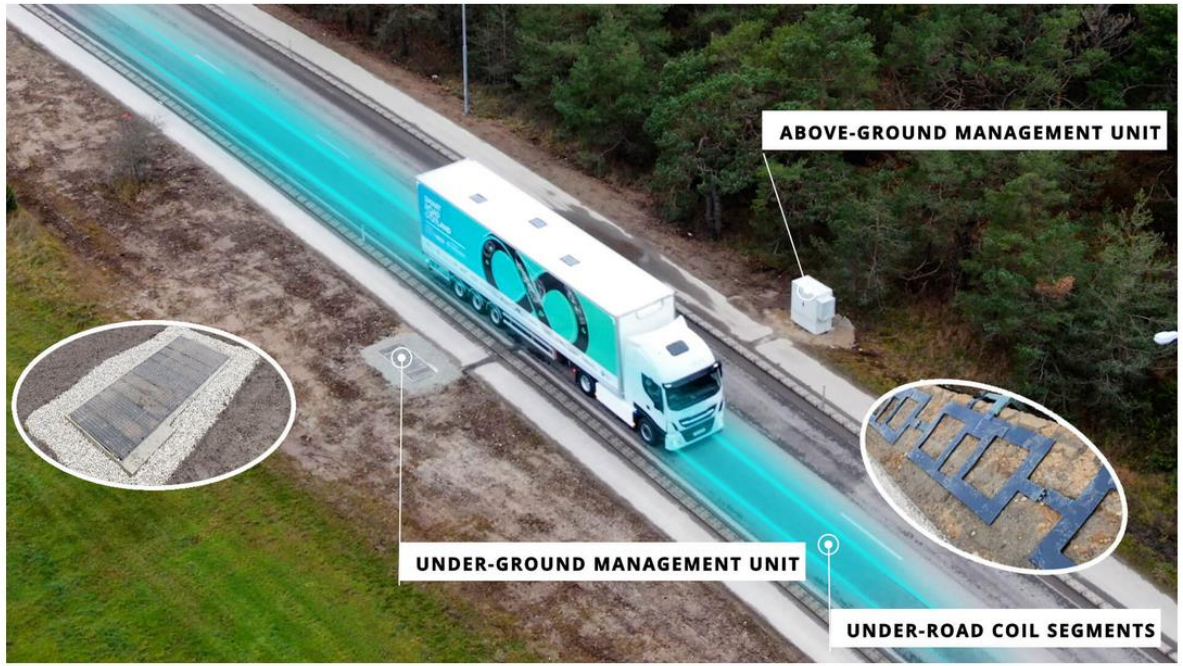

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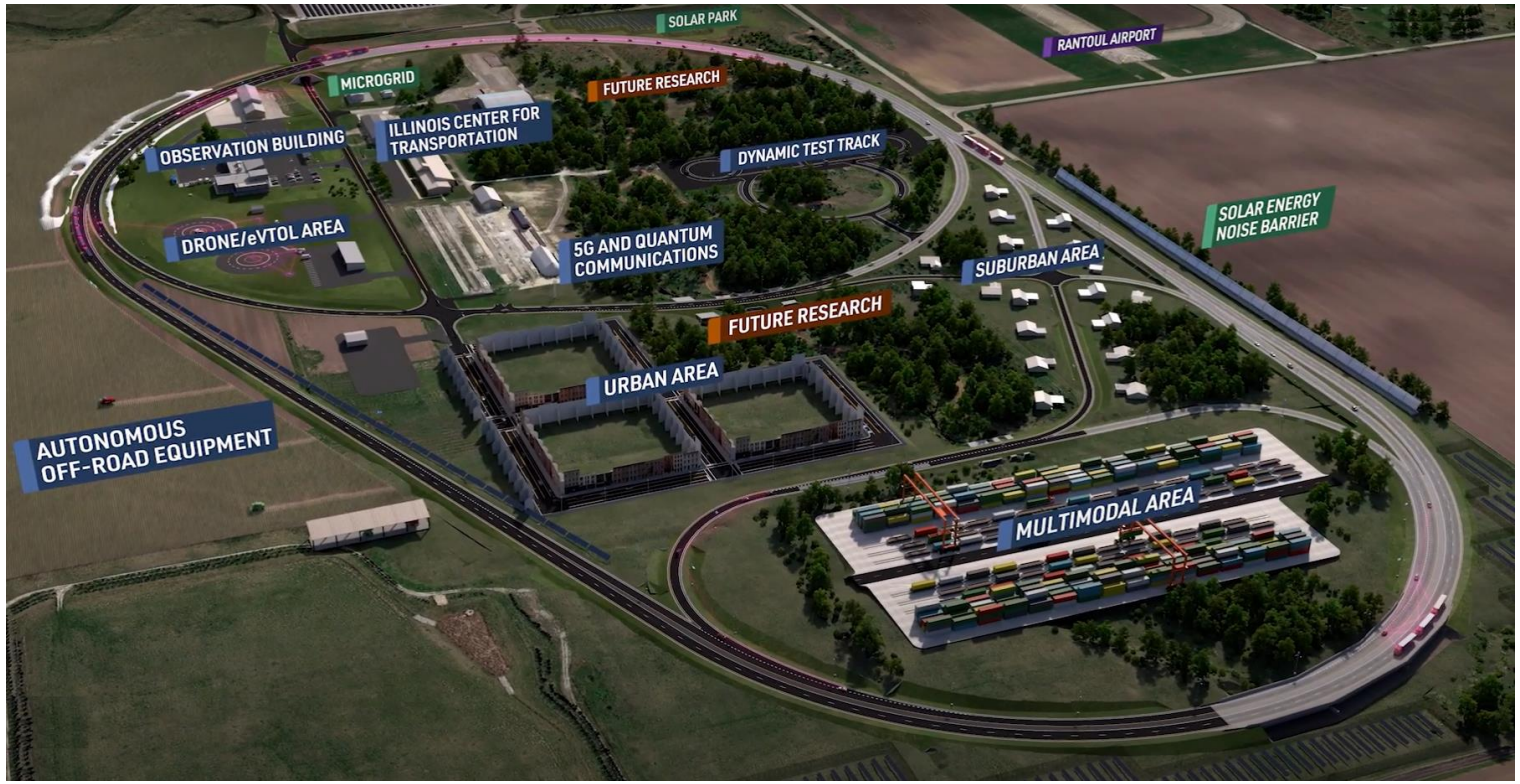
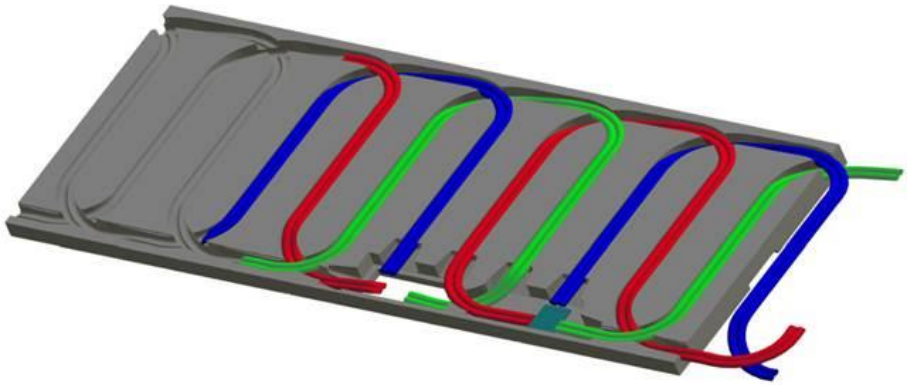
Other AECOM DWPT Projects

Illinois Autonomous and Connected Track (I-ACT)

- University of Illinois Urbana Champaign - Illinois Center for Transportation
- Electrified pavements for inductive wireless charging & energy harvesting





