NextGen Highways

February 15th, 2022

NGI Consulting & The Ray
The Ray and NGI Consulting

Allie Kelly
Exec. Director at The Ray
The Ray runs an 18-mile test bed in partnership with GA DOT and is working to deploy proven solutions with over 25 DOTs across the country
Twenty years experience leading non-profits and working in government affairs

Morgan Putnam
Founder of NGI Consulting
Created and led the MN Solar Pathways project, which highlighted the value of overbuilding and curtailment
Worked with utilities across the country to improve the interconnection process for DERs (see white paper)

Laura Rogers
Deputy Director at The Ray
Led work to open up Maryland’s highway ROW for solar energy projects
Decade plus of experience handling environmental regulations and permitting
NextGen Highways

NextGen Highways are highways with the strategic co-location of:

► electric transmission lines
► ZEV charging/fueling infrastructure
► fiber, 5G, and other communications infrastructure

as discussed in this white paper
Why NextGen Highways?

A. To prepare for the Future of Transportation

A single heavy-duty vehicle will require 1,200 homes worth of power when fast-charging

https://rmi.org/insight/seattle-city-light/
New Transmission is Needed to Support Fleet and Highway Electrification

Why fleets and highways: The scope and scale of fleet & highway charging loads will require both T&D solutions

- **Residential**: At home or on residential street typically overnight
- **Local**: At station equivalent to gas station, visited for the recharge
- **Commercial**: While parked at a venue such as work, shop, hotel etc.
- **Fleet**: At depot / hub for fleets including delivery and transit
- **Highway**: At station, on driver routes enabling long journeys

Source: National Grid.

‘Full Speed Ahead: Enabling Future Fleet and Highway Electrification.’

D-TECH+ Series, July 22nd, 2021
NextGen Highways Prepare for Transportation Electrification

Transportation electrification inherently links transportation and grid infrastructure.

States are making 50-year infrastructure investments in transportation and grid infrastructure that don’t consider that linkage.

The two projects shown here started construction within 12 months of each other and provide a good example of how states are not yet planning for transportation electrification.
NextGen Highways Enable the Macro Grid Needed for a Low-cost, Clean, and Reliable Grid

The black lines in the figure represent an HVDC grid that could deliver $1-2 of net benefits for every $1 invested and enable 85% renewable penetration.

The dark blue lines represent the parts of the existing federal highway system that could be used for the construction of a nearly equivalent HVDC grid.

As can be seen, there is a strong overlap between the two.

NextGen Highways Improve Broadband in Urban and Rural Areas
Organizations Interested in Further Exploration of the NextGen Highways Concept

- GREAT PLAINS INSTITUTE
- NEMA
- DEPARTMENT OF TRANSPORTATION
- Americans for a Clean Energy Grid
- NACFE
- ITC
- CLEAN GRID ALLIANCE
- THE MCKNIGHT FOUNDATION
- ENERGY FOUNDATION
- Fresh Energy
- GridLAB
- CONSERVATION MINNESOTA
- ELECTRANIX
- ESIG
Federal Funding and Policy
US DOE & DOT Secretaries Are Collaborating on Co-Location

White House press release discussing US DOT and US DOE actions to support Clean Energy and Connectivity projects in highway ROW

“I think it’s important for us to think about digging once and also potentially using those rights-of-way if we have to ground grid transmission wires or if we would like to get broadband to rural communities.”
Federal Policy and Direction

April 2021 - FHWA Memo
Clarified that highway right-of-way (ROW) “can be leveraged by State DOTs for pressing public needs relating to climate change, equitable communications access, and energy reliability.”[4]

December 2021 - FHWA Memo regarding US DOT Funding
Highlighted that priority will be given to projects “that maximize the existing right-of-way for accommodation of non-motorized modes and transit options that increase safety, accessibility, and/or connectivity.”[21]

December 2021 - FHWA Rulemaking
FHWA amended its regulations governing the accommodation of utilities to implement requirements of the Consolidated Appropriations Act, 2018, for broadband infrastructure deployment. [20]
NextGen Highways Feasibility Assessment with MnDOT
Buried HVDC Transmission Feasibility Assessment

- MnDOT’s Sustainable Transportation Advisory Council recommended MnDOT analyze the NextGen Highways Concept; MnDOT joined the project in Summer 2021
- This is a proactive planning project that was initiated by NGI Consulting and The Ray and paid for by philanthropy; a report will be released in March 2022
- The project is focused on evaluating the feasibility of new technology (buried HVDC transmission) to help address significant decarbonization barriers (transmission siting and transportation electrification)
MnDOT’s NextGen Highways Workgroup Composition

