

Contact: [Gail Kiles Krumenauer](#)

503-947-1268

July 2019

Occupations Affected by Autonomous Vehicle Adoption in Oregon

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

Oregon's AV Task Force consists of leaders and experts from various state agencies, labor organizations, private employers, and state lawmakers. The Task Force is currently in its second phase, working primarily through six subcommittees to develop recommendations for the Oregon Legislature related to AV adoption.

Each subcommittee focuses on one subject area related to autonomous vehicles: road and infrastructure design; public transit; vehicle code amendments and public safety; cybersecurity and privacy; land use; and workforce changes. This summary provides 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.

Measuring Employment in Oregon's AV-Affected Occupations

A 2017 paper from economists in the U.S. Department of Commerce Economics and Statistics Administration¹ identifies primary driving and other on-the-job driving-related (or "secondary") occupations most likely to be affected by AV adoption in the U.S. Primary driving occupations include light and heavy-duty drivers, whose primary responsibilities include driving cars, vans, small trucks or heavy-duty commercial vehicles on the road.² Secondary occupations include those where driving is not

Defining "Affected" Occupations and Timelines

Affected occupations are not synonymous with lost jobs. Some jobs in AV-affected occupations may be eliminated, while others will change substantially over the next 20 to 30 years, but still exist. In other areas of the economy, new jobs and entirely new occupations will also be created due to mainstream AV adoption.

Timelines are also important. One study prepared by the UC-Berkeley Labor Center suggests widespread AV adoption will take between 25 and 30 years for commercial trucks. Another study prepared for Securing America's Future Energy estimates widespread household AV adoption starting around the year 2030, and full commercial truck automation occurring through the 2040s.

the primary responsibility, but often required, and some jobs could be eliminated by AVs.

Estimates from the Oregon Employment Department’s long-term occupational projections show nearly 95,000 jobs statewide in AV-affected occupations in 2017. That accounts for 5 percent of all employment, with 56,000 jobs across the eight primary driving occupations, and 39,000 jobs in the 14 secondary AV-affected occupations.

Among primary driving occupations, the median (or middle among all jobs) hourly wage in 2019 ranged from a low of \$13.56 for taxi drivers and chauffeurs to a high of \$25.36 for transit and intercity bus drivers. For secondary affected occupations, median hourly wages varied from \$12.31 for service station attendants to \$48.80 for supervisors and managers of police and detectives. By comparison, the median wage for all occupations in Oregon was \$19.46 per hour.

Employment and Wages for Autonomous Vehicle-Affected Occupations in Oregon

Standard Occupational Classification Title	2017 Employment	2019 Median Hourly Wage
Total, All Occupations	2,045,907	\$19.46
All Autonomous Vehicle-Affected Occupations	94,776	-
Truck Drivers, Heavy and Tractor-Trailer	24,289	\$22.82
Truck Drivers, Light or Delivery Services	10,532	\$17.10
Driver/Sales Workers	7,282	\$15.24
Bus Drivers, School or Special Client	6,634	\$17.44
Taxi Drivers and Chauffeurs	2,795	\$13.56
Bus Drivers, Transit and Intercity	2,326	\$25.36
Motor Vehicle Operators, All Other	2,167	\$14.47
Ambulance Drivers and Attendants, Except Emergency Medical Technicians	77	\$12.71
Security Guards	8,527	\$13.31
Automotive Service Technicians and Mechanics	7,423	\$21.19
Service Station Attendants	5,912	\$12.31
Police and Sheriff’s Patrol Officers	5,289	\$35.57
Postal Service Mail Carriers	3,496	\$22.90
Refuse and Recyclable Material Collectors	2,199	\$22.43
Automotive Body and Related Repairers	1,971	\$18.81
Couriers and Messengers	1,406	\$16.43
Supervisors and Managers of Police and Detectives	1,293	\$48.80
Parking Lot Attendants	745	\$12.81
Automotive Glass Installers and Repairers	271	\$15.82
Travel Guides	82	\$15.81
Electronic Equipment Installers and Repairers, Motor Vehicles	60	\$20.10
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

Projected Employment Changes for AV-Affected Occupations

Oregon’s current long-term projections estimate employment changes through 2027, which falls before the window of mainstream AV adoption identified in academic studies.^{1,2} Between 2017 and 2027, Oregon will add 246,000 jobs, a growth rate of 12 percent (Table 2). Primary driving occupations are also projected to grow by 12 percent,

adding 6,500 new jobs over the decade. The fastest growth among this set of occupations is expected for light truck drivers and taxi drivers and chauffeurs (17% each). *Note these projections include self-employment.*

Secondary AV-affected occupations will add 2,900 jobs (8%). Couriers and messengers' employment will grow 14 percent by 2027, the fastest among this set of occupations. Meanwhile, two others – postal service mail carriers, and motor vehicle electronic equipment installers and repairers – will see employment declines by 2027.

