// EXECUTIVE SUMMARY ////

People: the heart of the freight system.

The freight transportation system in the United States is a fundamental part of our economy, infrastructure, and environment. Sprawling ports, large rail yards, train tracks cutting through sparse deserts and dense urban centers, millions of miles of roads, massive warehouse complexes and more: the system delivers grapes from Chile and electronics from China to our neighborhood stores—if not our doorsteps.

If steel is the bones and diesel fuel is the blood of the freight system, people who move our goods and work incredibly hard are its heart. People like Maria, whose warehouse work often requires her to carry boxes as heavy as 60 pounds. People like Wendell Mitchell, a 25-year veteran big-rig driver who knows the global positioning system (GPS) can get you lost in a minute. People like James, a railroad conductor who has had to work with his crew to reboot a train blocking an intersection during rush hour. Many of the freight system's frontline workers work incredibly hard in arduous conditions, yet receive low wages and limited benefits.

Frontline freight workers aren't the only ones who know the intricacies of the freight transportation system: fence-line communities know them as well. Where there's freight, there are people living and working close by—typically people with low incomes and people of color. Often, they are remarkably close, both physically and economically, to trains, warehouses, ports, and busy truck routes. For example, there's John Bagakis, a small business owner whose 52 employees regularly make pizza deliveries to a nearby port. Then there's Veronica Roman, whose dining room shakes when the trains go by her home, and whose family cannot consider leaving the windows open overnight due to the noise and soot.

Wendell Mitchell, over-the-road truck driver / Vivian Malauulu, International Longshore and Warehouse Union Local 13 Registered Longshore Worker and Benefits Officer

Freight automation: it's here and growing.

Although people are still key to making the freight system move, technological change is coming. In some corners of the freight system, it's already here. Various forms of freight automation, where some or all human labor is replaced by machines, are already operational or in different stages of development and testing. In addition to technological advances, the future of freight automation will be determined by negotiations and disputes between workers and employers. Below are sector-by-sector snapshots of what freight automation looks like now and how it may look over the next 5 to 15 years.

Trucking

Driver-assistance technologies for big-rig trucks, such as automated breaking and blind-spot detection, are widely available now, and the next 5 years will likely bring a substantial increase in the use of these technologies. Companies and drivers are also likely to put platooning—where technology enables a string of trucks to drive at proximities that would otherwise be unsafe to do without computer assistance—into widespread use. Within 5 to 15 years, trucks that self-drive—meaning with no driver intervention, and possibly with no driver in the cab at all—will likely be commercially deployed on some freeways and highways, likely first in the Southwest, because of its better weather and long stretches of road.

Warehouses

Extensive warehouse automation is in place right now, with autonomous robots and automated guided vehicles taking the place of humans. Yet, the presence of automation is limited to a smaller portion of early adopters across the sector. Over the next 5 to 15 years, warehouse-related automation is likely to increase. Although slim profit margins make automation investments difficult, factors such as a tight labor market and the ever-increasing demand for e-commerce suggest the sector is moving toward an ever-more automated future.

Rail

Many automated technologies that complement or replace worker's responsibilities are already widely in use, such as train "cruise control" to save fuel, as well as safety systems such as Positive Train Control technology. Higher levels of train automation, including reducing the number of crew members working on trains partially or fully, are technologically feasible now in certain conditions and may become feasible in broader conditions in the near term. In early 2020, the nation's largest freight railroads and unions representing more than 125,000 workers launched a contract negotiation process, and crew size and automation will be at the heart of the likely multiyear negotiation.

Ports

Significant port automation is in place right now. For example, at the twin ports complex of Los Angeles and Long Beach in southern California, several terminals are human-free zones

as computer-controlled equipment and vehicles hum around the terminals. Such automation in the United States is not widespread. Whether that changes substantially in the next 5 to 15 years will depend on economic and labor factors. Upfront costs to automation investments are very high, and productivity gains can be uncertain. As for workers, automation will likely be one of the central and contentious issues for labor and port employers to negotiate when two major labor agreements in the United States end in 2022 and 2024.

COVID-19'S UNCERTAIN IMPACT ON FREIGHT AUTOMATION

About midway through writing this report, the coronavirus pandemic surged across the globe, killing more than two million people, sickening tens of millions, and wreaking havoc on local and global employment and economies. The United States has been particularly affected, with more cases and deaths than any other country. The spread of COVID-19 is impacting the freight transportation system, too: trucking jobs have declined, and some ports have seen a record-setting surge in traffic.

Many questions remain about the pandemic's implications for the state of freight automation in the United States. Will COVID-19 ultimately speed up or slow down the pace of automation? Will we see different types of automation and an increase in e-commerce develop because of the impact of the virus? Because the United States continues to struggle with the coronavirus, and because the path of the virus is anything but clear, the answers to these questions are uncertain.

