2020
REVIVE, RECOVER, RESTORE
MOBILIZING YOUR TALENT & ECONOMY FOR THE FUTURE

Preparing for An Automated World

2020 Virtual Annual Conference and Forum

C2ER THE COUNCIL FOR COMMUNITY AND ECONOMIC RESEARCH

LMI Institute
Navigating the World of Labor Market Information

Today’s Speakers

- Team NEO
  - Jacob Duritsky
  - Sydney Martis
- Union County-Marysville Economic Development
  - Eric S. Phillips
- Oregon Employment Department
  - Sarah Cunningham

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LMI Institute
Navigating the World of Labor Market Information

The Potential Economic Impact of Manufacturing Innovation

2020 Virtual Annual Conference and Forum

Agenda

- About Team NEO
- IIoT Roadmap
- Talent for Automated World
- Conclusion
- Sources

About Team NEO

Team NEO is a non-profit business development organization accelerating business growth and job creation throughout the 18 counties of Northeast Ohio.

We work to generate more jobs faster for more people, retain existing jobs, create a more inclusive workforce, and attract new investment to build a more robust and equitable regional economy.

JobsOhio | TeamNEO

Advance Technology Adoption

Address the Talent Supply/Demand Gap

Serve as a Regional Table, as the JobsOhio Network Partner, to Accelerate the Pace of Growth and Equity relating to Business Development Outcomes throughout the 18 Counties of Northeast Ohio

Strengthen a Better Coordinated Regional Network

Grow a Pipeline of Competitive Sites

Promote Team NEO, the Region, and Network Performance

Team NEO Core Strategies

Team NEO Advances Technology Adoption

Team NEO facilitates regional innovation clusters for smart and additive manufacturing.

We create innovation roadmaps to address the risks companies face in adopting new technology.

The Industrial Internet of Things (IIoT) Roadmap

To Win Globally, We Must Innovate Locally

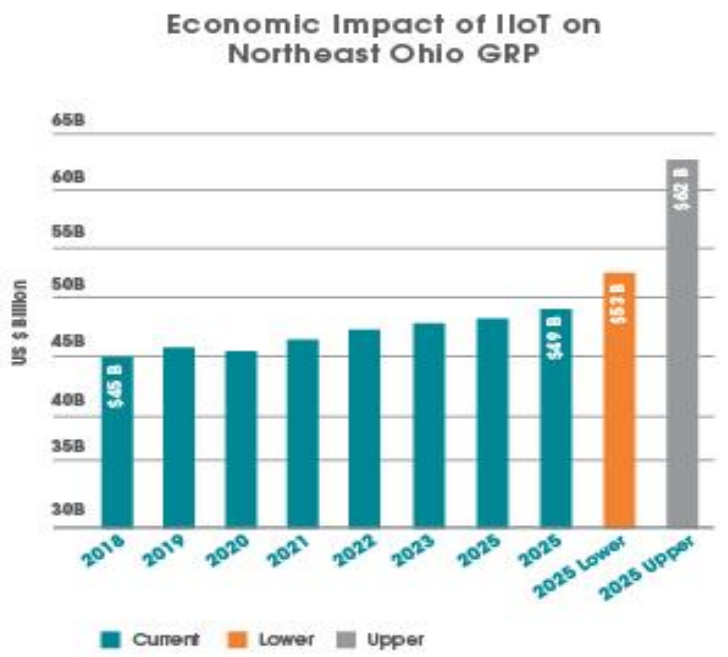
Northeast Ohio Currently ranks 162nd out of 380 Metros in Innovation Capacity

Clusters Ignite Innovation & Economic Growth

Team NEO facilitates regional innovation clusters for both Smart Manufacturing and Additive Manufacturing

NEO's Smart Manufacturing Cluster initiative could generate up to $13B in incremental economic output by 2025

- The Innovation Clusters **generate connectivity and interoperability of companies, entrepreneurs, academia, incubators and investors** to drive implementation, innovation and resource development of two emerging technologies to improve company's global competitiveness and propel economic growth.
- Team NEO's cluster role includes the **development of Innovation Roadmaps** that catalyze broad regional sharing of a commercialization plan of initiatives that addresses time, risk and revenue potential for companies to accelerate the rate of emerging technology adoption.
- **Readiness Assessments** have been developed for companies to determine their state of technology adoption and outlines path forward options.
- Clusters can contribute to global **"Center of Excellence"** recognition for technology implementation, innovation and resource development.



Source: McKinsey Global Institute/Accenture estimates and Moody's Economy.com data analyzed by Team NEO

What Do We Hope to Accomplish Through the Launch of the IIoT Roadmap?

Vision

Accelerate growth in the Northeast Ohio economy through the implementation of industrial IoT that leverages the region's rich manufacturing heritage, unique assets and talented workforce.

Goals

- Drive demand for Industrial IoT
- Increase regional productivity
- Spur product innovation
- Develop resources to support Industrial IoT implementation and innovation

Industrial IOT Roadmap Work Team

ARCONIC

aws

CLEVELAND STATE UNIVERSITY 1964

EATON Powering Business Worldwide

CASE WESTERN RESERVE UNIVERSITY EST. 1826

HYPERPRODUCTIVE

Lorain County Community College

HITACHI Inspire the Next

MANUFACTURING WORKS

Parker

MCPc

Rockwell Automation

TeamNEO

usafirmware

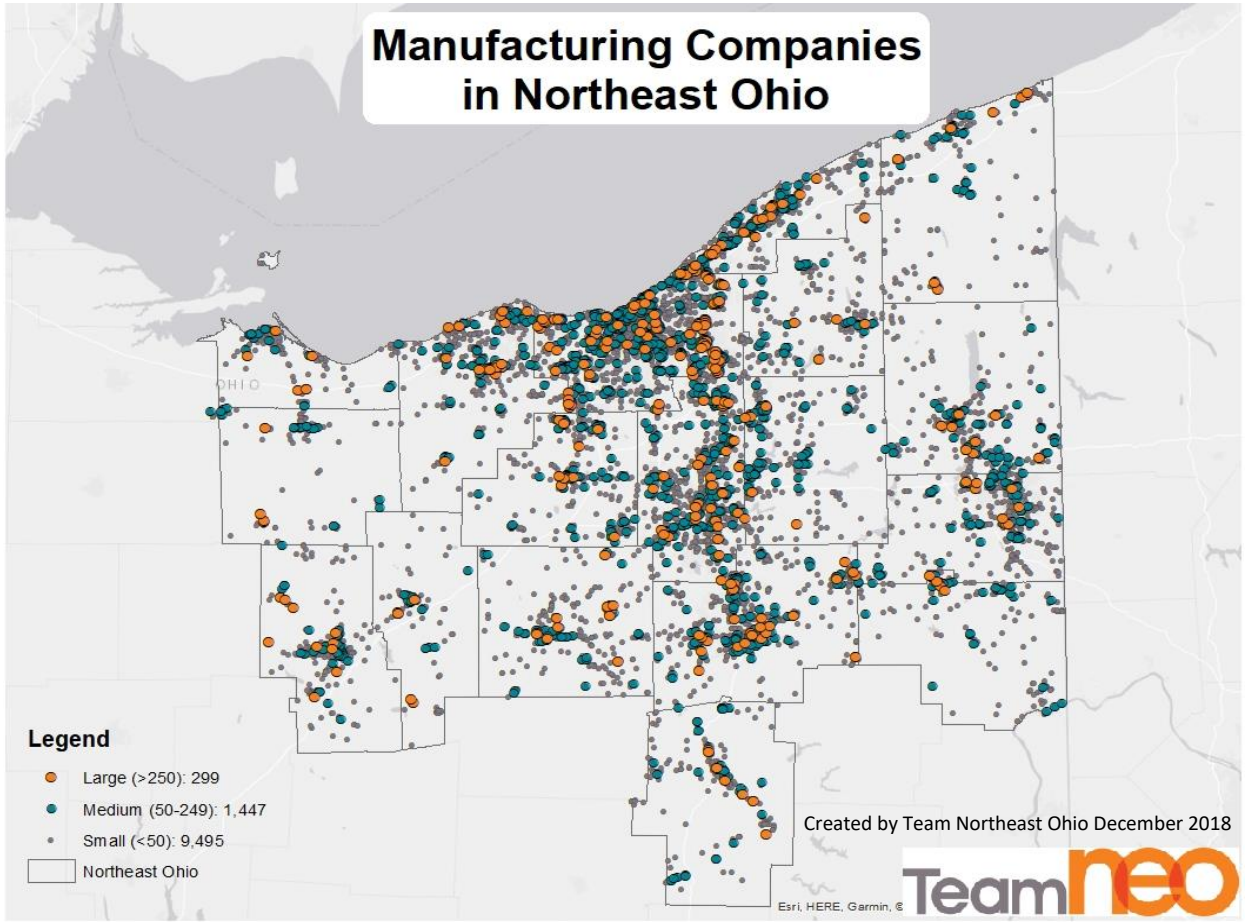
MAGNET

Ohio Manufacturing Extension Partnership

JobsOhio

LOGISYNC systems solutions through innovative technology

Northeast Ohio is Home to More than 7,000 Manufacturing Establishments



Source: Reference USA

Northeast Ohio's Top 20 Headquarters Alone Give You Access to Manufacturers Throughout the World

Headquarters of 20 Northeast Ohio Manufacturing Companies:

A.Schulman- Lyondellbasell ● Aleris Corporation ● Applied Industrial Technologies ● Eaton Corp. ● Hyster-Yale Materials Handling ● Lincoln Electric Holdings ● Parker-Hannifin Corporation ● PolyOne Corporation ● RPM International ● The Goodyear Tire & Rubber Company ● The J.M. Smucker Company ● Lubrizol ● Nordson Corporation ● The Sherwin-Williams Company ● The Timken Company ● TransDigm Group Incorporated ● Steris Corp ● Ferro Corporation ● Diebold Nixdorf Inc. ● Swagelok Co.

