JANUARY 20, 2021

MINNESOTA CAV IDEA (INNOVATIVE DELIVERY & ENGAGEMENT ANALYSIS)

VEHICLE FIBER OPTIC STUDY

NORTH/WEST PASSAGE OPERATIONS TASK FORCE MEETING

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DEPARTMENT OF TRANSPORTATION

JANUARY 20, 2021

WHY THE TOPIC IS TIMELY

PRESIDENT BIDEN PROPOSES $2 TRILLION IN FIRST 4 YEARS TO MEET CLIMATE PROGRESS – NET ZERO BY 2050

- Infrastructure – sustainable growth; roads, bridges, electricity grids and universal broadband
- Auto industry – new jobs from parts to charging stations.
- Transit – provide every city with 100,000+ residents with high quality, zero emissions public transport.
- Power sector – Carbon pollution free by 2035.
- Innovation – drive dramatic cost reduction in critical clean energy technologies

FIRST DAY IN OFFICE

- Rejoining The Paris Climate Accord
- Revoking the Keystone XL Permit

NEW INNOVATION ALLIANCE MODEL

CAV ADVISORY COUNCIL

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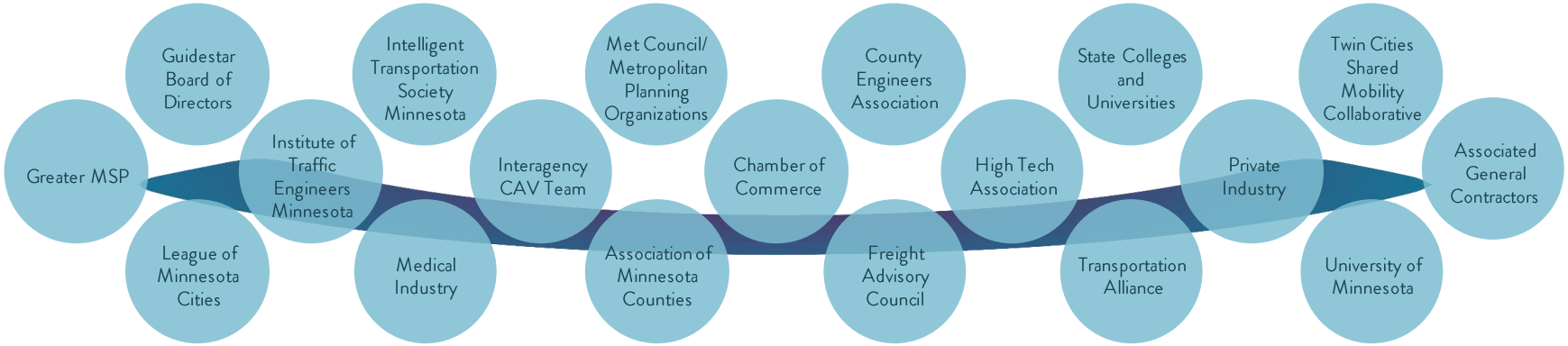
STATEWIDE INNOVATION ALLIANCE



COMMITTEES

- Safety
- Labor & Workforce Development
- Connectivity & Data
- Infrastructure Investment
- Education & Outreach

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STATE'S CAV GOALS

TRAFFIC SAFETY & OPERATIONS

WORKFORCE IMPACTS

GREATER MOBILITY & EQUITY

ECONOMIC DEVELOPMENT

INFRASTRUCTURE

HEALTH & ENVIRONMENT

HOW DO YOU PLAN FOR AN UNKNOWN FUTURE?

IN COMPLETING THE STRATEGIC PLAN, MNDOT PRIORITIZES ITS CAV APPROACH IN 3 WAYS

STRATEGIC INVESTMENT

INNOVATION

COLLABORATION & KNOWLEDGE-SHARING

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CAV STRATEGIC PLAN #1 PRIORITY

PLAN RECOMMENDS FIBER INVESTMENTS AND OPPORTUNITIES TO PARTNER WITH PRIVATE INDUSTRY

- CAPITAL INVESTMENT
- RESEARCH
- PARTNERSHIPS
- REGULATION & POLICY
- OPERATIONS & MAINTENANCE
- MULTIMODAL
- STRATEGIC STAFFING
- COMMUNICATIONS
- LONG-RANGE PLANNING

RECOMMENDATION #1: ASSESS COMMUNICATIONS INFRASTRUCTURE AND PUBLIC-PRIVATE PARTNERSHIP FEASIBILITY TO SUPPORT CAV TECHNOLOGIES

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MINNESOTA CAV CHALLENGE

GEORGE CRONIN ★ awards for ★ *Procurement Excellence* ™

68
VENDOR MEETINGS

39
PROPOSALS SUBMITTED

14
AWARDED PROJECTS

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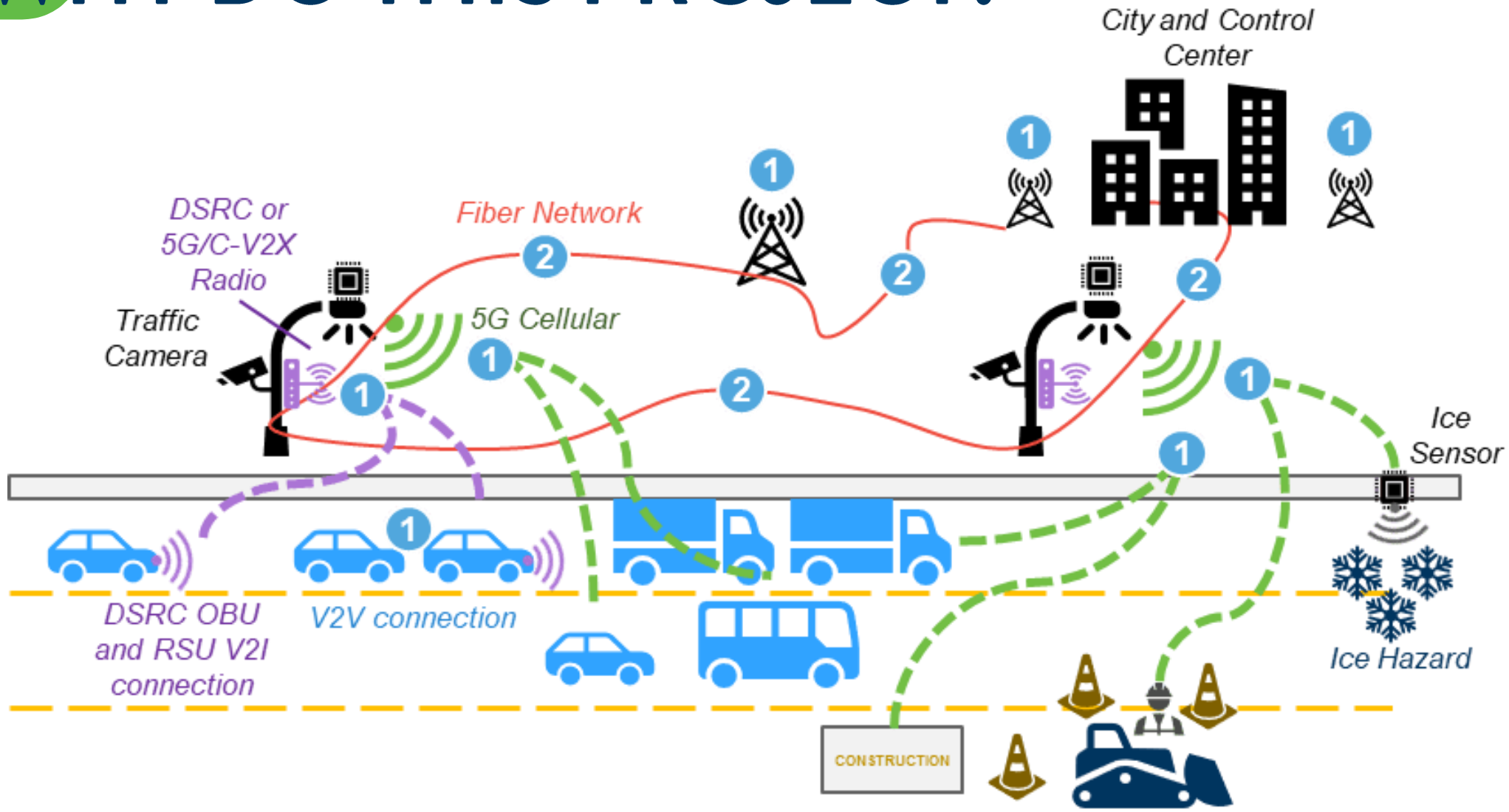
PROJECT GOALS

