The Impacts of Vehicle Automation on the Public Transportation Workforce

September 2022 Tech Talk
Michigan DOT

September 7, 2022

TCRP Report 232

Agenda

Study purpose and methodology

Front-line employee survey

Potential Workforce Effects

Conclusion

Purpose and Methodology

A quick summary of the study's methodology

Why the Study?

- Vehicle automation: It's coming…

- Transit workforce impacts not well-documented or understood
  - Type of impacts
  - Magnitude of impacts
  - By agency type
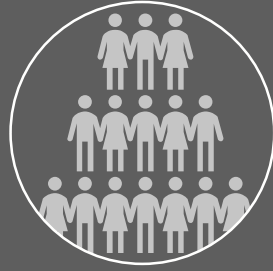 - By position

- Knowledge empowers preparation

Use Case List

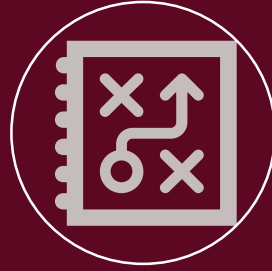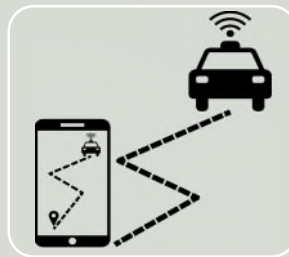**Use Case #1**
Bus Automation for Maintenance and Yard Operations

Use Case #2
Low-Speed Automated Shuttles
For fixed-route circulator or feeder service

Use Case #3
Automated Bus Rapid Transit

Use Case #4
Automated Mobility on Demand (MOD)*
For non-ADA demand response

Use Case #5
Automated Local Bus Transit

* MOD: demand-responsive approach to mobility

Affected Bus Transit Jobs

Directly Affected Operations Jobs

- Bus operators
- Bus mechanics / maintenance technicians
- Bus service persons / fuelers / cleaners
- Dispatchers / controllers
- Road or street supervisors / traffic controllers

Automation impact
was **quantified**

Indirectly Affected Key Jobs

- Bus garage superintendent
- Bus operations trainer
- Maintenance trainer
- Parts clerk
- Operations and maintenance facilities maintainer
- Short-range transit planner / schedule maker
- Transit police officer

Automation impact
was **discussed**

Estimated Bus Transit FTEs

Directly Affected Operations Job	Agency Type			
	Rural	Small Urban	Large Urban	Grand Total
Bus Operator	17,834	13,266	136,522	**167,623**
Dispatcher	1,791	705	7,238	**9,733**
Street Supervisor	691	623	4,133	**5,447**
Mechanic	2,479	926	21,207	**24,612**
Service Person	495	558	12,123	**13,176**
Total	**23,289**	**16,079**	**181,223**	**220,592**

FTE estimates developed using a combination of National Transit Database data, transit agency survey responses of staffing counts, and comparisons with Bureau of Labor Statistics estimates. Excludes school bus, intercity bus, tour, and charter bus, and other forms of bus service that is not public transit.

Values exclude the many other bus transit positions not shown (e.g., schedulers, planners, administrative personnel, customer service agents, etc.).

