



# // FREIGHT AUTOMATION'S IMPACTS ON THE ECONOMIC SECURITY, HEALTH, AND SAFETY OF FRONTLINE WORKERS //

## Current dangers:

- Automation has resulted in fewer available jobs for some frontline freight workers, as well as decreased income for some contract workers who experience automation-related work slow-downs.
- Automation in warehouses has resulted in worker injuries and death.

## Future threats:

- Automation will likely generate job losses and decrease the total number of jobs available for frontline workers across multiple freight sectors. Given automation's likely effects on other, nonfreight industries, finding new employment may be difficult.
- Job wages and benefits in existing and new positions will also likely decline due to the expansion of the gig economy.
- Working alongside automated technologies such as robots will likely continue to negatively affect worker safety and health.
- Low-income workers and workers of color will be disproportionately affected if employment and workplace impacts unfold as expected.
- Local economies will experience ripple effects from job loss, because people will have less income to spend in communities.

## Opportunities:

- Automation will likely create new employment opportunities for current frontline workers, though for how many is unclear.

# Summary Trends: What Freight Automation Means for Frontline Workers' Economic Security and Safety

***"I look at automation as a short-term fix for the financial health of the country. Automation eliminates jobs which eliminates the ability for people to buy goods and services."***

– Buddy Smith, President, Local 1233, International Longshoremen's Association

***"Health and safety is an issue. Because the pace is increasing [with automation], are we going to see more accidents and injuries or even heart attacks? We've had a couple members at Amazon have strokes."***

– Roberto Clack, Associate Director, Warehouse Workers for Justice

***"Every industry is being impacted [by automation], which presents a lot of danger to our industry because when people get hurt on our job they don't get paper cuts, they don't get headaches. When people get hurt on the docks they lose limbs or they lose lives."***

– Vivian Malauulu, ILWU Local 13 Registered Longshore Worker and Benefits Officer

Given the outsized role that the freight transportation system and its workers play in the US economy, it is no surprise that automation holds the potential for significant—and in many cases, negative—impacts.

## Automation has already negatively affected the health and well-being of freight's frontline workers.

Automation in the freight industry is already impacting the livelihood, health, and safety of workers across the country. A recent report found that the rate of serious injuries at an Amazon warehouse facility in Tracy, CA, almost quadrupled after robots were introduced.<sup>45</sup> At seaports, slowdowns occur from clogged automated systems causing drivers to wait hours longer for their workloads and reducing their wages, because they get paid by the load, not by the hour.

## Increased automation may bring job losses and lower benefits, and worsen many worker conditions, especially for low-income workers and people of color.

Job loss and a reduction in the number of jobs available are potential side effects of automation in the freight system. In addition, these job losses will likely happen in an economy where automation will simultaneously be increasing unemployment across a variety of

nonfreight sectors: some estimates predict that up to 30% of workers may need to transition to different occupations by 2030 as a result of automation.<sup>46</sup> Automation may create some new employment opportunities for current frontline workers, but for how many is unclear.

Because income and economic security are key social determinants of health, job loss and economic insecurity can lead to negative health outcomes, such as chronic illness and premature death. Such economic losses would also have ripple effects in nearby communities.

Some models predict that automation will contribute to fragmentation of worker benefits like health care. Automation also can, and already has, increased the workload and pace of work, with consequences for employee safety.

These automation impacts are likely to be concentrated among low-income workers and people of color, who are overrepresented in various freight sectors compared with the overall population.

## A Closer Look: Sector-Specific Examples

Sectors within the freight industry will feel the effects of job losses differently.

**Trucking:** Within the long-haul trucking sector, one recent report found that without policy intervention, up to 294,000 long-distance driving jobs could be eliminated with automation.<sup>16</sup> Another report estimates that between 300,000 and 900,000 trucking jobs could be lost over the next 10 to 20+ years to automation, out of a total of nearly 1.9 million heavy and tractor-trailer truck driver jobs.<sup>14</sup> These estimates vary considerably in part because, as noted previously under *State of Automation in the Freight Industry*, there are still considerable uncertainties related to automation's deployment.