1. Identify opportunities for MnDOT to install fiber to advance:
    1. Traffic safety
    2. Promote ITS Statewide Plan priorities
    3. Advance TSMO priorities
    4. Plan and prepare for CAV
2. Connect state facilities
3. Identify funding gaps
4. Expand statewide telecommunications access
5. Identify opportunities to partner with private sector fiber buildout

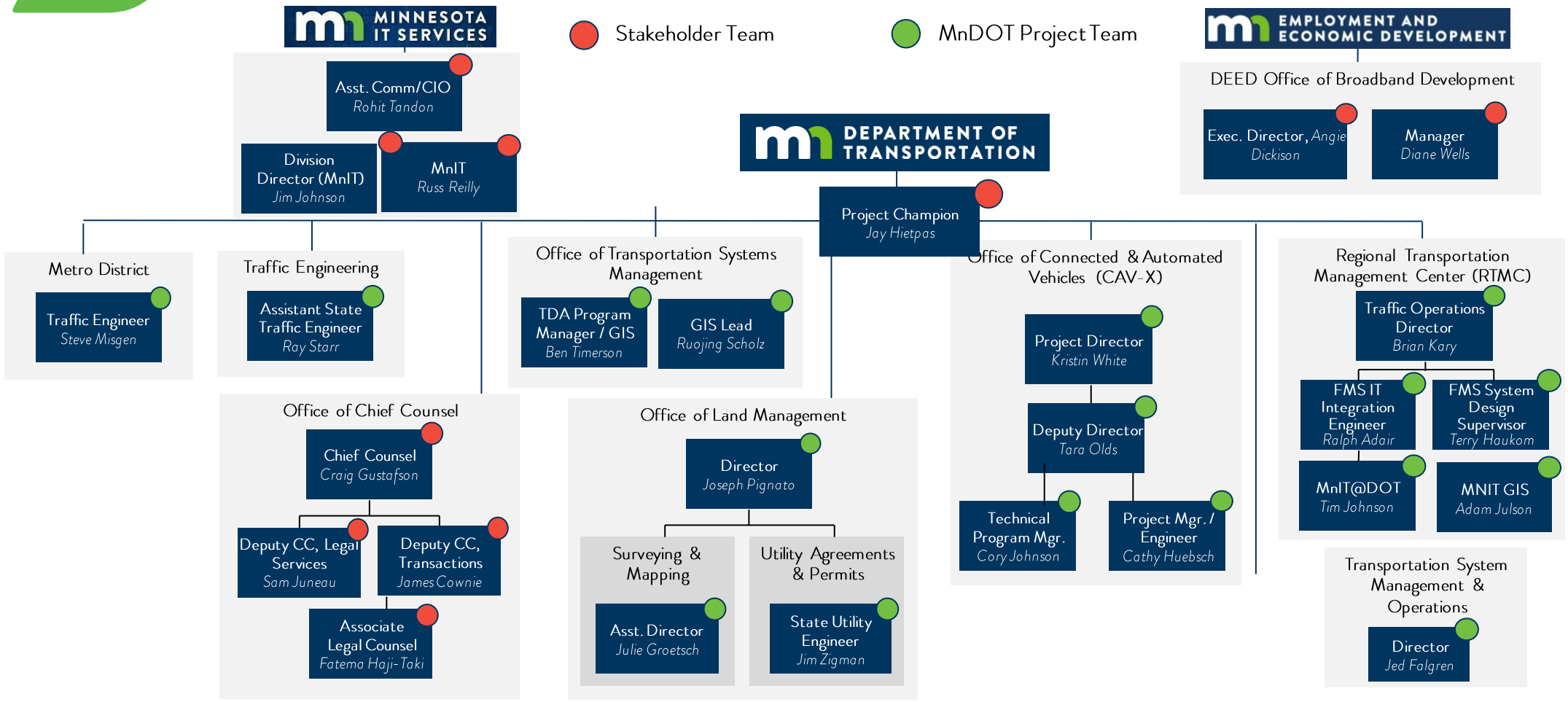
WHY DO THIS PROJECT?



REGULATORY REVIEW

1. Limited authority for a telecommunications public-private partnership (P3)
2. Previous project partner faced financial challenges
3. State currently has strong relationships with telecommunications firms
4. Any fiber expansion needs to be coordinated, collaborative and include the right stakeholders
5. In current climate, many stakeholders support fiber expansion
6. State laws allow bartering up to a certain amount with private sector
7. Utility accommodation laws and policies need to be addressed
8. 5G wireless “small cells” may pose safety/engineering challenges to infrastructure

STAKEHOLDER TEAM



- AASHTO
- Association of Minnesota Counties
- Blandin Foundation
- County Engineers Association
- Governor's Advisory Council
- League of Cities

- Aeronautics
- Asset management
- GIS Steering Committee
- Freight and Commercial Vehicles
- Government Affairs
- Policy and Planning
- State Aid
- Statewide Radio Communications
- Tribal Affairs

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STAKEHOLDER INTERVIEWS

MnDOT	MnIT	DEED	EDUCATION	AASHTO	BROADBAND TASK FORCE
• Fiber concerns include tech evolution, effective communications and community involvement • RTMC lays fiber as opportunities arise; includes ITS • OLM amended Utility Policy to include small cells	• MnIT has fiber on I-94 MnDOT can lease • Existing fiber addresses current needs, but not future • MnIT goals include increasing bandwidth & consolidating data centers • MnIT required to serve all 87 counties	• Office of Broadband Development goals include high-speed internet to all homes • Gives $40M+ last-mile grants to locals • Strong relationships with telecoms, MnIT • Could update grants to include CAV	• Local school districts fostered fiber build-outs • DBFOM model • School district acts as anchor tenant and coordinates leasing • MnIT uses school districts to connect fiber for state facilities	• UT, CO, WA, GA & other states building statewide fiber • UT installed ~1,000 miles via public-private partnership • AASHTO prioritizing broadband, CAV, TSMO coordination in its committees	• Rural MN needs broadband, especially in the pandemic • Task Force can use this project's data to advance broadband buildout • MN Rural Broadband Coalition can help advance rural broadband • Want more coordination with MnDOT

GIS MAPPING TOOL DEVELOPMENT

Traffic layer - Shows AADT and heavy commercial AADT. Helps prioritize investment where most traffic is.