Participants

Operator; 63; 49%
Other Jobs; 41; 32%
Dispatcher; 6; 5%
Street Supervisor; 7; 5%
Mechanic; 12; 9%
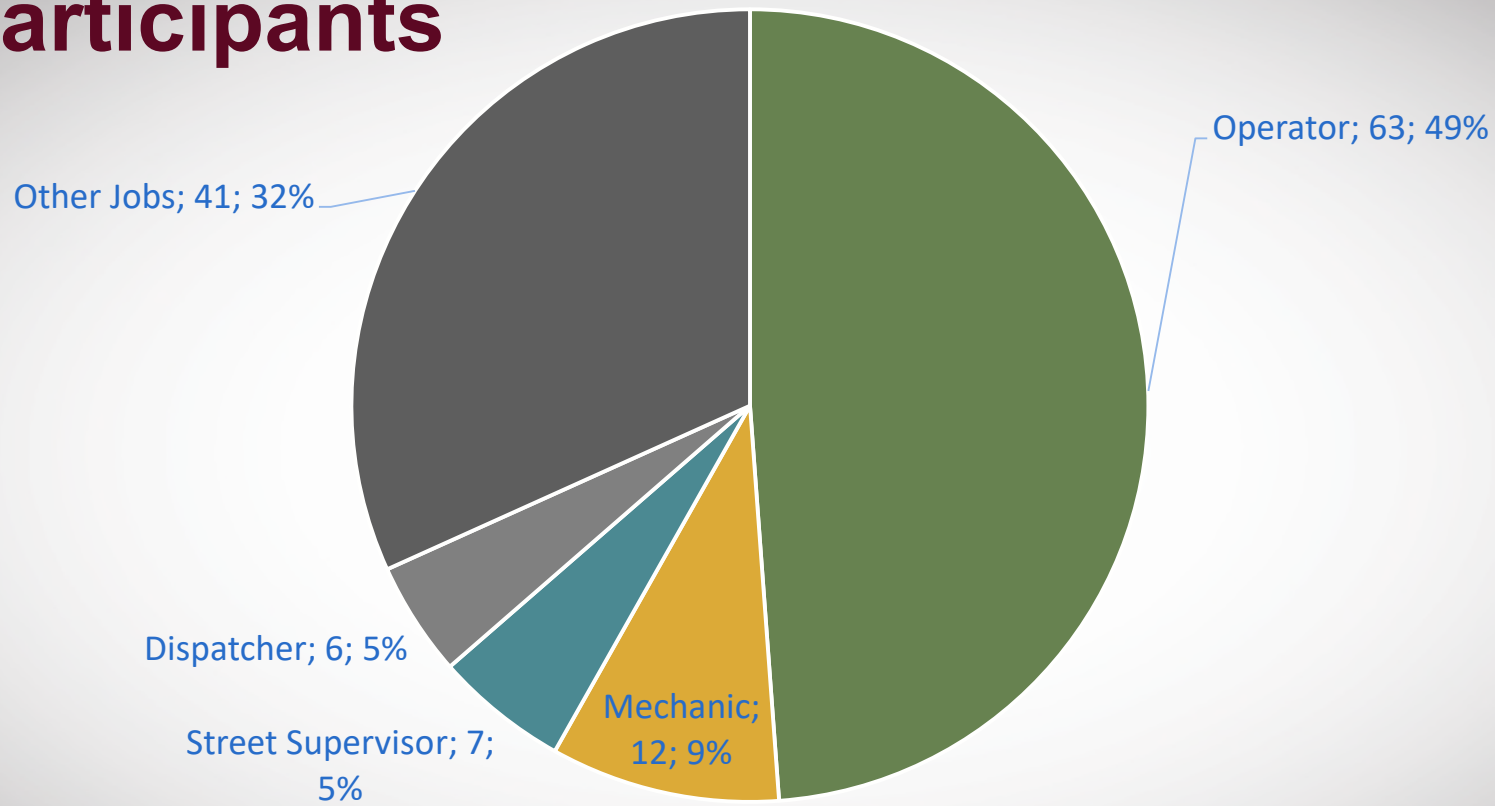
N = 129

Selected Open-Ended Responses

"The connection I have with my passengers is valuable. We greet each other, they trust me, and they know me . . . My passengers should be seated and secured. Spoken with (not to) and they enjoy their trip in a safe and comfortable HUMAN environment. There is no replacement and certainly not value above that of human connection."

Work "might possibly be less stressful because of not having to deal with traffic."