**Ports:** A limited number of ports already have automated terminals, and others are under development. Given the technological feasibility of automating port operations now, it's clear the employment impacts can be significant. For example, the LBCT, which opened April 2016, has two-thirds fewer employees than do traditional terminals.<sup>40</sup> A recent study in Canada may also be illustrative for the United States. The authors found that automation at the Ports of Vancouver and Prince Rupert could reduce dockworker jobs by 50% if the ports semiautomate, and up to 90% if the ports fully automate.<sup>47</sup> The adjacent table shows examples of the number of workers used at three ports with varying levels of automation.

Conventional Terminal <sup>a</sup>	Semiautomated Terminal <sup>b</sup>	Fully Automated Terminal <sup>c</sup>
525 workers	213 workers	150 workers
1 million TEU <sup>d</sup>	1.6 million TEU	1 million TEU

<sup>a</sup> Prince Rupert terminal (British Columbia, Canada). <sup>b</sup> Port Botany terminal (New South Wales, Australia).

<sup>c</sup> Victoria International Container Terminal (Melbourne, Australia).] <sup>d</sup> TEU: 20-foot equivalent unit, a common measurement of cargo capacity.

**Warehouses:** In some warehouses across the country, workers are already working alongside automated robots. But researchers predict that automation within warehousing will not likely cause widespread job loss for at least the next 5 to 10 years.<sup>17</sup> There are already cases of automation resulting in job loss, though: in Japan, clothing company Uniqlo cut their staff by 90% at their Tokyo warehouse when they automated.<sup>48</sup> In contrast, leaders at retailer Boxed chose to retrain workers to run the new automated equipment instead of laying them off.<sup>49</sup>

**Rail:** Although automation advances such as PTC technology has helped set the stage for reducing the number of workers operating a train, whether it happens is a different story. The debate is a key part of the negotiations taking place between labor and the major railroad companies over the next several years.

Job losses within freight transportation are likely to occur against a backdrop of significant job losses driven by automation across a wide range of sectors within the US economy. “[F]uture waves of disruption may impact a wide variety of industries and occupations at the same time, making it more difficult for disrupted workers to find a stable industry or occupation into which to transition.”<sup>50</sup> One report estimates that between 16 and 54 million US workers, which is 10% to 32% of the workforce, may need new occupations by 2030.<sup>46</sup> Another group of researchers estimates that approximately 9% of US jobs are at risk of being lost to automation.<sup>51</sup> Estimates differ; however, the consensus is that jobs across multiple employment sectors will be affected, including but not limited to retail, sports, law, hedge funds, and the freight industry.



**Interested in more in-depth information about automation and job displacement? For a closer look see:**

**“A Future That Works: Automation, Employment, and Productivity”**  
by McKinsey & Company ([https://www.mckinsey.com/-/media/McKinsey/Featured%20Insights/Digital%20Disruption/Harnessing%20automation%20for%20a%20future%20that%20works/MGI-A-future-that-works\\_Full-report.ashx](https://www.mckinsey.com/-/media/McKinsey/Featured%20Insights/Digital%20Disruption/Harnessing%20automation%20for%20a%20future%20that%20works/MGI-A-future-that-works_Full-report.ashx))

**Unpacking Skill Bias: Automation and New Tasks**, which addresses automation’s historical contributions to income inequality (<https://www.aeaweb.org/articles?id=10.1257/pandp.20201063>) ■

Automation may also cause reduced wages for workers in the freight industry. For example, some truck drivers get paid by the load, so they get paid less when they can’t complete as many trips due to workflow inefficiencies and delays at ports. Such delays have been caused by automation, according to stakeholder interviews. Stakeholders report stalled operations when the computer system cannot locate a certain container load for a truck driver, and there have been times when outside truckers have had to wait for hours because a computer-directed machine “decked” the container in the wrong yard spot, or because the computer

is unable to locate the container in the yard pile where it was assigned, or because it was incorrectly delivered to the wrong driver.

## Remaining freight jobs may see a decline in employee wages and benefits, and access to newly created jobs may be difficult.