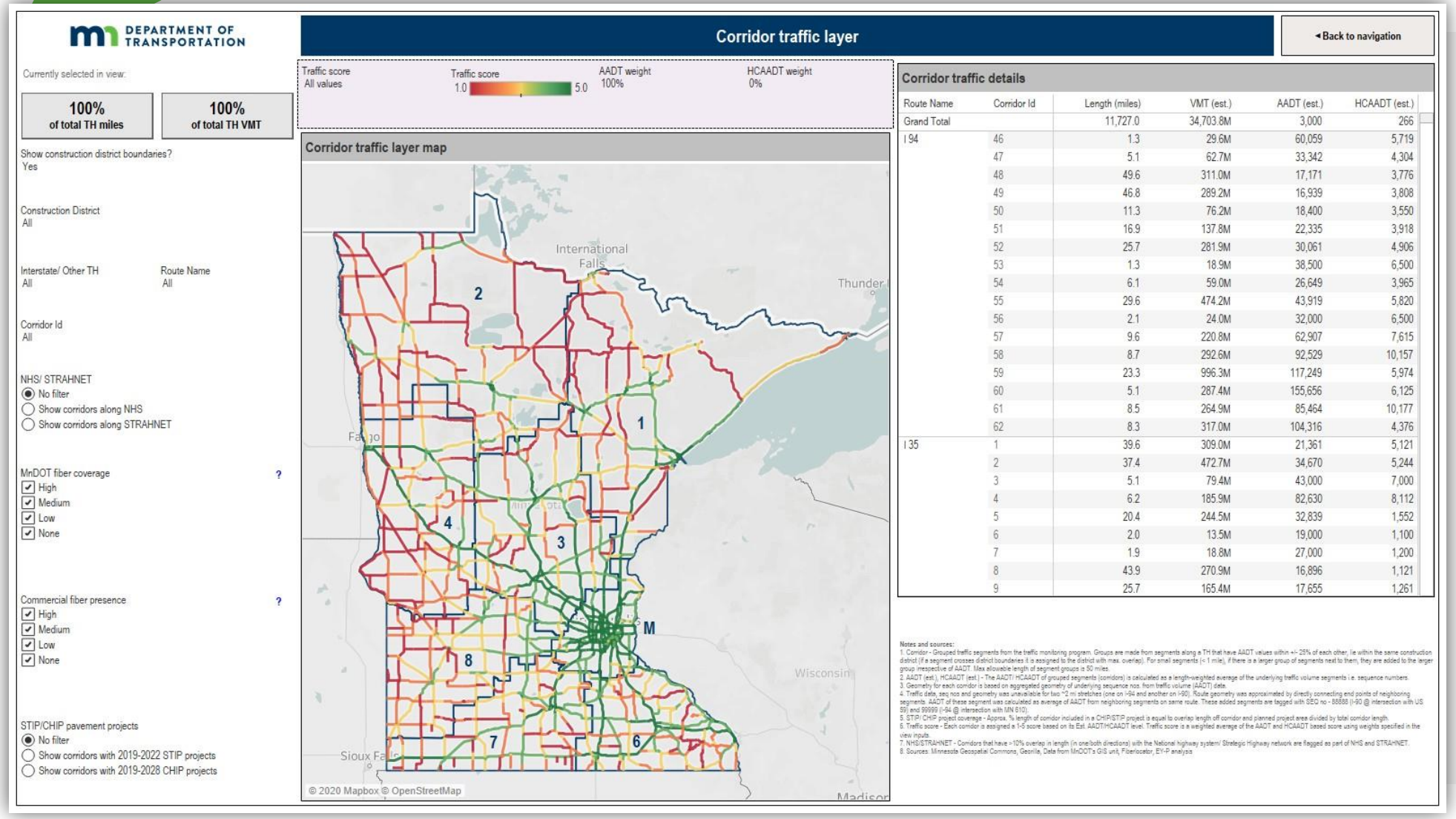
Opportunity layer – Shows MnDOT, state assets (cameras, buildings, signals, traffic data collectors). Helps prioritize corridors that connect assets and facilities and leverages current investments.

Commercial layer – Shows private sector fiber, broadband supply and demand. Helps prioritize investment based on layer of interest.

Combined – Shows all the layers to prioritize district/MnDOT needs.

Data – Includes: MnDOT Georilla assets, state GIS data, fiber locations, DEED underserved areas, nearby commercial fiber, STIP, tribal lands, ROW ownership, etc.

GIS MAPPING TOOL – TRAFFIC LAYER



Route Name	Corridor Id	Length (miles)	VMT (est.)	AADT (est.)	HCAADT (est.)
Grand Total		11,727.0	34,703.8M	3,000	266
I 94	46	1.3	29.6M	60,059	5,719
	47	5.1	62.7M	33,342	4,304
	48	49.6	311.0M	17,171	3,776
	49	46.8	289.2M	16,939	3,808
	50	11.3	76.2M	18,400	3,550
	51	16.9	137.8M	22,335	3,918
	52	25.7	281.9M	30,061	4,906
	53	1.3	18.9M	38,500	6,500
	54	6.1	59.0M	26,649	3,965
	55	29.6	474.2M	43,919	5,820
	56	2.1	24.0M	32,000	6,500
	57	9.6	220.8M	62,907	7,615
	58	8.7	292.6M	92,529	10,157
	59	23.3	996.3M	117,249	5,974
	60	5.1	287.4M	155,656	6,125
	61	8.5	264.9M	85,464	10,177
	62	8.3	317.0M	104,316	4,376
I 35	1	39.6	309.0M	21,361	5,121
	2	37.4	472.7M	34,670	5,244
	3	5.1	79.4M	43,000	7,000
	4	6.2	185.9M	82,630	8,112
	5	20.4	244.5M	32,839	1,552
	6	2.0	13.5M	19,000	1,100
	7	1.9	18.8M	27,000	1,200
	8	43.9	270.9M	16,896	1,121
	9	25.7	165.4M	17,655	1,261

Notes and sources:
1. Corridor - Grouped traffic segments from the traffic monitoring program. Groups are made from segments along a TH that have AADT values within +/- 25% of each other, lie within the same construction district (if a segment crosses district boundaries it is assigned to the district with max. overlap). For small segments (< 1 mile), if there is a larger group of segments next to them, they are added to the larger group irrespective of AADT. Max allowable length of segment groups is 50 miles.
2. AADT (est.), HCAADT (est.) - The AADT/ HCAADT of grouped segments (corridors) is calculated as a length-weighted average of the underlying traffic volume segments i.e. sequence numbers.
3. Geometry for each corridor is based on aggregated geometry of underlying sequence nos. from traffic volume (AADT) data.
4. Traffic data, seq nos and geometry was unavailable for two ~2 mi stretches (one on I-94 and another on I-90). Route geometry was approximated by directly connecting end points of neighboring segments. AADT of these segment was calculated as average of AADT from neighboring segments on same route. These added segments are tagged with SEQ no - 88888 (I-90 @ intersection with US 59) and 99999 (I-94 @ intersection with MN 610).
5. STIP/ CHIP project coverage - Approx. % length of corridor included in a CHIP/STIP project is equal to overlap length off corridor and planned project area divided by total corridor length.
6. Traffic score - Each corridor is assigned a 1-5 score based on its Est. AADT/HCAADT level. Traffic score is a weighted average of the AADT and HCAADT based score using weights specified in the view inputs.
7. NHS/STRAHNET - Corridors that have >10% overlap in length (in one/both directions) with the National highway system/ Strategic Highway network are flagged as part of NHS and STRAHNET.
8. Sources: Minnesota Geospatial Commons, Geonite, Data from MnDOT's GIS unit, Fiberlocator, EY-P analysis