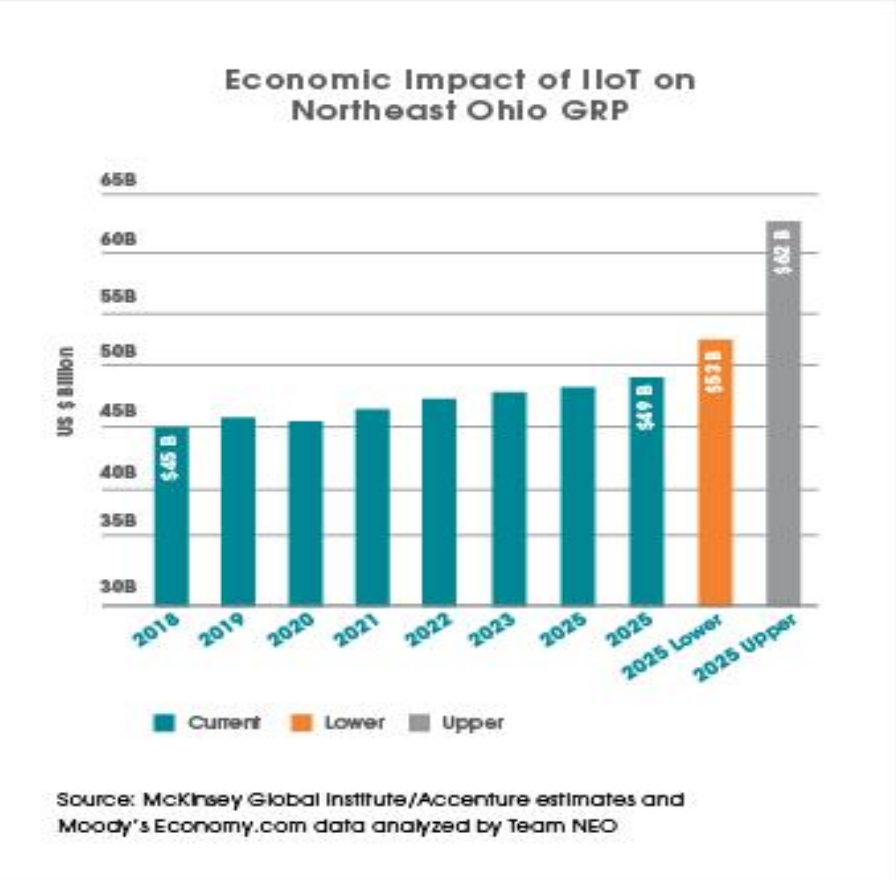
Legend

● Manufacturing Locations of Northeast Ohio Headquarters

Created by Team Northeast Ohio January 2019

Source: D&B Hoovers

Smart Manufacturing in Northeast Ohio Could Have An Incremental $4 - $13B Impact on GRP

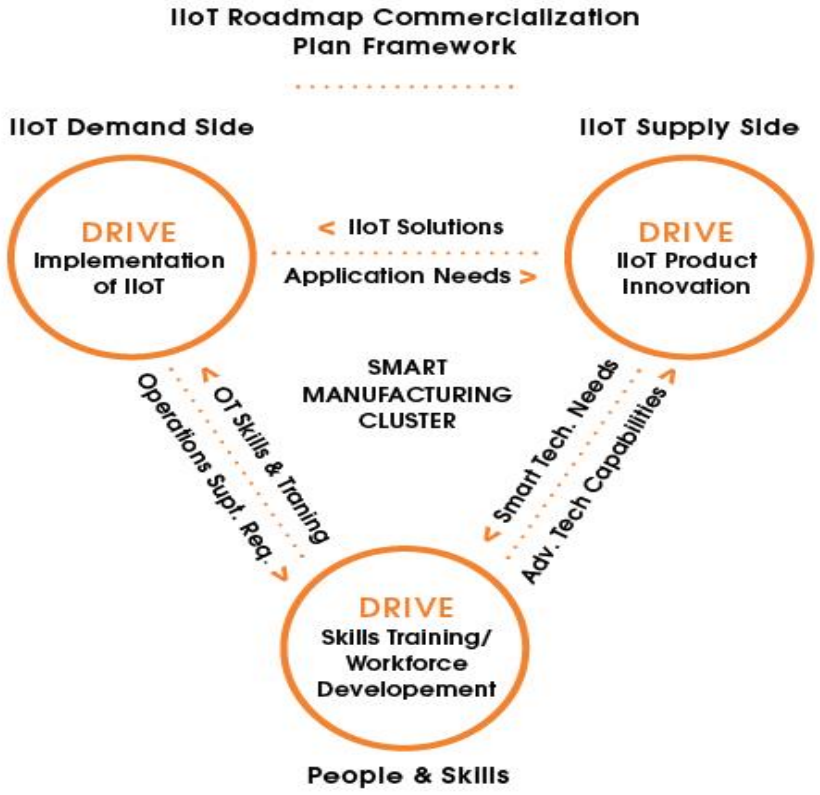


Source: Accenture and McKinsey Global Institute and Moody's Economy.com data analyzed by Team NEO

Left alone, manufacturing in Northeast Ohio is projected to grow by $4 billion through 2025

The incremental impact of IIoT could shift our growth trajectory to a $53-$62 billion sector

The Ultimate Goal is Coordinated Integration of IIoT into Regional Manufacturing

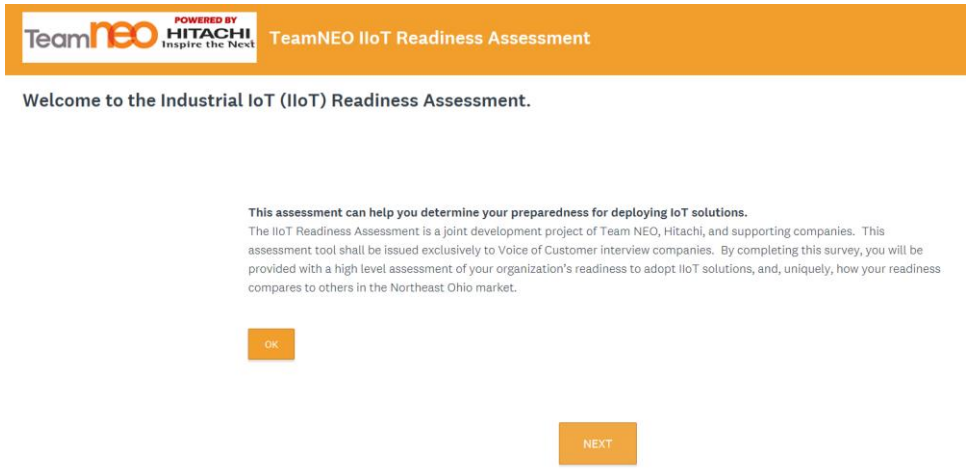


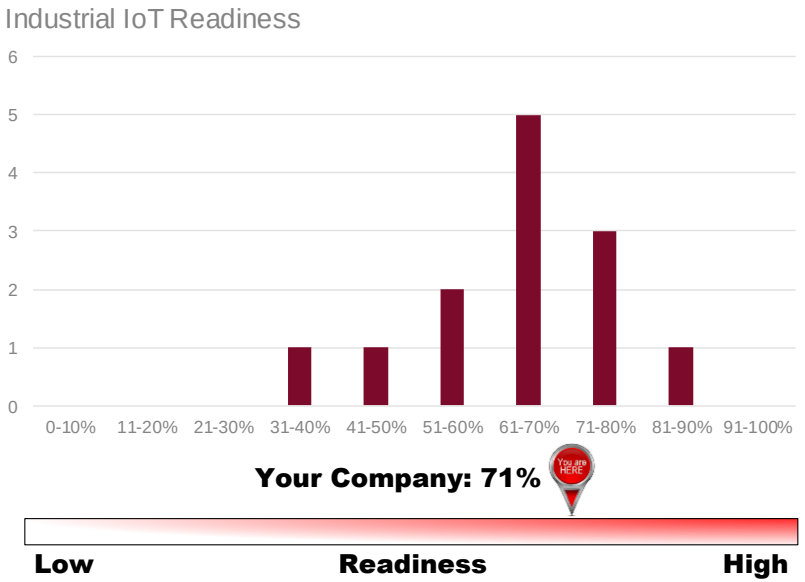
Source: Roadmap Working Group

The IIoT Readiness Assessment: How it Works?

Survey responses are…

- Confidential (anonymized data)
- Complimentary
- Analyzed by our experts with results returned to company leader…





Preparing Talent for an Automated World

“Productivity increases and competitive advantages of automation do not replace jobs – they will automate tasks, augment jobs and create new ones.”

MILTON GUERRY

PRESIDENT OF THE INTERNATIONAL FEDERATION OF ROBOTICS

IT Skills Demand – Present & Future

In 2019, there were 29,000 IT related job openings, this accounts for over 7% of all job openings.

Of those 29,000 IT job openings, **IT Automation** is the skill cluster projected to grow most rapidly (requested in 1,380 job postings or 5% of all IT job postings).