1. Sustainability & Public Health Division  
   a. Tim Sexton and Jessica Oh

2. Office of Environmental Stewardship  
   a. Jennifer Read, Tara Carson, and Tina Markeson

3. Regional Transportation Management Center (ITS)  
   a. Brian Kary, Ralph Adair, and Terry Haukom

4. Minnesota IT Services (MNIT)  
   a. Jim Johnson

5. Minnesota Connected and Autonomous Vehicles (CAV-X) Office  
   a. Tara Olds

6. Construction & Innovative Contracting Office  
   a. Troy Strassburg

7. MnDOT District 2  
   a. Jamie Hukriede (Maintenance)

8. Office of Maintenance  
   a. Tom Peters

9. Office of Land Management  
   a. Joseph Pignato and Julie Groetsch  
   b. Stacy Kotch Egstad, Ann Driver and Jim Zigman (Utilities Section)

10. District: Right of Way  
    a. Rebecca Parzyck (Engineer, Metro District)  
    b. Dale Nikkola (Utilities, Metro District)

11. Office of Transportation System Management  
    a. Anna Pierce

12. Chief Counsel  
    a. Sam Juneau, Jeff Metcalf

13. MN Dept. of Commerce  
    a. Louise Miltich (Energy Environmental Review and Analysis)  
    b. Katherine Blauvelt (CC-ed for broad awareness)

14. MN Public Utilities Commission  
    a. Bret Eknes (Energy Facilities Permitting)
Snapshot of Questions from MnDOT

 ► **Safety**: how can maintenance work be done in the vicinity of buried transmission lines?

 ► **Expansion**: how do we preserve ROW for future expansion?

 ► **Current Policy Environment**: what are the considerations for changing the long-standing prohibition on longitudinal lines in controlled access highways?

 ► **Relocation Cost**: how is the cost of relocation of a transmission line paid for?

 ► **Adjacent Infrastructure**: are there impacts on existing utilities?

 ► **Jurisdictional authority**: how would MnDOT’s jurisdictional authority of the ROW impact the transmission siting and approval process conducted by MN Department of Commerce and the MN PUC, respectively?
## Examples of PRELIMINARY Study Findings

<table>
<thead>
<tr>
<th>Topic</th>
<th>Finding</th>
<th>Opportunity</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>Potential Impacts to Existing Infrastructure from Operation of the Buried HVDC Line</td>
<td>Buried HVDC transmission lines do not induce currents or create voltage potentials, do not affect nearby communication infrastructure, and do not corrode adjacent metal pipes. HVDC converter stations could interfere with communication infrastructure but are designed not to.</td>
<td>Buried HVDC transmission can be co-located fiber. Latest buried HVDC technology eliminates adjacent infrastructure impacts that were of concern for earlier buried HVDC transmission.</td>
<td>None outstanding</td>
</tr>
<tr>
<td>Future Highway Maintenance &amp; Construction</td>
<td>MnDOT must be able to maintain and expand the highway ROW as needed to serve the State of Minnesota’s transportation needs. Non-transportation infrastructure must not unreasonably impede highway maintenance and expansion.</td>
<td>Learn from WisDOT’s experience siting transmission in interstate and highway ROW (e.g., the Badger-Coulee transmission line in the I-90/I-94 corridor)</td>
<td>Need granular assessment to understand the potential impacts to MnDOT ROW</td>
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The goal when siting a buried HVDC transmission line or major fiber line is to place it where it won’t have to move. However, if a line needs to be moved, MnDOT bears at least some of the cost (and in some cases the entire cost) of utility relocation.

WisDOT’s model requires utilities to pay for relocation and can be used as a guide. Utilities are accustomed to paying relocation costs throughout most of the US.

Legislative change is needed to transfer cost allocation from MnDOT to the utility. The utility locate process has existing challenges. These include insufficient communication, inaccurate data, and a volume of work that can require contractors to be on the ROW into the evening hours.
Transportation Decarbonization Requires New Transmission
New Transmission is Needed for:

Fleet & Highway Electrification

Grid Decarbonization

Grid Reliability & Resilience

Economy-Wide Electrification

Important to remember: transportation electrification requires grid decarbonization & grid resilience
Thankfully DOTs can Help

DOTs can help build the transmission needed for transportation electrification by sharing their ROW and thus solving the transmission siting challenge - one of the major barriers to new transmission development.