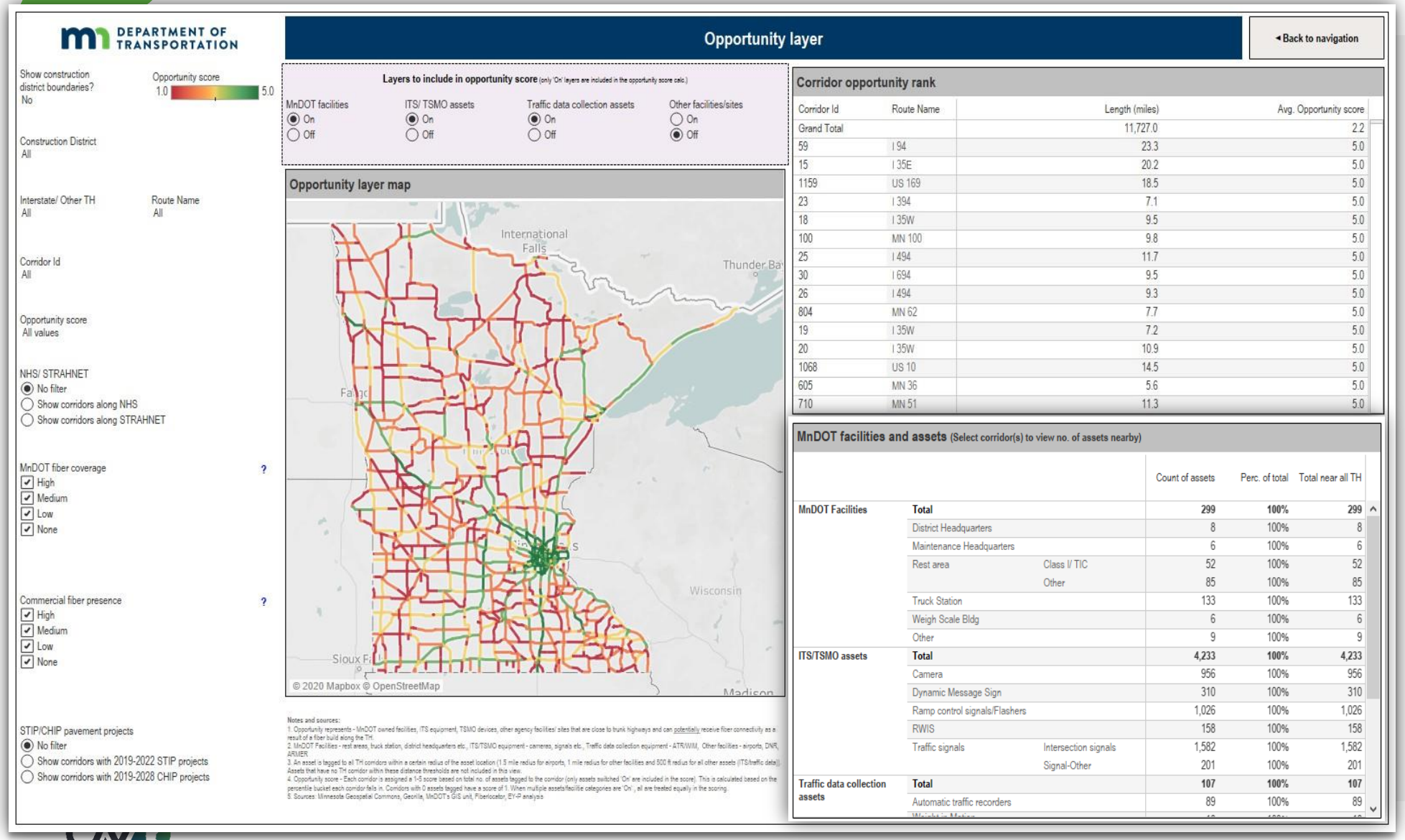
Shows vehicle traffic and heavy commercial traffic patterns across the state

Valuable for prioritizing routes for traffic safety

Green represent high traffic areas

The view can be adapted to alter the importance level between AADT and HCAADT for analysis.

GIS MAPPING TOOL - OPPORTUNITY



Shows the number of MnDOT facilities - ITS/TSMO assets, traffic data collection, airports, ARMER sites, DNR office locations near highway corridors

Useful for identifying routes with many nearby facilities and assets that benefit from fiber

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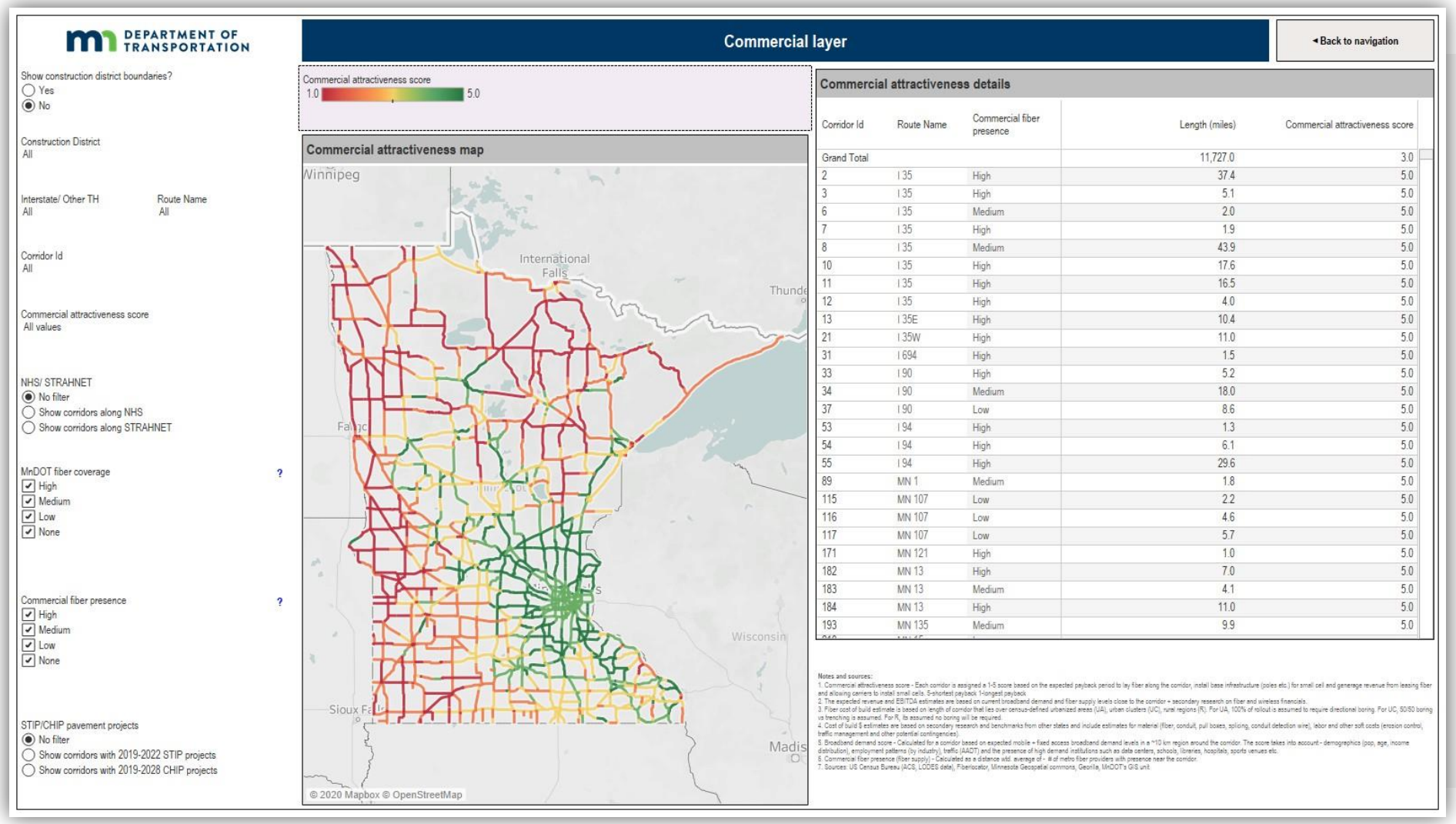
GIS MAPPING TOOL - COMMERCIAL