Source: Burning Glass Labor Insight/Jobs

Growth in Automation & AI Job Demand

In 2019:

- 29,000 IT job openings
- 3,646 job postings included the keyword ‘automation’
- 182 included the keyword ‘artificial Intelligence’
- 293 included the keyword ‘AI’

In 2014:

- 22,801 IT job openings
- 1,512 job postings included the keyword ‘automation’
- 5 included the keyword ‘artificial Intelligence’
- 10 included the keyword ‘AI’

Source: Burning Glass Labor Insight/Jobs

Emerging Computer & IT Careers

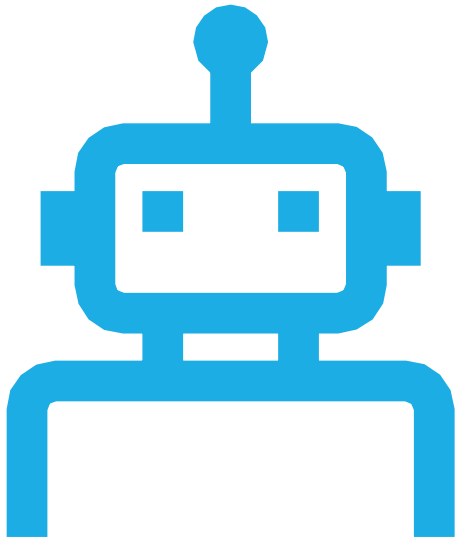
- **Artificial Intelligence Engineer**
- Data Scientist
- Cybersecurity Specialist

aligning OPPORTUNITIES

	Occupation Group	Total Demand 2019	Entry-Level Demand 2019	Credentials Awarded 2018	Alignment	Entry-Level Alignment
IT	Computer & IT Workers	17,442	6,457	2,208	(15,234)	(4,249)

Lorain County Community College Case Study

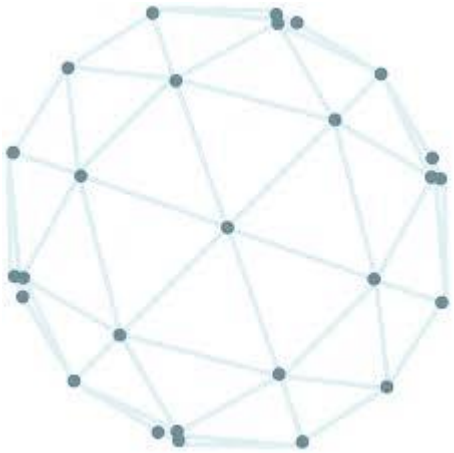
- How are current education and training programs preparing people to work with robots in manufacturing?
- Through the Team NEO IIoT Roadmap process, industry and education representatives came together to develop IIoT & automation-centric curriculum to educate the next generation of talent.



Lorain County Community College

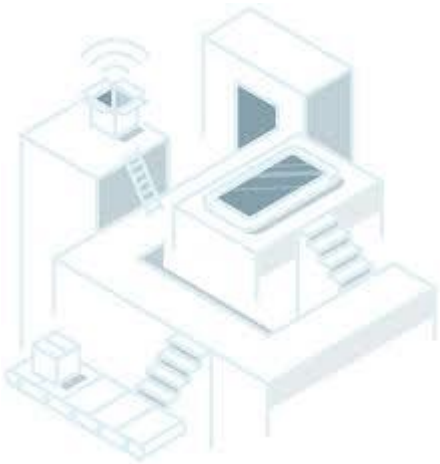
Concluding Statements

- To equip the workforce with the soft skills and technical knowledge required in the post-COVID-19 economy and a more automated world, a tight collaboration between industry, government, and education institutions is required



Sources

- Burning Glass Labor Insight/Jobs
- Moody’s Economy.com
- Reference USA
- D & B Hoovers
- International Federation of Robotics



More Information…

Northeast Ohio Manufacturing Innovation Clusters: https://teamneo.org/innovation-clusters/

smart MANUFACTURING CLUSTER OF NORTHEAST OHIO

Northeast Ohio Talent Insights: https://teamneo.org/talent-insights/

aligning OPPORTUNITIES

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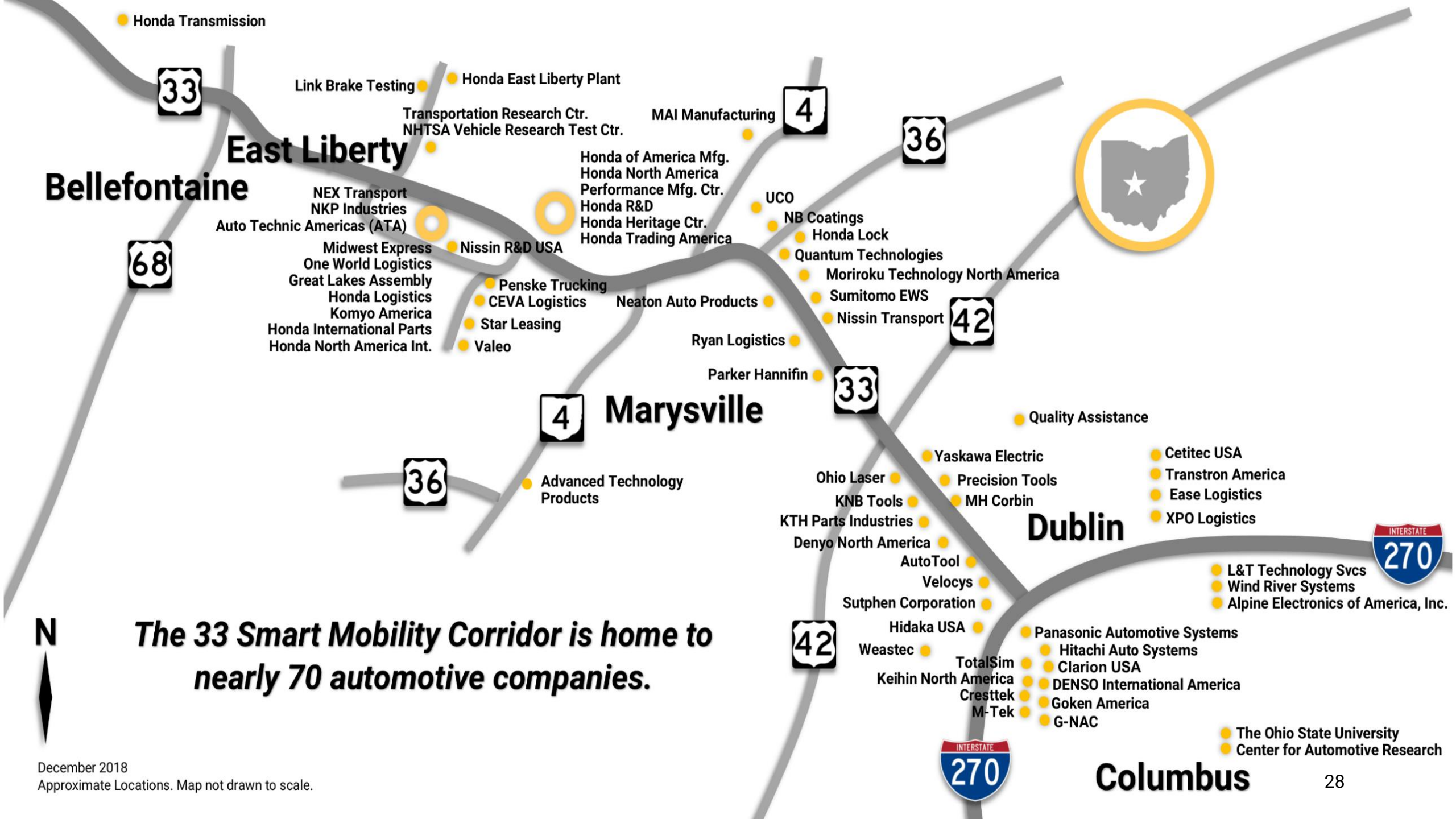
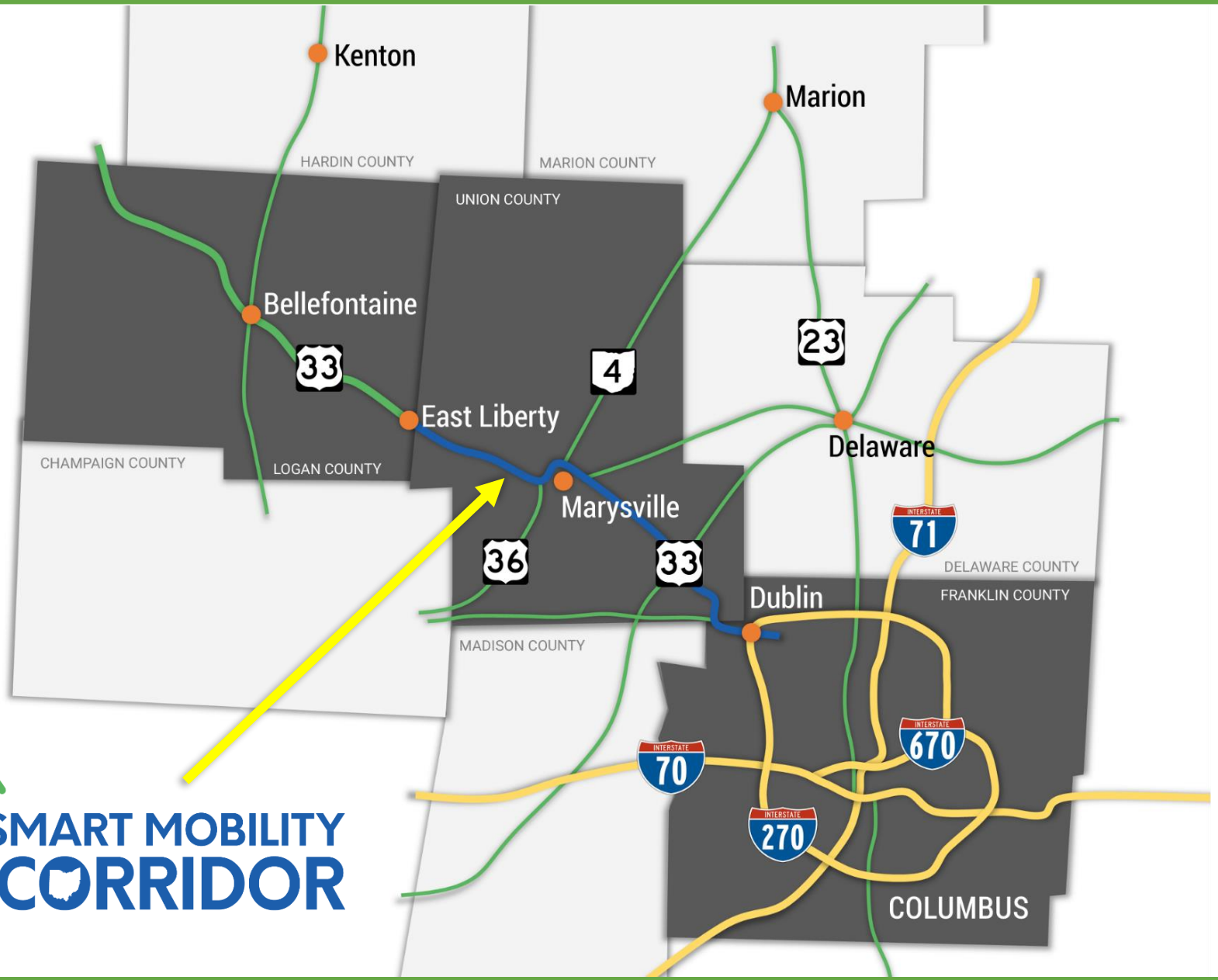
33 SMART MOBILITY CORRIDOR