In the near term, community residents and advocates have expressed concern that the pandemic will result in less-transparent decision-making processes, not only for automation but for freight decisions in general. Longer term, there's some industry sentiment that the pandemic will ultimately speed up freight automation to reduce human-to-human interactions (and thus help prevent contagion) or to reduce human involvement entirely so that future upheavals like COVID-19 have less of an impact on the freight system.

The counterargument to the view that COVID-19 will speed automation rests on matters of money and the heart. First the money: ever increasing levels of automation are more expensive. Given the fallout in the US economy in 2020, the freight transportation system will also need time to recover. Then there's the heart: Throughout the pandemic, the public and policymakers have hailed frontline essential workers as heroes of the moment as they've kept supplies on shelves and food delivered to our doors. Policymakers can build on that sentiment to protect and enhance workers' experience—not simply replace it with automation. ■

A critical window of opportunity.

The extent to which freight automation replaces traditional workers is not an "all or nothing" proposition. Nor can freight automation, however it's conceived, be implemented immediately across the vast and complex freight transportation systems. In light of the timelines described above, there is a critical window of opportunity: policymakers, industry stakeholders, frontline workers, fence-line community members, and the public have time to better understand the implications of freight automation. More importantly, they can make decisions, through policies and programs, that promote health and equity for frontline workers and fence-line communities.

Bracing for impact: increased freight automation will have significant and largely negative health and equity effects on frontline workers and fence-line communities.

Better understanding and addressing the implications of freight automation on frontline workers and fence-line communities are essential. As this analysis details, increased freight automation will have significant, and largely negative, health and equity impacts on frontline workers and fence-line communities. Through extensive literature review and in-depth interviews with key stakeholders, this report details the anticipated effects of freight automation related to various social determinants of health, including employment, air quality, traffic safety, and noise and vibrations. Within each of these determinants, the report details current freight-related dangers, future automation-related threats, and possible beneficial opportunities.

Absent a concerted effort from policymakers and other stakeholders, automation will likely result in the following:

Employment: Automation has already and will likely continue to cut jobs for frontline workers, and wages and benefits may also decline. With less income to spend in communities, local economies closely tied to freight infrastructure will consequently experience negative ripple effects. In addition, automation has and will likely continue to negatively affect frontline worker safety through increased workload and pace of work. All these impacts will inequitably affect lower-wage workers and workers of color.

Air quality: Air pollution from freight transportation currently creates significant health problems, especially for fence-line communities. In limited scenarios, automation may slightly reduce pollution through efficiency gains, but caution is warranted: more real-world testing is needed, and such reductions may be negated by changes in trucking operations. If automation proceeds without electrification and decarbonization, air pollution and related health risks will continue unabated, further affecting frontline workers and fence-line communities. Adopting zero-emission technologies, with or without automation, would provide much more significant pollution reductions.

There is a critical window of opportunity. Policymakers, industry stakeholders, frontline workers, fence-line community members, and the public can make decisions—through policies and programs—that promote health and equity.

Noise and vibrations: The noise and vibrations from freight transportation are significant and have negative health consequences. To the extent that freight automation permits freight facilities to run for longer periods, including during more traditional "off-hours," the burden of noise and vibrations for frontline communities may increase. Although automation itself will have little impact on noise and vibrations, electrifying freight with zero emission technologies would reduce noise and vibrations.

Traffic safety: Similar to air pollution, collisions involving freight trains and trucks cause deaths and serious injuries across the United States. Automation that complements or augments some truck and train driver labor holds significant promise for improving traffic-related safety. Automation may also play a helpful role in safety inspections of freight equipment. However, automation that replaces most or all truck and train driver labor may worsen traffic-related safety in some situations; overall much more research is needed.

Freight automation is at an inflection point. We have the opportunity to deploy technology to create healthier, more equitable workplaces and communities. But policymakers need to make the right choices.

Implemented thoughtfully, freight automation can improve the health and safety of the low-income workers and communities of color who make up substantial portions of the freight workforce and nearby neighborhoods. For example, an automatic braking system that reacts far faster than any human to prevent collisions makes our highways safer. With proper training, a forklift operator can transition into a job fixing an automated forklift. Tying zero-emissions technology to automation will greatly reduce air pollution (and associated greenhouse gases) and noise far more than automation can alone. Where freight automation supports these types of changes, it can be a tool to advance public health, workers' rights, racial justice, and a "just transition" to a carbon-free economy.