Automation-related job losses may happen along with some job growth within other freight industry sectors. For example, the Bureau of Labor Statistics estimates a modest increase in the need for diesel service technicians and mechanics through at least 2029.<sup>52</sup> Growth in e-commerce-related jobs is also expected, which is likely to increase the new job opportunities for women, who are “more likely to be employed in e-commerce warehouses than in traditional ones.”<sup>17</sup>

But the quality and stability of these jobs may not be strong. Many jobs will be part of the gig economy, meaning workers are independent contractors without the rights and benefits of employees. Misclassification is already a significant problem that affects the wages and benefits of many within the freight sector. Jorge Mayorga, a veteran port truck driver, notes, “Unlike employees, independent workers usually have no access to unemployment benefits, disability pay or workers’ compensation. In many cases, trucking companies also pass costs on to drivers, including expenses for fuel, maintenance, repairs, insurance, permits and truck leases.” This problem is likely to be exacerbated by automation, particularly in e-commerce warehouses.<sup>17</sup> Similarly, as automation works its way further into the trucking sector, newer jobs will mostly be local driving and “last-mile” delivery jobs that, without policy intervention, risk misclassification as independent contractor jobs with lower income and fewer protections.<sup>16</sup>



**Interested in more in-depth information about trucking misclassification? For a closer look see:**

***Big Rig Overhaul: Restoring Middle-Class Jobs at America’s Ports Though Labor Law Enforcement***, from the Economic Analysis and Research Network (EARN) (<https://earn.us/publications/the-big-rig-overhaul-restoring-middle-class-jobs-at-americas-ports-though-labor-law-enforcement/>) ■

New jobs will emerge, including automated equipment service and maintenance jobs; technology repair specialists; software, computer programming, and electrical engineering positions; jobs with firms that map the nation’s highways; and jobs related to technology development, financial analytics, and patent infringement law.<sup>53</sup> With policy and program interventions, current freight workers could be retrained to take over some of these newer jobs. For instance, a forklift mechanic could undergo training in the controls of automated guided vehicles.<sup>54</sup>

***“Latinx and Black workers are overrepresented in the industry compared with the total U.S. workforce: both groups are employed in warehousing at twice the rate of all other industries.”***

– Beth Gutelius and Nik Theodore  
*(The Future of Warehouse Work: Technological Change in the U.S. Logistics Industry; 2019<sup>17</sup>)*

But for other jobs, such a transition might be more difficult, particularly if the skills needed for newer positions aren't aligned with existing skills. The percentage of displaced freight workers who will be able to transition into new positions that are created by automation is unclear and unpredictable; this is an area ripe for additional research.

## **Automation can significantly change workplace conditions.**

***“Trying to figure out a way to have a one-man road freight train... Can you imagine being by yourself in a train for 12 hours, 9 o'clock in the night to 9 o'clock the next morning? Going to the desert by yourself from LA to Yuma, Arizona. That's just ridiculous especially what happens if the train breaks down too? Too much to put it on one guy.”***

– James, railroad conductor

Automation can create changes in workplace conditions, including increased worker isolation and reduced ability of workers to make decisions. In warehouses, robots and productivity software can cause work speed-ups which push workers to move faster,<sup>45</sup> and workers also face direct interaction with robots that roam warehouse floors more freely.<sup>55</sup>

Driver-assist automation has already changed truck driver's experiences. For example, automatic braking can react faster than a driver can. Changes will depend in part on how automation unfolds. Even with increasing levels of automation, a driver may still need to be “on call” to instantly take over if needed. Meanwhile, a fully automated truck self-driving a portion of a route may not require any driver oversight. In instances where drivers are still required to be in the cab, they may have longer driving shifts. As one researcher observed, without policy intervention, “the nation could easily end up with a model of autonomous trucking where humans are simply poorly paid attendants to robots, working in cramped and lonely conditions, with little sleep, and few prospects.”<sup>56</sup>

# How Freight Automation's Impacts on Employment and Workplace Conditions Will Affect Health and Equity

## Job losses will inequitably affect low-income workers and workers of color.

Without policy and program interventions, the impact of automation on job loss and accompanying economic insecurity will have significant health effects and will disproportionately impact low-income, lower-skilled, and less-educated workers.<sup>51</sup> Workers who are young, male, Latinx, and Black are overrepresented in the warehousing industry; for example, workers of color make up 66% of warehousing industry workers.<sup>17</sup> As such, automation's impacts will disproportionately affect these workers.