Some states have enacted laws and policies to promote the co-location of transmission in transportation corridors:

- Wisconsin passed legislation that established existing highway ROW as a priority siting corridor for new transmission
- Maine and New Hampshire passed legislation clarifying that certain interstate corridors could be utilized for electrical transmission
Existing ROW Can Generate Billions in Societal Value

<table>
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<tr>
<th>Metric of Interest</th>
<th>Value</th>
<th>Assumption</th>
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<tbody>
<tr>
<td>Renewable Energy Transmitted</td>
<td>8,760 GW hours per year</td>
<td>2 GW line with 50% utilization</td>
</tr>
<tr>
<td>Avoided Carbon Emissions</td>
<td>4,380,000 tons per year</td>
<td>Baseline: 0.5 tons emitted per MWh</td>
</tr>
<tr>
<td>Value of Avoided Emissions</td>
<td>$219 million per year</td>
<td>$50 per ton of carbon</td>
</tr>
<tr>
<td>Reduction in Permitting Timeline</td>
<td>5 years</td>
<td>10+ years → 5 years</td>
</tr>
<tr>
<td><strong>Societal Value of DOT ROW</strong></td>
<td><strong>$1,095,000,000</strong></td>
<td>5 years * $219 million/yr</td>
</tr>
</tbody>
</table>
NextGen Highways in Real Life
Electric Transmission in the ROW

- WisDOT has sited transmission in interstate & highway ROW
- $10,000/mile in fees to WisDOT plus additional fees for bridge crossings

- Italy and France worked together to site buried HVDC transmission in highway ROW

https://www.rte-france.com/projets/nos-projets/operation-190-km-de-solidarite-europeenne-entre-chambery-et-turin#Leprojet
A Number of Projects in Development

- Major deployments underway in the US and Europe using highway, railway, and waterway rights-of-way
- Buried HVDC transmission is able to use existing rights-of-way and offers significant grid and climate resilience benefits
Five Lessons from Wisconsin

► Establish highway and railway corridors as priority corridors for new transmission development (see Wisconsin’s Act 89 from 2003)

► Updated DOT utility accommodation manual and policy to facilitate the longitudinal installation of transmission in DOT ROW

► Establish a cooperative agreement between the DOT and the utility commission that establishes procedures for planning and review and for conflict resolution (see Wisconsin’s Cooperative Agreement)

► When DOT ROW is used for new transmission, require utilities to submit ‘Constructability Reports’ to the utility commission as part of their application process (see Constructability Report from WI)

► Where possible utilities should seek to utilize engineering firms that the DOT already uses

*For more information on Wisconsin, see this overview
The Ray - A Technology Testbed
Smart Infrastructure for Transport
Safety, Resiliency & Electrification
WHO WE ARE

Ray C. Anderson (1934-2011)
• “America’s Green Industrialist”
• Global pioneer of corporate sustainability
• Circular economy now mainstream

The Ray Highway
• A publicly accessible living laboratory
• A proving ground for the transportation infrastructure of the future
THE RAY TODAY

THE RAY WELCOME CENTER
- Tire Safety Check Station
- Solar-Paved Highway
- Solar Powered Vehicle Charging
- Pollinator Meadow

THE RAY
- Smart Striping
- Rubberized Asphalt

ZERO WASTE. ZERO CARBON. ZERO DEATHS.
PARTNERSHIPS

The Ray Partners

Friends of The Ray
Is Buried Transmission Affordable?
Buried HVDC Transmission is Cost Competitive with Existing Transmission
Important Not Just to Consider Cost But Also Benefits

- Weather-Hardened
- Option to EMP-Harden
- Permitting Timeline
- Land Use (new build)
“All nine transmission lines that deliver power into the Lake Charles area are currently out of service as a result of storm damage to multiple structures and spans of wire.

A significant number of transmission structures were damaged beyond repair and require complete replacement.”
Wildfire Risk

Kincade Fire

Largest fire in CA in 2019

A PG&E transmission tower is the believed source of the fire

Three million people without power due to system de-energization
If Everything’s Electric...
Outages Are all the More Significant

During Texas’s rolling blackouts and natural gas outages, the loss of heat led to knock-on property damage losses, citizens implementing extreme measures to stay warm, and loss of life.
Opportunities in Washington State
Build on ESHB 1457

- Utilize the upcoming change to WSDOT policies to additionally allow for buried HVDC transmission in the interstate ROW
- Have WSDOT site new fiber lines such that buried HVDC transmission could be added at a later date (in line with Dig-Once best practices)

Plan for Electric & Communications Infrastructure

- When updating Washington’s Transportation Plan make sure that planning for the electric and communications infrastructure required to support WA’s electric, connected, and autonomous transportation future is included

Begin Implementing Lessons from Wisconsin

- Establish highway ROW as a priority corridor for the siting of new transmission
- Establish a Cooperative Agreement between WSDOT and the WA UTC
Questions?

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