February 2020


Honda Transmission
33
Link Brake Testing
Honda East Liberty Plant
Transportation Research Ctr.
NHTSA Vehicle Research Test Ctr.
MAI Manufacturing
4
36
East Liberty
Bellefontaine
Honda of America Mfg.
Honda North America
Performance Mfg. Ctr.
Honda R&D
Honda Heritage Ctr.
Honda Trading America
NEX Transport
NKP Industries
Auto Technic Americas (ATA)
UCO
NB Coatings
Honda Lock
Quantum Technologies
Moriroku Technology North America
Sumitomo EWS
Nissin Transport
68
Midwest Express
Nissin R&D USA
One World Logistics
Great Lakes Assembly
Honda Logistics
Komyo America
Honda International Parts
Honda North America Int.
Penske Trucking
CEVA Logistics
Star Leasing
Valeo
Neaton Auto Products
Ryan Logistics
Parker Hannifin
42
33
4
Marysville
Quality Assistance
36
Advanced Technology Products
Yaskawa Electric
Ohio Laser
Precision Tools
KNB Tools
MH Corbin
KTH Parts Industries
Denyo North America
AutoTool
Velocys
Sutphen Corporation
Hidaka USA
Weastec
TotalSim
Keihin North America
Cresttek
M-Tek
Cetitec USA
Transtron America
Ease Logistics
XPO Logistics
Dublin
INTERSTATE
270
L&T Technology Svcs
Wind River Systems
Alpine Electronics of America, Inc.
42
Panasonic Automotive Systems
Hitachi Auto Systems
Clarion USA
DENSO International America
Goken America
G-NAC
The Ohio State University
Center for Automotive Research
INTERSTATE
270
Columbus
N
The 33 Smart Mobility Corridor is home to nearly 70 automotive companies.
December 2018
Approximate Locations. Map not drawn to scale.

The 33 Smart Mobility Corridor

is a 35-mile stretch of connected highway between Dublin and East Liberty, Ohio.



33 SMART MOBILITY CORRIDOR

Project Evolution

2014-15

- Collaborative Group Formed to Explore Development Issues along US-33
- Collaborative Group Prioritizes Fiber Connectivity along US-33

2016-17

- Fiber Strategy Consultant
- OSU Mobility Concept
- Smart Project Introduced
- ODOT Commits to Fiber Construction
- USDOT Awards ATCMTD Grant
- NW 33 COG Formed
- Fiber Installation Occurs along US-33 (ODOT)
- Ohio Announces $45 M for TRC SMARTCenter

2018

- Project Manager Hired
- First DSRCs Installed in Uptown Marysville
- Connected Marysville is Planned
- Installation of Local Fiber Network (Redundant Loop)
- DriveOhio Established
- UAS Program Launched
- Dublin Launches Connectivity Initiatives

2019-20

- Phase II Fiber Installation Completed
- Construction of TRC SMARTCenter Completed
- DSRCs, RSUs and OBUs Installed
- Statewide Data Exchange Implemented
- 33 Smart Mobility Ecosystem Operational
- CV Application Fully Operational

Management Structure

NW 33 Innovation Corridor Council of Governments

Member Governments:

- City of Dublin
- City of Marysville
- Union County
- Marysville-Union County Port Authority

COG Partners:

- ODOT, DriveOhio, FHWA, USDOT
- Honda of America, Transportation Research Ctr.
- Battelle, The Ohio State University
- Logan County, Smart Columbus

Executive Committee

Infrastructure Working Group

Vehicle Working Group

Smart Network Working Group

Engagement Working Group

Finance Working Group

Overall Project Goals

- Improve Public Safety
- Install Smart Infrastructure
  - RSUs & OBUs
- Improve Connectivity
  - Extensive Fiber Network
- Support CAV & UAS Testing
- Encourage Economic Growth
  - Business & Talent Attraction

2018 Ohio Traffic Incidents:

294,789 accidents

& 1,072 fatalities

Financial Support

$93 million of smart infrastructure has been invested/pledged along the corridor, including:

$15 million ODOT Fiber Network Installation

$5.9 million USDOT Smart Infrastructure Grant

$45 million TRC SMARTCenter

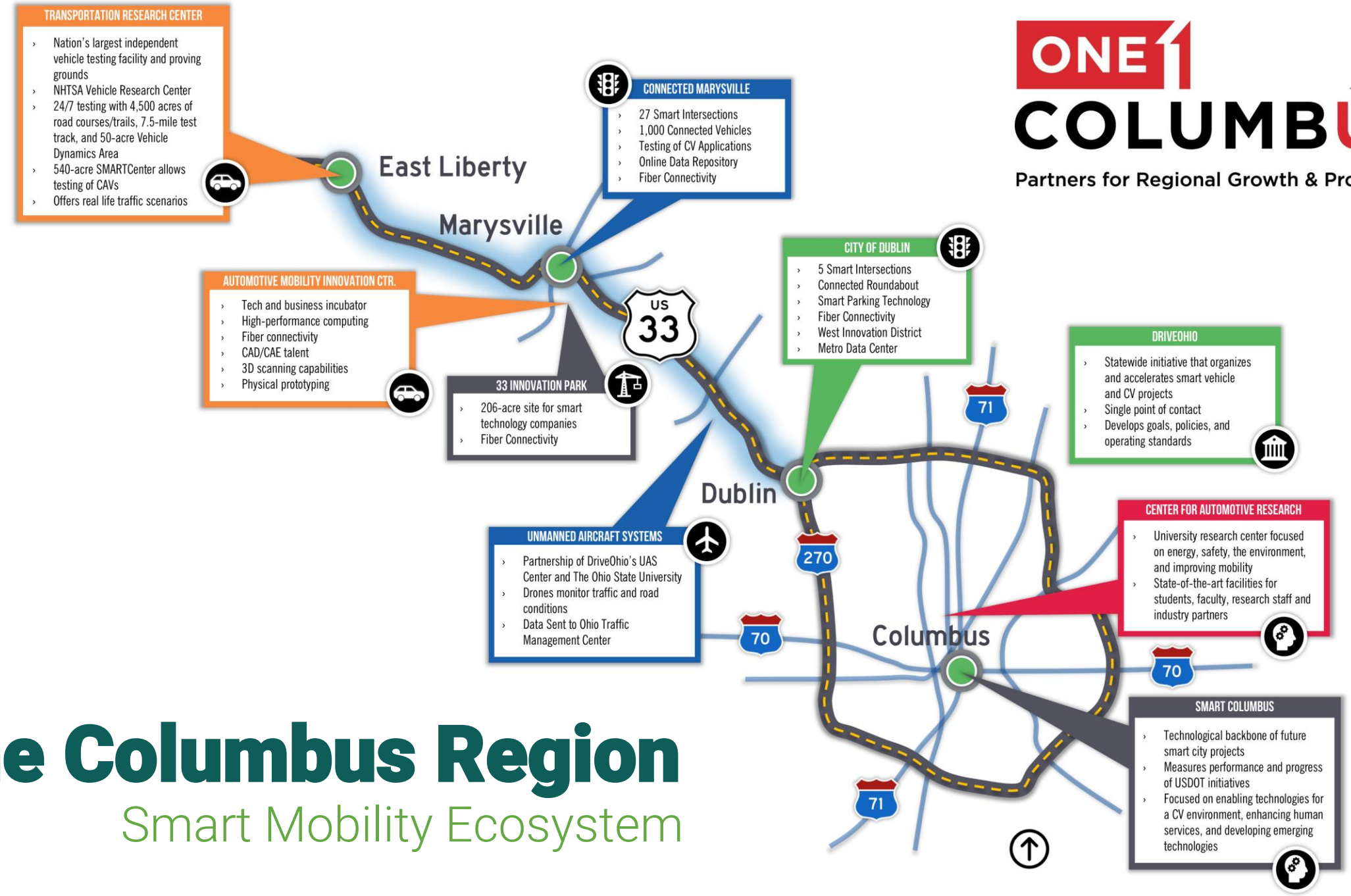
$3.4 million local matches

ONE COLUMBUS

Partners for Regional Growth & Prosperity

The Columbus Region

Smart Mobility Ecosystem



Corridor Assets

The 33 Smart Mobility Corridor is the **nation's ultimate playground** for the development and testing of CAV technologies.