Across all occupations in Oregon, for every one new job created, there will also be roughly nine job openings requiring newly trained workers to replace those who leave the labor force (largely due to retirement) or make major occupational changes. Among primary driving occupations, that ratio will be 10-to-1, and among secondary affected occupations, projections show 15 replacement openings for every one new job by 2027. Overall, primary driving and secondary AV-affected occupations will account for 117,500 of Oregon's 2.6 million total job openings.

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

Potential Job Effects from Mainstream AV Adoption

A 2018 report prepared by Groshen, Helper, MacDuffe, and Carson for Securing America's Future Energy (SAFE) outlines a framework for determining the shares of jobs in primary driving and secondary AV-affected occupations under four different autonomous vehicle adoption scenarios.³ The report assumes household and

commercial AV adoption occur separately from one another, on slightly different timeframes.

The report identifies two household AV adoption scenarios.⁴ In one scenario, most households own their autonomous vehicle (“Cars Personal”). The other household scenario involves the use of AVs through a shared fleet of vehicles owned by a company (“Cars Fleet”). Both scenarios assume household AV adoption begins around 2020, and rapid adoption starts near 2030.

The SAFE report also identifies two commercial AV adoption scenarios.⁵ Under “Trucking slow” adoption, Level 1/2 automation becomes mainstream in the 2020s, Level 3/4 automation goes mainstream in the 2030s, and advanced Level 4/5 starts becoming available in the 2040s. Their “Trucking Fast” scenario uses the same progression, and assumes roughly 10 years faster timeline, with Level 4/5 full automation nearly complete in the 2040s.

Under each of these scenarios, the SAFE report estimates the share of jobs affected in primary driving and secondary AV-affected occupations (see Appendix A).⁶ The 2027 employment estimates for primary driving and secondary AV-affected occupations in Oregon combined with the SAFE shares of affected jobs in those occupations create a foundation for additional analysis. Using these numbers, we can make rough estimates of the number of Oregon jobs affected by the 2040s under each combination of household and commercial AV adoption scenarios (see Appendix B for more details).

Oregon’s primary driving occupations and secondary AV-affected occupations will still account for 5 percent of total employment with 104,000 jobs in 2027. Over the following 10 to 15 years, the household AV adoption scenarios could affect between 11,700 and 14,700 jobs. That totals between 11 percent and 14 percent of all jobs in those occupations. Commercial trucking scenarios could affect between 29,800 and 32,600 jobs in these occupations looking into the 2040s. Those impacts would be felt for between 29 and 31 percent of all jobs in primary driving and secondary affected occupations.

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

Combined Household and Commercial Scenario	Jobs Affected*
Personal cars + slow trucking	41,500
Fleet cars + slow trucking	44,400
Personal cars + fast trucking	44,300
Fleet cars + fast trucking	47,200

**Affected does not always equal "lost." Some affected occupations may still exist, with notably different skills and responsibilities on the job.*

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

Taken together, the various combinations of personal and commercial AV adoption scenarios could affect between 41,500 and 47,200 jobs in Oregon, starting around the

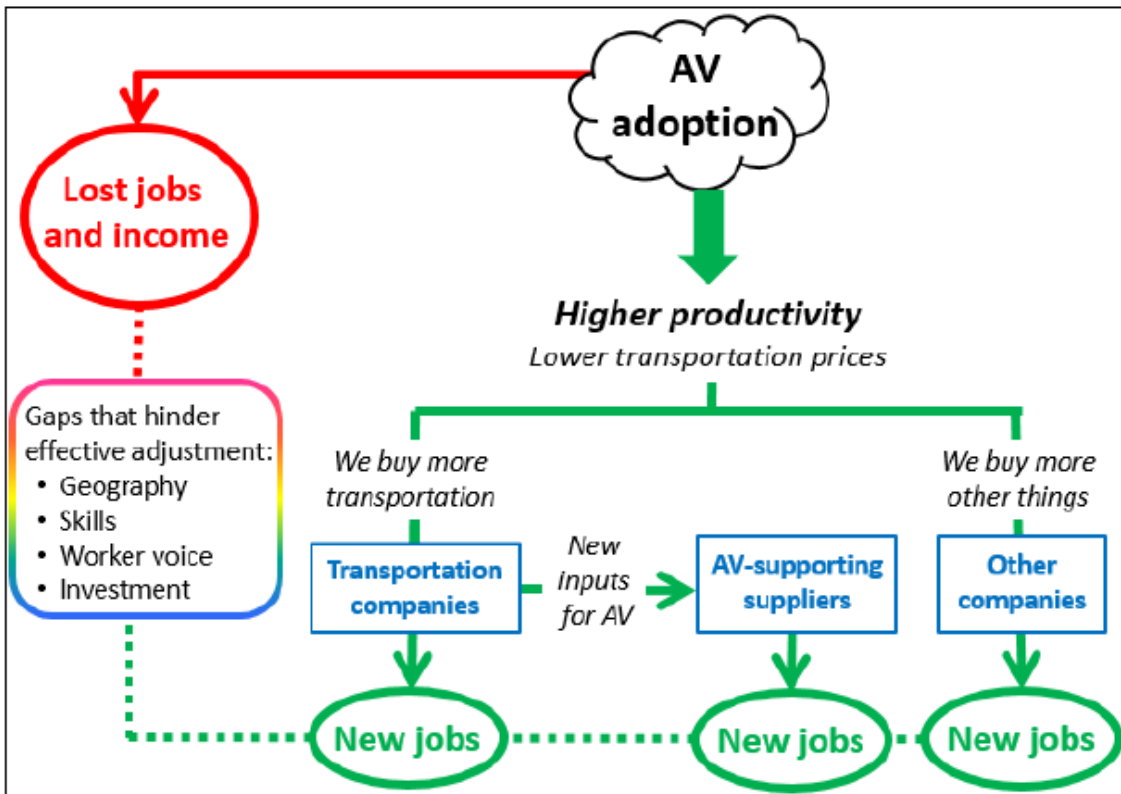
year 2030 (see Appendix B). The largest impacts would occur for heavy and tractor-trailer truck drivers under the commercial scenarios, where 16,200 to 17,500 jobs could be affected. Under the household AV adoption scenarios, estimated job effects are largest for automotive service technicians and mechanics (4,000) and service station attendants (2,600 to 3,900).