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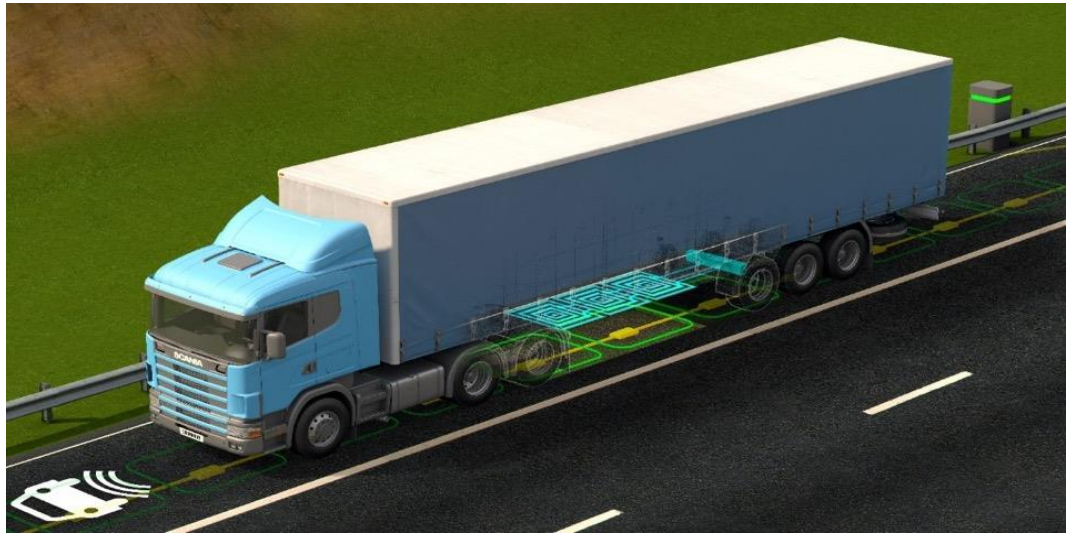
Other AECOM DWPT Projects

NDOT I-80 In-Road Charging

- 6-Lane widening west of Lincoln, NE
- Interstate DWPT pilot



Contact Information.

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Thank you.

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