- 35-mile stretch of Continuous Connected Vehicle Infrastructure
- 94 Road Side Units & 1,000 On Board Units
- 27 Smart Signals in City of Marysville; 5 in City of Dublin
- 147 Smart Signals in City of Columbus (Regional Partners)
- 432-strand Redundant Fiber Network
- Closed Testing at 540-acre TRC SMARTCenter
- Open Testing on US-33, Connected Marysville & Dublin, & Smart Columbus Platforms
- All-Weather Testing Environment
- Testing in Rural, Exurban, Suburban, and Urban Environments
- Testing of Unmanned Aircraft Systems
- ~$600 million Being Invested in Regional Smart Mobility Infrastructure

Corridor Assets

AUTOMOTIVE JUGGERNAUT

- 70 + Automotive Companies within Corridor
- 150+ Automotive Suppliers within Region
- Over 645,000 Vehicles Produced Annually within Corridor
- Smart Mobility Incubator and Collaboration Space
- Sites for Development, including the 33 Innovation Park and West Innovation District

ACADEMIA & INDUSTRY PARTNERS

- Transportation Research Center
- NHTSA Research and Test Center
- OSU Center for Automotive Research
- Honda-OSU Partnership
- Columbus State Modern Manufacturing Apprenticeship Program
- Ohio University

BEST IN TALENT – COLUMBUS REGION

- One of the highest concentrations of college students in the nation with approximately 134,000 students
- 52 Colleges and Universities
- 18,000+ Automotive Employees
- On average, 7-times more Engineers than Ann Arbor, Michigan MSA and Las Vegas, Nevada MSA, which are peer CV regions.
- 25% of workforce dedicated to Research & Development

Connected Marysville

27 connected traffic signals + RSUs + OBUs

- First Honda Smart Signal Equipped at Fifth & Main Streets in 2018
- All 27 Signals to by Equipped by Early 2020
- First Contained City to Realize All Smart Signals
- 10% of Vehicles in City to be Outfitted with OBUs by 2020

- Applications: Red Light Warning, Pedestrian Warning, Reduced Speed Zone Warning, Curve (Speed) Warning

CITY OF marysville

Connected Dublin

Avery-Muirfield Corridor

- ATCMTD Grant
- Traffic Signals (6 intersections) outfitted with RSUs

Bridge Park East Smart Parking

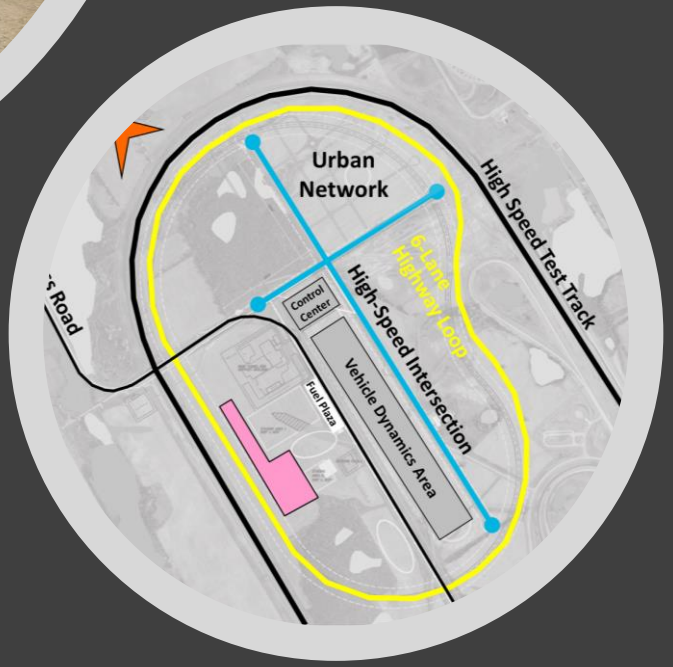
- New parking inventory
- Increasing demand
- NO existing meter infrastructure
- Interesting opportunity
  - No capital investment
  - No clutter
  - Ample off-street parking alternatives

OH-161/Riverside Drive Roundabout

- Multilane roundabout within 2 signalized corridors
- CV research and operations study
- Collect data of circulating vehicles in roundabout to inform approaching vehicle decision-making

City of Dublin
OHIO, USA

Transportation Research Center



Transportation Research Center:

- 24/7 testing
- 4,500 acres of road courses, wooded trails, a 7.5-mile test track, 50-acre Vehicle Dynamics Area
- National Highway Traffic Safety Administration's (NHTSA) Vehicle Research and Test Center

SMARTCenter:

- $45 million; 540-acre development
- Opened July 2019
- Dedicated AV/CV Test Facility
- 6-lane High Speed Intersection
- Urban Network
- Centralized Control Building
- V2X Covering Entire Site
- Fiber Network

Automotive & Mobility Innovation Center

- Partnership with The Ohio State University
- Located at the 33 Innovation Park in Marysville
- Entrepreneurial center and business incubator
- Office and co-working space for emerging companies
- Offices for state agencies involved in automotive and smart mobility
- Testing lab and data center
- Space for K-12 and higher education institutions
- Space for a Traffic Management System operations office
- Space to inspire innovative thought and collaboration among the tenants, automotive, and smart mobility companies

Workforce & Talent

Promotion of educational and training opportunities for students and incumbent workers interested in CAV careers.

Committee Partners

- DriveOhio & ODOT
- The Ohio State University
- Columbus State Community College
- Transportation Research Center
- Ohio Hi-Point Career Center
- Marion Technical College
- Marysville Schools/Early College HS
- Private Sector Partners
- Governmental Partners

Unmanned Aircraft Systems Testing

- Three-year partnership DriveOhio's UAS Center and The Ohio State University College of Engineering.
- Monitor traffic and roadway conditions from the air along the corridor in conjunction with the state's current fixed-location traffic camera system.
- Identify specific use cases
- Will also use sensors and communication devices to ensure the unmanned aircraft will not collide with each other or with manned aircraft.

DriveOhio

Safety

Mobility

Access

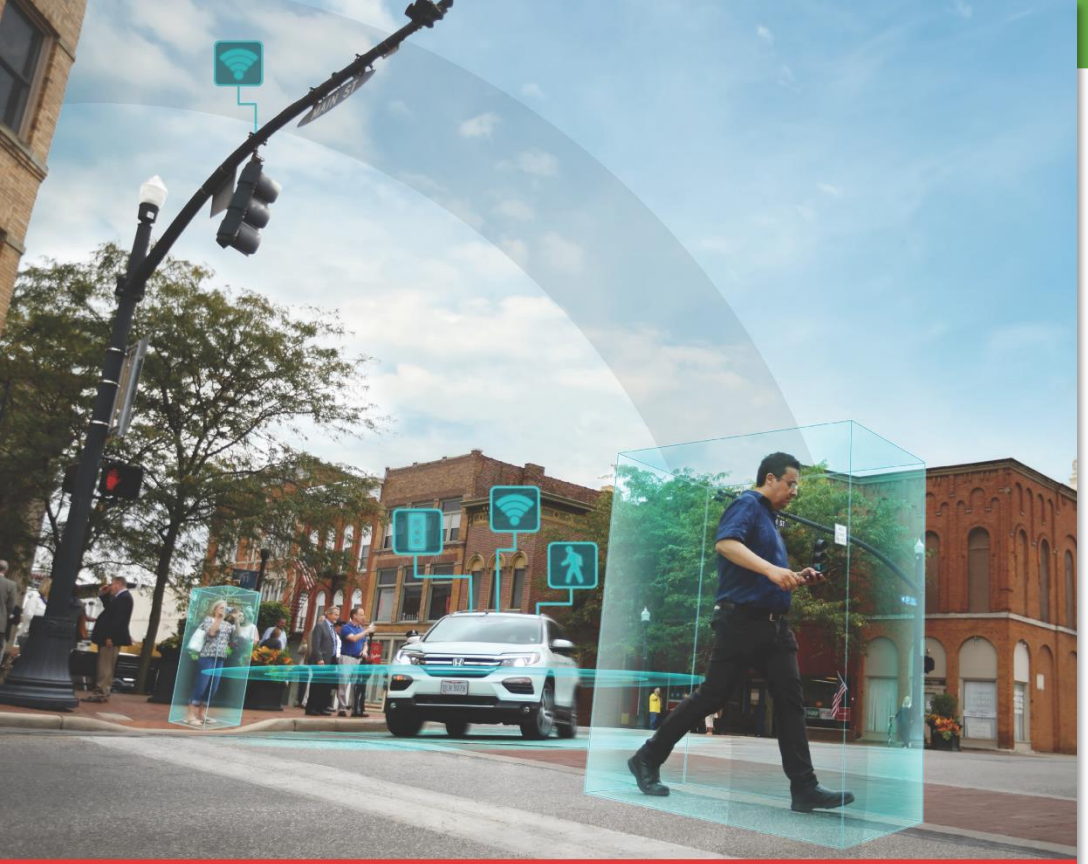
Reliability

Talent

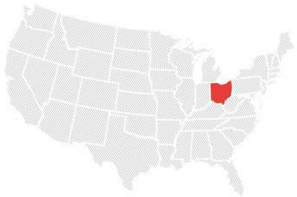
DriveOhio

The Future of Smart Mobility

A Safer, more Mobile and Connected State



Creating smart cities together: ***Make Ohio home.***



The successful shift to smart cars and smart cities depends on an integrated network of resources that inspire innovation. Ohio's unparalleled combination of physical assets, smart city initiatives and automotive test facilities create an ideal environment to research, test and deploy smart technologies. Moreover, Ohio's recent executive order authorizing autonomous vehicle testing will accelerate mobility innovations to improve quality of life for people around the world. We invite you to join us in Ohio as we create a safer, smarter, more connected future.