But freight automation only realizes improvements in the livelihoods and lives of frontline workers and fence-line communities when those same people are prioritized in decision-making. Job losses, the decline in workplace benefits and working conditions, and erosion of environmental quality could all occur if freight automation is implemented without placing people at the center. The freight transportation system is trending toward an ever-more automated future, but decisions about if, when, and how to use automation will determine its effects. Some of those choices will happen at the organizational level. For example, when Boxed, a bulk retailer, automated one of its warehouses in Union, New Jersey, company leaders decided to retain warehouse staff, shifting many of them into new roles through training and additional support.

Although such decisions should be celebrated, automation-related choices cannot and should not be left to individual companies. Public policies and programs enacted by decision-makers at multiple levels of governance are critical to ensure that the future of freight automation promotes health and equity rather than sustaining and worsening problems inherent with the freight system. Policies and programs should not only help mitigate current harms created by a system that relies heavily on low-wage workers and creates pollution, noise, and safety problems for nearby communities; new hazards and harms need to be prevented as well.

Equally important, policies and programs need to reflect the input, knowledge, and experiences of frontline workers and fence-line communities who bear the brunt of freight's current effects and who have the most to lose from decisions that amplify those effects. Also, policies and programs needed for freight automation should not undercut solutions to current problems that can be enacted now: an overworked warehouse employee shouldn't have to wait for tomorrow's automation to spare her back when helpful changes like rotating task stations can be put into practice today.
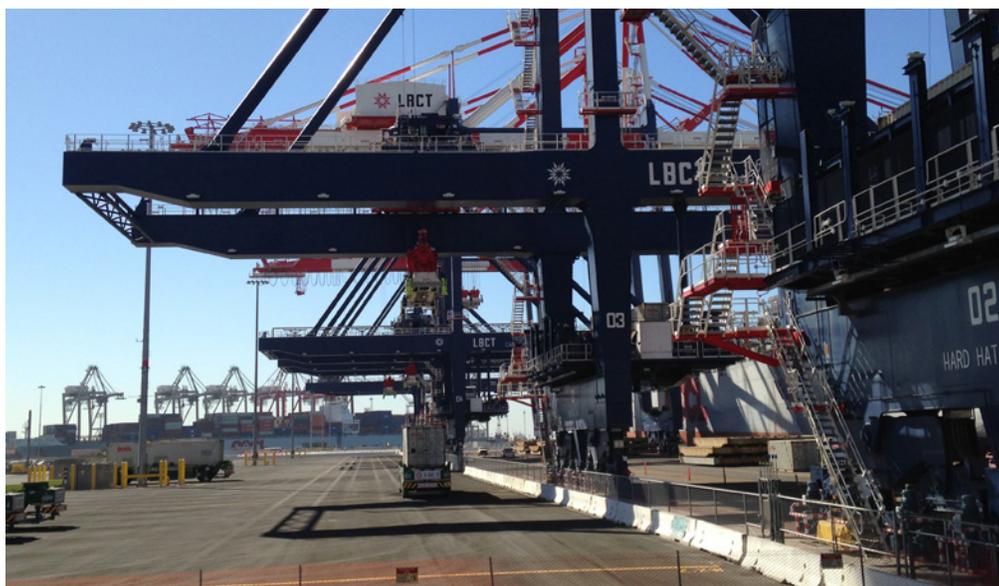
Policy and Program Recommendations for Health and Equity

These policy and program recommendations orient freight automation to support health over harm, and equity over injustices, for frontline workers and fence-line communities.

Engage frontline workers and fence-line communities in automation decisions.

- Decision makers at all levels of government should ensure that automation-related policy and program decisions reflect the input and perspectives of frontline workers and fence-line communities.
- Leaders in businesses considering automation should also engage workers in thinking through automation-related decisions and impacts.

Support frontline workers.

- Plan for automation that advances frontline workers, not just technology.
- Strengthen workers' rights to organize for fair wages, benefits, and a say in automation-related decisions.
- Enforce and improve safety standards for workplace conditions to prevent the negative effects of automation on worker safety and health.
- Reinvigorate and expand programs to meet the needs of frontline workers displaced by automation.
- Correct worker-status misclassification of truck drivers and other freight workers to promote livable wages and benefits.
- Implement broader policies and programs that address automation's impact across the entire US economy.

Support frontline workers and fence-line communities.

- Require Automation Impact Reports (AIRs) to better understand and mitigate automation's effects on health and equity.
- Prohibit the use of public funding for any freight automation that may have negative effects on worker and community health.
- Accelerate efforts to shift freight transportation to a zero-emission system through incentives, regulations, and permitting decisions.
- Implement federal policies to prioritize the safety of freight drivers and other road users.

Finally, where there are still questions about the health and equity consequences of freight automation, additional research is needed.