Additional Considerations

Workers in primary driving jobs affected by AV adoption are slightly more likely to be workers nearing retirement. While one out of every four jobs in Oregon is held by a worker age 55 or older, about one-third of workers in primary driving jobs are at least 55 years old (see Appendix C).

The mainstream adoption of autonomous vehicles will also create new jobs and entirely new occupations in transportation, in supplier and support activities related to AVs, and in other areas of the economy. Future research efforts can more fully capture workforce effects by including an analysis of new and emerging occupations related to autonomous vehicles.

In addition, we currently only have the capacity to discuss net employment changes beyond 2027. Yet net employment growth accounts for approximately one-tenth of total job openings. We expect autonomous vehicles to disrupt the pattern of replacement job openings, which account for the bulk of total openings. We currently lack a framework to quantify that change.



Source: *Securing America's Future*

References

¹Beede, Powers, and Ingram. August 2017. "The Employment Impact of Autonomous Vehicles." Office of the Chief Economist, Economics and Statistics Administration, U.S. Department of Commerce. ESA Issue Brief #05-17.

²Groshen, Helper, MacDuffe, and Carson. June 2018. "Preparing U.S. Workers and Employers for an Autonomous Vehicle Future." Prepared for *Securing America's Future Energy*.

³ibid, p.32-33

⁴ibid, p.31-32

⁵ibid, p.34

⁶ibid, p.37

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

³⁸ Assumes wider penetration under fast scenario.

³⁹ Assumes wider penetration under fast scenario.

⁴⁰ Assumes wider penetration under fast scenario.

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.

⁴¹ Assumes more electric vehicles in fleets.

Appendix B: Estimates of Affected Jobs in Primary Driving and Secondary Occupations in Oregon

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

SOC Code	Standard Occupational Classification Title	Household Scenarios		Commercial Scenarios	
		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		primary driving occupations	
	Fleet cars + slow trucking	44,440		secondary affected occupations	
	Personal cars + fast trucking	44,278			
	Fleet cars + fast trucking	47,208			

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

Notes and Assumptions:

***Affected does not always equal "lost." Some affected occupations may still exist, with notably different skills and responsibilities on the job.**

Affected occupations identified by U.S. Dept. of Commerce Office of Chief Economist; shares of affected jobs in occupations identified by Groshen et al. (p.36-37)

Per report (p.31-32): "In both the fleet and personal ownership light duty scenarios, most AV are initially shared, with initial deployment around 2020, and an inflection point into rapid adoption around 2030." "Cars personal" means a scenario where most households own their own AV, "Cars fleet" means most households use shared AV fleet owned by a company.

Per report (p.33-34): "Trucking slow" means Level 1/2 automation mainstream in 2020s, Level 3/4 automation mainstream in 2030s, and advanced Level 4/5 becoming available in 2040s. "Trucking fast" uses the same progression, and assumes roughly 10 years faster timeline, so Level 4/5 automation is nearly completed in the 2040s.

Appendix C: Shares of Workers Ages 55 and Older in AV-Affected Occupations

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>

U.S. Workers Ages 55 and Older in Autonomous Vehicle-Affected Occupations, 2018

	55 or Older	All Workers	% Ages 55 and Older
All Workers	36,270,000	155,761,000	23%
All AV-affected occupations	2,283,000	8,239,000	28%
Primary driving occupations	1,589,000	5,000,000	32%
Other on-the-road driving-related occupations	694,000	3,239,000	21%

Source: Current Population Survey