Key Survey Take-Aways

Front-line transit employees have significant concerns

Concerns are perceived as much more likely to occur than potential benefits

Biggest concern is potential job loss

Most are skeptical that benefits would actually materialize

Workforce Effect Calculator

All Bus Employees and Bus Services

Agencies that Operate the Service Type for the Use Case

Agencies the Actually Implement the Use Case

Eligible Services at Implementing Agencies

Replaced Eligible Services
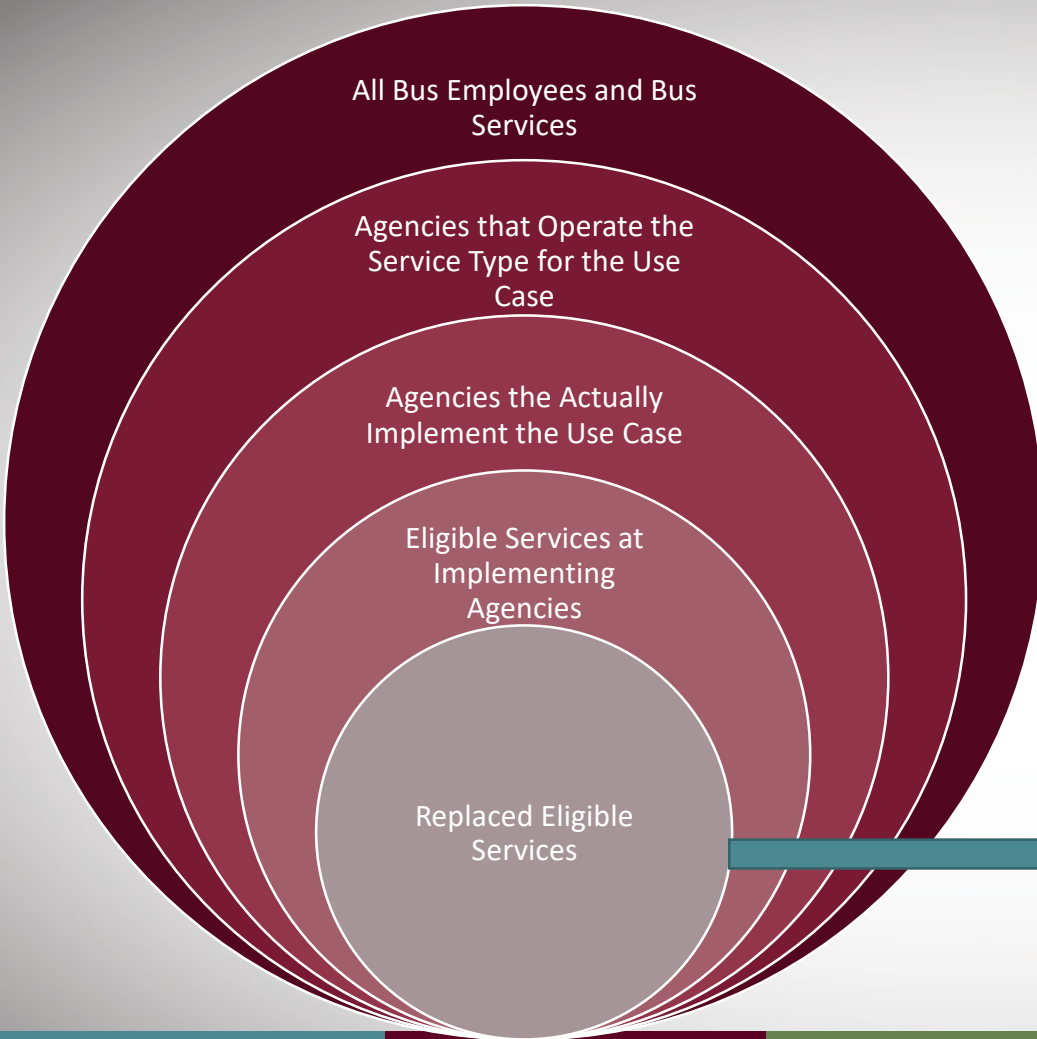
Task-by-task impacts per job

Estimated effects per job

Impact Scenarios

Operational Model	**Remote operations**: vehicles monitored by a remote operator and remotely controlled, if necessary
	In-person operations: a person is on board every vehicle, but mostly not driving
Adoption	**Partial**: "reasonable" implementation; not all transit agencies and not all eligible services replaced
	Full: complete implementation; all transit agencies with eligible services replace all eligible services

Estimated Workforce Effects: All Use Cases

Operational Model & Use Case	Partial Adoption		Full Adoption	
	Affected Jobs[1]	Job Gain (Loss)[2]	Affected Jobs[1]	Job Gain (Loss)[2]
Remote Operations				
Use Case 1: Bus Automation for Maintenance & Yard Operations	43%	1%	100%	2%
Use Case 2: Low Speed Automated Shuttles	1%	-1%	2%	-1%
Use Case 3: Automated BRT	0%*	0%*	0%*	0%*
Use Case 4: Automated MOD	2%	-1%	8%	-4%
Use Case 5: Automated Local Bus Service	25%	-11%	71%	-32%
In-Person Operations				
Use Case 1: Bus Automation for Maintenance & Yard Operations	43%	1%	100%	2%
Use Case 2: Low Speed Automated Shuttles	1%	0%*	2%	0%*
Use Case 3: Automated BRT	0%*	0%*	0%*	0%*
Use Case 4: Automated MOD	2%	0%*	8%	0%*
Use Case 5: Automated Local Bus Service	25%	2%	71%	5%

Notes:
[1] The percentage of all **bus transit** employees that would see the use case impact their agency and role.
[2] The percentage of change in **bus transit** employee FTEs.
* - value is less than 0.5%

Estimated Effects: Bus Automation for Maintenance & Yard Operations (Use Case 1)

Position	Partial Adoption		Full Adoption	
	Affected Jobs[1]	*Job Gain (Loss)[2]*	*Affected Jobs[1]*	*Job Gain (Loss)[2]*
Operator	43%	0%	100%	0%
Dispatcher	39%	0%	100%	0%
Street Supervisor	41%	0%	100%	0%
Mechanic	44%	10%	100%	22%
Service Person	47%	-3%	100%	-7%

Notes: [1] The percentage of **bus transit** employees that would see the use case at their agency.
[2] The percentage change in **bus transit** employee FTEs.