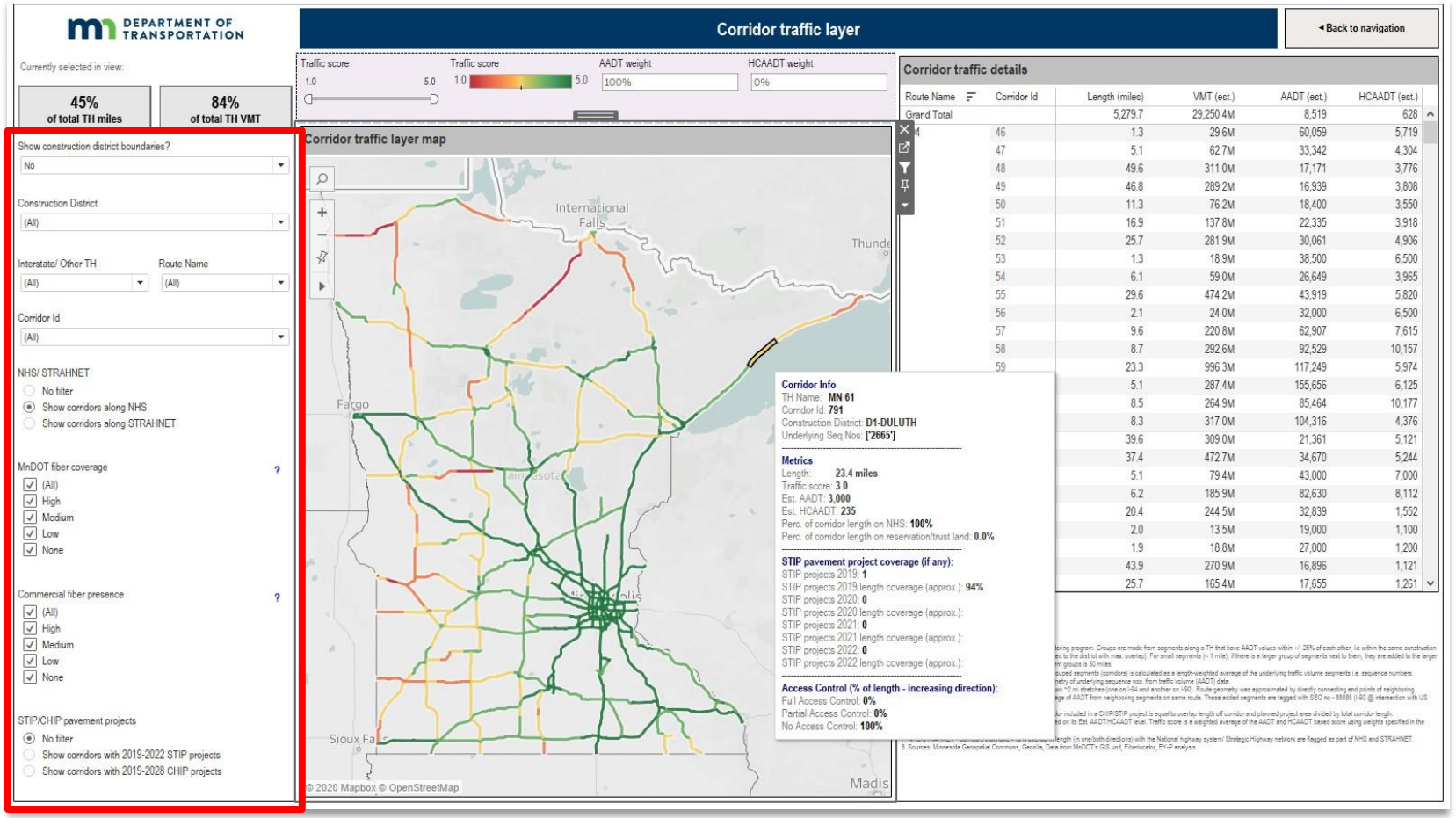


Indicates where private sector interest is higher/ lower

Based on current broadband demand and existing supply of fiber in the area.

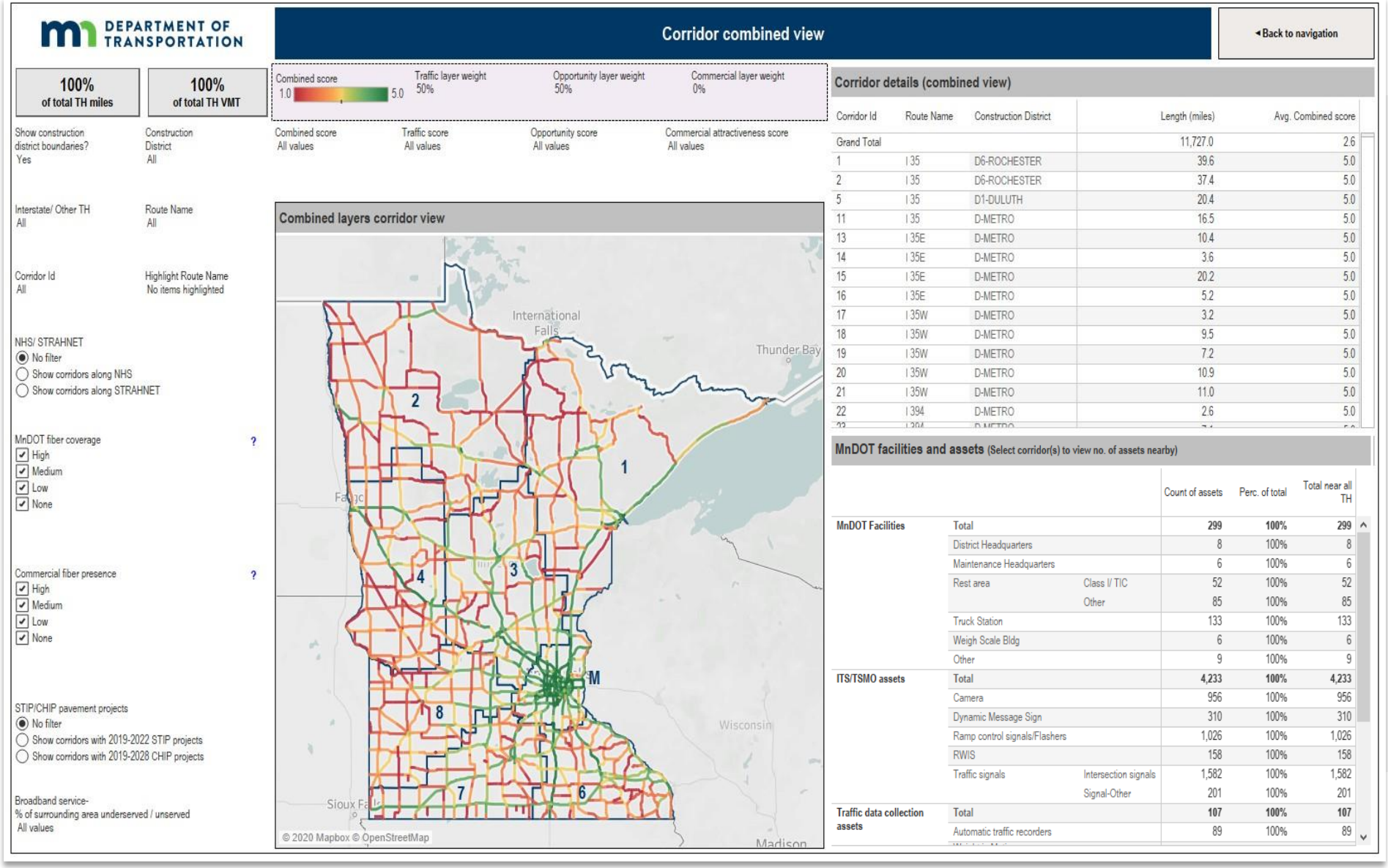
Helps understand where private sector interest may align with state priorities, showing potential partnership corridors

GIS MAPPING TOOL AVAILABLE DATA



- Uses MnIT, DEED, Census, FCC, MnDOT, and other data
- Additional datasets available across all layers can be used to review corridors that meet certain criteria
- This view shows corridors for potential buildout have a significant overlap with the National Highway System

GIS MAPPING TOOL – COMBINED LAYERS



Brings together the **Traffic layer**, **Opportunity layer**, **Commercial layer** and all additional data layers into a single view

Allows MnDOT to prioritize corridors based on our STIP, district and other needs

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HOW WE DEVELOPED RECOMMENDATIONS