JobsOhio.com/Automotive

Welcome to Ohio. Ohio

Statewide Projects

Smart Mobility Projects

1. Self-Driving Shuttle on the Scioto Mile
2. Unmanned Traffic Management Pilot
3. Connected Marysville
4. Smart Columbus
5. Uber Movement, Cincinnati Mobility Lab Project
6. Dublin Connected Roundabout
7. Smart[2]
8. FlyOhio: SkyVision

Connected Corridors

1. U.S. 33 Smart Mobility Corridor
2. Ohio Turnpike Corridor
3. Future Ohio Turnpike Corridor Expansion
4. Cincinnati/Dayton Workforce Corridor
5. Lake Effect Corridor
6. SmartLane

City Use Cases in Development

DriveOhio

Smart Region Taskforce

Vision:

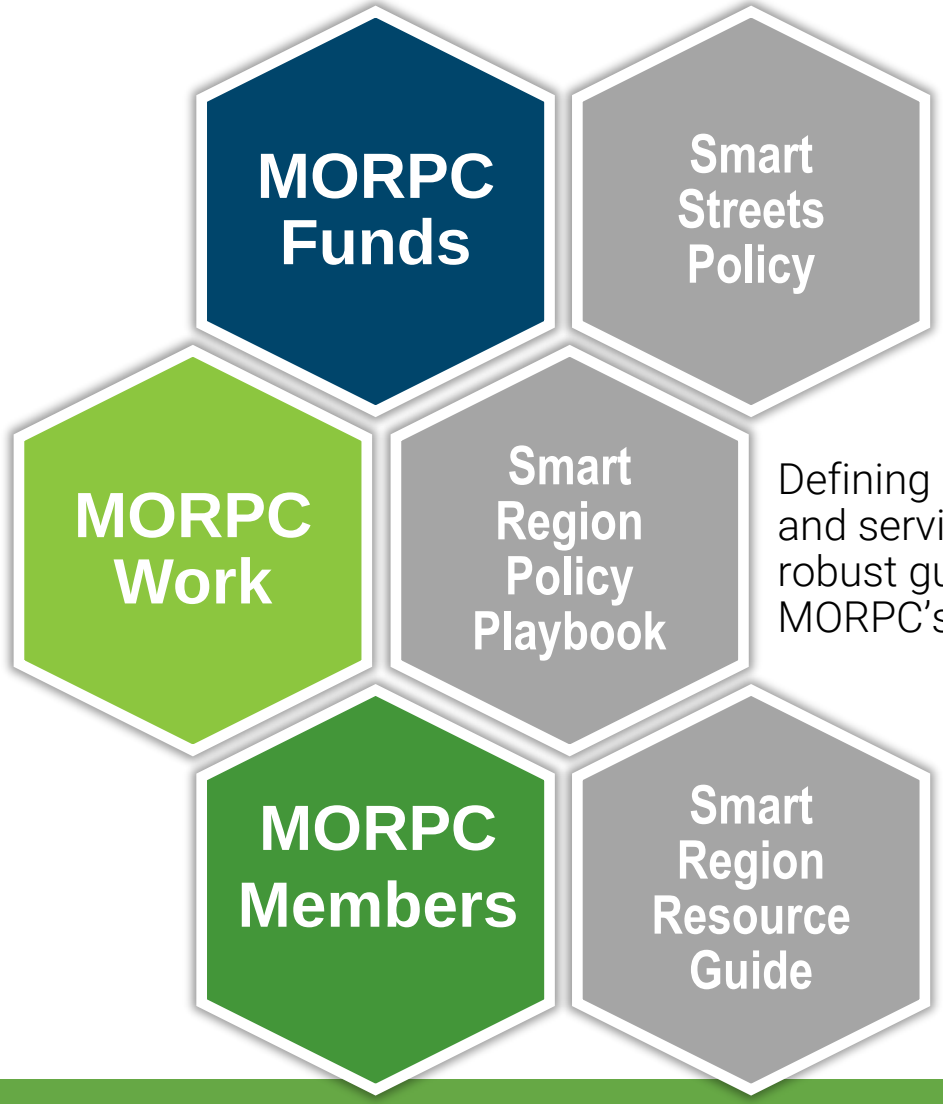
- Convene thought leaders within Central Ohio to develop a shared vision for what it means to be a Smart Region

Questions to Answer:

- What is a “Smart Region?”
- What are mutually beneficial “smart” policies that can guide investment decisions for our local communities?
- What resources can MORPC provide to help?

Structure:

- Duration: 18-24 months
- Representation: 2/3 local governments, 1/3 technical experts
- Membership appointed by MORPC Executive Director



Helping guide investments with regional smart priorities

Defining regional goals and serving as a robust guide for MORPC’s work

Helping communities with best practices, policies & funding opportunities

Thank You! Questions?

www.33smartcorridor.com

UNION COUNTY
MARYSVILLE
ECONOMIC DEVELOPMENT

C2ER THE COUNCIL FOR COMMUNITY AND ECONOMIC RESEARCH

LMI Institute
Navigating the World of Labor Market Information

Occupations Affected by Autonomous Vehicle Adoption in Oregon

Presented by Sarah Cunningham, Occupational Economist, Oregon Employment Department

2020 Virtual Annual Conference and Forum

In 2018, HB 4063 established the Oregon Department of Transportation as the lead agency for autonomous vehicle (AV) policy which required ODOT to convene and facilitate a Task Force on Autonomous Vehicles.

The Oregon Employment Department was asked to participate in the task force's Workforce Changes subcommittee in 2019 to assess the employment impacts of AV adoption.

Specifically, they wanted a summary of labor market information related to occupations most likely to see workforce reductions associated with autonomous vehicle adoption over the next 20 to 30 years in Oregon.

Primary affected occupations and occupations affected to a lesser degree

- Employment (OES)
- Wages (OES)
- Projections
- Age of affected workers

Building a Framework

Primary and secondary affected occupations

- U.S. Department of Commerce paper
- https://www.commerce.gov/news/fact-sheets/2017/08/employment-impact-autonomous-vehicles

Timeline and share of affected occupations

- Securing America's Future Energy report
- https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/Groshen-et-al-Report-June-2018-1.pdf

8 primary and **14 secondary** AV-affected occupations existed in Oregon in 2017

Primary driving occupations include occupations whose primary responsibilities include driving cars, vans, small trucks or heavy-duty commercial vehicles on the road.

Secondary driving occupations occupations include occupations where driving is not the primary responsibility but often required.

SOC Code	Standard Occupational Classification Title
00-0000	**Total, All Occupations**
	All Autonomous Vehicle-Affected Occupations
53-3032	Truck Drivers, Heavy and Tractor-Trailer
53-3033	Truck Drivers, Light or Delivery Services
53-3031	Driver/Sales Workers
53-3022	Bus Drivers, School or Special Client
53-3041	Taxi Drivers and Chauffeurs
53-3021	Bus Drivers, Transit and Intercity
53-3099	Motor Vehicle Operators, All Other
53-3011	Ambulance Drivers and Attendants, Except Emergency Medical Technicians
33-9032	Security Guards
49-3023	Automotive Service Technicians and Mechanics
53-6031	Service Station Attendants
33-3051	Police and Sheriff's Patrol Officers
43-5052	Postal Service Mail Carriers
53-7081	Refuse and Recyclable Material Collectors
49-3021	Automotive Body and Related Repairers
43-5021	Couriers and Messengers
33-1012	Supervisors and Managers of Police and Detectives
53-6021	Parking Lot Attendants
49-3022	Automotive Glass Installers and Repairers
39-7012	Travel Guides
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles
13-1032	Insurance Appraisers, Auto Damage

primary driving occupation
secondary affected occupation

Nearly **95,000 jobs** (5%) existed across the 22 AV-affected occupations in 2017. Median hourly wages ranged from $12.31 to $35.96 in 2019.

Employment and Wages for Autonomous Vehicle-Affected Occupations in Oregon

SOC Code	Standard Occupational Classification Title	2017 Employment	2019 Median Hourly Wage
00-0000	**Total, All Occupations**	**2,045,907**	**$19.46**
	All Autonomous Vehicle-Affected Occupations	94,776	-
53-3032	Truck Drivers, Heavy and Tractor-Trailer	24,289	$22.82
53-3033	Truck Drivers, Light or Delivery Services	10,532	$17.10
53-3031	Driver/Sales Workers	7,282	$15.24
53-3022	Bus Drivers, School or Special Client	6,634	$17.44
53-3041	Taxi Drivers and Chauffeurs	2,795	$13.56
53-3021	Bus Drivers, Transit and Intercity	2,326	$25.36
53-3099	Motor Vehicle Operators, All Other	2,167	$14.47
53-3011	Ambulance Drivers and Attendants, Except Emergency Medical Technicians	77	$12.71
33-9032	Security Guards	8,527	$13.31
49-3023	Automotive Service Technicians and Mechanics	7,423	$21.19
53-6031	Service Station Attendants	5,912	$12.31
33-3051	Police and Sheriff's Patrol Officers	5,289	$35.57
43-5052	Postal Service Mail Carriers	3,496	$22.90
53-7081	Refuse and Recyclable Material Collectors	2,199	$22.43
49-3021	Automotive Body and Related Repairers	1,971	$18.81
43-5021	Couriers and Messengers	1,406	$16.43
33-1012	Supervisors and Managers of Police and Detectives	1,293	$48.80
53-6021	Parking Lot Attendants	745	$12.81
49-3022	Automotive Glass Installers and Repairers	271	$15.82
39-7012	Travel Guides	82	$15.81
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	60	$20.10
13-1032	Insurance Appraisers, Auto Damage	-s-	$35.96

Cells with "-s-" suppressed for confidentiality or data quality
Sources: Oregon Employment Department, 2017-2027 Employment Projections
2019 Occupational Wage Information

primary driving occupation
secondary affected occupation

Primary and secondary driving occupations will account for **117,500** (4%) of Oregon's 2.6 million job openings through 2027.