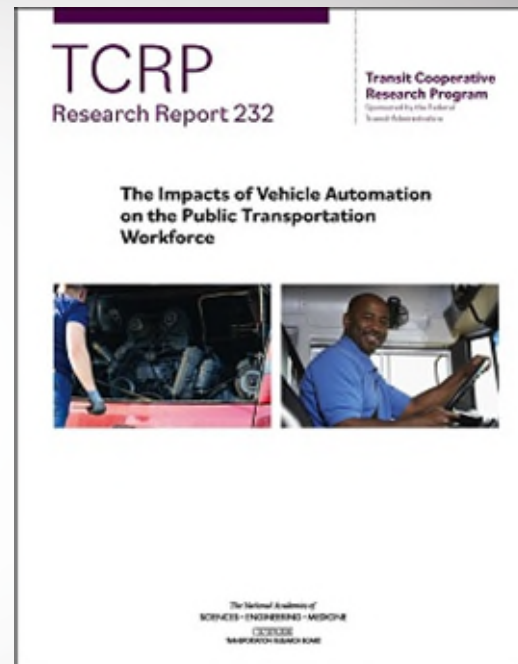# Estimated Impacts: Automated Local Bus Service (Use Case 5)

Operational Model & Position	Partial Adoption		Full Adoption	
	Fixed Route Affected Jobs[1]	*Job Gain (Loss)[2]*	*Fixed Route Affected Jobs[1]*	*Job Gain (Loss)[2]*
Remote Operations				
Fixed-Route Operator	35%	-27%	100%	-77%
Fixed-Route Dispatcher	34%	-6%	100%	-18%
Fixed-Route Street Supervisor	35%	-3%	100%	-9%
Fixed-Route Mechanic	36%	19%	100%	52%
Fixed-Route Service Person	36%	27%	100%	75%
In-Person Operations				
Fixed-Route Operator	35%	0%	100%	0%
Fixed-Route Dispatcher	34%	-1%	100%	-2%
Fixed-Route Street Supervisor	35%	-1%	100%	-4%
Fixed-Route Mechanic	36%	19%	100%	52%
Fixed-Route Service Person	36%	1%	100%	4%

Notes: [1] The percentage of **fixed-route bus** employees that would see the use case at their agency.
[2] The percentage change in **fixed-route bus** employee FTEs.

Full Detail Available In Report

- Outputs
  - Number of affected employees
  - Job gain (loss)
  - Number of remining unaffected employees
- Grouping Levels
  - By use case
  - By agency type
  - By directly affected job
  - By adoption scenario
  - By operational model

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Transit Cooperative Research Program

The Impacts of Vehicle Automation on the Public Transportation Workforce

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRANSPORTATION RESEARCH BOARD

Full Report and Attachments available at:
https://www.trb.org/Main/Blurbs/182705.aspx

Proposed Guiding Principles for Preparation and Mitigation

Take an employee-centric approach

- Involve current employees from the start
- Retain as many *current* employees as long as feasible (current working conditions, pay, benefits)

Prepare employees for success and advancement in automation

- Identify knowledge, skills, and abilities needed for transit automation jobs
- Provide assessments and training for employees to qualify for jobs

Create meaningful and similar alternative job opportunities (for employees who are displaced)

- Formalize procedures for displaced employees to qualify for alternative jobs

When necessary, provide off ramps

- Early retirement buyout programs(?)
- Support (training, financial, job search, etc.) for terminated employees

Conclusion

Summary

- **Directly affected operations workforce** effects vary widely based on the use case, adoption rate, operational model, and position

- Preliminary estimates of effects from use cases
  - Partial adoption scenarios:
    - Employees affected (see a change): between 0.5% and 43%
    - Job gains or losses: between -11% and 2%
  - Full adoption scenarios:
    - Employees affected: between 0.5% and 100%
    - Job gains or losses: between -32% and 5%

- Much more needs done to fully understand potential impacts and to prepare

Note: Percentages shown use the number of directly affected operations jobs in the bus transit industry as the denominator, which includes operators, mechanics, service people, dispatchers, and street supervisors only.

Data Needed

- Actual transit job counts per position
    - Could be collected annually or triennially
    - National Transit Database? Other industry org?
- Hours worked and wages per position

Future Research

Transit workforce counts and demographic tracking	Concepts of operation and task-level analyses for automated transit services	Job descriptions and KSAs for automation-related transit jobs
Potential wage effects of automation	Interactive cost-benefit analyses tools (using different ConOps)	More robust workforce effects model that includes • Electrification of vehicles • Attrition

Question & Discuss

Contact Info

Michael J. Walk

m-walk@tti.tamu.edu

512-407-1135