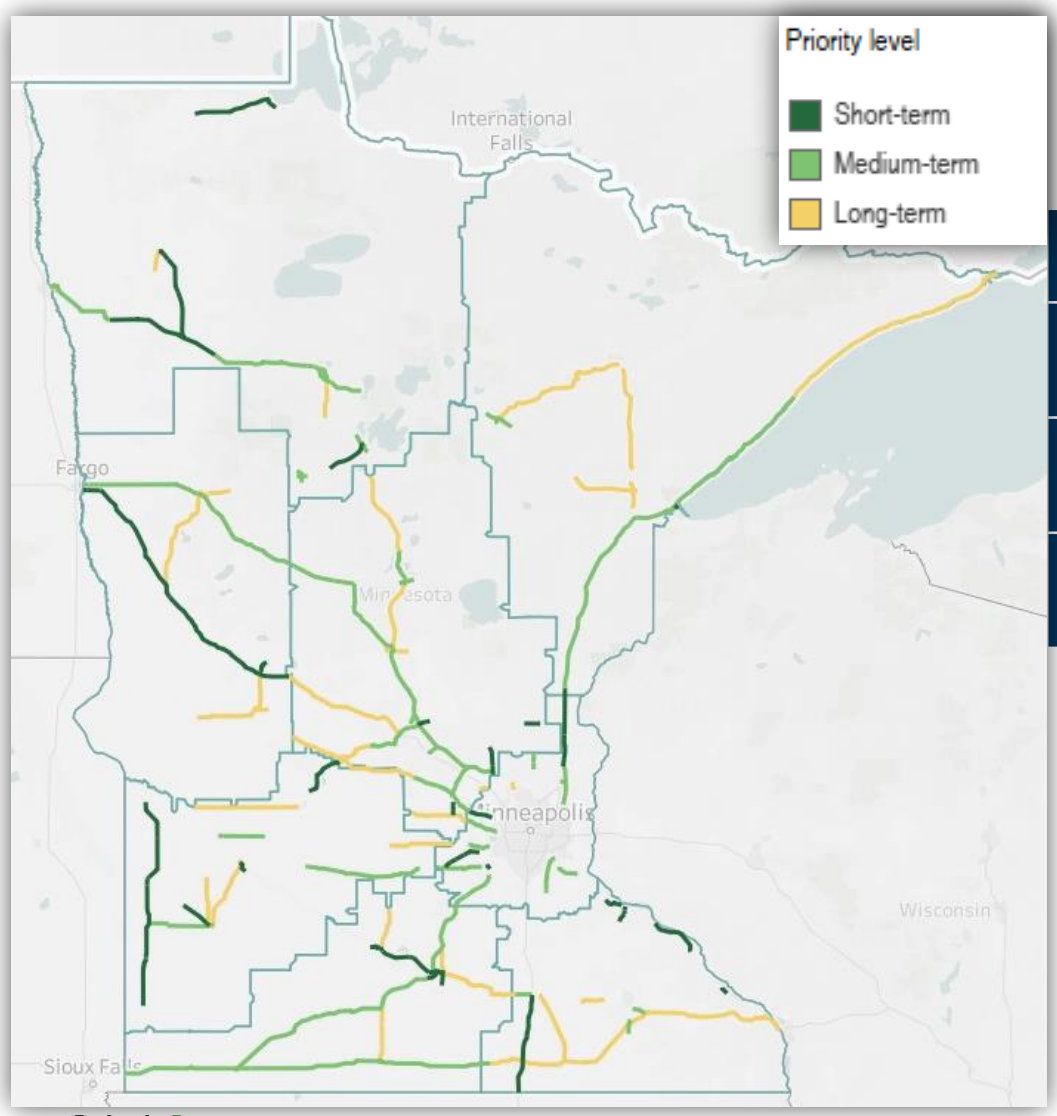
1. 10 workshops held in all MnDOT districts
2. Participants: DLT, engineers, traffic safety, ITS, TSMO, planners, project managers, maintenance, operations, CAV, and other functions
3. Real-time use of GIS tool to review potential investments that align with planned construction projects in the STIP and CHIP, as well as “stand-alone” projects.
4. Districts developed short-, medium- and long-term fiber priorities. Districts prioritized their “top 3” corridors for buildout
5. Consultant developed cost valuations and additional recommendations
6. Recommendations vetted and revised with PMT and stakeholder team

PRELIMINARY SCENARIO OPTIONS

SCENARIO	SCENARIO DESCRIPTION	STATUS
A Full Priority Build	Fiber installed on all short-term, medium-term, and long-term district selected priority corridors to advance full transportation and broadband goals	✓
B Strategic Investment – Top 3 Priorities in Each Geographic District	Fiber installed in the top 3 priorities for each MnDOT geographic district identified through district workshops.	✓
B+ Add Pilot Regional Corridors	Scenario B and add strategically selected regional corridors that benefit statewide operations and TSMO	Under discussion
C Leverage Existing Fiber	Low-cost option leveraging existing fiber public and private sector fiber. Use Connecting Minnesota fiber along I-94.	Under discussion

Focus for current meeting

SCENARIO A – FULL PRIORITY CORRIDOR BUILD



	Short-term (1-4 years)	Medium-term (5-9 years)	Long-term (10+ years)	Total
New miles with fiber	559	1,051	916	2,527
% of total Trunk Highway miles	5%	9%	8%	22%
% of Total Trunk Highway VMT	7%	13%	8%	28%
% of Total Trunk Highway NHS miles	8%	19%	15%	42%

This fiber connects:

- 150 MnDOT facilities
- 800 ITS, traffic safety and traffic data collection assets
- 47 Airports
- 75 DNR locations
- 50 ARMER sites

I-94 fiber can be leased thru MnIT

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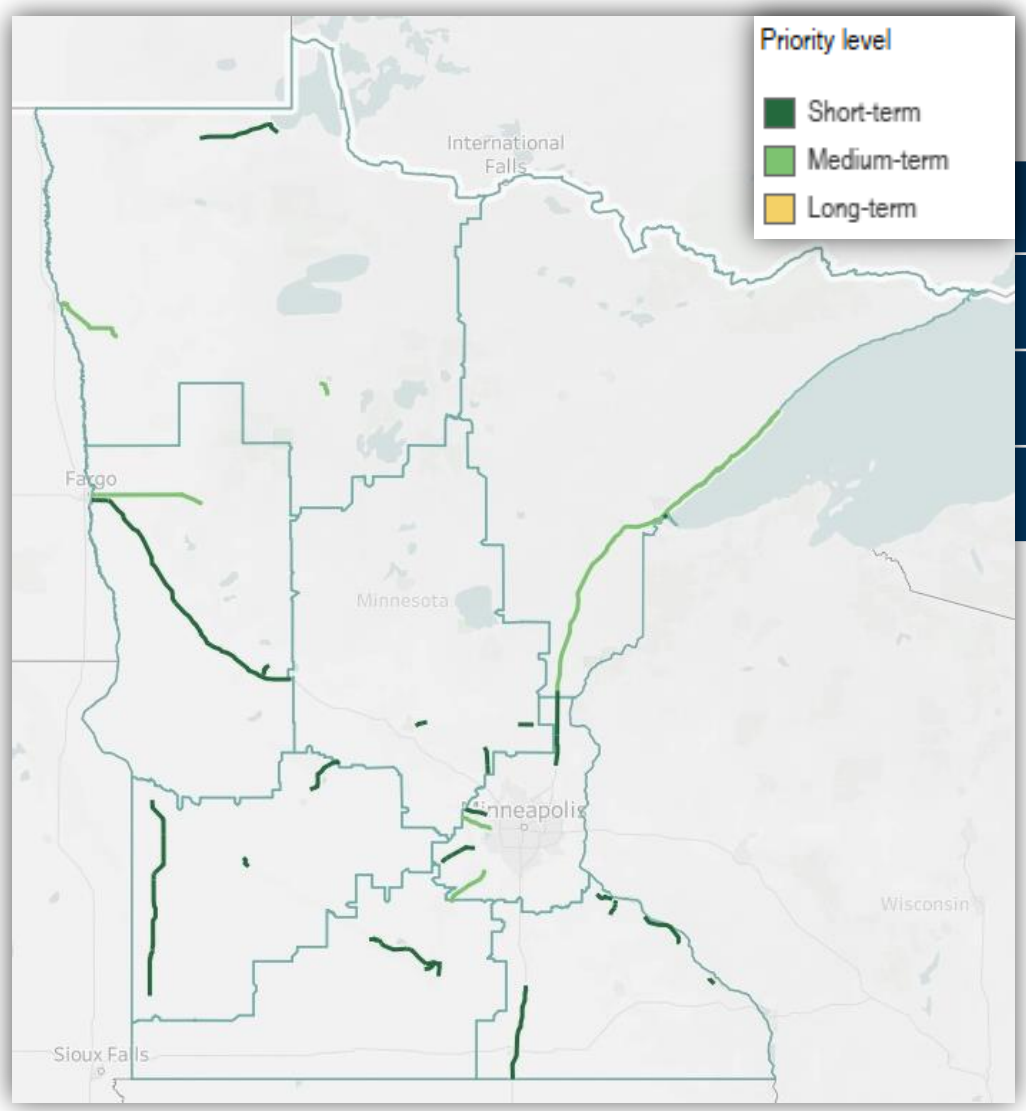
SCENARIO B – TOP 3 DISTRICT PRIORITIES