In addition, Black workers are greater than 1.5 times more likely to work in easily automated jobs, including freight movers. The employment category "laborers & freight, stock & material movers, hand" employs 1,900,000 people, of whom 378,000 are Black employees. This category of work makes up 1.8% of the total Latinx workforce and 2.1% of the Black workforce, - both more than the 1.2% of the White workforce employed in this area.<sup>57</sup>

Black people are overrepresented as drivers in the trucking industry; a greater proportion of truck drivers are Black compared with their proportion within the US population.<sup>58</sup> One estimate predicts that without policy intervention, automation could "increase the African American unemployment rate from 7.5 percent to over 20 percent"<sup>57</sup> due to the number of Black workers in jobs that are at high risk of elimination due to automation.

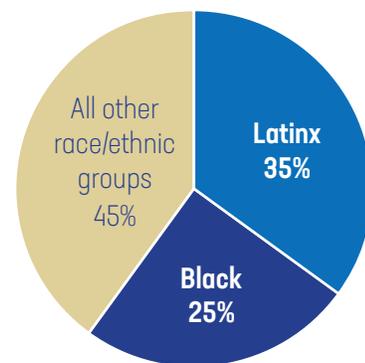
Lower-wage jobs are at greater risk from automation. The White House Council of Economic Advisors found that "83 percent of jobs making less than \$20 per hour would come under pressure from automation," compared with only "4 percent of jobs making above \$40 per hour."<sup>57</sup>

## Joblessness is a health risk.

Losing a job can have consequences on a worker's physical and mental health and influence how long they live.<sup>59</sup> For example, a displaced worker's mortality rate in the year after displacement is 50% to 100% higher than would be expected.<sup>60</sup> Once displaced workers are

**Frontline Warehousing Jobs, by race/ethnicity**

(Adapted from Gutelius and Theodore<sup>17</sup>)



re-employed, they experience improved physical functioning and mental health.<sup>59</sup> Job loss can also make it hard for families to afford food, utilities, medications, and housing.<sup>61</sup>

## Loss of access to health care harms health.

Accompanying job loss is a loss in health care, which also harms health. Having access to health insurance improves health by increasing the likelihood that an individual will access and use health care.<sup>62</sup> People who are uninsured are less likely to get preventive care and are more likely to die earlier than people who have health insurance.<sup>63</sup>

## Automation changes to workplace conditions can risk worker health and safety.

Automation can considerably change workplace conditions for frontline workers. What follows are the wide range of health and safety implications of those changes.

**Injuries and illness:** Automated technologies can cause work speed-ups that push workers to move faster than is safe, leading to injuries.<sup>45</sup> Workers also face potential harm from robots that roam warehouses floors more freely, which is much different than previous iterations of robots that were behind cages for the safety of workers.<sup>55</sup> Warehouses with robotics often have higher injury rates than warehouses without robots; for example, all five of the Amazon warehouses with the highest number of injuries in 2018 had robotics in the facilities.<sup>45</sup>



**Interested in more in-depth information about warehouse worker safety? For a closer look see:**

**Behind the Smiles**, published by Reveal from the Center for Investigative Reporting (<https://revealnews.org/topic/behind-the-smiles/>). ■

Workplace stress from a variety of factors, such as increased pace of work, also likely plays a role in the development of illnesses. According to the National Institute for Occupational Safety and Health, “evidence is rapidly accumulating to suggest that stress plays an important role in several types of chronic health problems—especially cardiovascular disease [and] musculoskeletal disorders.”<sup>64</sup>

It’s critical to note that injuries and illnesses aren’t inherent to automation. Proper planning, training, and oversight can ensure technologies don’t harm workers.<sup>55</sup> Also, workers can and should be protected from workplace injuries without any automation at all. For example, supervisors can rotate warehouse workers to different positions to reduce repetitive stress injuries.