2017-2027 Employment Projections for Primary Driving and Secondary AV-Affected Occupations in Oregon

Occupation Title	2017 Employment	2027 Employment	Percent Change	Employment Change	Replacement Openings	Total Openings
Total, All Occupations	**2,045,907**	**2,291,921**	**12%**	**246,014**	**2,383,309**	**2,629,323**
Primary Driving Occupations	***56,102***	***62,641***	***11.7%***	***6,539***	***65,168***	***71,707***
Ambulance Drivers and Attendants, Except Emergency Medical Technicians	77	88	14%	11	117	128
Bus Drivers, Transit and Intercity	2,326	2,571	11%	245	2,921	3,166
Bus Drivers, School or Special Client	6,634	7,297	10%	663	8,309	8,972
Driver/Sales Workers	7,282	7,650	5%	368	7,856	8,224
Truck Drivers, Heavy and Tractor-Trailer	24,289	26,988	11%	2,699	26,977	29,676
Truck Drivers, Light or Delivery Services	10,532	12,347	17%	1,815	12,036	13,851
Taxi Drivers and Chauffeurs	2,795	3,270	17%	475	3,028	3,503
Motor Vehicle Operators, All Other	2,167	2,430	12%	263	3,924	4,187
Secondary Affected Occupations	***38,674***	***41,564***	***7.5%***	***2,890***	***42,908***	***45,798***
Insurance Appraisers, Auto Damage	-s-	-s-	-s-	-s-	-s-	-s-
Supervisors and Managers of Police and Detectives	1,293	1,376	6%	83	784	867
Police and Sheriff's Patrol Officers	5,289	5,663	7%	374	3,456	3,830
Security Guards	8,527	9,544	12%	1,017	11,732	12,749
Travel Guides	82	91	11%	9	148	157
Couriers and Messengers	1,406	1,597	14%	191	1,344	1,535
Postal Service Mail Carriers	3,496	3,354	-4%	-142	2,288	2,146
Electronic Equipment Installers and Repairers, Motor Vehicles	60	59	-2%	-1	57	56
Automotive Body and Related Repairers	1,971	2,131	8%	160	1,932	2,092
Automotive Glass Installers and Repairers	271	289	7%	18	266	284
Automotive Service Technicians and Mechanics	7,423	7,854	6%	431	7,019	7,450
Parking Lot Attendants	745	764	3%	19	1,107	1,126
Service Station Attendants	5,912	6,473	9%	561	10,077	10,638
Refuse and Recyclable Material Collectors	2,199	2,369	8%	170	2,698	2,868

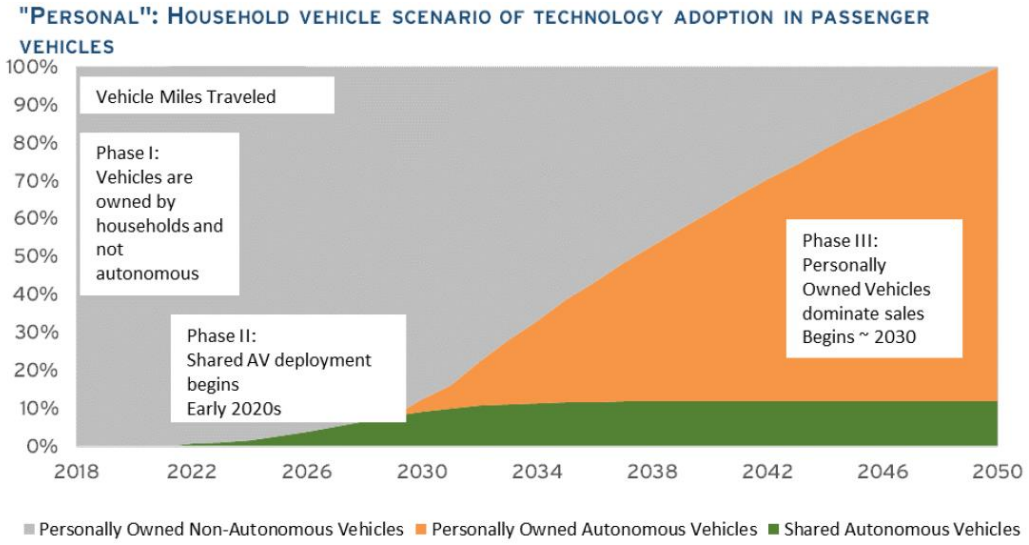
Cells with "-s-" suppressed for confidentiality or data quality
Source: Oregon Employment Department, 2017-2027 Employment Projections
Primary and secondary occupations as defined by Chief Economist Office, Economics and Statistics Administration, U.S. Dept. of Commerce

How many of these jobs will be affected?

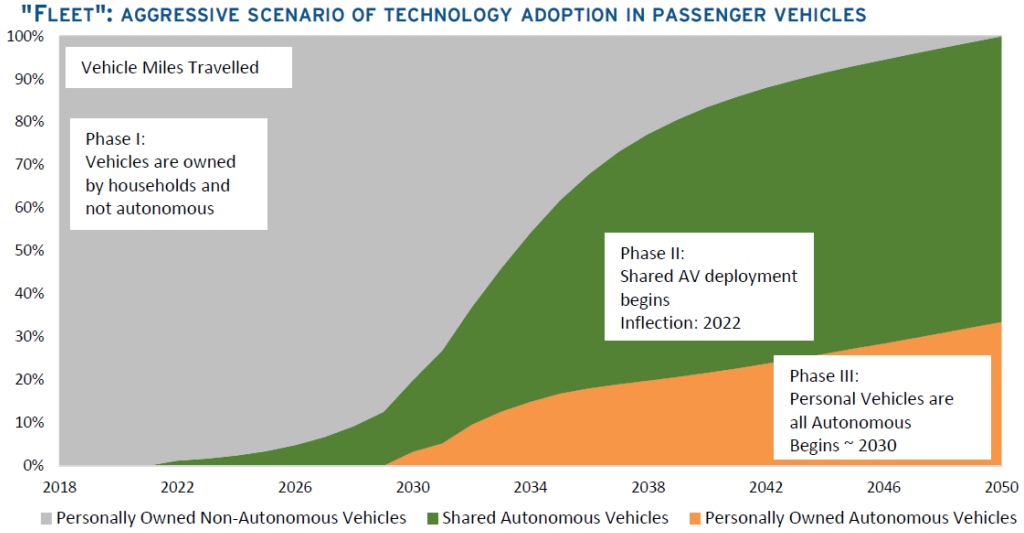
When will they be affected?

4 scenarios were adopted from the Securing America's Future Energy (SAFE) Report.

PERSONAL HOUSEHOLD VEHICLES SCENARIO



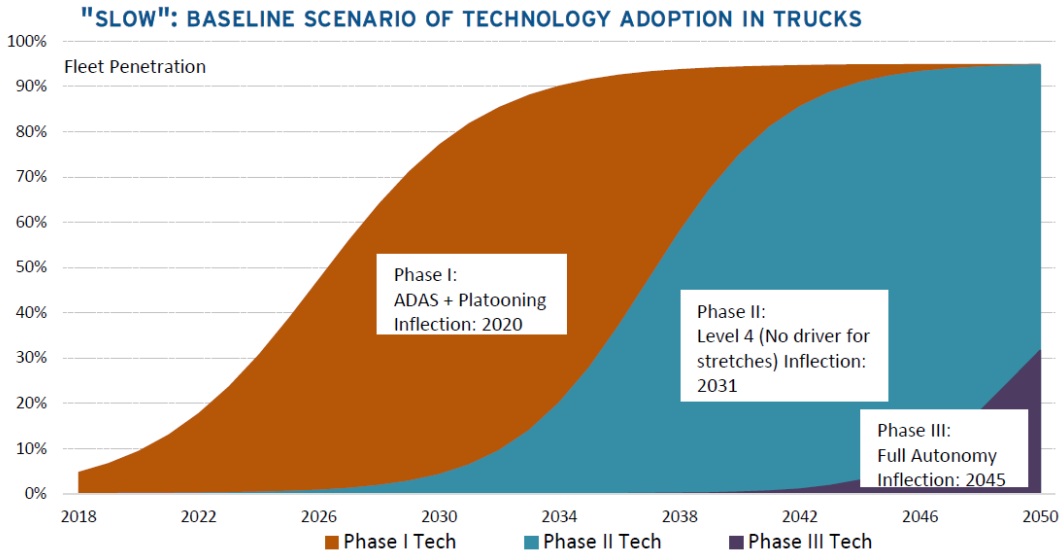
FLEET SCENARIO



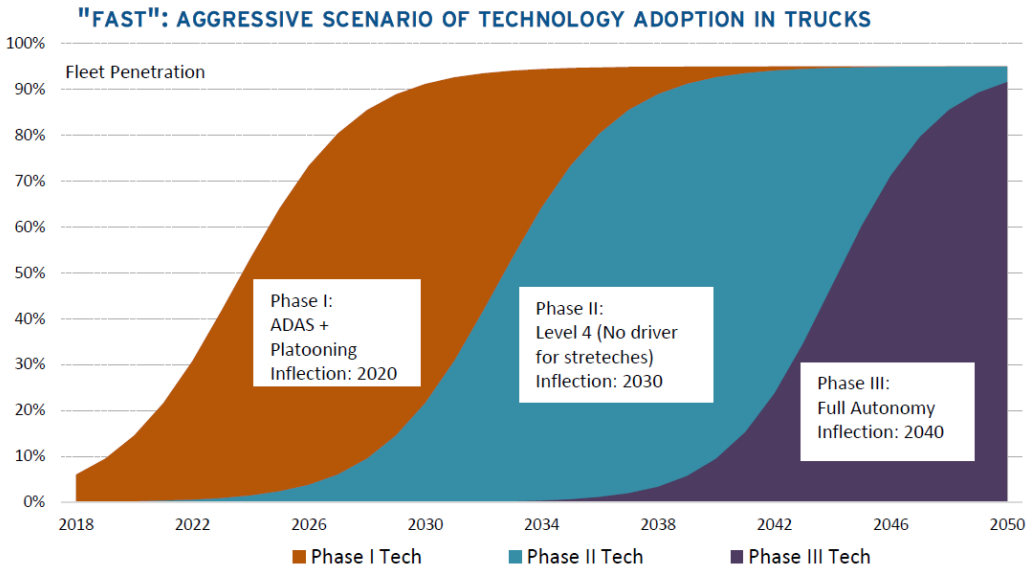
Source: Securing America's Future Energy