	Total
New Miles with fiber	700
Perc. of total Trunk Highway miles	6%
Perc. of total Trunk Highway VMT	11%
Perc. of total Trunk Highway NHS miles	11%

This fiber connects:

- 57 MnDOT facilities
- 300 ITS, traffic safety and traffic data collection assets
- 13 Airports
- 37 DNR locations
- 22 ARMER sites

NOTE: I-94 fiber is available via MnIT

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I-94 fiber can be leased thru MnIT

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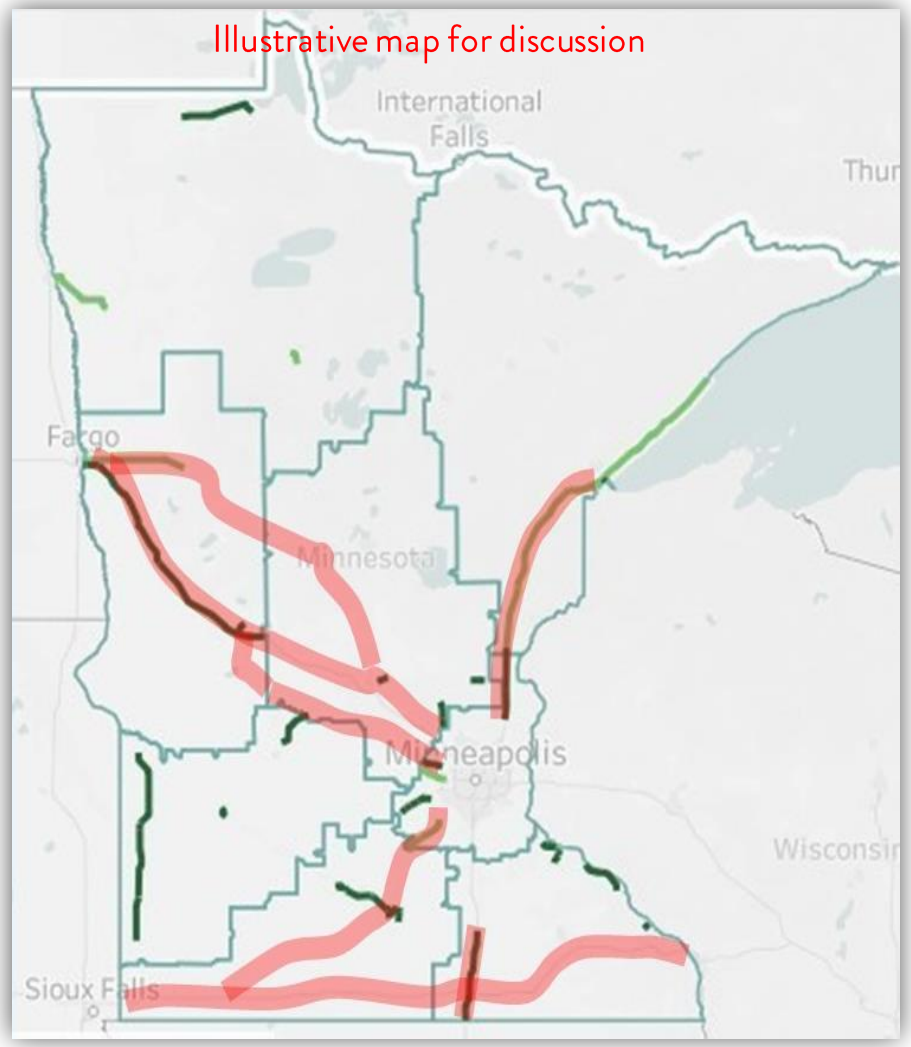
SCENARIO B+ REGIONAL CORRIDORS



- Add corridors of regional importance for statewide operations, ITS and TSMO
- Benefits include:
  - Advancing the statewide ITS Plan's goals to cover high traffic corridors
  - Providing additional redundancy of the fiber network to prevent system failures in events of fiber disconnection
  - Connecting "orphaned" fiber connections that are not currently part of the system
  - Covering additional corridors of regional significance
- Recommended pilot routes (in order of priority):
  - I-35/MN-97/US-61
  - Highway 55
  - MN 23
  - US-12

NOTE: I-94 fiber is available via MnIT

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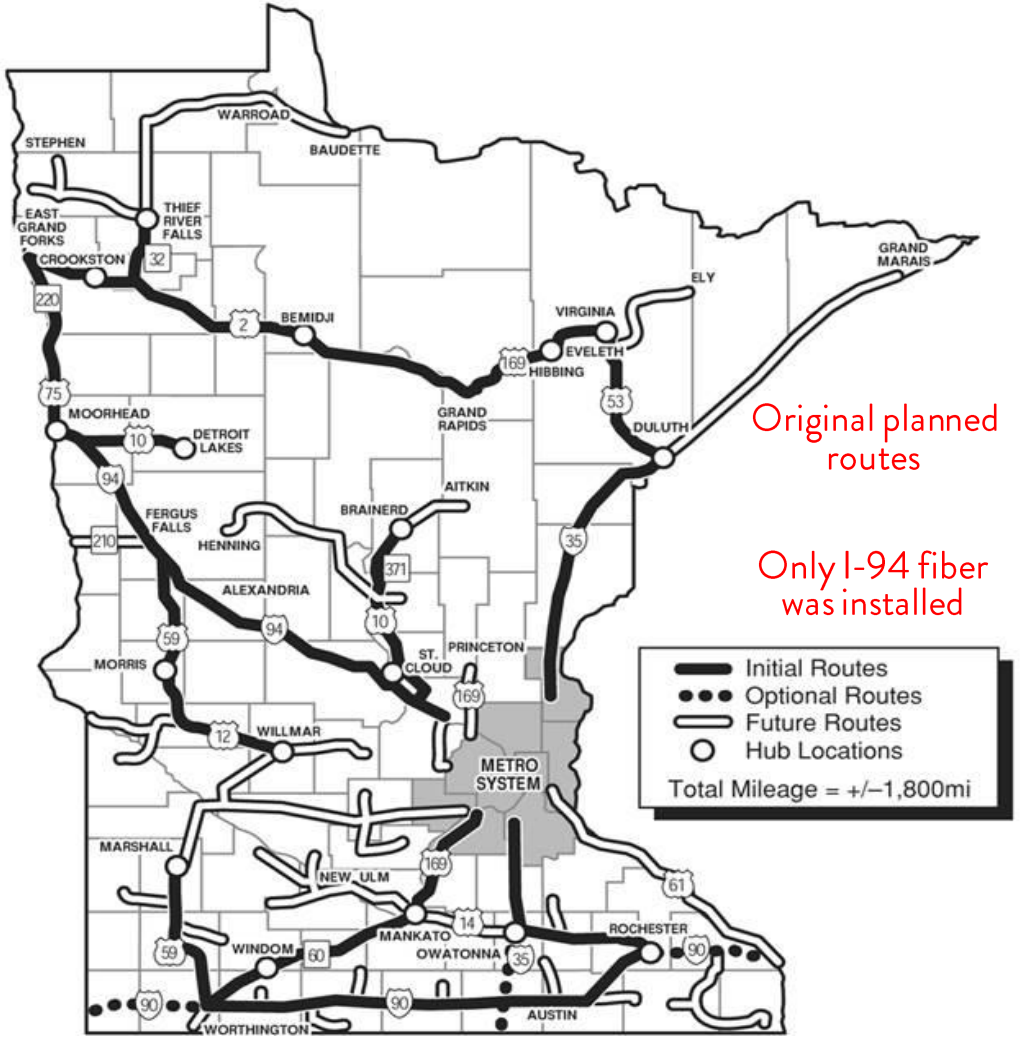
ALTERNATIVE OPTION C – USE EXISTING CONNECT MINNESOTA FIBER