In contrast, low levels of automation for truck drivers may reduce physical injuries. Currently, professional drivers are 10 times more likely to be killed on the job and nearly 9 times more

likely to be injured than the average worker.<sup>65</sup> Automation that makes truck driving safer, such as automatic braking, will support driver health. As for increased levels of automation, including reducing the need for a driver at all, the safety implications are much less certain. Please see the section, *Freight Automation's Impacts on Traffic and Health*, for more information.

**Mental health:** Workers with less control, decision latitude, and agency over their work environment have worse mental health than those with greater control,<sup>66,67</sup> including higher rates of depression, anxiety, insomnia, and exhaustion.<sup>66,68</sup> In contrast, the physiological stress experienced by workers was reduced as they gained more agency on the job.<sup>69</sup>

## OF LITTLE LEAGUE TEAMS AND BALLET CLASSES



John Bagakis

John Bagakis is a San Pedro small business owner who works near one of the most massive port complexes in the United States. Before the LBCT was automated, his restaurant made 12 to 15 deliveries a week to the facility. Now, they only receive one order every 2 weeks. If APM Terminals Pier 400 becomes automated, John's business would be affected even more. Currently, he makes 4 to 5 deliveries per day to Pier 400 Maersk and its approximately 500 employees. If the terminal automates, they

could go down to zero deliveries, and John would most likely have to lay off workers and delivery drivers. So, in addition to the roughly 500 employees at Pier 400 Maersk, the effects would reverberate out, impacting the entire community. "We small businesses give back a lot to our communities. Whether it's a local little league team, or whether it's a fundraiser for someone battling an illness ... We give money to that, we give food donations to that... If there's less money coming into our business, that's less money for us to funnel back into the community."



Vivian Malauulu

Vivian Malauulu, a registered longshore worker with ILWU Local 13 in Southern California, shares similar perspectives. "We're not completely against automation. We're only against automation that replaces human labor. If you're going to introduce automation, do so with a conscious effort to preserve a job that allows for somebody to pay taxes, that allows for somebody to buy a home, to contribute to the community, to eat at a local restaurant, to shop at a local store, to send their kids

to ballet. Because if you automate terminals and you take away the jobs and the human factor, that's less revenue, less taxes, less payroll, less going back into the community, and a reduced quality of life for families." ■

**Increased isolation:** Loneliness can create a greater risk of cardiovascular disease, increased risk of depression, compromised immunity, and even a shorter lifespan.<sup>70</sup>

**Concerns about impacts of 5G on health:** Stakeholders interviewed as part of this project shared concerns over the impacts of the radio waves that are used to power 5G and other technologies that make automated equipment run. Although there is evidence that 5G is not harmful to health,<sup>71</sup> companies owe workers research and transparency on the full spectrum of effects new technologies will have on worker health before installing and running automated technologies at workplaces.

## Automation's impacts on economic security will have a ripple effect on communities.

The freight industry is massive, and increased automation leading to job losses will have ripple effects across the local economies that are tightly intertwined with the freight system. Take the more than 600,000 people working in the marine cargo industry. These workers generate economic activity in their communities via “re-spending” and local commerce and consumption. Marine cargo worker spending was estimated at \$139.2 billion in 2018 alone.<sup>72</sup> One study found that for every additional industrial robot introduced into a local labor market, an average of 6.2 workers in that labor market lost their jobs. These losses include direct factory job losses as well as indirect losses, particularly in the construction, business services, wholesale, service, and retail industries.<sup>50</sup> If ports continue to semi- or fully automate, the impacts on local businesses and economies would be sizable. If trucking and warehousing continue to automate, the effects will ripple out through the many local communities across the country that are hubs for freight industry workforces.

### AREAS FOR EXPLORATION

-  What percentage of displaced freight workers will be able to transition into new positions created by automation?
-  Which current positions might translate easily to a more automated industry? Which will be more difficult?
-  Is there any emerging evidence indicating 5G's effects on health? ■