Continued…

SLOW TRUCKING ADOPTION SCENARIO



FAST TRUCKING ADOPTION SCENARIO



Source: Securing America's Future Energy

Shares of jobs affected by occupation and Autonomous Vehicle adoption scenario

Appendix A: Shares of Jobs Affected by Occupation and Autonomous Vehicle Adoption Scenario

Occupation	Employment Level in thousands, 2016	Share of jobs eliminated under full implementation of scenario				Number of jobs eliminated under full implementation of scenario			
		Trucking-Fast	Trucking-Slow	Cars–Fleet	Cars–Personal	Trucking-Fast	Trucking-Slow	Cars–Fleet	Cars–Personal
Primary Driver Occupations									
Heavy and Tractor-Trailer Truck Drivers[38]	1,532	0.65	0.6	0	0	996	919		
Light Truck or Delivery Services Drivers[39]	781	0.55	0.45	0	0	430	351		
Bus Drivers, School or Special Client	212	0.5	0.5	0	0	106	106		
Driver/Sales Workers	383	0	0	0.2	0.2			77	77
Taxi Drivers and Chauffeurs	300	0	0	0.7	0.2			210	60
Bus Drivers, Transit and Intercity[40]	75	0.75	0.7	0	0	56	53		
Ambulance Drivers and Attendants, Except Emergency Medical Technicians	10	0.05	0.05	0.05	0.05	1	1	1	1
Primary Driver Total (percent of total jobs)	3,293					**1,588 (48%)**	**1,430 (43%)**	**287 (9%)**	**137 (4%)**
Other On-The-Job Driver Occupations									
Security Guards	646	0.024	0.024	0.024	0.024	16	16	16	16
Police and Sheriff's Patrol Officers	673	0.05	0.04	0.05	0.05	34	27	34	34

Source: Securing America's Future Energy

Some occupations are expected to be more heavily impacted than others.

Automotive Service Technicians and Mechanics	711	0.1	0.1	0.5	0.5	71	71	356	356
Postal Service Mail Carriers	271	0	0	0.2	0.2			54	54
Parking Lot Attendants	48	0	0	0.5	0.5			24	24
Automotive Body and Related Repairers	116	0.05	0.05	0.5	0.5	6	6	58	58
Refuse and Recyclable Material Collectors	64	0.5	0.5	0.0	0.0	32	32		
Automotive and Watercraft Service Attendants[41]	57	0	0	0.6	0.4			34	23
First-Line Supervisors of Police and Detectives	103	0.05	0.05	0.05	0.05	5	5	5	5
Couriers and Messengers	143	0	0	0.02	0.02			28	28
Automotive Glass Installers and Repairers	15	0	0	0.25	0.25			4	4
Insurance Appraisers, Auto Damage	14	0.3	0.2	0.25	0.25	4	3	4	4
Electronic Equipment Installers and Repairers, Motor Vehicles	7	0	0	0.5	0.5			4	4
Travel Guides	1	0	0	0.5	0.5			1	1
Total, Other On-The-Job Driver Occupations (percent of total jobs)	**2,869**					**167 (6%)**	**159 (6%)**	**620 (22%)**	**608 (21%)**
Grand Total (percent of total jobs)	**6,162**					**1,756 (28%)**	**1,589 (26%)**	**907 (15%)**	**745 (12%)**

Notes: 1. For Phase II of Truck scenarios we use 0.1*full implementation job losses. 2. For combined AV scenarios (such as the "Trucking-Fast" Scenario combined with the Cars-Fleet scenario) the shares displaced are added together. Sources: Occupational employment: Bureau of Labor Statistics Occupational Employment Survey 2015. Share of jobs eliminated based on consultation with industry experts.

The various combinations for AV adoption scenarios could affect between **41,500** and **47,200** jobs.

Estimates of Oregon Jobs Affected by 2040s Under Various Household and Commercial Autonomous Vehicle Adoption Scenarios

		Household Scenarios		Commercial Scenarios	
SOC Code	**Standard Occupational Classification Title**	**Cars Personal**	**Cars Fleet**	**Trucking Slow**	**Trucking Fast**
53-3011	Ambulance Drivers and Attendants, Except Emergency Medical Technicians	4	4	4	4
53-3021	Bus Drivers, Transit and Intercity	0	0	1,800	1,928
53-3022	Bus Drivers, School or Special Client	0	0	3,649	3,649
53-3031	Driver/Sales Workers	1,530	1,530	0	0
53-3032	Truck Drivers, Heavy and Tractor-Trailer	0	0	16,193	17,542
53-3033	Truck Drivers, Light or Delivery Services	0	0	5,556	6,791
53-3041	Taxi Drivers and Chauffeurs	654	2,289	0	0
53-3099	Motor Vehicle Operators, All Other	122	122	0	0
13-1032	Insurance Appraisers, Auto Damage	n/a	n/a	n/a	n/a
33-1012	Supervisors and Managers of Police and Detectives	69	69	69	69
33-3051	Police and Sheriff's Patrol Officers	283	283	227	283
33-9032	Security Guards	229	229	229	229
39-7010	Tour and Travel Guides	46	46	0	0
43-5021	Couriers and Messengers	32	32	0	0
43-5052	Postal Service Mail Carriers	671	671	0	0
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	30	30	0	0
49-3021	Automotive Body and Related Repairers	1,066	1,066	107	107
49-3022	Automotive Glass Installers and Repairers	72	72	0	0
49-3023	Automotive Service Technicians and Mechanics	3,927	3,927	785	785
53-6021	Parking Lot Attendants	382	382	0	0
53-6031	Service Station Attendants	2,589	3,884	0	0
53-7081	Refuse and Recyclable Material Collectors	0	0	1,185	1,185
		11,706	**14,636**	**29,804**	**32,572**

Combined Household and Commercial Scenario	**Jobs Affected***
Personal cars + slow trucking	41,510
Fleet cars + slow trucking	44,440
Personal cars + fast trucking	44,278
Fleet cars + fast trucking	47,208

primary driving occupations
secondary affected occupations

Sources: Preparing U.S. Workers and Employers for an Autonomous Vehicle Future, Groshen et al., June 2018, and Oregon Employment Department

Demographics of workers

Workers in AV-affected occupations have a higher share of workers approaching retirement compared to workers across all occupation.

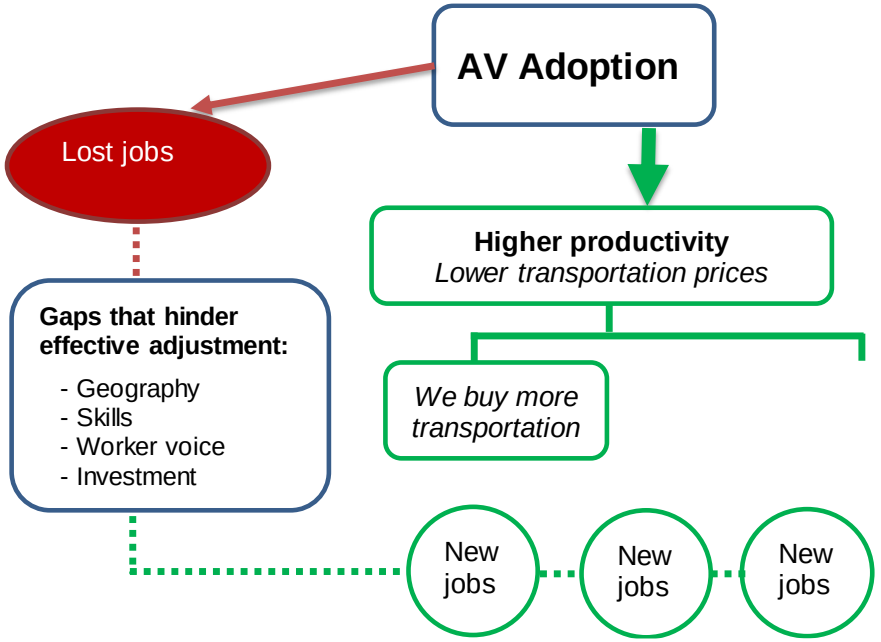
Oregon Workers Ages 55 and Older in Autonomous Vehicle-Affected Occupations, 2013-2017

	55 or Older	All Workers	% Ages 55 and Older
All Workers	**416,750**	**1,886,042**	**22%**
All AV-affected occupations	25,568	93,390	27%
Primary driving occupations	17,721	51,141	35%
Other on-the-road driving-related occupations	7,847	42,249	19%

Source: U.S. Census Bureau, American Community Survey, using IPUMS USA, https://usa.ipums.org

Affected Occupations ≠ Only Lost Jobs

- Some jobs may be eliminated
- Others will be changed substantially but still exist
- New jobs and occupations will also be created



In Conclusion…

- Between 41,500 and 47,200 jobs could be affected by autonomous vehicle adoption in Oregon by the 2040s.
- Affected occupations include high wage and lower wage occupations.
- Workers in these occupations are older than workers across all occupations.
- In addition to jobs lost, some jobs will change and others will be created.

Future Research

- Changes to replacement rate of workers in AV affected jobs—Currently lack the necessary framework
- More demographic research

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Questions or Comments? Contact me!

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