Original planned routes

Only I-94 fiber was installed

- Lower-cost alternative
- Uses existing MnIT fiber to connect facilities and assets
- Includes existing “Connecting Minnesota” fiber (1990s install) on I-94 from Wisconsin to North Dakota
- Meets goals of the MnDOT 2015 Statewide ITS Plan
- Optional: Use private MnIT fiber parallel leases
  - Highway 169, Highway 60 and Interstate 90 in District 7
  - Connects some ITS assets on cell modems
  - Could support more reliable fiber connections

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POTENTIAL COSTS AND VALUE

WITHOUT PRIVATE INVESTMENT OR FEDERAL GRANTS

SCENARIO A –Full Priority Build

		Fiber	Small cell	Total
Capital Costs	Total	$312M	$91M	$403M
	Short-term	$69M	$19M	$89M
	Medium-term	$134M	$45M	$179M
	Long-term	$108M	$26M	$134M
Annual Revenue	Total	$40M	$17M	$57M
	Short-term	$8M	$3M	$12M
	Medium-term	$16M	$9M	$25M
	Long-term	$15M	$4M	$19M
Annual Earning Potential (EBITDA)	Total	$20M	$10M	$30M
	Short-term	$4M	$2M	$6M
	Medium-term	$8M	$5M	$13M
	Long-term	$7M	$3M	$10M

SCENARIO B –Top 3 Priorities in Each District

	Fiber	Small cell	Total
Total Capital Investment	$89M	$28M	$117M
Annual Run-Rate Revenue Potential	$11M	$5M	$16M
Annual Run-Rate EBITDA Potential	$5M	$3M	$8M

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DELIVERY MECHANISMS

PUBLIC PRIVATE PARTNERSHIPS POSE REGULATORY CHALLENGES FOR THE STATE. OTHER OPTIONS ARE AVAILABLE

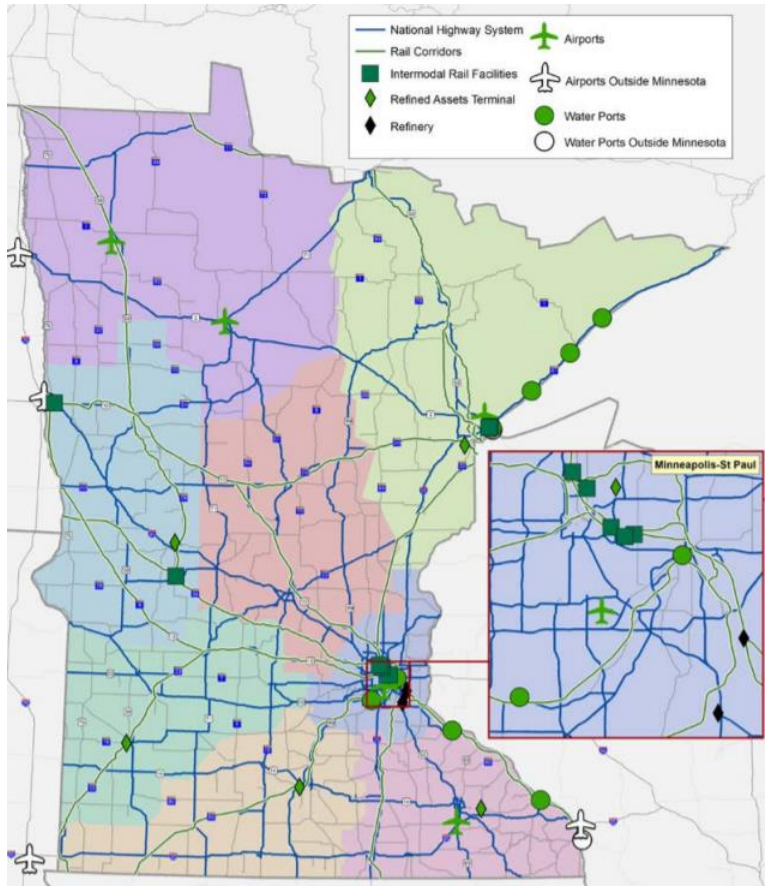
Delivery Approach	Description	Applicability for MnDOT/State
P3 (including DBFOM)	• Structured long-term agreement; • Developer designs, builds, finances, operates and maintains infrastructure • May include the commercialization rights for the private player	Limited/no alignment without statutory change
Design-Build/ Design-Bid-Build	• Used for the larger-scale fiber installs/ middle mile • Requires public funding for construction • State owns fiber and can monetize commercialization rights once installed	Strong alignment
Operating Concession	• DOT installs fiber • Private developer pays, provide services or both for commercialization rights	Strong alignment
Lease/License	• DOT leases ROW to neutral hosts, fiber companies or telecoms to install infrastructure, operations/maintenance • Companies pay leasing fees and share the broadband revenue over lease term	Some alignment
Shared Resource Agreement (RSA)	• DOT provides ROW to private entities to commercialize broadband • DOT is granted access to the fiber/network at low/no cost	Some alignment

MARKET SOUNDINGS

- Goal: Understand private industry's interest in MnDOT fiber expansion
- Conversations addressed interest, opportunity, risk, and potential partnership methods
- Met 1:1 with 13 industry members, including Verizon, AT&T, T-Mobile, Excel, Uniti, Zayo, EX2, Mobilitie, Crown Castle, American Tower and others
- Strong interest from industry
- Pilot projects recommended

MARKET SOUNDING KEY TAKEAWAYS

- **Need clearer goals and valuations** - In the past, the state's expected value of ROW was mismatched from industry's.
- **Pilot corridors** - met with mixed reaction. Could incentivize with right of first refusal
- **Revenue sharing** can mitigate risk for private industry's upfront investment
- Opposition to capturing future revenue to offset costs
- Most want **exclusive ROW access and ownership** of underlying infrastructure
- Industry wants more active **MnDOT engagement**
- Could have **grant funding** similar to DEED
- DOTs need to be **more flexible on timing, location** of build out
- 3-6 month RFI, RFP process is ideal
- Share this report with industry to help them prepare



LEADERSHIP & COORDINATION RECOMMENDATIONS

1. Statewide leadership body coordination - Share findings and coordinate with Governor's Advisory Council on CAV, CAV Innovation Alliance, State Broadband Task Force, and Blue Ribbon Council
2. Establish an internal DOT Broadband Policy Group with representatives from OLM, Ops, CAV, ITS, TSMO, RTMC, traffic and maintenance
3. Future coordination among MnDOT, MnIT and DEED technical staff
4. Develop process to maintain telecom/industry relationships across enterprise system with MnDOT, MnIT and DEED

LAW & POLICY RECOMMENDATIONS

5. Update state law to accommodate public-private partnerships and expand telecommunications leasing authority
6. Update state law on relocation reimbursement expenses
7. Update MnDOT's utility accommodation policy
8. Review internal MnDOT's utility accommodations process

FUNDING & OUTREACH RECOMMENDATIONS

9. Fund district fiber investments
10. Apply for federal fiber grants
11. Identify incentives for rural buildout
12. Continued public and stakeholder engagement

PARTNERSHIPS & PROCUREMENT RECOMMENDATIONS

13. Develop a fiber accommodation plan for leases
14. Create a fair market valuation process for longitudinal fiber leases
15. Explore partnership opportunities and services in lieu of rent

NEXT STEPS

November

- Add market sounding analysis to report
- Finish CAV-X report review
- Share report with MnDOT core team and stakeholders

December

- Meet with SLT for feedback
- Final report

January 2020

- Publish report
- CAV Innovation Alliance Infrastructure Investment Committee update
- DEED & MnIT meetings
- Meet with Broadband Task Force

2020-2021

- Potential pilot
- RFI
- RFQ
- RFP

AND FINALLY……

- Huge priority for Congress and USDOT
- AASHTO & USDOT webinar series on P3's https://www.fhwa.dot.gov/ipd/p3/
- More than a business Case
  - Next Generation Highways: Co–Locating the transport of vehicles, energy and information.
- Strong interest from industry
- SpaceX Starlink Broadband coverage

THANK YOU!

CONNECTED & AUTOMATED VEHICLES INNOVATIVE DELIVERY & ENGAGEMENT ANALYSIS (CAV IDEA)

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